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Determinants of taxation in South Africa: An econometric approach

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Abstract: The study analyses the determinants of taxation in South Africa for the period from 1972 to 2021. The utilised borrowed time series data from the World Bank. The study employed economic growth, trade, inflation, and government expenditure as control variables. The study performed ADF and PP unit root test, ARDL Bounds test to cointegration, optimal lags model and residual diagnostics. The results of the ARDL model revealed that government spending is a positive statistically determinant while inflation and trade negative statistically significant determinants of taxation in both the short and long run period. Economic growth was found to be a positive statistically significant determinant in the short run while negative statistically insignificant determinant of taxation in the long run. The study provided several policy recommendations such as boosting government expenditure to increase tax collected while revising policies on inflation and trade.

Keywords: Taxation, ARDL Model, Fiscal Policy, South Africa.

JEL Specification: *C01, H2, H30, H50.*

1 Introduction

Fiscal policy is one of the instruments the government uses to control economic activities in many countries today. This refers to the use of government expenditure and taxation as the main instruments behind the fiscal policy of an economy. It is very crucial that the components of fiscal policy must be studied to understand how fiscal policy operates in any economy to stimulate economic activities during periods of recession and how it can be used to prevent economic melting during periods of economic recovery. Tax revenue helps the government in its fiscal policy in economies.

According to OECD (2021) taxes on goods and services were the main sources of tax revenue in Africa, which accounted for 51.9% to total revenue. VAT accounted for 29.3%. taxes on income and profits amounted to 38.4% of tax revenues and taxes on property and labour remained low. The overall tax revenue in Africa was sitting at 49.2% in 2019 in the OECD with property tax only at 1.9%. goods and services tax were the main source of revenue for 22 African countries in 2019, the other eight had taxes on income and profits as their largest revenue and five of those countries are from the SACU community, including Botswana, Eswatini, Lesotho, Namibia, and South Africa and the other three from the oil rich countries such as Chad, Equatorial Guinea, and Nigeria. The objective of this study is to analyse the determinants of taxation in South Africa.

2. Literature

Robinson and De Beer (2021) focused on revising the corporate income tax determinants in Southern Africa using the cross-section panel method from 1980-2017. The study argued that corporate income tax systems have a potential to contribute or hinder economic development in these developing countries. The study found that factors that may explain changes in corporate taxes included differences in wealth for the developing countries due to commodity booms and slumps because of the financial crises.

Okonkwo (2018) studied the determinants of taxation in Nigeria between 1980-2014 using the Ordinally Least square (OLS) method. The study revealed income, money supply, interest rate and inflation as the main determinants of taxation in Nigeria. The study recommends that government must strengthen the processes of tax collection and regular revision of tax policies to sustain the tax income in the country

Addison and Levin (2012) identified the determinants of tax revenue in sub-Saharan Africa between 1980-2005 using the unbalanced panel dataset of 39 countries. According to the study, some of the factors influencing tax revenue include tax base, structural factors, foreign aid and conflict. The study further analysed the impact of these determinants on the overall revenue by incorporating three tax types, which are the international trade taxes, domestic indirect taxes, and domestic direct taxes. The study found the overall tax to GDP ratio to be higher in more open and less agricultural dependent states, less populated and peaceful nations. Furthermore, introducing VAT has a positive impact on the total tax-GDP ratio. Lastly foreign aid and the size of the agricultural sector have a negative impact on tax revenue

Ade, Rossouw et al. (2018) investigated the determinants of tax revenue is 15 Southern African Development Community Countries between 1990-2010 using panel-data, specifically using two broad methods, to test country specific data namely the least squares dummy variables fixed effects and the feasible generalised least squares. The study also introduced a value added tax harmonisation variable and corporate income tax variables through a tax policy harmonisation measure to investigate impact of foreign direct investment and taxation on tax revenue collected. The results showed a positive impact of taxation in increasing tax revenue in the SADC region, especially through the tax rates and tax policy harmonisation variables. The results also highlighted the importance of FDI inflows in improving tax revenue and an existence of a causal relationship between taxation and FDI. Finally, the study pointed out the need for SADC countries to carry out coordinated tax reforms, create a regional tax forum and promote initiatives for improving FDI and tax revenue.

Du Preez and Stoman (2019) focused on analysing the current tax revolt factors in South Africa. The purpose of the study was to determine whether the factors identified through literature could predict the possibility of a tax revolt in South Africa. According to the study, South Africa is experiencing frequent tax increases, tax related protests, corruption, and lack of service delivery. The method used in the study included Twitter feeds collected from February 2017 to March 2017, before and after the National budget speech. The feeds were analysed using a thematic analysis. The results of the study found factors such as failure of government to address the imminent collapse, a large number of people with substantial debt, onerous tax systems, high unemployment rate, education frustration, increase in tax rates on overburdened taxpayers, poor quality of governors and the country's leader's performance and administration as well as fraud.

Alabede (2018) aimed at expanding the conventional tax effort model by introducing the relevant economic freedom variables to investigate the role of economic freedom in enhancing tax revenue performance in sub-Saharan Africa. The study used data from 42 countries across the four sub-Saharan African countries from 2005-2012 and the method of study was the feasible generalised least squares and panel-corrected standard errors. The study found that economic freedom promotes tax revenue performance, specifically the property rights freedom, freedom from corruption and investment freedom, as well as composite economic freedom. The study also confirmed the traditional theory that agriculture share in GDP per capita income show a negative relationship with tax revenue performance.

Feger (2014) analysed the tax revenue components in sub-Sahara Africa using the unbalanced panel data from 43 SSA countries between 1990-2008. The data was analysed using the dynamic panel system GGM to address the autoregressive component of the dependent variable and to address the endogeneity from the variables. The study found that tax revenue determinants affect individual tax revenue components in various ways. More specifically, the study found that the tax structure in SSA is driven by indirect taxes because of the existing structural, institutional and policy instruments in these countries, which are insufficient for direct taxes collection. The study also concluded that indirect taxes are less capable to provide sufficient revenue.

Mahdavi (2008) focused on the level and composition of tax revenue in developing countries using the unbalanced panel data method for periods between 1973-2002. The study found that some variables affect both level and composition of total revenue while some affect the composition of tax in opposite directions making their net effects on the revenue level insignificant. This conclusion brought forward the need to be mindful of the policy instruments to utilise as they might affect individual tax types

Sen Gupta (2007) studied the determinants of tax revenue efforts in developing countries using a broad database set and accounted for some econometric issues previously ignored. The study found that structural factors like per capita GDP, agricultural share in GDP, trade openness and foreign aid affect tax revenue performance of the economy. The study also found other factors such as corruption, political stability and share of direct and indirect taxes. The study also adopted the revenue performance index and found that the Sub-Saharan Africa countries performed more significantly above their potential while some Latin America countries fell short of their performance.

GARIKAI (2009) analysed the determinants of tax buoyancy in developing countries using panel data for fourteen SADC countries between 1994-2005. The empirical evidence revealed monetization as one of the factors affecting tax buoyancy. According to the results, mismanagement of monetization in these developing countries negatively affects annual tax buoyancy. Other factors found to be affecting tax buoyancy include growth in agricultural and industrial sector contributions to national income, growth in external aid, increased fiscal deficit and total expenditure. The study suggests a strong link between fiscal and monetary sectors, improve tax administration through proper reforms and improved infrastructure to facilitate tax collection and stable macroeconomic environment.

Lanem, Jocelyn et al. (2020) examined the effect of taxation on revenue generation in Nigeria using the Ex-post facto research method. The study included all taxes collected by the Federal government of Nigeria including income tax, petroleum profit tax, value added tax and company income tax. The study used the Engel-Granger approach to cointegration to test the relationship between revenue generation and taxation with the data collected from the Federal Inland Revenue Services and National Bureau of statistic. The results showed a positive relationship between tax and revenue generation in Nigeria. This shows that increases in all various sources of tax will lead to an increase in revenue. The study recommended that efforts should be made to increase the tax net in the country.

Prowd and Kollie (2021) studied the determinants of taxation revenue in Liberia using time series data and the Johansen cointegration approach as well as the Vector Error Correction Model (VECM) technique of estimation. The results of the empirical analysis revealed that tax revenue has a positive relationship with real property, income and profit, property income, tax on goods and services, administrative fees, import duties excise tax, grant, loan, inflation, and GDP growth in the long run. Furthermore, tax revenue has a negative relationship with social development contribution from agriculture and mining, real exchange rate and population growth. From the results, the study recommended that Liberia should limit the over-reliance on direct tax revenue and adopt a VAT regime to replace the current GST regime.

Onakoya, Afintinni et al. (2017) studied the impact of taxation on economic growth in Africa from 2004-2013 using several empirical tests including descriptive statistics and stationary tests, as well as the Hausman-test for the appropriation of the estimators between fixed and Random Effect. The study found that tax revenue and economic growth have a positive relationship in Africa. The study confirmed that high and low tax levels both increase economic

growth as suggested by the economic effect of Ibn Khaldun's theory of tax. However, the study suggested that government should prepare to develop comprehensive tax structures to grow, nurture and sustain tax economic base to enhance economic growth in difficult economic conditions such as oil prices crashes.

The study by Fjeldstad, Schulz-Herzenberg et al. (2012) examined the analytical foundation, methodological approaches and key findings of the available literature on the behaviour of taxpayers in Africa. According to the study, broadening the tax base requires understanding of how citizens experience and perceive the tax system and their perception on whether to pay tax or not, what they eventually pay, their views of tax administration and how their tax behaviour correlates to their views on the country. The study suggested that the surveys of current and potential taxpayers can also help identify weaknesses of the tax system and enable the authorities to focus on high-risk categories of taxpayers.

Moore and Prichard (2020) suggested several ways in which governments in developing countries can increase their tax revenue by answering the question; how can governments of low-income countries collect more tax revenue? They started by acknowledging the seven potential tax revenue sources not used sufficiently by governments in low-income countries. These include mining, tobacco and alcohol, income, and wealth from well off people and properties in these countries. These countries can reduce the use of transfer mispricing in international economic transactions as well as tax exemptions and improve the Value Added Tax effectiveness and its collection. The study also examined the potential of increasing tax revenue through changes in domestic and international tax policies, including shifting to taxing companies on business turnover rather than profit.

Castro and Camarillo (2014) studied the determinants of tax revenue in Organisation for Economic Co-operation and Development (OECD) countries between 2001-2011 using static and dynamic panel data techniques. The study aimed to analyse the impact of economic, structural, institutional, and social factors on tax revenue across the 34 OECD countries. The study found that GDP per capita, industrial sector and civil liberties have a positive impact on tax revenue. The study also found that the agricultural sector and the share of FDI in gross fixed capital formation have a negative impact on tax revenue. Lastly, the study found evidence of tax effort and tax gap and that they are stable overtime however diverse across the countries under study. One of the recommendations from the study is that middle income countries need to improve on the highlighted variables to achieve high level of revenue.

Gurama, Mansor et al. (2015) aimed at reviewing the taxation and tax evasion of Nigeria and proving the overall overview of Nigeria's tax system. The study provided the conceptual and empirical evidence of tax evasion cruelty and the global motives behind tax evasion. The study also provided a brief knowledge of the Nigerian tax system, tax policy and the tax law. And lastly, the study also discusses the objectives, guiding principles, driving institution of Nigerian tax system, administration and policy and concept of U-TIN.

Salman (2014) examined the impact of Value Added Tax on economic growth in Nigeria, the perception of the VAT payers and assessed the impact of adequate accounting procedures on VAT efficiency. The study also investigated the impact of VAT, Petroleum tax, Excise duties and company tax on GDP. The study collected data on questionnaires from 258 randomly selected respondents and secondary data was obtained from FIRS and other sources. The data collected was analysed using multiple regression analysis and Pearson Product Moment Correlation Coefficient. The results of the study showed a positive response and payment of VAT since its introduction in the country. The results also revealed adequate accounting procedures of VAT contribute to economic growth and lastly the results showed a positive impact of VAT level on social welfare and populace. The study therefore recommended that the government should adopt strategies aimed at maintaining the efficiency of VAT accounting procedures and increase the number of VAT agencies in the country to boost the VAT productivity.

Mwakalobo (2015) studied the dynamics of revenue generation in Tanzania, Kenya, and Uganda. The results found revenue generation to be low in Tanzania, compared to Uganda and Kenya. Factors found to contribute to revenue generation in these countries includes macroeconomic environment, economic structure, and level of development. The study further found that the countries under study have a potential of generating more revenue provided they address the problems from their tax system. Some of the ways to improve revenue generation suggested by the study includes computerisation of tax collection, tax base expansion, addressing the tax revenue leaking challenges and instituting strong legal enforcements.

Nzimande and Ngalawa (2022) investigated the relationship between revenue and spending in the Southern African Development Community (SADC) using the panel bootstrap Granger Causality technique for periods between 1980-2018. The study found no evidence of a causal relationship between revenue and spending in eleven SADC countries under study. This means that the government in these countries can change either their spending or revenues or both. In

Botswana, however, the study did show evidence of a relationship between spending and revenue, implying that governments should change their revenues to eliminate the budget imbalances. Lastly, the study also found evidence of a spend-tax hypothesis in Mauritius and Mozambique, suggesting that both past and current expenditures are the sources of revenue in these countries. As a result, a reduction in spending would reduce the budgetary disequilibrium in these countries.

3. Methodology

3.1 Data and empirical model estimation

The study utilises borrowed time series data spanning for the period from 1972 to 2021 sourced from the World Bank to analyse the determinants of taxation in South Africa utilising gross domestic product per capita (GDP) as a proxy for economic growth, the level of trade, inflation, and government expenditure as control variables shown in the tax function below.

TAX = f(GDP, TRADE, INFLATION, GOVERNMENT EXPENDITURE)…… (3.1)

Table 3.1 Data Sources and Description

Symbol	Variable	Description	Unit	Source
LTAX	Taxes on goods and services	Taxes on goods and services include general sales and turnover or value added taxes, selective excises on goods, selective taxes on services, taxes on the use of goods or property, taxes on extraction and production of minerals, and profits of fiscal monopolies.	% Of revenue	World Bank
LGDP	Gross Domestic Product per Capita	It measures a country's economic output per person and is calculated by dividing GDP by population of a country.	Annual %	World Bank
LTRA	Trade	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	% of GDP	World Bank
LINF	Inflation	Inflation as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole. The	Annual %	World Bank

		GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency.		
LGOV	Government expenditure	General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defence and security but excludes government military expenditures that are part of government capital formation.	% of GDP	World Bank

Source: Authors' own compilation

The empirical model estimation utilised in the study was adopted from the studies of Okonkwo (2018). The study modifies this model to suit the study's main objective. The linear econometric model can be specified as follows:

$$LTAX_t = \beta_0 + \beta_1 LGDP_t + \beta_2 LTRA_t + \beta_3 LINF_t + \beta_4 LGOV_t + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots (3.2)$$

Whereby,

LTAX = natural logarithm of tax revenue as a percentage of GDP

LGDP = natural logarithm of gross domestic product per capita

LTRA = natural logarithm of trade as a percentage of GDP

LINF = natural logarithm of inflation rate

LGOV = logged government expenditure as a percentage of GDP.

ε_t = is the error term

t = refers to the period

β_{0_4} = refers to the constants

3.2 Unit root

Tests of unit root are estimated at first before estimating Autoregressive Distributed Lags (ARDL) model. This is done to determine the level of integration of variables and avoid problems of spurious regressions if the variables are found to be stationary. The study employs the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root test proposed by Dickey, Hasza et al. (1984) and Phillips and Perron (1988). This study is used to determine the long-time properties of the variables employed in the model. If a time series is found to be stationary, it means that its variance, mean, and covariance remain constant over time, and that the result of their analysis is reliable and can be used to forecast future economic activities. The study also employs the VAR lags criterion to determine the optimal number of lags to use in the estimation.

3.3 ARDL Model and long run relationships

The study adopts the Autoregressive Distributed Lags model proposed by Pesaran, Shin et al. (2001) to analyse the determinants of taxation in South Africa. Studies that make the literature review shows that majority of the studies on the determinants of taxation has been utilizing panels models, Ordinary Least Squares and Vector Error Correction Granger Causality models. This study, however, utilises the ARDL model to show the short run and long run relationships between the variables and to reveal if the results found by majority of the studies in the literature section is the same in South Africa. The ARDL model for long run relationships can be specified as given in Equations 3.3 to 3.7 below:

$$LTAX_t = \beta_{01} + \sum_{i=1}^{p} k_{11}\, LTAX_{t-i} + \sum_{i=1}^{q} k_{21}\, LGDP_{t-i} + \sum_{i=1}^{q} k_{31}\, LTRA_{t-i} + \sum_{i=1}^{q} k_{41}\, LINF_{t-i} + \sum_{i=1}^{q} k_{51}\, LGOV_{t-i} + \varepsilon_t \quad \text{(3.3)}$$

$$LGDP_t = \beta_{02} + \sum_{i=1}^{p} k_{12}\, LGDP_{t-i} + \sum_{i=1}^{q} k_{22}\, LTAX_{t-i} + \sum_{i=1}^{q} k_{32}\, LTRA_{t-i} + \sum_{i=1}^{q} k_{42}\, LINF_{t-i} + \sum_{i=1}^{q} k_{52}\, LGOV_{t-i} + \varepsilon_t \quad \text{(3.4)}$$

$$LTRA_t = \beta_{03} + \sum_{i=1}^{p} k_{13}\, LTRA_{t-i} + \sum_{i=1}^{q} k_{23}\, LGDP_{t-i} + \sum_{i=1}^{q} k_{33}\, LTAX_{t-i} + \sum_{i=1}^{q} k_{43}\, LINF_{t-i} + \sum_{i=1}^{q} k_{53}\, LGOV_{t-i} + \varepsilon_t \quad \text{(3.5)}$$

$$LINF_t = \beta_{04} + \sum_{i=1}^{p} k_{14}\, LINF_{t-i} + \sum_{i=1}^{q} k_{24}\, LTRA_{t-i} + \sum_{i=1}^{q} k_{34}\, LGDP_{t-i} + \sum_{i=1}^{q} k_{44}\, LTAX_{t-i} + \sum_{i=1}^{q} k_{54}\, LGOV_{t-i} + \varepsilon_t \quad \text{(3.6)}$$

$$LGOV_t = \beta_{05} + \sum_{i=1}^{p} k_{15}\, LGOV_{t-i} + \sum_{i=1}^{q} k_{25}\, LINF_{t-i} + \sum_{i=1}^{q} k_{35}\, LTRA_{t-i} + \sum_{i=1}^{q} k_{45}\, LGDP_{t-i} + \sum_{i=1}^{q} k_{55}\, LTAX_{t-i} + \varepsilon_t \quad \text{(3.7)}$$

3.4 ARDL-Error Correction Model and short run relationships

After confirmation of long run relationships existing between taxation, economic growth, trade, inflation, and government expenditure using the ARDL-Bounding tests to cointegration, the study employs the ARDL-ECM model to determine the short run relationships between the variables. Short run dynamic error correction model can be derived from the ARDL long run estimations models made through a simple linear transformation. Equations 3.8 to 3.12 below shows the ARDL-ECM model whereby, ECT_{t-1} is an error correction term that should be negative and statistically significant, Δ represents the differenced short run variables while λ shows the coefficient of the speed of adjustment to long run equilibrium:

$$\Delta LTAX_t = \beta_{01} + \sum_{i=1}^{p} \alpha_{11} \Delta LTAX_{t-i} + \sum_{i=1}^{q} \alpha_{21} \Delta LGDP_{t-i} + \sum_{i=1}^{q} \alpha_{31} \Delta LTRA_{t-i} + \sum_{i=1}^{q} \alpha_{41} \Delta LINF_{t-i} + \sum_{i=1}^{q} \alpha_{51} \Delta LGOV_{t-i} + \lambda ECT_{t-1} + \varepsilon_t \quad \text{(3.8)}$$

$$\Delta LGDP_t = \beta_{02} + \sum_{i=1}^{p} \alpha_{12} \Delta LGDP_{t-i} + \sum_{i=1}^{q} \alpha_{22} \Delta LTAX_{t-i} + \sum_{i=1}^{q} \alpha_{32} \Delta LTRA_{t-i} + \sum_{i=1}^{q} \alpha_{42} \Delta LINF_{t-i} + \sum_{i=1}^{q} \alpha_{52} \Delta LGOV_{t-i} + \lambda ECT_{t-1} + \varepsilon_t \quad \text{(3.9)}$$

$$\Delta LTRA_t = \beta_{03} + \sum_{i=1}^{p} \alpha_{13} \Delta LTRA_{t-i} + \sum_{i=1}^{q} \alpha_{23} \Delta LGDP_{t-i} + \sum_{i=1}^{q} \alpha_{33} L\Delta TAX_{t-i} + \sum_{i=1}^{q} \alpha_{43} \Delta LINF_{t-i} + \sum_{i=1}^{q} \alpha_{53} \Delta LGOV_{t-i} + \lambda ECT_{t-1} + \varepsilon_t \quad \text{(3.10)}$$

$$\Delta LINF_t = \beta_{04} + \sum_{i=1}^{p} \alpha_{14} \Delta LINF_{t-i} + \sum_{i=1}^{q} \alpha_{24} \Delta LTRA_{t-i} + \sum_{i=1}^{q} \alpha_{34} \Delta LGDP_{t-i} + \sum_{i=1}^{q} \alpha_{44} \Delta LTAX_{t-i} + \sum_{i=1}^{q} \alpha_{54} \Delta LGOV_{t-i} + \lambda ECT_{t-1} + \varepsilon_t \quad \text{(3.11)}$$

$$\Delta LGOV_t = \beta_{05} + \sum_{i=1}^{p} \alpha_{15} \Delta LGOV_{t-i} + \sum_{i=1}^{q} \alpha_{25} \Delta LINF_{t-i} + \sum_{i=1}^{q} \alpha_{35} \Delta LTRA_{t-i} + \sum_{i=1}^{q} \alpha_{45} \Delta LGDP_{t-i} + \sum_{i=1}^{q} \alpha_{55} \Delta LTAX_{t-i} + \lambda ECT_{t-1} + \varepsilon_t \quad \text{(3.12)}$$

3.5 Diagnostics Tests

3.5.1 Serial Correlation: The study will utilise the Breusch-Godfrey Serial Correlation LM test to determine serial correlation in the model.

3.5.2 Heteroskedasticity: The study will utilise the Breusch-Pagan-Godfrey test to find out if the condition of homoscedasticity is found or not in the estimated model.

3.5.3 Normality test: The study will employ the Jarque-Berra histogram normality test to check if the estimated model's residuals are normally distributed and ascertain no violation of the normality rule of linear models.

3.5.4 Stability tests: The study will rely on the CUSUM SUM, CUSUMSQ and Ramsey RESET tests to ensure the stability of the estimated parameter.

4. Results and Interpretations

Table 4.1: ADF and PP Unit root test

Variables	**Augmented Dickey-Fuller**				**Phillips-Perron**			
	Constant		Trend & Intercept		Constant		Trend & Intercept	
	Level	Δ	Level	Δ	Level	Δ	Level	Δ
LTAX	-1.8007	-6.9079 ***	-1.5126	-7.8744 ***	-1.8007	-7.0156 ***	-1.5126	-7.4536 ***
LGDP	-4.9668 ***	-7.1857 ***	-4.9270 ***	-7.0451 ***	-4.9868 ***	-21.285 ***	-4.9486 ***	-20.525 ***
LTRA	-2.1440	-6.8659 ***	-2.4239	-6.7853 ***	-2.0284	-7.8132 ***	-2.3629	-7.6824 ***
LINF	-1.2722	-10.791 ***	-4.8507 ***	-10.652 ***	-2.3902	-11.178 ***	-4.9665 ***	-11.031 ***
LGOV	-1.9050	-7.3106 ***	-2.009	-7.4836 ***	-1.9188	-7.3127 ***	-1.9457	-7.5045 ***

Source: Authors' own computation

The study performed the unit root test as shown in Table 4.1 above for the ADF and PP tests. The results reveal that LTAX, LTRA, LINF and LGOV are stationary at first difference as shown by the ADF and PP unit root test results. However, LGDP is found to be stationary at the level form and first difference. These results bring to a conclusion that LTAX, LTRA, LINF and LGOV are integrated of high order one, I(1), while LGDP is integrated of order zero, I(0). This means that it is suitable to employ the ARDL model since it can only be estimated if the variables are stationary at level form, first difference or a mixture of both I(0) and I(1) to analyse the determinants of taxation in South Africa for the period from 1972 to 2021. The study continues to perform the optimal lag length criterion as shown in Table 4.2 below to reveal the optimal number of lags to employ in the model.

Table 4.2: Lag Length Criterion

Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-447.0186	NA	576.4869	20.54630	20.74905*	20.62149

1	-412.1916	60.15573*	371.9575*	20.09962*	21.31611	20.55075*
2	-389.2355	34.43415	427.2052	20.19252	22.42276	21.01960
3	-371.5136	22.55513	670.6827	20.52334	23.76733	21.72637
4	-350.9349	21.51410	1050.126	20.72431	24.98204	22.30328

Source: Authors' computation

The ADF and PP unit root tests confirmed that the variables selected in this study are stationary at level, that is, LTAX, LTRA, LINF and LGOV, while LGDP is stationary first difference. The study performed the optimal lag length criterion as shown in Table 4.2 above to reveal the optimal or recommended number of lags to utilise in the study. The results of LR, FPE, AIC and HQ revealed that only one lag can be utilised in this study while the results of SC reveal zero lags to be utilised in the study. The study, however, will utilise one lag as revealed by majority of the criterions in Table 4.2 above. The study continues to perform the ARDL Bounds tests to check for cointegration relationships among the variables in the study as shown in Table 4.3 below.

Table 4.3 ARDL Bound Test to Cointegration

F-Bounds Test		**Null Hypothesis: No levels relationship**		
Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	19.90372	10%	2.45	3.52
k	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06
t-Bounds Test				
t-Statistic	-8.512195	10%	-2.57	-3.66
		5%	-2.86	-3.99
		2.5%	-3.13	-4.26
		1%	-3.43	-4.60

Source: Authors' own computation

Upon determining the optimal number of lags to utilise in the model, the study employed the ARDL F-Bounds and t-Bounds test as shown in Table 4.3 above to reveal if there is presence of long run relationships among the variables. The resulst of F-Bounds has an F-statistic of 19.90372 that is greater than the I(0) and I(1) bound value at 1%, 2.5%, 5% and 10% level of significance which confirms the rejection of the null hypothesis (Ho) of there being no long

run relationship. The t-Bounds test has a t-statistic of -8.512195 that is below the I(0) and I(1) bound value at 1%, 2.5%, 5% and 10% level of significance which confirms the rejection of the null hypothesis (Ho) of there being no long run relationship, leading to the conclusion that there, in fact, exists a long run relationship among the variables in the model. This means that the study will estimate both the short run and long run relationships by utilising the regressions in given in equations 3.3 to 3.12 in section 3 above. The study therefore, continues to estimate long run relationship as given in Table 4.4 below:

Table 4.4 ARDL Long Run Results

Variable	Coefficient	Standard Error	Probability
LGDP(-1)	-0.020902	0.101543	0.8380
LTRA(-1)	-0.106097	0.054877	0.0607
LINF(-1)	-0.320284	0.108034	0.0052
LGOV(-1)	1.481772	0.534615	0.0086

Source: Authors' own computation

From the results in Table 4.4 above, there is a negative statistically insignificant long relationship between economic growth and taxation in South Africa. A 1% increase in economic growth in the long run in South Africa, will insignificantly result in taxation declining by 0.02%, ceteris paribus. Though the resulst are insignificant in the long run, these results entail that an increase in economic growth in South Africa has a detrimental effect of taxation. This entail that if they want to increase the level of taxation in South Africa, the policy makers and the government must revise policies on economic growth so ita can significantly influence taxation in the long run. These results are inconsistent with the studies of Okonkwo (2018), Onakoya, Afintinni et al. (2017) and Lanem, Jocelyn et al. (2020).

Furthermore, the results reveal that there is a negative statistically significant long run relationship between trade and taxation in South Africa. A 1% increase in trade in the long run in South Africa, significantly result in taxation declining by 0.11%, ceteris paribus. These results entail that increase in the level of trade has a detrimental effect on taxation. Therefore, the policy makers, government and Department of Trade in South Africa need to revise policies on trade if they want to raise taxation.

Moreso, the results in Table 4.4 above reveal that there a negative statistically significant long run relationship between inflation and taxation in South Africa. A 1% increase in inflation in

South Africa in the long run, significantly result in taxation falling by 0.32%, ceteris paribus. These results entail that inflation has a detrimental effect on the level of taxation in South Africa and calls for the government, Minister of Finance and policy makers to revise policies on inflation when it comes to taxation. These results are inconsistent with the results of Prowd and Kollie (2021), while consistent with the study of Okonkwo (2018).

However, the results reveal that there is a positive statistically siginificant long run relationship between government expenditure and taxation in South Africa. A 1% increase in government expenditure in the long run in South Africa, siginificantly result in taxation rising by 1.48%, ceteris paribus. These results entail that general government final consumption expenditure is the only detrminat that positively influence taxation in the long run. These results make economic sense since the fiscal policy is financed through government expenditure and taxation, therefore, it makes economic sense that the more the government collects, the more it can spend in the economy. The study continues to estimate short run relationships as shown in Table 4.5 below.

Table 4.5 ARDL ECM Regression

Unrestricted ARDL Error Correction Regression			
Variable	**Coefficient**	**Standard Error**	**Probability**
C	-0.018705	0.180407	0.9180
DLGDP(-1)	0.347555	0.077236	0.0001
DLTRA(-1)	-0.117215	0.057211	0.0474
DLINF(-1)	-0.168574	0.038191	0.0001
DLGOV(-1)	0.807455	0.223938	0.0009
CointEq(-1)	-1.104786	0.105340	0.0000
R-Squared	0.770445		
Adjusted R-Squared	0.748583		
Durbin-Watson	2.115152		

Source: Authors' own computation

From Table 4.5 above, there is a positive statistically significant short run relationship between economic growth and taxation in South Africa. A 1% increase in economic growth in the short run in South Africa, it will significantly result in taxation rising by 0.35%, ceteris paribus. This entail that economic growth is favourable for the growth of taxation in South Africa. This means that the current policies on economic growth are favourable for taxation. These results

makes economic sense as we economically expect that the rise in economic growth will result in more taxes collected. These results are consistent with the study of Okonkwo (2018), Onakoya, Afintinni et al. (2017) and Lanem, Jocelyn et al. (2020).

Furthermore, there is a negative statistically significant short run relationship between trade and taxation in South Africa at 5% level of significance. A 1% increase in trade in the short run in South Africa, will significantly result in taxation falling by 0.12%, ceteris paribus. These results entail that trade is detrimental for taxation in South Africa. Therefore, policymakers and government must revise trade policies if they want it to be favourable for taxation in South Africa. These results are consistent with the study of Sen Gupta (2007).

There is a negative statistically significant short run relationship between inflation and taxation in South Africa. A 1% increase in inflation in South Africa in the short run, will significantly result in taxation falling by 0.17%, ceteris paribus. This entail that inflation is a detrimental factor towards the level of taxation in South Africa. This means policy makers and government needs to keep observing the policies on inflation as they significantly affect taxation in South Africa.

Moreover, there is a positive short run statistically significant relationship between government expenditure and taxation in South Africa. A 1% increase in government expenditure in the short run in South Africa, will significantly result in taxation rising by 0.81%, ceteris paribus. This entail that the rise in government expenditure in South Africa is the key driver in increasing taxation. This means that if the government and policy makers want to increase taxation, they need to increase their government spending as part of the fiscal policy to stimulate economic activities in South Africa as alluded by Hlongwane, Mmutle et al. (2021). These results are inconsistent with the study of Du Preez and Stoman (2019).

The results in Table 4.5 above shows an error correction term of -1.104786 that is negative statistically significant with a p-value of 0.0000. This means that 104% errors in taxation are corrected annualy towards long run equilibrium. The R-Squared is having a value of 0.770445, indicating a favourable goodness of fit, meaning 77% of the results in the model are explained by the model while 23% of the results is explained by the error term. The adjusted R-squared is 0.748583, meaning that 75% of the results are adjusted for the degrees of freedom. The Durbin-Watson statistic has a value of 2.115152 that is greater than 2, indicating that the residuals from the model won't be suffering from serial correlation issues. The study therefore

continues to perform residual diagnostics as shown below in Tables 4.6 to 4.8 and Figures 4.1 to 4.3 respectively.

Table 4.6 Heteroskedasticity Test

TEST	PROBABILITY	DECISION
Breusch-Pagan-Godfrey	0.4134	Fail to reject Ho
Harvey	0.2265	Fail to reject Ho
Glesjer	0.3135	Fail to reject Ho
ARCH	0.1945	Fail to reject Ho

Source: Authors' own computation

The results show that the probability for all the four residual diagnostic tests, that is, Breusch-Pagan-Godfrey (0.4134), Harvey (0.2265), Glesjer (0.3135) and ARCH (0.1945) is greater than 0.05 or 5% and meaning that we cannot reject the null hypothesis (Ho) of homoskedasticity. This concludes that there is no heteroskedasticity present in the residuals of our selected model. These results are consistent with the prior expectations of our model as stated in the preceding chapter that a good model must not suffer from heteroskedasticity of the residuals.

Table 4.7 Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test			
Null hypothesis	**No serial correlation at up to 1 lag**		
F-statistic	1.377468	Prob. F(1, 37)	0.2480
Obs*R-squared	1.686953	Prob. Chi-Square(1)	0.1940

Source: Authors' own computation

The results of the Breusch-Pagan-Godfrey serial correlation test above has a probability Chi-Square of 0.1940 meaning that we fail to reject the null hypothesis (Ho) of no serial correlation up to 1 lag that was used in the study. We can therefore conclude that there is no serial correlation present in the residual from the model utilised in the study.

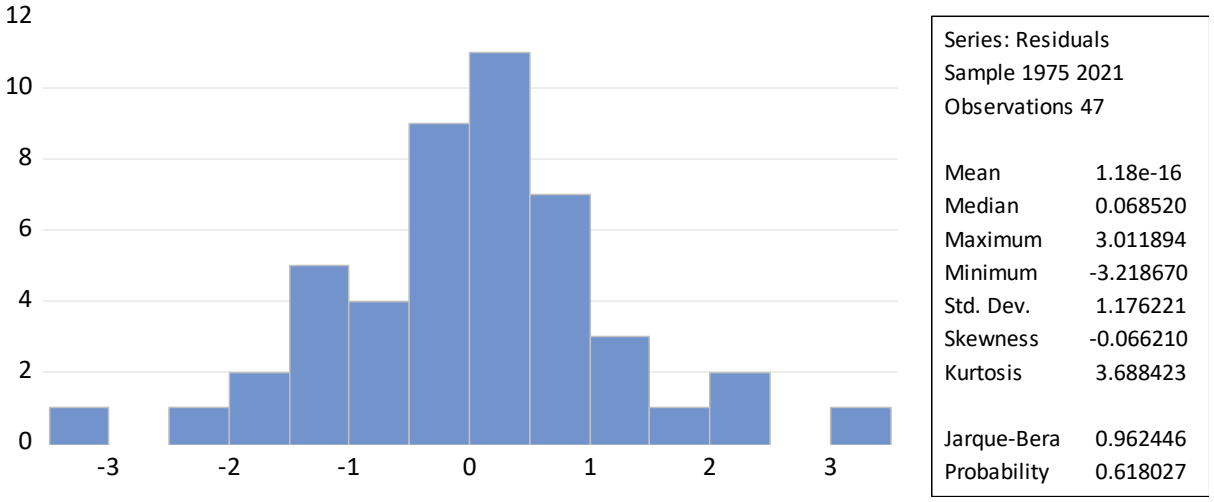
Table 4.8 Ramsey RESET Test

Tests	Value	df	Probability
t-statistic	0.323782	37	0.7479
F-statistic	0.104835	(1, 37)	0.7479
Likelihood ratio	0.132981	1	0.7154

Source: Authors' own computation

The results in Table 4.8 above from the Ramsey test have the F-statistical probability of 0.7479 that is above 5%. This means that we fail to reject the null hypothesis and conclude that the model was correctly specified for analysing the relationship between the variables for the period understudy and linearity in the data used.

Figure 4.1 Histogram Normality Test



Source: Authors' own computation

The study performed the Jarque-Berra histogram normality test highlighted in Section 3 of the study as shown in Figure 4.1 above. The JB statistic is 0.962446 with a p-value of 0.618027 implying that we fail to reject the null hypothesis (Ho) that the residuals from the model are normally distributed. This brings us to a conclusion that the residuals are indeed normally distributed, and this is consistent with the expectations of the linear model. The study continues to perform the CUSUM stability tests as shown in Figures 4.2 and 4.3 below.

Figure 4.2: Cusum Test

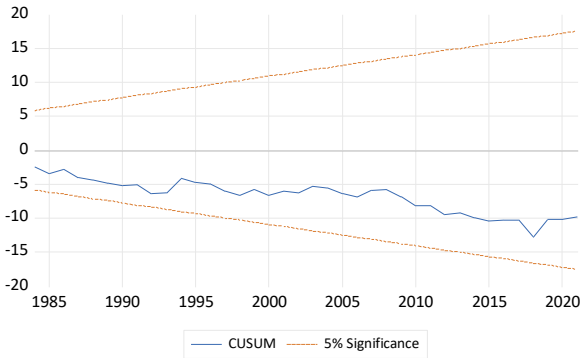
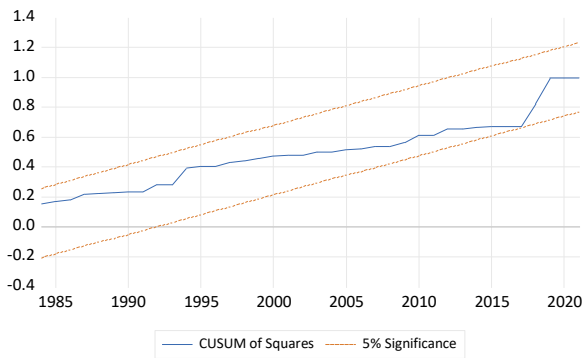


Figure 4.3: Cusum of Squares



Source: Authors' own computation Source: Authors' own computation

The study performed the CUSUM stability tests as shown in Figures 4.2 and 4.3 above. As shown in figure 4.2 and 4.3 above, the results of the CUSUM and CUSUM square test shows that the model is stable as indicated by the blue lines lying within the 5% critical regions. The blue line trend in figure 4.2 and 4.3, drifts upwards and downwards without overshooting the 5% (red lines) meaning the residuals are stable for the period understudy. In simplicity this confirms that our chosen model for the study is stable and reliable.

5. Conclusion and recommendations

The study analysed the determinants of taxation in South Africa by using economic growth, trade, inflation, and government expenditure to formulate a multivariate equation. The study performed the ADF and PP unit root test, ARDL Bounds test to cointegration, and optimal lag length criterion. The objective was fulfilled by employing the ARDL model to check the short and long run relationships among the variables. The study checked for the reliability of the results from the model by performing model and residual diagnostics tests of CUSUM, Ramsey RESET, Jarque-Berra normality, heteroskedasticity and serial correlation tests and found that all the properties of linear model were not violated, and the results are reliable for policy making.

These results bring to the following policy implications for the study: Firstly, the ARDL model revealed that there is a negative statistically insignificant long run and positive short run statistically significant relationship between economic growth and taxation in South Africa. This supports the idea that economic growth plays an important role for taxation in the short run and in the long run, however, it is found to be negative. The government and policymakers must revise policies on economic growth if they want to increase taxation since the effect in the long run it is detrimental.

Secondly, there is a negative statistically significant short and long run relationship between trade and taxation in South Africa. This calls for the Department of Trade, the government, and policymakers to revise policies on trade so it can increase the level of taxation collected in South Africa to boost fiscal stimulus. The government can improve this by checking on specific taxes applicable to trade of goods and services.

Thirdly, the government must revise fiscal policies on inflation as it is detrimental for taxation in South Africa since it was found to have a negative statistically significant relationship both

in the short and long run period. The government can improve policies on inflation by implementing instruments that help keep the inflation levels at minimal points so as to increase the amount of taxes collected to help stimulate fiscal policy much needed for improving the economic health.

Fourthly, there is a positive statistically significant short and long run relationship between government expenditure and taxation in South Africa. This confirms that for South Africa to collect more taxes, it should increase its government consumption expenditure. Therefore, this brings to a policy implementation of increasing government expenditure in South Africa to stimulate tax revenue collected.

The primary objective of this study was to analyse the determinants of taxation in South Africa. The objective was discovered by the discovery of the results in Section 4 of the study with economic growth, trade, inflation, and government expenditure as control variables on an ARDL model for short and long run relationships. In conclusion, government expenditure is a positive determinant, inflation and trade are negative determinants, while economic growth based on short run results is a positive determinant of taxation. Studies in future should consider using different models and data span to reveal new insights in the field.

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