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Modelling the nexus between income inequality and shadow economy in Nigeria

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ABSTRACT

Purpose — *This paper aims to examine the relationship between the shadow economy and income inequality in Nigeria.*

Method — *The paper employed Autoregressive Distributed Lag (ARDL), Fully Modified Ordinary Least Square (FMOLS), and Granger causality. This methodology is used to avoid endogeneity and heterogeneity in the model. This paper gauged income inequality using two diverse indicators of the Gini coefficient: the Gini index in proportion to household disposable income and the Gini index in proportion to household market income. In accordance with the literature, our empirical analysis draws on data from the Standardized World Income Inequality Database (SWIID), the World Bank, World Development Indicators, and the International Country Risk Guide (ICRG) for Nigeria from 1991 to 2018.*

Result — *The findings of ARDL and FMOLS suggested a positive relationship between income inequality and the shadow economy, based on both measures of income inequality. In the short term, however, the shadow economy and income inequality are negatively correlated. Furthermore, we discovered a one-way causal relationship exists in Nigeria between the shadow economy, household disposable income, institutional democracy, household market income, and corruption control (CCI).*

Recommendation — *Shadow economy has been regarded as an avenue to create job opportunities and raise poverty-income levels. It is critical that, for the shadow economy to reduce income inequality in Nigeria, policymakers should develop much better policies aimed at addressing income inequality.*

Contribution – *In order to understand the relationship between income inequality and shadow economy activities in Nigeria, this study employed three methodologies, namely: Autoregressive Distributed Lags (ARDL), Fully Modified Ordinary Least Squares (FMOLS), and Granger Causality. The result offers reliable recommendations for pro-poor interventions that aim to limit the growth of informality via redistributing incomes.*

Keywords*: shadow economy, income inequality, ARDL, FM-OLS, granger causality, Nigeria*

INTRODUCTION

In the developing world, the informal sector of the economy has been regarded as an avenue to create and expand job opportunities through the production of goods and services (Mugoda et al., 2020). The shadow economy contributed approximately 56.8 percent and 56 percent of Nigeria's and Tanzania's gross domestic product, respectively. Similarly, the sector contributed approximately 62.9 percent of Bolivia's gross domestic product, and approximately 62% of Georgia's and Europe's gross domestic product, respectively (Medina and Schneider, 2019). These statistics demonstrated the importance of the shadow economy to these countries, and also envisioned it as a means to improve the livelihood of certain income brackets (Esaku, 2022). However, the growth of the shadow economy is often described as a limiting agent of economic growth (Esaku, 2021a), exacerbating income inequality (Esaku, 2021b), and encouraging tax evasion (Buehn and Schneider, 2012). In Nigeria, income inequality and extreme poverty have been on the rise for several decades, and has compelled the weakening of domestic growth and persistent poverty (Maku et al., 2021). Surprisingly, this outlook provides a picture of Nigeria's current inequality situation as well as a consideration of whether opportunities for the active population exist solely in the informal or shadow economy. As a result, the present paper scientifically responds to the questions of how the shadow economy tends to affect income inequality in Nigeria.

Numerous empirical literatures have explored the connection between the informal sector and economic progress (Asea, 1996; Baklouti and Boujelbene, 2019; Goel, Saunoris, and Schneider, 2017; Loayza, 1996; Schneider and Enste, 2000; Nguyen and Duong, 2021; Williams, 2006). According to these studies, the nexus remains controversial. In addition, a significant proportion of empirical research has focused on clarifying the importance of the distribution of income in determining the size of the shadow economy through advanced econometric analysis methodologies (Chong and Gradstein, 2007; Dell'Anno, 2016b; Esaku, 2021b). This suggests that income inequality has a positive effect on the shadow economy, as the majority of the academic literature suggests. For instance, Dell'Anno (2016b) argues that greater income disparity results in the expansion of a segment completely reliant on a mechanism by which disparities contribute to economic growth. It also argued that the shadow economy may be one of the primary causes of income inequality (Esaku, 2021b). However, there is a paucity of literature on the relationship between the shadow economy and income inequality in developing economies, and even less on Nigeria. In addition, the majority of earlier research on income inequality focused on its interaction with macroeconomic factors (Bahmani-Oskooee et al., 2008; Kuznets, 1955).

Furthermore, given the growing disparity between the rich and the poor (Ogede, 2020), it is troubling that prior research has underestimated the shadow economy's potential for the generation of jobs for low-skilled and unskilled labours, along with those that are unable to find work in the formal economy. Based on empirical evidence, it is possible to conclude that studies did not leave much room for the shadow economy to act as a bridge between the rich and the poor and to accelerate economic growth in general. As a result, the relationship between the two major determinants appears to be context-dependent and continues to remain ambiguous. To the best of the researcher, a handful of investigations have been made on the connection between income disparity and the shadow economy, or its consequences (Esaku, 2021a).

This study adds to the growing knowledge base in a multitude of ways. First, Medina and Schneider's (2019) data on the shadow economy in 157 countries were utilized. The selection of these data is crucial because they are derived from a multiple indicator-multiple cause (MIMC) approach that models determinant and cause. This strategy is superior to both direct and indirect approaches (Medina and Schneider, 2019). Second, to assess income inequality, two distinct measures were employed to determine whether household market income or household disposable income is more significant. In addition, the paper highlights the impact of shadow economy activities on income inequality, which previous studies have neglected, and compels the need to establish the connection, or interrelation, and the direction of causality between these two variables of interest, all of which have yet to be established in Nigeria.

LITERATURE REVIEW

The relationship between shadow economy or underground economy activities and a variety of factors, such as economic growth, financial sector development, tax rate, institutional quality, democratic accountability, level of development, corrupt practices, etc., has been studied extensively (Berdiev and Saunoris, 2019; Buehn and Schneider, 2012; Choi and Thum, 2005; Dreher, Kotsogiannis, and McCorriston, 2009; Elgin and Erturk, 2016; Esaku, 2021b; Guillermo and Deyvi, 2018; Johnson, Kaufmann, and Zoido-Lobaton, 1998). Dreher, Kotsogiannis, and McCorriston (2009), for instance, argued that institutional quality decreases the size of the shadow economy and corrupt practices, highlighting the importance of institutions in limiting the transmission of informal sector activities. The results of Johnson, Kaufmann, and Zoido-Lobaton (1998) and Buehn and Schneider (2012) indicated that there is a complementary relationship between corruption and shadow economy size. In terms of economic growth, Elgin and Erturk (2016) argued that a large shadow economy correlates with lower growth

rates, while Esaku (2021b) argued there is a negative relationship between the shadow economy and the economy.

The recent empirical literature has extended the focus of discourse on the determinants of the shadow economy by examining the relationship between the shadow economy and income inequality. The discussion has remained unresolved with uncertain outcomes (Bhattacharya 2011; Chong and Gradstein, 2007; Esaku, 2021b; Mishra and Ray, 2010; Huynh and Nguyen, 2020; Pashardes and Polycarpou, 2008; Saha et al., 2021; Wai et al., 2017). Rosser Jr., Marina, and Ahmed (2000) examined the relationship between income inequality and the size of the shadow economy in transition countries and concluded that income inequality is positively correlated with the proportion of output produced in the shadow economy. The findings of the study also demonstrated that any changes in income inequality are followed by changes in the proportion of output produced in the shadow economy, indicating that income inequality may be one of the shadow economy's determinants. Similarly, Chong and Gradstein (2007) analyzed the effect of income inequality on the shadow economy and concluded that there is a positive correlation between income inequality and the size of the shadow economy.

For the panel data set of selected Asian countries spanning from 1990 to 2015, Huynh and Nguyen (2020) argue the relationship between income inequality and the shadow economy is negative compared to previous studies. The authors noted that despite a positive and statistically significant effect of the shadow economy on income inequality and income shares held by the lowest and highest quintiles, the authors noted that it is negative and statistically significant on income shares held by the lowest and highest quintiles, respectively. Wai et al. (2017) assessed whether the size of the shadow economy could increase income inequality through a nonlinear relationship between the shadow economy and income inequality. According to their findings, income inequality and shadow economies are correlated differently in developed and developing countries, with developed countries having an inverted-N relationship whereas developing countries do not. However, in developing countries, income inequality and the shadow economy revealed an inverted-U nexus, which is comparable to the Kuznets hypothesis. In studying Uganda's shadow economy and income inequality, Esaku (2021b) recently suggested there may be a short- and long-run relationship between the shadow economy and income inequality. In addition, the results of the autoregressive distributed lag bound test indicated that all else being equal, income inequality leads to significant increases in Uganda's shadow economy.

As a result, the preceding suggests that income inequality should be investigated further as a potential determinant of the shadow economy in developing countries. It also implies that studies on the impact of the shadow economy on income inequality are still scarce, particularly in Nigeria, with most previous studies focusing on the relationship between the shadow economy, informal sector, or underground economy, and economic growth. As a result, the current study attempts to determine whether there is a significant connection between the shadow economy and income inequality.

METHOD

In accordance with the literature, our empirical analysis draws on data from the Standardized World Income Inequality Database (SWIID), the World Bank, World Development Indicators, and the International Country Risk Guide (ICRG) for Nigeria from 1991 to 2018. Sufficient data on the variables of interest are available, including the Gini index concerning household disposable income, the Gini index about household market income, the size of the shadow economy, the consumer price index, GDP growth, government spending, corruption control, institutionalized democracy, and financial development. Following Solt (2020), both the Gini index in proportion to household disposable income and the Gini index in proportion to household market income was adopted. The two indicators of income inequality were chosen for their robustness. The major explanatory variable size of the shadow economy is estimated using Medina and Schneider's (2019) methodology and data series. Inflation is measured using the consumer price index, as suggested by Siami-Namini and Hudson (2019). Economic growth is proxied by GDP growth and is used to assess Nigeria's level of development. We contend that this is relevant in the provision of public goods and services that have the potential to improve the citizenry's standard of living (Goel and Nelson, 2016). As a result, an increase in economic growth could either increase or decrease income inequality (Fawaz et al., 2014). Government spending has been identified as an important determinant of the shadow economy in the literature. According to these studies, government spending on public goods and services could have a positive effect on the welfare of poor citizens, thereby narrowing the income gap between the rich and the poor (Doumbia and Kinda, 2019; Lustig et al., 2013). As a result, the government expenditure in this study was calculated as a percentage of GDP. Another important control variable is institutionalized democracy, which is proxied by the corruption control index. We contend that institutional quality and/or corruption control are important in shaping the structure of economic activities in the economy, whereas governance is equally important in the efficient

allocation of productive resources and the provision of public goods and services in the country.

However, findings on the impact of financial development on the shadow economy are contradictory. The size of the shadow economy expands to a tipping point during the early stages of financial sector development and then decreases as financial sector development progresses. Furthermore, studies such as Clarke et al. (2006) assert that financial development is appropriate for reducing income inequality. Seven and Coskun (2016) have refuted it. Given the disparities in responses regarding financial development, the gauged financial development with money and quasi money as a share of GDP (m2). Similarly, the Center for Systemic Peace measures democracy using institutionalized democracy. It is critical to state that the inclusion of all control factors is consistent with the existing literature. However, Dell'Anno (2016a) and Esaku (2021b) demonstrated that the shadow economy can affect the size of income inequality and that the two variables can be correlated.

Model specification

We specify a baseline model which addresses the impact of the shadow economy on income inequality in Nigeria. It expresses income inequality as a function of the shadow economy and a set of control variables:

$$GIN_t = z_0 + z_1 SES_t + z_i X_t + \varepsilon_t \quad (1)$$

Where GIN captured income inequality, SES stands for the shadow economy size and X expresses the control variables. The model equation (1) was further re-modified to include the control factors as specified below:

$$GIN_t = z_0 + z_1 SES_t + z_2 GEX_t + z_3 FLA_t + z_4 CCI_t + z_5 IZD_t + z_6 GDP_t + z_7 FIN_t + \varepsilon_t \quad (2)$$

Thus, in the light of the specification in equation (2), the present study follows the ARDL bounds method introduced by Pesaran et al. (2001) for testing the cointegrating relationship between income inequality and the shadow economy, which is considered a more appropriate method to establish the long-run relationship over other traditional cointegration techniques of estimation.

However, this new approach/technique is seen as the best method for investigating time series data either if the sample size is larger or small (Tang, 2010). Furthermore, the use of the ARDL approach has the merit that can adjust for any endogeneity problem among the regressand variables (Wolde-Rufael, 2010). In addition, this method allows scholars to use the correct dynamic framework, such that inferences on long-run estimates are made possible but not in other co-integration approaches (Adegboyega et. al., 2021). And above all, the fact that the approach could be used either if the series are integrated of zero (0) or integrated of order one I(1) and not I(2) (Pesaran and Shin, 1999). Given the advantages stated above, equation (2) is transformed to suit the Pesaran et. al., (1995) ARDL model to determine the short-term and long-term nexus between the shadow economy and income inequality in Nigeria between 1991 and 2018. The model equation (2) transformed to equation (3) as:

$$\Delta \text{GIN\_HDY}_{t-1} = z(\text{GIN\_HDY}_{t-1} - z_0 + z_1\text{SES}_t + z_2\text{GEX}_t + z_3\text{FLA}_t + z_4 CCI_t + z_5\text{IZD}_t + z_6\text{GDP}_t + z_7\text{FIN}_t) + z_8\Delta\text{SES}_t + z_9\Delta\text{GEX}_t + z_{10}\Delta\text{FLA}_t + z_{11}\Delta\text{CCI}_t + z_{12}\Delta\text{IZD}_t + z_{13}\Delta\text{GDP}_t + z_{14}\Delta\text{FIN}_t + \varepsilon_t \quad (3)$$

In a similar instance, to determine if there is any short- and long-run nexus between shadow economy and income inequality (household disposable income) in Nigeria, as stated earlier. The choice of using this to infer good economic policy for both participants and government of the country. Hence, we have the equation below:

$$\Delta \text{GIN\_HMY}_{t-1} = z(\text{GIN\_HDY}_{t-1} - z_0 + z_1\text{SES}_t + z_2\text{GEX}_t + z_3\text{FLA}_t + z_4 CCI_t + z_5\text{IZD}_t + z_6\text{GDP}_t + z_7\text{FIN}_t) + z_8\Delta\text{SES}_t + z_9\Delta\text{GEX}_t + z_{10}\Delta\text{FLA}_t + z_{11}\Delta\text{CCI}_t + z_{12}\Delta\text{IZD}_t + z_{13}\Delta\text{GDP}_t + z_{14}\Delta\text{FIN}_t + \varepsilon_t \quad (4)$$

Where z stands for the error corrector mechanism effect (ECT). The error terms ε_t are independently dispersed across time and units. Hence, for a country-specific analysis, the consistent issues related to data comparability, measurement error, and consistency would not arise given all information (Adegboyega et. al., 2021).

Summarily the current study employed the ARDL and Fully Modified Ordinary Least Square (FMOLS). This is justified by the fact that the methodology provides reliable, non-spurious, accurate, and consistent estimates whenever a greater number of indicators are utilized as opposed to other conventional estimators

(Pesaran, Shin, and Smith, 2001). Furthermore, the methodology can estimate both short- and long-term dynamics, and it is compatible with a mixed order of stationarity, but not I (2) (Shin, Yu, and Greenwood-Nimmo, 2014).

RESULT AND DISCUSSION

Table 1 displays the summary statistics for the sample data used in this study's empirical analysis. Summary statistics and a correlation matrix for the variables used to determine the relationship between the shadow economy and income inequality are shown in Table 1. The average values of the key variables are income inequality (GIN_HDY), 43.125, (GIN_HMY), 45.396, growth (GDP), 3.254, government expenditure (GEX), 93.492, inflation (FLA), 18.984, financial development (FIN), 16.238, control of corruption (CCI), 7.759, institutionalized democracy (IZA), 8.712 and shadow economy (SES), 56.608. Also, based on the output of both skewness and kurtosis, the variables of interest were normally distributed. Table 1's correlation matrix also shows a positive correlation between the variables of interest (GIN_HDY and GIN_HMY) and the size of the shadow economy. This assumes that the shadow economy has a positive impact on these variables. Furthermore, the positive correlation between income inequality and the shadow economy does not imply that the size of the shadow economy will reduce Nigeria's income inequality. Given this, it is critical to determine whether long-term and short-term nexus exist in Nigeria.

Table 1. Summary of statistics and correlation matrix

	GIN_HDY	GIN_HMY	GDP	GEX	FLA	FIN	CCI	IZA	SES
Mean	43.125	45.396	4.369	93.492	18.984	16.238	7.759	8.712	56.608
Median	43.1	45.4	4.823	93.577	12.941	15.439	9.04	9.94	57.7
Maximum	43.7	46.2	15.329	102.99	72.835	25.122	19.42	18.75	64
Minimum	42.2	44.2	-2.035	76.949	5.382	9.063	0.000	0.000	47.6
Std. Dev.	0.416	0.571	3.861	5.909	17.296	4.634	6.167	6.449	4.392
Skewness	-0.638	-0.494	0.408	-0.73	1.964	0.177	-0.07	-0.24	-0.35
Kurtosis	2.67	2.309	3.64	3.831	5.68	1.76	1.706	1.668	2.098
Correlation Matrix									
	GIN_HDY	**GIN_HMY**	**GDP**	**GEX**	**FLA**	**FIN**	**CCI**	**IZA**	**SES**
GIN_HDY	1.000								
GIN_HMY	0.991	1.000							
GDP	-0.053	-0.082	1.000						
GEX	-0.388	-0.3626	-0.187	1.000					
FLA	0.468	0.443	-0.463	-0.001	1.000				
FIN	-0.648	-0.707	0.080	0.209	-0.280	1.000			
CCI	-0.606	-0.625	0.209	0.231	-0.488	0.619	1.000		
IZA	-0.766	-0.773	0.206	0.169	-0.540	0.583	0.868	1.000	
SES	0.733	0.781	-0.209	-0.070	0.534	-0.698	-0.62	-0.723	1.000

Source: authors' compilation (2022)

Aside from the result emanating from the summary of statistics and correlation matrix. Importantly, the stationarity test is also germane, especially for macroeconomic analysis. Hence, two different tests of stationarity were employed for the robustness outcome. Table 2 presents the outcome of Augmented-Dickey–Fuller test (ADF) and Phillip–Perron (PP) tests, with intercept and; trend and intercept. The result from the table confirms that all variables of choice are either stationary in levels or after first differencing, and vary according to the type of stationarity test used, suggesting that they are integrated of order zero, I(0), and/or order one, I(1). The outcome of the unit root test in Table 2 that produced a varying degree of integration i.e I(0) and I(1) provides us with the opportunity of using the ARDL bounds testing approach.

Table 2. Outcome of the unit root test

Variable	Level				First Difference			
	Intercept		Trend and Intercept		Intercept		Trend and Intercept	
	ADF	PP	ADF	PP	ADF	PP	ADF	PP
SES	-1.407	-1.136	-3.211*	-3.243*	-5.961**	-6.801**	5.835**	-6.612**
GIN_HDY	-1.897	-1.599	-1.784	-1.994	-2.767*	-2.767*	-3.029*	-2.971*
GIN_HMY	-2.032	-1.753	-0.342	-2.559	-3.907**	-3.907**	-3.828**	-4.161**
GDP	-2.662*	-2.608	-2.516	-2.451	-4.596**	-7.117**	-5.512**	-7.597**
GEX	-4.035**	-4.635**	-4.290**	-4.290**	-3.800**	-13.25**	-4.239**	-15.18**
CCI	-1.697	-2.178	-3.026*	-3.791**	-3.272*	-9.827**	-3.165*	-9.687**
FIN	-1.021	-1.190	-3.708*	-1.918	-4.396**	-2.901	-4.345**	-2.830*
IZA	-0.684	-2.467	-3.973**	-7.488**	-15.54**	-18.66**	-15.23**	-17.60**
FLA	-1.934	-2.099	-2.578	-2.891*	-5.035**	-5.203**	-4.925**	-5.502**

* and ** represents 5% and 10% respectively

Source: authors' compilation (2022)

Table 3 presents the results of the ARDL Bounds test for cointegration. Table 3 reveals that the calculated F-statistic, where the equation for a measure of income inequality GIN_HDY and GIN_HMY were estimated to be 4.156 and 5.714 respectively, which is higher than the asymptotic critical value bounds given in Pesaran et al. (2001) at both lower bound and upper bound level. Based on the estimated F-statistic results, we reject the null hypothesis of no cointegration and conclude that the variables are cointegrated. After evidence of a long-run cointegrating relationship between income inequalities captured either by using household disposable income (GIN_HDY) or household market income (GIN_HMY) and the shadow economy, we proceeded to estimate the long-run and short-run coefficients for the model by first determining the optimal lag length according to the Alkaike information criterion (AIC). For robustness check, two different methods were used to establish the relationship between

income inequality and the shadow economy, as the outcomes presented in Table 4 reveal the outcome from these methods. Although, the ARDL approach is used to establish the relationship between income inequality and the shadow economy in Nigeria between 1991 and 2018, a fully modified ordinary least square (FMOLS) was used to corroborate the outcome of the ARDL technique. The choice of employing FMOLS is necessitated at addressing the activities of nuisance parameters, the possibility endogeneity plight of regressand variables, good for small sample size analysis and take into account the serial correlation problem (Menegaki, 2019).

From column (1A), based on the ARDL outcome household disposable income (GIN_HDY) was used as a proxy for income inequality the coefficient on shadow economy size (SES) is positive but statistically insignificant. This implies that a large size of the shadow economy has a positive influence on income inequality in the long run and this contravenes the findings conducted by Huynh and Nguyen (2020) but such influence could not reduce the disparity between the poor and rich in Nigeria. However, the insignificance of the shadow economy could be ascribed to various forms of monetary and fiscal policies of the Nigerian government which are hindering individual participation in the informal sector of the economy. Similarly, with major playmakers being unskilled and poor, this may increase the level of disparity between the population (rich and poor). Hence, addressing these factors that lead to the expansion of shadow economy size in the rise of income inequality in the long-run need to be reviewed. The finding from this study contravenes the submission by Esaku (2021b) and Fourie (2018), where they claimed that the shadow economy is a refuge that serves as means of survival for the unemployed population in a country. Furthermore, from column (1A), it is shown that a rise in economic growth (GDP) results in a rise in income inequality, that is an increase in economic growth leads to 0.006 units rise in income inequality and is found to be statistically significant at 5% level. This finding contravened the submission by Esaku (2021b) and Rajaram (2012) that reveals a negative relationship. In addition, coefficient on government expenditure (GEX) shows that a rise in government spending results in a reduction in income inequality. The coefficient on government expenditure shows that an increase in government spending leads to -0.004 units decrease in income inequality and is statistically significant at a 5% level. Also, the coefficient on inflation (FLA) shows that a rise in the consumer price index results in a rise in income inequality (household disposable income). This shows that an increase in the inflation rate results in an increase in income inequality by 0.005 units and is statistically significant at a 5% level. Whereas, the control of corruption (CCI), institutionalized democracy (IZA), and financial development (FIN) were found to be statistically insignificant on income inequality. This corroborates the

finding by Saha et al. (2021). As a robustness check, the outcome of the FMOLS presented in column 1B shows a bit of difference as the control of corruption (CCI) and institutionalized democracy (IZA) were statistically significant at a 5% level as against the ARDL outcomes. However, the coefficient on government expenditure (GEX) for both methods shows that a rise in government spending results in a reduction in income inequality. Given our findings, we can conclude that a rise in the shadow economy size increases income inequality in the long run, but the two methods used were found to be insignificant in Nigeria.

Table 3. Outcomes of the ARDL bound test

ARDL equations summary			**Diagnostic Test**		
Model	**Lag summary**	**F-Stat**	**Normality**	**Heteroscedasticity**	**Correlation (LM)**
GIN_HDY	(1, 0, 0, 0, 0, 1, 1, 0)	4.516	0.604	0.131	0.076
GIN_HMY	(2, 1, 1, 1, 1, 1, 1, 1)	5..571	0.782	0.137	0.043

Critical Values	**Lower Bound I(0)**	**Upper Bound I(1)**
10%	2.03	3.13
5%	2.32	3.5
1%	2.96	4.26

Source: authors' compilation (2022)

Table 4. Outcomes of cointegrating nexus between income inequality and the shadow economy

	Regressor Variable: Income Inequality (GIN_HDY and GIN_HMY)							
	Column (1A)		Column (1B)		Column (2A)		Column (2B)	
Variable	GIN_HDY (ARDL)		GIN_HDY (FMOLS)		GIN_HMY (ARDL)		GIN_HMY (FMOLS)	
	Coef.	**T-stat.**	**Coef.**	**T-stat.**	**Coef.**	**T-stat.**	**Coef.**	**T-stat.**
SES	0.005	1.521	0.024	1.313	0.012	2.191**	0.043	1.851*
GDP	0.006	2.431**	0.003	0.224	0.000	0.021	-0.004	-0.213
FLA	0.005	5.190**	0.004	1.041	0.003	2.081**	0.002	0.502
FIN	0.006	0.909	-0.018	-1.223	-0.007	-1.211	-0.031	-1.623*
GEX	-0.004	-2.508**	-0.026	-3.144**	-0.004	-1.953*	-0.032	-3.060**
IZA	0.002	0.669	-0.061	-3.658**	0.002	0.452	-0.075	-3.571**
CCI	0.003	0.880	0.038	2.391**	0.005	1.372	0.046	2.302**
C	-0.713	-0.385	44.627	32.878**	0.249	0.086	46.716	27.054**
R-Squared	0.994		0.763		0.998		0.798	

* and ** represents 5% and 10% respectively

Source: authors' compilation (2022)

Similarly, column 2A of Table 4 shows the outcome of the ARDL where income inequality is measured by gin household market income (GIN_HMY). The coefficient on shadow economy size (SES) is positive and statistically significant level at 5% level. This means that an increase in shadow economy leads to 0.012

units rise in income inequality. This result validated the research conducted by Esaku (2021b) and Rajaram (2012). This implies that a sizable shadow economy has a positive impact on income inequality (based on household market income) and that this impact may narrow the gap between the rich and the poor in Nigeria over time. The findings of this study back up the findings of Esaku (2021b) and Fourie (2018), who claimed that a country's unemployed population relies on the shadow economy to survive. Furthermore, the government expenditure (GEX) coefficient in column (2A) shows that increasing government spending reduces income inequality. A 10% increase in government spending results in a statistically significant reduction in income inequality of -0.004 units, according to the government spending coefficient. According to the coefficient on inflation (FLA), an increase in the consumer price index (FLA) causes an increase in income inequality (household market income). This demonstrates that a 5% increase in inflation causes a 0.003-unit increase in income inequality, which is statistically significant. Economic growth (GDP), the fight against corruption (CCI), institutionalized democracy (IZA), and financial development, on the other hand, were found to be statistically insignificant (FIN). Looking at column (2B), we can see that the result for GIN HMY was not significantly different from the result in column (2A). Furthermore, the coefficient on government expenditure (GEX) in column (2) for both approaches show that increasing government spending reduces income inequality. The two methods used were found to be statistically significant in Nigeria over the long run, and we can conclude from our findings that increasing the size of the shadow economy increases income inequality.

Considering the research on the short-term relationship between Nigeria's shadow economy and income inequality In Table 5, columns 1 and 2, where GIN HDY and GIN HMY are used as regressors, the coefficients of the shadow economy are positive and statistically significant at the 10% level for the result in Column 1. All else being equal, a sizable shadow economy would increase income inequality in the short run. This indicates a long-term and short-term correlation between income inequality and the shadow economy, an important finding for Nigerian policymakers Furthermore, Columns 1 and 2 of Table 5 show that high levels of corruption statistically significantly increase income inequality, based on the coefficient on the corruption control index, which is statistically significant at the 5% level. These findings are consistent with Esaku (2021b)'s research. Furthermore, it was discovered that the inflation coefficient is positive and statistically influences Nigeria's income inequality at a level of 5% rather than reducing it. As a result, a positive relationship between inflation and income inequality raises serious concerns among policymakers and other economic actors because it threatens to widen the gap between rich and poor

and, more importantly, to make the poor population poorer than the rich. Furthermore, evidence suggests that increasing government spending (GEX) only marginally reduces income inequality, which is consistent with the arguments advanced by Doumbia and Kinda (2019) and Lustig et al. (2013).

Table 5. Outcome of short-run nexus between income inequality and shadow economy in Nigeria

Regressand	Regressor Variable: Income Inequality (GIN_HDY and GIN_HMY)					
	Column 1			Column 2		
	GIN_HDY (ARDL)			GIN_HMY (ARDL)		
	Coefficient	t-statistic	Prob.	Coefficient	t-statistic	Prob.
SES	0.006	1.968*	0.064	0.004	0.607	0.550
GDP	0.003	1.388	0.182	0.005	1.146	0.339
FLA	0.003	4.780**	0.000	0.003	3.213**	0.004
FIN	0.0003	0.088	0.930	-0.007	-1.558	0.136
GEX	-0.005	-3.308**	0.004	-0.002	-0.981	0.339
IZA	-0.001	-0.477	0.638	-0.004	-0.742	0.467
CCI	0.007	2.500**	0.022	0.010	2.104**	0.049
Ecm(-1)	-0.257	-2.433**	0.0	-0.452	-3.106**	0.003

* and ** represents 5% and 10% respectively

Source: authors' compilation (2022)

As shown in Table 5, the coefficient of the error correction term for columns 1 and 2 was negative and statistically significant at the level of 5%. In addition, we demonstrate the short-run relationship of the model, which finds that the short-run change velocities are 0.257 percent and 0.452 percent. Additionally, a relatively short transition time has resulted in relatively little change, and even in cases where there has been disruption, the return to equilibrium has been relatively rapid, with 25.7% and 45.2% happening in the first year. Given our findings, it is imperative that for the shadow economy to have any effect on income inequality in Nigeria, policies maker needs to come up with much better policies that are aimed at addressing income inequality through the activities of the shadow economy, in solving the economic plight affecting the country among which are poverty reduction, high taxes (progressive tax as against regressive tax), and proper control on the use of monetary policies. Residual diagnostics for the ARDL are also performed to ensure the accuracy of these results. According to the results of the Breusch-Godfrey serial correlation LM, Heteroskedasticity, Breusch Pagan-Godfrey, and normality tests, there is no indication of any biases in the empirical estimation (see Table 3).

Table 6. Outcome of the Pairwise Granger Causality test

Null Hypothesis:	Obs	F-Stat	Decision
SES does not Granger Cause GIN_HDY	27	7.870**	One-way Causality
GIN_HDY does not Granger Cause SES		1.337	(SES → GIN_HDY)
IZA does not Granger Cause GIN_HDY	27	2.866	One-way Causality
GIN_HDY does not Granger Cause IZA		17.082**	(GIN_HDY → IZA)
CCI does not Granger Cause GIN_HDY	27	0.110	One-way Causality
GIN_HDY does not Granger Cause CCI		3.725*	(GIN_HDY → CCI)
IZA does not Granger Cause SES	27	2.478	One-way Causality
SES does not Granger Cause IZA		6.284**	(SES → IZA)
GEX does not Granger Cause SES	27	0.367	One-way Causality
SES does not Granger Cause GEX		3.135*	(SES → GEX)
FIN does not Granger Cause SES	27	2.015	One-way Causality
SES does not Granger Cause FIN		5.118**	(SES → FIN)
CCI does not Granger Cause SES	27	4.391**	One-way Causality
SES does not Granger Cause CCI		2.390	(SES → CCI)
FIN does not Granger Cause IZA	27	1.851	One-way Causality
IZA does not Granger Cause FIN		8.392**	(IZA → FIN)
FIN does not Granger Cause FLA	27	0.385	One-way Causality
FLA does not Granger Cause FIN		7.579**	(FLA → FIN)
CCI does not Granger Cause FIN	27	7.666**	One-way Causality
FIN does not Granger Cause CCI		0.237	(FIN → CCI)
IZA does not Granger Cause GIN_HMY	27	4.864**	Two-way Causality
GIN_HMY does not Granger Cause IZA		17.038**	(GIN_HMY ↔ IZA)
GEX does not Granger Cause GIN_HMY	27	0.104	One-way Causality
GIN_HMY does not Granger Cause GEX		2.539*	(GIN_HMY → GEX)
FLA does not Granger Cause GIN_HMY	27	4.964**	One-way Causality
GIN_HMY does not Granger Cause FLA		0.133	(GIN_HMY → FLA)
CCI does not Granger Cause GIN_HMY	27	0.902	One-way Causality
GIN_HMY does not Granger Cause CCI		3.825*	(GIN_HMY → CCI)

** and * stands for 5% and 10%

Source: authors' compilation (2022)

From the correlation matrix in Table 1, there exists a strong positive association between shadow economy size (SES) and the employed measure of income inequality (i.e GIN_HDY and GIN_HMY stand for Household disposable income and Household market income respectively). As noted by Dell'Anno (2016a) and Esaku (2021b) the shadow economy and income inequality are both correlated and intertwined. Consequently, on the above views, the present study tries to establish the direction of causation in the discourse in the Nigerian context. Table 6 presents the outcome of the Pairwise Granger Causality test and shows two-way causality between household money income (GIN_HMY) a measure of income inequality and institutionalized democracy (IZA), suggesting that GIN_HMY ganger caused institutionalized democracy and vice versa and were found to be statistically significant at 5% level. Aside from this relationship, also at a 5% significance level, a one-way relationship exists among the following; shadow economy (SES) and household disposable income (GIN_HDY) indicating

that shadow economy granger caused household disposable income. Also, household disposable income (GIN_HDY) and institutional democracy (IZA), suggest that GIN_HDY ganger caused institutionalized democracy (IZA). Whereas, household disposable income (GIN_HDY), and household market income (GIN_HMY) as a measure of income inequality and control of corruption (CCI) reveal a one-way direction of causality only at a 10% statistically significant level. This suggests that the GIN_HDY ganger caused control of corruption (CCI), as well as the GIN_HMY Granger, caused control of corruption (CCI).

In addition, income inequality captured by household market income (GIN_HMY) exhibits a one-way causal relationship between government expenditure (GEX), control of corruption (CCI), and inflation rate (FLA). This implies that household market income granger caused government expenditure and control of corruption at a 10% significant level whereas household market income granger caused inflation rate at a 5% significant level. In addition, at a 5% significant level one-way causality relationship exists between shadow economy (SES), institutionalized democracy (IZA), financial development (FIN), and control of corruption (CCI). This indicates that the shadow economy granger caused institutionalized democracy. Similarly, the shadow economy granger caused financial development and the shadow economy granger caused control of corruption in Nigeria. On the contrary, a one-way directional relationship exists between the shadow economy and government expenditure (GEX). This indicates that shadow economy granger caused government expenditure only at a 10% significant level. Aside from looking at the direction of causality from the shadow economy, we also considered inflation as one of the determinants of income inequality and found that inflation (FLA) fuel both financial development (FIN) and control of corruption (CCI). This implies that inflation granger caused financial development and also control of corruption in Nigeria and significantly associated at the 5% level. This outcome is of great concern for the policymaker and a strong indication for the government of the country to critically look into its policies in addressing poverty, level of unemployment, and both its fiscal and monetary policies.

CONCLUSION

The present paper investigates the nexus between income inequality and the shadow economy in Nigeria using time series data between1991 and 2018, while data were sourced from various sound avenues. Three methodologies were employed namely autoregressive distributive lag (ARDL), fully modified ordinary least square (FMOLS), and granger causality, to examine the nexus as

well as causal linkages between the income inequality and shadow economy. For the robustness of the study, two measures of income inequality were used as regressors: households' disposable income (GIN_HDY) and households' market income (GIN_HMY). The bounds test results show that the lower and upper bound test statistics at 1%, 5%, and 10%, respectively, are lower than the calculated F-statistics of 4.516 and 5.571 at the 5% significance level, indicating the presence of cointegration among variables in the model. Furthermore, the error correction coefficient term was negative and statistically significant at a 5% level of significance.

In this study, there are missed reactions based on the two regressors employed, from the outcome of the ARDL, although there exists a positive relationship between the two employed measures of income inequality and the shadow economy, the relationship was only statistically significant at 5% level between shadow economy and household market income as against house disposable income in the long run and the outcome from the FMOLS also supported the outcome from the ARDL. However, in the short run there exist a positive relationship between shadow economy and income inequality but the relationship was only statistically significant at a 10% level between shadow economy and household disposable income as against house market income. This implies that the shadow economy enhances the income inequality in Nigeria as against reducing it to close the gap between the rich and the poor in the country. In addition, the coefficient on inflation (FLA) shows that a rise in the consumer price index results in a rise in income inequality (household disposable income). This demonstrates that a 5% statistically significant increase in income inequality occurs when the inflation rate increases by 0.05 units. This, however, is an ominous sign for the well-being of the poor population and will further deprive the poor in a low-income nation like Nigeria. The granger causality outcome shows a one-way relationship among the following; shadow economy (SES) and household disposable income (GIN_HDY) indicating that shadow economy granger caused household disposable income. Also, household disposable income (GIN_HDY) and institutional democracy (IZA), suggest that GIN_HDY ganger caused institutionalized democracy (IZA). Whereas, household disposable income (GIN_HDY), and household market income (GIN_HMY) as a measure of income inequality and control of corruption (CCI) reveal a one-way direction of causality only at a 10% statistically significant level.

Our findings indicate that policymakers should develop better policies to address income inequality through the shadow economy, such as poverty reduction, high taxes (progressive rather than regressive taxes), and proper

control over the use of monetary policies. As part of policies addressing the shadow economy, it is critical to consider how the poor life, as well as eradicating poverty and reducing inequality. Similarly, governments should manage the shadow economy due to its shortcomings. Despite these disadvantages, the shadow economy has advantages such as job creation and raising poverty-level incomes. Because the shadow economy is the poor's primary source of income, policies aimed at reducing it must be implemented alongside measures to eradicate poverty and reduce inequality.

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