Journal of Social Sciences *Vol. V, no. 2 (2022), pp. 72 - 86*
Fascicle *Social Science* *ISSN 2587-3490*
Topic *Sociology* *eISSN 2587-3504*

https://doi.org/10.52326/jss.utm.2022.5(2).06
UDC [339.19:338.22+328.185]:330.56(669)

INTERACTION EFFECT OF INFORMALITY AND CORRUPTION ON INCOME INEQUALITY IN NIGERIA

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Received: 03. 11. 2022
Accepted: 05. 04. 2022

Abstract. Engagement in informal economic activities serves as a survival strategy for underprivileged majority in developing economies with high level of corruption. Consequently, this study examined the main and interaction effects of informality and corruption on income inequality in Nigeria from 1996 to 2020 using autoregressive distributed lag-bound testing technique. The study result showed evidence of long-run relationship among informality, corruption and income inequality. The main effects of informality and corruption on income inequality are negative and statistically significant in both the short and long run. However, corruption reduction in a year was found to reduce income inequality in the subsequent year. Furthermore, the interaction effect of informality and corruption on income inequality was found to be negative and statistically significance in both the short run and the long run. Corruption reduction was found to be a necessary but not sufficient condition for reduction of inequality. Consequently, this study recommended creation of socioeconomic environment conducive for the growth, expansion and eventual formalization of informal businesses. The study also recommended that inequality-reduction be made the end goal of corruption-reduction by ensuring that the proceeds from successful anticorruption campaign are channelled to policies and public projects which redistribute income to the less privileged.

Keywords: *elite capture, income redistribution, shadow economy, underprivileged majority, socioeconomic environment.*

Rezumat. Implicarea în activități economice informale servește drept strategie de supraviețuire pentru majoritatea defavorizate din economiile în curs de dezvoltare cu un nivel ridicat de corupție. În consecință, acest studiu a examinat efectele principale și de interacțiune ale informalității și corupției asupra inegalității veniturilor din Nigeria, din 1996 până în 2020, utilizând tehnica de testare autoregresivă a întârzierilor distribuite. Rezultatul studiului a arătat dovezi ale relației pe termen lung între informalitate, corupție și inegalitatea veniturilor. Principalele efecte ale informalității și corupției asupra inegalității veniturilor sunt negative și semnificative statistic atât pe termen scurt, cât și pe termen lung.

Cu toate acestea, sa constatat că reducerea corupției într-un an reduce inegalitatea veniturilor în anul următor. Mai mult, efectul de interacțiune al informalității și corupției asupra inegalității veniturilor sa dovedit a fi negativ și semnificativ statistic atât pe termen scurt, cât și pe termen lung. S-a constatat că reducerea corupției este o condiție necesară, dar nu suficientă, pentru reducerea inegalității. În consecință, acest studiu a recomandat crearea unui mediu socioeconomic propice creșterii, expansiunii și, eventual, formalizării afacerilor informale. Studiul a recomandat, de asemenea, ca reducerea inegalității să devină obiectivul final al reducerii corupției, asigurându-se că veniturile din campania de succes anticorupție sunt canalizate către politici și proiecte publice care redistribuie veniturile către cei mai puțin privilegiați.

Cuvinte cheie: *captarea elitei, redistribuirea veniturilor, economia subterană, majoritate defavorizată, mediu socioeconomic.*

Introduction

Despite her internal challenges, Nigeria remains Africa's largest economy and one of the rapidly growing economies in the world. However, the proceeds of such growth accrue to a small group of privileged elite at the expense of the underprivileged majority who have to live in extreme poverty. Even though income disparity is a common global challenge, income inequality in Nigeria is at the extreme [1]. According to Forbes' 2016 ranking of World's billionaires the richest Nigerian can earn 8000 times more than the average yearly basic consumption spending of the poorest 10% of Nigerians in on day. Furthermore, the Nigerian legislators with a yearly salary of $189,000 (equivalent to 116 times the country's GDP per capita) are one of the highest paid lawmakers in the world [2]. Besides high cost of governance, elite capture of public policies and resources, regressive taxation and misallocation of public resources are other factors contributing to income inequality in Nigeria [1]. According to [1] the culture of corruption and rent-seeking combined with political elite disconnected from the daily challenges of everyday Nigerian are the root cause of the aforementioned factors contributing to income inequality. This view has been corroborated by several empirical studies which found significant positive effect of corruption on international income inequality [3 - 5]. These studies recognize the adverse effect of corruption on socioeconomic conditions of the underprivileged at the bottom of income distribution. It is therefore no coincidence that severe income inequality is inherent in developing countries with high level of corruption. Engagement in informal economic activities is a common survival strategy for the less privileged majority facing inhumane socioeconomic conditions in developing countries. However, the recent fall in global demand; disruptions in global supply chains and capital flows and travel and lockdown necessitated by the emergence of COVID-19 pandemic have had adverse effect on the livelihood of informal workers in Nigeria [6]. For instance, the 3 month nationwide economic lockdown necessitated by the pandemic was estimated to result in job loss for about 13 million Nigerians, with most job loss occurring in the informal sector [7]. The fact that most informal workers earn daily-survival income shows that income insecurity is inherent in the informal sector. Besides, low income and income insecurity, the informal sector is also bedevilled by other unfavourable socioeconomic conditions such as high cost of living and poor social safety nets resulting from years of systemic corruption and mismanagement [6].

Furthermore, several empirical studies have discovered positive relationship between level of corruption and size of informal sector [8 - 10]. Since developed countries usually

have better corruption indicators than their developing counterpart then level of corruption may explain why developing countries like Nigeria have large informal sector. According to the corruption perception index 2021, developed countries of Western Europe and European Union had the best regional corruption perception index with a regional average score of 66% while developing countries of Sub-Saharan Africa had the worst regional corruption perception index with a regional average of 33% [11]. Hence, it is not surprising that the informal sector provides about 93% of all employment in Nigeria which doubles as the most populated and largest economy in sub-Saharan region and Africa [12].

According to [13], prevalence of bribery and rent seeking behaviour among corrupt politicians, bureaucrats, law enforcement agencies and other regulators is responsible for the positive relationship between corruption and informality. Such distortional behaviour often creates unfavourable socioeconomic conditions which limit the access of the underprivileged majority to formal economic opportunities, thereby forcing them to earn a living via informal economic activities. Furthermore, corrupt government often lack the political will to address informality as doing so may redistribute income away from the privileged minority who controls the socioeconomic and political dimension of the society. Similarly, given loss of confidence in corrupt administration the masses may see any attempt to develop and formalize informal businesses as a threat to a source of their livelihood. Consequently, corrupt government often shy away from addressing informality to appease the less privileged majority who determines the election and re-election of those in government.

The notion that engagement in informal economic activities serve as a survival strategy for the underprivileged majority in developing economies with high level of corruption may fill an important gap in the study of income inequality. As such notion implicitly assumes that access to informal economic opportunities reduce income inequality at higher levels of corruption. However, studies on the interaction effect of informality and corruption on income inequality are relatively scarce [14 - 16]. Besides, none of these studies focused on the interaction effect of informality and corruption on income inequality in Nigeria. Furthermore, there is yet no consensus among scholars on the main effects of corruption and informality on income inequality as mixed effects of both variables on income inequality are recorded in the literature [17 - 20].

Despite having abundance of human and non-human natural resources, Nigeria like other developing countries is bedevilled by corruption; large informal sector and income inequality which prevent the optimization of the developmental benefits of her natural resources. Consequently, this study aims to investigate the interaction and main effects of informality and corruption on income inequality in Nigeria from 1996 to 2020 using the autoregressive distributive lag bounds testing technique. The subsequent sections of this study include literature review; research methods; presentation and discussion of empirical findings; conclusion and policy recommendation.

Literature Review

There are a few distinct but complementary theoretical perspectives to informal economy which explains the link between informal economy, corruption and income inequality. Specifically, the dualist perspectives to informal economy opined that the informal economic activities are small businesses (distinct and unrelated to formal economic activities) which provide safety net and income for the underprivileged majority facing unfavourable socioeconomic conditions such as income inequality and unemployment [21 - 23]. However,

the dualist theoretical perspective only emphasised the reasons why the less privileged majority engage in informal economic activities without laying much emphasis on the root cause of unfavourable socioeconomic conditions which compel the underprivileged majority to resort to informal economic activities for survival.

The legalist theoretical perspective to informal economy corroborated the submissions of the dualist theoretical perspective by concluding that informal economic activities exist due to systemic corruption which enables the privileged minority to influence government decisions making process to their advantage. The inhumane socioeconomic conditions emanating from such state capture by the elite force the underprivileged majority to engage in informal economic activities for survival [24]. This notion is similar to the submission structuralist theoretical perspective which sees informal economic activities as masses-owned small businesses highly exploited by elite-owned large businesses for minimization of labour and other input cost. Each of this theoretical perspective suggested creation of enabling socioeconomic conditions which provides a level playing ground for everyone in the economy [25]. In sum, systemic corruption force the less privileged majority is to operate in the informal economy to minimize the adverse effect of unfavourable socioeconomic conditions (income inequality).

The findings of a study on the impact of the size of informal sector on the relationship between corruption and income inequality in 50 developing countries using quintile regression approach and Kao residual co- integration test revealed that large informal economy mitigate the positive effect of corruption on income inequality. The mediating effect of informality on the positive impact of corruption on income inequality was attributed to the ability of the informal sector in developing countries to increase earnings among the less privileged majority who remained unemployed. Furthermore, the findings from the study revealed that corruption creates asymmetry in distribution of income and that such asymmetry is higher at higher levels of corruption [15].

Investigation of the claim by previous Latin American studies that the trade-off between corruption and inequality in Latin America was due to large informal sector [26 - 28] in 141 developing countries using ordinary least square, instrumental variable, modified limited information maximum likelihood and panel estimation techniques confirms the impact of informal sector on the link between corruption and income inequality. Specifically, the marginal impact of corruption on income inequality was found to be negative at higher levels of informality. Furthermore, the findings from the study confirm mediating effect of informality on the relationship between corruption and income inequality in Latin America [14].

Similarly, [16] investigated whether purported effect of informality on the link between corruption and income inequality is applicable to 19 developing countries in Asia using panel least square and fixed effects models. The result from the study which span from 1995 to 2008 discovered that corruption increase income inequality in developing countries of Asia. Using south Asian dummy to capture predominance of shadow economies in south-eastern Asia, the study discovered that corruption increases inequality in the absence of the shadow economy. However, the relationship between corruption and inequality becomes negative as shadow economies in the South Asian countries become bigger. Furthermore, findings from the study revealed that large shadow economies reduce income inequality even if corruption is rising.

The empirical study of the effect of corruption on income inequality in 48 contiguous states in the United States of America from 1981 to 1987 using the Arrelano-Bover/ Blundell-

Bond system GMM estimation technique revealed a significant positive effect of corruption on income inequality in the United States [3]. This finding was affirmed other studies using different estimation technique and sample [5, 17]. Conversely, [28] found strong evidence that corruption increases income inequality if the level of corruption is above the threshold of corruption otherwise the effect of corruption on income inequality is not detrimental.

However, using dynamic GMM model [18] discovered insignificant effect of corruption on income inequality despite finding a significant positive effect of income inequality on corruption in a panel of 50 countries from 1995 to 2015.

Using fixed effect, random effect and simultaneous generalised method of moments [19] examined the impact of shadow economy on income inequality in 19 Asian countries from 1990 to 2015. The findings from the study revealed that the shadow economy significantly increases the income share held by the less privileged majority at the bottom of income distribution ladder and decreases the income share of the privileged minority at the top of income distribution ladder. Combining the dualist, legalist and voluntarist schools of thought on shadow economy, the study concluded that shadow economy is not always bad especially for the poor. Consequently, policies directed towards contraction of shadow economy should simultaneously provide other solutions to poverty and income inequality. Conversely, [20] discovered a positive long run and short run effect of shadow economy on income inequality in Uganda using autoregressive distributed lag (ARDL) bounds testing approach to co-integration. The findings from the study suggested that large shadow economy worsen income inequality because the less privileged majority who survives in the shadow economy have limited access to livelihood opportunities.

Research Methods

Data Source and Description

This study analysed annual time series data on Nigeria from 1996 to 2020. The study period was determined data availability. Time series study is opted for due to its ability to detect the peculiarities and uniqueness which are usually lost in panel studies. The data analysed were sourced from world governance indicators, [29] and World Income Inequality database. The dependent variable, Income inequality (INE) is proxied by Gini market income which measures inequality in pre-tax and pre-transfer income. The explanatory variable corruption (COR) is proxied by control of corruption which measures the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as capture of the state by elites and private interests. The explanatory variable Informality (INF) proxied by share of informal economy in gross domestic product measures the size of informal economy in a country.

Model Specification

This study is based on the submissions of the dualist theoretical perspective that the underprivileged engage in informal economic activities in order to mitigate the adverse effect of unfavourable socioeconomic conditions such as income inequality; and the believe of the legalist theoretical perspective on informality that inhumane socioeconomic conditions which necessitates engagement in informal economic activities is caused by systemic corruption. Given this theoretical submission the implicit model for the study is specified as:

$$INE = f(COR, INF, INFO * COR) \quad (1)$$

The implicit model in Eq. (1) can be explicitly specified in ARDL form as

$$\Delta INE_t = \beta_0 + \beta_1 \Delta INE_{t-1} + \beta_2 \Delta COR_t + \beta_3 \Delta COR_{t-1} + \beta_4 \Delta COR_{t-2} + \beta_5 \Delta COR_{t-3} + \beta_6 \Delta INF_t + \beta_7 \Delta (INF * COR) + \beta_8 \Delta (INF * COR)_{t-1} + \alpha_1 INE_{t-1} + \alpha_2 COR_{t-1} + \alpha_3 INF_{t-1} + \alpha_4 (INFO * COR)_{t-1} + \mu_t \quad (2)$$

Given the long run model as

$$INE = \alpha_1 COR + \alpha_2 INF + \alpha_3 INF * COR + ECT \quad (3)$$

Superimposing

$$\boldsymbol{\alpha} X_t = \alpha_1 COR + \alpha_2 INF + \alpha_3 INF * COR \quad (4)$$

Then

$$ECT = INE - \boldsymbol{\alpha} X_t \quad (5)$$

And lagged error correction term (ECT) is:

$$ECT_{t-1} = INE_{t-1} - \alpha X_{t-1} \quad (6)$$

Replacing the long-run effects in the ARDL model in equation (2) with the one period lag of error correction term (ECT_{t-1}) and making θ the coefficient of ECT_{t-1} then restricted version of the ARDL model [(error correction model (ECM)] is specified as:

$$\Delta INE_t = \beta_0 + \beta_1 \Delta INE_{t-1} + \beta_2 \Delta COR_t + \beta_3 \Delta COR_{t-1} + \beta_4 \Delta COR_{t-2} + \beta_5 \Delta COR_{t-3} + \beta_6 \Delta INF_t + \beta_7 \Delta (INF * COR) + \beta_8 \Delta (INF * COR)_{t-1} + \boldsymbol{\theta} + \mu_t \quad (7)$$

Where: INE is the income inequality proxied by Gini market income COR is corruption proxied by control of corruption INF is share of informal economy in gross domestic product β_0 is the intercept or constant β_1, β_2, β_3, β_4, and β_5 are short-run coefficients α_1, α_2, α_3, α_4, are long-run coefficients **θ** is the coefficient of the error correction term μ_t is the error term.

A Priori Expectation

Given the theoretical framework, the main effect of corruption control (COR) on income inequality is expected to be negative (coefficient of COR < 0) since decrease in corruption is expected to create socioeconomic conditions which facilitate redistribution of income to those at the bottom of the income distribution pyramid. Similarly, the main effect of informality (INF) on income inequality (INE) is expected to be negative (coefficient of INF < 0) since increase in the share of informal economy in the GDP is expected to redistribute more income to the less privileged majority who earn a living in the informal economy. Furthermore, the interaction effect of informality and corruption control on income inequality is expected to be either negative, positive or zero. (Coefficient of INF*COR < > = 0). Specifically, the effect of informality on income inequality depends on the level of corruption. Higher levels of corruption control (Lower levels of corruption) is expected to create socioeconomic conditions which increase access of the less privileged majority (hitherto earning meagre income in the informal economy) to more lucrative formal economic opportunities thereby reducing informality and income inequality. Conversely, lower levels of corruption control (higher levels of corruption) is expected to create socioeconomic conditions which force more less privileged people (hitherto earning sufficient income in the formal economy) to earn meagre income in the informal economy thereby increasing informality and income inequality. However, informality is expected to have no effect on income inequality at critical level of corruption. The coefficient of the error correction term (θ) is expected to fall between 0 and -1 and statistically significant.

Estimation Technique

This study used autoregressive distributive lag bounds testing (ARDL-Bounds Testing) technique to estimate the link between corruption, informality and income inequality in Nigeria. The ARDL-Bounds testing technique requires series to be integrated either of order

zero [I(0)] or order one [I(1)] such that the variables estimated are a mix of both orders. Consequently, the Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Unit-root test unit root tests were employed to ensure that the study variables meet this requirement. Specifically, the ARDL-bounds testing technique is used to ascertain evidence of long-run effects of corruption and informality on income inequality and co integration amongst variables. Having rejected the null hypothesis of no long-run relationship, the error correction model (ECM) was estimated for the short- run effects of corruption and informality on income inequality and the coefficient of the error correction term (ECT) which measures the speed of adjustment of short-run deviation from long-run equilibrium. Afterwards, post estimation diagnostics was carried out to ensure the reliability of the estimates. The optimal lag for the autoregressive distributive lag model is selected using the Akaike information criterion (AIC). Descriptive analysis was also carried out to analyse the descriptive properties of the study variables. The correlation matrix of the pair wise correlation coefficients of the study variables was used to ensure that none of the explanatory variables are perfectly correlated.

Presentation and Discussion of Empirical Findings

Descriptive Statistics

Table 1 presents the descriptive properties of the variables used in this study. The differences between the median and mean values of each of the variables are negligible. This minimal difference implies the absence of outliers in the series since mean values are more susceptible to outliers than median values. The maximum value of income inequality (INE) shows that income inequality during the study period was below possible average. The maximum value of corruption (COR) shows that Nigeria's performance in corruption control during the study period was far below possible average. The maximum and minimum value of informality (INF) shows that share of informal economy in the GDP during the study period was above possible average. The probability values of the Jarque-Bera statistics fails to reject the null hypothesis of normal distribution at 5% significance level. This implies that the series used in this study are normally distributed. The standard deviation values of the corruption (COR) and income inequality (INE) are below one standard deviation while the standard deviation value of Informality (INF) is slightly above four standard deviations. This implies that income inequality (INE) and corruption (COR) are more concentrated around their mean than informality (INF).

Table 1

Descriptive Statistics

Statistic	INE	COR	INF
Mean	46.19600	-1.148400	59.50920
Median	46.20000	-1.150000	59.49000
Maximum	47.00000	-0.890000	67.65000
Minimum	45.20000	-1.430000	52.08000
Standard Deviation	0.452290	0.117249	5.743543
Possible minimum - Possible minimum	0 – 100	-2.5 – 2.5	0 – 100
Jarque-Bera	0.776084	1.053604	0.466969
Probability	(0.678384)	(0.590490)	(0.791770)

Source: Authors' Computation Using E-view 10 (2022).

Correlation Matrix

Table 2 presents the correlation matrix of the pair wise correlation coefficients of the variables used in the study. The pair-wise correlation coefficients of the explanatory variables show that no pair of explanatory variables is perfectly correlated.

Table 2

Correlation Matrix

	logINE	COR	INF	INFO*COR
logINE	1			
CORR	-0.280258	1		
INF	-0.698837	0.556870	1	
INFO*COR	0.229123	0.713144	-0.181186	1

Source: Authors' computation using E-view 10 (2022).

Unit Root Test

Table 3 presents the results of the Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin unit root tests. The ADF statistics for log of income inequality (logINE), corruption (COR) and informality (INF) exceeds their respective 5% critical values at first difference while the ADF statistics for the interaction of corruption and informality (INF*COR) its 5% critical value at level. This implies that income inequality (INE), corruption (COR) and informality (INF) are integrated of order one I(1) while the interaction of corruption and informality (INF*COR) is integrated of order zero I(0). Conversely, the KPSS statistics for log of income inequality (logINE), corruption (COR) and interaction of corruption and informality (COR*INF) are below their 5% critical value at level while the KPSS statistics for informality (INF) is below 5% critical value at first difference. This implies that income inequality (INE), corruption (COR) and interaction of corruption and informality (INF*COR) are integrated of order zero I(0) while informality (INF) is integrated of order zero I(1). In sum, the results of the unit root tests confirm that the series to be estimated fulfils the stationary requirement of ARDL-bounds testing technique.

Table 3

Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin Unit-root Test

	ADF			**KPSS**		
	H_0: Unit Root			**H_0: Stationarity**		
Variable	I(n)	Statistic	Critical Value 5%	I(n)	Statistic	Critical value 5%
logINE	I(1)	-4.3155	-2.9981	I(0)	0.0716	0.1460
COR	I(1)	-6.2334	-3.0404	I(0)	0.2206	0.4630
INF	I(1)	-7.2307	-2.9919	I(1)	0.0977	0.4630
INF*COR	I(0)	-3.0345	-2.9919	I(0)	0.0901	0.4630

Source: Authors' computation using E-view 10 (2022).

Bounds Test Result

Table 4 presents the result of the bounds test for levels relationship among corruption, informality and income inequality. The absolute values of F-statistics (9.2341) and T-Statistic (5.5660) exceed the upper bound values of 4.35 and 3.78 at 5% significance level respectively. This suggests rejection of the null hypothesis of no levels relationship among corruption, informality and income inequality. Hence there is evidence of long run relationship among the study variables.

Table 4

Bounds test

H_0: No levels Relationship			
F Statistic	9.2341	T Statistic	-5.5660
5% Lower Bound 1(0)	3.23	5% Lower Bound 1(0)	2.86
5% Upper Bound 1(1)	4.35	5% Upper Bound 1(1)	-3.78

Source: Authors' computation using E-view 10 (2022).

Longrun and Shortrun Estimates of the Main and Interaction Effects of Informality and Corruption on Income Inequaity

Table 5 presents long-run estimates of the ARDL model, Error correction Model estimates and analysis of the interaction effect of informality and corruption on income inequality. The p-values of the long-run coefficients of corruption control (0.0010), informality (0.0003) and interaction of informality and corruption control (0.0025) are statistically significant at 1% level. Similarly, the p-values of short-run coefficients of corruption control (0.0000), one period lag of corruption control (0.0354) and interaction of informality and corruption control (0.0000) are statistically significant at 5% level. However, the p-value of two period lag of corruption Δ [COR (-2)]) is not statistically significant at 5% level. The sign of the long-run and short-run coefficients of the explanatory variables reveals that corruption control and informality have negative interaction effect on log of income inequality (logINE) in both the long run and short run. Conversely, the main effect of corruption control (COR) on log of income inequality (INE) in the short run and long run is positive. However, one period lag of corruption control (Δ [COR(-1)]) have negative effect on income inequality (INE).

The long-run coefficient of corruption (0.4148) implies that 1 index increase in control corruption index will yield about 41.48 % increase in income inequality in the long run. Similarly, the short run coefficient of corruption (0.3237) implies that 1 index increase in control of corruption index (reduction in corruption) in the current year will yield about 32.37 % increase in income inequality in the same year. This may also imply that corruption reduction in itself is not a sufficient condition for inequality reduction. The negative effect of corruption on income inequality implied by the findings of this study disagrees with a priori expectation since reduction in systemic corruption is expected to redistribute income to the underprivileged majority. This finding however partially agrees with Messy [28] and disagrees with Dincer and Gunalp [3]; Gupta et al. [17]; Dwiputri et al. [5]. Nevertheless, the coefficient of one period lag of corruption (-0.0164) shows that 1 index increase in corruption control in the current year will yield about 1.64 % reduction in income inequality) in the subsequent year. This implies that the inequality-reduction effect of intensified anticorruption effort in the current year may materialize in the subsequent year.

The long-run coefficient of informality (-0.0099) implies that 1 % increase in informality will yield about 0.99 % decrease in income inequality in the long run. The negative effect of informality on income inequality agrees with a priori expectation since increase in the share of informal economy in the gross domestic product is expected to redistribute income to the underprivileged majority. This finding agrees with with Huynh and Nguyen [19] but disagrees with Esaku [20]. The coefficient of error correction term (ECT(-1)) is negative and between 0 and 1 as expected. The coefficient of error correction term (-0.8040) suggests

a high speed of adjustment of short-run deviation from long-run equilibrium. This shows that about 80.40% of the short run deviation from long-run equilibrium is corrected yearly. This implies that about 1.24 years (0.8040^{-1}) to correct current year deviation from long-run equilibrium. The R square value of 0.8047 implies that the error correction model explains about 80.47% variation in income inequality in Nigeria during the study period. This is corroborated by the highly significant F-statistic which confirms the joint significance of the explanatory variables.

Table 5

ARDL Long-run and ECM Short-run Estimates of the Effects of Corruption and Informality on Income Inequality

Dependent Variable: logINE
Model Selection Criteria: Akaike Information Criteria
Selected Model: ARDL(1, 3, 0, 1)
Case: Unrestricted Constant and No Trend

Long-run Estimates				
Variable	**Coefficient**	**Standard Error**	**T-statistic**	**Probability**
COR	0.4148	0.0982	4.2229	0.0010
INF	0.0099	0.0020	-4.9288	0.0003
INF*COR	-0.0062	0.0017	-3.7372	0.0025
Error Correction Model estimates				
Variable	**Coefficient**	**Standard Error**	**T-statistic**	**Probability**
C	3.5936	0.5331	6.7414	0.0000
Δ[COR]	0.3237	0.0542	5.9689	0.0000
Δ [COR(-1)]	-0.0164	0.0070	-2.3472	0.0354
Δ [COR(-2)]	-0.0112	0.0057	-2.0483	0.0613
Δ[INF * COR]	-0.0055	0.0009	-5.9347	0.0000
ECT(-1)	-0.8040	0.1192	-6.7424	0.0000
R SQUARED	0.8047			
F-Statistic	13.1833			0.0000

Source: Authors' computation using E-view 10 (2022).

Analysis of the Interaction Effect of Informality and Corruption on Income Inequality in Nigeria

Table 6 presents the analysis of the interaction effect of informality and corruption on income inequality. As shown in Table 5 the long-run and short-run interaction effect of informality and corruption on income inequality is negative. The negative sign of the long-run and short-run coefficient of the interaction of informality and corruption (INF*COR) means that informality have negative effect on income inequality at lower levels of of corruption. Specifically, as shown in the interaction analysis in Table 6 informality has negative effect on income inequality at corruption levels below the critical level of corruption (COR = -1.60). This implies that corruption in Nigeria during the study period is slightly below the critical corruption level where the interaction effect of informality and corruption on income inequality becomes zero and changes to positive afterwards. The fact that average corruption

control index and maximum corruption control index in Nigeria are (-1.15) and (-0.89) respectively corroborates the fact that Nigeria's corruption level during the study period is below the critical corruption level (-1.60).

As shown in Table 5 the long-run and short-run interaction effects of informality and corruption on income inequality are -0.0062 and -0.0055 respectively. These coefficients implies that an index decrease in corruption control index will reduce the magnitude of the negative (desirable) effect of informality on income inequality by 0.0062 and 0.0055 in the long-run and short-run respectively. For instance, as shown in Table 6, an index decrease in control of corruption from maximum possible value 2.5 to 1.5 in the long run caused the negative effect (desirable effect) of informality on income inequality to reduce from 0.0254 to 0.0192 (by 0.0062) in the long run. The reduction in the negative (desirable) effect of informality on income inequality continues with decreases in corruption control index (worsening corruption) till corruption control index (corruption) reaches its critical level (-1.60) where informality have no effect on income inequality. This implies that informality is only beneficial to income inequality at corruption level below the critical corruption level.

The long-run interaction effect of informality and corruption becomes positive at corruption levels above the critical corruption level. For instance, as shown in Table 6, a 0.5 index increase in control of corruption from minimum possible control of corruption index of -2.5 to - 2.0 caused the positive effect (undesirable effect) of informality on income inequality to reduce from 0.0056 to 0.0025 (by 0.0031 = half of 0.0062) in the long run. The reduction in the positive (undesirable) effect of informality on income inequality continues with increases in corruption control index (decreasing corruption) till corruption reaches its critical level (-1.60) where informality have no effect on income inequality. This implies that informality is only detrimental to income inequality at corruption level above the critical corruption level.

Table 6

Analysis of the interaction effect of informality and corruption on Income inequality in Nigeria

Level of corruption	Corruption Control Index	$\delta logINE/\delta INF$ **– 0.0099 – 0.0062*COR**	Remarks
Lowest	↓ 2.5	–0.0099 – 0.0062*2.5 = – 0.0254	Negative effect of informality on income inequality.
Below Critical Level	↓ 1.5	–0.0099 – 0.0062*1.5 = – 0.0192	Reduced negative effect of informality on income inequality by by-0.0062
Critical	-1.60	–0.0099 – 0.0062*-1.6 = 0.0000	Informality has no effect on income inequality.
Above Critical Level	↑-2.00	–0.0099 – 0.0062*- 2 = 0.0025	Reduced positive effect of informality on income inequality by-0.0031=half of -0.0062
Highest	↑-2.5	–0.0099 – 0.0062*–2.5 = 0.0056	Positive effect of informality on income inequality.

Source: Authors' computation.

Note: Critical Corruption level in the long-run is the level of corruption which equates the main effect of informality on income inequality in the long run to interaction effect of informality on income inequality in the long run.

4.7 Post Estimation Tests

Table 7 presents the post estimation test which confirms the reliability of the estimates. The probability of the Jarque-Berra statistic suggests that the residuals are normally distributed since the null hypothesis of normality cannot be rejected at 5% level of significance. The probability values of F-statistic associated with serial correlation langrage multiplier test and Breusch-Pagan-Godfrey heteroscedasticity test confirms absence of serial correlation and heteroscedasticity in the model. Similarly, the probability of the F statistic associated with Ramsey regression specification error test fails to reject the null hypothesis of correct specification. This implies that the estimated model is not mis-specified. Figure 1 presents the result of the cumulative sum (CUSUM) test. The result shows that the CUSUM plot falls within the 5% level of significance lines. This suggests that the coefficients of the error correction model are stable and can be used for policy making purposes.

Table 7

Diagnostics tests

Test	Statistic	Probability
Serial Correlation LM Test		
F-Statistic	0.4687	0.7579
B-P-G Heteroscedasticity Test		
F-Statistic	0.5681	0.7863
Normality Test		
Jarque-Bera	1.2228	0.5425
Ramsey RESET Test		
F Statistic	0.0922	0.7665

Source: Authors' computation using E-view 10 (2022).

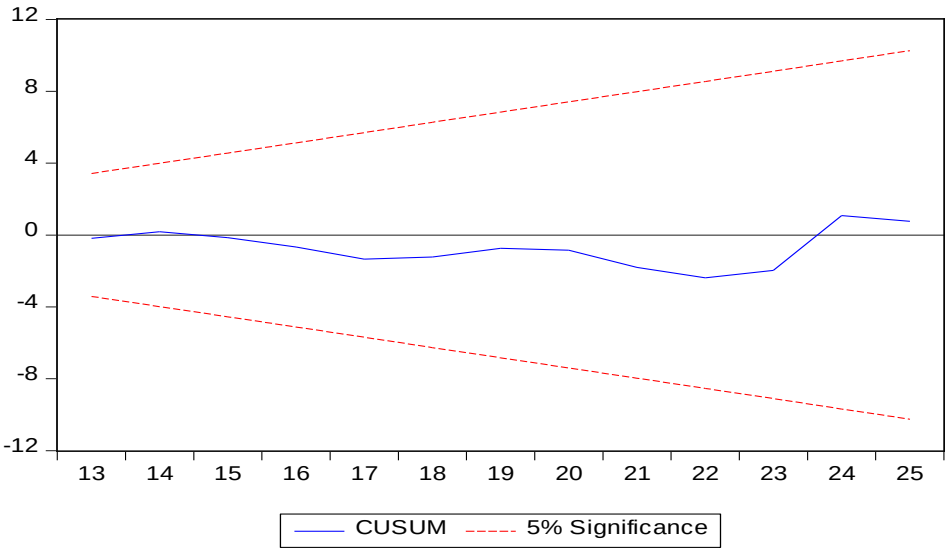

Figure 1. Cumulative Sum Plot.

5. Conclusions and Policy Recommendations

Engagement in informal economic activities serves as a survival strategy for the underprivileged majority in developing economies with high level of corruption. This notion implicitly assumes that increased access to informal economic opportunities reduce the severity of income inequality at higher levels of corruption. Given this implicit assumption, it becomes timely and necessary to investigate the mediating effect of corruption on the relationship between informality and income inequality. Consequently, this study investigated the link among informality, corruption and income inequality to ascertain the main and interaction effect of informality and corruption on income distribution in Nigeria from 1996 to 2020.

The long-run and short-run estimate of the ARDL and ECM Models revealed a positive main effect of corruption control (negative main effect of corruption) on income inequality in Nigeria. This unexpected result may be due to the failure of incorporating income redistribution and welfare improvement as the paramount motive for anticorruption effort. However, the ECM model estimate also showed that the negative effect of anticorruption in the current year will reflect in the subsequent year. Policy makers need to create mechanism which ensures that success in anticorruption war translates to redistribution of income from corrupt elite to the masses at the bottom of the income distribution. Specifically, this may be achieved by ensuring that proceeds from anticorruption campaign are channelled to policies and projects which redistribute income to the less privileged.

The long-run estimate of the ARDL-Model revealed a negative main effect of informality on income inequality. This is expected since the underprivileged majority at the bottom of the income distribution ladder earn a living through informal employment. Hence, policy makers need to provide economic environment conducive for the growth, expansion and eventual formalization of informal businesses. The long-run and short-run estimates of the ARDL and ECM models revealed a negative interaction effect of informality and corruption on income inequality. This is not surprising as lower levels of systemic corruption is expected to create conducive socioeconomic environment which increase access of the less privileged to lucrative formal economic opportunities thereby reducing informality and redistributing income to those at the bottom of the income distribution. Consequently, policy makers need to engage in sincere anticorruption campaign targeted at creating conducive socioeconomic conditions which increase the access of the underprivileged to formal economic opportunities. Incorporating creation of conducive socioeconomic environment into anticorruption policies is necessary for reduction of income inequality since reduction of corruption is only a means to an end and not an end in itself.

Overall, the bounds test result; the statistical significance of long run and short run coefficient of the explanatory variables; F statistics and adjusted R square of the error correction model and the statistical significance of the coefficient of error correction term all showed that informality and corruption are important policy variables policy makers that must be taken seriously for short term and long term reduction of income inequality in Nigeria.

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APPENDIX

Interaction Analysis.

Given the long-run regression equation

$$logINE = 0.4148COR - 0.0099INF - 0.0062INF * COR$$

Then total effect of change in informality (INF) on income inequality (INE) equals the main effect of informality on income inequality plus the interaction effect of informality on income inequality.

$$\delta logINE/_{\delta INF} = -0.0099 - 0.0062COR = 0$$

The critical corruption control index can be obtained from equation x as

$$COR = {}^{-0.0099}/_{0.0062} = -1.60$$

The critical corruption control index (COR = -1.60) represents the corruption control index at which the derivative of income inequality with respect to informality changes from positive to negative or vice versa. Specifically, informality have negative effect on income inequality at corruption control levels above the critical corruption control index (COR = -1.60). Conversely, informality have positive effect on income inequality at corruption control levels below the critical corruption control index (COR = -1.60). Using the highest possible value of control of corruption index (2.5) and the lowest possible control of corruption index (-2.5) as the Corruption Control Index above and below critical control of corruption index respectively.