



Determinants of tax ratio in selected east african community member states

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Abstract

This study investigates the key determinants of tax-to-GDP ratio in selected East African Community (EAC) from 2013 to 2023. Despite sustained economic growth, EAC member states persistently exhibit tax ratio below the 20% threshold recommended for sustainable development. The analysis employs a fixed effects panel regression model on data from five EAC countries namely Kenya, Tanzania, Rwanda, Uganda, and Burundi. The study uses fixed effects model. The results identify GDP per capita and the share of manufacturing in GDP as the statistically significant drivers of tax-to-GDP ratio, with coefficients of $\beta = 3.88$ ($p = 0.002$) and $\beta = 0.16$ ($p = 0.007$) respectively. The study concludes that GDP per capita and manufacturing are the foundational drivers of sustainable revenue mobilization. Based on the results, the study recommends East African countries should prioritize broad-based economic growth and industrial policy in order to enhance domestic revenue generation.

Keywords: Tax ratio, tax revenue, East African Community, panel regression, economic development, manufacturing, GDP per capita

Introduction

The capacity to generate tax revenue by governments provides resources that governments use to drive national development by funding public services, investing in infrastructure, and ensuring macroeconomic stability. Tax ratio, measured as the total tax revenue as a percentage of GDP determines a country's capacity to mobilize domestic resources from its economic base. At the global level, tax ratios vary significantly across countries. Advanced economies typically exhibit tax ratios exceeding 30% of GDP, supported by robust tax systems, broad formal sectors, and high compliance levels (Piancastelli & Thirlwall, 2020) [20]. Conversely, developing nations often struggle with ratios below 15%, constrained informality, narrow tax bases, and weak administrative capacity (World Bank Group, 2024) [27].

This challenge is typical in the East African Community (EAC). Despite economic growth and fiscal reforms, member states like Kenya, Tanzania, Rwanda, Uganda, and Burundi have average tax-to-GDP ratios ranging between 12-16% for the period running from 2013 to 2023. This is significantly below the 20% threshold considered necessary for sustainable development and far behind developed nation averages (Choudhary *et al.*, 2024) [5]. This chronic underperformance has critical implications, forcing governments to rely on unsustainable external borrowing, which can lead to debt distress, exchange rate volatility, and inflationary pressures that disproportionately affect the poor. Existing literature on the determinants of tax ratio in East Africa remains limited, with most studies focusing on individual countries and failing to capture the broader regional dynamics, particularly the interaction between macroeconomic conditions and institutional weaknesses

(Muriithi, 2018; Musisi, 2020) [17, 19]. Although past literature by Tanzi (1992) [24] and Gupta (2007) [8] identifies common determinants such as GDP per capita, trade openness, and sectoral composition, their interplay and relative importance within the specific institutional and economic context of the EAC remain inadequately explored. This study aims to address this gap by conducting a panel analysis of the determinants of the tax-to-GDP ratio across five EAC member states from 2013 to 2023. This paper is specifically guided by the research question: What are the determinants of tax ratio in the selected East African Community countries?

The findings offer evidence-based insights for policymakers, providing a clear understanding of whether revenue shortfalls are due to structural economic limitations or inefficiencies in tax administration. This is crucial for designing targeted reforms that align with the EAC's broader goals of deepening integration, enhancing self-reliance under EAC Vision 2050 and fulfilling the domestic resource mobilization objectives of Africa's Agenda 2063 and the UN Sustainable Development Goals (SDG 17).

Literature Review

Empirical research has provided valuable evidence on the factors shaping the tax-to-GDP ratio. Murunga, Muriithi and Kiiru (2016) investigated determinants of tax shares and tax effort in Kenya. On using ordinary least square regression method, the study showed that manufacturing, trade openness were important determinants of tax shares in Kenya. The tax effort was found to be 0.6 on average for the years of study. Although the study identified determinants of the tax ratio, key diagnostic tests revealed problems; specifically, the Ramsey RESET test ($p=0.0021$) indicated

significant model misspecification, likely due to omitted variables. In another study, Gaspar, Jaramillo & Wingender (2016), on using panel regressions estimated optimal tax ratio. Their findings revealed that optimal tax to GDP ratio for a country should be 12.75 percent of GDP. Their results illustrated that countries that cross this threshold experience a much more durable economic growth. The study controlled for political factor and institutional quality. Although this study stands out as having a robust econometric analys, its major drawback is making the assumption of a uniform threshold. The countries may not have same characteristics and therefore the ratio obtained may not be optimal for every country.

Focussing on role of institutions in affecting tax to GDP ratio, Akanbi (2019) ^[1] used a panel vector error correction model (VECM) on 110 non-resource rich countries for the period running from 1996 to 2017. The findings showed presence of a bi-directional causality between the quality of institutions and tax to GDP ratio. In other words, the results implied that quality institutions lead to higher tax to GDP ratios, while increasing tax revenues improves institutional quality. The strength of the study is in carrying out dynamic view of the variables. The drawback is in the use of governance indices which may suffer from measurement errors and perception bias. This therefore raises great concerns on the robustness of the results. In addition, excluding the resource-rich countries raises concerns on the generalizability of the study findings in cases where resource-rich countries are dominant.

In another study Aktar and Babyenda (2024) ^[2] studied the effect of regional integration on tax performance in East African Community (EAC) countries. On using random and fixed effects as well as Generalized Method of Moments (GMM), the findings showed a negative relationship between regional integration and tax revenues. Although the study highlights key policy trade-off between integration and tax performance, its application to individual member countries may not plausible due to potential heterogeneity among the member countries.

In another study Ibrahim and Jairo (2023) ^[9] investigated the effect of administrative efficiency on tax on EAC member countries for the period running from 2009 to 2018. On

using random effects estimations, the findings showed that improvements in the taxpayer management, staff productivity and cost of collection significantly improve the performance of tax revenue. Although this study points out the importance of tax administration on tax revenue performance, the proxies that were used to capture efficiency may not measure deeper compliance and institutional factors.

Research Methodology

1. Model Specification

The specified econometric model is shown in equation 1.

$$(TRGDP)_{it} = \beta_0 + \beta_1(GDPPC)_{it} + \beta_2 \ln(MANU)_{it} + \beta_3 \ln(TRADEOP)_{it} + \beta_6 \ln(M2)_{it} + \beta_7 \ln(INF)_{it} + \beta_8 \ln(EXCRATE)_{it} + \sigma_i + \mu_{it} \dots 1$$

The study considered six main individual independent variables to explain the tax performance of countries over the period 2013-2023, all in natural logarithms to narrow the variance in the data. The independent variables include the per capita income of countries (**GDPPC**) as a measure of the capacity of individuals to pay tax; the share of trade in GDP (**TRADEOP**) as a measure of the capacity of a country to tax trade; the manufacturing (MANU), agriculture (AGRIC) and mining (MINE) in GDP as a measure of the capacity to tax profits, the degree of monetization of an economy measured by broad money (M2), exchange rate (EXCRATE) to control for external sector effects in the tax ratio and inflation (INF) to control for the effect of rising prices on nominal revenue. The parameters β_1 to β_8 are coefficients representing the effects of the variables, σ represents the fixed effects for each country while μ is the error term.

Table 1: Variable Description, Measurement, and Expected Signs

| Variable | Abbreviation | Description, Measurement | Measurement | Expected Sign |
|----------------------------|----------------------|---|-----------------|----------------------|
| Tax Ratio to GDP | TRGDP | Tax as a percentage of GDP | Ratio | - |
| Estimated Tax Ratio to GDP | TRGDPI _{it} | Predicted value of tax ratio from the model | Ratio | - (Model output) |
| GDP Per Capita | GDPPC | Gross Domestic Product per capita | USA Dollar | + |
| Agriculture value | AGRIC | Value of the agricultural productivity | Percentage | - |
| Manufacturing Output | MANU | Value of manufacturing production | Percentage | + |
| Trade Openness | TRADEOP | Sum of exports and imports as a % of GDP | Percentage | + |
| Mining Sector Value | MINE | Value added by the mining and extractive sector | Percentage | + |
| Broad Money Supply | M2 | Broad money (M2) as a proxy for financial deepening | Dollar | + |
| Inflation | INF | Consumer Price Index (CPI) or annual inflation rate | Percentage | - |
| Exchange Rate | EXCRATE | Official exchange rate (local currency per USD) | Index or LC/USD | ± (Context-specific) |

2. Data

We employ a balanced panel of 5 countries in East Africa for the period 2013–2023. The countries sampled are Kenya, Tanzania, Rwanda, Uganda, and Burundi. Selection of countries for inclusion in the study and the period of study is mainly based on availability of data. Data are sourced mostly from World Bank's World Development Indicators and International Financial Statistics (IFS) databases.

Table 1 presents the descriptive statistics for the variables used in the analysis. The average tax-to-GDP ratio (TRGDP) across the five EAC countries from 2013 to 2023 was 13.2%, with a range of 9.5% to 16.4%. This confirms

the central challenge under investigation, which is the persistent revenue mobilization below the 20% sustainable development threshold.

The data reveal significant economic disparities and structural profiles within the region. The average GDP per capita (GDPPC) was \$1,010, but with a wide range between \$260 to \$2,270, highlighting the vast income differences between nations like Burundi and Kenya. The economic structure is predominantly agrarian, with agriculture (AGRIC) contributing an average of 25.2% to GDP, while manufacturing (MANU) remains modest at 9.98%, underscoring the challenge of taxing largely informal sectors.

Table 1: Descriptive Statistics (2013–2023)

| Variable | Mean | Min | Max | SD |
|-----------------|-------|------|-------|-------|
| Year | 2018 | 2013 | 2023 | 3.19 |
| TRGDP (%) | 13.2 | 9.5 | 16.4 | 1.73 |
| GDPPC | 1.01 | 0.26 | 2.27 | 0.54 |
| MANU (% GDP) | 9.98 | 7.00 | 18.00 | 18.00 |
| TRADEOP (% GDP) | 41 | 27 | 65 | 8.67 |
| AGRIC (% GDP) | 25.2 | 18.3 | 38.4 | 3.71 |
| MINE (% GDP) | 7.4 | 1.2 | 19.1 | 5.06 |
| M2 (% GDP) | 28.21 | 1.66 | 4.28 | 0.80 |
| INF (%) | 5.77 | 0.5 | 15.8 | 3.01 |
| EXCRATE | 1675. | 0.86 | 23.83 | 7.70 |

3. Estimation Techniques and Preestimation Tests

The study used the fixed effect panel model which is a multiple regression model. The choice of fixed effects was informed by Hausman specification test. The Hausman specification test results are shown in Table 2.

The test revealed probability value that was smaller than

0.05. This led led to rejection of null hypothesis. The null hypothesis in this test suggests use of random effects model in the estimation of the panel model.

Stationarity test was carried out using Levin-Lin-Chu (LLC) test. The results are shown in Table 3.

Table 2: Hausman Specification Test

| Test Summary | Chi-Square Statistic | Degrees of Freedom | p-value |
|--|----------------------|--------------------|---------|
| Hausman Test (H ₀ : RE is consistent) | 21.83 | 7 | 0.002 |

Table 3: Unit Root Test

| Variable | Coefficient estimate | Std. Error | t-statistic | P-value | LLC Adjusted t |
|----------|----------------------|------------|-------------|---------|----------------|
| TRGDP | -0.396** | 0.154 | -2.572 | 0.042 | -3.45** |
| GDPPC | -0.521* | 0.218 | -2.389 | 0.048 | -3.21** |
| MANU | -0.610*** | 0.182 | -3.352 | 0.008 | -4.02*** |
| TRADEOP | -0.455* | 0.241 | -1.888 | 0.082 | -2.98* |
| AGRIC | -0.502** | 0.196 | -2.561 | 0.043 | -3.40** |
| M2 | -0.488** | 0.205 | -2.380 | 0.049 | -3.18** |
| INF | -0.741*** | 0.167 | -4.277 | 0.001 | -4.56*** |
| EXCRATE | -0.422* | 0.229 | -1.843 | 0.092 | -2.87* |

The unit root test results confirmed that all variables were stationary, rejecting the null hypothesis of a unit root at least at the 10% significance level, thus avoiding spurious regression.

The study also used Variance Inflation Factor (VIF) to test for presence of multicollinearity. The results are shown in Table 4.

Table 4: Variance Inflation Factor (VIF) Results for Multicollinearity

| Variable | Variance Inflation Factor (VIF) |
|----------|---------------------------------|
| GDPPC | 3.63 |
| MANU | 1.98 |
| TRADEOP | 1.80 |
| AGRIC | 2.71 |
| M2 | 2.02 |
| INF | 1.37 |
| EXCRATE | 2.32 |

The VIF test results showed that all independent variables were below the threshold of 5. This indicated that multicollinearity is not a concern and coefficient estimates are stable.

4. Empirical Results

The results of the Fixed Effects regression, presented in Table 5.

Table 5: Fixed Effects model estimation results

| Variable | Estimate | Std. Error | t-value | Pr(> t) |
|----------|----------|------------|---------|----------|
| GDPPC | 3.8812 | 1.1692 | 3.32 | 0.0018 |
| MANU | 0.1565 | 0.0550 | 2.85 | 0.0068 |
| TRADEOP | -0.000 | 0.0139 | -0.01 | 0.9918 |
| AGRIC | 0.0487 | 0.0647 | 0.75 | 0.4559 |
| M2 | 0.2459 | 0.3003 | 0.82 | 0.4173 |
| INF | -0.0064 | 0.0376 | -0.17 | 0.8658 |
| EXCRATE | 0.0803 | 0.0793 | 1.01 | 0.3170 |

| | |
|------------------|-------|
| Observations | 55 |
| Number of Groups | 5 |
| R-squared | 0.570 |
| Adj. R-squared | 0.447 |
| F-statistic | 6.964 |

Note: Dependent variable is (TRGDP).

The model is jointly significant (F-statistic = 6.96, $p < 0.001$) and explains a substantial portion of the within-country variation in tax ratios ($R^2 = 0.57$). The results reveal that only two variables are statistically significant drivers of tax ratio in the EAC

GDP per capita (GDPPC) shows a positive and significant relationship ($\beta = 3.88$, $p = 0.002$). This confirms that economic development is an important determinant of tax ratio in East Africa. Manufacturing share (MANU) also exhibits a positive and significant effect ($\beta = 0.157$, $p =$

0.007). This underscores the importance of manufacturing as an important determinant of tax ratio in East Africa.

However, the coefficients of trade openness, agricultural share, financial depth, inflation, and exchange rate volatility were found to be statistically insignificant. This suggests that short-term macroeconomic fluctuations and external sector changes have less systematic impact on tax revenue than the fundamental, structural factors of overall economic development and industrialization.

This insignificance presents a notable divergence from some

cross-sectional studies like in Le *et al.*, (2012) ^[11] but is powerfully explained by our methodological choice. The use of a fixed effects model controls for unobserved, time-invariant country-specific characteristics such as a country's inherent trade dependence, historical sectoral composition, or stable institutional features. The model used in the current study focuses solely on within-country variation over time, revealing that once these fixed national factors are accounted for, short-term changes in macroeconomic variables have no consistent explanatory power over changes in the tax ratio. Also, the lack of a significant negative relationship with agriculture, contrary to Tanzi's (1992) ^[24] foundational work, may reflect subsequent structural changes and improved collection mechanisms like value-chain taxation within the EAC that are captured by the country-specific fixed effects.

Conclusion and Recommendation

The results of the study indicate that the coefficients of GDP per capita and manufacturing are positive and statistically significant. The study therefore concludes that GDP per capita and manufacturing are important determining factors of East Africa region's tax ratio. The results support the existence of positive relationship between GDP per capita and manufacturing and the tax ratio. Therefore, the findings reveal that GDP per capita and manufacturing can lead to better tax ratio for countries in Sub-Saharan Africa region. The study therefore recommends that East African countries should consider improving GDP per capita and manufacturing sector since they can immensely contribute to high tax revenue.

Based on the results, the study recommends that the EAC governments should prioritize long-term structural transformation by introducing policies that focus on stimulating broad-based economic growth and executing strategic industrial policy. Efforts to promote agro-processing, light manufacturing, and other value-added sectors are growth strategies and critical revenue expansion strategies because they create a larger base of formal, taxable enterprises.

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