

Trade Openness, Institutional Quality, and Income Inequality in Developing Countries; Evidence from Nigeria

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Abstract

Purpose

As African economies integrate through the African Continental Free Trade Area, it matters whether trade openness narrows or widens income gaps. Pooled African evidence is inconclusive on the sign of the effect and the role of institutions. This study asks whether institutional quality and the political regime condition the effect of trade openness on income inequality in Nigeria, Africa's largest, oil-dependent economy.

Design/methodology/approach

Using data for 1990–2023 from UNU-WIDER, Freedom House, and the World Development Indicators, we estimate four nested autoregressive distributed lag (ARDL) error-correction models. These add a trade-institution interaction, a 1999 level shift and regime-specific slopes for trade openness and institutional quality. A Chow test identifies 1999, the return to civilian rule, as the only significant structural break.

Findings:

Models that ignore the break do not yield a valid error-correction mechanism. The full break model does, with about 75% of disequilibrium corrected within a year. Before 1999, higher trade openness is associated with higher inequality; after the transition, the net effect is slightly negative. Institutional quality shows a similar reversal, and it Granger-causes inequality. Agricultural value added and urban population growth reduce inequality, while inflation raises it slightly.

Conclusion

African studies rely on pooled panels and treat institutions as constant-slope covariates. The results suggest that gains from trade integration depend on the governance regime, and that accountable institutions are a precondition for inclusive trade.

1. Introduction

Income inequality is among Africa's most persistent development problems. Sub-Saharan Africa (SSA) is the second most unequal region in the world, with an average Gini coefficient of about 0.43 (Abdalla et al., 2026), and growth has translated only weakly into shared prosperity (Byaro et al., 2024; Kassouri et al., 2025). Reducing inequality is Sustainable Development Goal (SDG) 10, and strong institutions are SDG 16. As African economies integrate further, notably through the African Continental Free Trade Area (AfCFTA), a central policy question is whether openness narrows or widens the income gap, and under which institutional conditions.

Recent evidence from Africa points in three directions. Some studies find that openness raises inequality: Xu et al. (2021) for 38 SSA countries, Gonesse et al. (2022) for 16 Southern African Development Community (SADC) economies, and Byaro et al. (2024) for 66 low-income countries. Ouedraogo et al. (2025), using 39 SSA countries over 2002–2022, find the opposite, with stronger effects in the most unequal countries. A third group finds conditional effects: openness offsets the inequality-widening effect of infrastructure (Abdalla et al., 2026) and complements institutions in promoting inclusive growth (Agyei and Idan, 2022). The sign of the pooled estimate therefore changes with sample, period and estimator, and what the effect of trade depends on remains unsettled.

Institutions are the condition most often invoked, but the African evidence on them is inconsistent. Governance mitigates inequality in Nunoo et al. (2024) and Kassouri et al. (2025) and amplifies the gains from trade in Ouedraogo et al. (2025). Yet Xu et al. (2021), Gonesse et al. (2022) and Acheampong et al. (2023) find that institutional or democratic indicators raise inequality, and Kunawotor et al. (2020) find no effect of aggregate institutions but significant effects of corruption control and rule of law. The sign seems to depend on which institutions are measured and on the political regime in which they operate, a proposition that pooled cross-country designs are poorly placed to test.

Nigeria is a theoretically informative case, for four reasons. First, it is a hard test of the factor-endowment logic. Stolper-Samuelson predicts that opening to trade raises returns to the abundant factor, labour, and so lowers inequality in developing countries (Stolper and Samuelson, 1941). Nigeria is labour-abundant, but its exports are dominated by oil (Afreximbank, 2020), a capital-intensive sector in which the gains from trade take the form of rents whose distribution depends on institutions, not factor prices. Mehidi and Oukaci (2025), whose oil-rich sample includes Nigeria, find that oil rents lower inequality only above an institutional-quality threshold. Nigeria is also comparatively closed: its trade-to-GDP ratio averaged about 29% over 1990–2023 (Section 5), less than half the 68–69% averages in recent SSA panels (Abdalla et al., 2026; Abdi et al., 2024; Ouedraogo et al., 2025). Second, it offers institutional variation within one country that pooled panels cannot exploit: trade was liberalised in the mid-1980s under military rule, and the 1999 return to civilian government changed the environment in which trade policy is made and its proceeds distributed. Kassouri et al. (2025) show that growth-inequality patterns differ sharply across African countries, with Nigeria one of nine showing an inverted U. Third, Nigeria's inequality profile is puzzling. Its mean Gini over 2005–2023 is the seventh lowest among 44 SSA countries (Abdalla et al., 2026), yet 63% of the population is multidimensionally poor (NBS, 2022) and wealth is concentrated at the top (Oxfam International, 2017), so the conditions under which trade helps or hurts must be established country by country. Fourth, as Africa's largest economy, Nigeria is central to AfCFTA implementation.

Nigeria-specific work has begun to address part of this. Ogede et al. (2022) find that openness reduces inequality in the short run (1981–2019). Onatunji and Akinlo (2026) find that openness raises inequality while governance lowers it (1996–2022). Olanrewaju and Akintayo (2026) use a Fourier

ARDL to study institutions and inequality in Nigeria and South Africa, and Ike et al. (2026) find regime-dependent trade effects on Nigeria's ecological footprint. These studies treat governance as a direct determinant, or trade as one covariate among several. None, to our knowledge, tests whether the distributional effect of trade in Nigeria is conditioned by the political-institutional regime or changed when the regime changed.

The literature therefore leaves four gaps. (1) Pooled African estimates disagree in sign, and country-level evidence for Nigeria is thin or uses other outcomes. (2) Institutions enter as direct determinants, aggregate mediators or constant-slope interactions, although effects differ by institutional dimension (Kunawotor et al., 2020). (3) Regime change is not modelled. (4) Short- and long-run effects are rarely separated, and openness effects change sign across horizons (Gonese et al., 2022; Ogede et al., 2022).

This study addresses these gaps and makes three contributions. First, it tests, in a single-country time-series framework, whether institutional quality conditions the effect of trade openness on income inequality, where pooled work treats institutions as one channel among several (Ouedraogo et al., 2025). Second, it allows the level of inequality and the slopes of the trade and institutional effects to shift at the 1999 democratic transition, identified by structural-break tests, to ask whether the same trade exposure produces different distributional outcomes under military and democratic rule. Third, it uses an ARDL bounds and error-correction framework to separate short- and long-run effects and to estimate adjustment speed. The research questions are: (RQ1) What are the short- and long-run effects of trade openness on income inequality in Nigeria? (RQ2) Does institutional quality condition that effect? (RQ3) Did the relationship change after 1999? Section 2 reviews the literature, Section 3 sets out the theoretical framework, Section 4 the methodology, and Section 5 the results, discussion and conclusion.

2. Literature Review

2.1 Theoretical anchors

The Stolper-Samuelson theorem predicts that, in a labour-abundant developing country, opening to trade raises the real wage of unskilled labour and lowers inequality (Stolper and Samuelson, 1941). The evidence does not follow this prediction: Meschi and Vivarelli (2009) find that trade worsens inequality in developing countries, and Goh and Law (2019) find the same in a 65-economy panel, with institutional quality exerting a corrective influence. Institutional political economy explains why. Institutions are the humanly devised constraints on political and economic interaction (North, 1990). Where they constrain rent-seeking, the gains from trade are more likely to be shared; where they are extractive, the gains accrue to a narrow elite (Acemoglu and Robinson, 2012). Nam et al. (2024) and Lin and Fu (2016) find that institutional quality moderates the trade-inequality link, and Ouedraogo et al. (2025) apply the same logic to SSA. For a resource exporter such as Nigeria the implication is sharper: if trade is dominated by a rent-generating sector, its distributional effect should depend on the political-institutional regime that governs rent capture, as Mehidi and Oukaci (2025) show for oil rents.

2.2 Trade openness and inequality in Africa

Pooled African estimates largely, but not uniformly, indicate inequality-increasing effects. Xu et al. (2021), using system GMM for 38 SSA countries (2000–2015), find that openness raises inequality, which they attribute to raw-material exports and import dependence. Gonese et al. (2022) find a positive long-run but insignificant short-run effect in 16 SADC countries, with openness reducing inequality only where growth, human capital and financial development are high. Byaro et al. (2024) find positive effects across almost all quantiles in 66 low-income countries, and Sattar and Khan (2021) find the same for 45 lower- and middle-income economies while also finding that inequality reduces openness. Ouedraogo et al. (2025) reverse this: for 39 SSA countries (2002–2022), openness reduces inequality, particularly through exports and in the most unequal countries, operating through institutional quality, human capital and income. Differences in period, coverage and the treatment of institutions (a control in Xu et al., a mediator in Ouedraogo et al.) are plausible sources of the conflict, but the papers do not resolve it, and Ouedraogo et al. leave non-linearity to future work.

Conditional findings point the same way. Abdalla et al. (2026) find that openness and urban growth offset the inequality-widening effect of infrastructure across 44 SSA countries. Kassouri et al. (2025) find that growth-inequality patterns differ by country. Abdi et al. (2024) find that openness lowers FDI inflows in 24 African economies and call for country-specific analysis. Němečková and Hayat (2022) add reverse causality: liberalisation improves institutional quality in 34 African countries, but unevenly by component.

2.3 Institutions and inequality in Africa

African studies that treat institutions as moderators or channels mostly find a mitigating role. Corruption control and government effectiveness offset the inequality-enhancing effect of human capital (Nunoo et al., 2024); government stability and bureaucratic quality strengthen the equalising effect of financial development (Oladejo 2024; Kassouri et al., 2025); and institutions complement trade in promoting inclusive growth (Agyei & Idan, 2022). The interaction approach is spreading to other outcomes (Kwakwa, 2023; Onatunji, 2025), and Mehidi and Oukaci (2025) find that the effect of oil rents changes sign at an institutional threshold.

Other evidence is less favourable. Democracy indices raise inequality in 43 SSA countries, significantly in West, Central and Southern Africa (Acheampong et al., 2023). Xu et al. (2021) find positive coefficients on political stability, rule of law and corruption control, and Gonese et al. (2022) find that the openness-institution interaction raises inequality in SADC, which they attribute to corruption and weak enforcement. Similar adverse patterns appear for other outcomes (Chhabra et al., 2023; Soti et al., 2025). Three sources of divergence emerge. Institutions are measured differently. Effects are averaged over regimes with different political economies. And the dimension matters: Kunawotor et al. (2020) find that aggregate institutional quality is insignificant in 40 African countries, while corruption control and rule of law each reduce inequality.

2.4 Evidence for Nigeria

Nigeria-specific studies are few and mostly use other outcomes or treat trade and institutions separately. Ogede et al. (2022) find that openness and FDI reduce inequality in the short run (1981–2019), without testing institutional conditioning. Onatunji and Akinlo (2026) find that growth, openness and inflation raise inequality while education and governance reduce it (1996–2022); governance enters as a direct determinant. Olanrewaju and Akintayo (2026) find in a Fourier ARDL that institutional quality is associated with higher inequality, though trade is not their focus. Adegboyega et al. (2022) show that the interaction of trade with institutional quality enlarges Nigeria's shadow economy, and Ike et al. (2026) find regime-dependent effects of trade on the ecological footprint and call for models that capture structural breaks. The distributional analogue, a test of whether the institutional regime changed the effect of trade on inequality, has not been done.

Table 13 summarises the evidence (Appendix 1). Three regularities stand out: pooled African estimates of the effect of trade on inequality disagree in sign; the direction of institutional conditioning varies, and only some institutional dimensions seem to matter; and the closest Nigeria studies use other outcomes or do not allow the trade-institution relationship to change over time. These motivate the four gaps in Section 1. This study addresses them by estimating short- and long-run effects, testing an openness-institution interaction, and allowing level and slope shifts at the 1999 transition.

3. Theoretical Framework and Methodology

3.1. Theoretical Framework

The present study is based on the Stolper-Samuelson theorem, which is one of the most-commonly used theoretical frameworks in the analysis of the effect of trade liberalisation on income inequality. The Stolper-Samuelson theorem, an extension and more encompassing adjustment of the Heckscher-Ohlin model, suggests a significant link between trade liberalisation and income distribution. The model's hypothesis states that in an open economy, a rise in the price of a good will increase the returns to the factor used intensively in its production while reducing the returns to the other factor.

Through further investigation, the theorem suggests that in advanced economies, often characterised by skill-intensive production, increased trade may lead to a rise in the skill premium, consequently worsening income inequality. Conversely, in less developed countries with an abundance of unskilled workers, trade liberalisation is expected to increase the demand for unskilled labor, potentially reducing income inequality by opening up more income to the relatively poor in that economy.

However, the empirical literature presents a more nuanced picture. While some studies align with the Stolper-Samuelson predictions (Lin and Fu, 2015), others suggest that in their empirical findings, trade openness in developing countries has often led to a rise in the demand for skilled labor, potentially contributing to rising inequality (Aradhyula, Rahman and Seenivasan, 2007). This divergence from the expected outcomes specified by theory exposes the need to consider other factors, for instance institutional quality, in shaping the relationship between trade and inequality.

One theory that sheds light on the relationship between income inequality and institutional quality is the human capital theory. This study also uses this theory as its basis for a priori expectations. The theory of human capital provides strong beliefs that the earnings of any given individual is dependent on the human capital that individual possesses. The relationships being that, the more human capital stock the individual has (that is, the more educated, the more experienced and even the healthier, the individual is), the more earnings he/she is able to receive when working in the labor market. Their production value increases and they become more desirable to employ in a firm or any relevant place of work. In line with the reasoning behind this theory, the better the institutions in an economy are, the less income inequality will be present in that economy.

4. Methodological Approach

4.1 Data and Variables

The study uses 33 annual observations (1990–2023) for Nigeria, covering six variables: income inequality (INQ/Gini Index) as the dependent variable, and Trade Openness (TO), Institutional Quality (INS), Inflation (INF), Agriculture (logAGRIC), and Urban Population Growth (UPG) as regressors.

4.2 ARDL Model Specifications

Four nested ARDL models were written for this study progressively increasing in complexity from model 1 to model 4.

Model 1: Baseline ARDL without break. The baseline model used in this research work is based on the adaptation of the econometric model of Goh et al. (2019) specified in Eq. (4.1)

$$INQ_t = f(TO_t, INS_t, INF_t, \log AGRIC_t, UPG_t).$$

4.1

With the following econometric form:

$$INQ_t = \alpha_0 + \alpha_1 TO_t + \alpha_2 INS_t + \alpha_3 INF_t + \alpha_4 \log AGRIC_t + \alpha_5 UPG_t + \mu_t$$

4.1.1

Where INQ_t is income inequality (Gini index), TO_t is trade openness, INS_t is Institutional Quality, INF_t is inflation, $\log AGRIC_t$ is agricultural value added in log, UPG_t is urban population growth, α_0 is the constant and μ_t error term.

Equation (4.1) has been adapted to best suit the current study and its objectives, giving rise to a new equation, Eq. (4.2) which is the Model 2: Adds a centered $TO \times INS$ interaction term (no break):

$$INQ_t = f(TO_t, INS_t, TO_t \times INS_t, INF_t, \log AGRIC_t, UPG_t).$$

4.2

With the following econometric form:

$$INQ_t = \beta_0 + \beta_1 TO_t + \beta_2 INS_t + \beta_3 (TO_t \times INS_t) + \beta_4 INF_t + \beta_5 \log AGRIC_t + \beta_6 UPG_t + \epsilon_t$$

4.2.1

where $TO_t \times INS_t$ highlights the moderating role of institutional quality in the relationship between trade openness and inequality.

In order to account for the potential impact of the democratic transition on the level of inequality, we then extend the basic model by introducing a dummy variable D_{1999} , which leads to Eq. 4.3:

$$INQ_t = f(TO_t, INS_t, INF_t, \log AGRIC_t, UPG_t, D_{1999,t})$$

4.3

With the following econometric form:

$$INQ_t = \gamma_0 + \gamma_1 TO_t + \gamma_2 INS_t + \gamma_3 INF_t + \gamma_4 \log AGRIC_t + \gamma_5 UPG_t + \gamma_6 D_{1999,t} + u_t$$

4.3.1

where $D_{1999,t} = 0$ before 1999 and 1 after 1999, which makes it possible to examine the shift in the level of inequality between the military period and the democratic period.

At last, based on structural break tests suggesting that the 1999 transition also altered the sensitivity of inequality to trade openness and institutional quality, we extend the model by allowing for differentiated slope effects via interaction terms with D_{1999} , resulting in Eq. 4.4 (Model 4: with break in level and slope):

$$INQ_t = f(TO_t, INS_t, INF_t, \log AGRIC_t, UPG_t, D_{1999,t}, D_{1999,t} \times TO_t, D_{1999,t} \times INS_t)$$

4.4

With the following econometric form:

$$INQ_t = \delta_0 + \delta_1 TO_t + \delta_2 INS_t + \delta_3 INF_t + \delta_4 \log AGRIC_t + \delta_5 UPG_t + \delta_6 D_{1999,t} + \delta_7 (D_{1999,t} \times TO_t) + \delta_8 (D_{1999,t} \times INS_t) + e_t$$

where $D_{1999,t} \times TO_t$ and $D_{1999,t} \times INS_t$ allow the trends in trade openness and institutional quality to vary between the military regime (pre-1999) and the democratic regime (post-1999).

4.3.2 Technique of Estimation

The present study makes use of descriptive statistics which shows the mean, maximum, minimum, median, skewness, standard deviation and the kurtosis of variables used in the study. Furthermore, the chosen estimation techniques and methods are based on the objectives of the present study. To lay a determining foundation, the present study will make use of the Augmented Dickey-Fuller (ADF), PP and KPSS unit root tests, then a cointegration test is performed on the data with an error correction model estimation. And the use of ARDL necessitates each of the fundamental variables in use to stand as a single equation; this reduces the issue of endogeneity in a model.

5. Results

Descriptive patterns

Table 1 shows that Nigeria's income inequality (INQ) averaged 42.64 between 1990 and 2024. The median (38.91) is noticeably lower than the mean, indicating a right-skewed distribution (skewness: 0.66). High-inequality years peaked at 57.15, while most years ranged from 35 to 40 on the Gini scale.

Trade Openness (TO) averaged 28.83% of GDP and was nearly symmetric (skewness: -0.40). The range, from 8.73% to 42.93%, demonstrates variation from near-total trade limitation to significant opening between 1980 and 1990.

Table 1
Descriptive Statistics

Variable	N	Mean	Median	SD	Min	Max	Skewness	Kurtosis
INQ	34	42.6364	38.9140	7.8856	35.4193	57.1500	0.6620	1.7996
TO	34	28.8271	29.6621	9.7409	8.7292	42.9310	-0.4033	2.0099
INS	34	4.6029	4.5000	0.8685	3.5000	7.0000	1.5450	4.3319
INSTO	34	127.9743	131.1980	37.3392	43.6460	184.2279	-0.2946	2.2207
INF	34	16.4947	10.3066	15.2785	0.6861	75.4017	2.1671	8.0324
logAGRIC	34	29.8213	29.9904	0.6284	28.8737	30.5915	-0.2932	1.4666
UPG	34	4.4479	4.2907	0.5122	3.5121	5.5670	-0.0125	2.2786
Authors compilation 2026 (Software used: R 4.5.2)								

Institutional Quality (INS) shows the greatest distributional error, with a pronounced right tail, a mean of 4.60, a median of 4.50, a skewness of 1.54, and a kurtosis of 4.33. Rather than gradual changes, Nigeria experienced sharp but rare improvements in institutional quality, a pattern confirmed by Fig. 1, which shows a dramatic INS spike in 1999 followed by a gradual decline. The interaction term (INSTO) mirrors TO's distribution, as expected from the mathematics. The inflation index shows extreme price fluctuations, with an average of 16.49% and a standard deviation of 15.28%. The data shows extreme positive skewness of 2.17 and an excess kurtosis of 8.03. LogAGRIC distribution is stable, with a standard deviation of 0.63, indicating that the agricultural GDP share changes slowly and predictably. Nigeria's urban population grows at 4.45% annually, showing little variation nationwide.

The ADF, PP and KPSS tests (Table 2) in supplementary materials) show that only inflation is stationary in level. All other variables (inequality, trade openness, institutional quality, agriculture, urbanisation) become stationary after differentiation, leading to their classification as I(1). Overall, the combination of an I(0) variable and I(1) series justifies the use of the ARDL framework and the bounds test of Pesaran et al. (2001). The Chow rupture test (Table 3 in in supplementary materials) indicates that only the 1999 break is significant ($F = 28.02$, $p < 0.001$). The Chow test splits the sample into Period 1 (1990–1998, $n = 9$) and Period 2 (1999–2024, $n = 25$). This indicates that Nigeria's shift to democracy brought about a major change in the model's parameters.

Figure 1 demonstrates a scientific break across all four panels. The INQ panel shows inequality rising from about 54 to 75 (a 21-point increase) during 1990–1999 at a rate of 2.3 points per year, then slowing to 0.45 points per year after 2000. This marks a dramatic slope change. The TO panel shows deceleration from 2.2 points per year before 1999 to 0.5 points per year after. INS shows its most visible break, remaining stable between 5.0 and 5.0 from 1990 to 1998, then spiking to 7.0 in 1999 and continuously dropping to 6.0 by 2020. The INF panel shows a break at 1995–1996, when hyperinflation ended, not in 1999. This confirms that macroeconomic stabilization happened before democratization.

Authors compilation 2026 (Software used: R 4.5.2)

Table 4 (in supplementary materials) reveals key patterns. The strong negative TO–INS correlation (-0.574) shows trade expansion coincided with institutional decline. Oil price booms drove trade openness but reduced governance through rent-seeking (Kolstad & Wiig, 2016). The positive correlation between institutions and inflation (0.564) appears paradoxical but can be explained by the timing: the high inflation of the 1990s preceded institutional improvements, and this time lag automatically produces a positive correlation, whereas, in theory, better institutions should curb inflation. The negative correlation between inflation and agriculture (-0.538) indicates that episodes of hyperinflation were accompanied by a decline in the agricultural sector. Furthermore, the moderately positive correlations between urbanisation, trade openness and their interaction suggest that trade integration and urbanisation have progressed in tandem. Table 5a (in supplementary materials) shows no multicollinearity issues. All VIFs are below 10; most are below 5 (Hair et al., 2019).

Long-run relationship

Table 5 provides critical diagnostic comparisons. The first model shows $ECT = 0.014$, indicating positive results, but it lacks error-correction capability because the p-value is 0.934. The second model shows $ECT = -0.221$ because the result is not significant (p-value = 0.325). The third model reaches statistical significance with $ECT = -0.499$ and a p-value of 0.008 because it uses a one-year half-life, which marks the first valid error-correction model, implemented with an intercept dummy for 1999. Model 4 shows dramatic improvement: $ECT = -0.751$ ($p < 0.001$), half-life = 0.5 years (approximately 6 months). The system achieves the maximum correction speed because the slope dummies, which separate TO and INS effects before and after 1999, were implemented. The progression from Model 1 (invalid) to Model 3 (valid, slow) to Models 4 (valid, fast) demonstrates that both level and slope shifts in 1999 are necessary to properly model Nigeria's trade-inequality dynamics.

Table 5
Adjustment Speed Across Models

Model	ECT Coeff.	Std. Error	t-Value	P-Value	Half-Life (Yrs)	Significant
Model 1	0.0142	0.1683	0.0840	0.9335	-49.2600	No
Model 2	-0.2209	0.2199	-1.0050	0.3247	2.7800	No
Model 3	-0.4994	0.1737	-2.8750	0.0081	1.0000	Yes
Model 4	-0.751	0.091	-8.277	0.000	0.500	Yes
Authors Compilation 2026 (Software used R 4.5.2)						

Table 6 shows that under military rule, a 1 percentage point increase in trade openness significantly increases inequality ($\beta = 0.270$; $p < 0.001$), whereas after 1999 the net effect becomes slightly negative due to the interaction term with democracy ($0.270 - 0.286 = -0.016$; $\beta \text{ TO} \times \text{D1999} = -0.286$; $p < 0.001$). Institutional quality undergoes a similar reversal: prior to 1999, an improvement in institutions increases inequality ($\beta = 1.329$; $p = 0.001$), whereas after democratization the net effect becomes reducing ($1.329 - 1.687 = -0.358$; $\beta \text{ INS} \times \text{D1999} = -1.687$; $p = 0.001$). Among the control variables, inflation has a slightly inequality-increasing effect ($\beta = 0.007$; $p = 0.045$), whereas agricultural productivity ($\beta = -9.149$; $p < 0.001$) and urban population growth ($\beta = -1.836$; $p < 0.001$) significantly reduce inequality.

Table 6
Long-Run Estimates (Model 4)

Variable	Coefficient	Std. Error	t-value	P-value
TO	0.270	0.042	6.394	0.000
INS	1.329	0.323	4.120	0.001
INF	0.007	0.003	2.204	0.045
logAGRIC	-9.149	0.260	-35.136	0.000
UPG	-1.836	0.160	-11.490	0.000
D1999 (intercept)	10.107	2.671	3.784	0.002
TO $\times$ D1999	-0.286	0.041	-7.055	0.000
INS $\times$ D1999	-1.687	0.387	-4.360	0.001
Authors compilation 2026 (Software used: R 4.5.2)				

Short-run dynamics and adjustment

Table 7 shows that the error correction term is negative and highly significant ($\text{ECT} = -0.751$), which confirms cointegration and implies that around 75% of imbalances are resolved within a year. In the short term, an increase in trade openness increases inequality ($\beta = 0.208$; $p < 0.001$), whilst an improvement in institutional quality reduces it moderately ($\beta = -0.298$; $p = 0.017$). Gains in agricultural productivity are also associated with a marked decline in inequality ($\beta = -2.611$; $p < 0.001$), suggesting a rapid pro-poor effect. By contrast, the regime change associated with democratic transition is accompanied by a slight increase in inequality ($\beta = 3.878$; $p < 0.001$).

Table 7
Short-Run ECM Estimates (Model 4)

Variable	Coefficient	Std. Error	t-value	P-value
ΔTO	0.208	0.015	14.258	0.000
ΔINS	0.298	0.110	2.714	0.017
$\Delta \log \text{AGRIC}$	-2.611	0.501	-5.211	0.000
ΔD1999	3.878	0.795	4.876	0.000
ECT(-1)	-0.751	0.091	-8.277	0.000
Authors compilation 2026 (Software used: R 4.5.2)				

Table 9 assesses the regime-specific effects and shows the importance of the structural break, and Fig. 4 presents its visual representation. The coefficient for military operations before 1999 shows trade openness at 0.118, while democratic systems after 1999 show a -0.056 coefficient. The present situation shows a 147% transformation, encompassing both a change in size and a complete change in direction. Figure 4 displays military-period trade openness at 51.5%-58.5%, a narrow range, and democratic-period trade openness at 58.5%-69.5%, a broader range. The military cluster's tightness suggests constrained trade policy under authoritarian rule; democracy's wider spread reflects policy responsiveness to electoral cycles and

interest groups. NATOTO levels are shown in Fig. 4, while Table 9 shows the TO at which different regimes produce different inequality outcomes: military regimes with 60% TO generate more inequality than democratic regimes with the same TO level.

Table 9
Regime Effects – Pre- and Post-1999

Variable	Pre-1999 (Military)	Post-1999 (Democracy)	Change	% Change
Trade Openness (TO)	0.1183	-0.0560	-0.1743	-147.34%
Institutions (INS)	0.4264	0.0627	-0.3636	-85.29%
Authors compilation 2026 (Software used: R 4.5.2)				

Table 11 shows asymmetric causal relationships between different variables. INS Granger-causes INQ ($F = 5.36$, $p < 0.001$), which proves that institutional quality exists as an external factor that governs inequality because changes in governance will first occur before they bring about modifications in income distribution. Figure 1's INS panel visually supports this: the 1999 INS spike precedes the 1999–2000 deceleration in INQ growth.

The research found that INQ Granger-causes TO, as indicated by $F = 10.18$ and $p < 0.001$. The research found that high inequality levels create political pressures that lead to protectionism, while more equal societies show a higher willingness to adopt free trade agreements. The positive correlation between INQ and TO indicates that both variables increase together, although Granger tests show that INQ leads TO more than the reverse.

The Granger test shows that TO does not have a significant causal impact on INQ, as indicated by $F = 1.79$ and $p = 0.071$. The cointegration results from Models 3–5 demonstrate that trade openness actually affects inequality. The causal effect operates through long-run equilibrium adjustment, as ECT shows to be significant, whereas TO lagged values do not provide any short-term predictive ability. Granger causality tests evaluate short-term predictive abilities but do not assess long-term structural connections.

Table 11
Granger Causality Tests

Direction	F-Statistic	P-Value	Causality
TO → INQ	1.7874	0.0706	No
INS → INQ	5.3603	< 0.001	Yes
INQ → TO	10.1799	< 0.001	Yes
Authors compilation 2026 (Software used: R 4.5.2)			

Discussion

The empirical results, which combine tabular data with visual evidence from Figs. 1–5, demonstrate that Nigeria's trade-inequality relationship requires the 1999 democratic transition as its fundamental explanation. The sign reversal of trade openness's effect from positive under military rule to negative under democracy has profound implications for theory and policy.

The Chow rupture test and Fig. 1 suggests that the trade-inequality relationship remained stable despite external shocks, while permanent changes arose from domestic political regime transition, a contrast that will be further explored in subsequent interpretation, drawing on Acemoglu & Robinson (2019).

The 2008 global financial crisis ($F = 1.13$, $p = 0.380$) and 2016 recession ($F = 0.29$, $p = 0.937$) produced no structural break upon visual inspection of Fig. 1. The reversal from $\beta = 0.118$ to $\beta = -0.056$ shows the regime-dependent policy effects and different governance systems yield different distributional outcomes from the same policy variable (Baccaro and Pontusson 2018). Figure 3 shows this visual representation through two trend lines which appear on the same scatterplot with one line showing positive military results and another line showing negative or flat democracy results. The mechanism depicted in Fig. 1 shows that military rule from 1990 to 1998 led to steeply rising inequality, which increased by 2.3 points per year as trade openness rose. The visual evidence confirms that democratization decoupled trade expansion from inequality growth.

The results show that Nigeria's transition to democracy created a new system which changed how economic policy affected distribution of resources. The military dictatorship implemented trade liberalization through structural adjustment programs which required fiscal austerity measures and elimination of subsidies and devaluation of currency. The lack of democratic accountability permitted authorities to distribute benefits according to their preferences. The democratic system enabled ongoing trade liberalization while increasing social expenditure and introducing conditional cash transfer programs and fostering political competition which resulted in wider distribution of trade advantages (Dorn et al., 2022).

ECT value of -0.751 from Model 4, together with its half-life of 0.5 years, which equals about 6 months, shows that Nigerian inequality quickly reacts to changes in government policies and the rapid adjustment speed. The 6-month half-life is exceptional, as macroeconomic studies typically report half-

lives of 2 to 5 years (Samargandi et al. 2019). The rapid adjustment process demonstrates how Nigeria's economy functions because its informal sector enables quick changes to prices and wages and employment levels without any restrictions from formal businesses. The political system responds quickly to inequality shocks which lead to rapid policy changes in democratic systems.

The institutional quality puzzle shows that the INS coefficient decreased from 0.426 to 0.063 which represents an 85% reduction. The INS panel in Fig. 1 shows a threshold effect, with a 1999 spike followed by a continuous decline. Institutional quality matters for inequality primarily at very low levels. The transition from military era institutions which operated at $INS \approx 5.0$ to democratic transition institutions which operated at $INS \approx 7.0$ created significant distributional outcomes. The system showed only slight changes after moving from $INS = 7.0$ to $INS = 6.0$ which represents an actual decline. The research demonstrates that institutional theories based on linearity encounter problems because Dell (2018) shows that institutional structures create non-linear institutional-inequality links which result in decreasing outcomes.

The coefficient of logAGRIC coefficient is shown in Fig. 1 and tells us of the agricultural dominance. The INQ panel shows inequality rising over time; the logAGRIC panel (not shown in Fig. 1 but implied by Table 1's stability) would show a gradual decline in agriculture as Nigeria's economy shifted toward oil and services. The inverse relationship, agricultural share falling, inequality rising, is consistent with agriculture's role as a buffer for the poor. Agricultural growth directly increases the incomes of the bottom 40% while decreasing food prices which creates two advantages that help reduce inequality (Christiaensen et al., 2018).

The UPG panel in Fig. 1 shows the equalizing effect operates through migration composition because rural poor people who move to cities create decreased measurement of inequality between rural and urban areas. Urban residents experience superior access to health and education and social services compared to rural populations. The finding presents a warning: unregulated urban growth leads to slum development, whereas Nigeria demonstrates that adequate infrastructure spending during urban growth creates broader benefits (Glaeser 2020).

This study helps to understand the significance of the policy which directly affect Nigeria's implementation of the agreement of the African Continental Free Trade Area (AfCFTA) as shown by the results. The results demonstrate that distributional outcomes depend on the particular governance framework which governs their execution. The current democratic regime will create neutral economic outcomes through its market-opening policies, with an effect equivalent to that in the post-1999 period. The introduction of democratic backsliding or the restoration of authoritarian rule will create a trade imbalance which leads to increased economic inequality. The maintenance and strengthening of democratic institutions serve as both a political goal and an essential economic requirement for achieving inclusive trade integration (World Bank 2022).

Limitations of the study

The sample size ($N = 33$) yields only 9 observations in the pre-break period, leaving pre-1999 coefficients estimated with low precision despite statistical significance. The INS panel in Fig. 1 shows that institutional quality declines after 1999 because the post-1999 period comprises multiple political systems with distinct development trajectories that begin with democracy and end in democratic decline. The analysis treats 1999–2023 as homogeneous, but Fig. 1 suggests otherwise. Future research should test for second-order breaks within the democratic period. The analysis fails to separate democracy from other events that occurred in 1999, which included debt relief, changes in oil prices, and the telecommunications revolution.

In conclusion, the empirical analysis, with tables and figures, shows that Nigeria's democratic transition in 1999 radically changed the trade-inequality nexus. Trade openness increased inequality under military rule, whereas it decreased under democracy. This regime-dependent effect is clearly evident in the change in slope shown in Fig. 1, the duality in trend lines in Fig. 3, and the ECT dynamics in Fig. 5, all of which shed light on the impact of governance on distributional outcomes. From other developing economies that have managed trade liberalization, the Nigerian experiment has a clear takeaway: trade policy is not predetermined; its outcomes are shaped by the political and institutional contexts in which trade is transacted.

Use of AI Statement

Claude AI was used for the reference's corrections and arrangement tables, figures and list of references. Perplexity AI tool was used to assist with writing and refining R scripts for data processing, statistical analysis, and table generation. All analyses were executed, verified, and interpreted by the authors, who take full responsibility for the results and conclusions.

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Figures

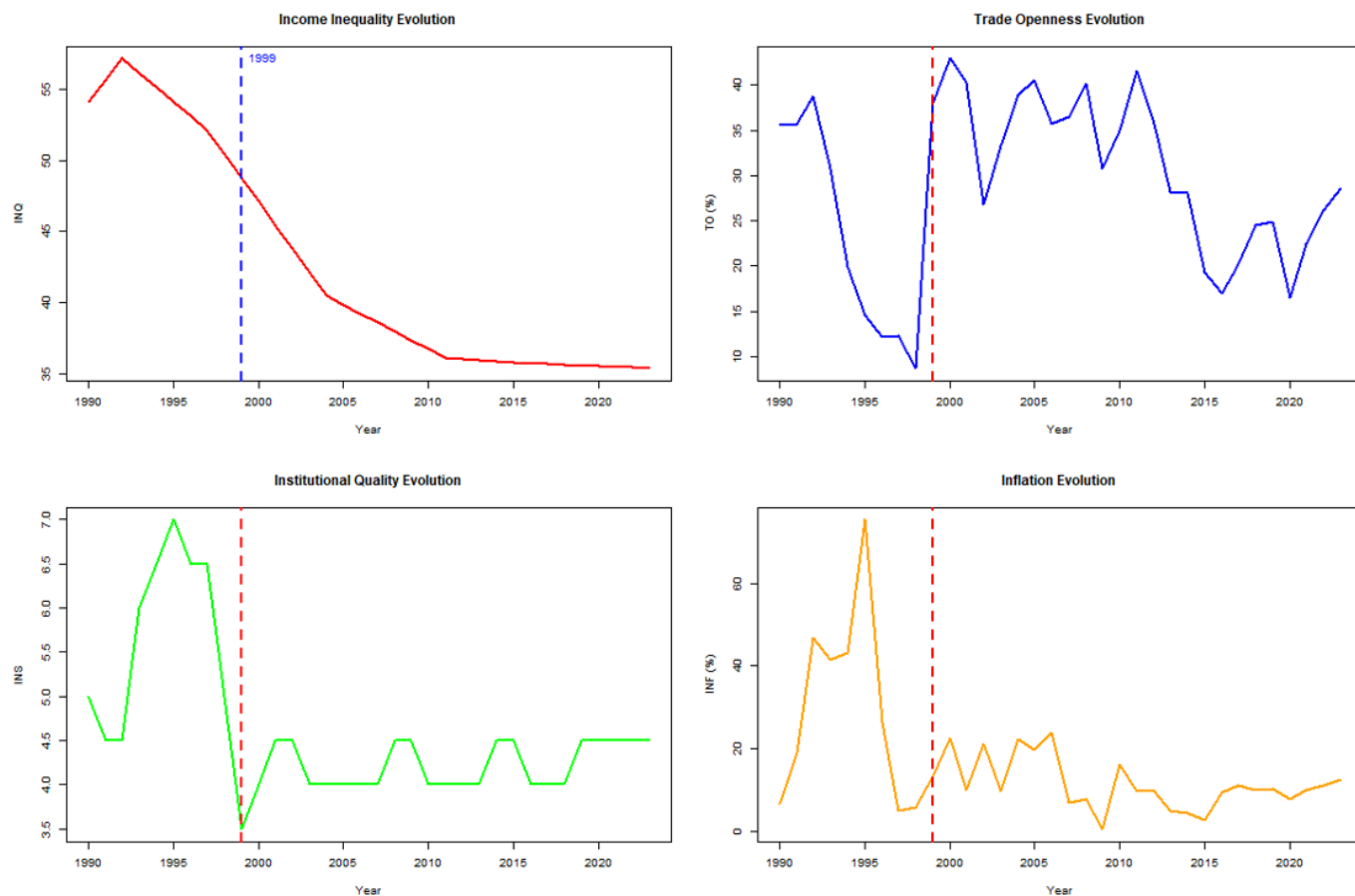


Figure 1

Time Evolution of Key Variables (1990–2023)

Note: Dashed lines indicate the 1999 political transition (structural break).

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Figure 2

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