TAX REVENUE PERFORMANCE IN SUB-SAHARAN AFRICA COUNTRIES: ARE THERE EMPIRICAL EVIDENCE FOR MACROECONOMIC VARIABLES?

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Abstract: *This study, examines the dynamic effects of macroeconomic factors on the overall tax revenue performance of thirty-three (33) Sub-Saharan African countries for eighteen years that range from 2000-2017 employing the system generalized method of moments methodology. This study provides empirical evidence for the dynamic and significant effects of macroeconomic variables on tax revenue performance in SSA countries. Arising from our empirical findings, the study recommends that, on the average, governments of SSA countries should establish the necessary macroeconomic preconditions for the effective and efficient administration of the countries' tax systems to further boost her taxable capacity and fiscal surpluses.*

1. Introduction

The issue of the effects of macroeconomic variables on tax revenue performance has often times been of concerns to governments of the Sub-Saharan Africa (SSA) countries because of the relatively low tax bases and tax returns from the SSA region compared to those of the other regions of the world. For instance, the tax-to-Gross Domestic Product (GDP) ratio of the sub-Saharan Africa region ranges between 13.8 percent to 18.5 percent from 2003 through 2015 compared to that of the European Union that ranges between 19.5 percent to 20.6 percent for the same period (World Bank, 2016).

The declining level of tax returns in the SSA region may be attributed to the inabilities of most countries in the SSA region to lift its tax share above some five percentage points of GDP since the mid-1990s while other regions like the Common Wealth of Independent States, Latin America and emerging Asia have maintained a flat or marginal increase in their tax-to-GDP ratios (International Monetary Funds, 2015).

The disturbing trend of the relatively low tax returns as a percentage of GDP may likely be attributed to the effects of macroeconomic variables on the tax bases of the various countries that comprise the region. However, macroeconomic factors had often been identified in literature (for example the studies; Ghura, 1998; Yohou, Goujon, Larporte and Guerineau 2015 etc) as factors determining tax revenue performance. A large proportion of the recorded evidence are related to regions like Asia and Latin America. To the best of our knowledge, the investigation of the effects of various macroeconomic factors on tax revenue performance in SSA countries is yet to receive adequate empirical investigation. This study contributes to existing economic literature by bridging this identified gap.

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The findings of the study would advance thoughtfulness in tax planning and in turn, would guide tax policy choices and facilitate implementation of appropriate tax policy reforms. The study used annual data for thirty-three (33) sub-Saharan Africa countries for sixteen (18) years that range from 2000 to 2017, and the choice of the period and countries are based on data availability, and countries included are fair representation of the SSA region, accounting for over 70 percent of the region's GDP. Following the introductory section, the study includes: the review of relevant literature, empirical methodologies, the presentation and discussion of empirical results, recommendations and conclusion of the study.

2. Review of Relevant Literature

Torrance and Morrissey (2014) investigate the relationship between taxation and indigenous institutions in thirty-six SSA countries from the period of 1970 to 2010, using the Persimonious model and incorporating institutional variables with threshold effects. Their empirical results show that institutional variables have a positive relationship with tax ratios. Yohou, Goujon, Laporte and Guerineau (2015) examine the influence of high aid flows on the tax effort of twenty-eight SSA countries from the period of 1984 to 2010, using the panel smooth threshold regression model. Their results showed that aid has a country specific and time - varying differentiated effect on the countries' tax revenue. Furthermore, they revealed that lower aid flows are harmful to tax effort while larger ones promote tax collection. Again, trade openness indicators are found to depend on the aid and tax indicators used.

Series of researchers (for example, Lotz and Morss, 1967; Stotsky and WoldeMariam, 1997; Piancastelli, 2001; Teera and Hudson, 2004, and Fenochietto and Pessino, 2013) believe that the level of development of countries greatly influence their tax revenue performance, and they have found empirical support for a positive and significant relationship between real gross domestic product per capita and tax revenue performance.

The theoretical framework for this study is rooted in the prescription of extant literature (like Leuthold, 1987; Ghura, 1998; Oriakhi, 2005; and Langford and Ohlenburg, 2015) with significant modifications. In finding the various element of tax bases, existing studies (for example, Leuthold, 1987; Ghura, 1998; Oriakhi, 2005; Langford and Ohlenburg, 2015 and Arodoye and Izevbigie, 2019) have demonstrated that specific tax bases(for example, agriculture value added, real GDP, trade openness, private sector credit etc) significantly influence tax shares. Therefore, the effects of some of the tax bases are endogenously incorporated in developing the general framework for this study.

As a way of contributing to extant literature, this study added two new variables to the tax performance models and the determinants of tax ratio in SSA. These variables include: government expenditure as a percentage of GDP and private sector credit as percentage of GDP. The first variable captured the consistency of government expenditure programmes as well as the provision of public goods and services, and private sector credit as percentage of GDP captured the influence of the actual allocation of credit to the private sector on tax revenue mobilization, and this allows us to capture the private sector fiscal capacity in this study.

3. Methodology

To examine the dynamic effects of macroeconomic variables on tax revenue performance in SSA, this study adopted the dynamic Autoregressive Distributed Lag (ARDL) framework using system-Generalized Method of Moments (sys-GMM) estimation technique as well as fixed effect and random effect methodologies for robustness checks.

The sys-GMM is better suited for this study because: it is more robust for missing data; accounts for simultaneity bias and reversed causality, especially when lagged values of the

dependent variable enter the equation as an instrument, instead of entering explicitly as regressors.

The sys-GMM regression is undertaken with the share of total tax revenue in *gross domestic product* (ttr_gdp) as the dependent variable which represents the overall tax system of the SSA countries. The instrumental variables this study adopted were the lagged values of all the independent variables. The model specified for this study is based on the theoretical literature reviewed – (like: Leuthold, 1987; Ghura, 1998; Oriakhi, 2005; and Langford and Ohlenburg, 2015) with significant modifications as identified in the section for theoretical framework. This study analyzed the following Panel sys-GMM model:

$$ttr\_gdp_{i,t} = \alpha_0 + \alpha_1 ttr\_gdp_{i,t-1} + \alpha_2 ECON_{i,t} + \varepsilon_{it} \qquad \dots \qquad 1$$

Where: $ECONS_{i,t}$ represents a vector of traditional economic determinants of tax revenue performance. These economic factors are: *real per capita gross domestic product* $(rgdppc)$, *share of agriculture in gross domestic product* (agr_gdp), *trade openness* $(open)$, *inflation rate(infl), public debt* $(pdebt)$, *Private Sector Credit to GDP ratio(psc), natural resource rent(percent GDP)* $(nresd)$, *government expenditure to gross domestic product ratio(gexpr)* while $i's$ and $t's$ represent individual country and time frame, respectively. For fixed effects specification, $\varepsilon_{i,t} = \mu_{i,t}$, where μ_i denotes the country specific effects and ε_{it} captures the random effects. The data employed for the study were sourced from the 2018 World Bank Development Indicators (WDI) and the 2018 International Centre for Tax and Development (ICRD) datasets.

4. Empirical Analysis

This study, investigates the dynamic impacts of macroeconomic factors on tax revenue performance. The scope of the study consists of thirty-three SSA countries, between 2000 and 2017. Tax revenue performance may be significantly influenced by several macroeconomic factors that have been tested by the dynamic panel data econometric methodology.

Descriptive Statistics

The average tax revenue contributed by the selected thirty-three (33) countries in SSA is 16.15 percent of the region's GDP. Among other variables, the average contribution of agriculture is 25.53 percent of the region's GDP, and the average value of trade openness is 76.18 percent in the SSA region. These marked difference in trade openness, agriculture value added (percent of GDP) and the level of development are indicative of the different tax bases among the different groups within the SSA region. The kurtosis for the variables of the SSA countries have positive excess values, suggestive of the presence of leptokurtic behaviours in the distributions, and the variables are closely bunched around the mode (See Table 1 in Annex).

Properties of Dataset: Tests for Stationarity and Panel Co – integration Tests

To conduct the stationarity tests, this study employed the Levin, Lin and Chu (LLC) technique, that is, homogeneous in the dynamics of autoregressive coefficients for the elements of the panel structure (common unit roots processes) test, and Im, Pesaran and Shin (IPS), Augmented Dickey Fuller-Fisher (ADF-F) and Phillip Peron-Fisher (PP-F) that allows for heterogeneity in dynamic relationships (individual unit roots processes) test and

controlled for cross – sectional dependence among the variables. Essentially, the stationarity test for this study follows the heterogeneous unit root processes (IPS, ADF-F and PP-F), though, the homogeneous unit root process (LLC) results is reported alongside for completeness. The results show that the variables have first - order integration, and hence the panel estimations exhibit both common and individual unit root processes.

The panel co - integration tests for this study show evidence of a co-integrating relationship as indicated by the significance of the homogeneous residual-based - and heterogeneous residual-based co integration tests. Hence, the result from the co-integration test supports panel pooling procedures for estimation in this study (See Tables 2 and 3 in the Annex)

Econometric Analysis of the dynamic effects of Macroeconomic Factors on Tax Revenue Performance in sub-Saharan Africa

Table 4 (see Annex) reported the empirical outputs of the fixed effect model, random effect model and the System - Generalized Method of Moments. The variables employed in the system GMM estimation technique are in their first difference, and the sys-GMM technique is based on the Arellano-Bond's estimation procedure. However, the variables are in their levels in both the fixed effect and random effect models. The fixed effect and random effect models are relevant for this study because we will rely on these methods to ascertain the robustness of our results. Moreover, this study conducted similar analysis for the Middle-Income Countries (MICs) and Low-Income Countries (LICs) SSA countries in order to verify if these respective groupings have effects on our baseline equation, and if tax revenue performance models in SSA are susceptible to changing levels of development.

The diagnostic statistics for the SSA region, and those of their respective groupings are quite impressive. The F-statistics show that macroeconomic factors employed in the analysis are jointly significant. This simply suggests that the macroeconomic factors are collectively significant to explaining tax revenue performance (proxy by tax-to-GDP ratio) in SSA and across the various groupings at one percent significance level. The Hausman's model specification test reveals preference for random effect (that is, indicating that random effect is more appropriate) in the SSA and Middle-Income Countries, while those of Low-Income Countries indicate that fixed - effect model is more appropriate, that is, indicating concern for individual country-specific effects in the LICs.

This study conducted the Hansen's J over-identifying restriction test of the respective models, and the result indicates the acceptance of null hypothesis of the validity of the instruments, and this satisfies the conditions of the over-identifying restriction test statistics of greater than 0.1, and no statistical significance. Our study reports the absence of second order autocorrelation for SSA and the respective income groups in the region.

We begin our analysis from the SSA region and then successively see how the macroeconomic factors perform in the other income groups. The sys-GMM estimates have impressive statistical performance than those of the static estimators (fixed - and random effect models) in the SSA region. However, the coefficients of macroeconomic factors in the three estimation techniques essentially have similar signs, while virtually all the variables are statistically significant in the sys-GMM estimates (except for that of inflation (CPI)).Hence, we adopted the sys-GMM estimates for this study for interpretational convenience, and also to alleviate the fear of endogeneity bias and possible bias in our regression estimates.

The effect of agriculture as share of GDP is negative and statistically significant at 10% level. The estimated coefficient indicates that a one percent increase in agriculture value added lowers tax ratio by about 6.6 percent. This suggests that increasing agriculture value added in the SSA region leads to lower tax ratio. This finding is indicative of large subsistence sector with a low taxable surplus of the agricultural sector in the SSA region. This finding is consistent with the studies of Stotsky and WoldeMariam (1997), Teera and Hudson (2004), Oriakhi (2005), Addison and Levin (2011) and Fenochietto and Pessino (2013) that agricultural sector is notably a "hard-to -tax" sector as a result of its subsistence nature.

The effect of trade openness is positive and statistically significant at 10% significance level. A one percent increase in trade openness is expected to increase tax shares by 16.6 percent. This finding suggests that a favourable improvement in trade openness will stimulate the tax revenue performance of the SSA region. This finding is consistent with those of Ghura (1998); Teera and Hudson (2004); Oriakhi (2005); Cottarelli (2011) and Addison and Levin (2011) that the degree of trade openness is a fundamental factor determining tax revenue performance in most developing countries (SSA countries inclusive).

The level of development (measured by real GDP per capita) is statistically significant, and exerts positive impact on the SSA region's tax revenue performance. A percentage increase in real GDP per capita is expected to increase tax-to-GDP ratio by 54.9%, which indicates a relatively high magnitude compared to that of the agriculture and trade sectors. Rising per capita GDP results in higher tax-to-GDP ratio. This finding is in line with those of Stotsky and WoldeMariam (1997); Ghura (1998); Pessino and Fenochietto (2010) and Ndiaye and Korsu (2011) that the level of development is more relevant in examining tax revenue performance. Consumer Price Index has negative and not significant impact on SSA's tax ratio. A percentage increase in the CPI decreases the tax ratio of the region by 3.6 percent. Increase in CPI leads to lower tax-to-GDP ratio in the region.However, the not significant effect of the CPI may have resulted from the likely indirect effect of inflation on tax ratio.This finding is in line with the studies of Ghura (1998); Pessino and Fenochietto (2010); Fenochietto and Pessino (2013) and Langford and Ohlenburg (2015) that inflation constrains tax revenue collection effort, and inflation may also shrink the overall tax revenue performance of most developing countries.

The effect of government expenditure (percent of GDP) - measures the active participation of government in economic activities, is positive and statistically significant at one percent level. A percentage increase in government expenditure (percent of GDP) is expected to increase tax shares by 26.6%. The result confirms that active participation of government in economic activities stimulates the willingness to pay taxes in the SSA region. This finding is in agreement with the study of Oriakhi (2005) that government expenditure (percent of GDP) has direct impact on tax revenue collection in African economies.

The estimated impact of public debt is negative and significant, and this suggests that higher debt reduces tax ratio (a percentage increase in the level of public debt lowers tax ratio by 1.4%) in the SSA region. This result also indicates that rising public debt burden may create macroeconomic imbalance that may invariably reduce the tax levels of the SSA countries. This finding is consistent with the conclusion of Teera and Hudson (2004) and Gupta (2007) that rising public debt creates imbalance in the economy, and this may constrain the taxable capacity of the country.

Aid has a significant negative effect on tax ratio. A percentage increase in aid lowers tax ratio by 2.9%. This simply suggests that rising aid in the SSA region lowers tax revenue collection. This result is in line with the study of Addison and Levin (2011) that aid inflows shrink the level of taxation in the SSA region.

The effect of natural resource rent (percent of GDP) is negative and significant at 10% level. A percentage increase in the variable lowers tax level by 1.7%. This suggests that countries raising substantial revenue from natural resource may have reduced incentives for tax collection.This result is in agreement with the study of Bornhorst, Gupta and Thornton (2008) that hydrocarbon revenues lowers domestic tax revenue mobilization.

Private sector credit (percent of GDP) has a significant positive impact on tax shares. A percentage increase in the variable is expected to stimulate tax ratio by 7.1%. This suggests that rising allocation of credit to the private sector of the economy will stimulate overall tax revenue mobilization, and the taxable capacity of countries. This finding is in line with the conclusion of Langford and Ohlenburg (2015) that the higher level of the variable reflects

more effective and efficient tax administration, and by extension enhance tax revenue mobilization.

The results of the sys-GMM estimates are similar (in terms of signs and significance effects) to that of the fixed effect and random effect models except for the not significant government expenditure (percent GDP) variable). This shows the stability and consistency of our parameters. Apparently, virtually all economic factors appear to significantly influence tax revenue performance.

For the different income groups, the sys-GMM estimates are quite impressive and similar to that of the SSA region. First, for the MICs, all variables are rightly signed (except for natural resource rent and agriculture value added, and they were both not significant).In this case, inflation was found to exert negative and significant effect on tax ratio unlike that of the full sample analysis. Additionally, in the MICs, trade openness and real GDP per capita had positive and significant effects on tax ratios. Second, for the LICs, the variables have expected signs (except for agriculture value added, and it was not significant). However, virtually all variables are not significant (except for that of real GDP per capita). These findings of both income groups emphasized the overwhelming influence of the level of development on tax revenue performance in SSA countries. However, the wide variation in the level of significance amongst the variables across the income groups may be due in part to the smaller sample size(this is because the sys-GMM requires a relatively large observations), and the empirical outcomes may also suggests evidence of structural changes across the income groups.

5. Recommendations and Conclusion
(i) Recommendations:
Some policy lessons can be drawn from the findings of this study that will necessitate some policy directions which may proffer relevant policy recommendations for policy makers.

1. There is need to provide policy options that will make the tax systems of the SSA region more buoyant by instituting tax policies that would reduce informalities in agricultural sector, and establishing open macroeconomic policies (particularly anti-smuggling policies) to enhance tax yields from international trade.
2. It is necessary for the governments of the SSA region to initiate and implement policies that will reduce external debts and debt service payment obligations to avert the "crowding out" effect of debt on investments vis-à-vis economic growth, this would enhance the taxable capacity of private and public sector investors
3. There is need for the governments of the various SSA countries to consistently embark on capital projects and programmes that will directly affect the citizens and/or tax payers welfare, and this will further boost the income tax capacities and yields of the SSA countries.

(ii) Conclusion:
The concerns for the assessment of tax revenue performance for most SSA countries is the curtailment of fiscal deficits and the overall improvement in the development of the countries in the SSA region. Moreso, this study has analyzed the dynamic effects of macroeconomic variables on the overall performance of the tax systems for thirty – three countries over a period of eighteen (18) years taking into account the level of development or income groups employing the system generalized methods of moment methodology.

The results from this study revealed that macroeconomic factors contribute significantly to the tax revenue performance of the SSA countries. Our empirical results show that trade openness, real GDP per capita, government expenditure (percent of GDP) and private sector credit (percent of GDP) exert positive and significant impact on the overall tax revenue performance of the SSA region. However, agriculture value added, public debt,

inflation, natural resource rent (percent of GDP) and aid (ODA received) mostly exert negative and significant effect

This study was constrained by the fact that the entire SSA countries were not covered due to data non-availability. In addition, some variables like tax exemptions, tax treaties and tax incentives were not tested due to the inability to physically visit the various tax authorities of the SSA countries, and these variables would have been interacted with macroeconomic factor to achieve more substantive policy implications. Further research direction can be gained be introducing governance factors into the tax-growth regression model to ascertain the impact of institutional quality on tax revenue performance in SSA countries.

Acknowledgement

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ANNEX Table 1: Descriptive Statistics of variables for the estimation of macroeconomic variables and tax performance in the sub-Saharan Africa countries (2000 – 2017)

Variables	Mean	Median	Standard Deviation	Minimum	Maximum	Skewness	Kurtosis	Jacque Bera	
								statistics	Prob.
Total Tax Revenue as percentage of GDP	16.15	13.52	9.84	0.95	62.83	1.88	6.83	633.94	0.00
Real per capita GDP constant 2010 US $' 000	2108.20	774.55	2861.62	205.07	13617.88	1.93	5.77	497.37	0.00
Trade Openness	76.18	65.71	37.81	20.96	225.02	1.35	4.74	226.44	0.00
Agriculture value added as percentage of GDP	25.53	25.71	15.55	1.95	59.23	0.05	2.06	19.6	0.00
Inflation(annual CPI,inflation%)	88.87	87.48	30.22	2.91	250.62	0.54	4.91	105.91	0.00
Public Debt	8592.7	1261.01	34626.79	2.43	396970.70	7.19	62.02	81176.6	0.00
Government expenditure as percentage of GDP	109.37	109.88	18.37	59.50	200.97	0.91	7.31	482.64	0.00
Private Sector Credit (domestic credit to private sector % of GDP)	20.73	13.92	26.12	0.20	160.13	3.48	15.81	4673.30	0.00
Aid (Net ODA received)	8.66	7.28	7.86	0.25	62.19	1.82	9.09	1106.02	0.00
Natural Resource Rent, % of GDP	14.65	9.37	15.29	0.01	77.06	1.80	5.82	460.91	0.00

Source: Authors' Computation

Table 2: Stationarity Tests - analysis of macroeconomic variables and tax performance of the sub –Saharan Africa countries

Table 2.a.

Variables	Homogeneous (Common Unit Root Process) Null hypothesis:Unit root (assumes common unit root process) LLC				Remarks
	I(0)		I(1)		
	Stat.	Prob.	Stat.	Prob.	
Tax Revenue(% GDP)	-3.27***	0.00	-10.39***	0.00	I(1)
Real GDPpc	-0.74	0.23	-7.74***	0.00	I(1)
Agric. Value Added	-4.82***	0.00	-9.18***	0.00	I(1)
Trade Openness	-8.37***	0.00	-13.90***	0.00	I(1)
Govt. Exp.(%GDP)	-3.28***	0.00	-12.89***	0.00	I(1)
Private Sect. Credit	-0.88	0.19	-5.44***	0.00	I(1)
Aid	-5.08***	0.00	-12.51***	0.00	I(1)
Natural Resource Rent	-4.84***	0.00	-9.98***	0.00	I(1)
Inflation	-0.14	0.12	-5.93***	0.00	I(1)
Public Debt	22.8	1.00	-4.28***	0.00	I(1)

Table 2.b.

Variables	Heterogeneous				(individual Unit Root Process)								Remarks
	Null hypotheses : Unit root				(assumes individual unit root process)								
	IPS				ADF- F				PP - F				
	I(0)		I(1)		I(0)		I(1)		I(0)		I(1)		
	Stat.	Prob.	Stat.	Prob.	Stat.	Prob.	Stat.	Prob.	Stat.	Prob.	Stat.	Prob.	
Tax Revenue(% GDP)	-2.04**	0.02	-6.41***	0.00	90.30**	0.03	158.77***	0.00	105.62***	0.00	433.32***	0.00	I(1)
Real GDPpc	-1.36	0.91	-4.15***	0.00	55.94	0.81	123.90***	0.00	53.26	0.87	284.09***	0.00	I(1)
Agric. Value Added	-1.54*	0.06	-5.69***	0.00	102.03***	0.00	148.11***	0.00	213.72***	0.00	108.12***	0.00	I(1)
Trade Openness	-4.45***	0.00	-8.85***	0.00	114.82***	0.00	190.18***	0.00	248.39***	0.00	106.81***	0.00	I(1)
Govt. Exp.(%GDP)	-0.60	0.27	-8.21***	0.00	71.31	0.31	187.96***	0.00	98.00***	0.00	429.57***	0.00	I(1)
Private Sect. Credit	-1.47	0.93	-3.08***	0.00	56.64	0.79	105.79***	0.00	67.70	0.42	238.56***	0.00	I(1)
Aid	-2.53***	0.01	-8.65***	0.00	99.76***	0.00	194.32***	0.00	182.16***	0.00	462.79***	0.00	I(1)
Natural Resource Rent	-1.22	0.11	-6.00***	0.00	80.03	0.11	147.64***	0.00	96.43***	0.01	397.59***	0.00	I(1)
Inflation	2.51	0.99	-2.56***	0.01	47.18	0.96	110.07***	0.00	68.09	0.41	185.41***	0.00	I(1)
Public Debt	2.87	0.97	-3.07***	0.01	17.08	1.00	155.92***	0.00	33.85	0.99	265.87***	0.00	I(1)

Source: Authors' Computation. LLC : Levin, Lin and Chu t* ; IPS = Im, Pesaran and Shaw W-stat, ADF - F: Augmented Dickey Fuller-Fisher Chi-Square, PP - F = Phillips Peron -Fisher Chi - Square; stat. = statistics; prob. = probability. *** 1%; **5%; *10% Significant levels

Table 3: Residual - Based Co - integration Test Results of macroeconomic variables and tax revenue performance in sub-Saharan Africa countries

Homogeneous – Kao					statistics	Heterogeneous - Pedroni			
	Series					Series			
Statistics	Full Sample		Macroeconomic Variables and Tax Performance		statistics	Macroeconomic Variables and Tax Performance		Weighted	
	stat.	Prob	stat.	prob.		stat.	prob.	stat.	prob.
ADF	-5.29	0.00***	-4.74	0.00***	Within Dimension (Common AR Coef.)				
					panel v-statistics	13.97	0.00***	15.92	0.00***
					panel rho - statistics	-6.70	0.00***	-5.58	0.00***
					panel PP - statistics	-14.38	0.00***	-20.16	0.00***
					panel ADF statistics	-4.50	0.00***	-4.50	0.00***
					Between Dimension (Individual AR Coefs.)				
					Group rho statistics	-7.34	0.00***		
					Group PP statistics	-28.93	0.00***		
					Group ADF statistics	**-2.63**	**0.00*****		

Source: Authors' Computation. stat. = statistics; prob. = probability. *** 1%; **5%; *10% Significant levels.

Table 4: Macroeconomic Variables and Tax Revenue Performance in SSA Countries. 2000 – 2017

Variables	SSA Region			Middle Income Economies+			Low Income Economies		
	Fixed Effect	Random Effect	Sys-GMM	Fixed Effect	Random Effect	Sys-GMM	Fixed Effect	Random Effect	Sys-GMM
Constant	1.978*** (10.337)	1.921*** (11.957)		4.875*** (2.817)	4.282*** (4.283)		1.660*** (6.704)	1.822*** (8.042)	
One-Period lag of Tax-to-GDP Ratio			0.224*** (16.255)			0.244*** (7.894)			0.382* (1.693)
agriculture value added	-0.013*** (-2.532)	-0.011*** (-2.513)	-0.066* (-1.886)	-0.088* (-1.814)	-0.081* (-1.723)	0.018 (0.839)	-0.021** (-2.152)	-0.051** (-2.008)	0.072 (0.162)
Trade Openness	0.006*** (8.763)	0.006*** (8.928)	0.166* (1.816)	0.415*** (4.613)	0.413*** (4.657)	0.149* (1.739)	0.003*** (2.997)	0.031*** (3.405)	0.121 (1.205)
Real GDP per capita	0.875* (1.828)	0.586* (1.816)	0.549*** (3.951)	0.161* (1.946)	0.145* (1.827)	0.202** (2.636)	0.001* (1.698)	0.001** (2.028)	0.826* (1.820)
Inflation (annual CPI, %)	-0.053 (-0.036)	-0.001 (-0.649)	-0.036 (-0.769)	-0.138 (-1.532)	-0.145** (-2.189)	-0.053* (-1.887)	-0.003*** (-3.283)	-0.001 (-1.172)	-0.282 (-0.681)
Government Expenditure (% GDP)	0.002 (1.511)	0.002 (1.539)	0.266*** (-2.552)	1.051*** (4.084)	0.964*** (3.968)	0.054 (1.221)	0.002 (1.165)	0.002 (0.861)	0.423 (0.897)
Public Debt	-0.061** (-2.401)	-0.012** (-2.429)	-0.014*** (-5.248)	-0.041** (-2.481)	-0.045*** (-2.763)	-0.005 (0.513)	-0.529* (-1.867)	-0.078* (1.944)	-0.025 (-0.234)
Aid (Net ODA Received, %GDP)	-0.008*** (-3.022)	-0.007*** (-2.870)	-0.029*** (5.937)	-0.087** (-2.465)	-0.084** (-2.434)	-0.012 (-1.434)	0.003 (1.284)	0.005 (1.423)	-0.017 (-0.319)
Natural Resource Rent (% GDP)	-0.006*** (-3.993)	-0.006*** (-3.843	-0.017* (1.962)	-0.053*** (3.275)	-0.051*** (3.272)	0.008 (0.681)	-0.001 (-0.189)	-0.001 (-0.394)	-0.002 (-0.033)
Private Sector Credit (%GDP)	0.004*** (5.053)	0.004*** (5.248)	0.071*** (3.604)	0.151*** (2.958)	0.154*** (3.040)	0.009 (0.020)	0.032*** (10.328)	0.027*** (9.902)	0.065 (0.284)
R-Square	0.507	0.499		0.503	0.497		0.462	0.404	
Adjusted R-Square	0.484	0.491		0.447	0.477		0.413	0.385	
F-Statistics	21.556***	57.540***		8.981***	25.035***		9.416***	20.974***	
Hausman Test	6.895			2.201			26.175***		
Arellano Bond AR(1)			-3.863***			NA			NA
Arellano Bond AR(2)			-0.942 (0.346)			-0.336 (0.737)			-0.426 (0.669)
Hansen J-Statistics			16.726 (0.860)			108.565(0.310)			5.391 (0.715)

Source: Authors' Computation. *, **,*** = 1%, 5% and 10%. + MICs= 2001-17, NA = Not Available.