

A System- GMM Model for Evaluating Natural Resource Revenues and Shadow Economies in African Context: Evidence from Sub-Saharan African Countries

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ABSTRACT: This present study explored the linkage of natural resources revenues and the shadow economies with consideration for sub-Saharan African contexts. It is an inquiry in the degree to which rents from oil, forest, coal, mineral and gas and total natural resources can impact shadow economy in the SSA countries. The study's data was collated from the selected sub-Saharan African countries and covered the period 2000-2022. The study adopts the system GMM techniques as the major estimation technique. Summarizing the econometric results, findings reveal direct and significant impact of forest rent, coal rent, mineral rent and total natural resources on the shadow economy. Also, the empirical results reveal an indirect but indistinguishable impact of oil rent on the informal economy. The evidence further found negative and insignificant impact of gas rent on the shadow economy. The study suggested that the government should establish a robust institutional framework that can prevent the misappropriation of natural resource revenues, decrease the extent of the shadow economy, and improve the depth of financial institutions, all of which can contribute to the African continent's economic progress. Furthermore, the findings from this study have shown that there is a need for the government to ensure that measures that increase economic competition, loosen restrictions, lessen the incentives for corruption and encourage businesses to transition from the shadow economy to the legal one. Instead of focusing on expanding the number of rules, the government should prioritize the rule of law and the rigorous enforcement of the bare minimum required by law.

KEYWORDS: Africa, Institutions, Resources, Shadow economy, Estimation methods

JEL Classification: C23, N57, Q23, Q26, Q32, Y10.

INTRODUCTION

Interest in the informal economy is increasing globally, particularly among low-income emerging countries, academics and policymakers. Even studies of African extraction such as David, Gamal, Salem and Abdul Jalil (2024), Fonsoh, Njong and Nchofoung (2025), and Simwanza (2025), have all canvassed that natural resources revenues significantly enhance the shadow economy. Holding similar positions are studies of Nguyen (2022), and Qian and Chen (2025). The connection between natural resource earnings and the informal economy is quite widely covered in the literature. Further, it may be important to state that informal or shadow economy is crucial in any climes of the world because it create employment, economic resilience and income generation, especially in emerging markets, and provides a safety-net for the poor. This is hinged on the assumption that informal economy plays a vital role on the economy.

This article proposes to contribute to empirical studies related to the nexus between natural resources and informal sector in sub-Saharan African countries. A portion of the economy known as the "shadow economy" is exempt from taxation and typically involves the tracking of products and services that are paid for with cash. This shadow economy's growth has the potential to stifle economic growth by distorting investments, raising income inequality, unfairly competing with established businesses, and lowering living standards (Nguyen, 2022). In view of the importance of the shadow economy, scholars have tried to juxtapose the key determinable factors affecting the informal or shadow economy. Furthermore, it didn't take long for people to realise that the "resource curse" phenomenon is the reason why the majority of developing nations with abundant natural resources have lagged behind their counterparts with limited resources in terms of social, political, and economic advancement (Raihan, 2024). Theoretical arguments suggest that the advent of the informal sector is facilitated by the abundance of natural resources (Sawadogo and Ouoba,

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2024., Nguyen, 2022). Ajide and Dada (2024) found that investments and expenses associated with the profits from natural resource restrict chances in the formal sector, which pushes more individuals and businesses into the unorganized sector. Also, Etim and Daramola (2020) in their empirical research stated that a significant amount of a nation's foreign exchange earnings come from the export of its natural resources. All natural resources discovered are utilized whichever in the organized sector or unorganized sector depending on the perceived pros and cons of each sector. More so, numerous empirical arguments have been put out on the connection between the shadow economy and natural resource earnings (Qian and Chen, 2025., Slesman, 2025). The recent study by Teneja, Bhatnagar, Kumar and Rupeika-Apoga (2023) offers factual support for the multifaceted examination of natural resource rents and their effects on the shadow economy. The authors contend that the chances for long-term economic growth and, consequently, sustainable development depend heavily on the prudent use of natural resources, the reduction of pollution, and consideration of other environmental considerations.

While academics have proposed a number of theoretical explanations to substantiate the existence of shadow economy in different economies contexts, the commonly cited justification is that it is recognized as a result of insufficient economic strategies and defects in the formal economic system (Sargsyan, 2024; Choi and Moon, 2024). Also, series of studies have shown that corruption, excessive taxation, excessive government regulation of businesses, and poor performance by government agencies (Schneider and Enste, 2000; Schneider and Buehn, 2018; Yefimenko and Dubovenko, 2024). Furthermore, scholars have mentioned that there exists quantum of natural resources in the interior of the African continent, which stretches from West Africa to South Africa and all points (Aladejare, 2025). However, most African countries, including oil-rich Nigeria and diamond-rich Sudan, have been plagued by a resource curse. Africa is also known for having a higher percentage of the informal sector than other parts of the world. Nonetheless, the African continent's informal sector is a major problem, accounting for an estimated 38.4% of the continent's GDP. The shadow economy is especially prevalent in countries like Nigeria, Gabon, Zimbabwe, and the Democratic Republic of the Congo. In fact, when compared to other climes of the globe, Sub-Saharan Africa has the largest percentage of informal employment. For example, 36.5% come from Europe and Central Asia, which is much more than the 13.5% that comes from high-income OECD countries. This study looks at the link between natural resource revenues and the shadow economy in sub-Saharan African nations because issues raises on what actually causes the paradox of plenty syndrome in Africa or what is the missing link connecting the continent's economic growth and its natural resource abundance is yet to be conclusive among scholars.

Additionally, the current study adds to the body of literature in a number of ways. First, it is the primary academic study that looks at the crucial influence of natural resource revenue (including aggregated and disaggregated factors) on the informal sector. Further, the study used recently developed analytical tools to examine the relationship between the factors that were intended and to provide useful policy implications for countries in Sub-Saharan Africa (SSA). To make progress on the nexus between natural resources revenues and shadow economy discourse, this present study bring together a rich collection of micro-data within the context of Africa geographic clime that includes a vast researches across different countries. This makes it possible to observe the actual linkages between both disaggregated and aggregated impacts of natural resource revenues on the shadow economy in Africa. Second, we adopt a thorough econometrical approach to subject the study data to robustness checks. Third, while the study is Africa context in scope, it focuses on region where the impact of natural resources revenues are most pronounced, such as emerging and developing economies in Africa and countries where natural resources are in abundance and still at potential stage of utilization. The research acknowledges certain limitations, including the inherent unpredictability of geopolitical developments within the selected countries. Therefore, this study's objective is to investigate the interconnectedness between natural resources revenues (disaggregated and aggregated impacts) and the shadow economy as twin brothers in Africa context.

The hypotheses are presented in null forms to achieve the stated objectives as follows:

H1: Disaggregated impacts of natural resource revenues do not affect the shadow economy in African countries

H2: Aggregated impacts of natural resource revenues do not affect the shadow economy in African countries

The remaining section of the study is organised as follows: Part 2 discusses the study's underlying theory and literature; Section 3 presents the research methodologies; Section 4 summarises the findings; and Section 5 assesses, evaluates, and recommends appropriate actions.

2. REVIEW OF RELATED LITERATURE

Numerous literatures in developed countries and other emerging markets have shown empirical data to support the nexus that correlate between natural resources revenues phenomena and shadow economy. However, these studies are to the exclusion of African nations. Indeed, the newly emerging work had been captured by Vataru, Tudoresce, Lobout, Moldovan and Costea (2025) who examined the empirical research and offered fresh data on Environmental challenges and Effects induced by shadow economy. The empirical analysis covers EU countries within the scope ranging from 2009 to 2019. The analysis adopts shadow economy (% GDP) as the explanatory variable while three environmental proxies such as Agriculture methane emissions, Methane emissions for the energy sector and Tax on pollutions were the response variables. Also, simple linear regression models were used as the data analysis technique. Findings from the study revealed that the evolution of the shadow economy is on a downtrend. However, the

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study only offered a cursory analysis of the empirical results; its findings are limited in data and models selection. Such findings cannot juxtapose within the Africa contexts.

Tong and Duong (2025) used data from 2002 to 2017 in a panel regression model and Bayesian approach in an attempt to further examine the nexus between Happiness and its relationship with the shadow economy management by adopting pooled data of ASEAN nations. The study's data originated from many sources such as World Development Indicators, New Economics Foundation, Heritage Foundation, and World Governance Indicators. Explanatory variables include: happiness, GDP per capita, governance, trade openness and tax burden while the response factor was the size of informality. The study found that happiness harms the shadow economy in ASEAN nations. Likewise, GDP per capita, trade openness and governance adversely affect the shadow economy. Inversely, tax burden is positively related to this economic sector. Due to disparities in institutional and economic frameworks, the study's policy recommendations, however, will not be suitable for application in Africa climes. Although, it is beyond the scope of this research, a new study by Qian and Chen (2025), investigate how green growth is affected by the rents from natural resources. In order to close the gap, the study looked at how the green growth of the G7 countries was affected by the rents from coal, oil, minerals, natural gas, and all natural resources. The results of the panel ARDL approach show that natural gas rent, coal rent, and total natural resources all have long-term detrimental effects on green growth. Additionally, research shows that while minerals rent has a negligible long-term effect on green growth, oil rent has a positive effect. These findings provide critical insights into the broader economic ramifications of natural resources and informal economy.

Another strand of the literature by Amare, Demissie, and Massa (2025) examine the impact of natural resource rents on the quality of institutions in a few African countries. Data from a panel of 43 African countries from 1996 to 2022 using the cross-sectional augmented autoregressive distributed lags (CS-ARD) model show that natural resource rents have an indirect and indistinguishable impact on institutional quality. However, this research, while contributing significantly to understanding the natural resource rents in enhancing shadow economy, highlights several areas where further exploration is necessary. One limitation of the study is its focus on institutional quality alone. This narrow scope limits the applicability of the findings to other economies. Also, Kazeem and Lanre (2023) examine how the abundance of natural resources either encourages or inhibits shadow market activity in 42 African nations between 1991 and 2015. The results of the dynamic system Generalised Method of Moments show that although forest, mineral, and composite natural resource rents serve as mitigating instruments for the shadow economy, coal, natural gas, and oil rents have magnifying effects. Furthermore, the analysis discovered a non-linear nexus between the informal economy and natural resources rents.

Tabash, Mesagan, and Farooq (2022) study the dynamic link between natural resources, complexity, and economic growth, with a focus on Africa. The study examined the relationship between natural resource rents and economic complexity as predictors of economic growth, while accounting for corruption, gross capital creation, total labour force, foreign direct investment inflow, and trade openness. The empirical data suggest that economic complexity has a beneficial impact on economic growth, whereas natural resource rents have an indirect effect. Numerous connections between natural resources and economic growth have been explored in the literature, but little has been done to examine how these natural resource components affect the shadow economy as a whole. The application of theoretical frameworks has been limited, and quantitative and mixed methods have been used relatively infrequently, which limits the specificity of insights about the shadow economy. As a result, new research of this kind is required in the African context.

Despite the extensive body of research, several gaps remain unaddressed. First, few empirical findings exist on the nexus between natural resource rents and informal economic system. Second, existing studies often focus on isolated sectors, or regions, overlooking the interconnectedness of these informal sector phenomena. Finally, there is a need for more empirical research on the nexus between natural resource rents and informal sector. By addressing these gaps, the current study aims to contribute a comprehensive and interdisciplinary analysis that advances the understanding of this critical sector of the economy.

Theoretical Framework

The Institutional Theory or Institutionalism

This study is underpinned by the Institutionalism theory propounded by American economist Walton H Hamilton (1918). In its simplest form, the institutionalism theory focuses on how economics must follow certain rules to deal with daily challenges. With the discovery of natural gas, oil, and other related natural resources the prediction is that their exploration will highly favour the people of the host country. Though, Africa countries repeatedly experience either (or both) increased corruption or paradoxically slower economic growth after discovery of the resources. This anomaly is often described as the resource curse which can also be traced to weak institutions in Africa.

3. METHODOLOGY AND MODEL

Employing a conservative methodological approach, the research synthesizes quantitative forecasting models to delineate the cascading nexus between natural resource revenues and shadow economy within the Sub-Saharan Africa context. Using a secondary

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dataset available from 2000 to 2022, we cover thirty-five (35) Africa countries (see Appendix 1). The difference and system-GMM estimators, as well as the generalised least square (GLS) (static panel), are employed. Our final conclusion, however, is based on the system-GMM data. We prefer system-GMM in order to address the shortcomings of GLS estimators. The dependent variable becomes correlated with the quasi-demeaned residuals as a result of the quasi-demeaning of the data used in the GLS estimator, rendering it biased and inconsistent. The variables' dynamic behaviour is another area of interest for this present research (Arellano & Bond, 1991; Magazzini, 2024) and dealing with the variables' endogeneity issue (Liengard, Becker, Bennedsen, Heiler, Taylor & Ringle, 2025). Sawadogo and Ouoba (2024) aver that the system-GMM manages the issue of possible endogeneity that could emerge from possible reverse causation between the explanatory variables and the shadow economy. For example, the expansion of the shadow economy may also persuade a nation to enhance revenue collection or raise forest fees in order to encourage greater resource management in the unorganised sector of the economy. Similarly, system-GMM is best suited to resolve the unobserved heteroscedasticity of the series since several of the variables, including Oil Rent, Coal Rent, Gas Rent, Mineral Rent, and Total Natural Resources Rent, are time invariant (Adam & Alzman, 2024.; Carvelli, 2024). The system-GMM model is expressed as:

$$SE_{it} = \delta_0 + \sum_{t=1}^k \delta_1 SE_{it-1} + \sum_{t=1}^k \delta_2 OR_{it} + \sum_{t=1}^k \delta_3 FR_{it} + \sum_{t=1}^k \delta_4 CR_{it} + \sum_{t=1}^k \delta_5 MR_{it} + \sum_{t=1}^k \delta_6 GR_{it} \\ + \sum_{t=1}^k \delta_7 TNR_{it} + \sum_{t=1}^k \delta_8 TR_{it} + \sum_{t=1}^k \delta_9 INF_{it} + \sum_{t=1}^k \delta_{10} UNEMPL_{it} + \sum_{t=1}^k \delta_{11} INC. INEQ_{it} \\ + \mu_{it}$$

Table 1: Measurement of Variables

Variable	Proxy	Data source
Shadow Economy(SE)	Measured as proportion of the size of shadow economy to GDP.	World Bank
Forest Resources (FR)	This is used as values associated with forested landscapes.	Medina and Schneider databases
Oil Rent (OR)	Computed as the difference between world pricing value of hard and soft oil output and their combined production costs.	WDI database
Coal Rent (CR)	This is measured as resource rent from coal production	WDI database
Coal Rent (CR)	This is measured as resource rent from coal production	WDI database
Gas Rent (GR)	Economic surplus generated from natural gas extraction	WDI database
Mineral Rent (MR)	Economic gains derived from the extraction and sale of minerals.	WDI database
Total Natural Resource Rents	Whole natural resources rent (% of official GDP	WDI database
Tax Revenue (TR)	Measured as a nation's tax revenue to the size of its economy	IMF Database
Inflation (INF)	Measured as the percentage change of a price index over time	WDI database
Unemployment (UNEMP)	Measured as number of unemployed population in the selected countries.	WDI database
Income Inequality (INC. INEQ)	Measured using the Gini coefficient of the selected countries	World Bank DataBank

Source: Researchers' compilation from available Literature, 2025.

4. DISCUSSION OF RESULTS

The analytical results of the study present a comprehensive depiction of the interconnected of natural resources revenues and shadow economy within the Africa context.

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Descriptive Analysis

Table 2 below depicts an overview of the descriptive results of the data used; the shadow economy (SE) has a mean value of 37.39 suggesting the large size of the shadow economy across African continent. Notably, Nigeria has the peak average value of 66.61, while Mauritius has the lowest at 19.23. Despite this variation, the dispersion from the mean is quite low, with a standard deviation of only 0.01. This suggests that the size of the shadow economy in African countries does not exhibit significant disparity.

Table 2: Summary Statistics

	Obs	Std. Dev.	Mean	Minimum	Maximum
SE	659	0.01	37.39	37.34	37.40
FR	659	5.67	5.25	0.00	40.41
OR	659	1.45	3.78	4.35	16.80
CR	659	0.43	0.09	0.00	5.86
GR	659	0.93	0.38	0.00	6.77
MR	659	2.28	1.07	0.00	14.99
TNR	659	5.22	14.19	5.80	27.69
TR	659	0.68	0.25	0.00	11.85
INF	659	951.79	47.75	-9.80	24411.03
UNEMP	659	7.80	7.35	8.90	25.65
INC.INEQ	659	41.35	41.49	41.62	41.49

Source: Output of summary statistics obtained from E-views 12, 2025

Correlation Matrix

The results as shown in Table 3 reveal that all the natural resources are weak positively correlated with shadow economy. From the table, we can deduce that our variables are not suffering from multicollinearity.

Table 3: Correlation Analysis

	SE	OR	FR	CR	MR	GR	TNR	TR	INF	UNEMP	INC.I NEQ
SE	1	-	-	-	-	-	-	-	-	-	-
OR	0.29	1	-	-	-	-	-	-	-	-	-
FR	0.13	0.32	1	-	-	-	-	-	-	-	-
CR	0.08	0.09	0.01	1	-	-	-	-	-	-	-
MR	0.07	0.21	0.05	0.02	1	-	-	-	-	-	-
GR	0.03	0.30	0.24	0.16	-0.17	1	-	-	-	-	-
TNR	0.99	0.31	0.17	0.01	0.05	0.07	1	-	-	-	-
TR	0.1	0.30	0.14	0.08	0.06	0.04	0.99	1	-	-	-
INF	0.00	0.02	0.001	0.28	0.08	0.02	-0.01	0.04	1	-	-
UMEMP	0.10	0.30	0.15	0.09	0.06	0.05	0.10	0.95	0.07	1	-
INC.INEQ	0.10	0.29	0.13	0.08	0.07	0.03	0.99	0.93	0.06	0.08	1

Source: Output of summary statistics obtained from E-views 12, 2025

Table.4: Estimated outcomes of the models

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Oil Rent	-1.49** (2.73)	-	-	-	-	-
Forest Rent	-	3.30*** (5.60)	-	-	-	-
Coal Rent	-	-	2.65*** (4.8)	-	-	-
Mineral Rent	-	-	-	-2.53**	-	-

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				(1.21)		
Gas Rent	-	-	-	-	1.744*** (3.24)	-
Total Natural Resources Rent	-	-	-	-	-	0.00*** (1.16)
Control Variables						
Tax Revenue	0.16*** (0.00)	0.16*** (0.00)	0.16*** (0.00)	0.16*** (0.00)	0.16*** (0.00)	0.19*** (9.52)
Inflation	9.2 (3.26)	4.68 (3.24)	-2.14 (3.29)	1.41 (3.31)	8.51 (3.26)	-2.67 (2.26)
Unemployment	-0.07*** (0.00)	-0.07*** (0.00)	-0.07*** (0.00)	-0.07*** (0.00)	-0.07*** (0.00)	-0.13*** (0.00)
Income Inequality	0.86*** (1.94)	0.86*** (1.96)	0.86*** (1.89)	0.86*** (1.89)	0.86*** (1.98)	0.86*** (1.36)
R-Squared Durbin-Watson	0.99 0.00	0.99 0.00	0.99 0.01	0.99 0.00	0.99 0.00	0.99 0.00

Source: Output of summary statistics obtained from E-views 12, 2025

Table 4 above show the disaggregated results of the relationship between natural resource rents and the shadow economy. Models 1 and 4 indicate that oil rent and mineral rent exhibit an inverse association with the shadow economy, and this relationship is statistically significant at the 5% level. Specifically, in Model 1, a one-unit increase in oil rent leads to a 149% decrease in the shadow economy, which is statistically significant at the 5% level.

In contrast, the other models show that forest rent, coal rent, gas rent, and total natural resource rent have a positive relationship with the shadow economy. This result diverges from the expected a priori hypothesis, which suggests that natural resource rents should foster job creation and reduce the size of the shadow economy, assuming all other things remain equal (*ceteris paribus*). Overall, while natural resources appear to act as a driving force of the shadow economy, their effects are significant at varying levels across the models. This highlights the complex and sometimes counter-intuitive role that natural resource rents play in shaping the dynamics of the shadow economy.

Table 5: Empirical results for Pooled OLS, Fixed effect and Random effect model

Dependent variables Methods of estimation	Shadow economy POLS	FE	RE
Independent Variables			
Oil Rent	-6.25 (3.82)	0.96* (1.36)	0.49* (1.59)
Forest Rent	-5.94 (4.27)	-0.28 (1.60)	0.47 (1.73)
Coal Rent	10.65** (3.94)	-26.24 (44.94)	16.10** (5.43)
Mineral Rent	-5.85 (4.0)	0.25 (1.48)	0.13 (1.67)
Gas Rent	-8.243* (4.7)	0.60 (2.47)	0.92 (2.12)
Total Natural Resources Rent	5.97 (3.92)	-0.56 (1.43)	-0.30 (1.63)
Control variables			
Tax Revenue	-0.56 (0.42)	0.25 (0.23)	0.00 (0.24)
Inflation	-0.08 (0.27)	0.06 (0.08)	0.01 (0.10)

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Unemployment	0.18 (0.35)	0.18 (0.25)	-0.02 (0.27)
Income Inequality	-0.04 (0.22)	0.45* (0.23)	0.15 (0.23)
R-Squared	0.67	0.68	
Hausman Test		20.81*** (0.0015)	
F-Test		11.95***	
Standard errors in parentheses *** p<0.01, ** p<0.05, *p<0.1			

Source: Researchers' Computation from Eviews, 2025

The F-test results (value = 11.95, significant at the 1% level) indicate the presence of unobserved heterogeneity across units (countries, regions, etc.), meaning that the assumption of no fixed effects in the Pooled OLS (POLS) model does not hold. Therefore, we reject the null hypothesis ($\omega_i = 0$), confirming that the Fixed Effects (FE) model is the more suitable approach. This suggests that individual-specific effects (unobserved factors) play a significant role in explaining variations in the dependent variable, the shadow economy (SE). To further select between fixed effect (FE) and random effect (RE) models, the Hausman test is used, with a test statistic of 20.81 (significant at the 1% level). The rejection of the null hypothesis (H_0) implies that the differences in the coefficients between FE and RE are not random, and thus, the Fixed Effects model is preferred. This supports the notion that the unobserved heterogeneity is correlated with the explanatory variables, making RE inappropriate in this case.

The result reveals that a 1% increase in oil rent leads to a 96% increase in shadow economy activities. This positive relationship reflects the notion that as oil rents increase; people are more likely to shift to the informal economy due to strict regulations and tax burdens in the formal economy. In such cases, the formal sector's regulations can push people to seek economic opportunities in the informal sector. In addition, 1% increases in forest rent results in a 28% reduction in the shadow economy. This finding suggests that when forest rents are managed properly and reinvested into the formal economy (e.g., through better governance and job creation), it can help to formalize activities and reduce the size of the shadow economy. Forests and other natural resources have the potential to support more sustainable formal sector jobs if managed appropriately. Similarly, coal rents have no robust association on the shadow economy. The negative relationship here suggests that revenues from coal can be used for formal economic development, and like forest rents, they can reduce informal sector activity when harnessed effectively. Also, Total Natural Resource Rents (aggregates) shows that 1% increase in total natural resource rents results in a 56% reduction in shadow economy activities. This supports the argument that better management and use of natural resource rents (including oil, coal, and forest rents) can reduce reliance on the informal sector and stimulate formal economic activity while 1% increases in income inequality leads to a 45% increase in shadow economy activities. This suggests that higher income inequality pushes individuals and businesses toward the informal economy as they may not have access to opportunities in the formal sector due to the growing disparity in income distribution. Income inequality often exacerbates the shadow economy as those in lower-income brackets may resort to informal economic activities as a means of survival.

Table 6: Two- step system GMM Results

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Dependent Variables						
Lag-Shadow Economy	0.99*** (0.01)	0.96*** (0.01)	1.02*** (0.02)	0.95*** (0.02)	0.98 (6.67)	1.03*** (0.01)
Independent Variables						
Oil Rent	-0.02* (0.01)	-	-	-	-	-
Forest Rent	-	0.03 (0.03)	-	-	-	-
Coal Rent	-	-	0.11*** (0.02)	-	-	-
Mineral Rent	-	-	-	0.00 (0.01)	-	-
Gas Rent	-	-	-	-	-0.02 (244.17)	-

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Total Natural Resources Rent	-	-	-	-	-	0.01 (0.01)
Control Variables						
Tax Revenue	-0.02 (0.01)	-0.01 (0.01)	-0.02 (0.02)	-0.01 (0.01)	-0.01 (23.83)	-0.03* (0.02)
Inflation	-0.01 (0.01)	0.02 (0.01)	-0.04 (0.03)	0.02 (0.02)	0.01 (5.99)	-0.07* (0.03)
Unemployment	-0.04 (0.01)	0.00 (0.01)	0.01 (0.03)	-0.01 (0.01)	-0.00 (20.23)	0.03** (0.01)
Income Inequality	-0.00 (0.00)	0.02*** (0.00)	-0.01 (0.01)	0.02** (0.01)	0.01 (3.26)	-0.01** (0.01)
AR (2)	0.38	0.24	0.87	0.75	0.12	0.94
Year Dummies	Yes	Yes	Yes	Yes	Yes	yes
Hasen	0.86	0.63	0.57	0.23	0.31	0.78
Number of Observation	31	35	35	35	35	35
Number of instruments	15	16	16	16	16	16
Number of groups	34	34	34	34	34	34
Note: The P-value is reported at 95% confidence level *p<0.05, **p<0.01, ***p<0.001. Standard errors in parentheses. Constant not reported						

From Table 5, the Path Dependency shows that the impact of shadow activities is significant at the 1% level across all models, except Model 5. This indicates that past shadow market activities have a positive effect on current shadow economy activities. Specifically, it was found that Oil Rent has a negative impact on the shadow economy, suggesting that oil revenues are effectively used in the formal economy, possibly through job creation. Our empirical evidence validates some theoretically-derived predictions for the relationship between oil rent and shadow economy. The evidence provided from our results do not support the findings of Qian and Chen (2025) and Kazeem and Lanre (2025) who established a positive and significant association between oil rent and informal economy.

In addition, the result shows that Forest resource has positive and statistically indistinguishable relationship with shadow economy. The finding that forest resource improves the informal economy is opposite to Kazeem and Lanre (2025), who found that forest resource worsen the shadow economy. Also, the result reveals that Coal rent have positive and significant association with shadow economy. This is in tandem with extant theoretical and empirical evidence discovered by Kazeem and Lanre (2025) who established a positive and significant impact of coal rent on informal economy. However, the empirical results do not support the findings of Qian and Chen (2025) who found an insignificant association of coal rent and shadow economy.

The analysis found that the positive and significant association between the mineral rent and shadow economy, indicating that higher mineral revenues can lead to a larger informal economy. This finding connotes that investments and expenditures related to mineral revenues might limit opportunities in the formal sector, potentially pushing more labour and firms into the shadow sector. However, the finding do not conform the findings of previous studies such as Kazeem and Lanre (2023) who found negative and insignificant impact of mineral rent on shadow economy.

The results indicated that Gas rent have a negative impact on the shadow economy. These results disagree with Slesman (2025) and Qian and Chen (2025), which throws light that declining oil and gas rents might not lead to higher tax efforts in nations with a sizable shadow economy. And last, the coefficient of total natural resources is significant and positive over the study period, implying that the higher the total natural resources, the more appreciable is the value of shadow economy in sub-Saharan African countries. These findings are not matched with the outcomes of Amare, Demissie and Massa (2025) who found a negative and significant impact of natural resources on the informal economy.

CONCLUSION

In this paper, it has been argued that in order for nations to benefit from the informal economy, our attention must be shifted from the formal economic system to the shadow economy because of its sizeable portion that permit countries, most especially emerging markets to improve their revenue and thereby create employment and other essential projects. The study recommended that the

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government should establish a robust institutional framework that can prevent the misappropriation of natural resource revenues, decrease the extent of the shadow economy, and improve the depth of financial institutions, all of which can contribute to the African continent's economic progress. Furthermore, the findings from this study have demonstrated that there is a need for the government should attempt to loosen some business laws that drive the private enterprises to go into hiding, so not revealing their income that should be subject to tax. Also, the government should ensure that measures that increase economic competition, loosen restrictions, lessen the incentives for corruption and encourage businesses to transition from the shadow economy to the legal one. Instead of focusing on expanding the number of rules, the government should prioritize the rule of law and the rigorous enforcement of the bare minimum required by law.

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Appendix A: List of selected countries

Nigeria	Benin
Ghana	Cameroon
Egypt	Angola
Kenya	Sierra Leone
Liberia	Sudan
Madagascar	South Sudan
Malawi	Chad
Central Africa Republic	Togo
Morocco	Uganda
Mozambique	Tunisia
Niger	Mali
Rwanda	Libya
Senegal	Guinea
South Africa	Guinea Bissau
Tanzania	Gabon
Zambia	Algeria
Zimbabwe	Burundi
Botswana	

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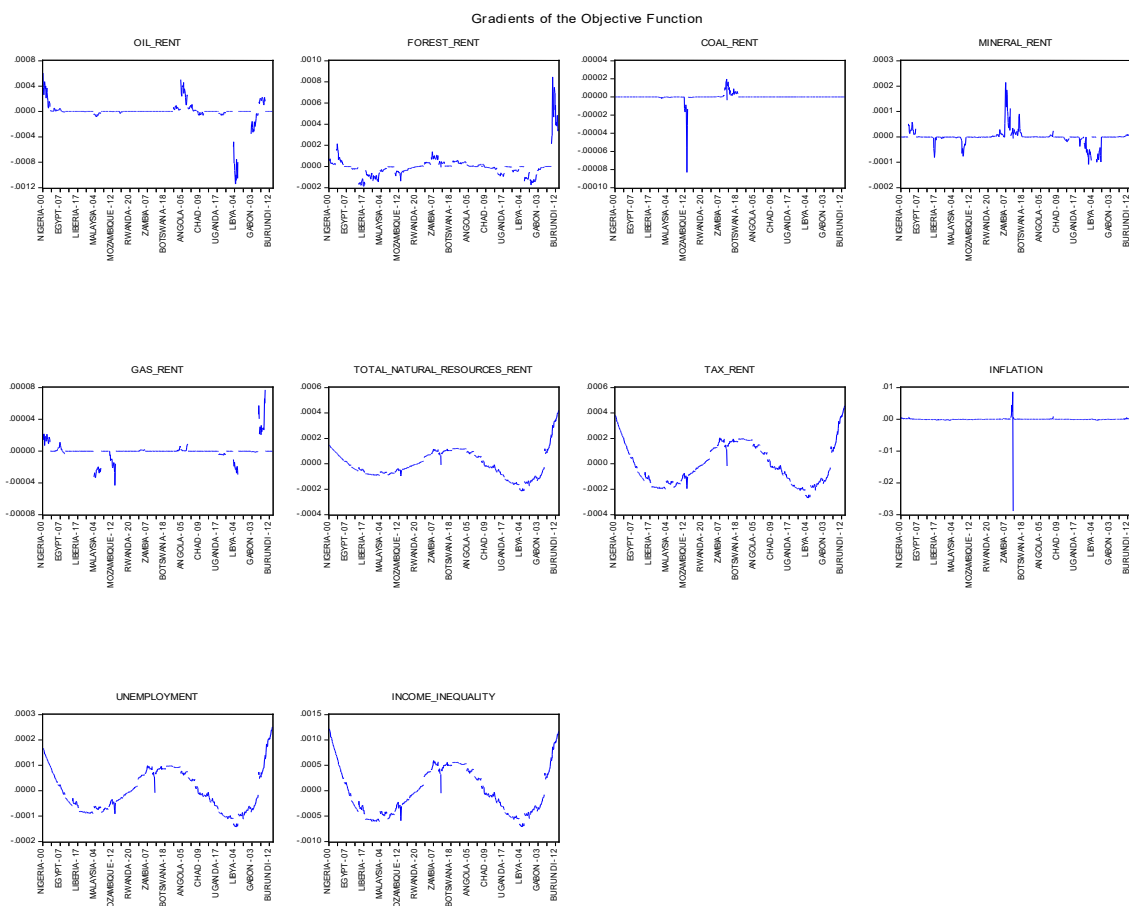


Fig.1: GRADIENT GRAPH OF THE SELECTED VARIABLES



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