Modelling Growth Implication of Corruption and Income Inequality in Nigeria

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Abstract
This study looks at how corruption affected Nigeria's economic development from Q1 of 1996 to Q2 of 2020, controlling for wealth inequality. It expands on the theoretical foundation of the corruption ideas of the "sand in the wheel" and "grease in the wheel." The study used a variety of methods to estimate the growth implication of rising corruption and income inequality in Nigeria using the vector error correction (VECM) framework. Time series analysis indicates that a rise in corruption promote economic growth. Additionally, unidirectional causality was discovered to flow from Corruption Perception to Per Capita Income (PCI) and from Gini Coefficient (GINI) and the income gap in Nigeria has exacerbated corruption according to the impulse response graph. According to the study, corruption is a result of growing wealth inequality in Nigeria, which fuels the threat of corruption. It also supports the grease hypothesis by unintentionally stimulate productivity.

Keywords: Corruption, Income Inequality, Economic Growth, Modeling, Implication

Introduction

The misappropriation of public monies and the imbalance between the rich and the poor have produced a chain that has diminished nation's economic progress. According to Montes and Luna (2021), corruption is a worldwide occurrence that has varied in severity across nations. It is seen as an exceptional crime since it undermines social order by stealing the rights of some people in order to benefit others (Yunan, 2018). Corruption can exist in capitalist, socialist, and feudal societies as well as democratic and autocratic ones (Dike, 2005). Research has shown a connection between thief and growth (Amar & Pratama, 2020 & Islam & McGillivray, 2020). Corruption has many complex origins, and one of the main causes of it in every nation is its political and economic environment (World Bank, 1992). Osoba (1996) presents the following defence of Nigeria: The ability of the authorities to protect everyone's welfare is weakened by anti-social behaviour that grants improper benefits in contravention of the law and moral principles, which also institutionalises corruption. This resulted from post-independence political activity influenced by the decolonization era. He contended that the government's implementation of the "settlement syndrome" institutionalised corruption

There are two schools of thought that have influenced how corruption is conceptualized such as Sand and Grease the wheel hypothesis. According to Méon and Weill (2010), there is a suggestion that in areas where bureaucracies and organizations are ineffective, corruption may serve as a catalyst for development. On the other hand, researchers who put out the "sand in the wheel" idea said that corruption acted as a systemic leak and would hinder economic progress (Leff, 1964; Mauro, 1995; Méndez & Seplveda, 2006; Mo, 2001).

An economy can be described as growing steadily as its output capacity increases over time Jhingan (2007) defined economic growth as the measureable increase outputs. Akpakpan (1987) defined economic growth as the attainment of an annual upsurge in per capita output. It discusses how the nation's real output of goods and services has been rising gradually over time. The aforementioned data makes it abundantly evident that economic growth strongly prioritises the measureable upsurge in productivity.

Nigeria's successive governments have attempted to lower the country's degree of corruption by forming anti-corruption organisations such as; the economic and financial crimes commission (EFCC) and the independent corrupt

practices and other related crimes commission (ICPC). Nigeria's level of corruption in 2021 and 2022 was 24 out of 100, according to Transparency International (TI). TI uses a score to indicate a country's corruption level, with 100 being extremely clean and 0 representing seriously corrupt. Numerous empirical results on the association among rising corruption and productivity in Nigeria have been carried out, with differing degrees of causality. For example, Abiloro et al., 2019; Adinde & Stephannie, 2017; Rabnawaz, 2015 established a negative association among productivity and corruption. In the words of Makar, Ngutsav, and Ayaga (2023), household consumption, foreign direct investment, domestic investment, government spending, and productivity growth are all victims of corruption in Nigeria. Because of this, there is a lack of information in the literature about the role that income inequality plays when examining the impact of corruption on economic growth.

Three point's views that guide our theories are highlighted as we review the literature in the section that follows. These will be followed by sections on model estimates and empirical analysis. Finally, we have our results summarised and interpret the data in accordance with the relevant guidelines. This includes; the effect of corruption on economic growth, effect of inequality on economic growth, effect of corruption on productivity. This research involves three points of view. As the third viewpoint is the subject of this study, it has gotten little to no attention as opposed to the first two, which have attracted greater attention and have been incorporated into relevant theories in both. Several research clarified the debate over corruption and economic growth. Research by Nwankwo (2019) and Rabnawaz (2015) has demonstrated corruption reduce productivity growth in Nigeria. This study may support the sand in the wheel argument by indicating that economic growth is impossible without zero tolerance for corruption. Yusuf (2013) and Omodero and Ogbonnaya (2018) did more research that supported this position and asserted that, the rise in corruption causes reduction in productivity in Nigeria in support of sand in the wheels hypothesis.

Finally,the grease in the wheels theory was promoted by Leff (1964), who established that corruption had a strong positive long- and short-term link with productivity growth. This perspective was reinforced by the unidirectional causal relationship that was put forth by (Obilikwu, 2018; Oke & Sanusi, 2021; Rotimi & Obasaju, 2015) between corruption and economic growth. The study's second perspective, which depicts the linear relationship between productivity growth and wealth disparity, connected to the research of (Nwosa, 2019). The autoregression distributed lag estimation approach (ARDL) was utilized by Nwosa (2019) to demonstrate that economic growth has a marginally favorable effect on income disparity in Nigeria. According to Adinde's and Stephannie (2017) observations, the following factors influence wealth disparity in Nigeria: population growth, education, GDP, and the Corruption Perception Index (CPI). However, Binatli (2012) believes that after taking into account the role that human capital development plays in such a connection, economic growth is a negative driver of income disparity (Binatli, 2012). According to Abiloro et al. (2019), showed that income inequality and corruption reduced productivity growth. In order to better understand how corruption affects economic growth in Nigeria and how wealth inequality mitigates it, this study looked into this topic. VEC, variance decomposition function, impulsive response function as the main departure from the reviewed empirical literature.

Model
Based on a modified version of Binitie and Ugwu, (2022) estimated the association among income inequality, corruption on productivity growth with foreign direct investment acting as a control variable. This study examines how corruption affects economic growth in Nigeria when it is tempered by income disparity. The theoretical clarification of Mauro (1995), Mo (2001), and Leff (1964), which touches on two schools of thought, serves as the foundation for this. The first school of thinking, known as the "grease in the wheels theory," held that corruption significantly contributes to economic growth, whereas the second school of thought, known as Sand in the Wheels Theory. The theory opined that corruption is to blame for the drop in economic growth. Institutional academics seem to be more perplexed by these two opposing perspectives.

We assume that income inequality is one of the primary factors that either initiates or eradicates corruption in all aspects of the Nigerian economy, given the country's high levels of poverty and wealth disparity. So, foreign direct investment acts as a control variable in the model, while income inequality—proxied by the Gini Coefficient—is introduced as a moderating variable. The influence of foreign revenue or business on corruption in Nigeria will be examined in the context of this work through the lens of foreign direct investment. Those who seek to imitate foreign investment or consumption habits are likely to get deeply entangled in corruption, rational thought tells us. The underlying premise of Townsend's (1979) "relative deprivation" hypothesis is a dearth of necessities. This theory is

relevant because it addresses the notion that the underlying reason of corruption in the country is growing income inequality. By using this theory, the true nature of economic growth would be revealed.

Binitie and Ugwu, (2022)'s baseline endogenous growth model has foreign direct investment as a control variable, while corruption index and inequality are independent variables, and the following expression for economic development, which is the dependent variable:

$$PCIt = f(CPI, GINI, FDI) \tag{1}$$

The linear form of the model is expressed as;

$$LOG(PCIt) = \beta_0 + \beta_1 CPI_t + \beta_2 GINI_t + \beta_3 LOG(FDI)_t + U_t \tag{2}$$

Where
PCIt = Per Capita Income at time t
CPIt = Corruption Perception Index at time t
GINIt = Gini-Coefficient at time t
FDIt = Foreign direction investment at time t
β_0 = Constant term
$\beta_1 - \beta_3$ = Parameter estimates of the explanatory variables
Ut = Random disturbance term.
while foreign direct investment will have a positive impact.
$\beta_1, \beta_2 < 0$ while $\beta_3 > 0$
a priori expectations are theoretical statements. It is likely that corruption will have a and income inequality will have a negative effect on productivity growth.

Empirical Analysis

Table 1: Descriptive statistics

	lnPCI	CPI	GINI	lnFDI
Mean	1560.979	21.27577	45.16959	1.501386
Median	1960.000	24.00000	43.97500	1.616648
Maximum	2940.000	28.00000	56.00000	2.931336
Minimum	390.0000	6.900000	35.10000	0.502904
Std. Dev.	850.7891	5.679038	5.450921	0.657396
Skewness	-0.082017	-0.632615	0.438672	0.243613
Kurtosis	1.520261	2.061514	2.319217	1.909932
Jarque-Bera	8.958497	10.02965	4.984173	5.761951
Probability	0.051342	0.066390	0.082737	0.056080
Sum	151415.0	2063.750	4381.450	145.6344
Sum Sq. Dev.	69488844	3096.142	2852.404	41.48831
Observations	97	97	97	97

In Nigeria, the average values of per capita income (PCI), foreign direct investment (GDI), corruption perception index (CPI), Gini coefficient (GINI), and mean value (PCI) are 1.501386, 21.27577, 45.16959, and 1560.979, respectively; the median value is 1960,000. The numbers are, in order, 24.00000, 43.97500, and 1.616648. 2940.000, 28.00000, 56.00000, 2.931336; and 390.0000, 6.900000, 35.10000, and 0.502904, are the maximum and minimum values, respectively. The income inequality and foreign direct investment have positive skewness, as indicated by 0.438672 and 0.243613, whereas per capita income and corruption have long left tails, as indicated by their skewness values of -0.082017 and -0.632615. The corruption perception index and the Gini coefficient are mesokurtic, according to the kurtosis values of 2.061514 and 2.319217, respectively, but the kurtosis values of 1.520261 and 1.909932 show that the series is platykurtic relative to the mean. Finally, the series seems to follow normal distributions since the probability of the Jacque Bera statistics is greater 0.05.

Table 2: Stationarity Test (PP)

Variables	Level		1st Difference		Order
	T-Stat.	5% Critical Value	T-Stat.	5% Critical Value	
CPI	-2.483109	-2.892871	-4.140225	-2.892210	1(1)
FDI	-1.485788	-2.892871	-4.871820	-2.892210	1(1)
GINI	-1.150899	-2.892871	-2.908789	-2.892220	1(1)
PCI	-1.190759	-2.892871	2.992844	-2.892220	1(1)

Source: Authors compilation from Eview-10.05

The data in Philip and Perron's (1988) test show that the results were neither stationary at level zero nor mean reverting. This suggests that the series became stable after first differencing. Box and Jenkins (1987), cited in Hagan and Behr (1987), claim that non-stationary time series data must first undergo differencing in order to become stationary. This assertion became imperative since the stationarity test showed evidence of order one I(1). Hence the need to adopt Johansen (1982) test to decide whether or not there is a long run association among the model.

Table 4: Johansen Cointegration Test

Hypothesized No. of CEO	Trace Stat.	Critical Values	Max-Eigen Stat.	Critical Value
None	50.30819	47.85623	29.43755	27.58414
At most 1	24.87124	29.79717	13.57216	21.13102
At most 2	11.29858	15.49441	7.410175	14.26420
At most 3	3.888822	3.941456	3.888802	3.941416

The data in Philip and Perron's (1988) empirical work show that the results were neither stationary at level zero nor mean reverting. This suggests the series in the model was stationary at order one. Box and Jenkins (1987), cited in Hagan and Behr (1987), claim that non-stationary time series data must first undergo differencing in order to become stationary. The Johansen framework enables the researcher to determine the presence of long run relationship among the variables. The test statistics show the presence of at least one cointegrating relationship among the variable since the t-statistic value is greater than the critical value at 5%.

Table 5: vector error correction mechanism (vecm)

Variables	Coefficient	Standard Error	t-Statistics
Constant	0.025192	0.05534	0.45524
D(PCI(-1))	0.002581	0.00312	0.828301
D(PCI(-2))	-0.026700	0.01325	-2.01509
D(CPI(-1))	0.697231	0.20903	2.33554
D(CPI(-2))	0.042772	0.10964	0.39012
D(GINI(-1))	0.044960	0.14896	0.30183
D(GINI(-2))	-0.042924	0.01476	-3.04607
D(FDI(-1))	0.267007	0.44567	0.59911
D(FDI(-2))	-0.125487	0.44104	-0.28452
ECM (-1)	-0.057400	0.02561	-2.24131
R-squared	0.859176		
Adj. R-squared	0.844087		

The long- and short-term coefficients for the variables from Table 5 that were used in the empirical evaluation how rising corruption and income inequality influence productivity growth. The model of per capita income is first demonstrated to be well-fitted by the R-Square value of 0.859176. The error term externally captures the remaining 16% of the variance in economic development, leaving around 84% of the fluctuations owing to the interaction of the variables in the model, as indicated by the corrected R-Square value of 0.844087. On the other hand, a statistically significant 5% decline in per capita income is brought on by the dependent variable PCI's lagged value (-1).

Consequently, a one percent increase in the prior realisation of the dependent variable. The coefficient of the corruption perception index (CPI) emitted a significant increase on productivity growth in the short-term by 0.697231. all things being equal, productivity growth expands by an increase in the perception of corruption will lead to a 70%. According to one argument, perceptions of corruption are higher in developing countries like Nigeria when there are lower levels of output, investment, unemployment, and per capita income in support of grease-in-wheel hypothesis.

Table 6: Causality Result

Hypothesis:	Obs	F-Statistic	Prob.
cpi does not granger cause pci	95	0.94196	0.3937
pci does not granger cause cpi		6.39186	0.0025
gini does not granger cause pci	95	3.55104	0.0328
pci does not granger cause gini		0.68688	0.5058
fdi does not granger cause pci	95	1.50273	0.2281
pci does not granger cause fdi		1.86616	0.1607
gini does not granger cause cpi	95	1.61303	0.2050
cpi does not granger cause gini		0.24494	0.7833
fdi does not granger cause cpi	95	0.13801	0.8713
cpi does not granger cause fdi		0.64467	0.5272
fdi does not granger cause gini	95	0.15214	0.8591
gini does not granger cause fdi		0.18433	0.8320

Granger causality is not present in the link amongst productivity growth, corruption and inequality, this study is consistent with short-run causation since it contends that significant FDI inflows do not raise Nigeria's per capita income (PCI). Alternatively, one could contend that foreign direct investment (FDI) into Nigeria is not nearly enough. Alternatively, we could argue that Nigeria doesn't receive enough foreign direct investment to increase productivity growth going to industries that increase productivity. Nigeria's economic growth has a significant positive feedback effect, as seen by the long- and short-term PCI responses to a single norm.
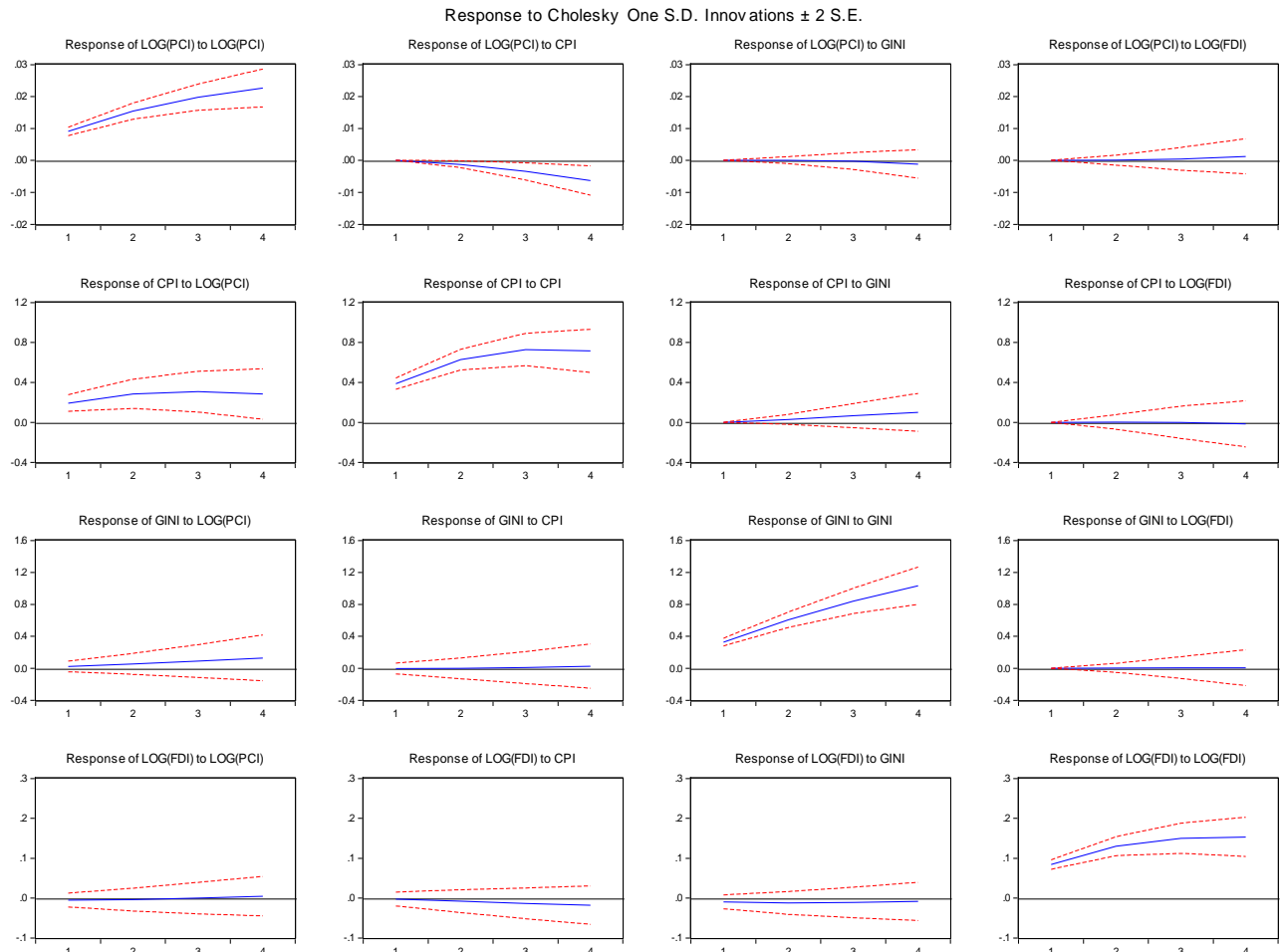
Response to Cholesky One S.D. Innovations ± 2 S.E.

Figure 1: Impulse Response Functions

For both the PCI and the GINI, the short- and long-term responses to the shock and innovation to GINI and PCI, respectively, began in the positive region and stayed there until the following policy regime. In both the short and long terms, the GINI's reaction to shocks on FDI and CPI has stayed constant. However, FDI responded to innovation to CPI and GINI in a negative region that lasted until the next policy regime; FDI also assumed a positive dimension in both periods. FDI also responded to shock on PCI in a stationary state. In contrast, every trust-related measure has shown a positive response to shocks, with the exception of FDI, which was predicated on a stationary disposition, and the influence of invention on productivity growth. It might be inferred that the Nigerian economy can grow more quickly if the money taken from corruption is used for this purpose.

Table 7: Variance Decompositions Functions

Variance Decomposition of LOG(PCI):

Period	S.E.	LOG(PCI)	CPI	GINI	LOG(FDI)
1	0.009062	100.0000	0.000000	0.000000	0.000000
2	0.017929	99.51373	0.483840	0.000968	0.001460
3	0.026914	98.08862	1.872871	0.009052	0.029454
4	0.035781	95.59548	4.157494	0.107918	0.139107

The variance error decomposition test mentioned earlier revealed that PCI contributed 100.0000, 99.51373, 98.08862, and 95.59548 forecast errors on its own, while other variables contributed less than 5%. This suggests that PCI continued to have a significant endogeneity influence on itself from the short to the long term. Economic advancement in Nigeria is likely to have a positive feedback effect when used properly.

Table 8: variance decomposition of CPI:

Period	S.E.	LOG(PCI)	CPI	GINI	LOG(FDI)
1	0.431727	19.89667	80.10333	0.000000	0.000000
2	0.813674	17.87936	81.99551	0.123828	0.001300
3	1.136874	16.43662	83.15938	0.403278	0.000722
4	1.376183	15.46003	83.74108	0.785947	0.012949

The variance error decomposition of the CPI shows that the variable of interest has a significant endogeneity influence on itself from the short run through the long run by emitting prediction error variances of 80.10333, 81.99551, 83.15938, and 83.74108. Over an extended period, PCI has produced predicted error variances on CPI of 19.89667, 17.87936, 16.43662, and 15.4603, among other factors, indicating a weak exogeneity influence on the index. Thus, one of the main causes of corruption in Nigeria is the chase of greater revenue at all levels.

Table 9: variance decomposition of GINI:

Period	S.E.	LOG(PCI)	CPI	GINI	LOG(FDI)
1	0.327494	0.436815	0.006313	99.55687	0.000000
2	0.691631	0.682176	0.001810	99.31210	0.003918
3	1.093154	0.953503	0.005967	99.03474	0.005786
4	1.509575	1.237576	0.034620	98.72338	0.004420

According to the variance decomposition of the GINI index, the variable has a significant endogeneity influence on itself, generating forecast error variances of 15.46003, 99.31210, 99.03474, and 98.72338 across the short and long periods. Other factors had a negligible impact. Therefore, it follows that the persistence of income inequality is one of the primary drivers of corruption in Nigeria.

Table 10: Variance Decomposition of Log (FDI):

Period	S.E.	LOG(PCI)	CPI	GINI	LOG(FDI)
1	0.084726	0.369097	0.104666	1.341075	98.18516
2	0.155751	0.181082	0.282500	1.030106	98.50631
3	0.216819	0.093626	0.526263	0.798681	98.58143
4	0.266292	0.090890	0.812161	0.633991	98.46296

The variance decomposition of FDI ultimately shows that the variable of interest has a significant endogeneity influence on itself in the short run through the long run by emitting 98.18516, 98.58143, and 98.46296 while others contributed less than 2%. As a result, even while foreign direct investment (FDI) contributed to Nigeria's economic expansion, corruption rates also increased.

Table 11: Diagnostic Checking

Lag	LRE* stat	Df	Prob.	Rao F-stat	df	Prob.
1	14.63305	16	0.5517	0.91559	(16, 235.9)	0.5520
2	7.939229	16	0.9507	0.48983	(16, 235.9)	0.9507
3	7.500433	16	0.9624	0.462369	(16, 235.9)	0.9624

The post estimation test's primary objective is to confirm that the OLS assumptions are being met.
The test statistic shows that the variables were well behaved and the estimated model does not violate any assumption of the classical least square. The test statistic indicates that in the serial correlation LM test, the probability values of 0.5520, 0.9507, and 0.9624 were greater than the 5% significant level. Consequently, the residual of the model's series shows no signs of serial correlation.

Discussion:
Thus, the primary means by which corruption can boost output is by reinvesting funds that were obtained through the same system. Second, the fact that corruption increases per capita income suggests that most people view corruption as a normal part of life. This explains why those with a history of corruption are revered and adored in Nigeria. The findings of this investigation corroborate the assertions made by Onakoye and Folorunsho (2015) that corruption has a favourable impact on economic growth. This, however, runs counter to the negative causality presented by researchers like as Rotimi and Obasanju (2019), Adinde (2017), Nwankwo (2019), Abiloro, Olawole, and Adeniran (2019), and others. The coefficient of the second-year emitted a negative sign on productivity growth. As a result, a growth in income inequality will, under all circumstances, result in a temporary 4% decrease in per capita income. Conventional wisdom holds that growing inequality reduces investment, savings, aggregate demand, and per capita income. Finally, even if FDI has an unpredictable short-term influence on economic growth, data collected from the test statistics shows that the impacts are not.

The Granger causality shows the presence of a one way causality. This suggests that corruption in Nigeria is caused by economic prosperity. Even though this illustrates inverted causation, it nonetheless paints a clear picture of the current state of affairs in Nigeria, where the need to raise income at all costs serves as the catalyst for theft and the continuation of criminal activity. Short-run causality is in conflict with long-run causality. One possible explanation for such an abnormality is the entrenched corruption. There is a Granger causation connecting the Gini coefficient to per capita income over the long run (PCI). Because a higher proportion of the population lives in poverty, aggregate demand is

Conclusion
The study came to the conclusion after carefully going through various estimations.
i. The corruption perception index (CPI) and per capita income have a one-way Granger causal relationship with a tone of -6.37186.
ii. There is a one-way Granger causality at tone 3.55104 that connects inequality to per capita income.
iii. According to the impulse response function, corruption perception has a significant exogeneity effect on itself over the long term.
iv. While the shock to economic development resulting from foreign direct investment is in the negative zone, the shock originating from one standard deviation of corruption has stayed in the positive regime.
v. For these reasons, we contend that the widening wealth disparity, which has slowed Nigeria's economic progress during the research period, is to blame for the rise in corruption. This explanation is given regardless of the rise in foreign direct investment into the nation. Thus, it is imperative to heed the ensuing advice.
vi. The Federal Government of Nigeria must intensify its efforts to combat corruption to facilitate the nation's growth and development.
vii. Foreign direct investment should be directed towards projects with the potential to bolster Nigeria's economy, aligning with the overarching objective of all investments.
viii. Efforts should be made to stimulate implementation of price regulation and elevating the minimum wage emerge as effective strategies to mitigate wealth disparity. Therefore, addressing corruption, strategic

investment, and socioeconomic policies aimed at reducing wealth disparity are vital steps towards fostering Nigeria's economic advancement.

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