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Structural Determinants of Tax Revenue in Zambia

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Abstract
This study investigates the structural determinants of tax revenue in Zambia between 1991 and 2020. The ARDL bounds testing approach to cointegration is applied while robustness of long-run relationship is established by using a rolling window approach. We show that in the long run, tax revenue is largely influenced by the level of trade openness, inflation rate, exchange rate and GDP per capita. We find that trade openness and exchange rate have a positive impact on tax revenue while the inflation rate and GDP per capita have a negative influence. However, mineral rents and labour force participation rate are insignificant. Our findings are consistent with those of other studies conducted around the world, and they demonstrate the importance of a sound and stable macroeconomic condition, as well as favourable trade policies that may increase tax revenue inflows.
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1. Introduction

Taxes are a key source of revenue for most countries in the world including Zambia. This revenue inter alia is spent on improving and maintaining public infrastructure and funding public services. This in turn, promotes economic growth and macroeconomic stability for the benefit of all citizens. The history of human development has shown that taxes are essential, as they are related to the birth, existence and development of the state (Ha *et. al*., 2022). Taxes are not just an important source of revenue for the state budget but also related to economic growth, equitable distribution, and social stability. The primary goal of taxation is to generate income to cover government expenditures as well as to redistribute wealth and control economic activities (Jhingan, 2004). Anyanwu (1993) noted that taxes had three primary goals: raising money for the government, regulating the economy and economic activity, and controlling income and employment. Taxes also play an economic role in allocation, distribution, and stabilization. The allocation function of taxes consists of determining the pattern of production, the items that should be produced, who produces them, the connection between the private and public sectors, and the social balance between the two sectors (Nzotta, 2007). The distribution function of taxes refers to how the effective demand for economic products is distributed across people in society. The stabilization function of taxes tries to achieve a high level of employment, a tolerable degree of price stability, and an adequate pace of economic growth, while accounting for trade and balance-of-payments consequences (Ojong et al., 2016). According to Nwezeaku (2005), the extent of these tasks is determined by the people's political and economic orientation, their wants and ambitions, and their willingness to pay taxes. Therefore, the extent to which a government can conduct its responsibilities is mainly determined by its capacity to establish and administer a tax system, as well as citizen compliance.

Between 2014 and 2023, tax revenue contribution to the total budget in Zambia averaged approximately 55.2 percent but was on a downward trend (table 1). Domestic revenue generation further remained lower than other regions. Compared to Zambia, the average tax to GDP ratio in Eastern and Southern Africa is higher by two percent while Europe and central Asia by three percent. This can be evidenced from high levels of public debt and budget deficits. In 2013, the fiscal deficit was 5.7 percent but had risen to 8.2 percent by 2022. Though elevated, it is a reduction from 2020 when it had increased to as high as 14.0 percent (Ministry of Finance, 2015; Ministry of Finance and National Planning, 2023).

Table 1: Tax Revenue as a Percentage of Total Budget

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Tax revenue as a percentage of the total budget	62.4	67.0	57.2	58.0	57.4	54.1	50.7	44.5	45	55.9

Source: National Assembly of Zambia (2023)

An increase in tax revenue supports a balanced budget and as espoused by Keynesian economists, results in lower interest rates, increased savings and investment, reduced trade deficits, and faster long run economic growth. Wilford (1978) recommended that developing countries increasingly mobilise their own internal resources through tax revenue generation to enhance economic growth. Fiscal imbalance remains a major problem for most developing countries the past several decades. This is mainly attributed to rapid expansion of

government expenditure and low revenue collection (Ansari, 1982). Therefore, studying the effects of low tax revenue on economic performance depends on identifying factors affecting revenue and hence understanding the rationale for low levels of tax revenue which poses remedial mechanisms to correct prevailing problems of debt. Over dependence on foreign financing may in the long run lead to problems of debt sustainability. Furthermore, financing of a budget deficit through foreign borrowing may adversely affect the balance of payments, interest rates and the value of the local currency. In this regard, identifying the structural factors that affect tax revenue is important to ensure sufficient resources are generated which can then foster economic development.

The purpose of this paper is to identify the main structural determinants of tax revenue in Zambia. We use the autoregressive distributed lag (ARDL) approach of Pesaran and Pesaran (1997) and Pesaran et al. (2001) to test for the existence of a relationship between the tax revenue and various macroeconomic factors, namely, the inflation rate, real GDP per capita, exchange rate, mineral rents, trade openness and the labour force participation. Using an annual sample from 1991 to 2020, we show that in the long run, tax revenue is largely determined by the level of trade openness, inflation rate, exchange rate and GDP per capita. We find that trade openness and exchange rate have a positive impact on tax revenue while the inflation rate and GDP per capita have a negative influence. However, mineral rents and the labour force participation rate are insignificant. In the short run, labour force participation rate is significant and exerts a positive influence on tax revenue while mineral rents are insignificant. Trade openness and the exchange rate remain positively related to tax revenue in the short run while the inflation rate has a negative effect. In addition, the error correction term was negative and significant as expected implying that whenever there is a shock to the system, the model adjusts to its long run equilibrium at the speed of 131.6 percent within a year. This suggests an oscillatory approach towards the long run equilibrium.

Most studies done on this topic are multi-country in nature and use panel data for the Sub-Sahara African region or developing countries as a whole. Examples include Tanzi (1981), Leothold (1991), Stotsky and WoldeMariam (1997), Gupta (2007), Mahdavi (2008), Ahmed and Mohhamed (2010) and Ghani (2012). These studies generally focus on the role of social, political, economic, demographic, and historic factors as determinants of tax revenue with varying results. Country specific outcomes are, however, not clearly discernible from these studies and hence the results from our study provide new insights on factors that affect tax revenue in Zambia. Closely related to this paper is Haabazoka and Kaulu (2023) who examined the relationship between tax revenue mobilization and three of its predictors, external debt, FDI inflows and copper prices, in Zambia. They find a positive long run relationship between tax revenue and external debt and copper prices, while FDI inflows were insignificant. In this paper, our focus is on domestic macroeconomic indicators of economic performance and their relevance for explaining tax revenue generation.

The rest of the paper is organized as follows: Section two presents stylised facts on Zambia's taxation while section three surveys the literature. The methodology is presented in section four while the results and deliberations of the main findings are provided in section five. Section six concludes.

2. Tax Revenue in Zambia: Some Stylized Facts

This section provides a summary of what we know about tax revenue, fiscal deficit and economic growth in Zambia using a set of stylized facts.

Stylised fact 1: Zambia's tax to GDP ratio between 2009 and 2019 has been increasing but remains low relative to the average in other regions.

As stated in the introduction, tax revenue collection in Zambia is low. Figure 1 shows the revenue to GDP ratio for Zambia and the average for Eastern and Southern Africa and Europe and Central Asian regions between 2009 and 2019. We see that the tax to GDP ratio for Zambia has risen from 12.5 percent in 2009 to 17.5 percent in 2019. Notwithstanding, when compared to Zambia, the average tax to GDP ratio in Eastern and Southern Africa is two percentage points higher, while Europe and Central Asia is three percentage points higher. In the period under review, the average revenue to GDP ratio in Eastern and Southern Africa was relatively stable and oscillated around 18 percent and 19 percent for Europe and Central Asia. This is compared to an average of 16 percent for Zambia. As a result, our concern here is to identify factors that are driving Zambia's low revenue-to-GDP ratio. What structural factors influence tax revenue collection?

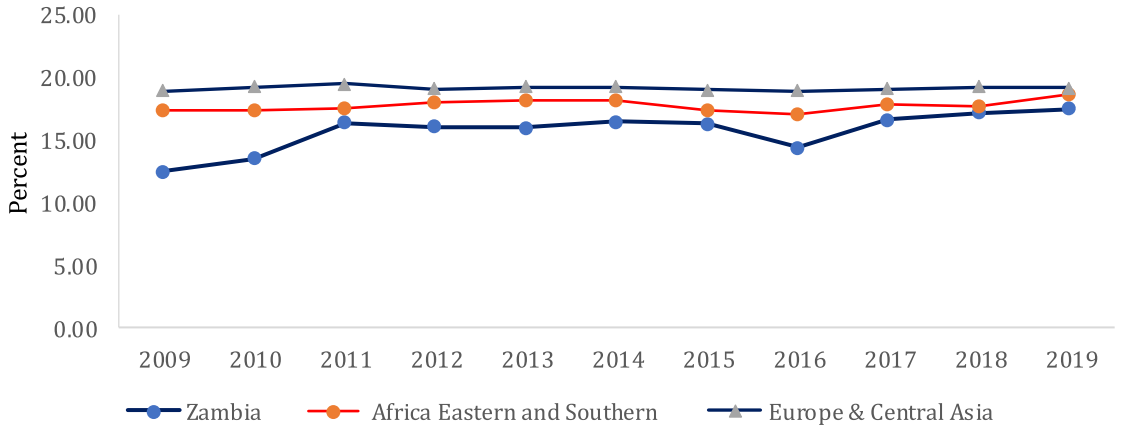

Figure 1: Tax Revenue to GDP Ratio (2009 – 2019)
Source: Zambia Revenue Authority (2023) and World Bank (2023)

Stylised fact 2: The fiscal imbalance in Zambia has been persistent and is rising.

An IMF study suggests that once the tax to GDP ratio reaches 12.75 percent, real GDP per capita increases sharply. Therefore, countries should aim to remain comfortably above this threshold — say, above 15 percent. In about half of all developing countries, tax ratios are below 15 percent of GDP compared with 18 percent in emerging economies and 26 percent in advanced economies (Gaspar *et al*., 2016). In this regard, much as a threshold of 12.75 percent may be good, improvement towards the 26 percent mark of the advanced economies, would be more desirable and "sufficient" for Zambia. This can be further confirmed by its expenditure pattern over the past nine years. Figure 2 compares the ratio of government expenditure to GDP with that of tax revenue to GDP from 2013 to 2022 as presented in the successful national budgets. It can be seen and observed that the country has been spending more than the revenue it generates. The expenditure to GDP ratio has averaged 26 percent while the revenue to GDP averaged 16.8 percent during the period under review. In this regard, a higher tax to GDP ratio of 26 percent would result in a balanced budget. On average, the gap between expenditure and revenue has averaged 9.2 percent but has risen from 10.6 percent in 2013 to 19.3 percent in 2022. The reasons behind this increase in the fiscal imbalance is high public expenditure amidst low revenue collection which induces the government to resort to other financing measures including debt. A more efficient tax system is crucial in closing this gap for Zambia.

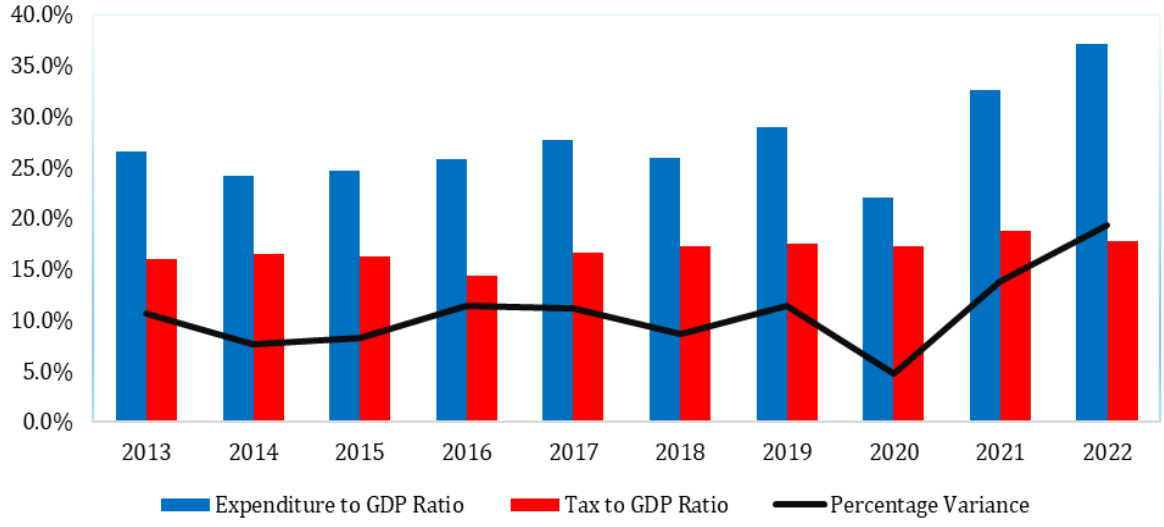

Figure 2: Ratio of Government Expenditure to GDP and Tax Revenue to GDP
Source: National Assembly of Zambia (2023) and Zambia Revenue Authority (2023)

Stylised fact 3: In terms of outcomes, tax revenue has a negative relation to economic growth between 1991 and 2020 but has some positive redistributive effects, particularly for the very vulnerable in Zambia.

Tax revenue is expected to have positive economic and redistributive effects. However, economically, tax revenue in Zambia is negatively correlated with economic growth, suggesting that as economic activity is increasing, the amount of tax revenue generated is reducing (Figure 3). Though counter-intuitive, this is

consistent with the findings of Mubanga (2022) that direct taxes in Zambia negatively affected economic growth in the short run, implying that every increase in direct taxes led to a reduction in economic growth, though there were positive benefits that could be expected in the long run. In terms of redistribution, from a global perspective, tax revenue as a percent of GDP positively impacts on intergenerational mobility (as measured by the years of schooling), a key aspect in reducing the persistence of inequality. For Zambia, tax revenue as a percent of GDP is relatively lower and levels of mobility are also lower, suggesting inequality persistence in the face of insufficient revenue generation as evidenced by the increasing fiscal deficit discussed in stylized fact 2. Interesting, between 2006 and 2022, we do find a negative relationship between tax revenue and both health and education spending in Zambia (Figure 4). This suggests that as tax revenue increased, budget allocations for some core public social services decreased. However, higher tax revenue is also associated with increased spending on social protection measures, which are primarily aimed at Zambia's vulnerable population, implying that this has been the main route of redistribution during the period. Given the negative correlation between growth in the economy and tax revenue, as well as evidence of some positive benefits of increased revenue collection, we seek to identify factors that are critical to understanding tax revenue generation.

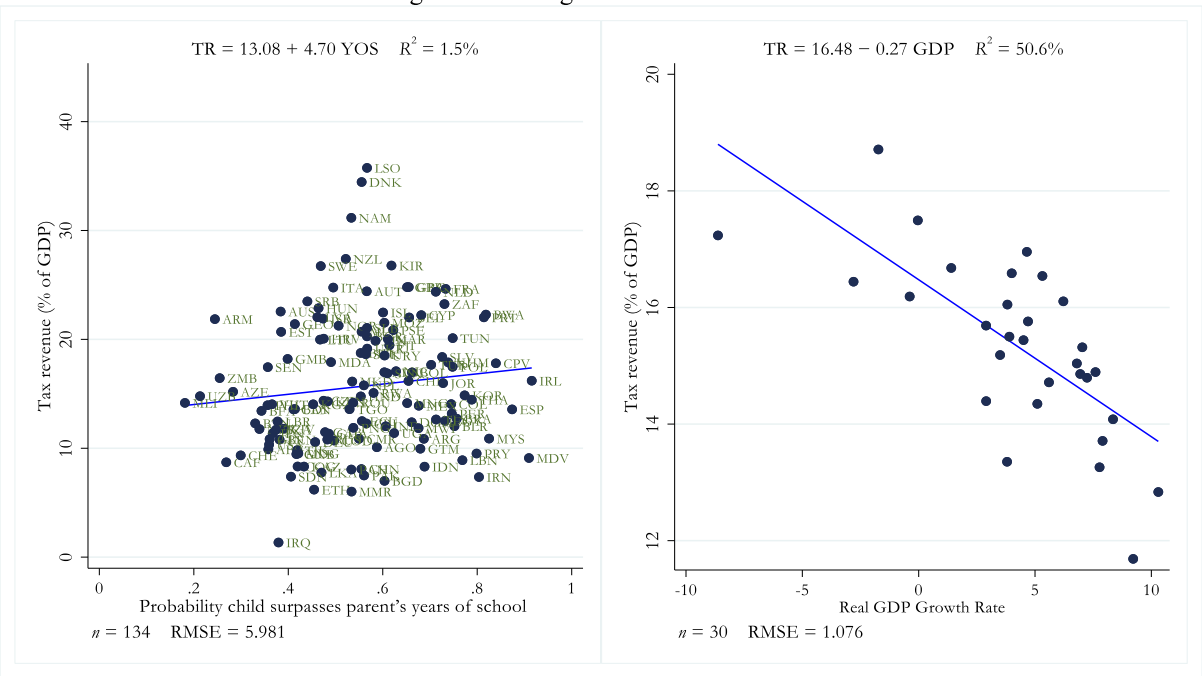

Figure 3: Tax Revenue, Economic Growth and Mobility
Notes: TR represents tax revenue as a percent of GDP, YoS is the years of schooling of the parent, GDP is the real GDP growth rate. Source: Authors computation from World Bank (2023), Zambia Statistics Agency (2023) and Zambia Revenue Authority (2023).

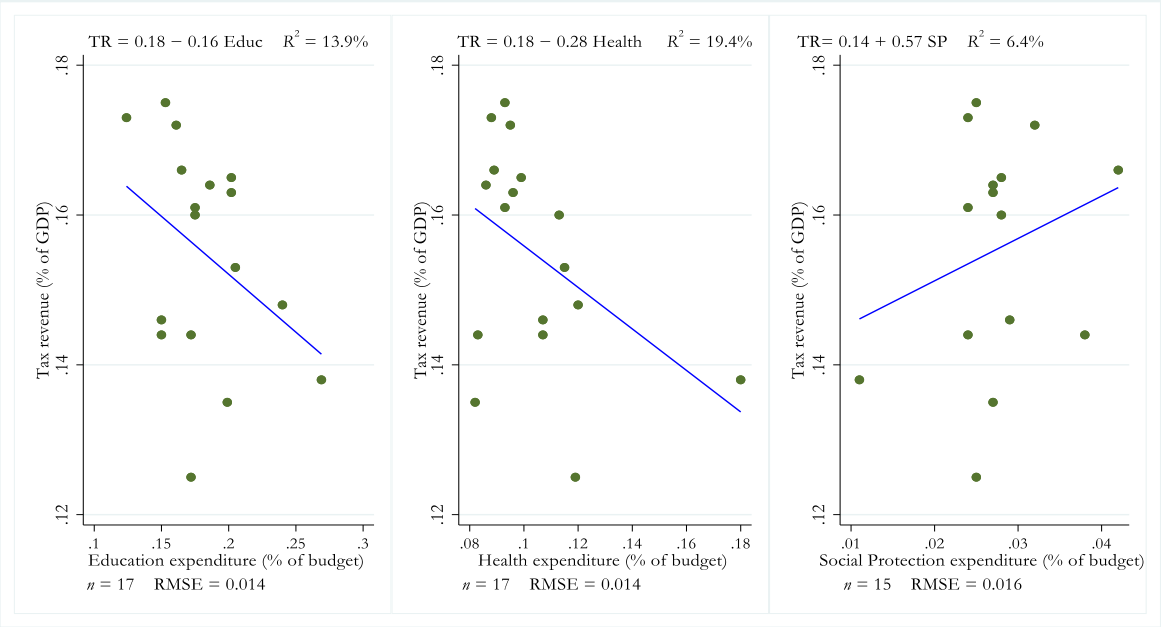

Figure 4: Correlations between Tax Revenue and Social Sector Spending in Zambia
Notes: TR represents tax revenue as a percent of GDP, Educ is planned education expenditure as percent of total budget, Health is planned health expenditure as percent of total budget, SP is planned social protection expenditure as percent of total budget. Source: Authors computation from National Assembly (2023)

3. Review of Empirical Studies

Most empirical works done that include Zambia are multi-country studies which focus on SSA countries or developing countries in general. Examples include Tanzi (1981); Leothold (1991); Stotsky and WoldeMariam (1997); Gupta (2007); Mahdavi (2008); Ahmed and Mohammed (2010) and Ghani (2012). For Sub-Sahara Africa (SSA), Tanzi (1981) found that mining and non-mineral export share positively affected the tax ratio. Still in the same region, Leuthold (1991) found a positive influence from trade share, but a negative one from the share of agriculture. Similarly, Stotsky and WoldeMariam (1997) found that both agriculture and mining share were negatively related to the tax while export share and per capita income had positive effect. They also found a positive but weak link between International Monetary Fund (IMF) programs and tax share. Ghura (1998) concluded that the tax ratio increases with income and the degree of openness and decreases with the share of agriculture in GDP. He also found that other factors like corruption, structural reforms and human capital development affected the tax ratio. While a rise in corruption is linked with a decline in tax ratio, structural reforms and an increase in the level of human capital was associated with an increase in tax ratio. In a study of the determinants of tax buoyancy of 25 developing countries, Ahmed and Mohammed (2010) revealed that growth in import and manufacturing sector had positive impact on growth of tax collection. The effect of agriculture was insignificant but unlike of the previous studies which found insignificant impact of service sector on tax buoyancy, this study found positive and significant impact on tax buoyancy due to the development of service sector in 1990s. One of the drawbacks of multi-country studies is that it is not easy to isolate a country's specific determinants of tax revenue. Hence, for more thorough analysis, country specific studies such as ours may be more appropriate.

Various country studies examining the determinants of tax revenue have been conducted. For Nigeria, Muibi and Sinbo, (2013) found that tax revenue tended to be significantly responsive to changes in income level, exchange rate and inflation rate, while Okonkwo (2018) identified money supply and interest rates as additional determinants of tax revenue. In Sierra Leone, in the long run real GDP, openness and official development assistance were found to be the main determinants of tax revenue, with positive coefficients (Tarawalie and Hemore, 2021). Aggrey (2011) examined the determinants of tax revenue with evidence from Ghana. The result showed that government expenditure was significant in generating tax revenue in the long run while it had a negative effect in the short run. In addition, the real gross domestic product exhibited a positive effect on tax revenue in the short run while it showed a negative impact in the long run. Furthermore, financial deepening had a negative impact on tax revenue both in the short run and long run. In South Africa, Hlongwane *et. al.* (2022) found that government spending had a positive impact while inflation and trade had a negative impact on taxation in both the short and long run. 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.

Karagöz (2013) found that in Turkey tax revenue was significantly affected by agricultural and industrial

sector share in GDP, foreign debt stock, monetisation rate of the economy and urbanisation rate whereas the sign of the agricultural sector's share was negative as expected. The results suggested that openness to foreign trade had no significant impact on tax revenues. In the Kenyan context, Aloo (2012) found that changes in oil prices and the exchange rate had a positive impact on tax revenue while GDP and changes in tax rates reflected a negative effect. Mossie (2011) examined the determinants of tax revenue in Ethiopia. The findings showed that in the long run real GDP per capita income, foreign aid and industrial value-added share of GDP positively and significantly affected tax revenue. However, inflation exerted a negative and significant influence. Whereas, in the short run only the level of real GDP per capita income, industrial value-added share of GDP and inflation rate were statistically significant. Real GDP per capita income and inflation had negative effects whereas industrial value-added share of GDP had a positive effect. Teera (2002) examined the tax system and tax structure of Uganda by investigating the factors effecting tax revenue in that country. The results showed that agriculture ratio, population density and tax evasion affected all types of taxes. The GDP per capita, tax evasion and openness showed a negative sign while aid had a positive sign.

For Zambia, aside from Haabazoka and Kaulu (2023) who found a positive long run relationship between external debt and tax revenue while copper prices only had a positive long run relationship with tax revenue at the 10 percent significance level and FDI inflows showed no relationship, there are no other existing works. Hence this paper contributes to the literature by highlighting the domestic structural determinants of tax revenue. A detailed summary of these studies is presented in Table 3A and 4A of the Appendix.

4. Data and Methodology

The study uses annual time series data for the period 1991 to 2020 to examine the structural determinants of tax revenue in Zambia. The data is obtained from the World Development Indicators. Tax revenue is defined as compulsory transfers to the central government for public purposes. Certain compulsory transfers such as fines, penalties, and most social security contributions are excluded. Refunds and corrections of erroneously collected tax revenue are treated as negative revenue (World Development Indicators, 2023).

Explanatory variables used are the exchange rate, trade openness, Gross Domestic Product (GDP) per capita, inflation rate, labour force participation rate and mineral rents. Variable selection was largely guided by literature review on the main determinants of tax revenue in developing countries as identified by Bahl (1971) and Chelliah *et. al*. (1975). The factors are consistent with more recent studies conducted on countries within the Sub-Saharan African region which include Gupta (2007), Keen *et. al*. (2009), Ghura (1998), Mahdavi (2008), Agbeyegbe *et al*. (2006) and Khattry and Mohan Rao (2002). All data is expressed in natural logarithms. Variable description and transformations are presented in Table 1A of the Appendix.

In this regard, tax revenue is expressed as a function of inflation rate, real GDP per capita, exchange rate, mineral rents, trade openness and the labour force participation rate as shown in equation 1 below.

Tax Revenue = f (Mineral Rents, Labour Force Participation Rate, Gross Domestic Product per Capita, Inflation Rate, Exchange Rate, Trade Openness) ……...……. (1)

Theoretically, trade liberalisation is expected to increase total tax revenue by increasing the share of trade tax revenue through imposing customs and excise duties on both imports and exports, Keen and Ligthart, (2002). In contrast, others argue that under trade liberalisation reforms, the reduction of trade restriction leads to reduction in trade tax receipts to federal government and thus less proportionate increase in total tax collection, Pritchett and Sethi, (1994). On the other hand, high inflation weakens the efficiency of tax collection (Tanzi 1978), even though a real depreciation of the exchange rate reinforces public revenues by boosting the tradable goods sector. Mineral rents, GDP per capital and labour force participation should enhance tax revenue generation based on the mining taxes and Pay As You Earn (PAYE). Correlations tests of our data presented in Table 2A in the appendix indicate positive relations between tax revenue and the inflation rate, labour force participation and trade openness while other variables are negatively related.

Table 2 summarises the results of the Phillips–Perron (PP), Kwiatkowski–Phillips–Schmidt–Shin (KPSS) and Augmented Dickey-Fuller (ADF) unit root tests for stationarity of the variables. The results show that the order of integration of the variables is a mix of both I(0) and I(1). The unit root analysis was undertaken using EViews 12.

Table 2: Results for the Unit Root Test

Variable	ADF Statistic	PP Statistic	KPSS Statistic	ADF order	PP order	KPSS order
Mineral Rents	-6.810	-10.653	0.366	I(1)	I(1)	I(1)
GDP per Capita	-12.040	-6.403	0.146	I(1)	I(0)	I(1)
Trade Openness	-6.084	-6.066	0.235	I(1)	I(1)	I(0)
Inflation	-4.399	-13.682	0.500	I(1)	I(1)	I(1)
Tax Revenue	-5.127	-7.278	0.308	I(1)	I(1)	I(0)
Labour Force Participation Rate	-4.161		0.102	I(0)	>I(1)	I(0)
Exchange Rate	-6.064	-5.029	0.422	I(0)	I(0)	I(1)

Source: Author's computation

4.1. Empirical Model

Under certain conditions (a mixed order of integration I(0) and I(1)), Pesaran and Shin (1995) later on developed by Pesaran *et. al*. (2001) discovered that long run relationships among macroeconomic variables can be studied using the Autoregressive Distributive Lag (ARDL) model. Furthermore, they showed that provided the lag order for the ARDL procedure has been correctly undertaken, OLS may be used for estimation and identification. Standard estimation results and inference can be made through the presence of unique long run association that is critical. These inferences are not only valid on long run results but also on the short run results. This implies that coefficients estimated can be used to conclude that the ARDL model is correctly augmented to explain simultaneous correlations between the stochastic terms of the data generating process included in the ARDL results. In addition, the understanding is that the ARDL model can also be applied even when the independent variables are endogenous. Moreover, the ARDL model is still valid regardless of the order of integration of the independent variables. However, caution is made when the variables are integrated of order I(2) because the model collapses when the variables are integrated more than I(1). The computed F-statistics give misleading results (Pesaran *et al.,* 2001). Hence, the importance of carrying out the unit root test to eliminate any uncertainties of having variables integrated of order I(2) or more.

Given that the variables are integrated both in levels and first difference, we adopt the ARDL model which can be specified as:

$$\Delta \log TR_t = \beta_1 + \sum_{i=1}^{n} \gamma_{1i}\, \Delta GDPPC_{t-i} + \sum_{i=1}^{n} \theta_{1j}\, \Delta LFPR_{t-j} + \sum_{i=1}^{n} \pi_{1p}\, \Delta TO_{t-p} + \sum_{i=1}^{n} \varphi_{1q}\, \Delta INFL_{t-q}$$

$$+\mu_1 \Delta MR_{t-1} + \mu_2 \Delta ER_{t-1} + \varepsilon_{1t} \quad \text{(2)}$$

On the other hand, in the presence of cointegration, the error correction representation of the ARDL that measures short run dynamics is specified as follows;

$$\Delta \log TR_t = \beta_1 + \sum_{i=1}^{n} \gamma_{1i}\, \Delta GDPPC_{t-i} + \sum_{i=1}^{n} \theta_{1j}\, \Delta LFPR_{t-j} + \sum_{i=1}^{n} \pi_{1p}\, \Delta TO_{t-p} + \sum_{i=1}^{n} \varphi_{1q}\, \Delta INFL_{t-q}$$

$$+\mu_1 \Delta MR_{t-1} + \mu_2 \Delta ER_{t-1} + \lambda ECT_{t-1} + \varepsilon_{1t} \quad \text{(3)}$$

5. Results and Discussion

Given that the variables are integrated both in levels and first difference, we adopt the ARDL model and proceed to test for cointegration within the framework of bounds testing approach to cointegration. The results confirm the presence of cointegration among the variables. The F-statistic value of 9.970 is greater than the upper bound values at all levels of significance. Therefore, we can reject the null hypothesis of no levels relationship. Empirically, the presence of cointegration means that there is a long run equilibrium relationship among the variables.

Table 3: Lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	36.20949	NA	0.006275	-2.246884	-1.908166	-2.149346
1	40.30763	5.674345*	0.004979*	-2.485203*	-2.098096*	-2.373730*
2	40.49295	0.242332	0.005350	-2.422534	-1.987039	-2.297127
3	40.51738	0.030076	0.005836	-2.347491	-1.863608	-2.20815
4	41.07562	0.644123	0.006129	-2.313509	-1.781238	-2.160234

Notes: *denotes selected optimal lag length selected. Source: Author's computation

The ARDL model is sensitive to the number of lags selected. Hence, the optimal lag length procedure was followed for all the criterion available in E-views 12 namely, Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), Hannan-Quinn Information Criterion (HQ), adjusted R-squared and Final Prediction Error (FPE). In this regard, the AIC is applied, and the criterion shows that the optimal lag in this case is one as shown in table 3 above. In addition, with the lag of one, the model exhibits no serial correlation and all other diagnostic tests namely normality, heteroscedasticity and functional form results are in order as shown in table 4 below.

Table 4: Diagnostic test results

Item	Test Applied	F-statistic	Prob
Serial correlation	Breusch-Godfrey LM test	1.834	0.197
Normality	Test of skewness and kurtosis	2.379	0.378
Heteroscedasticity	Breusch-Pagan-Godfrey	0.771	0.678
Functional form	Ramsey reset test	1.817	0.199

Source: Author's computation using EViews

Table 5 below shows the selected ARDL model based on the Akaike info criterion (AIC). The results indicate that the rate of inflation, GDP per capita and the lag of trade openness are statistically significant while mineral rents, labour force participation rate and exchange rate are statistically insignificant. The bounds test results show that there is cointegration in the model hence, indicating presence of long run relationship among the variables. The F-statistic is 9.970 and is significant at 5 percent level.

Table 5: Selected ARDL (1, 1, 1, 0, 1, 1, 1) based on Akaike info criterion.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Tax revenue**	-0.316	0.187	-1.692	0.111
Exchange rate*	0.227	0.117	1.935	0.072
Exchange rate**	0.110	0.082	1.336	0.202
Inflation*	-0.180	0.045	-4.001	0.001
Inflation**	-0.062	0.030	-2.030	0.061
GDP Per Capita*	-0.654	0.108	-6.070	0.000
Mineral rents*	0.008	0.006	1.360	0.194
Mineral rents**	0.009	0.006	1.406	0.180
Trade openness*	0.256	0.123	2.078	0.055
Trade openness**	0.494	0.157	3.142	0.007
Labour force participation rate*	4.653	2.353	1.977	0.067
Labour force participation rate**	-6.945	4.971	-1.397	0.183
C	14.663	13.716	1.069	0.302
@TREND	0.039	0.009	4.088	0.001

*= period 1 or t=1 and **=period 2 or t=2. Source: Author's computation

5.1. Long Run Results

Having established the existence of cointegration among the variables, we now proceed to estimate the long run equilibrium relationship. Table 6 below shows the results. In the long run, trade openness, inflation rate, exchange rate and GDP per capita are statistically significant. In particular, the inflation rate has a negative effect on tax revenue at 5 percent level of significance thereby confirming the Oliver–Tanzi effect with a coefficient of -0.183. According to Tanzi (1989), in developing countries, there exists a sizable time lag between the actual tax collection and the transaction to be taxed, in which tax at time of payment is small in real value as tax obligations become lower. This result is consistent with the findings of similar studies done in Ethiopia, Nigeria and Sub-Sahara Africa by Mossie (2011), Muibi and Sinbo (2013) and Oliver and Tanzi (1989) respectively.

The study also finds that trade openness has a positive influence on tax revenue with a coefficient of 0.570. This implies that a one percent increase in trade openness will result in tax revenue increasing by 0.57 percent in Zambia. This result is consistent with the findings of Gobachew *et al.* (2018) and Gnangnon and Brun (2019) who looked at similar studies in other parts of the world. However, Karagöz (2013) found no relationship in

Turkey while Teera (2002) found a negative relationship in Uganda.

Economic theory has also shown that changes in economic fundamentals such as exchange rate can either directly or indirectly change the size and structure of the tax base. We find that the exchange rate has a positive effect on tax revenue with a coefficient of 0.256. This is generally in line with findings by Aloo (2012) for Kenya and Muibi and Sinbo (2013) for Nigeria. However, Adam, Bevan and Chambas (2000) noted that depreciation and removal of real exchange rate disequilibrium lowers tax yield in French Community of Africa (CFA) countries while it has the opposite effect in non-CFA countries. A real depreciation of a currency would lead to an increase in excise tax and VAT or sales tax collections from imports Ebrill et al (2001). Labour force participation rate and changes in mineral rents are found to be insignificant determinants of tax revenue in Zambia in the long run. This is despite mineral exports accounting for up to 72 percent of total exports. However, the sign for mineral rents conforms to the literature reviewed and our general expectations while that of the labour force participation rate shows a surprising negative sign, suggesting that an increase in employment reduces tax revenue.

Table 6: Long Run Equilibrium Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Exchange rate	0.256	0.049	5.282	0.000
Inflation	-0.183	0.035	-5.257	0.000
GDP per capita**	-0.497	0.075	-6.601	0.000
Mineral rents	0.013	0.006	2.065	0.057
Trade openness	0.570	0.099	5.755	0.000
Labour force participation rate	-1.741	2.586	-0.673	0.511

** Variable interpreted as Z = Z(-1) + D(Z) where Z is the GDP per capita. Source: Author's computation using EViews

5.2. Short Run Results

After estimating the long run relationship, the final step in the ARDL model is the estimation of the error correction representation to get the short run relationship among the variables before performing diagnostic tests. Table 7 below presents the results of the error correction representation.

Bannerjee and Mestre (1998) emphasised that the existence of a stable long-run relationship among the variables is further confirmed by a significant error correction term. Thus, as expected, the error correction term is negative and significant implying that whenever there is a disturbance or shock to the system, the model adjusts to its long run equilibrium at the speed of 131.6 percent within a year. The behaviour of the speed of adjustment is similar to the findings of Teera (2002) in Uganda and described it to suggest that Uganda seeks to overcompensate for any shortfall in tax revenue in the previous period. Furthermore, Narayan and Smyth (2006) explained the meaning of a speed of adjustment that is more than 100 percent to imply that instead of monotonically converging to the equilibrium path directly, the error correction process fluctuates around the long-run value in a dampening manner. However, once this process is complete, convergence to the equilibrium path is rapid.

In contrast to the long run results, labour force participation rate is significant and exerts a positive influence on tax revenue while mineral rents remain insignificant. The results of labour force participation rate can be likened to the findings of Teera (2002) in Uganda who used population density to capture the effect of population on tax revenue and found a positive relationship. On the other hand, both trade openness and exchange rate maintained a positive influence on tax revenue both in the short run and long run. Inflation has a negative effect on tax revenue in the short run as well which reinforces the Oliver-Tanzi effect and in line with other studies.

Table 7: Error Correction Representation of the Selected ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	14.663	1.487	9.860	0.000
@TREND	0.039	0.004	10.019	0.000
Exchange rate	0.227	0.043	5.236	0.000
Inflation	-0.180	0.021	-8.464	0.000
Mineral rents	0.008	0.004	2.114	0.052
Trade openness	0.256	0.071	3.589	0.003
Labour force participation rate	4.653	1.449	3.211	0.006
CointEq(-1)*	-1.316	0.133	-9.885	0.000

Source: Author's computation using EViews

5.3. Model Stability

To check the stability of the model, the CUSUM and CUSUMSQ plots are presented in Figures 5 and 6 respectively. The results show that the model is stable at five percent level of significance.

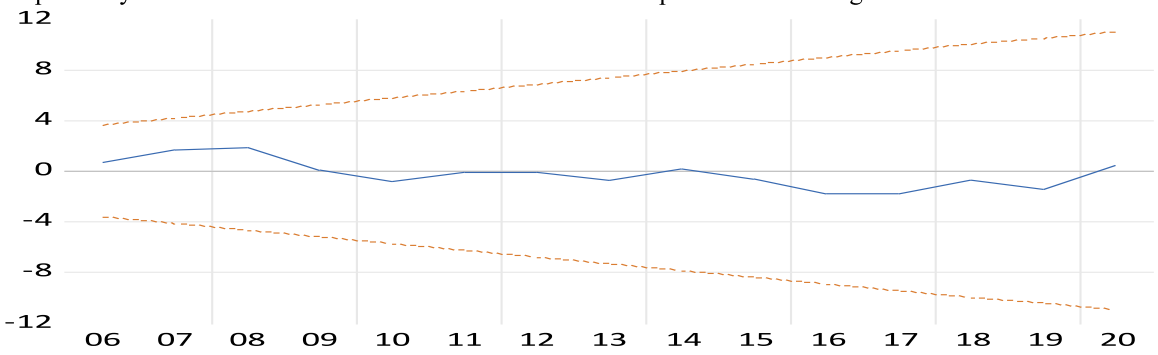

Figure 5: Results of Cumulative Sum of Recursive Residuals
The straight lines represent critical bounds at 5% level of significance.

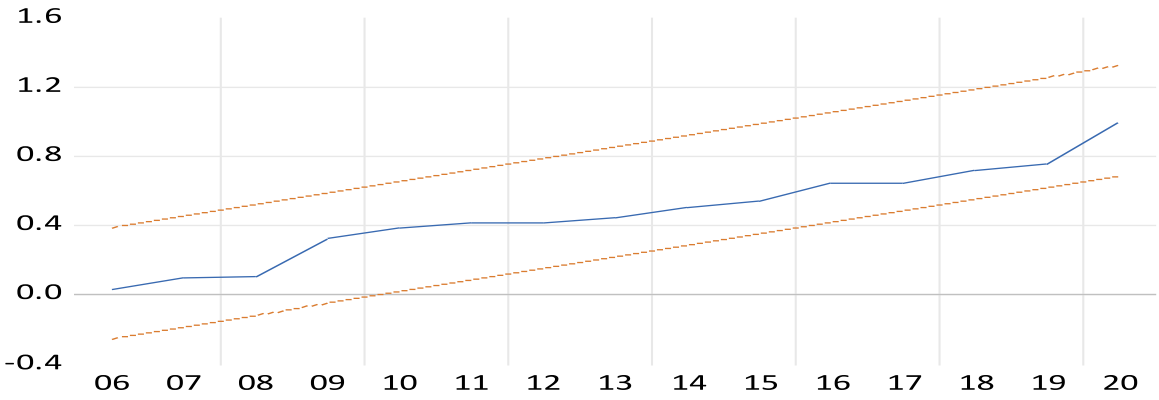

Figure 6: Results of Cumulative Sum of Squares of Recursive Residuals
The straight lines represent critical bounds at 5% level of significance.

6. Conclusion

This study examined the structural determinant of tax revenue in Zambia from 1991 to 2020. The exogenous variables were the inflation rate, exchange rate, mineral rents, trade openness, GDP per capita and labour force participation rate. The order of integration of the variables was a mixture of I(0) and I(1) and this rendered the application of the ARDL model developed by Pesaran and Shin (2001) appropriate.

The results show that in the long run, inflation rate, trade openness, exchange rate and GDP per capita are the main drivers of tax revenue in Zambia while mineral rents and labour force participation rate are statistically insignificant. In the short run, inflation rate, exchange rate, trade openness and labour force participation rate show some influence while mineral rents remain statistically insignificant determinants of tax revenue. The error correction (ECM) mechanism is negative and significant with the speed of adjustment of 131.6 percent if there is a shock in the model/system. The results are in line with similar studies in other parts of the world.

In terms of policy recommendations, the study emphasizes the importance of a strong and stable macroeconomic environment, as well as favourable trade policies, in increasing tax revenue inflows. Given that the Zambian economy is heavily reliant on the mining sector, and our findings that mineral rents are insignificant determinants of tax revenue in both the short and long run, we recommend a further investigation of how revenues from mining can be leveraged in such a way that it gradually contributes to the country's tax revenue generation.

The main limitation of the study is the lack of higher frequencies data for some variables, namely, trade openness, tax revenue, labour force participation rate, GDP per capita and mineral rents. This resulted in the adoption of annual data time series in the study. Future research may consider using higher frequency data such as quarterly or monthly data to improve insight. Furthermore, given that we focus on macroeconomic variables, the study can be extended by including demographic, social, historic and political variables in the model.

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Appendix

Table 1A: Variable description

Variable	Definition	Source of data	Transformation
Gross Domestic Product Per Capita (GDPPC)	Real Gross Domestic Product per Capita	World Bank (World Development Indicators)	Log of GDPPC
Annual Inflation Rate (INFL)	Inflation rate as measured by the growth rate in the average annual consumer price index.	World Bank (World Development Indicators)	Log of INFL
Exchange Rate (ER)	Nominal Kwacha to dollar exchange rate	World Bank (World Development Indicators)	Log of ER
Trade Openness (TO)	Sum of exports and imports as a percentage of GDP	World Bank (World Development Indicators)	Log TO
Mineral rents (MR)	The difference between the value of production for a stock of minerals at world prices and their total costs of production	World Bank (World Development Indicators)	Log of MR
Labour force Participation Rate (LFPR)	Labour force participation rate	World Bank (World Development Indicators)	Log of LFPR
Tax revenue (TR)	Tax revenue as a percentage of GDP	World Bank (World Development Indicators)	Log of TR

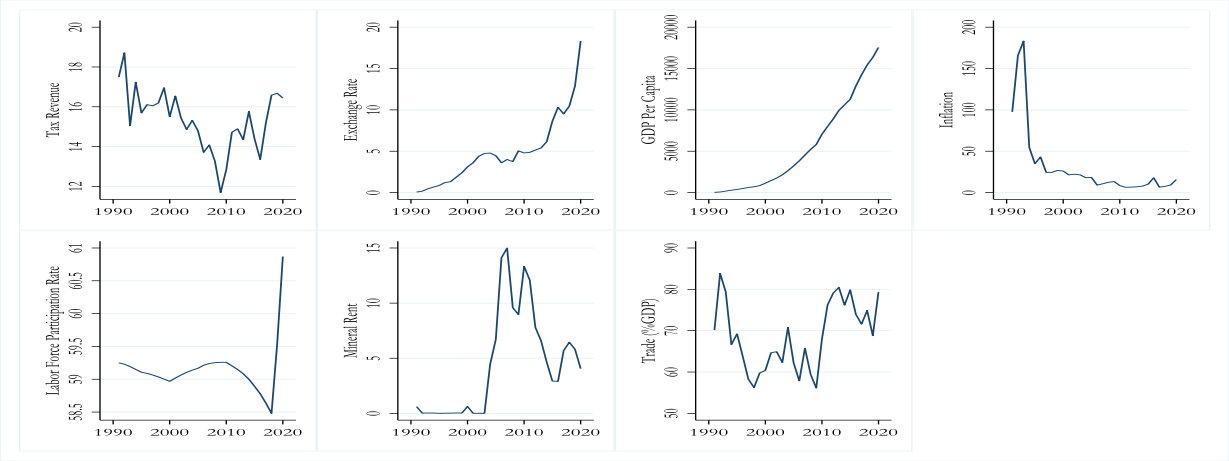

Figure 1A: Graphical Illustration of the Key Variables
Source: Authors computation

Table 2A: Pairwise Correlation Coefficients

	Tax revenue	Exchange rate	GDP per capita	Inflation	Labor force participation rate	Mineral rent	Trade (% GDP)
Tax revenue	1						
Exchange rate	-0.1404	1					
GDP per capita	-0.202	0.9227*	1				
Inflation	0.4377*	-0.4763*	-0.4676*	1			
Labor force participation	0.0807	0.3854*	0.1846	0.0548	1		
Mineral rent	-0.6371*	0.2601	0.3991*	-0.4469*	0.1052	1	
Trade (% GDP)	0.2238	0.3333	0.4651*	0.3125	0.1239	-0.0105	1

*Significant at the 5 percent level. Source: Authors computation

Table 3A: Summary Literature Review Country specific studies

Authors	Country/Title	Objective	Main variables	Methods	Result
Haabazoka and Kaulu (2023)	Zambia, External Debt, FDI and Copper Prices and their relationship with Tax Revenue Mobilization: The Case of Zambia	To assess the relationships between tax revenue mobilization and three of its predictors in Zambia.	External debt, FDI and copper prices	ARDL	External debt was found to have a positive long run relationship with tax revenue. Copper prices only had a positive long run relationship at the 10% significance level. The FDI inflows showed no relationship with tax revenue in both the short and long run. External debt and copper prices both had positive significant short run relationships with tax revenue.
Muibi and Sinbo, (2013)	Nigeria, Macroeconomic Determinants of Tax Revenue in Nigeria (1970-2011)	To examine the most relevant macroeconomic policy variables to stimulate tax revenue.	Real GDP, Trade Openness, the official exchange rate, inflation rate and the ratio of external debt to GDP	Error Correction Mechanism (ECM)	Tax revenue tends to be significantly responsive to changes in income level, exchange rate and inflation rate. The income elasticity of tax shows that a unit percentage increase in income level will probably lead tax revenue increase by 0.63% In the immediate and 0.33% in the second year.
Tarawalie and Hemore (2021)	Sierra Leone, Determinants of Tax Revenue in Sierra Leone: Application of the ARDL Framework	To investigate the determinants of tax revenue in Sierra Leone, over the period 1990Q1 to 2020Q1, within the context of the ARDL estimation procedure.	Trade openness, official development assistance, real GDP growth, consumer price index, exchange rate and population growth	Autoregressive Distributed Lag Model (ARDL)	In the long run real GDP, openness and official development assistance are the main determinants of tax revenue in Sierra Leone, with positive coefficients. Similar findings were found in the short run. However, the short run result also suggests that inflation has a negative impact on tax revenue.

Authors	Country/Title	Objective	Main variables	Methods	Result
Mossie, (2011)	Ethiopia, Determinants of Tax Revenue in Ethiopia (Johansen Co-Integration Approach)	To empirically examine the major determinants of tax revenue in Ethiopia for the Period 1975-2013, using Johansen maximum likelihood co-integration approach	Consumer price index, agricultural value-added share as percentage of GDP, Official Development Assistance, Industrial value added as a percentage GDP, GDP per capita and government expenditure on education	Johansen maximum likelihood cointegration approach and Error Correction Mechanism (ECM)	In the long run real GDP per capita income, foreign aid and industrial value added share of GDP positively and significantly affect tax revenue as percentage of GDP. However, inflation exerted a negative and significant influence. Whereas, in the short run only the level of real GDP per capita income, industrial value-added share of GDP and inflation rate are statistically significant in determining tax revenue. Real GDP per capita income and inflation have negative effect, whereas industrial Value-added share of GDP has positive effect.
Okonkwo (2018)	Nigeria, Determinants of Taxation in Nigeria, 1980 - 2014	To investigate the determinants of taxation in Nigeria for the periods 1980 to 2014.	Real GDP, money supply (M2), interest rate and inflation rate	Ordinary Least Squares (OLS)	Income, money supply, interest rate And inflation are significant determinants of taxation in Nigeria.
Aggrey (2011)	Ghana, Determinants of Tax Revenue: Evidence from Ghana	To find out the variables that determine tax revenue in Ghana.	Real GDP, financial deepening and government expenditure	Autoregressive Distributed Lag Model (ARDL)	Government expenditure is positively related in the long run while it has a negative effect in the short run on tax revenue. Real GDP exhibited a positive effect on tax revenue in the short run while it showed a negative impact in the long run. Financial deepening had a negative impact both in the short run and long run.
Hlongwane et al (2022)	South Africa, Determinants of taxation in South Africa: an econometric approach	To study was to analyse the determinants of taxation in South Africa	GDP per capita, Trade, Inflation and government expenditure	Autoregressive Distributed Lag Model (ARDL)	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.

Table 4A: Summary Literature Review for Panel Studies

Authors	Topic	Variables	Methodology	Results
Nguyen Minh Ha, Pham Tan Minh & Quan Minh Quoc Binh (2022)	The determinants of tax revenue: A study of Southeast Asia	GDP per capita, trade, FDI, Proportion of value added in Agriculture, Proportion of value added in manufacturing, political rights index, civil liberties index, the ratio of public expenditure on education as a percentage of GDP, average life expectancy of the population, the number of deaths per 1,000 live births, cumulative external public debt as a percentage of GDP, percentage of net ODA inflows in comparison with GDP and inflation	Pooled Ordinary Least Squares (OLS), fixed effects (FE) model, random effects (RE) model and Driscoll-Kraay standard error) as well as dynamic panel data (system–generalized method of moments) regression techniques	The openness of the economy, foreign direct investment (FDI), the ratio of foreign debt to the gross domestic product (GDP), the share of value added in industry to GDP have positive impacts on tax revenue, and official development assistance has a negative impact.
Boukbech et al (2018)	Determinants of tax revenues: Evidence from a sample of Lower Middle Income countries	GDP per capita, value added of agriculture as a percentage of GDP, openness degree, population growth, inflation, public expenditure, official development assistance and external debt stocks	Panel data technique	The per capita GDP and the value added of agriculture are significantly and positively correlated with tax revenues. The degree of openness has a positive but insignificant effect on tax revenues. The impact of population growth rate is negative but not significant. For the determinants of tax effort, the impacts of inflation and public spending are significant and positive. The relationship between the tax effort and the variables "public aid received" and "foreign debt" is significantly negative.
Stotsky and WoldeMariam (1997)	Tax effort in Sub-Saharan Africa	Agricultural share, Export share, import share and per capita income	Ordinary Least Squares	The share of agriculture in GDP is negative and significant, export share in GDP is positive and significant, per capita income is not significant, and import share is positive and significant in some variants.

Authors	Topic	Variables	Methodology	Results
Ghura (1998)	Tax revenue in Sub-Sahara Africa: Effects of Economic Policies and corruption	Per Capita Income, Trade openness, Inflation rate, percentage change in the real effective exchange rate and share of agriculture in GDP	Regression framework	Tax revenue ratio rises with income and that element of a country's tax base influence tax revenue.
Eltony (2002)	The Determinants of Tax Effort in Arab Countries	Share of agriculture, share of mining, share of manufacturing, per capita income, the share of exports in GDP, share of imports in GDP and share of outstanding foreign debt	Fixed effect mode	Agricultural share in GDP, the mining share and the export share are negative and significantly related to the tax ratio while the import share and per capita income are positive and also significant at the 10% level of significance.
Addison and Levin (2012)	The Determinants of Tax Revenue in Sub-Saharan Africa	Trade openness, Per capita GDP, population, Aid to GDP, urbanisation and agriculture to GDP	GMM	The overall tax to GDP ratio is higher in more open and less agricultural dependent economies, less populous and peaceful countries. There was evidence of relationships between the effect of openness and per-capita GDP on the trade-tax GDP ratio. The size of the agricultural sector and foreign aid affects the direct-tax GDP ratio negatively.
Ihuarulam (2021) et al	Macroeconomic Determinants of Tax Revenue in Economic Community Of West African States	Inflation, GDP, Exchange rate, Trade openness and unemployment rate	Pooled Regression Model (PRM), Fixed Effect Model (FEM) and Random Effect Model (REM)	Inflation was positively related to tax revenue and statistically significant at 5 percent. A unit increase in inflation led to 0.007 increase in tax revenue measure; economic growth was also positive and statistically significant at 5 percent; a unit rise in GDP resulted in 0.78 rise in governmental tax revenue variable. Tax revenue variable decreased by 0.10 with a unit increase in unemployment.
Saptono and Mahmud (2021)	Macroeconomic Determinants of Tax Revenue and Tax Effort In Southeast Asian Countries	GDP per capita, manufacturing value added share as percentage of GDP, inflation and trade openness	FE model, RE model	The study finds positive and significant effects of per capita income, manufacturing, and trade openness on the actual tax-to-GDP ratio and tax effort. In contrast, inflation is considered a superfluous determinant because of its insignificant effect on the two measures of tax performance.