

Regulatory Efficiency and Informal Economy: Impact on Tax Revenue in West Africa

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Abstract

Unregulated activities in the informal sector contribute to governance and institutional challenges, ultimately impacting tax revenue collection. This study examined the role of regulatory efficiency in the effect of the size of the informal economy of tax revenue in West Africa. Panel regression analysis, employing both Fixed Effects and Random Effects models, was used to estimate the relationship in 13 West African Economies between 2011 to 2022, with the Hausman test guiding model selection. The results suggest that the informal economy indicator has a negative and significant effect on tax revenue with an average coefficient of -0.3 at a 5% significant level. Implying that informal economic activities undermine tax collection. Monetary efficiency was found to have a positive and statistically significant impact on tax revenue with an average coefficient of 0.08 at a 5% significant level, while business efficiency and labour efficiency were statistically insignificant. Furthermore, the interaction of monetary efficiency with the size of the informal economy signified a positive effect with a coefficient of 0.005 at a 5% significant level. Among other control variables, the unemployment rate exhibited a statistically significant negative effect, whereas trade openness had a statistically significant positive effect. Given the findings, the study recommends the gradual formalisation of the informal sector and the strengthening and simplifying of the regulatory frameworks by policymakers in this region.

Keywords: Informal Economy, Tax Revenue, Regulatory Efficiency, West Africa.

Introduction

The informal economy which encompasses economic activities that operate outside the formal legal and regulatory frameworks, has been a persistent challenge for many developing countries, particularly in West Africa (Omodero, 2020). Participants in the informal sector not only evade taxation but the sector also contributes to governance and institutional challenges, ultimately impacting tax revenue collection. While the informal economy can provide economic opportunities and flexibility, its large size can hinder the effectiveness of government policies and limit the potential for sustainable economic development. (Akande 2022; Makochehanwa, 2020; Meagher, 2018; Sebele-Mpofu & Msipa, 2020).

In West Africa, the size of the informal economy has been a significant concern, as it is estimated to account for a substantial portion of the region's economic activities (Loayza

et al., 2005). The widespread nature of informality in West Africa raises critical questions about its implications for tax revenue generation. A large informal economy often results in a narrow tax base, placing disproportionate pressure on the formal economy to meet national revenue targets. This, in turn, affects public service delivery, infrastructure development, and economic stability. The sector spans a diverse range of industries, including construction, transportation, healthcare, recreation, animal husbandry, milling, entertainment, cooperative ventures, and urban agriculture, contributing significantly to employment and income generation (World Bank, 2020). Despite its economic significance, the sector operates largely outside government regulation and taxation frameworks, leading to revenue losses for governments and challenges in economic planning. Moreover, the persistence of informality is often linked to regulatory inefficiencies, such as cumbersome business registration processes, high tax burdens, weak enforcement mechanisms, and limited access to financial services, which discourage businesses from formalizing (Schneider & Enste, 2000).

Problem Statement

Managing informal sector taxes and policies is central to the ongoing debate about raising additional revenue for developing countries. Taxation is not only a tool for increasing revenue but also serves as an instrument for wealth redistribution, reducing income inequality, and promoting citizen representation (Meagher, 2018; Rogan, 2019). Over the past few years, governments have grappled with the challenge of establishing governance and administrative models that effectively address the informal sector's complexities (World Bank, 2020).

Government regulatory efficiency plays a crucial role in determining how effectively economic governance addresses citizens' needs. Government regulation could be a double-edged sword in influencing the informal sector. Efficient regulation can significantly influence tax revenue and mediate the relationship between the informal economy and tax revenue (Riski, 2020). However, bureaucratic regulation can also create barriers to formalization and hamper economic growth. Excessive Labour regulations, for instance, may increase labour and production costs, prompting firms to operate informally to avoid these expenses (Schneider & Enste, 2000). Similarly, complex business regulations, compounded by corruption and bureaucratic hurdles in the registration process, create barriers to entry for new firms, leading them to remain informal. Understanding the complexity of the relationship between the informal economy, regulatory efficiency, and tax revenue is crucial for policymakers. Effective regulatory frameworks that incentivize formalization while minimizing compliance costs could enhance tax collection without stifling economic activity.

Previous studies (e.g., Seyto & Hapzi, 2018; Muahamed, 2023; Gbadegesin et al., 2022) have examined the effects of regulatory efficiency on tax revenue. While others such as (Almustapha and Hamza 2017; Dauda 2023; Harjo and Alifone 2023; Grace et al 2019; James et al 2021) have examined the effect of the informal economy on tax revenue. However,

these studies have typically focused on either the effect of the informal economy or regulatory efficiency in isolation. This paper aims to contribute to the existing literature by providing a comprehensive analysis of the joint effect of the size of the informal economy and regulatory efficiency on tax revenue in West African countries, thereby offering valuable insights for policymakers in the region.

Objectives of the Study

1. To examine the individual effect of regulatory efficiency and the size of the informal economy on tax revenue.
2. To examine the joint effect of regulatory efficiency and the size of the informal economy on tax revenue.

Literature Review

Conceptual Framework

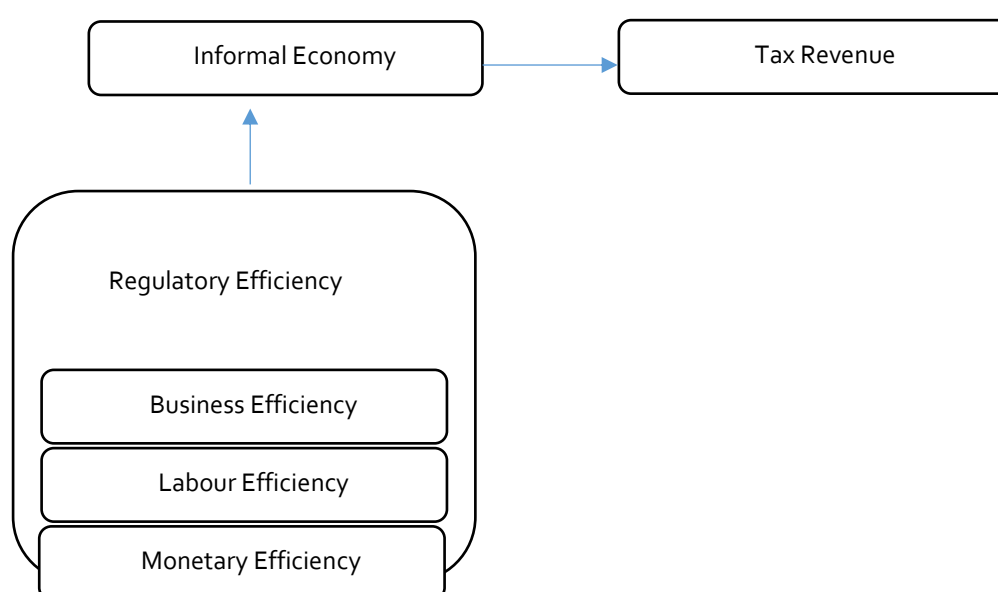


Figure 1: Conceptual Framework of the Relationship Between Informality, Regulatory Efficiency and Tax Revenue

The figure above is a conceptual framework showing the interaction between informality, regulatory efficiency and tax revenue. Tax revenue and informality are the dependent and independent variables while the three regulatory efficiency variables consisting of business efficiency, labour efficiency and monetary efficiency are the moderating variables. It is anticipated that higher levels of informality (such as unreported income and informal

companies) will result in lower tax collections because these activities frequently evade taxation. However, strong business, labour, and monetary regulations may raise tax collection by decreasing informality.

Theoretical Review

There are several theories of taxation in the literature, but this study focuses on four key theories: the benefit theory, the ability-to-pay theory, the socio-political theory, and the Laffer theory. Each of these theories provides a different perspective on how taxes should be structured and justified, particularly in the context of informality, regulatory efficiency, and revenue generation.

The benefit theory argues that individuals and businesses should pay taxes in proportion to the benefits they receive from government services (Wicksell, 1896). In other words, those who benefit more from public services—such as infrastructure, security, and healthcare—should bear a greater share of the tax burden (Akwe, 2015). However, in many West African countries, a significant portion of economic activity occurs within the informal sector, where businesses often operate outside the tax system while still enjoying the benefits of public services. This creates an imbalance, as formal enterprises shoulder the bulk of the tax burden, while informal businesses contribute little to government revenue.

The ability-to-pay theory takes a different approach, emphasizing that taxation should be based on an individual's or business's financial capacity (Kendrick, 1939; Pigou, 1959). This means that those with higher incomes should contribute more, ensuring a fair and progressive tax system. The principle suggests that an effective tax system should be designed so that tax rates increase with income levels, preventing undue burdens on low-income earners and small businesses. In the context of informality, inefficient regulations and excessive tax burdens often push businesses to remain in the shadows rather than formalize and pay their fair share. A well-structured regulatory framework that balances tax obligations with economic realities could encourage voluntary compliance and broaden the tax base.

The socio-political theory highlights the broader role of taxation in society. It asserts that a tax system should not only fund government activities but also address social and economic inequalities (Ogbonna & Appah, 2014). Since society is more than just the sum of its members, taxation should be structured in a way that promotes overall social welfare. In many developing economies, however, ineffective regulation leads to tax evasion and low compliance, making it difficult for governments to generate sufficient revenue for public services. A tax system that is fair, transparent, and well-regulated can build trust between taxpayers and the government, thereby increasing compliance, even among informal businesses.

Lastly, the Laffer theory offers insights into the relationship between tax rates and revenue generation. According to Laffer (1986), both extremely high and extremely low tax rates result in low revenue collection. At a 0% tax rate, there is no revenue, and at a 100% tax rate, individuals and businesses have no incentive to earn income, leading to economic

stagnation. This theory suggests that beyond a certain threshold, raising tax rates further can reduce revenue by discouraging economic activity. In many West African countries, high tax burdens and complex regulations often drive businesses into informality, reducing overall tax compliance. A more efficient regulatory environment—one that ensures reasonable tax rates and simplified compliance processes—could encourage businesses to formalize and contribute to government revenue without stifling economic growth.

Empirical Review

Informality and Tax Revenue

Numerous studies have explored the relationship between the informal economy and tax revenue, with a consensus that informality negatively affects tax collection. Harjo and Alifone (2023) examined the shadow economy in Mojokerto City, Indonesia, and found that the informal sector significantly influences tax revenues. They identified tax allocation, income distribution, and policy stabilization as factors that indirectly affect tax revenue through the shadow economy. Similarly, James et al. (2021) investigated the size of the informal sector in Kenya using an ordinary least squares (OLS) model and concluded that informality negatively impacts tax revenue, despite its positive effect on employment. Likewise, Muchiri (2014) highlighted how the informal sector limits Kenya's tax revenue performance despite multiple tax reforms.

The findings align with those of John (2019), who estimated the underground economy in Ghana using an autoregressive distributed lag model. The study confirmed the existence of a large informal sector, contributing to high levels of tax evasion. Cordelia (2019) also found that both the shadow economy and corruption negatively affect tax revenue performance in Nigeria. A similar pattern was observed in Uganda, where Mawejje and Munyambonera (2016) revealed that the informal economy and the agricultural sector were significant barriers to tax revenue performance. Tedika and Mutascu (2013), using a panel model covering multiple African countries from 1999 to 2007, further confirmed the significant negative impact of the informal economy on tax revenue across the continent.

On the enforcement side, Ajichi et al. (2023) assessed how taxation enforcement could expand Nigeria's revenue base. They examined three informal sector categories: self-employed traders and SMEs, community levies, and income from religious institutions. Their study highlighted the significant impact of the informal economy on tax non-compliance, ultimately leading to revenue losses. However, they also noted that corruption, weak rule of law, and inefficiencies in tax collection make taxation of the informal sector costly and difficult.

Studies have also explored the regulatory challenges of taxing the informal sector and their implications for tax revenue performance. Dauda (2023) examined the revenue implications of taxing the informal sector, revealing that Nigeria's tax system is highly reliant on oil revenue and characterized by unnecessarily complex and inequitable tax laws. The study emphasized that while taxing the informal sector could enhance revenue generation, the

government has not adequately addressed structural issues that keep businesses outside the formal tax net. In a similar vein, Awasthi and Engelschalk (2018) analyzed the relationship between taxation and informality, finding a strong negative correlation between tax revenue collection and the size of the informal economy. They argued that taxation could play a crucial role in incentivizing business formalization if regulatory policies are well-designed.

Regulatory efficiency and Tax revenue

Several studies have examined how tax administration and compliance influence tax revenue with many of the studies supporting that excessive regulation could be counterproductive for compliance and increasing tax revenue. Lawal et al. (2024) investigated the impact of tax compliance on revenue generation in Nigeria, employing an ex-post facto research design. Their findings indicate that while higher tax rates and penalties initially boost tax revenue, excessively high audit penalty rates can discourage compliance, ultimately reducing revenue collection. In contrast, lower audit penalty rates encourage taxpayers to adhere to tax regulations, leading to increased revenue generation. Similarly, Clement and Ayodele (2019) explored the effects of tax audits on compliance and tax remittance in Ekiti State, Nigeria. Their study found that tax audits significantly improve tax compliance, leading to higher revenue collection. However, they highlighted the need for better taxpayer sensitization and the eradication of multiple taxation to further enhance compliance. Likewise, Emmanuel (2018) examined tax administration in Gombe State, revealing inefficiencies in tax collection due to low taxpayer awareness and widespread tax evasion. The study recommended improving tax worker efficiency and automating tax administration systems to enhance revenue generation. John and Olabisi (2012) also analyzed tax administration and revenue generation in Lagos State, concluding that effective tax administration—encompassing clear tax policies and efficient enforcement mechanisms—plays a crucial role in increasing government revenue.

On the role of regulatory quality on tax complexity, Muhammad (2023) explored how government effectiveness moderates the relationship between regulatory quality and tax complexity, employing a moderated regression analysis. The study found that regulatory quality significantly influences tax complexity and that government effectiveness can mitigate these complexities, enhancing fairness and efficiency in tax collection. However, the study was limited to a single-year analysis, constraining the generalizability of its findings.

Similarly, while exploring the determinants of tax revenue, Emilio and Suparna (2023) examined the moderating role of regulatory quality on tax revenue using panel regression analysis. Their findings indicate that regulatory quality positively affects tax revenue, particularly when agricultural activities are considered. However, they noted that when foreign direct investment is moderated by regulatory quality, its effect on tax revenue becomes negative, suggesting potential inefficiencies in tax policy implementation.

Salman et al. (2022) explored the impact of governance institutional indicators—such as political stability, voice and accountability, and the rule of law—on tax revenue performance in West Africa. They found that while regulatory quality, political stability, and voice and accountability had no significant effect on tax revenue, government effectiveness, the rule of law, and control of corruption positively influenced revenue performance. These findings highlight the crucial role of strong institutions in enhancing tax administration and compliance.

Baneng (2021) examined the interrelationship between business freedom and tax revenue performance, employing dynamic panel data analysis. The study found that while tax revenue mobilization is influenced by both conventional and unconventional factors, business freedom negatively impacts tax revenue performance in Africa due to the widespread presence of the informal economy. The study concluded that weak regulatory frameworks make it difficult to effectively tax the informal sector, limiting the benefits of business freedom.

Gaps in Empirical Research

From the reviews in Subsections 2.2.2 and 2.2.3, several studies have been carried out separately on how informality affects tax revenue and the effect of regulations on tax revenue. However, none of them have examined the interconnectedness of these relationships, particularly the role regulation efficiency plays on the effect of the size of the informal economy on tax revenue. The present study examined these effects by exploring 2 aspects of regulation efficiency as measured by the Heritage Foundation – business freedom and labour freedom.

Methods and Data

Theoretical Framework and Model Specification

The model specification on the theoretical background of the foundation of Laffer theory (Laffer, 1986) and the model of Heijman and van Ophem (2005) on tax revenue maximization, a function of tax revenue is specified as follows:

$$T = f(Y) \quad 3.1$$

$$Y = Y_f + Y_{inf} \quad 3.2$$

Where Y is potential income, Y_f is income from the formal sector and Y_{inf} is the income from the informal sector. Given that Y_{inf} is largely hidden the effective tax base income is expressed as:

$$T = Y - Y_{inf} \quad 3.3$$

Where T is tax revenue, Y is potential income, Y_f is registered income, and Y_{if} comprises the non-registered and non-realised income. Non-registered income is a result of the inactive population, while non-realised income is because of the informal or hidden economy. As the tax rate increases, the non-realised and non-registered income increases thereby

reducing the potential tax revenue. Given the above function, the study adapts the Heijman and van Ophem (2005) to specify the model below:

$$TR = \beta_0 + \beta_1 PCG_{it} + \beta_2 IE_{it} + \beta_3 TRO_{it} + \beta_4 ME_{it} + \beta_5 LE_{it} + \beta_6 BE_{it} + \beta_7 INT + \beta_8 FDI_{it} + \beta_9 UMR_{it} + \beta_{10} TRO_{it} + u_{it} \quad 3.4$$

Where IE is informal economy, BE is business efficiency LE is labour efficiency, ME is monetary efficiency, INT is the interaction term which represents each of the regulatory efficiency variables (i.e., ME x IE, LE x IE and BE x IE), TR is tax revenue, PCG is per capita GDP, FDI is foreign direct investment, UMR is unemployment rate, TRO is trade openness *it* represents country and time and *u* is the error term. The parameters ($\beta_0 - \beta_{10}$) represent the coefficients of the variables.

Method of Analysis

The study adopted descriptive and regression analyses. The type of regression carried out is the panel fixed and random effect. To determine the choice between the fixed and random effects, the Hausman test was carried out. Diagnostic tests such as autocorrelation, heteroscedasticity and normality tests were carried out too.

Data Description and Source

The study employed panel secondary data covering the period of 2011 to 2022 for 13 West African Economies which includes Nigeria, the Republic of Congo, Ghana, Cameroon, Cote d'Ivoire, Niger, Burkina Faso, Mali, Senegal, Chad, Togo, Mauritania, and Equatorial Guinea. The countries were selected based on the availability and accessibility of the data. Also, the countries in this subregion have similar large size of informal economies and dwindling revenue generation (OCED, 2021). Table 1 below gives a summary of the data definition and measurements.

Table 1: Variable Description and Source

Variable	Description	Unit of Measurement	Source	Apriori Expectations
Tax Revenue	Compulsory transfer to the government	Percentage of GDP	World Development Indicator (WDI), (2023)	Positive
Labour efficiency	Described as a person's ability to find employment. The labour force score is based on 9 equal weighted sub-factors namely: Minimum wage, Associational right, Paid annual leave, The notice period for redundancy dismissal, Severance pay for redundancy dismissal, Labor productivity, Labour force participation rate, Restrictions on overtime work, and Redundancy dismissal is permitted by law.	A score between 0 to 100 with 100 being an efficient labour market.	Heritage Foundation, (2023)	Positive
Business Freedom	Described as the ability of individuals to create and conduct business without bureaucratic state regulations. Business freedom is based on 4 subfactors.	A score between 0 to 100 with 100 being the freest business environment.	Heritage Foundation, 2023	Positive
Monetary freedom	Associated with a stable currency and market-determined prices that enable people to create long-term credit and amass capital. The score of monetary freedom is based on 2 sub-factors which are the weighted average rate of inflation for the most recent three years and a qualitative judgement about the extent of government manipulation of prices through direct controls or subsidies.	A score between 0 to 100 with 100 being the highest level of monetary freedom	Heritage Foundation, 2023	Positive
Per capita GDP	Described as the sum of gross value added by all resident producers in the economy plus any product taxes (less subsidies) not included in the valuation of output, divided by mid-year population.	US dollars	World Development Indicator, 2023	Positive
Foreign direct investment	Described as a category of cross-border investment in which an investor resident in one economy establishes a lasting interest in and a significant degree of influence over an enterprise resident in another economy.	Percentage of GDP	World Development Indicator, 2023	Positive

Unemployment rate	Described as the number of unemployed persons as a percentage of the labour force, where the latter consists of the unemployed plus those in paid or self-employment.	Percentage of total labour force (addition of employed and unemployed).	World Development Indicator, 2023	Negative
Trade openness	Described as the ratio of exports plus imports over Gross Domestic Product.	Percentage of GDP	World Development Indicator 2023	Positive
Informal economy	Described as those working outside the purview of regulatory authority.	Percentage of GDP	World Bank 2021	Negative

Authors' construct (2025)

Results and Discussion

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
TR	139	11.965	2.92	3.1	23.6
IE	117	39.55	6.217	30	55.9
BE	143	47.469	10.512	24.9	65.4
LE	143	50.365	10.763	29.8	84.4
ME	143	77.199	5.631	61.7	88.3
PCGDP	143	.617	4.061	-12.9	8.5
UMR	143	5.534	5.222	.5	22.6
TRO	143	52.663	24.82	16.5	187.6
FDI	143	2.606	3.846	-11.2	20.6

Explanatory Note: TR=tax revenue, IE=informal economy, BE=business efficiency, LE=labour efficiency, ME=monetary efficiency, PCGDP=per capita GDP, UMR=unemployment rate, TRO=trade openness, FDI=foreign direct investment, OBS=observation.

Source: Authors' Computation, (2025)

Table 2 presents the descriptive statistics which includes the Observation, mean, standard deviation, minimum value and maximum value. From the table, tax revenue (TR) has a mean of 11.97% and a standard deviation of 2.92%, ranging from 3.1% (Equatorial Guinea, 2022) to 23.6% (Republic of Congo, 2022). The informal economy (IE) averages 39.55% with a standard deviation of 6.22%, peaking at 55.9% (Nigeria, 2016) and reaching its lowest at 30% (Cameroon, 2019). Business efficiency (BE) and labour efficiency (LE) have means of 47.47% and 50.37%, respectively, with standard deviations of 10.51% and 10.76%. Monetary efficiency (ME) has the highest mean (77.20%) and the lowest standard deviation (5.63%), with values ranging from 61.7% (Nigeria, 2020) to 88.3% (Niger, 2014). Per capita GDP (PCGDP) fluctuates widely between -12.9% (Republic of Congo, 2016) and 8.5% (Côte d'Ivoire, 2013), with a mean of 0.62%. Unemployment (UMR) varies significantly, averaging 5.53%, with a maximum of 22.6% (Republic of Congo, 2021). Trade openness (TRO) shows the highest variability, with a mean of 52.66% and a peak of 187.6% (Republic of Congo, 2016). Foreign direct investment (FDI) has a mean of 2.61%, spanning from -11.2%

(Mauritania, 2019) to 20.6% (Mauritania, 2012). The standard deviations of all variables indicate that they cluster around their respective means, suggesting a normal distribution suitable for estimation.

Table 3: The Correlation matrix

Variables	(1) TR	(2) IE	(3) BE	(4) LE	(5) ME	(6) PCGDP	(7) UMR	(8) TRO	(9) FDI
(1) TR	1.000								
(2) IE	0.045 (0.633)	1.000							
(3) BE	0.151 (0.077)	-0.097 (0.300)	1.000						
(4) LE	0.026 (0.761)	0.464 (0.000)	0.404 (0.000)	1.000					
(5) ME	0.257 (0.002)	-0.260 (0.005)	-0.193 (0.021)	-0.446 (0.000)	1.000				
(6) PCGDP	0.335 (0.000)	-0.013 (0.887)	0.312 (0.000)	0.257 (0.002)	-0.010 (0.905)	1.000			
(7) UMR	-0.265 (0.002)	0.064 (0.491)	-0.188 (0.024)	-0.262 (0.002)	0.009 (0.918)	-0.367 (0.000)	1.000		
(8) TRO	-0.137 (0.108)	-0.155 (0.096)	-0.259 (0.002)	-0.403 (0.000)	-0.004 (0.962)	-0.297 (0.000)	0.701 (0.000)	1.000	
(9) FDI	0.057 (0.503)	-0.087 (0.353)	-0.144 (0.086)	-0.133 (0.112)	0.129 (0.125)	0.001 (0.993)	0.102 (0.227)	0.349 (0.000)	1.000

Explanatory Note: TR=tax revenue, IE=informal economy, BE=business efficiency, LE=labour efficiency, ME=monetary efficiency, PCGDP=per capita GDP, UMR=unemployment rate, TRO=trade openness, FDI=foreign direct investment. Probability values are reported in parentheses next to the coefficients.

Source: Author's Computation, (2024)

The correlation matrix in Table 3 presents the statistical relationships between each pair of variables, with significance determined at a 5% threshold. The correlation coefficient ranges from -1 to +1, where -1 indicates a perfect negative correlation, 0 signifies no correlation, and +1 represents a perfect positive correlation (Kilishi, 2016). The results reveal varying degrees of association among the variables. Tax revenue (TR) is positively correlated with monetary efficiency (ME) and per capita GDP (PCGDP), negatively correlated with the unemployment rate (UMR), and uncorrelated with the informal economy (IE), labour efficiency (LE), business efficiency (BE), trade openness (TRO), and foreign direct investment (FDI). Similarly, IE is positively correlated with LE, negatively correlated with ME, and uncorrelated with BE, PCGDP, UMR, TRO, FDI, and TR. BE is

positively correlated with LE and PCGDP, negatively correlated with ME, UMR, and TRO, and uncorrelated with FDI, IE, and TR.

Further analysis shows that LE is positively correlated with PCGDP, BE, and IE, negatively correlated with ME, UMR, and TRO, and uncorrelated with FDI and TR. ME is positively correlated with TR, negatively correlated with LE, BE, and IE, and uncorrelated with PCGDP, UMR, TRO, and FDI. PCGDP is positively correlated with LE, BE, and TR, negatively correlated with UMR and TRO, and uncorrelated with FDI, ME, and IE. UMR is positively correlated with TRO, negatively correlated with PCGDP, LE, BE, and TR, and uncorrelated with FDI, ME, and IE. TRO is positively correlated with FDI and UMR, negatively correlated with PCGDP, LE, and BE, and uncorrelated with ME, IE, and TR. Finally, FDI is positively correlated with TRO, uncorrelated with all other variables, and not negatively correlated with any variable. These results highlight the diverse relationships among economic indicators, with some showing strong linkages while others remain independent.

In Table 4, the estimates of tax revenue are reported in four models. The first model examines the impact of the informal economy and regulatory efficiency on tax revenue. The second equation incorporates the interaction of the informal economy and labour efficiency (IExLE). The third equation includes the interaction of the informal economy and business efficiency (IExBE), while the final equation considers the interaction of the informal economy and monetary efficiency (IExME).

The results from the Hausman test indicate that the Fixed Effects (FE) estimation method is preferred over the Random Effects (RE) method in all models except Model 3, where the RE estimator is superior due to a p-value greater than the 0.05 significance threshold. Similarly, the poolability test results show that the FE estimator outperforms the Pooled Ordinary Least Squares (OLS) method in all models except Model 3, where RE is found to be more suitable. Furthermore, the Breusch-Pagan Lagrange Multiplier test confirms that the RE estimation method is superior to the Pooled OLS method across all models. Based on these results, the RE estimation method is the most efficient for Model 3, as it is selected as superior in two out of three tests, while the FE method is deemed the most appropriate for all other models. The study considers variables to have a significant effect if their p-values are 0.05 or lower, in line with the established decision rules.

Table 4: Empirical Estimates of Tax Revenue Equations

Variables	Model 1	Model 2	Model 3	Model 4
IE	-0.329** (-2.59)	-0.292** (-2.14)	-	-0.536* (-3.38)
BE	0.007 (0.29)	0.005 (0.23)	-	0.007 (0.33)
LE	0.042 (1.40)	-	0.045 (1.62)	0.036 (1.18)
ME	0.081** (2.20)	0.083** (2.24)	0.070 (1.95)	
PCGDP	0.024 (0.65)	0.022 (0.58)	0.033 (0.89)	0.021 (0.57)
FDI	0.009 (0.23)	0.009 (0.349)	0.014 (0.36)	0.008 (0.22)
UMR	-0.429* (-3.19)	-0.428* (-3.17)	-0.460* (-5.87)	-0.424* (-3.18)
TRO	0.046* (5.26)	0.046* (5.23)	0.046* (5.19)	0.047* (5.37)
IELE	-	0.0009 (1.29)	-	-
IEBE	-		0.0008 (1.48)	-
IEME	-		-	0.002** (2.55)
Obs.	117	117	117	117
R-squared	0.446	0.445	0.457	0.455
F/Wald chi statistic for R ² and its p-value	65.19 (0.000)	64.32 (0.000)	66.34 (0.000)	65.86 (0.000)
VIF statistic for multicollinearity test	1.88	2.50	1.95	3.20
Wooldridge F statistic for autocorrelation test and its p-value	8.428 (0.000)	8.692 (0.000)	8.608 (0.000)	8.341 (0.000)
Modified Wald χ^2 statistic for heteroscedasticity test and its p-value	1412.13 (0.000)	1291.38 (0.000)	-	967.54 (0.000)
Galvao et al. (2013) χ^2 statistic for normality test and its p-value	2.80 (0.2472)	6.19 (0.0453)	4.33 (0.1147)	2.78 (0.2493)
Variant of Panel OLS Estimation Method	FE	FE	RE	FE

*Explanatory Note: TR=tax revenue, IE=informal economy, BE=business efficiency, LE=labour efficiency, ME=monetary efficiency, PCGDP=per capita GDP, UMR=unemployment rate, TRO=trade openness, FDI=foreign direct investment, IELE=interaction of informal economy with labour efficiency, IEBE=interaction of informal economy with business efficiency, IEME=interaction of informal economy with monetary efficiency. *, ** and *** represent 1%, 5% and 10% significant level respectively. The Hausman (p-value) indicates probability values to select the preferred estimator between the Fixed and*

Random Effect estimators. Poolability (p-value) indicates probability values to select the preferred estimator between pooled OLS regression and Fixed Effect estimator. LM Test (p-value) indicates probability values to select the preferred estimator between pooled OLS regression and Random Effect estimator.

The diagnostic tests are also presented in the lower part of Table 4 indicating that the p-values of the F-statistics are 0.000, confirming the overall statistical significance of the models. However, these models exhibit low explanatory power. The Wooldridge test for autocorrelation shows p-values of 0.0000 for all equations, leading to the rejection of the null hypothesis and confirming the presence of autocorrelation. To address this issue, a robust version of the Fixed Effects (FE) regression model was employed, as it was deemed the most appropriate corrective approach. Similarly, the panel-modified Wald heteroscedasticity test for FE regression reveals p-values of 0.000 for all equations, indicating the presence of heteroscedasticity in the models. Consequently, a robust FE regression was estimated to correct for heteroscedasticity.

The normality test, conducted using the Galvao et al. (2013) approach, indicates that the residuals in the models are not normally distributed, as its chi-square probability value is below the 0.05 significance threshold. Conversely, the null hypothesis of normality is not rejected for the models, implying that their residuals follow a normal distribution. To correct for non-normality in the equations a robust FE regression was applied. Lastly, the Tolerance test for multicollinearity that all explanatory variables have Tolerance values exceeding 0.1, indicating that multicollinearity is not a significant concern in any of the equations.

Moving to the main regression results, the results indicate that the informal economy (IE) has a significant negative effect on tax revenue. The coefficients of IE in Equations 3.2, 3.4, and 3.5 are -0.329, -0.292, and -0.536, respectively, with p-values of 0.011, 0.035, and 0.001. These findings suggest that a one percent increase in the size of the informal economy leads to respective declines of 0.329%, 0.292%, and 0.536% in tax revenue in West Africa. This outcome aligns with the theoretical expectation that an expanding informal economy reduces tax compliance, given that businesses operating informally often evade taxation. These findings are consistent with those of Guillermo and Deyvi (2019), Awasthi and Engelschalk (2018), and Peter (2017).

Business efficiency (BE) does not significantly influence tax revenue, as indicated by its coefficients of 0.007, 0.005, and 0.007 in Equations 3.2, 3.3, and 3.5, respectively, with p-values exceeding the 0.05 significance level. Similarly, labour efficiency (LE) has an insignificant effect, with coefficients of 0.042, 0.045, and 0.036 in Equations 3.2, 3.4, and 3.5, respectively, and p-values of 0.166, 0.105, and 0.242. These findings suggest that variations in business and labour efficiency do not substantially impact tax revenue generation.

Monetary efficiency (ME), on the other hand, exerts a positive and significant effect on tax revenue. In Equations 3.2, 3.3, and 3.4, the coefficients of ME are 0.081, 0.083, and 0.070,

respectively, with p-values of 0.030, 0.027, and 0.051. This implies that a one per cent increase in monetary efficiency results in respective increases of 0.081%, 0.083%, and 0.070% in tax revenue. These results align with prior expectations and are consistent with the findings of Emmanuel (2018) and John & Olabisi (2012). Improved monetary regulation within the informal sector can enhance tax compliance, thereby boosting government revenue.

Per capita Gross Domestic Product (PCGDP) and Foreign Direct Investment (FDI) show no significant effect on tax revenue. The coefficients of PCGDP in all equations are positive but statistically insignificant, with p-values greater than 0.05. Likewise, FDI exhibits positive but insignificant coefficients across all equations, suggesting that changes in per capita income and foreign investments do not directly impact tax revenue in West Africa.

The unemployment rate (UMR) has a significant negative effect on tax revenue, with coefficients of -0.429, -0.428, -0.460, and -0.424 in Equations 3.2 to 3.5, respectively, and p-values all below 0.05. These findings imply that a one per cent increase in the unemployment rate leads to a corresponding decrease in tax revenue. This result supports the theoretical expectation that higher unemployment forces individuals into the informal economy, reducing formal tax contributions. The findings are consistent with Tatariyonto (2014), Muchiri (2014), and John (2019). Moreover, Oduh et al. (2008) argue that increased labour supply in the informal sector indicates a shift of resources away from the formal economy, thereby constraining economic growth and exacerbating unemployment.

Trade openness (TRO) is positively associated with tax revenue. The coefficients of TRO in all equations are 0.046, 0.046, 0.046, and 0.047, respectively, with p-values of 0.000. This suggests that a one per cent increase in trade openness leads to a corresponding increase in tax revenue. These results conform to prior expectations and align with the findings of Mawejje & Munyambona (2016) and Muchiri (2014). However, the informal sector's involvement in international trade could counteract these gains if smuggling and other illicit activities increase, thereby reducing tax collection efficiency.

The results indicate that the interaction between the informal economy and labour efficiency (IELE) has no significant effect on tax revenue. The coefficient of IELE in Equation 3.3 is 0.009, with a p-value of 0.200, which is greater than the 0.05 significance threshold. This suggests that while labour efficiency may enhance productivity, its presence does not alter the impact of informality on tax revenue, implying that informal businesses continue to operate with minimal tax compliance regardless of improvements in labour efficiency.

Similarly, the interaction between the informal economy and business efficiency (IEBE) does not significantly influence tax revenue. The coefficient of IEBE in Equation 3.4 is 0.008, with a p-value of 0.139, indicating a statistically insignificant relationship. This implies that even when business efficiency improves, it does not mitigate the negative effects of informality on tax revenue. Informal businesses likely continue to evade taxes despite enhanced operational efficiency, suggesting that factors beyond business efficiency, such

as regulatory compliance and enforcement mechanisms, play a more crucial role in determining tax revenue outcomes.

Conversely, the interaction between the informal economy and monetary efficiency (IEME) has a significant positive effect on tax revenue. The coefficient of IEME in Equation 3.5 is 0.002, with a p-value of 0.013, which is below the 0.05 significance threshold. This indicates that an increase in monetary efficiency moderates the negative impact of the informal economy on tax revenue, leading to a 0.013% increase in tax revenue. This suggests that effective regulation of financial transactions within the informal sector can encourage tax compliance and formalization of businesses. Strengthening monetary controls, such as improved financial inclusion and digital payment adoption, could facilitate better tax collection from informal enterprises, thereby enhancing overall revenue generation.

Conclusion and Recommendations

Conclusion

This study has established that the size of the informal economy and regulatory efficiency are key determinants of tax revenue generation in West African countries. Empirical findings indicate that compelling the informal sector to register and operate formally can enhance revenue collection through improved regulatory efficiency. Panel regression analysis, employing both Fixed Effects and Random Effects models, was used to estimate the relationships, with the Hausman test guiding model selection. The results suggest that the informal economy indicator showed a negative and significant relationship with tax revenue, reinforcing the idea that informal economic activities undermine tax collection. Meanwhile, monetary efficiency was found to have a positive and statistically significant impact, while business efficiency and labour efficiency were statistically insignificant. Among other control variables, the unemployment rate exhibited a statistically significant negative effect, whereas trade openness had a statistically significant positive effect. Further analysis of moderating effects revealed that regulatory efficiency interacts positively with the informal economy, though not all coefficients were statistically significant. Specifically, the interaction between the informal economy and monetary efficiency was positive and significant, while interactions with labour and business efficiency were positive but not statistically significant. This suggests that while regulatory efficiency can mitigate the negative impact of informality on tax revenue, its effectiveness may vary across different economic dimensions.

Recommendations

Given the findings of the study, the following recommendations are suggested:

- The government in West Africa should implement policies that encourage the gradual formalization of the informal economy. Rather than imposing punitive measures, incentives such as simplified tax structures, access to financial services, and business support programs should be introduced to encourage informal enterprises to transition into the formal sector.

- Strengthening and simplifying regulatory frameworks, particularly in labour and business efficiency, is crucial for enhancing tax compliance.
- Furthermore, targeted employment policies should be developed to reduce the unemployment rate, given its significant negative effect on tax revenue.
- Strategies should focus on job creation, vocational training, and entrepreneurship development to integrate more workers into the formal economy.
- Additionally, trade policies should be designed to enhance openness while ensuring that increased trade benefits domestic revenue generation.
- Monetary and fiscal policies should also be refined to improve financial efficiency, ensuring that monetary efficiency continues to positively impact tax revenue collection.
- Governments should enhance transparency and ease of doing business to encourage investment and increase formal sector participation. Lastly, tax administration should be modernized through digitalization and automation to improve tax collection efficiency and compliance rates.

Limitations of the Study

The study is limited because of inadequate data for most of the West African countries, there is insufficient longitudinal annual time series data for some of the key variables in this study thereby limiting the temporal scope of the study to only the 2011 to 2022 period. Also, the study could benefit from qualitative analysis to give more specific evidence as to the experience of the participants in the informal sector. Future researchers can explore this aforementioned area.

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