Scientific Annals of Economics and Business
71 (3), 2024, 381-398
DOI: 10.47743/saeb-2024-0019

The Nexus between Illicit Financial Flows and Tax Revenue: New Evidence from Resource-Rich African Countries

Joshua Adeyemi Afolabi[*], **Abayomi Samuel Taiwo**[**], **Nurudeen Adebayo Sheu**[***]

Abstract: Resource-rich economies, especially those in Africa, are plagued with the resource curse and Dutch Disease syndromes, which undermine the quest for effectively mobilizing domestic resources toward sustainable and inclusive development. Empirical evidence on the role illicit financial flow (IFF) plays in this regard is relatively scarce. Thus, this study evaluates the volume of IFF and its effect on tax revenue in seven resource-rich African countries. Panel data, sourced for the 2009-2021 period, were analysed using the fixed effect and random effect models while the Instrumental Variable Generalised Method of Moment (IV-GMM), a dynamic estimator, was used for robustness check. Findings revealed that IFF has been on the rise and has detrimental effects on the tax revenue of the sampled countries' national governments. This is inimical to sustainable development. Thus, the governments and policymakers in these countries must develop pragmatic policy and institutional approaches toward tackling the IFF menace.

Keywords: tax revenue; illicit financial flows; sustainable development; fixed and random effect models; Africa.

JEL classification: C23; F36; H20.

[*] Innovation and Technology Policy Department, Nigerian Institute of Social and Economic Research (NISER), Ibadan, Oyo State, Nigeria; e-mail: *joshuaaafolabi@gmail.com* (corresponding author).
[**] Department of Economics, Tai Solarin University of Education, Ijagun, Ogun State; e-mail: *taiwoas@tasued.edu.ng*.
[***] Department of Economics, Federal College of Education (Special), Oyo, Oyo State; e-mail: *aramiatoke@yahoo.com*.

Article history: Received 10 December 2023 | Accepted 22 September 2024 | Published online 25 September 2024

To cite this article: Afolabi, J. A., Taiwo, A. S., Sheu, N. A. (2024). The Nexus between Illicit Financial Flows and Tax Revenue: New Evidence from Resource-Rich African Countries. *Scientific Annals of Economics and Business*, 71(3), 381-398. https://doi.org/10.47743/saeb-2024-0019.

1. INTRODUCTION

Sustainable development has been largely elusive in Africa due to the limited available financial resources needed to drive development agendas in the continent. The impressive and sustained economic growth of many African countries as well as the increasing volume of foreign capital inflows to the continent prior to the emergence of the COVID-19 pandemic shone a ray of hope for economic transformation in the continent (Raifu, 2023). These increased the volume of tax revenue needed for development financing and made the achievement of sustainable development more feasible. However, the hope of actualizing sustainable and inclusive development in Africa has often been tainted by the colossal amount of financial resources that are illegally moved to foreign countries through various channels. There are growing concerns about the approximately US$50 billion that leaves Africa annually in the form of illicit financial flows (IFFs), as it drains the continent of the financial resources needed to finance development objectives (Signé, 2020; Muslim *et al.*, 2021).

Despite being a global phenomenon, the macroeconomic impact of IFF in developing regions, particularly Africa, is more severe and corrosive given their low financial base and weak institutional quality (Signé, 2020). The high volume of IFF from Africa aggravates the already precarious economic situations in the continent and hampers the capacity of the government to provide basic public goods and services. Empirical evidence has shown that IFF is pervasive in resource-rich countries, where multinational companies operate (Igbatayo, 2019; Cobham and Janský, 2020). Multinational companies have intricate structures with several subsidiaries, most of which operate in tax havens or countries with weak institutions (Babatunde and Afolabi, 2023). Profit allocation among multinational companies' subsidiaries is often done through internal trading, a structure that is complex and difficult to decipher even by domestic tax authorities (Ogunjimi and Amune, 2019).

In general, multinational companies often leverage the weak institutional quality in developing economies to engage in tax evasion, round-tripping, falsified invoicing and transfer mispricing (Cobham and Janský, 2020). These practices place an unbalanced burden on small domestic firms, which employ a large proportion of the African labour force. The burden could force some of these small firms out of business or compel them to lower their operative capacity, either of which will increase the number of labour force in the unemployment pool. It could also further overcrowd the already saturated labour market and worsen the unemployment rate in African countries. The dominance of multinational corporations in the extractive sectors of resource-rich African countries suggests the possibility of a reduction in government tax revenue and a low prospect for domestic resource mobilization. This could lead to exchange rate problems as there will be less demand for the domestic currency, a situation that causes exchange rate depreciation that hurts import-dependent countries (Ogunjimi, 2019, 2020a). Sadly, many resource-rich African countries are import-dependent, explaining the pervasive exchange rate misalignment across the continent and the far-reaching effects of IFF on the domestic economy.

There is a budding literature on the effect of IFF on revenue mobilization (UNECA, 2017; Muslim *et al.*, 2021; Thiao, 2021; Uzoechina, 2023; Afolabi, 2023a). However, there seems to be only a few studies on the subject matter in Africa, particularly studies with a specific focus on resource-rich African countries. Demystifying the link between IFF and tax revenue in resource-rich African countries is crucial because these countries have not been able to translate their huge resource endowment into economic prosperity due to economic leakages. This study,

therefore, attempts to fill this knowledge gap by evaluating the effect of these flows on tax revenue in resource-rich African countries. It is important because many African countries, including resource-rich countries, failed to achieve the Millenium Development Goals (MDGs) due to limited domestic resources (Afolabi, 2023a). Resource-rich countries are expected to be able to raise and mobilize the necessary financial resources required to achieve development agendas. So, to change the narrative, it then becomes important to map out plans for effectively mobilizing financial resources to achieve the United Nations' Sustainable Development Goals (SDGs) no later than 2030. With the set date for achieving the SDGs drawing closer, it is pertinent to devise strategic means of blocking all financial leakages from resource-rich economies and effectively mobilizing tax revenue to drive sustainable development. The fixed effect and random effect models are used as the primary estimation methods while the instrumental variable generalised method of moment (IV-GMM) method is used to test the robustness of the estimates. These estimation methods are complements and robust to the analysis of the IFF-tax revenue nexus in Sub-Saharan Africa.

This study is structured into five sections. Following the current section, Section 2 presents relevant stylized facts on selected resource-rich African countries with respect to their natural resources as well as the trend behaviour of IFF and the tax revenue of each country. Section 3 describes the methodology adopted in this study while Section 4 discusses the empirical findings and Section 5 draws conclusion based on the findings.

2. RELEVANT STYLIZED FACTS ON RESOURCE-RICH AFRICAN COUNTRIES

According to the World Bank report in 2018, there are 10 major resource-rich countries in Africa including Angola, Botswana, the Democratic Republic of Congo, Equatorial Guinea, Gabon, Nigeria, South Africa, Sudan, Tanzania and Zambia. However, stylized facts on all the countries, except Equatorial Guinea, Gabon and Sudan, are presented based on data availability. Each of these countries has numerous natural resources but there are specific natural resources they possess in abundance, which serve as the mainstay and major source of foreign exchange for each economy.

2.1 Overview of the Natural Resources in Resource-Rich African Countries

Angola

Angola, a country in the Southern African region, has large reserves of crude oil deposits, iron ore, copper, gold, manganese, feldspar, platinum, uranium and phosphates. However, the country is highly dependent on crude-oil deposits than other mineral resources. Specifically, Angola has a proven oil reserve of 9 billion barrels and natural gas reserve of 11 trillion cubic feet. Angola is a member of the Organization of Petroleum Exporting Countries (OPEC), producing about 1.3 million barrels of crude oil and 17,904.5 million cubic feet of natural gas daily (World Bank, 2019). The country is the largest oil-producing country in the Southern African region and the second-largest oil-producing country in Sub-Saharan Africa. Its oil and gas industry contributes significantly to aggregate output and it is a major source of foreign exchange and government revenue. The oil and gas industry has three key sectors – upstream, midstream and downstream sectors. However, the upstream sector is the most dominant among the three sectors. The top destinations of Angolan crude oil and gas are Brazil, China, France and South Korea.

Despite being an oil-exporting country, Angola has insufficient capacity to meet local demand for refined petroleum products (such as diesel, oil fuel, gasoline, asphalt, lubricants and aviation fuel). The country only produces about 20 percent of refined oil products locally and imports a whopping 80 percent of these refined petroleum products from foreign countries to meet local demands. However, the Angolan government has been making efforts toward reducing its heavy dependence on the importation of refined petroleum products by constructing three national refineries and expanding the existing refinery, which is located in Luanda with an installed capacity of 65,000 barrels per day. In addition, the government introduced legal reforms, created a national concessionaire and set up institutions and policies to ameliorate the prevailing situations in the oil and gas industry. Several projects have also been inaugurated to revamp the oil and gas industry in Angola. The top five oil and gas projects in Angola include the Kaombo project; the Angolan LNG project; Plutão, Saturno, Vênus, and Marte (PSVM) project; the Platina project; the east and west hub; and Cravo, Lirio, Violeta, and Orquidea (CLOV) Phase 2 project (Goosen, 2022).

Botswana

Botswana is endowed with mineral resources such as diamond, copper, gold, nickel, coal and soda ash, among others. It is adjudged one of the notable resource-abundant countries in Africa that have defied the resource curse syndrome and have been able to exploit its mineral resources for structural economic transformation (Biedermann, 2018). The extraction of these mineral resources makes the mining industry in Botswana very active and a major contributor to national output. It also constitutes a major source of foreign exchange for the national government with diamonds being the mainstay of the economy. Specifically, diamond export makes up about 80 percent of export earnings and 60 percent of government tax revenue in Botswana (Biedermann, 2018). Diamond has been the core mineral resource produced by Botswana since its large-scale production in 1972 and the country is ranked among the world-leading diamond producer. Specifically, Botswana has the second-largest diamond reserve in the world, totalling 300 million carats. The major diamond reserves are largely domiciled in the Central and Kgalagadi districts of the country.

The mining sector, and the diamond industry in particular, absorbs a large proportion of the labour force in Botswana. Thus, the country is highly dependent on the diamond industry, whose era is gradually coming to an end. The government has been putting measures in place to diversify the economy. Despite being a diamond-producing country, Botswana sorts, cuts, polishes and makes jewellery designs from its rough stones in countries like China, India, Israel, Belgium and the United States. The focus on sustainable development, instead of wholesale pillage of natural resources, has attracted multinational corporations to Botswana. Thus, different multinational companies extract different mineral resources in the Botswanan mining industry. Favourable government policies, good governance, strong institutions and political stability played key roles in helping the country attract foreign direct investment and maintain its upper middle-income nation status (Sebudubudu and Mooketsane, 2016).

The Democratic Republic of Congo

The Democratic Republic of Congo (DRC), like other resource-rich African countries, has a variety of natural resources in abundance. Some of these natural resources include copper, tantalum, tungsten, tin and cobalt, among others. These resources form the mainstay of the DRC's economy and serve as the main source of government revenue (World Bank,

2023). The prices of these natural resources in the international market greatly affect the revenue that accrues to the government through their exports and determines the government's capacity to adequately provide public goods and services to its citizens. Some of the factors that affect the exploration and processing of natural resources in the DRC include the pervasively weak institutional quality, incessant conflicts, inflation, and lack of political will, among others (Nichols, 2018). The top five export destinations of DRC's natural resources are China, Singapore, South Africa, Tanzania and Zambia.

Nigeria

Nigeria has a vast array of mineral resources located across the six geopolitical zones in the country. Some of these mineral resources include gold, copper, tin and columbite, crude oil and natural gas, among others. However, the contribution of the mining sector, excluding oil and gas, to the national gross domestic product (GDP) is negligible. Of all these mineral resources, Nigeria is heavily dependent on the exploitation, sales and exports of crude oil and natural gas such that a shock to oil price in the international market has a direct effect on fiscal buffers in the country (Aminu and Ogunjimi, 2019; Ogunjimi, 2020b). The country has a proven oil reserve of 37.1 billion barrels and natural gas reserve of about 5.8 trillion cubic feet. Nigeria became a member of the OPEC in 1971 and produces about 1.56 million barrels of crude oil and 1.3 million cubic feet of natural gas daily (OPEC, 2021). The country doubles as the largest oil-producing country in the West African region and the African continent at large. Nigeria is also among the top five liquefied natural gas (LNG) exporters in the world. The Nigerian oil and gas sector makes significant contributions to aggregate output, exports and employment in Nigeria and it earns the country's government huge foreign exchange (Afolabi and Oji, 2021; Bolaji *et al.*, 2021).

The Nigerian oil and gas sector has three main sectors – upstream, midstream and downstream sectors. Nigeria has four oil refineries, which are located in Warri, Kaduna and Port Harcourt, and are highly inefficient as they operate below par, having a combined installed capacity of producing 445,000 barrels daily. The country's refineries lack the capacity to meet the daily oil demands of its teeming population. The government, therefore, takes its crude oil abroad for processing and imports refined petroleum products (such as diesel, oil fuel, gasoline, asphalt, lubricants and aviation fuel) despite being a notable oil-exporting country. Oil importation takes a large chunk of the Nigerian import basket. All institutional, legal and policy efforts toward reducing oil importation and improving oil production by local refineries have been sabotaged by rent-seeking political elites (Ogunjimi, 2020b; Afolabi, 2024). However, the private sector, notably the Dangote Oil Refinery, is gradually wading into the exploration and refining of crude oil in Nigeria.

South Africa

South Africa, the most advanced and diversified African economy, has a wide range of mineral resources, which serve the domestic economy and the export market. These mineral resources include but are not limited to gold, diamond, platinum, chromium, coal, nickel, manganese, uranium and copper, among others (Joshua and Bekun, 2020). Even though the tertiary sector contributes the largest to national output, the primary sector also makes a significant contribution to the gross domestic product (GDP). The abundance of mineral resources in South Africa makes it holds some world records. For example, South Africa is the world's largest producer of platinum, which is mostly mined in *Platreef*, Upper Group 2

(UG2) Reef and *Merensky* Reef. It is also the world's largest natural reserve of manganese ore, chrome ore and gold as well as the world's largest diamond producer. In addition, South Africa has the second-largest vanadium, zirconium and titanium reserves in the world. The abundant availability of these precious stones makes the jewellery industry highly lucrative in South Africa.

The South African mining industry produces five major classes of mineral resources: precious metals and minerals (such as diamonds, andalusite, limestone and kyanite); ferrous minerals (such as gold, platinum and aluminium); non-ferrous metals and minerals; industrial minerals and energy minerals (such as coal). Generally, the South African mining sector comprises both domestic and foreign companies, that carry out various extractive operations and activities. Different legal, institutional and policy efforts put in place by the South African government and policymakers have contributed substantially to the development of the country's mining sector. The government used the mining sector as a platform for reducing the income gaps in South Africa. The current performance of the South African mining sector is impressive and it has a promising future as there are yet unexploited and newly discovered natural resource deposits (Nathaniel, 2021).

Tanzania

Tanzania, a lower middle-income country located in the Southern African region, is another major African country with abundant mineral resources such as diamond, gold, copper, kaolin, titanium, platinum, cobalt and gemstone, among others. The mining industry in Tanzania is very active and contributes largely to GDP, exports, employment and government revenue. Tanzania's gold reserve is about 10 million ounces. The country has several gold and diamond mines. The major companies in the Tanzanian mining sectors include Williamson Diamond Limited, *Geita* Gold Mining Limited, North Mara Gold Mine Limited, Pangea Minerals Limited, *Samaz* Resources Limited, *Shanta* Mining Company Limited, Pan African Energy Tanzania Limited, and *Tancoal* Energy Limited, among others. However, illegal mining pervades the sector due to the presence of weak institutions and pervasive corruption and poor political will. Tanzania's main export destinations are China, India, the European Union, Kenya, South Africa and the United States (High Commission of the United Republic of, 2024).

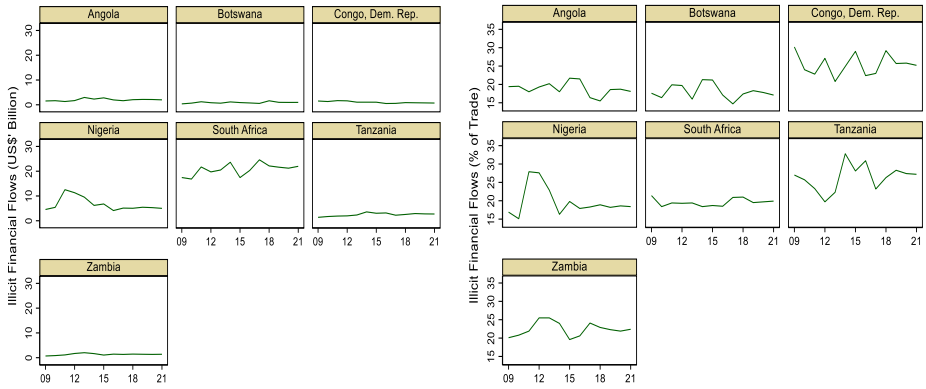
Zambia

Zambia is also abundantly rich in natural resources such as gold, tanzanite, diamonds, coal, nickel, cobalt, uranium and iron, among others. However, the country is heavily dependent on the extraction of copper and uranium together with a few industrial deposits, gold and nickel. The Zambian mining industry contributes about 12% to aggregate output and employs a large proportion of the Zambian labour force (Kolala and Dokowe, 2021). The industry is also a viable source of foreign exchange earnings for the government. Mining activities in Zambia are guided by the Mines and Minerals Development Act of 2015 and mining companies are regulated by the Zambian Ministry of Mines and Minerals Development, which gives operating licenses to mining companies. Zambia's main export products to countries like China, Singapore, Switzerland and Luxembourg include copper, cobalt, precious stones, and cotton. Given the enormity of mineral resource reserves in Zambia, there are several mines from where these mineral resources are extracted (Franks *et al.*, 2020).

2.2 Trend of IFF and Tax Revenue in Resource-Rich African Countries

Resource-rich countries are highly susceptible to having a high volume of illicit financial flow (IFF) due to the heavy presence of multinational companies, whose parent companies are often domiciled in developed economies (Cobham and Janský, 2020). This subsection, therefore, describes the trend of IFF in selected resource-rich African countries. Due to the difficulty in getting an accurate measure for IFF worldwide, Global Financial Integrity, a Washington DC-based organization, intervened and is renowned for publishing trade-based IFF reports and data annually. Trade-based IFF (trade value gap) is the difference in the reported trade value of two trade partners, which results from the deliberate falsification of trade invoices submitted by exporters and importers to customs authorities (Global Financial Integrity, 2021). The motive behind this illegal international money transfer includes tax or customs duties evasion, currency control circumvention and concealment of profits in offshore bank accounts, among others. Trade value gap reflects the inability of the extant institutional framework to charge/collect the accurate trade-related taxes and a loss of huge financial resources in uncollected trade-based tax revenues. According to the 2021 report of Global Financial Integrity, 80 percent of illicit financial outflows from African countries, among other developing countries, are channelled through trade mis-invoicing.

The volume of trade-based illicit financial flows (in US dollars and percentage of total trade) in resource-rich African countries between 2009 and 2021 is presented in Figure no. 1.



Illicit Financial Flows (US$' Billion) *Illicit Financial Flows (% of Trade)*

Figure no. 1 – Illicit Financial Flows in Selected Resource-Rich African Countries

Source: Global Financial Integrity (2021)

It shows that South Africa has the highest volume of trade-based IFF (in US dollars) among the seven selected countries while Nigeria follows distantly in the second position. These two countries are the largest economies in Southern and Western Africa, respectively. They are also the two largest economies in Africa in terms of GDP, international trade and other notable macroeconomic variables. Sadly, IFF has been added to their ranks. The narrative changed when the volume of trade-based IFF was expressed as a percentage of total trade. The trend of trade-based IFF appears volatile in all the countries. South Africa and Nigeria, which had the largest and second-largest average volume of trade value gaps among

the seven resource-rich countries under consideration, have relatively low trade-based IFF (% of total trade). Democratic Republic of Congo and Tanzania, which are among the countries with low trade-based illicit financial flows (US$), are the top two countries with the highest share of trade-based IFF in total trade, respectively. This shows that the volume of trade in Democratic Republic of Congo and Tanzania is low. It also gives credence to the earlier assertion that South Africa and Nigeria are the largest economies in Africa, particularly in terms of total trade. The high volume of trade of these two African giant economies made the volume of trade gaps in the countries look meagre. Overall, the trend suggests that IFF is prominent in resource-rich African countries and the menace needs to be addressed to actualize development agendas.

One of the notable sources of government revenue is taxation. It is often expressed as a percentage of GDP to assess the size and efficiency of a country's tax system relative to the overall economic output. Tax revenue (% of GDP) represents the proportion of total tax collections relative to the total value of goods and services produced within a country's borders over a specific period, typically a fiscal year. It provides insights into the extent to which a government relies on taxation to finance its expenditures and public services, as well as the level of fiscal capacity and revenue mobilization within the economy. A higher tax revenue-to-GDP ratio generally indicates a greater ability of the government to generate income through taxation, which can support public investments, social welfare programs, infrastructure development, and other government activities. Conversely, a lower tax revenue-to-GDP ratio may suggest lower revenue mobilization capacity, potentially leading to budget deficits, inadequate public services, or reliance on alternative sources of financing such as borrowing or external aid. The trend of tax revenue (% of GDP) of selected resource-rich African countries is presented in Figure no. 2.

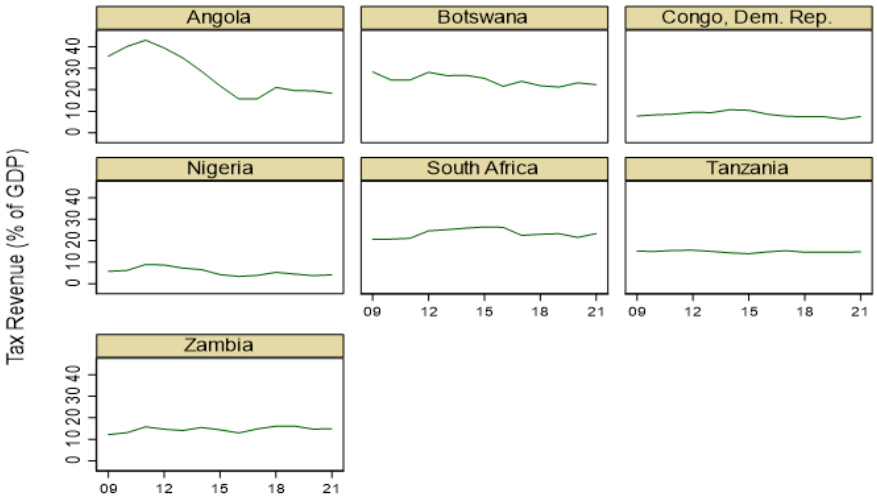


Figure no. 2 – Tax Revenue in Selected Resource-Rich African Countries (% of GDP)
Source: International Monetary Fund (2021)

It shows that Angola has the highest tax revenue (% of GDP) between 2009 and 2012 but its government has lost some ground on the control of the country's resources afterwards.

Despite having the second largest government revenue (% of GDP) among the seven selected countries in 2009, Botswana's government has a fairly good control over its country's resources in the subsequent years. Tax revenue (% of GDP) steadied in countries like Democratic Republic of Congo, Nigeria, Tanzania and Zambia for the period under consideration. Generally, there is a decline in tax revenue across the seven countries and this might not be unconnected from the high volume of IFF that leaves these countries regularly. The downward sloping scatterplot line, showing the inverse relationship between IFF and tax revenue (see Figure no. 3), confirms this notion. Simply, it indicates that tax revenue reduces with increasing volume of IFF and vice versa.

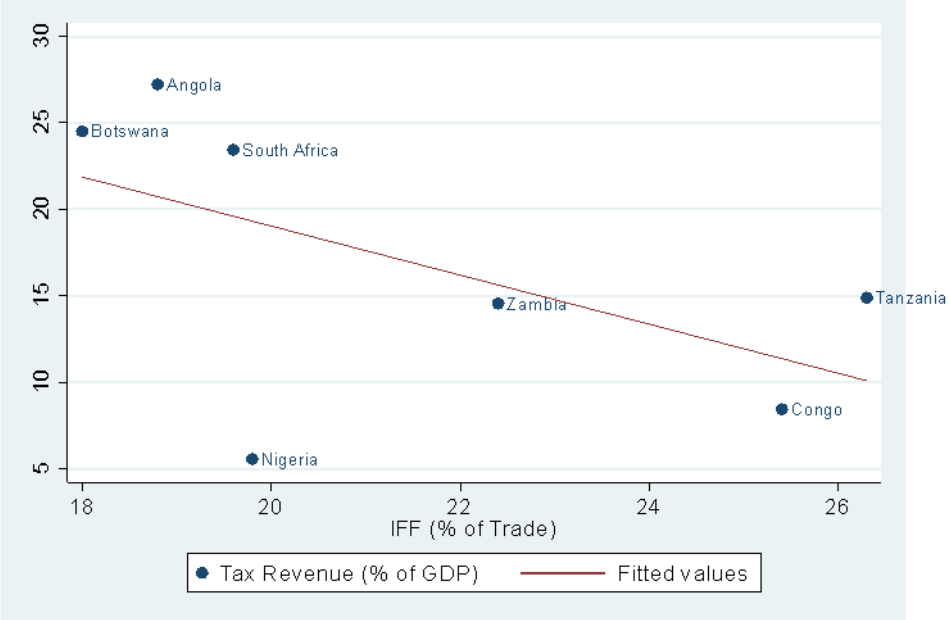


Figure no. 3 – Relationship between Average Values of IFF (% of Trade) and Tax Revenue (% of GDP)
Source: Global Financial Integrity (2021) and International Monetary Fund (2021)

3. METHODOLOGY

3.1 Model Specification

The empirical model is anchored on Wagner's law, which simply states that government expenditure and revenue rise when per capita income increases (Wagner, 1980). This suggests that tax revenue is an increasing function of per capita income. This is written mathematically as:

$$\text{Government Revenue} = f(\text{per capita income}) \quad (1)$$

This study extends Wagner's law by incorporating IFF and three control variables (trade openness, natural resource rent and inflation) into equation (1). This is to account for the effect

of IFF and other control variables on tax revenue. Thus, equation (1) is rewritten econometrically as follows:

$$DRM_{it} = \delta_0 + \delta_1 GDP_{it} + \delta_2 IFF_{it} + \delta_3 TRPN_{it} + \delta_4 NRR_{it} + \delta_5 INF_{it} + \delta_6 ECI_{it} + \varepsilon_{it} \quad (2)$$

where DR, GDP, IFF, TRPN, NNR, INF, ECI ε, δ, i and t represents domestic resource mobilization, gross domestic product growth rate, illicit financial flows, trade openness, natural resource rent, inflation, economic complexity, error term, parameters, individual countries and time period, respectively.

The inclusion of the control variables in the empirical model is based on their empirical links with tax revenue. Past studies revealed ambiguity in the revenue-trade nexus as trade openness could either boost or lower government revenue (Afolabi, 2022, 2023c). For net importing countries, government revenue tends to be drained when trade openness increases while the converse is true for net exporting countries because they earn more foreign exchange that boosts the government's revenue mobilization capacity. Therefore, the sign of the trade openness coefficient could either be positive or negative. The revenue that accrues to the government through natural resource rent increases with increasing natural resource exploitation (Aminu and Ogunjimi, 2019; Afolabi, 2023b). Thus, the sign of the natural resource rent coefficient should be positive. Inflation reduces real money balances and the purchasing power in a domestic economy, thereby lowering tax revenue in real terms (Afolabi, 2023c). So, inflation is expected to have an inverse relationship with tax revenue. While it is expected that GDP growth rate will have a positive effect on government revenue as predicted by Wagner's law, the coefficient of IFF is expected to be negative to show that IFF adversely affects tax revenue. The sophistication of an economy's products, measured using the economic complexity index, earns more revenue for such an economy (Boleti *et al.*, 2021). Thus, economic complexity is expected to have a positive effect on tax revenue.

The panel fixed effect and random effect estimation methods are adopted to examine the effect of IFF on tax revenue in selected resource-rich African countries. The key strengths of these estimation methods are threefold. First, they control for time-invariant omitted variables and are suitable in studies requiring small cross-sectional units. Second, it controls for country-level heterogeneity. Third, they allow for the correlation of individual or time specific effects with the independent variables (Fetai *et al.*, 2017). However, the fixed effect and random effect methods could not account for endogeneity, serial correlation and heteroscedasticity, which could result in the generation of bias estimates. The Instrumental Variable Generalised Method of Moments (IV-GMM) estimation method, a dynamic estimator, addresses these drawbacks (Baum *et al.*, 2007), and is therefore adopted for robustness and to generate reliable and efficient estimates.

3.2 Data Issues

The scope of this study covers seven of the ten resource-rich African countries identified by World Bank (2018). These countries include Angola, Botswana, the Democratic Republic of Congo, Nigeria, South Africa, Tanzania and Zambia with the exemption of Equatorial Guinea, Gabon and Sudan due to data unavailability. Annual data on key variables of interest covering 2009-2021 are obtained from reputable sources. Tax revenue data was obtained from

International Monetary Fund (2021)); trade-based illicit financial flows data was obtained from Global Financial Integrity (2021); economic complexity index data is sourced from the The Growth Lab at Harvard University (2019); and data on GDP growth rate, trade openness, natural resource rents and inflation were sourced from World Development Indicators (2021). For ease of result interpretation, IFF is expressed in natural logarithm since other variables are in percentages.

The description and summary statistics of the data are shown in Table no. 1. It shows a wide margin between the minimum and maximum values of tax revenue as a share of GDP in the sampled countries. This signals that despite their resource abundance, the share of tax revenue in GDP of the sampled countries differs significantly although it averaged 16.95 percent. A similar narrative is found for the share of natural resource rent of resource-rich Sub-Saharan African countries. The share averaged 11.89 percent but ranged between 0.63 percent and 41.09 percent. The range of IFF is equally high, which is a reflection of IFF being high in some countries but low in others. Similarly, the level of trade openness, GDP growth rate and inflation rate in each resource-rich country differ given the high disparity in the minimum and maximum values of these variables. The negative average value of economic complexity index suggests that the products of the countries under study are not sophisticated. This could be attributed to the raw form in which resource-rich African countries exports most of their primary export products.

Table no. 1 – Data Description and Summary Statistics

Variables	Description	Obs	Mean	Std. Dev.	Min	Max
TAX	Tax Revenue (% of GDP)	91	16.95	8.71	3.37	43.12
IFF	Trade Value Gaps (US$' Billion)	91	5.02	6.83	0.38	24.61
GDPGR	GDP Growth Rate (%)	91	3.60	3.96	-8.73	11.36
TROP	Trade (% of GDP)	91	64.02	24.19	20.72	122.55
NRR	Natural Resource Rent (% of GDP)	91	11.89	9.87	0.63	41.09
INF	Inflation, consumer prices (%)	91	8.73	6.13	0.74	30.70
ECI	Economic Complexity Index	91	-0.89	0.65	-2.11	0.38

Source: Author's Compilation

4. EMPIRICAL FINDINGS

4.1 Unit Root and Cross-Sectional Dependence Tests

Determining whether variables are stationary or not is important in time-series and panel studies. It guides the choice of appropriate estimation technique(s) that will produce unbiased estimates. The Levin, Lin and Chu (LLC) and Im, Pesaran and Shin (IPS) unit root test approaches developed by Levin *et al.* (2002) and Im *et al.* (2003), respectively, are used in this study. The results of the panel unit root test, reported in Table no. 2, indicate that all the variables are stationary at level. This implies that the variables have constant mean, variance and covariance and therefore, converge in the long-run. Furthermore, cross-sectional dependence (CD) test is important in panel studies. The CD test, developed by Im *et al.* (2003), is used in this study and its result is also reported in Table no. 2. The result confirms CD, implying that changes in any of the variables (such as IFF) in one country could have spillover effects on the other sampled countries.

Table no. 2 – Unit Root and Cross-Sectional Dependence Tests

Variable	IPS Z-t-tilde-bar	LLC Adjusted t Level	Pesaran CD-test
Tax Revenue	-1.880**	-4.715*	3.090*
Log of Illicit Financial Flows	-2.726*	-5.481*	2.960*
GDP Growth Rate	-4.282*	-1.359***	8.890*
Trade Openness	-2.234**	-2.546*	4.610*
Natural Resource Rent	-1.399***	-5.743*	11.880*
Inflation	-1.670**	-4.737*	2.170**
Economic Complexity	-3.506*	-3.709*	1.520

** p<0.01, ** p<0.05,*** p<0.1*

4.2 Main Estimation

The results of the unit root tests satisfy the condition for estimating the specified model using the fixed effect (FE) and random effect (RE) estimation methods. The models are estimated in a stepwise manner such that the baseline model (model without control variables) and the extended model (model with control variables) are estimated sequentially. This is to confirm whether the effect of IFF on tax revenue will remain unchanged (in terms of sign and significance) regardless of how the model is specified. The empirical results are presented in Table no. 3. The results of the baseline models show that IFF has an inverse but insignificant relationship with tax revenue. However, when control variables were introduced in the extended model, the coefficient of IFF became statistically significant but remained negative. The negative sign of the IFF coefficient indicates that IFF has a catastrophic and debilitating effect on tax revenue such that an increase in IFF by one percent will reduce tax revenue by about 2.6 percent. The result also suggests that reducing IFF by one percent will raise tax revenue by 2.6 percent, indicating that reducing the incidence of IFF is critical for improving tax revenue in resource-rich African countries. This shows that tax revenue is highly responsive to the dynamics of IFF.

This result corroborates the finding of Thiao (2021), which showed that IFF not only adversely affects government revenue but also diminishes the government's capacity to perform its constitutional duties of providing public products and services to its citizens. It also confirms the notion put forward by Muchala (2018); Afolabi (2023a), which alluded that the adverse impact of IFF on government revenue could compel the government to privatize public corporations and worsen the welfare of citizens, especially those in the low-income group who might not be able to access or afford patronizing private corporations. It also lends support to the finding of Brandt (2020), which showed that IFF reduces government revenue as multinational companies operating in countries in the Global South launder money to their parent companies. Interestingly, the probability value associated with the IFF coefficient indicates that IFF is a major determinant of tax revenue in resource-rich African countries.

There appears to be mixed findings with regard to the estimates of the control variables. While some variables have positive signs, some have negative which are either statistically significant or insignificant. For the estimate of GDP growth rate, the result suggests that Wagner's law does not hold in resource-rich African countries as the estimate is negative and statistically insignificant. This indicates that the observed economic growth in these countries

has not translated into an increase in their government tax revenue. While this finding appears counterintuitive, it confirms the earlier result that IFF has been hampering tax revenue in the sampled countries. On the other hand, trade openness has a significant positive relationship with tax revenue. This result is plausible as most resource-rich African countries export their natural resource abroad, which earns them foreign exchange and empowers the government to mobilize revenue for development purposes. Similarly, the coefficient of natural resource rent is positive and significant, indicating that natural resource exploitation plays an important role in boosting tax revenue in resource-rich African countries. This confirms the views of Aminu and Ogunjimi (2019); Afolabi (2023b), who showed that natural resource rent boosts government revenue in Nigeria and Sub-Saharan Africa, respectively.

However, inflation is found to adversely affect tax revenue in resource-rich African countries. A rise in the domestic general price level reduces tax revenue in real terms and lowers the number of development activities the government can embark on at a particular time. This explains why the monetary authorities in different countries often strive to keep inflation at bay through the deployment of different monetary policy measures, notably the inflation targeting measure. The coefficient of economic complexity is negative and not statistically significant. This implies that economic complexity does not contribute to improving tax revenue in the sampled countries. This contrasts the views of Boleti *et al.* (2021) and is unsurprising as these countries lack the capacity to produce sophisticated products and often export their natural resources in raw or unrefined form. This largely lowers the revenue that should accrue to government from the export of such products. The key difference in the results of the fixed effect and random effect models is their respective intercepts. The intercepts of the fixed effect baseline and extended models are lower than those of the random effect models. The similarity in the effects of IFF on tax revenue in both models signals that the results are robust and not sensitive to model specification. As expected, the coefficient of determination of the baseline model is less than that of the extended model, indicating that the confluence of IFF, GDP growth rate, trade openness, natural resource rent and inflation rate offer more explanation to the dynamics of tax revenue in resource-rich African countries than only IFF. Specifically, the coefficient of determination statistic shows that about 78.5 percent of changes in tax revenue is influenced by the confluence of the explanatory variables.

Table no. 3 – Effects of IFFs on Domestic Resource Mobilization

Variables	Fixed Effect		Random Effect	
	Coefficient	Coefficient	Coefficient	Coefficient
Log of Illicit Financial Flows	-2.518	-2.632***	-2.518	-2.632***
	(1.634)	(0.925)	(1.634)	(0.925)
GDP Growth Rate		-0.059		-0.059
		(0.096)		(0.096)
Trade Openness		0.151***		0.151***
		(0.026)		(0.026)
Natural Resource Rent		0.413***		0.413***
		(0.079)		(0.079)
Inflation		-0.295***		-0.295***
		(0.067)		(0.067)
Economic Complexity		-0.253		-0.253
		(1.053)		(1.053)

Variables	Fixed Effect		Random Effect	
	Coefficient	Coefficient	Coefficient	Coefficient
Constant	71.638**	61.273***	81.286**	65.342***
	(34.871)	(19.743)	(34.484)	(19.533)
Observations	91	91	91	91
R-squared	0.258	0.785	0.258	0.785
Country Dummies	YES	YES	YES	YES
Year Dummies	YES	YES	YES	YES

*Note: * p<0.01, ** p<0.05,*** p<0.1 while standard errors are in parentheses*

4.3 Robustness Check

To validate the previously reported fixed effect and random effect model estimates, a robustness check was carried out. This was done by re-estimating equation 2 using the dynamic instrumental variable generalised method of moments (IV-GMM) estimator with the share of IFF in total trade as the measure of IFF. The IV-GMM estimator addresses autocorrelation, heteroscedasticity and endogeneity problems; and produces unbiased estimates. The estimates generated by the estimator, shown in Table no. 4, lends support to the earlier results as they show that IFF (% of trade) and tax revenue move in opposite directions in resource-rich African countries. This implies that tax revenue will plummet when the share of IFF in total trade increases and vice versa. It also indicates that an increase in share of IFF in trade is at the detriment of tax revenue and tax revenue will surge when IFF is curtailed.

Table no. 4 – Effects of IFFs on Tax Revenue (IV-GMM Regression Estimates)

Variables	Coefficient	Coefficient
Illicit Financial Flows (% of Trade)	-0.769*	-0.417**
	(0.182)	(0.181)
GDP Growth Rate		-0.188
		(0.128)
Trade Openness		0.154*
		(0.019)
Natural Resource Rent		0.198***
		(0.115)
Inflation		-0.041
		(0.110)
Economic Complexity		6.138*
		(0.931)
Constant	33.467*	20.207*
	(4.503)	(4.156)
Observations	91	91
Mean dependent var	16.954	16.954
SD dependent var	8.714	8.714
R-Squared	0.124	0.571
Chi-square	17.879	287.998
Prob > chi2	0.000	0.000

*Note: * p<0.01, ** p<0.05, *** p<0.1 while standard errors are in parentheses*

Interestingly, the coefficient of IFF (% of trade) is statistically significant in both the baseline and extended models, which reveals that IFF is a major factor influencing tax revenue in the sampled resource-rich African countries. Despite the differences in the magnitude of IFF's impact on tax revenue revealed by the earlier and current estimators, IFF remains a major impediment to the revenue that accrues to the national governments of resource-rich African countries through tax. This is because the falsification of trade invoices to evade tax and enjoy tax incentives robs the government of its revenue accrual and limits its financial capability to fulfil its fiscal responsibilities. The IFF-induced tax revenue reduction has severe ripple effects on domestic resource mobilization; hence, the urgent need to expeditiously curtail the IFF menace. Overall, the IV-GMM estimates are similar to those of the fixed effect and random effect models, signifying that the results are valid and reliable for policymaking.

5. CONCLUSION

The primary focus of this study is the quantification of the volume of illicit financial flow (IFF) from selected resource-rich African countries and the investigation of how these illicit flows affect tax revenue. To achieve this purpose, panel data spanning 2000-2021 were sourced from various reputable databases. The fixed effect and random effect models were adopted for data analysis while the instrumental variable generalised method of moment (IV-GMM) estimation method was used to validate the results. The trend analysis revealed that South Africa and Nigeria, the two largest economies in Africa, are the top two countries with the highest IFF (in US dollars) among the seven sampled resource-rich African countries. However, the Democratic Republic of Congo and Tanzania are the top two countries with the highest share of trade-based IFF in total trade. The empirical results showed an overwhelming evidence of the negative effect IFF has on tax revenue, which could hamper domestic resource mobilization across the resource-rich African countries.

This finding has implications for policy formulation and implementation. Specifically, the result is crucial to the formulation of evidence-based policies to tackle IFF and foster effective domestic resource mobilization toward the realization of the Sustainable Development Goals (SDGs). First, there is a dire need to review extant anti-IFF policies and formulation as well as implement new ones that take cognizance of the modern ways through which domestic resources are illegally carted abroad. Second, countries need to synergize with their trade partners and other countries with whom they have economic and diplomatic relations in the sharing of financial information to detect culprits of IFF and penalize them accordingly. Anti-IFF agencies also need to be reinforced and their staffs need to be regularly trained on how to use modern tactics to detect and block IFF channels. These efforts will, to a large extent, reduce the incidences of IFF and substantially raise the volume of tax revenue. The key limitation of this study is that it focused mainly on the direct effect of IFF on tax revenue in resource-rich African countries. Future research can focus on exploring how IFF affects domestic resource mobilization in developing and developed regions through indirect channels.

ORCID

Joshua Adeyemi Afolabi http://orcid.org/0000-0003-2024-3942

References

Afolabi, J. A. (2022). Financial development, trade openness and economic growth in Nigeria. *Indian Economic Review*, *26*(1), 237-254. http://dx.doi.org/10.22059/ier.2022.86982

Afolabi, J. A. (2023a). Trade misinvoicing and domestic resource mobilization in Nigeria. *International Journal of Development Issues*, *22*(1), 91-106. http://dx.doi.org/10.1108/IJDI-09-2022-0208

Afolabi, J. A. (2023b). Natural resource rent and environmental quality nexus in Sub-Saharan Africa: Assessing the role of regulatory quality. *Resources Policy*, *82*(103488), 1-11. http://dx.doi.org/10.1016/j.resourpol.2023.103488

Afolabi, J. A. (2023c). Place a bar on government size to bar growth reversal: Fresh evidence from BARS curve hypothesis in Sub-Saharan Africa. *Tydskrif vir Studies in Ekonomie en Ekonometrie*, *47*(4), 303-320. http://dx.doi.org/10.1080/03796205.2023.2220079

Afolabi, J. A. (2024). Does Illicit Financial Flows Crowd Out Domestic Investment? Evidence from Sub-Saharan African Economic Regions. *International Journal of Finance & Economics*, *29*(2), 1417-1431. http://dx.doi.org/10.1002/ijfe.2740

Afolabi, J. A., & Oji, C. E. (2021). Nigeria-China bilateral relations: A skewed or balance relation? , *7*(2), 129-145. http://dx.doi.org/10.1504/IJDIPE.2021.118854

Aminu, A., & Ogunjimi, J. A. (2019). A small macroeconometric model of the Nigerian economy. *6*(2), 41-55. http://dx.doi.org/10.20448/journal.502.2019.62.41.55

Babatunde, M. A., & Afolabi, J. A. (2023). Growth Effect of Trade Misinvoicing in Sub-Saharan Africa: The Role of Governance. *International Journal of Development Issues*, *22*(2), 241-254. http://dx.doi.org/10.1108/IJDI-01-2023-0004

Baum, C. F., Schaffer, M. E., & Stillman, S. (2007). Enhanced routines for instrumental variables/GMM estimation and testing. *The Stata Journal*, *7*(4), 465-506. http://dx.doi.org/10.1177/1536867X0800700402

Biedermann, Z. (2018). Africa's dependency curse: The case of Botswana. Retrieved from https://roape.net/2018/09/27/africas-dependency-curse-the-case-of-botswana/

Bolaji, M., Adeoti, J. O., & Afolabi, J. A. (2021). The imperative of research and development in Nigeria: Lessons from the COVID-19 pandemic. International Journal of Technological Learning. *Innovation and Development, 13*(2), 168-189.

Boleti, E., Garas, A., Kyriakou, A., & Lapatinas, A. (2021). Economic Complexity and Environmental Performance: Evidence from a World Sample. *Environmental Modeling and Assessment*, *26*(February), 251-270. http://dx.doi.org/10.1007/s10666-021-09750-0

Brandt, K. (2020). Illicit financial flows and the Global South: A review of methods and evidence. *UNU-WIDER Working Paper*(169). http://dx.doi.org/10.35188/UNU-WIDER/2020/926-6

Cobham, A. C., & Janský, P. (2020). *Estimating illicit financial flows: A critical guide to the data, methodologies and findings*: Oxford University Press. http://dx.doi.org/10.1093/oso/9780198854418.001.0001

Fetai, B. T., Mustafi, B. F., & Fetai, A. B. (2017). An Empirical Analysis of The Determinants of Economic Growth in The Western Balkans. *64*(2), 245-254. http://dx.doi.org/10.1515/saeb-2017-0016

Franks, D. M., Ngonze, C., Pakoun, L., & Hailu, D. (2020). Voices of artisanal and small-scale mining, visions of the future: Report from the International Conference on Artisanal and Small-scale Mining and Quarrying. *The Extractive Industries and Society*, *7*(2), 505-511. http://dx.doi.org/10.1016/j.exis.2020.01.011

Global Financial Integrity. (2021). *Trade-Related Illicit Financial Flows in 134 Developing Countries*: Global Financial Integrity.

Goosen, M. (2022). Top five oil and gas projects in Angola. Retrieved from https://energycapitalpower.com/top-five-oil-and-gas-projects-in-angola/

High Commission of the United Republic of, T. (2024). Natural Resources and Mining in Tanzania. Retrieved from https://www.ke.tzembassy.go.tz/tanzania/natural-resources-and-mining-in-tanzania

Igbatayo, S. A. (2019). Combating illicit financial flows from africa's extractive industries and implications for good governance. *Africa Development. Afrique et Developpement, 44*(3), 55-86.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics, 115*, 53-74. http://dx.doi.org/10.1016/S0304-4076(03)00092-7

International Monetary Fund. (2021). World revenue longitudinal data. Retrieved from https://data.imf.org/?sk=77413f1d-1525-450a-a23a-47aeed40fe78

Joshua, U., & Bekun, F. V. (2020). The path to achieving environmental sustainability in South Africa: The role of coal consumption, economic expansion, pollutant emission, and total natural resources rent. *Environmental Science and Pollution Research International, 27*, 9435-9443. http://dx.doi.org/10.1007/s11356-019-07546-0

Kolala, C., & Dokowe, A. (2021). Economic potential of industrial minerals in Zambia - A review. *Resources Policy, 72*(101997), 101997. http://dx.doi.org/10.1016/j.resourpol.2021.101997

Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics, 108*, 1-24. http://dx.doi.org/10.1016/S0304-4076(01)00098-7

Muchala, B. (2018). The right to development and illicit financial flows: Realizing the sustainable development goals and financing for development. Retrieved from https://www.ohchr.org/sites/default/files/Documents/Issues/Development/Session19/A_HRC_WG.2_19_CRP_3.docx

Muslim, H. S., Jawad, A. K. K., & Jihad, J. H. (2021). Illicit financial flows and their impact on domestic resource mobilization in the Arab region. *6*(3), 1200-1210.

Nathaniel, S. P. (2021). Natural resources, urbanisation, economic growth and the ecological footprint in South Africa: The moderating role of human capital. *Quaestiones Geographicae, 40*(2), 63-76. http://dx.doi.org/10.2478/quageo-2021-0012

Nichols, E. (2018). The Resource Curse: A Look into the Implications of an Abundance of Natural Resources in the Democratic Republic of Congo. Scholarly Horizons: University of Minnesota. *5*(2), 1-26. http://dx.doi.org/10.61366/2576-2176.1062

Ogunjimi, J. A. (2019). Impact of public debt on investment: Evidence from Nigeria. *2*(2), 1-28.

Ogunjimi, J. A. (2020a). Exchange rate dynamics and sectoral output in nigeria: A symmetric and asymmetric approach. *American Journal of Social Sciences and Humanities, 5*(1), 178-193. http://dx.doi.org/10.20448/801.51.178.193

Ogunjimi, J. A. (2020b). Oil price asymmetry and sectoral output in Nigeria. International Journal of Economics. *7*(1), 1-15.

Ogunjimi, J. A., & Amune, B. O. (2019). Impact of infrastructure on foreign direct investment in nigeria: An autoregressive distributed lag approach. *10*(3), 1-8. http://dx.doi.org/10.7176/JESD/10-3-01

OPEC. (2021). Annual statistical bulletin. https://www.opec.org/opec_web/en/publications/202.htm

Raifu, I. A., & Afolabi, J.A. (2023). The Effect of Financial Development on Unemployment in Emerging Market Countries. *Global Journal of Emerging Market Economies, 15*(3), 354-384. http://dx.doi.org/10.1177/09749101221116715

Sebudubudu, D., & Mooketsane, K. (2016). Why Botswana is a deviant case to the natural resource curse. The African Review: A Journal of African Politics. *43*(2), 84-96.

Signé, L., Sow, M., & Madden, P. . (2020). Illicit financial flows in Africa: Drivers, destinations, and policy options. Retrieved from https://www.brookings.edu/wp-content/uploads/2020/02/Illicit-financial-flows-in-Africa.pdf

The Growth Lab at Harvard University, H. D., V4. (2019). Growth Projections and Complexity Rankings. Retrieved from http://dx.doi.org/10.7910/DVN/XTAQMC

Thiao, A. (2021). The effect of illicit financial flows on government revenues in the West African Economic and Monetary Union countries. *Cogent Social Sciences, 7*(1), 1-24. http://dx.doi.org/10.1080/23311886.2021.1972558

UNECA. (2017). Impact of illicit financial flows on domestic resource mobilization: Optimizing revenues from the mineral sector in Africa. Retrieved from https://repository.uneca.org/handle/10855/23862

Uzoechina, B. I., Ibikunle, J. A., Olasehinde-Williams, G., & Bekun, F. V. (2023). Illicit financial outflows, informal sector size and domestic resource mobilization in selected African countries. *Journal of Economic and Administrative Sciences, 39*(4), 1137-1159. http://dx.doi.org/10.1108/JEAS-12-2020-0208

Wagner, A. (1980). Three Extracts on Public Finance. In M. R. A. Musgrave and A. T. Peacock, London (Ed.), *Classics in the Theory of Public Finance* London: Third.

World Bank. (2018). *Reinvigorating growth in resource-rich Sub-Saharan Africa*: World Bank.

World Bank. (2019). *Environment and renewable natural resources in angola: opportunities to diversify the national economy, generate income for local communities, enhance environmental management capacity and build resilience to climate change*: World Bank.

World Bank. (2023). Democratic Republic of Congo: Overview. https://www.worldbank.org/en/country/drc/overview

World Development Indicators. (2021). Nigeria - Database of the World Bank. https://data.worldbank.org/country/nigeria