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Public Revenue/Gross Domestic Product (GDP.) Nexus: A Panel Data Analysis of Selected African Countries.

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ABSTRACT: Nigeria is the largest economy economy, surpassing South Africa in sub-Sahara Africa, yet her public revenue to GDP ratio is the lowest. This applies to the other African countries why? Thus our aim is to investigate the low public revenue as a percentage of GPD in African countries. We apply the panel data econometrics using cross sectional tax revenue data from ten randomly selected African countries for the period (2000 – 2020) twenty years. Two hypotheses: Ho_1: (a, Political instability, lack of the rule of law and Government effectiveness in African countries as measured by WGI's (i) the quality of civil service (ii) the quality of policy formulation and implementation could negatively impact the size of tax revenue (tax) to-GDP ratio in Nigeria and the other African countries. (b. The inability of African governments to control corruption as measured by Transparency International Index and the Worldwide Government Indicator, is an explanation for the low tax revenue-to-GDP ratio in African countries. Our findings confirmed that the many inefficient governments in Africa, public instability and corruption negatively impact public revenue generation. Adequate rule of law and regulatory quality could help improve the generation of public revenue in African countries.

Keywords: Public revenue, government efficiency, tax/gdp ratio, control of corruption tax evasion

INTRODUCTION

Placed side by side with Europe, North America, Asia and even most of South and Latin America countries, most sub-Saharan African economies appear to have very low public (tax) revenue to gross domestic product (GDP) ratio year-on-year. This ratio compares a country's net tax revue to (GDP). "It is the gauge of a nation's tax revenue relative to the size of her economy as measured by GDP)." Nigeria, albeit theoretically, is considered the largest economy by GPD size in sub-Sahara Africa. Yet her public (tax) revue-to-GDP ratio is the least and even behind smaller economies like Tanzania, Mali, carbon etc. It tax to gdp"decreased by 0.3 percentage points from 6.3% in 2018 to 6.0% in 2019." "The average for the 30 African countries increased by 0.3 percentage points over the same period and was 16.6% in 2019." https://www.oecd.org/countries/nigeria/revenue-statistics-africa-nigeria.pdf.

This awkward situation, painful as it is, has persisted over the decades to the chagrins of economic development of most sub-Saharan African economies, including Nigeria. Which variables explain or determine the steady positive progression of European and North American public revenue generation to GDP ability remain elusive to sub-Saharan African countries. We believe government effectiveness is one possible explanation for this unhealthy disparity. Government effectiveness is a broad concept

that captures "perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies." **https://govdata360.worldbank.org/indicators/h1c9d.** Government effectiveness and internally generated revenue reinforces each other, since indicators of government effectiveness: the quality of public service, policy formulation, implementation and Government credibility all work in tandem for an effective tax. Government effectiveness may also include corruption and institutional weakness, as recent studies have shown: (i) reduce public tax revenues (Ghura 1998; Tanzi and Davoodi, 2000; Attila et al., 2008),(ii) hurts the tax morality of taxpayers (Torgler, 2004, 2005, 2007),(iii) and distorts a country's tax structure.

Therefore the main objective of this paper is to examine why African countries generally record low public revenue as a percentage of GDP We also want to find out how variables such as government efficiency either aid or discourage the efficient collection of public revenue in sub-Saharan African countries. We argue further that the unscrupulous governments prevalent in many sub-Sahara African countries are the bane of the persistent weak tax revenue to GDP ratio. We theorized that the low tax revenue to GDP ratio could explain the region's failed sub-Sahara countries' development goals. An adequate level of internally generated public revenue inflow, besides those earned from international trade (for example, crude oil and gas in the case of Nigeria, coffee in Kenya, cocoa in Ghana etc. development aids and grants, support the provision of the most needed infrastructure, economic growth and development. It improves well-being and provides social security. Due to poor public revenue generation over the long term, sub-Saharan African countries will continue to experience low economic growth and slow economic development. They will also continue to employ foreign borrowing and other unhealthy financing practices in their development and infrastructure built-up efforts. Thus, this study investigates why most African countries' public revenue to GDP ratio is low.

1.2 Background

This persistent outcry has been against the large patches of underdevelopment and economic stagnation resulting in infrastructural deficit across sub-Sahara African countries, including Nigeria. Infrastructural provisions in these countries have largely been the product of foreign development aids, grants and external borrowings (debt) financing resulting in some cases, unstained public debt burdens, Nigeria as a case in point. The option of debt financing infrastructure prevalent in most of sub-Sahara economies could be partly due to the persistent *low public revenue generation (taxes and other charges) plus inadequate domestic saving and investment*. In a CID. Working Paper No. 38, Aryeetey and Udry (2000) noted that the average gross domestic saving in African countries in 2021 was only 8% of GPD compared with 23% in Southeast Asia. In 2020 average gross domestic savings was 21.66% of GDP in Nigeria based on World Bank development indicators.

Internally generated public revenue naturally contributes significantly to any country's economic growth and infrastructural development. Countries with higher internally generated public revenue ratio to gross domestic product (GDP), as is the case of OECD group, tend to have higher rates of economic growth, and development, higher per capita income and more improved quality of life. For instance, in a survey, Durden (2021) recorded that in 2019, 35 of the 37 OECD countries posted high internally generated public revenue as a percentage of GDP, averaging 33.8% in all of these countries. This compares negatively with the dismal 16.6% recorded for the 30 African countries during the same period. https://www.oecd.org/countries/nigeria/revenue-statistics-africa-nigeria.pdf. T**able** 1. Below in Table 1 is a sample of 5 of the 35 OECD countries with their respective tax revenue as a ratio to GDP.

Table 1: 1-5 of 37 OECD Countries Tax Revenue as % of GDP.

Rank	Country	Tax Revenue as % of GDP.
1	Denmark	46.3%
2	France	45.4%
3	Belgium	42.9%
4	Sweden	42.9%
5	Austria	42.4%

Source: Durden, T. (Zero Hedge, Sunday, 01 August 2021)

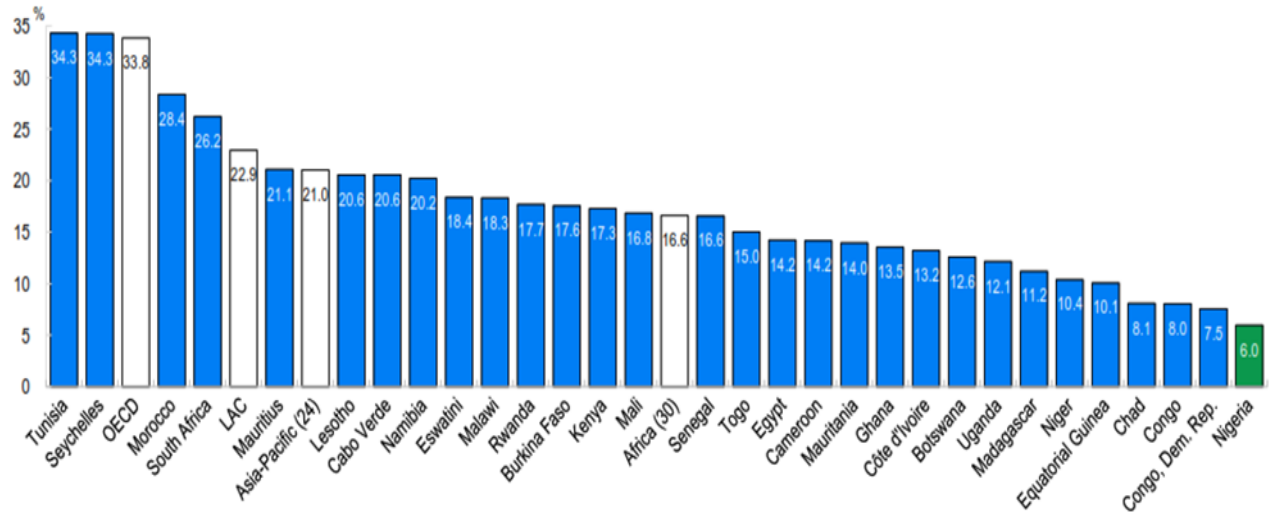
Denmark, with a 46.3 percent internally generated public revenue to GDP ratio, is known for its high quality of public services, disciplined civil service with a high degree of independence from political pressures, and good quality of policy formulation and implementation. This Government scored 88 out of 100 points and ranked (1) first out of 180 countries on the Transparency International Corruption Index. Compare this with Nigeria having a public revenue to GDP ratio of 6.3% in 2018 that decreased to 6.0% in 2019 from 7. 3%." Conversely, Nigeria is ranked 149 out of 180 countries and scored only 24 out of 100 points in 2021. There thus appears to be a link between government effectiveness and higher internally generated public (tax) revenue to gross domestic product.

Nigeria has credibility problems, with a poor perception of government effectiveness. Besides the well-known corruptible practices, Nigeria and most of sub-Sahara countries' civil service is undoubtedly under duress from the political class with the appointment of judges heavily influenced by the political class. Following the passage of the Fiscal Responsibility Act 2007,

Nigeria like Tanzania, Kenyan, and Uganda etc. adopted the Medium Term Expenditure Framework (MTEF) to guide their annual budgeting process and steadied their fiscal, monetary policies formulation and borrowing behaviour. Yet their Policy formulation, implementation and credibility of government commitment to these policies remain accentuated. For instance, recent years have seen Nigeria's borrowing binge increase over 70 percent. Nigeria debt management office (DMO) puts her external and domestic debts at US$87,239.12 as of 31 March, 2021. In part, this increased borrowing relates to the low level of internally generated public (tax) revenue which should add up in the provision of public goods and serveries.

Nigeria's tax administration system apportions tax revenue collection functions to the three tiers of Government. Taxes payable to the Federal Government are administered by the Federal Inland Revenue Service (FIRS), while those payable to the State Governments are administered by the State Boards of Internal Revenue (SBIRs) of the thirty- six states of the Federation, including the Federal Capital Territory - Abuja. Local Governments administer rates and levies collectible by them through their various councils" Strachan Partners (2016). Herein lies the role of government effectiveness that could impede the level of internally generated publicly (tax) revenue in any modern nation-state.

In Nigeria, tax structure exists a good number of rich tax bases. Tax payable by persons doing business in Nigeria includes companies' income tax, personal income tax, capital gains tax, value-added tax, education tax, technology tax, stamp duties, and withholding tax. By any account, accruing revenues from these tax bases should contribute sizable income to Nigeria's federal, state and local governments, especially as failure to pay when it falls due attracts penalties. Given this, the internally generated public revenue to GDP ratio should be reasonably high. Yet in Nigeria, publicly generated revenue (tax and non-tax that exclude grants) revenue to GDP ratio remains abysmally low even when compared to fellow sub-Sahara African countries as South Africa with 22.3 to G.D.P., Senegal 16.6%, and Mali 16.8% in the same period Nigeria having only 6.3%. Fig. 1.1 below lists further details of tax revenue to GDP ratio in these sub-Sahara African countries.



Sources: oe. cd/revenue-statistics-in-Africa
Figure. 1: Tax-Revenues-to-GDP-ratio

Given these facts, there is little doubt that effective public (tax) revenue generation could largely be a function of - *government effectiveness, regulatory quality, rule of law and control of corruption*. Government agencies that collect tax and non-tax revenues must be probity and audaciously regulated, strictly adhering to the rule of law and not corrupt. We, therefore, surmised that poor public (tax) revenue generation relative to GPD in Nigeria and the other sub-Sahara African countries, is a measure of these governments inefficiency expressed in poor regulatory quality, inefficient operationalization of the rule of law and inadequate control of corrupt practices in the public and civil service. The rest of this paper treats the literature review in section two, the methodology is in section three, and section four summarizes and discusses our findings. We conclude and provide some recommendations based on our findings in section five.

1.3. Conceptual Literature and general discussion

Clarification and a general discussion of applicable concepts are necessary to properly understand the parameters of these concepts when operationalized in the methodology.

Public revenue

The concept "public revenue" originates in revenue accruing to the general Government from the different tax bases. But Dalton (2008) cited by Chand (https://www.yourarticlelibrary.com/finance/public-revenue-meaning-tax-revenue-non-tax-revenue-with-classification-of-public-revenue/26277) identified two types of public revenue. Chand says: "Public revenue includes all income or receipts which a public authority may secure during any period from taxes and goods and services of public enterprises,

revenue from administrative activities such as fees, fines etc. and gifts and grants." Following Dalton in a wider application, public revenue includes "all the incomes, of the government received from formal sources." Public revenue is broadly divided into tax and non-tax revenues. Taxes are the foremost resources of public revenue and they accrue from the different tax bases. A tax base is the total amount of income, property, assets, consumption, transactions, or other economic activity subject to taxation by a tax authority." https://taxfoundation.org/tax-basics/tax-base/.

Tax bases do not have universal application though, as they vary between countries. In Nigeria for instance, tax base is structured following: Personal Income Tax (PIT), Stamp duties, Capital Gains Tax (CGT), Petroleum Profit Tax (PIT), Companies Income Tax (CIT), Education Tax (ET), Value-added Tax (VAT), Withholding Tax (WHT) and National Information Technology Development Levy (NITDL). Revenue Statistics in Africa (2019) recorded 46% for corporate income tax the highest contribution and the Valued Added tax (VAT) 14.% to Nigeria's total public tax revenue in 2019. Besides formal taxes revenue, non-tax sources: rent and royalties, property income, sales of goods and services, fines, penalties and forfeits also contribute to public revenue. In 2019, Nigeria's non-tax revenues was 3.2% of GDP This is lower than the average for the non-tax revenues for the 30 African countries of 6.3% of GDP See Figure 1. Rents and royalties in Nigeria had the largest shares of non-tax revenues in 2019.

Tax-to G.D.P. ratio

The tax-to-GDP ratio defines the total tax revenue, including compulsory social security contributions, as a percentage of the gross domestic product (GDP). Nigeria's Tax-to-GDP ratio was 6.0% in in 2019. This is far below the 34.3% obtained in the small Indian Ocean Island of Seychelles and 34.3% in Tunisia in the same year. The "resource coursed" phenomenon appears to apply here as all the nine resource-rich countries in Africa had tax-to-GDP levels below 15% in 2019, whereas most non-resource-rich countries had ratios above this. Besides revenue accruing from the tax bases, there is also the non-tax revenue. Non-tax revenues are mostly generated through rents and royalties.

Generally, tax and non-tax revenues provide important sources of domestic income available to a nation outside those from trade, and in the case of Nigeria, sales of crude oil, gas etc. These revenues contribute significantly to total public revenue and it gives impetus to economic growth and development. It could also substantially reduce the urge for debt financing of infrastructure. Thus the higher the level of tax-to-GDP ratio of a nation, the less such country will resort to debt financing her economic growth.

Government effectiveness

We had earlier conceptualized *government effectiveness* as a broad term that captures **"**perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies." In extant literature, *government efficiency* is conceptualized to mean "doing more for less. It involves maximizing outputs, for instance the volume of services provided and minimizing inputs such as the amount of resources or capital required to produce those services and maintaining or improving quality." Deloitte (2021).

Accordingly *(ibid), government efficiency* could be measured by comparing the current cost of delivering a government program to previous years, or the relative outcome that Government obtained from a previous level of expenditure. But these benchmarks fly in the face of facts. Just comparing previous years with current year costs could dangerously ignore changing production cost structure due to inflation and exchange rate fluctuations. Besides, evolving technological production skills and changing marginal rate of technical substitution (MRTS), population dynamics, and even consumption pattern could impact current cost negatively or positively than previously experienced in the delivery of the same government program. It thus appears these government efficiency measurement metrics suggested by Deloitte are myopic and not good enough.

More reliable parameters to measure government effectiveness are provided by the World Wide Governance Indicators www.govindicators.org. Among others are: (i) regulatory quality (ii) Rule of Law and (iii) Control of Corruption. These parameters are scored on a numerical scale of -2.5 (weak) to 2.5 (strong) governance performance. For example in 1996, Nigeria scored -1.9 in regulatory quality but improved to -0.8 in 2020. Government effectiveness for the country was -1.9 in 1996 but improved to -1.03, the score being based on 11 different sources of data. Togo scored -0.69 in regulatory quality but fell to -0.89 in 1998 and improved again to -0.69 in 2020, the score being based on 10 different sources of data. The concepts clarified and discussed here will be applied accordingly within this paper's context and the methodology's core part.

To compensate for changes in the value of money (inflation or deflation) the GDP or GNP is usually given in "real" or inflation adjusted, terms rather than the actual money figure compiled in a given year, which is called the nominal or current figure (Ayres and Warr, 2006). King and Levine (1993) and Beck and Web (2003) suggest that financial systems are important for productivity, growth and development. Well functioning institutions and markets, it is noted, augment technological innovation, capital accumulation, and therefore, economic growth. They also note that well-functioning financial markets lower transaction costs, increasing the amount of savings put into investment (Illyas and Siddiqi, 2010). They also allow for capital to be allocated to projects that yield the highest returns and therefore enhance economic growth rates.

REVIEW OF LITERATURE

We review extant literature to evaluate the extent of academic endeavors and the size of the body of knowledge available in this field of study. Tax remains the main source of government revenue generation, though her total "revenue" derives from sources other than tax. Non-tax revenue (grants, rent and royalties, sales of goods and services, fines and penalties etc.) In 2019 Nigeria's total non-tax revenue was only a paltry 3.2% of GDP relative to 46% from corporate income tax alone (OECD 2021). This explains the critical role of tax in generating public revenue needed for the sustenance of the Government.

The tax had earlier been clarified, but we add here that it is, a "pecuniary burden laid upon individuals or property to support government expenditure. A tax "is not a voluntary payment or donation, but an enforced/compulsory contribution exacted pursuant to legislative authority". Given the dominant role of tax in public revenue generation in countries across the world, we review the literature examining both classical conception of it and other recent economic thoughts. While non-tax revenue adds up to Government publicly generate revenue, tax provides the largest fraction of Government revenue.

Classical economists as J.S Mills, D. Ricardo and W. Petty theorized that the execution of taxation function – the provision of state revenue be achieved following the principle of equity and justice. This naturally leads to the principle of proportionate taxation that satisfies the idea of equity and justice in taxation. These economists are of the opinion that taxes proportionate to incomes of the individuals, will extract equal sacrifice. Noble as this argument, its downside is the "slippery" nature and the "doddery" tendency of the average taxable person, entity and even corporate organizations. For example, transfer pricing is often employed by Multinational Corporations as an income tax doddery instrument.

In an anonymous paper, an Indian author identified the prevalence of "black economy" and a "narrow tax base" as major hindrances to realizing a higher tax revenue to GDP ratio in many countries. **https://lms.indianeconomy.net/news/what-is-tax-gdp-ratio-why-it-matters/.** The **black economy**, also referred to as **underground** or **shadow economy** "involves business dealings that are untraceable and therefore not taxable". It is also called the **hidden economy. https://marketbusinessnews.com/financial-glossary/black-economy-definition-meaning.** Because business dealings conducted in the black economy are unnoticed and not recorded, revenue accruing to such businesses is not accounted for, constituting a tax revenue loss to the nation's economy. Thus black economic dealings do not reflect in a country's official GDP This in part, could explain the lower tax -to- GDP ratio in countries such as Nigeria and the many sub-Sahara African countries. The size of the black economy in Nigeria and many sub-Sahara African countries is fairly large – from thousands of roadside artisans evading tax payment to the informal self-employed tax dodger, small firms employing less than five persons and even more, all do not pay tax. A booming hidden economy is an indication of government ineffectiveness.

The argument of a narrow tax base - one which applies only to a few items; for example, income- appears plausible in Nigeria. Less than 5% of the working Nigerian population pays income tax. Artisans, private taxicab owners, small firm employees and many other privately employed persons pay little or no income tax. Large multinational corporations in Nigeria also evade corporate tax using transfer pricing techniques. These add up to a huge loss to the total tax revenue accruing to the Nigerian Government is substantially reduced by applying these antics.

Garcia Sanchez et al. (2013) tried to determine the parameters of government effectiveness. Unfortunately, these authors could not successfully establish the parameters of government effectiveness. Enache (2020), in an OECD report, examined the tax-to-GDP ratio in over thirty African countries and concluded an average of 16.5% for the thirty African countries. This seriously compares negatively with an OECD 35 country average of 34.3%, Latin America and the Caribbean average of 23.1%. Enache further noted that the tax-to-GDP ratio varies significantly across African countries; see fig1.2 below for details. Enache explains this variation as due to African countries' relatively higher reliance on personal income tax. These findings contradict that recorded in another OECD document in which Nigeria received only 11% of https://www.oecd.org/tax/tax-policy/revenue-statistics-africa-nigeria.pdf. Her total tax revenue from personal income tax far below the 46 % from corporate income tax and the 14 % from value-added tax (VAT) in 2019. Given these contradicting findings, we deduce that the tax structure may not effectively explain variations in tax-to-GDP ratios across countries.

Diverse tax policies across countries is given as another possible explanation for the differentials in the tax-to-GDP ratio (Jansen et al., 2020). These authors argued that differential tax policies explain the variations in tax revenue accruing from the different tax bases. In Jansen et al, opinion, the varying tax-to GDP ratios across the EU in 2019 is a function of the diverse tax policies across the European Union. For instance, the share of taxes on production and imports was highest in Sweden where they accounted for 22.2% of GDP Down the bottom line are Germany with a paltry 10.9% compared with the sizes of the German economy, Irelan7.8%, Romania 10.7%. In between are Croatia with 20.3, Hungary 18.1%. Following policy deferential, tax revenue from income and wealth bases is 30.7% in Denmark, Sweden 18.0% almost at par with Germany's 17.3%. While in Croatia and Hungary it contributes only 6.6%.

Nigeria tax policy is highly segmented. Company income tax rate is 30% of taxable profits. A lower income tax rate of 20% is applicable to manufacturing or agricultural production companies and companies engaged wholly in exports within the first five

years of operation and where the turnover does not exceed N1m ($3530) https://oxfordbusinessgroup.com/overview/widening-net-detailed-look-national-tax-policy-and-administration Taxes on transactions are subdivided into: Value Added tax (VAT), capital gains tax, stamp duty, excise duty, import duty and import duty. Yet this high segmentation cannot rake in lots of tax revenue to the Government of Nigeria.

The National Tax Policy provides the fundamental guidelines that enable an orderly development of the Nigeria tax system**.** Using a narrow tax base as recommended appears not plausible in the case of Nigeria and unfortunately, these measures of the Government.

Classical Theories of Taxation

Classical taxation theory emanates from the earlier works of Adam Smith who defined the taxation system, indicating the main conditions for its formation and putting forward four main taxation principles: equity, determination, convenience and thrift of taxation administration. "By equity is meant equality of sacrifice that is, people should pay taxes in proportion to their incomes". The whole idea of tax is premised on the provision of state revenue to be achieved on basis of the principles of equity and justice. Along this line of thought, similar principles of taxation – proportionate, convenience etc.- arouse. Time progression though threw up the alternative Keynesian economists thought with a different view of taxation.

The Keynesian Taxation Theory

John Maynard Keynes unveiled his main principles of taxation in his book "The General Theory of Employment, Interest and Money." Keynes' main thesis is that large amounts of not invested savings hinder economic growth. "Savings not invested is a passive form of income as such should be taxed". Keynes contended that the state must intervene to subtract income from savings with the help of taxation to finance investments and cover state expenditures. "Fast economic development must be based on a market expansion and an associated increase in consumption. As a result, state intervention is achieved at the level of effective demand.

This is why the state must intervene to subtract income savings with the help of taxation to finance investments and cover state expenditures." Keynes' argument is suggestive of an effective government being relevant to increased tax revenue. Arthur Laffer (1940 to date) contributed immensely to neoclassical taxation theory. Most importantly is Laffer's curve which established a quantitative relationship between tax and government revenue. Laffer's thesis is that as tax rates increase, "people's incentives to work and make investments decrease because they make less money from them."

He argued that when tax rate exceeds certain level it becomes "so onerous that total revenue goes down because people aren't as economically active as they would be in a world with lower taxes." Besley and Persson (2014) examined how tax revenue as a share of GDP varies with per capital income and the breath of a country's tax base. They identified: "structure of the economy, political factors as weak institutions, fragmented polities and lack of transparency due to weak news media" as explanatory factors why developing countries tax so little. They stated that most developing countries' economic structure usually has very large informal sectors and are often dependent on a few natural resources or commodities for public revenue, thus prone to receiving foreign aids. These findings compliments the "black" or "underground" economy phenomenon prevalent in most developing economies, including Nigeria. The large informal sector is tax is difficult to tax and are tax evasive. "Having a large informal sector makes broad base taxation of income next to impossible." Besley and Persson (ibid) concluded.

Kumri and Nene (2017) tried to determine factors impacting tax revenue in Ethiopia. Unfortunately, the work turned out to be turgid, and incomprehensible as the authors mixed several related and unrelated variables in an equation bound to produce multi-correlation in the estimated model. The conclusion drawn from the work is unclear and even appears unrelated to the work. Clark and Hollis (2013) defined the tax ratio to gdp "as a measure of tax paid which could be compared across years".

They noted that GDP is a credible denominator for tax paid because "most tax bases are related to economic activities, and an increase in economic activity will generally result in an increase in tax (and a decrease in ….."). The authors explained the Australian lower tax-to-GDP ratio as "cyclical in nature" because it follows gains or loss in the stock market. A second explanation for the smaller size of tax-to-GDP ratio is construed as structural since it follows changes in the composition of the tax base using both implicit and explicit government policies. For instance, it argued that large cuts in personal income tax and specific narrowing of corporate tax intended to reduce tax burden on foreign investments lower the tax-to-GDP ratio in Australia.

Tax evasion is considered anathema to the economy in terms of government expenditure and economic growth, just as it does on society's welfare (Aumeerun, Jugurnath, and Soondrum 2016). Citing Dalu et al. (2012), Aumeerun et al.,2021 stated, "A country facing an increasing amount of tax evasion and tax avoidance is likely to exhibit a low investment mix." This will in turn results in low economic growth. But in the so-called model estimated for this work, these authors strangely included inflation as an explanatory variable for gross domestic product (GDP). The

From extant literature reviewed this far, we could not find any that examined whether government effectiveness or ineffectiveness impacts public (tax and non-tax) revenue-to-GDP ratio. Clark and Hollis (2013) conceptualized this ratio "as a measure of tax paid which could be compared across years". The major component of public revenue in the majority of countries is tax revenue. Though much current literature rigged around tax revenue as percentage of GDP, none examined how *government effectiveness* or otherwise could impact the ratio of public revenue-to-GDP. This paper is structured to fill this gap. We believe government effectiveness following *Worldwide Government Indicators (WGI)* published by the World Bank could help increased the ratio of public revenue as a percentage of GDP Using conjectures and trend in the literature, over 50% of public revenue in most countries in the world is contributed by tax revenue. The hypothesis below will to guide this study.

Hypothesis

(a) Political instability, lack of the rule of law and Government effectiveness in African countries as measured by WGI's (i) the quality of civil service (ii) the quality of policy formulation and implementation could negatively impact the size of tax revenue (tax) to-GDP ratio in Nigeria and the other African countries. We believe a disciplined civil service independent of pressures from the political class is likely to be an effective government (tax) revenue-collecting agent. Also, good policy formulation and implementation is known to have enhanced government revenue generation. Examples are found in the OECD countries where public revenue-to-GDP ratio is as high as 46.3 in Denmark, 45.4 in France, 42.9 in Belgium and Sweden, respectively. On the other hand, Clark and Hollis (2013) pointed out how frequent changes in the composition of tax bases through implicit and explicit Government polices contribute to low tax-to- GDP revenue in Australia. This clearly demonstrates how inconsistent government policy could harmfully impact tax revenue generation.

Corruption prevalent in most of sub-Sahara African remains one of the most daunting problems facing sub-region's countries and dipping into the size of tax revenue. Corruption could partly explain the low tax-to-GDP ratio obtained in the countries of sub-Sahara Africa. We thus model corruption as an explanatory variable for the low tax-to-GDP ratio in Nigeria, where Transparency International has consistently scored Nigeria slightly below a quarter of a hundred over the past years. The Worldwide Government Indicators conceptualize corruption as "perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Given this conception, Nigeria is very corrupt, and Nigerians are extremely corrupt. Giving the level of pacified corruption, Nigeria's tax to GDP ratio will likely be negatively impacted by corruption. Thus we construct our second hypothesis.

(b) The inability of African governments to control corruption, as measured by the Transparency International Index and the Worldwide Government Indicator, explains the low tax revenue-to-GDP ratio in African countries.

METHODOLOGY

We use the panel data econometric to specify the relationship between public (tax) revenue size and government effectiveness across some ten African countries. The approach will help us test each of the two hypotheses stated in 2.3 (a) and ((b) above for his study.

Model specification

First, we specify the simple basic model following panel data econometric as below:

The panel data model specification combines the time series and cross-sectional data. The countries form the cross-section, while the variables: public revenue, government effectiveness, rule of law, control of corruption and regulations, as indicated in the data for this study are the time series data. Thus we have the time series model as:

$$Y_t = \alpha_t + \beta X_t + e_t \quad \text{.....(1)}$$

The $_t$ subscripts in the model above tells the reader that the model is a time series. Now suppose in the model in equation (1) above, we add i subscript such that we have:

$$Yi = \alpha_i + \beta X_i + e_i \quad \text{.....(2)}$$

Then we have a model for cross sectional data. Combining the models in equations (1) and (2) above, we have the panel data model which is a combination of time series and cross sectional data as in equation (3) below.

$$Y_{it} = \alpha_{it} + \beta X_{it} + e_{it} \quad \text{.....(3)}$$

Following Mundlak (1961), (1978), Hoch (1962), Balestra, and Nerlove (1966), cited by Gagliardini (2019), there are three specification in the panel data econometrics.

a) The pool effects model
b) The random effect model and
c) Fixed effect model

The random effect model

We specify the random effect model to address the different intercepts arising due to the randomness of the sample (selected countries). We specify the random effect model as in equation (4) below and use it to test hypothesis 2(a) and (b). The Hausman test statistics will tells us which model is appropriate. In the fixed effect model, we test for the differential intercepts due to specific difference amongst the countries included in the sample. The α term is the mean intercept for the random sample.

$$Y_{it} = \alpha + \beta X_{it} + e_{it} (\delta_{it} + \mu_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

In this model the (μ_{it}) term is the same as the error term in OLS following randomness and no trend. δ_{it} is different with all cross sections to get the individual intercepts when added to α. Though it varies cross sectionally, it is constant over time – they are time invariants (https://www.facebook.com/TJAcademyofficial).

$$Y_{it} = \alpha + \beta X_{it} + e_{it} (\delta_{it} + \mu_{it}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Rearranging we have the random effect model in equation (6) below

$$Y_{it} = \alpha + \beta X_{it} + \delta_{it} + \mu_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

DATA PRESENTATION AND ANALYSIS

A first step though in the data analysis, is to apply the descriptive statistics to examine the compliance of the variables included in the model for both the dependent (tax revenue) and independent (government effectiveness, public stability, control of corruption, rule of law and regulatory quality) variables to the assumptions of normality

Table 2: The Descriptive of Statistics of log_pbr gef, coc, rol and rqt.

	LOG_PBR	GEF	PLST	COC	ROL	RQT
Mean	11.47193	-0.539657	-0.465014	-0.476152	-0.468964	-0.437906
Median	12.05150	-0.696622	-0.481708	-0.593291	-0.609913	-0.503157
Maximum	15.40687	1.056674	1.219244	0.950537	1.077130	1.127270
Minimum	4.948050	-1.434841	-2.264047	-1.431231	-1.479573	-1.431044
Std. Dev.	2.258833	0.616602	0.915291	0.659705	0.716291	0.566100
Skewness	-0.530059	0.932982	-0.022813	0.567059	0.645627	0.839038
Kurtosis	2.651035	3.011402	2.081463	2.209370	2.268978	3.649435
Jarque-Bera	10.89923	29.01627	7.048268	15.92764	18.34776	26.98090
Probability	0.004298	0.000001	0.029477	0.000348	0.000104	0.000001
Sum	2409.105	-107.9313	-93.00275	-95.23031	-93.79284	-87.58123
Sum Sq. Dev.	1066.386	75.65934	166.7138	86.60703	102.1015	63.77341
Observations	210	200	200	200	200	200

Sources: Views Output by the Authors

Table 2 above expresses the different characteristics of the variables employed in the study. The mean value of all six variables employed except log_pbr in the study are negative. This speaks well of a large number of data with negative government revenue value included in the time series employed in the study. The values of the standard deviations: government effectiveness, political stability, control of corruption, the rule of law and regulatory quality are approximately .61 .91, .66, .72, and .57, respectively. Log_pbr appears the most volatile with a standard deviation of 2.26. Political stability and log_pbr both have negative skewness, implying they are negatively skewed or skewed to left, meaning that the left tail is longer**.** All the rest are positively skewed. This suggests that the tail of the distribution points to the right. By implication, the tails of their distribution are skewed to the left.

All the variables, except government effectiveness and regulatory quality have positive kurtosis values that are below 3. This suggest that the distribution has sharper peaks and heavier tails. The Jarque – Bera test statistic shows that the data do not support the supposition that each variable follows the normal distribution. This conclusion is because the null hypothesis that each variable has normal distribution is rejected based on the *p*-value = 0.0000

The random effect model for analysis

Given that we have structured this study to do a comparative analysis of ten randomly selected African countries, we first specify the random effect model to address the different intercepts based on the randomness of the sample.

$$Y_{it} = \alpha + \beta X_{it} + e_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$
$$Y_{it} = \alpha + \beta X_{it} + e_{it} (\delta_{it} + \mu_{it}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Here α represents the mean intercept for all across sections or entities. The e_{it} is divided into two parts $(\delta_{it} + \mu_{it})$. (μ_{it}) is the normal error term as in the OLS regression model following randomness and (no trend). δ_{it} is different for all intercepts to get the individual intercepts with α. Though it varies cross-sectionally, it is constant over time; that is, it is time-invariant (https://www.facebook.com/TJAcademyofficial).

$$Y_{it} = \alpha + \beta X_{it} + \delta it + \mu_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(9)$$

Based on the random effect model specified in equation (9) above, we run the regression in Table 3 below.

Table 3: The random effect panel model

Dependent Variable: LOG_PBR
Method: Panel EGLS (Cross-section random effects)
Date: 01/22/23 Time: 14:35
Sample: 2000 2020
Periods included: 20
Cross-sections included: 10
Total panel (balanced) observations: 200
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	11.23585	0.539599	20.82259	0.0000
GEF	-0.596808	0.570667	-1.045808	0.2970
PLST	-0.698400	0.195482	-3.572710	0.0004
COC	-1.934860	0.515658	-3.752215	0.0002
ROL	1.797432	0.501172	3.586456	0.0004
RQT	0.967609	0.488366	1.981320	0.0490

Effects Specification	SD.	Rho
Cross-section random	1.569270	0.7442
Idiosyncratic random	0.920075	0.2558

Weighted Statistics

R-squared	0.136252	Mean dependent var	1.499736
Adjusted R-squared	0.113990	SD dependent var	0.993401
SE of regression	0.935070	Sum squared resid	169.6249
F-statistic	6.120490	Durbin-Watson stat	0.195005
Prob(F-statistic)	0.000027		

Unweighted Statistics

R-squared	0.202366	Mean dependent var	11.53732
Sum squared resid	794.5202	Durbin-Watson stat	0.041632

Sources: Views Output by the Authors

The coefficients of government efficiency (gef) is insignificant with a negative value and a *p*-value of .2970. All the others = political stability (plst), control of corruption (coc) rule of law (rol) and regulatory quality (rqt) are all significant following their *p*-values. *Plst* and *coc* both have coefficients with negative signs though, implying; for instance, a 1% decrease in control of corruption or political satiability reduces public revenue. We see this outcome as not plausible and may not be correct. R^2 is extremely low at .136252 (13.62%).

The fixed effect model

Next we used the fixed effect panel dummy variable model in equation (10) to test for the parallel relationship, if any, between Public revenue (Tax revenue) and government effectiveness, control of corruption etc. to test our hypothesis. Following the seemingly implausible outcome from the random effect model, we specify the dummy variable fixed effect model as in equation (10).

$$Y_{it} = \beta X_{it} + \varrho D1 + \varrho D2 + {}_{Y}D3 + \mathrm{g}D4\ \phi D5 + \delta D6 + \hbar D7 + \Psi D8 + \kappa D9 + \lambda D10 + e_{it} \quad (10)$$

A major assumption of the panel data dummy variable fixed effect model is that the intercepts vary due to country specifics as: tax evasion, regulatory quality, size, population, etc. The dummy variables captures each country's difference expressed in the intercept.

The result of the fixed effect dummy variable model is shown in the e-View output in Table 4 below. There are not many differences between the result of the output obtained from the random and fixed effect models. Government effectiveness (gef) political stability (plst) and control of corruption (coc) still have negative coefficients. Though political stability (plst) and control of corruption (coc), are significant based on their *p*-values, they negative sign

Table 4: The Result of the Fixed Effect Model

Dependent Variable: LOG_PBR
Method: Panel Least Squares
Date: 01/22/23 Time: 14:42
Sample: 2000 2020
Periods included: 20
Cross-sections included: 10
Total panel (balanced) observations: 200

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	11.59885	0.239418	48.44603	0.0000
GEF	0.413843	0.581184	-0.712069	0.4773
PLST	0.666337	0.199270	-3.343894	0.0010
COC	1.934867	0.538825	-3.590898	0.0004
ROL	2.171465	0.513847	4.225897	0.0000
RQT	1.136474	0.499796	2.273874	0.0241

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.842777	Mean dependent var	11.53732
Adjusted R-squared	0.830879	SD dependent var	2.237299
SE of regression	0.920075	Akaike info criterion	2.743315
Sum squared resid	156.6095	Schwarz criterion	2.990689
Log-likelihood	-259.3315	Hannan-Quinn criter.	2.843423
F-statistic	70.83361	Durbin-Watson stat	0.219177
Prob (F-statistic)	0.000000		

Sources: Views Output by the Authors

Similar to the random effect model, in the fixed effect model, the rule of law (ROL) and regulatory quality (RQT) variables are significant and have positive signs. This implies that both variables can explain the ratio of tax revenue to GDP in African countries. Furthermore, the R-squared value provides a better measure of goodness of fit, indicating that the model explains approximately 84.27% of the variation in the fitted line.

Hausman Test

The results from the both the random and fixed effects models appear inconclusive. We run the Hausman test to choose between the random and fixed effect which is the more appropriate. The null for the Hausman test is: *the preferred model is the random effects; the alternate hypothesis is the appropriate model is the fixed effects.* The test statistics is: If the *p*-value is greater than alpha, we accept the null hypothesis and reject the alternative.

Table 5: The Hausman Test Statistic

Correlated Random Effects - Hausman Test

Equation: Untitled

Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	11.374902	5	0.0444

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob
GEF	-0.413843	-0.596808	0.012114	0.0964
PLST	-0.666337	-0.698400	0.001495	0.4070
COC	-1.934867	-1.934860	0.024430	1.0000
ROL	2.171465	1.797432	0.012865	0.0010
RQT	1.136474	0.967609	0.011295	0.1121

Cross-section random effects test equation:
Dependent Variable: LOG_PBR
Method: Panel Least Squares
Date: 01/22/23 Time: 14:48
Sample: 2000 2020
Periods included: 20
Cross-sections included: 10
Total panel (balanced) observations: 200

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	11.59885	0.239418	48.44603	0.0000
GEF	-0.413843	0.581184	-0.712069	0.4773
PLST	-0.666337	0.199270	-3.343894	0.0010
COC	-1.934867	0.538825	-3.590898	0.0004
ROL	2.171465	0.513847	4.225897	0.0000
RQT	1.136474	0.499796	2.273874	0.0241

Effects Specification
Cross-section fixed (dummy variables)

R-squared	0.842777	Mean dependent var	11.53732
Adjusted R-squared	0.830879	SD dependent var	2.237299
SE of regression	0.920075	Akaike info criterion	2.743315
Sum squared resid	156.6095	Schwarz criterion	2.990689
Log likelihood	-259.3315	Hannan-Quinn criter.	2.843423
F-statistic	70.83361	Durbin-Watson stat	0.219177
Prob (F-statistic)	0.000000		

Sources: Views Output by the Authors

The Hausman test statistics reject the null hypothesis, p-*value* is 0.044 and is less than the alpha *p-value* of 5%. The appropriate model is the fixed effect model, as in Table 5

FINDINGS, DISCUSSION AND CONCLUSION

The control of corruption (COC) has a negative impact on public revenue generation. Based on this finding, it can be deduced that these factors could explain the low ratio of public revenue to domestic product in African countries, including Nigeria. However, the improved rule of law (ROL) and regulatory quality (RQT) positively impact the public revenue to GDP ratio in African countries. Empirically, these findings appear plausible. The high incidence of enforcing the rule of law in EU countries such as Denmark, France, Belgium, and Sweden, where the ratio is significantly high, supports this finding.

Political stability contributes negatively to the public revenue to GDP ratio. This finding appears plausible, considering that politically stable OECD countries such as Finland, Spain, Portugal, and Luxembourg cannot compare with Denmark, Sweden, and France regarding public revenue generation relative to GDP ratio. France, Denmark, and even Sweden often experience both political and social instability, yet they have a higher ratio of public revenue to gross domestic product (GDP). It is plausible that political stability may not be necessary to explain a higher ratio of public revenue to GDP in African countries, mainly sub-Saharan African countries, or elsewhere in the OECD countries.

Regulatory quality (RQT) also explains a higher tax-to-GDP ratio. Good tax regulation, such as efficient tax assessment that effectively includes all taxable objects - individuals, businesses of all types and sizes, including privately employed persons, could work to improve the tax revenue to GDP ratio. Denmark, with the highest public revenue to GDP ratio, is a case in point. It has a large tax base, including student bursary receipts and summer employment. Artisans, the privately employed, etc., are all taxed.

Nigeria, and indeed the majority if not all sub-Saharan African countries have tax regulations and bases that are either grossly inadequate or too narrow to sufficiently generate public revenue. Small businesses (the informal sector), millions of privately employed persons, and many others, including students who do not pay taxes, certainly impact the size of the gross tax revenue accruing to the nations of Africa and decrease a country's tax revenue to GDP ratio. In conclusion, based on our findings, we believe there appears to be a strong relationship between these variables and the tax revenue to GDP ratio in countries of sub-Saharan Africa and even elsewhere.

LIST OF ABBREVIATIONS

1)	CIT	Company Income Tax
2)	CGT	Capital Gain Tax
3)	DMO	Nigeria debt management office
4)	ET	Education Tax
5)	EU.	European Union
6)	FIRS	Federal Inland Revenue Service
7)	G.D.P.	Gross Domestic Product
8)	NITDL	National Information Technology Development Levy
9)	OECD1	Organization for Economic Cooperation and Development
10)	PIT	Personal Income Tax
11)	PPT	Petroleum Profit Tax
12)	(SBIRs)	State Boards of Internal Revenue
13)	VAT	Value Added Tax
14)	WGI	World Government Indicators
15)	WHT	Withholding Tax

Author's Contributions

The authors have the same contribution.

Conflict of Interest

The authors have disclosed no conflict of interest.

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