Determinants of tax Revenue Performance in the East African Countries

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Abstract

This study explores the determinants of tax revenue performance in the East African Community (EAC) partner states of Burundi, Kenya, Rwanda, Tanzania, and Uganda. Using a panel dataset that spans over 10 years (2009-2018), the study specifically investigates whether administration efficiency impacts revenue performance. The study measures administration efficiency by using three indicators; a ratio of taxpayers to staff, a ratio of revenue generated to staff, and the cost of collection as a share of total collection. The estimated results from the random effect model show that administrative efficiency exerts a positive and significant effect on revenue performance. The pooled mean group (PMG) results show that in the short run, the administration efficiency indicators have a positive impact. However, in the long run the estimated results show that these variables have a negative impact on revenue collection. The study also shows that per capita income has a positive impact when interacted with the quality of institutional variable. This implies that in a short run revenue administration should consider increasing the number of staff to serve taxpayers and strengthen the quality of institutions by ensuring fairness in tax collection.

Key Word: Tax Capacity; Institutions; Administration Efficiency; East African Countries
JEL Classification Codes: H2; H21

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1. Introduction

This study investigates factors affecting tax revenue performance among East African Community (EAC) partner states of Burundi, Kenya, Rwanda, Tanzania, and Uganda. These countries share many features in common such as a common external tariff adopted since the year 2004. Rauschendorfer and Twum (2020) treat this initiative as a cornerstone in fostering regional integration in sub-Saharan Africa. The Common External Tariff facilitates the free movement of goods and lower tax competition on international trade in partner states. In fact, the Common External Tariff has resulted in the establishment of one-stop border posts since 2015. The one-stop border post aims to facilitate the movement of people and goods by reducing the number of mandatory stops in cross-border trade (Kapkai *et al*., 2020; Brunder, 2018; *East Africa Community*, 2015).

Besides, the partner states have also agreed on having similar or parallel fiscal years that run from June to July. In this regard, countries have agreed on presenting their government budget estimates before their parliament simultaneously on a pre-determined date at the end of each fiscal year. On this pre-determined date, each government announces its priorities and proposes changes in its fiscal policy. The proposed changes become evident in respective tax laws and become operational in July at the beginning of the fiscal year. A partner state has the mandate to change its customs duty and excise rates without exceeding the agreed upon rates.

Moreover, East African Countries had early reforms in domestic resources mobilization by establishing a semi-autonomous agency responsible for assessing, collecting, and accounting for central government tax revenue. Under the behest of the IMF, these East African Countries have embraced reforms and transformed their revenue administration with this function moving from the ministries of finance to semi-autonomous governmental revenue administration agencies. Uganda was the earliest to establish its revenue administration in 1992. Kenya followed in 1996, Tanzania in 1996, Rwanda in 1998, and Burundi in 2010. Generally, this reform aimed to strengthen revenue administration and improve domestic resource mobilization (Kidd and Crandall, 2006; Keen and Mansour, 2010; Dom, 2017).

Despite these initiatives, domestic resource mobilization among EAC partner states remains relatively low when compared to other sub-Saharan African. The average tax to GDP ratio in Sub-Saharan Africa is 18 percent, while in the EAC Kenya (16.6%), Uganda (12.3%), Burundi (13 %), Rwanda (14.6 %), and Tanzania (12%) (*African Tax Administration Forum*, 2019). In fact, inadequate mobilization of domestic tax revenue threatens to undermine the ability of these countries to achieve both national and regional goals. The initiatives highlighted under the UN's sustainable development goals (SDGs) and Africa Agenda 2063, *the Africa we want*, are achievable when a country can mobilize sufficient domestic resources to finance such initiatives. As these countries need more revenue to finance government spending, this study is conducted to investigate the factors affecting their tax revenue performance.

Actual tax revenues as a share of GDP remains one of the most used measures of tax effort for cross-country tax comparison. The ratio of tax revenue to GDP is widely available and provides a quick overview of tax trends across countries. However, as indicated by Musgrave (1987) and Minh Le, Moreno-Dodson, and Rojchaichaninthorn (2008), this measure is suitable for studies on

countries with similar economic structures and similar income levels. As such, the study uses panel data for East African countries to examine factors affecting their tax revenue performance. The study adopted an empirical approach that Minh Le, Moren-Dodson, and Bayraktar (2012) applied when examining factors affecting tax performance in the EAC. The thrust is to obtain administrative data from partner states. Specifically, the study uses a ratio of taxpayers to staff, a ratio of revenue generated to staff, and the cost of collection as a share of the total collection as indicators of administrative efficiency. The findings indicate that administrative efficiency has a significant positive effect on tax efforts. The study also reveals that per capita increase has a negative impact on tax effort but when interacting with the institutional quality it becomes positive. In other words, institutional quality is vital in efforts geared toward fostering domestic resource mobilization.

This study provides insight into the impact of the level of economic development, measured by per capita GDP, on the revenue performance in developing countries. The finding shows that an increase in per capita has a negative impact on revenue performance. This implies that as individual income increases there is a tendency of escaping the tax net. In other words, the tax system is unfair as it fails to tax the rich appropriately. The study also adds to a bunch of tax literature on the importance of administrative efficiency in tax administration. The fact that most developing countries have an inadequate level of technological development, the number of staff and their ability to serve taxpayers is of paramount importance. It also suggests that in the short run an increase in the cost of collection is associated positively with revenue collection.

The rest of the paper is organized as follows: Section 2 reviews literature related to the study; section 3 presents the empirical approach; section 4 presents the findings and discusses the results; and the final section concludes.

2. Literature Review

Since 1980s, changes in tax administration occurred in many developing countries. Most countries transitioned from the traditional approach under which revenue administration was a function in the Ministry of Finance to the establishment of an independent agency responsible for tax administration. The latter approach sought to improve revenue administration through improved pay, hiring of qualified individuals, and reduction of costs of collections (see, for example, Jenkins, 1994; Taliercio, 2004; Kidd and Crandall 2006). Countries in this study have adopted the approach of establishing a semi-autonomous revenue administration, which is responsible for assessing, collecting, and accounting for government tax revenue. Apart from their core activities, the revenue authority compiles statistical data for publication and for purpose of informing policy formulation.

Similarly, Tanzi and Zee (2000) in their study on tax policy in emerging markets highlight the key challenges that developing countries contend with to ensure effective and efficient tax administration. The foremost challenge lies in the structure of the economy that does not support taxing certain economic activities. The poor tax administration system, inferior quality of data, and lack of political will tend to inform the formulation of a tax system. Recent reforms, especially in relation to the establishment of semi-autonomous agencies aim to address these challenges. The semi-autonomous agency model strives to enhance the efficiency of tax administration in addition

to eliminating a challenge related to the availability of reliable revenue statistics. On the other hand, it signals political support for boosting domestic revenue mobilization.

Knowing that the countries have adopted the semi-autonomous model in collecting tax revenue, we find it interesting to investigate what other factors affect their revenue performance. The study follows the approach that has been used by scholars in studying the determinant of revenue performance in a country. Besides, this study contributes to the body of tax literature by providing estimates based on administrative data which were rarely available in previous years.

Among the first scholars to examine the determinants of the level of taxation are Lotz and Morss (1967), who explain on why tax to GDP can serve as a good measure of tax effort or tax capacity in a country. The authors focus only on the three measures of taxable capacity namely aggregate gross national product (GNP), per capita GNP and the size of the foreign trade sector. They find that in low income countries both per capita GNP and the degree of openness significantly relate to the tax ratio. However, the authors admitted that their study faced a challenge of obtaining reliable data, a situation that necessitate them to make some manipulation of data.

Tanzi (1987) discusses the tax systems of the eighty-six developing by studying the relationship between total tax revenue and gross domestic product and the empirical importance of various tax sources at different levels of per capita income. He finds a positive relationship between share of tax to GDP and per capita income. He divides the country into two groups; those with higher and those with lower per capita. He notices that those countries with lower per capita income their share of personal tax to GDP tends to be low. He argues that this may be due to the fact that majority of people are involved in agriculture, the sector that is difficult to tax. He also argues that in developing countries far more than in developed countries, the personal income tax is often a tax on the wages of public sector employees and of the employees of large, and often foreign, corporations. This implies that we should expect a different result of per capita income when analysing revenue performance in developing countries.

Musgrave (1987) in his study of tax reform in developing countries highlights some key issues that hinder tax effort. He notices that a large share of individuals in self-employment, small scale agriculture and retail establishment complicate tax collection. He further noted that availability of administrative staff also poses challenges in revenue collection. He recommends that it is more helpful to compare the tax effort of a particular country with that of others in the same region and subject to more or less similar circumstances. Therefore, this study brings into the body of literature the result from countries in the same region with similar economic structures.

Similarly, Tanzi and Zee (2000) while discussing the tax policy for emerging markets, notice that it is difficult to establish effective and efficient tax systems in developing countries. This is due to the structure of the economy, limited capacity of the tax administration and poor quality of basic data. They further notice that most developing countries are characterized by a large share of the agriculture sector, large informal sector activities, many small establishments and a small share of consumer spending. They concluded that these characteristics reduce the possibility of achieving high tax levels. In this study we have a sample of developing country with a well-established revenue authority and have basic data to allow us to carryout performance analysis on the factors affecting their revenue performance.

Gupta's (2007) empirical study uses a panel dataset covering 105 countries for a 25-year period. The study find per capita GDP, share of agriculture in GDP, and trade openness to be strong determinants of revenue performance. Moreover, foreign aid positively affected revenue performance whereas foreign debt did not have a significant effect. On the other hand, testing the effect of institutions using a corruption index established that corruption is a significant determinant of a country's revenue performance. Likewise, Tanzi and Davoodi (1997) find that corruption practices affect negatively the revenue performance of a country. An increase in corruption tends to affect government revenue, particularly because of excessive exemptions, tax evasion, or weak administration. This study, therefore, includes in the model the corruption index as a proxy for the institutional quality level in a country.

Gupta (2007) also notices that the effect of trade on revenue performance remains largely ambiguous as it can either raise or reduce taxes. In the same vain, Keen and Simone (2004) argue that openness might raise tax revenue if there is improvement in customs operations. Davoodi and Grigorian (2007), use regression to extend the conventional determinants of tax potential. They included measures of institutional quality and shadow economy in a panel data framework. The empirical analysis of this paper shows that, in Armenia, improvement in institutions, as well as policy measures designed to reduce the size of the shadow economy, are crucial factors in boosting tax revenue performance.

The review of literature reveals that there are number of factors that affect revenue performance. These factors may differ from country to country depending of the country's economic structure. The literature also acknowledges that countries of similar economic structure provide a good basis for comparison on the factors affecting revenue performance. Thus, in this study we provide comparison of countries with more less similar economic circumstances. Besides, we have noted that there is limited studies that have used administrative data in analysis the factors affecting revenue performance. Therefore, this study adds to a bunch of tax literature on the importance of administrative efficiency in tax administration as measured by the number of staff and their ability to serve taxpayers.

3.0 Empirical Approach

This paper follows a standard empirical specification used by numerous studies in examining the determinants of tax revenues. Specifically, the paper has adopted the specification by Minh le, Moren-Dodson and Bayraktar (2012) as a standard model, in which they specified an empirical model thusly:

$$Y_{it} = \beta_0 + \beta_1 GDPPC_{it} + \beta_2 DEMOG_{it} + \beta_3 TRADE_{it} + \beta_4 AGR_{it} + \beta_5 INST_{it} + \epsilon \qquad (1)$$

Where Y_{it} is the total tax revenue as percentage of the GDP of a country i at time t; $GDPPC$ per capita GDP; DEMOG is a demographic indicator (population growth); TRADE is the sum of imports and export as a percent of the GDP; AGR is the agriculture value addition as a percentage of the GDP; INST is the Institutional quality measured by corruption index; and ϵ is the error term.

The modification of the equation includes the administration variable and the measure of the underground economy. This study uses the taxpayer to staff ratio, revenue generated per staff, or cost of collection as a proxy for tax administration. Thus, the model's specification becomes:

$$Y_{it} = \beta_0 + \beta_1.GDPPC_{it} + \beta_2.DEMOG_{it} + \beta_3.TRADE_{it} + \beta_4.AGR_{it} + \beta_5.INST_{it} + \beta_6.SHADOW_{it} + \beta_7.ADM_{it} + \epsilon \quad (2)$$

Where ADM_{it} represents the administration variable and *SHADOW* stands for the shadow economy. The inclusion of these variables in the model follows the previous studies that show that per capita GDP measures a level of development in a country. The proposition is that an increase in per capita income is associated with increase in spending and personal income taxes. Thus, the coefficient of this variable is expected to be positive (Tanzi and Zee, 2000; Tanzi, 1987).

Population growth rate serves as a proxy for demographic characteristics of a country's taxable income can have a negative effect on tax capacity. Bird, Jorge and Benno (2004) suggest that a country may be lagging in registering new taxpayers relative to population growth. In other words, a population increase may not be associated with heightening number of taxpayers, hence deficient performance in revenue mobilization.

The trade variable measured as the sum of imports and export as a percent of the GDP, mostly refers to as a degree of openness, is crucial in taxation. In this regard, Gupta (2007) contends that the effect of trade on domestic tax mobilization is ambiguous as it could either raise or reduce taxes. Other scholars such as Keen and Simone (2004) argue that openness can hike tax revenue when improvement in customs operations occurs. Other studies such as Minh le, Moren-Dodson and Bayraktar (2012) include value addition in the agriculture sector as a percentage of the GDP when examining factors influencing tax revenue mobilization. This sector tends to be less taxed, which increases in its share associated tax revenue reduction.

Equation 2 includes the administration variable and aims at examining its impact on tax revenue mobilization using three different proxies: A ratio of taxpayer to staff, revenue generated per staff, and cost of collection. Revenue administrations among East African Community partner states initiated a process of sharing tax statistics. Thus, this study extracted administrative data extracted from the partner states' available dataset.

The empirical approach followed in estimating Equation 1 and 2 utilizes fixed and random effect approaches for panel data. However, due to the possibility of autocorrelation effect among variables, we also estimate the autoregressive distributive lag model (ARDL) to test the robustness of the results. Thus, a Pooled Mean Group (PMG) regression on the model specified as follows

$$\Delta Y_{it} = \theta\left[Y_{i,t-1} - \boldsymbol{\lambda}'_i \mathbf{X}_{i,t}\right] + \sum_{j=1}^{p-1} \xi_{ij} \Delta Y_{i,t-j} + \sum_{j=0}^{q-1} \boldsymbol{\beta}'_{ij} \Delta \boldsymbol{X}_{i,t-j} + \varphi_i + \epsilon_{it} \quad (3)$$

where ΔY_{it} is the difference of total tax revenue percentage of the GDP of a country *i* at time *t;* $\boldsymbol{\lambda}'_i$ is the vector of long-run relationships; $\mathbf{X}_{i,t}$ is the vector of independent variables of a country *i* at

time *t;* ξ_{ij}, $\boldsymbol{\beta}'_{ij}$ are the short run dynamic coefficients and θ is a group specific speed of adjustment coefficient. After testing our p value was 1 and q value was 0.

Following Pesaran and Smith (1995) and Pesaran, Shin and Smith (1999) we performed a correlation analysis of variables and unit root test. The former aims at viewing how variables are correlated and the other to observe if the data are stationary prior to estimating the equation. The results of the correlation and unit root test are as described in Table 5 and 6 respectively. Moreover, we performed a test for the maximum lag where we found, p to be 1 and q to be 0 for all variables.

3.1 Data Description

The study used a panel dataset covering five East African countries over a 10-year period. The choice of countries is primarily motivated by the desire to test whether tax administration has an impact on revenue collection in the region with a similar fiscal regime. The variables of interest include a number of taxpayers per staff, cost of collection and tax revenue generated per staff. These variables are available under the countries' programme of sharing tax statistical data. Other variables include per capita GDP, value addition to agriculture as percentage of the GDP, openness, size of the shadow economy, institution quality and demographic are extracted from the World Development Indicators. Table 1 summarises the descriptive statistics of key variables:

Table1: Descriptive statistics of key variables

Variable	Mean	Std. Dev.	Min	Max
Tax to GDP	12.51	3.06	0.00	16.90
Corruption index	-0.67	0.65	-1.45	0.76
Agriculture, value added(%GDP)	28.13	4.35	22.76	38.43
per capita GDP	741.89	288.80	210.08	1201.48
Openness (Trade)	43.12	7.41	31.34	60.40
shadow	34.97	5.57	26.70	49.50
Population growth	2.93	0.36	2.31	3.76
Taxpayer to staff	293	309	1	1260
Revenue to staff	1.47	0.55	0.40	2.88
Cost (share of tax collected)	2.31	0.65	1.00	4.00

4.0 Results and findings

The analysis of panel data poses a challenge to choosing estimation techniques on whether to use a fixed effect estimator or a random effect estimator. According to Wooldridge (2002), the fixed effect estimator removes both the unobserved effect and time-invariant variables before estimation. The random effect estimator, on the other hand, assumes that the unobserved effect is uncorrelated with the explanatory variable. If the effects are fixed, then the pooled OLS and random effect estimation are inconsistent, hence the need to use the fixed effect estimator instead based on Hausman's (1978) observation on the specification of tests. In this study, the standard equation (1) uses the Hausman test to determine whether to use a random or fixed effect estimator. The result suggests that the random effect provides consistent estimates due to failure to reject the null hypothesis. The results in this regard are as summarized in Table 2. This study, therefore, would use the random effect estimator if unobserved country specific variable does not correlate with explanatory variables.

Table 2: Result of Hausman Test for fixed effects

	Coefficients			
	Fixed effect	Random effects	Difference	SE
Agriculture, value added(%GDP)	0.0994	0.0809	0.0185	0.0136
Per capita GDP	-0.0031	-0.0024	-0.0007	0.0004
Openness (Trade)	0.1135	0.0382	0.0753	0.0313
Shadow (%GDP)	-0.238	-0.2414	0.0034	0.0164
Population growth	-3.1857	-3.3676	0.1819	0.163
Chi2	6.52			
Probability	0.259			

The estimation results from the use of a random effect estimator is as summarized in Table 3. Variables such as value-addition of agriculture per GDP, shadow economy, population growth and corruption have significant negative effects on domestic tax mobilization. Previous studies such as Lotz and Mors (1967), Davoodi and Grigorian (2007), and Gupta (2007) that sought to investigate factors affecting tax capacity or effort had come up with similar findings. Hence further validating the results of the current study following Minh le, Moren-Dodson, and Bayraktar (2012) whose specifications include variables on demography and quality of institutions in the model. Similarly, the study found that demographic characteristic measured by growth in population has a significant negative effect on tax revenue. Also, the quality of institutions measured by the level of corruption in a country has a significant negative bearing on domestic tax mobilization, as column 2 of the Table 3 illustrate.

Besides, this study investigated the effect of tax administration on domestic resource mobilization. To achieve this objective, the study selected three variables: Number of taxpayer per staff, revenue collection per staff, and cost of collection. The result presented in Table 3 column 3 uses a ratio of taxpayers to staff as an indicator of tax administration efficiency. The coefficient of this variable is positive and statistically significant, which implies that an increase in the number of taxpayers administered by a tax officer is associated with a rise in revenue performance. As the number of

taxpayers is usually larger than that of staff. The finding suggests that staff's ability to handle many taxpayers is crucial in revenue administration. This aspect is prominent in developing countries where operations are semi-automated, with the role of staff in serving taxpayers indispensable. In EAC countries, just like in many other developing countries, the digitalization level is largely low. Impliedly, the ability of one worker to serve many taxpayers is vital. After all, taxpayers need regular visits for enforcement of tax compliance purposes.

Column 4 uses a ratio of tax revenue to staff as an alternative indicator of administrative efficiency. The indicator serves as a proxy for staff productivity. The result is in line with the assumption that improved staff productivity enhances revenue performance. The coefficient of this variable is positive and statistically significant, implying that an increase in staff productivity is associated with an increase in revenue performance measured by tax per GDP. Moreover, the impact of cost of collection on tax revenue mobilization indicates, as column 5 illustrates, no significant relationship between the cost of collection and revenue performance. However, the impact of this variable to tax revenue collection cannot be ruled out; instead it is pertinent consider having a non-linear relationship, the introduction of a square variable of the cost of collection. In fact, column 6 introduces both variables cost and cost square. The marginal effect suggests the minimization of the cost when the share of cost reaches 2.89 percent. Implicitly, if the share cost is above 3% it can positively contribute to revenue collection. Overall, the minimum cost of collection for these East African countries should be at least three percent of the share of collection for it to have a positive bearing on tax revenue mobilization.

Unlike most previous studies, this study has established that an increase in per capita GDP tends to lower tax efforts. In the analysis (see also Table 3), the coefficient of per capita GDP remained negative throughout, implying that when incomes of individuals increases in these countries, less tax is collected. Implicitly, the increase in individuals' income makes them attempt to avoid paying taxes, a feature that could be attributable to poor institutional quality. That allows individuals with high income levels to corrupt tax officers, evade tax because of loopholes in tax laws or both. Hence, they end up paying an unfair share of their tax liability. For this problem, we generate the interaction term between the index of quality institutions and per capita income and re-estimate equation 2 as summarized in Table 4. After the inclusion of the interaction term, the per capita income has a positive impact on domestic revenue mobilization. Impliedly, a rise in per capita income has positive effect on tax revenue mobilization in a country with strong institutional quality.

Table 3: Result of Random Effect Model: Determinant of Tax Performance

VARIABLES	(1) tax_gdp	(2) tax_gdp	(3) tax_gdp	(4) tax_gdp	(5) tax_gdp	(6) tax_gdp
Agr_value	0.088	-0.041	-0.122*	0.0031	-0.089	-0.066
	(0.068)	(0.080)	(0.070)	(0.079)	(0.086)	(0.076)
GDP_PC	-0.00150	-0.0024**	-0.0079***	-0.0035***	-0.0040***	-0.0049***
	(0.0011)	(0.0011)	(0.0016)	(0.0011)	(0.0015)	(0.0013)
Openness	0.0399	0.0249	0.114***	0.0521	0.0232	0.0761**
	(0.0383)	(0.0364)	(0.0374)	(0.0368)	(0.0359)	(0.0345)
Shadow	-0.16***	-0.165***	-0.218***	-0.140***	-0.146***	-0.0995**
	(0.0508)	(0.0478)	(0.0425)	(0.0471)	(0.0491)	(0.0447)
Popn_growth	-3.51***	-5.23***	-3.91***	-3.76***	-5.11***	-2.03*
	(0.846)	(1.025)	(0.924)	(1.177)	(1.016)	(1.213)
Corruption		-1.518***	-0.941*	-0.405	-1.357**	0.437
		(0.574)	(0.506)	(0.739)	(0.578)	(0.698)
Taxpayer_Staff			0.00570***			
			(0.00135)			
Rev_staff				1.553**		
				(0.691)		
Cost					-0.879	-11.63***
					(0.607)	(2.933)
Cost Square						2.010***
						(0.539)
Constant	25.41***	34.76***	33.94***	26.40***	38.48***	40.04***
	(4.340)	(5.392)	(4.578)	(6.356)	(5.913)	(5.189)
Observations	50	50	50	50	50	50
Number of year	10	10	10	10	10	10

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4 shows that all other variables maintain their effect on revenue performance. Column (1) shows that the share of agriculture value addition, shadow economy, demographic features and corruption index have a negative significant effect on revenue performance. In other words, the interaction between per capita GDP and corruption index is positive and statistically significant. Of interest is the change of per capita GDP from a negative to a positive outcome albeit in a non-statistically significant manner. Also, the per capita GDP is positive and statistically significant in revenue mobilization in the equations presented. Column (4) of Table 4 also presents variables of the cost and square of cost in the equation. Both variables have a significant impact on revenue collection. The marginal effect of the share of cost suggests minimization at 3.4 percent, which is almost like the previous result in column (6) of Table 3. In other words, the cost of collection is supposed to be a least three percent of revenue collection for the revenue administration to run smoothly.

Table 4: Result of Random Effect Model: Focus on Institutional Quality

VARIABLES	(1) tax_gdp	(2) tax_gdp	(3) tax_gdp	(4) tax_gdp
Agr_value	-0.162**	-0.0947	-0.270***	-0.223***
	(0.0695)	(0.0816)	(0.0767)	(0.0709)
GDP_PC	0.00109	0.00725*	0.0106***	0.00281
	(0.00412)	(0.00401)	(0.00310)	(0.00369)
Openness	0.0763*	0.0151	-0.0169	0.0662*
	(0.0390)	(0.0367)	(0.0295)	(0.0361)
Shadow	-0.218***	-0.167***	-0.147***	-0.135***
	(0.0404)	(0.0448)	(0.0388)	(0.0428)
Popn_growth	-4.441***	-4.810***	-5.473***	-2.811***
	(0.908)	(1.156)	(0.806)	(1.052)
corruption	-6.396***	-7.958***	-12.47***	-7.389***
	(2.377)	(2.801)	(2.218)	(2.400)
Taxpayer_staff	0.00445***			0.00226
	(0.00139)			(0.00141)
Revenue_staff		0.782		0.419
		(0.699)		(0.699)
Cost			-1.924***	-7.296***
			(0.522)	(2.643)
GDP_PC *corruption	0.00733**	0.00963***	0.0156***	0.0105***
	(0.00313)	(0.00346)	(0.00304)	(0.00307)
Cost Square				1.055**
				(0.507)
Constant	31.67***	27.34***	37.72***	36.49***
	(4.458)	(5.910)	(4.677)	(5.035)
Observations	50	50	50	50
Number of years	10	10	10	10

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

We further test the robustness of our result using the pooled mean group and the result is as presented in Table 7. The advantage of this method is that it takes care of the autocorrelation effect of the variables which might have affected our previous estimates. Secondly, it provides estimate on both long run and short run relationship that exist among variables.

However, due to the span of the panel data that span for ten years we could not include many variables in the equation we have used a maximum of four variables in the equation. In this case we have used those variables which have been provided in the literature to be instrumental in affecting revenue performance in a country. These are GDP per capita, share of agriculture, population growth and the variables of interest the institutional quality.

Throughout the analysis we observe that the long run effect of the per capita GDP is not significant in EAC. While the short run effect is significant and have negative effect on revenue performance. This affirms what we have observed in our previous model. Also in Table 7 column 1 where we use revenue generated per staff as a proxy for institutional quality, the share of agriculture seems to have a positive impact in the long run while in the short run has a negative effect. This suggests that if agriculture activities are well monitored in a long run ought to have a positive impact on tax revenue performance.

Column 4 of Table 7 also provides insightful observation on the cost of collection. That in the short run an increase in the cost of collection has a positive significant impact on revenue performance. However, in the long run it has a negative impact, this suggests that there is a limitation in the effect of cost of collection on the revenue performance.

Table 5: Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) tax_gdp	1.000							
(2) agr_value	0.091	1.000						
(3) gdp_pc	0.036	-0.466	1.000					
(4) Open (trade)	0.263	-0.210	0.271	1.000				
(5) shadow	-0.486	0.198	-0.227	-0.094	1.000			
(6) pon_gro	-0.618	0.099	-0.333	-0.370	0.380	1.000		
(7) txp_staff	0.174	-0.027	0.712	-0.125	0.007	-0.225	1.000	
(8) rev_staff	0.388	-0.020	0.490	0.010	-0.223	-0.253	0.663	1.000

Table 6: Im-Pesaran-Shin Unit Root Test

	At Level		First Difference		
	Statistic	P-value	Statistic	P-value	Stationarity
lntax-gdp	0.2737	0.6079	-2.9154	0.0389	I(1)
lnagr-value	0.392	0.3475	-2.871	0.0154	I(1)
lngdp_pc	1.2494	0.8942	-3.1345	0.0099	I(1)
lnopen	0.5353	0.7038	-2.3498	0.0876	I(1)
lnshadow	-1.7269	0.0421			I(0)
lnpon_gow	-4.7824	0.0000			I(0)
lntaxp_staff	-2.9745	0.0015			I(0)
lnrev_staff	-0.4165	0.3385	-2.861	0.0160	1(1)
lncost	-0.1584	0.4371	-2.8014	0.0115	I(1)

Table 7: Result of Autoregressive Pooled Mean Group

In long run				
Variables	(1) lntax_GDP	(2) lntax_GDP	(3) lntax_GDP	(4) lntax_GDP
lngdp_pc	0.444	0.043	-0.022	0.623
	(0.242)	(0.059)	(0.133)	(0.082)***
lnrev_staff	0.422	-0.066		
	(0.1322)***	(0.019)***		
lntxp_staff			-0.018	
			(0.010)*	
lncost				-0.361
				(0.059)***
lnagr_value	0.743			-1.023
	(0.375)**			(0.117)***
lnpon_gro		-1.62	0.288	
		(0.245)***	(0.139)**	
In short run				
D1.lngdp_pc	-1.082	-0.695	-0.849	-0.891
	(0.415)***	(0.366)*	(0.463)*	(0.336)***
D1.lnrev_staff	-0.101	-0.127		
	(0.099)	(0.100)		
D1. lntxp_staff			0.007	
			(0.011)	
D1.lncost				0.180
				(0.081)**
D1.lnagr_value	-0.613			0.025
	(0.202)***			(0.175)
D1.lnpon_gro		-7.221	-4.338	
		(6.846)	(2.908)	
EC	-0.18	-1.04	-0.95	-0.62
	(0.241)	-0.678	(0.266)***	(0.098)***
Constant	0.598	-4.178	2.434	1.466
	(0.684)	(2.665)*	(0.705)***	(0.422)***

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.0 Conclusion

This study has established that the administration efficiency measured by three different variables namely; the ratio of taxpayers to staff, the ratio of revenue generated to staff, and the cost of collection as a share of the total collection, is crucial in revenue mobilization. The indicator of ratio of taxpayers to staff is also vital so long as the digitalization level remains low. Once the revenue authority has digitalized all it process, this ratio may no longer be important. Thus, the digitalization level should go hand-in-hand with structural changes in the entire economy. The full digitalization of the revenue authority can be counterproductive when the rest of the economy is lagging behind as most of these players would be operating in the shadow economy where it is difficult to trace their transactions.

The study also finds that the development level measured by per capita GDP has a negative impact on revenue collection, an effect that diminishes when the country builds the much needed strong institutions aimed to foster checks and balances as well as accountability. The corruption index as a measure of institutional quality shows that the interaction of this variable with per capita GDP results in a positive coefficient of the latter. Otherwise, individuals with a high level of income would seek to evade tax payments using various channels or loopholes in the tax regime.

On the other hand, the negative contribution of the per capita income may be an indication of the inability of the government to tax individual income. As Tanzi (1987), noted that in most developing countries majority of individuals are in the informal sector hence creating difficulties for the government to tax. Therefore, the government should rethink the best way to tax individuals rather than depending on the wages and salaries of public employees and those employed in big companies.

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