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Income inequality and deposit money bank profitability in Nigeria: A panel data analysis

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ABSTRACT

Nigeria faces persistent challenges of income inequality and poverty, which significantly affect bank performance and profitability. While many studies have investigated the relationship between income inequality and economic growth, few have examined how this affects bank profitability in developing countries. This study addresses that gap by using panel cointegration to investigate the relationship between income inequality and bank profitability in Nigeria. The study used data from five reputable banks (Zenith Bank, Access Bank, First Bank, United Bank for Africa, and Guaranty Trust Bank) in Nigeria from 2018 to 2023. It applied the Pedroni and Kao cointegration tests, panel fully modified ordinary least squares (FMOLS), and the panel generalized method of moments (GMM). The panel cointegration result indicates a long-run relationship between income inequality and bank profitability. Findings from FMOLS and GMM indicate that Gini coefficient has a negative and significant effect on return on capital employed. Per capita income and inflation rate also have negative but insignificant effects on return on capital employed, while exchange rate has a significantly negative effect on return on capital employed. Additionally, gross savings rate and direct investment show a positive relationship with ROCE; however, despite this positive relationship, they have not contributed to increased bank profitability in Nigeria due to rising income inequality. The findings highlight the adverse effect of income inequality on bank profitability in Nigeria, which could, in turn, hinder sustainable development. Therefore, this study emphasizes the need for regulators to facilitate the alignment of banking sector policies with Sustainable Development Goals (SDGs); the government should encourage collaborative strategies with banks to invest in initiatives that drive poverty reduction and reduce inequality, thereby supporting sustainable profitability through social responsibility.

1. Introduction

Income inequality has been a major economic debate. Several studies have been carried out on its effect on macroeconomic indicators such as poverty, unemployment, trade openness, foreign direct investment, financial growth, and overall economic growth (Ogede et al., 2023; Musa et al., 2024; Bayar, 2023; Mallela et al., 2023; Amponsah et al., 2023). These consequences have generated worries about their potential to undermine progress towards the United Nations' global development goals. Despite substantial research on the economic effect of income inequality, little emphasis has been dedicated to its effect on bank profitability; this gap is essential because increasing income inequality can reduce people's savings and investment in a nation, resulting in a reduction in bank patronages which is critical for bank profitability

(Abhijit, 2004). In contrast, decreasing income inequality may increase people's savings and investment, thereby affecting the overall development of financial sectors. (Neaime & Gaysset, 2018) (see Fig. 1).

In Nigeria, where income inequality is high (International Monetary Fund, 2015) it is pertinent to study its effect on the sectors of the economy, making it crucial to study its effect on bank profitability. According to data from World Bank Data (2023), Nigeria's Gini coefficient rose from 0.29 to 1.33 between 2000 and 2010, this dropped to 1.29 in 2020 and rose to 1.34 in 2022, marking the height of the country's inequality problem. This instantly ranked Nigeria as one of the world's most unequal nations, making it difficult to attain Sustainable Development Goal 10 (Reduced Inequality). Despite increasing government revenue (Ogunjumo et al., 2024; Oladipo et al., 2024), the country faces persistent challenges, such as increasing unemployment,

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poverty, and low per capita income (Asaleye et al., 2017; Popoola et al., 2019).

The financial sector is undeniably the engine of every economy as it makes resources accessible for investment, resulting in economic growth (Akintola et al., 2020; Okafor et al., 2023). Bank profitability is an essential instrument for assessing bank operations, determining management planning, and conducting strategic analysis (Akhtara et al., 2024). Nigeria has one of the biggest and most vibrant banking sectors in Africa (Samuel-Ogbu, 2022), with a variety of commercial, microfinance, and development banks contributing significantly to the economic activities. The income distribution of these banks' clients has a significant impact on their profitability since it dictates investment trends, deposit levels, and loan demand. As an emerging economy with characteristics similar to other developing nations, this study offers valuable knowledge that can be applied to several countries with high income inequality and evolving banking sectors. The findings from this study can contribute to broader discussions on financial stability, economic policy, and banking sector resilience in emerging markets.
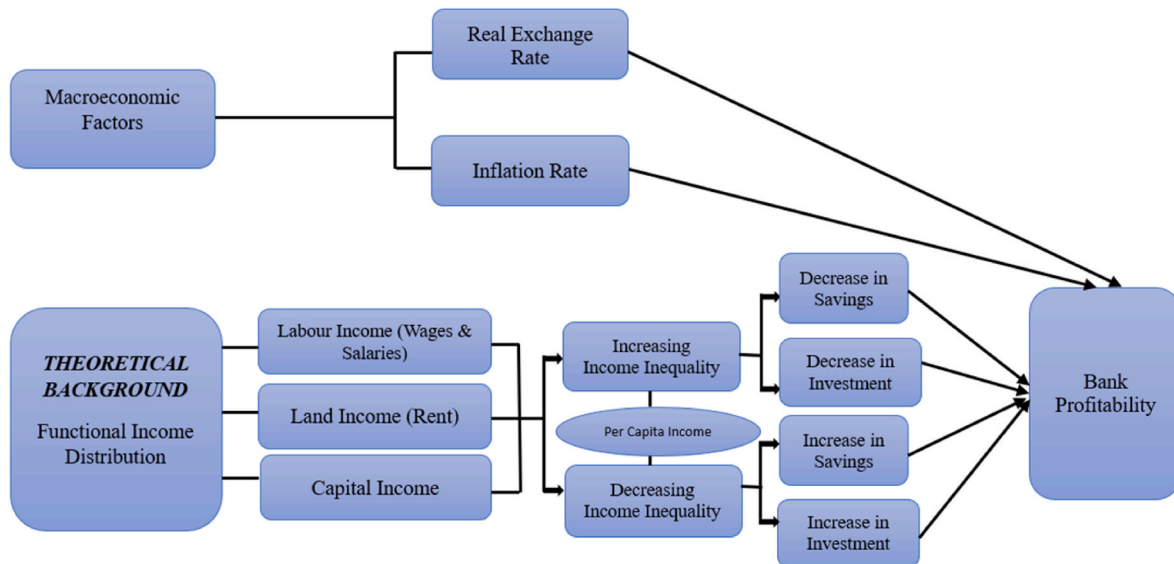
This study is inspired by three major elements that fill significant gaps in the literature and add to existing empirical research. First, the gaps, inconsistencies, and varied results in previous research highlight the need for more investigation of income disparities and their economic consequences, particularly in Nigeria, where economic instability is rapidly increasing. Second, Nigeria's increasing economic instability makes it particularly sensitive to income inequality, which can have far-reaching implications for several sectors, including the banking sector. Finally, this research is critical for understanding the link between income inequality and fulfilling the United Nations Sustainable Development Goals, notably in terms of reduced inequality as well as no poverty.

First, despite significant studies on the economic effects of income inequality on financial development (Adeleye et al., 2020; Okowa & Owede, 2022; Bayar, 2023; Hsieh et al., 2019; Seven, 2022), few or no research to the best of the researcher's knowledge, have evaluated its impact on banks profitability. According to a particular school of thought, inequality slows down economic growth (Stiglitz, 2012; Aghion et al., 1999; Persson & Tabellini, 1994; Alesina & Perotti, 1996). Due to inequality, people at the bottom have less aggregate demand, which causes them to spend a larger percentage of their income than people at the top. Another school of thought expressed that income inequality boosts economic growth (Forbes, 2000; Mirrlees, 1971; Galor & Tsiddon, 1997). This school of thought thinks that an agent's unobservable effort determines their output. If the compensation for each of these agents remains constant regardless of their productivity, this will deter them from exerting any more effort. Therefore, some inequality may be required to promote productivity and growth. Another body of literature asserts that income inequality does not harm growth (Okun, 1975; Barro, 1999; Kaldor, 1956). These theorists compare wealth transfers to a "leaky bucket," where some money will be lost as they are being carried in a leaky bucket. It is anticipated that equity will impact incentives, and policymakers need to decide whether to give equity or economic efficiency priority. It is also believed that the rich have a higher marginal propensity to save than the poor do, which explains this trade-off.

Second, given increasing income inequality in Nigeria (Adeleye et al., 2020; Okowa & Owede, 2022; Musa et al., 2024), income disparity can significantly affect key indicators such as economic growth, productivity growth and financial development, which are very crucial for bank profitability. Although several studies like those of Abidemi and Anthony (2020), Musa et al. (2024), Amponsah et al. (2023), Bayar (2023), Contreras et al. (2023), Pak-Hung (2000), Mallela et al. (2023), Delis et al. (2012), and Seven (2022) have examined the effect of income inequalities on various macroeconomic indicators, the specific influence on bank profitability remains unexplored; this study was further supported by Wang (2023).

Finally, this research is critical in promoting the United Nations' Sustainable Development Goals (SDGs), notably those related to no poverty (SDG 1), industry innovation and infrastructure (SDG 9), and reducing inequality (SDG 10). Given the importance of bank profitability in attaining sustainable and inclusive economic growth, knowing the impact of income inequality is vital for long-term planning and development. Income disparity can have an impact on people's capacity to receive financial services, hence having far-reaching repercussions on bank profitability. In line with the UN's global vision, this research offers workable solutions to guarantee that income equality translates into long-term bank profitability and sustainable development. The study's findings could guide policy recommendations to lessen the detrimental effects of income inequality on bank profitability, thereby aiding Nigeria's efforts to meet the UN's development goals; this research offers practical solutions for ensuring that reduced income disparity translates into sustained bank profitability and broader economic progress, in alignment with the UN's Sustainable Development Goals.

Fig. 1. A conceptual framework showing the relationship between income inequality and bank profitability.
Source: Author's Reasoning using materials online

1.1. Research gap

Despite a growing body of literature examining the relationship between income inequality and various economic indicators, there remains a notable gap in understanding how income inequality specifically affects bank profitability in developing economies such as Nigeria. This gap is critical, as bank profitability plays a vital role in ensuring financial system stability and promoting sustainable economic growth (Okafor et al., 2023). Therefore, this study seeks to fill this gap by providing empirical evidence on the relationship and impact of income inequality on bank profitability in Nigeria.

1.2. Research objectives

The first objective of this study is to examine the relationship between income inequality and bank profitability in Nigeria using the panel cointegration approach. The second objective is to assess the impact of income inequality on bank profitability in Nigeria by employing the Panel Fully Modified Ordinary Least Squares (FMOLS) method and the Generalized Method of Moments (GMM) technique.

The study revealed a negative relationship between the Gini coefficient (income inequality) and return on capital employed (bank profitability), thereby contributing to the discourse on sustainable development. The following summarizes the remainder of the paper: materials and methods are presented in Section 2, empirical results are presented in Section 3, Section 4 discusses the empirical results, and the study is concluded in Section 5.

2. Materials and methods

2.1. Theoretical framework

The theoretical framework specified in the model is the functional/ size distribution of income theory. The functional distribution of income entails the revenue generated by the factors of production. It focuses on how capital, labour, and land are distributed. According to the functional distribution theory, society is divided into three classes: capitalists (those who receive interest payments), labourers (those who receive wages or salaries), and landowners (those who receive income in the form of rent). The size distribution of income deals with the money received by individuals or households. This theory takes into account the distribution of total income, also known as national income, among families or individuals. Based on Marx's fundamental theory, the model is specified as:

$$a^\rho = c^\sigma + (j^\tau + k^\delta) \qquad 1$$

Equation (1) is the value per unit of commodity.

In terms of national income, the sum of value per unit of commodity in (1) can be re-specified as:

$$\sum a_i^\rho = \sum c_i^\sigma + \left(\sum j_i^\tau + \sum k_i^\delta \right) \qquad 2$$

$\sum c_i^\sigma$ denotes constant capital (i.e stock), $\sum j_i^\tau + \sum k_i^\delta$ denotes new value, i.e flow under current national income statistics, Gross Domestic Product (GDP) is the concept of flow, which includes the second part in the sum of commodity values in equation (2) i.e. $\left(\sum j_i^\tau + \sum k_i^\delta \right)$. Hence,

$$GDP = \sum j_i^\tau + \sum k_i^\delta \qquad 3$$

Equation (3) implies that GDP is divided into two parts, namely, labour income $\left(\sum j_i^\tau \right)$ and capital income $\left(\sum k_i^\delta \right)$. In this study, income inequality (Gini Index) captures labour income while per capita income captures capital income.

Expressing equation (3) in linear form below:

$$lnGDP = \sum ln\, j_i^\tau + \sum lnk_i^\delta + \varepsilon_t \qquad 4$$

2.1.1. Model specification and estimation techniques

In line with the theoretical framework adopted in this study, equation (4) is re-specified as follows:

$$lnROCE_t = \beta_o + \beta_1 lnGiNi_t + \beta_2\, ln\, PCI_t + \beta_3\, ln\, GSR_t + \beta_4\, ln\, DINV_t$$
$$+ \beta_5 lnREXR_t + \beta_6 lnINFR_t + \varepsilon_t \qquad 5$$

Return on capital employed is used to proxy for bank profitability, while Gini coefficient is used to proxy for income inequality. Hence, in equation (5), ROCE is the indicator for return on capital employed (dependent variable), and GiNi is the indicator for the gini coefficient (Independent variable). Other independent variables; PCI represents per capita income, GSR is gross savings rate, DINV is direct investment, REXR is real exchange rate, and INFR is inflation rate.

A panel data co-integration was conducted to examine the long-run relationship among identified variables. The data were first subjected to the property tests of a time series as the stationary properties were verified using a panel unit root test.

2.2. Technique of estimation

2.2.1. The panel unit root test

In finite samples, the panel unit root test performs significantly better than the typical time-series unit root test. This study adopts a variety of tests of the panel unit root, including the Fisher-type tests using ADF and PP tests, suggested by Maddala and Wu (1999), the LLC test, which was first presented by Levin et al. (2002), and the IPS test, which was suggested by Im et al. (2003).

2.2.2. Panel Co-integration technique

The residuals of a false regression are examined by Engle and Granger (1987) using I(1) variables or components. It implies that if factors are integrated, the residuals will also be integrated at the level; if not, first-order integration will be done.

$$Z_{it} = \rho_i + \sum_{q=1}^{j} \alpha_{qi} X_{qit} + \mu_{it} \qquad 6$$

Where i = 1,2 …., X is the number of banks in the sample, and t is the period considered. ρ_i permits the bank-specific fixed effects. μ_{it} is the error term that shows the deviation from long-term association in the process. The fixed effect was chosen since the random null hypothesis was rejected by the Hausman test's chi-square statistic. The residual evaluates the no co-integration (R = 1) hypothesis as follows:

$$\mu_{it} = R_i \mu_i(t-1) + N_{it} \qquad 7$$

Two co-integration tests were employed in this research. Pedroni (2004) is the first test, and Kao (1999) is the second test, which is based on Engle–Granger and requires homogeneity on units within the panel set.

2.2.3. Pedroni panel cointegration test

The regression equation used for this test is as follows:

$$z_{it} = \rho_i + \sigma_{it} + \propto_{1i} x_{1i,t} + \propto_{2i} x_{2i,t} + \ldots + \propto_{ni} x_{ni,t} + \mu_{i,t} \qquad 8$$

Where t = 1, …., i = 1, …. I; n = 1, …N and x is supposed to be I(1). The factors ρ_i and σ_i are both individual and drift effects, which can either be zero or fixed. Typically, the residuals from Equation (8) are used to conduct an auxiliary regression (Equation (9) and determine if I(1) for each cross-section.

$$\mu_{i,t} = \tau_i t_{i-1} + \varepsilon_{it} \qquad 9$$

2.2.4. KAO panel cointegration test

$$z_{iy} = \rho_i + \propto X_{it} + \mu_{it} \qquad 10$$

For

$$z_{it} = z_{it-1} + \varepsilon_{i,t} \qquad 11$$

$$x_{it} = x_{it-1} + \mu_{i,t} \qquad 12$$

Where t = 1, …., i = 1, …. I.

The equation for the pooled auxiliary regression ran by KAO

$$\mu_{it} = \tau e_{it-1} + \varepsilon_{i,t} \qquad 13$$

2.3. Type & sources of data

The study investigates the relationship between registered deposit money banks' profitability and income inequality in Nigeria. To achieve the objective of this study, the panel regression technique was used. This technique is suitable for the study because of the type of data collected, which revolves around the combination of cross-sectional and time series data. This study's population consists of five (5) deposit money banks registered on the Nigerian Exchange Group (NGX). This study focuses on only five banks, which may affect generalizability. However, these five banks were used to represent other banks in Nigeria due to their dominance in important financial metrics. They set industry benchmarks and reflect broader trends in Nigeria's banking sector. The banks were selected based on the Central Bank of Nigeria's (CBN, 2023) annual report, which ranks them among the top five banks in Nigeria. The selection criteria include total assets, market capitalization, profitability, customer deposits, and regulatory compliance, ensuring a transparent and objective sampling evaluation.

This research engages secondary data. The data were generated from the World Bank Data (2023), the Central Bank Statistical Bulletin (CBN, 2023), and the various account statements of the banks under study. This study covers 5 years (2018–2023), and there was no missing data for the period under study. The variables employed in this study are measured, as shown in Table 1 below. Gini coefficient, per capita income, gross saving rate, direct investment, exchange rate, and inflation rate are independent variables, while bank profitability is the dependent variable. The primary metric for assessing a bank's profitability is profit after tax (Return on Capital Employed).

3. Presentation of results

3.1. Descriptive statistics

The descriptive statistics of the variables in our investigation were examined before model estimation. According to Table 2 results, all variables have low standard deviations, which indicates that most of the data are concentrated around the mean and have few extreme values. This suggests that the sample mean is a fair representative of the population's true mean. Furthermore, there is a high degree of consistency between the variables since the range of the mean and median values for all of the variables falls between the minimum and maximum values.

However, all the variables have somewhat greater kurtosis values than usual, indicating that their distribution is not normal. This observation is corroborated by the positive or negative skewness of the variables. However, since the variables' kurtosis values are smaller than 3, we can infer that they are platykurtic.

Table 3 presents the estimated correlation matrix of the variables. The result of the correlation matrix was conducted as a preliminary test to help rule out any potential multicollinearity issues and to understand variable relationships (Shrestha, 2020). The result shows that return on capital employed is adversely related to gini coefficient, gross saving rate, real exchange rate, and inflation rate. It correlates positively with per capita income and direct investment. Hence, despite the improvement on these variables, the impact of bank profitability has not produced a desirable result.

Table 1

Data description, measurement, and sources.

Variables	Description	Measurement	Source
ROCE (Return on Capital Employed)	This is a financial ratio that assesses the profitability of a business using all of its capital.	A measure of Profit after Tax	Websites of the 5 banks considered in this study
Gini Coefficient (GiNI)	The Gini coefficient measures the inequality among the values of a frequency distribution, such as levels of income	A measure of income inequality	World Bank Data, 2023
Per Capital Income (PCI)	PCI measures the amount of money earned per person in a nation	A measure of income per head	World Bank Data, 2023
Gross Saving Rate (GSR)	Gross savings measures the difference between disposable income and consumption	A measure of savings in the economy	World Bank Data, 2023
Direct Investment (DINV)	Direct investment measures a company in one country opening its business operations in another country	A measure of investment in the economy	CBN, 2023
Real Exchange Rate (REXR)	Real exchange rate (RER) measures the purchasing power of a currency relative to another at current exchange rates and prices.	A measure of an economy's purchasing power	World Bank Data, 2023
Inflation Rate (INFR)	Inflation rate measures the overall increase in prices or the increase in the cost of living in a country.	A measure of the general price level of goods and services in the economy	World Bank Data, 2023

3.2. The panel unit root test

The null hypothesis of the IPS, ADF, and PP tests in Table 4 presupposes the presence of a standard unit root throughout the cross-sections, while the alternative hypothesis postulates the absence of a unit root across the cross-sections. Also, in Table 4, the individual unit root process is assumed to be dominant across all cross-sections in the LCC test. In all these tests, the alternative hypothesis asserts that there is no unit root across the cross-sections, while the null hypothesis states that there is a unit root across the cross-sections of variables.

The results of the group panel test via IPS, ADF and PP point to presence of unit root in the group sample, but the results from LCC point to a positive relationship, indicating that the series is free from unit root at the individual level.

To obtain the stationary group, the panel group test was conducted once again for the first difference in Table 5. All variables are therefore integrated to order one I(1) and stationary at the first difference.

3.3. Panel cointegration test

From Table 6, the Pedroni test revealed the presence of cointegration, as the p-values of the panel v statistics, panel PP statistics, panel ADF statistics, group rho statistics, and group ADF statistics are significant at 1 %.

The KAO statistics also suggest a cointegration relationship because its ADF statistics is significant at 5 %. Hence, we reject the null hypothesis and conclude that there is long-run relationship among the variables.

Table 2

Descriptive statistics of variables.

Variables	L_ROCE	L_GINI	L_PCI	L_GSR	L_DINV	L_REXR	L_INFR
Mean	11.58157	0.271503	5.095731	6.220993	10.44650	4.78490	2.87868
Median	12.01147	0.276977	5.085328	6.207667	11.17588	4.77295	2.88340
Maximum	13.76402	0.302745	5.180929	6.317742	11.22494	4.89177	3.28316
Minimum	5.089939	0.217072	5.024648	6.158461	0.113329	4.69959	2.43329
Std. Dev.	1.812972	0.029443	0.049742	0.060179	2.807789	0.06125	0.31107
Skewness	−2.871272	−0.77458	0.381807	0.434279	−2.47384	0.45587	−0.07556
Kurtosis	10.72840	2.439772	2.325032	1.694223	13.06908	2.36879	1.62039
Observations	30	30	30	30	30	30	30

Source: Author's Computation using E-views 10

Table 3

Estimated correlation matrix of variables.

	L_ROCE	L_GINI	L_PCI	L_DINV	L_GSR	L_REXR	L_INFR
L_ROCE	1.00000						
L_GINI	−0.19309	1.00000	−0.9274	−0.04979	0.888101	0.569529	0.900438
L_PCI	0.15887	−0.92744	1.00000	−0.07672	−0.93335	−0.33276	−0.95159
L_DINV	0.20978	−0.04979	−0.0767	1.00000	−0.03112	−0.49984	−0.22285
L_GSR	−0.15437	0.888101	−0.9333	−0.03112	1.00000	0.41367	0.93126
L_REXR	−0.22094	0.569529	−0.3327	−0.49984	0.41367	1.00000	0.42342
L_INFR	−0.21008	0.900438	−0.9515	−0.22285	0.93126	0.42342	1.00000

Source: Author's Computation using E-views 10

Table 4

Summary of group unit root at level form.

Variables: L_GiNi, L_PCI, L_GSR, L_DINV, L_REXR, L_INFR, L_ROCE				
Test	LCC	IPS	ADF Fisher	PP Fisher
Null	Consider the Common Unit Root Process		Consider the individual Unit Root Process	
Value	−0.98412	−0.98695	11.3765	9.02133
Significance	0.1625	0.7837	0.3289	0.5301

Notes: * Indicate significant at 1 % significance level.

Table 5

Summary of group unit root at first difference.

Variables: L_GiNi, L_PCI, L_GSR, L_DINV, L_REXR, L_INFR, L_ROCE				
Test	LCC	IPS	ADF Fisher	PP Fisher
Null	Consider the Common Unit Root Process		Consider the individual Unit Root Process	
	−6.74293	−2.90455	22.4373	34.4285
	0.0000*	0.0018*	0.0130*	0.0002*

Notes: * Indicate significant at 1 % significance level.

Table 6

Pedroni and KAO stat panel cointegration test results.

Panel Statistics				Group Statistics	
Panel	Statistics	Probability	Group	Statistics	Probability
v-statistics	−0.038	0.005*	rho-statistics	2.408	0.002*
rho-statistics	0.939	0.826	PP-statistics	1.453	0.927
PP-statistics	−0.278	0.000*	ADF-statistics	1.270	0.008*
ADF-statistics	0.237	0.006*			
KAO statistics		T-stat			Probability
ADF		−0.509076			0.0353**

Notes: *&** Indicate significant at 1 % & 5 % significance level respectively.

3.4. Panel fully modified OLS (FMOLS) & generalized method of moments (GMM)

Though the panel data appears to be convergent, OLS regression can occasionally produce biased results. Therefore, fully-modified OLS (FMOLS) and Generalized Method of Moments (GMM) were used in this work to validate the estimates. FMOLS and GMM are frequently combined in econometric research, especially in panel data and time series analysis, to guarantee estimation robustness and dependability (Alam et al., 2021). FMOLS was used to examine long-term relationships in cointegrated panels, while GMM was more concerned with short-term dynamics, especially in first-differenced or system GMM frameworks that eliminate unit roots and fixed effects. These two methods were used in this study to complement each other by balancing long-run and short-run estimates, addressing different sources of endogeneity, and providing robustness checks. Their collaborative application assures that empirical findings are reliable and less susceptible to estimation biases. Using both methods helps to cross-validate findings since consistent findings from both methods will strengthen confidence in the model's robustness.

3.4.1. Panel fully modified OLS (FMOLS)

From the FMOLS result in Table 7, the long-run coefficient of GiNi is negative (−8.578) and statistically significant at 10 %. This implies a negative relationship between income inequality and bank profitability, showing that an increase in income inequality will reduce bank profitability in Nigeria. Also, the coefficient of PCI is negative (−6.377), and its probability value is insignificant. This shows a negative relationship

Table 7

Panel fully modified OLS (FMOLS) results.

Dependent Variable (L_ROCE)	Coefficient	Probability
L_GINI	−8.578	0.0702**
L_PCI	−6.377	0.8488
L_DINV	0.411	0.0095*
L_GSR	1.267	0.0050*
L_REXR	−2.552	0.0000*
L_INFR	−3.442	0.0226
R^2	0.65	
Long-run Variance	3.15	

Notes: * & ** Indicate significant at 5 % & 10 % significant level respectively.

between per capita income and bank profitability in Nigeria.

Furthermore, the coefficient of GSR is positive (1.267) and significant, showing that an increase in gross saving rate has a prospect of increasing bank profitability. DINV has a positive coefficient (0.411), and its probability value is significant at 5 %, implying a positive and significant relationship between direct investment and bank profitability; this is in line with the findings of Nwanji et al. (2020). REXR has a negative coefficient (−2.552), and its probability value is significant at 5 %, indicating a significantly negative relationship between real exchange rate and bank profitability. Lastly, INFR has a negative coefficient (−3.442) with an insignificant probability value, it connotes an adverse relationship between inflation rate and bank profitability.

This is unfavourable to the economy in attaining sustainable and inclusive economic growth via banking innovations and inventions since increasing income inequality has a negative effect on bank profitability. The implication of this is that the banking sector might lack adequate abilities to promote its sectorial growth and expansion, as stated in financial intermediation theory. Furthermore, the post-estimation testing shows that the equation has a good fit. The value of R^2 is 0.65 indicating that 65 % variation of bank profitability (ROCE) is jointly explained by GiNi, PCI, GSR, DINV, REXR, and INFR. Implying that the model has strong explanatory power, meaning it fits the data well. The LCC statistic is not significant at 10 %; hence, the stability of the parameters is confirmed.

3.4.2. Panel generalized method of moments (GMM)

Table 8 presents the panel GMM result. The result revealed that the GiNi coefficient has a negative and significant relationship with ROCE. This connotes that reducing income inequality will increase bank profitability in Nigeria. Also, the coefficients of PCI and DINV are positive and significant. It could be discerned from this finding that when per capita income and direct investment increase, it will cause the bank's profit to increase.

The gross saving rate (GSR) has a positive and insignificant relationship with bank profitability in Nigeria. This implies that an increased saving rate will enhance the profitability of deposit money banks in Nigeria. The result also revealed that REXR and INFR have negative coefficients, although the latter is not significant. This implies that increasing exchange rate and inflation rate has an adverse effect on bank profitability in the economy. For the GMM, the post-estimation testing demonstrates that the equation is well-fitted. The R^2 value of 0.78 indicates that GiNi, PCI, GSR, DINV, REXR and INFR jointly explain 78 % of the variation in bank profitability (ROCE). This implies that the model has great explanatory power.

3.5. Diagnostic check

The diagnostic checks in Table 9 were employed to determine if the models were appropriately specified. The residual is normally distributed since the Jarque-Bera statistic is more than 5 %. There is no serial correlation in the model, because the probability value is greater than 5 %.

Table 8
Panel GMM results.

Dependent Variable L_ROCE)	Coefficient	Probability
L_GINI	−1.618	0.0733**
L_PCI	4.008	0.0773**
L_DINV	0.226	0.6956
L_GSR	1.658	0.0539**
L_REXR	−3.196	0.0727**
L_INFR	−1.194	0.8016
R^2	0.78	
Long-run Variance	24 (0.000)*	
Instrument Rank	7	

Notes: * & ** Indicate significant at 1 % & 10 % significant level respectively.

Table 9
Residual analysis.

Histogram Normality Test	**Jarque-Bera Value**	**p-value**
	62.1898	0.0000
Heteroskedasticity Test	**Breusch-pagan Test**	**p-value**
	37.023	0.0001
Serial Correlation Test	**Breusch-Pagan LM**	**p-value**
	6.7064	0.0752

Source: Author's Computation using E-views 10

The Chi-square probability value for the heteroskedasticity test indicates that there is no ARCH effect because the likelihood value is more than 5 %. Hence, the variables are normally distributed, homoscedastic, and devoid of serial correlation. The result in Table 10 shows the AC and PAC values for autocorrelation analysis, and it revealed that the results are not significant at 1 % and 5 %.

3.5.1. Confidence eclipse/intervals

3.5.1.1. Confidence eclipse. The confidence ellipses in Fig. 3 provide a visual representation of correlation (see Fig. 2). The ellipse compresses diagonally when the correlation between two variables approaches +1 or −1 (Meloun & Militký, 2011). When there is no correlation between two variables, the confidence ellipse becomes more circular. The ellipse in Fig. 3 is somewhat more elongated, reflecting a higher correlation observed in the correlation matrix in Table 3. For the bivariate normality check, the confidence ellipses contain observations appropriate to the 90 % confidence level specified. In this case, the plots have a smooth appearance, indicating that the data is continuous, and they follow the bivariate normal distribution. This confirms a strong relationship between income inequality and bank profitability (see Fig. 4).

3.5.1.2. Confidence intervals. Table 11 presents the confidence intervals and p-values used to assess the validity of the parameter estimates. The coefficients lie within the 90 % confidence intervals, and most of the p-values are significant at the 10 % level. This confirms the efficiency of the sampling process for the model parameters. Additionally, it indicates that more than 100 uncorrelated samples have been fully estimated, providing a sufficient basis for reliable posterior inference.

4. Discussion of findings

This study examined the effect of income inequality on the profitability of deposit money banks in Nigeria. To ascertain the time series properties, the panel unit root was used. The group panel unit root results are mixed; the IPS, ADF and PP point to the presence of unit root in the group sample, but the results from LCC point to a positive relationship, indicating that the series is free from unit root at the individual level. However, the panel group test was conducted once again at the first difference I(1), and all variables became stationary. Similarly, panel cointegration was adopted to ascertain the relationship. The cointegration results were ascertained via the Pedroni and KAO tests, which confirm the long-run relationship between the variables. This aligns with the study of Alam et al. (2021) that documents a cointegrating relationship between bank performance and economic growth. But

Table 10
Test of autocorrelation.

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. *|. |	. *|. |	1	−0.116	−0.116	0.3786	0.538
. |. |	. |. |	2	0.059	0.046	0.4799	0.787
. |**. |	. |**. |	3	0.268	0.284	2.6821	0.443
. *|. |	. *|.	4	−0.143	−0.090	3.3383	0.503

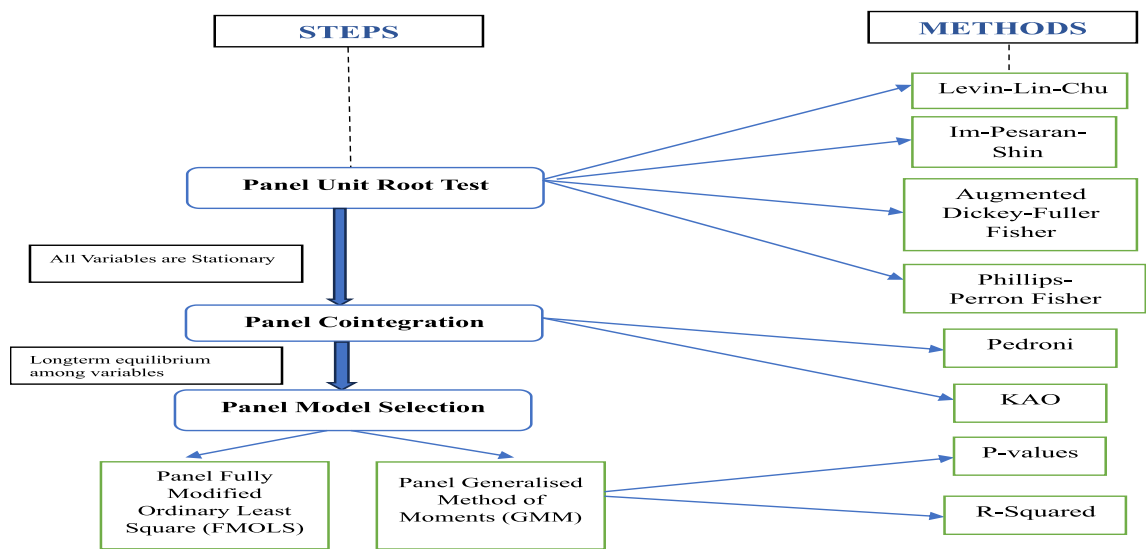**Notes**: * & ** Indicate significant at 5 % & 10 % significant level respectively.

Fig. 2. A flow chart of a panel regression model adopted in the study.
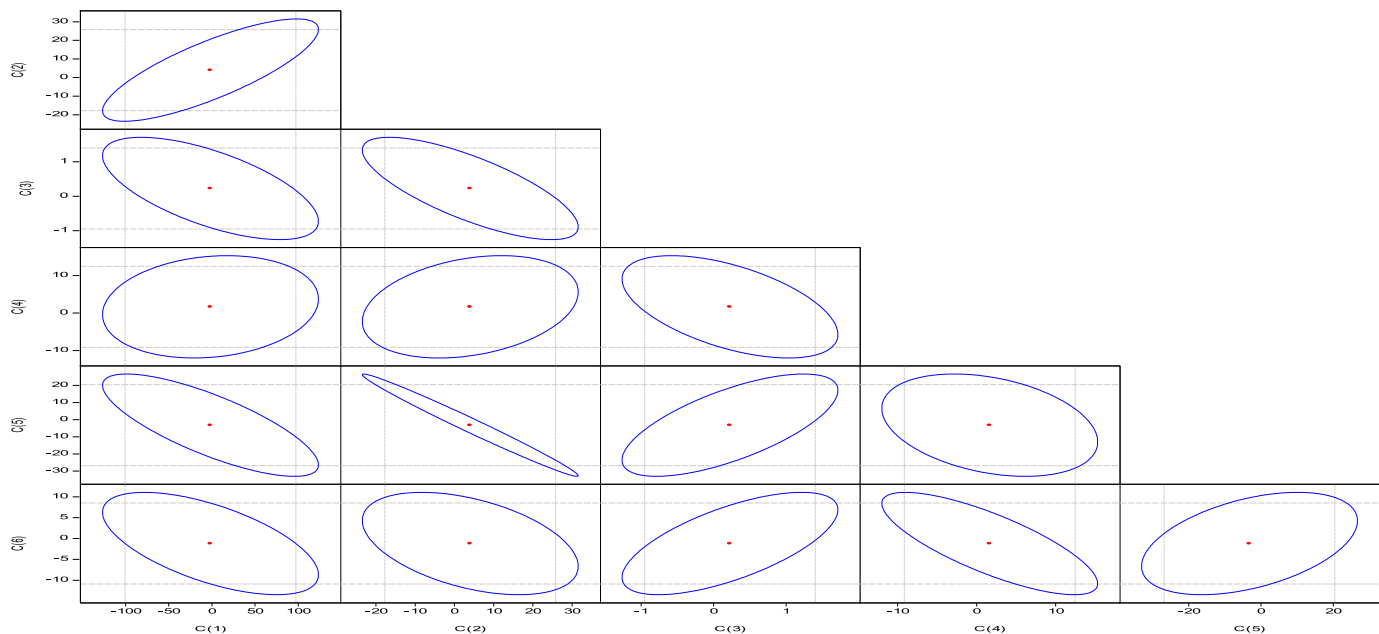Source: Author's Computation using materials online

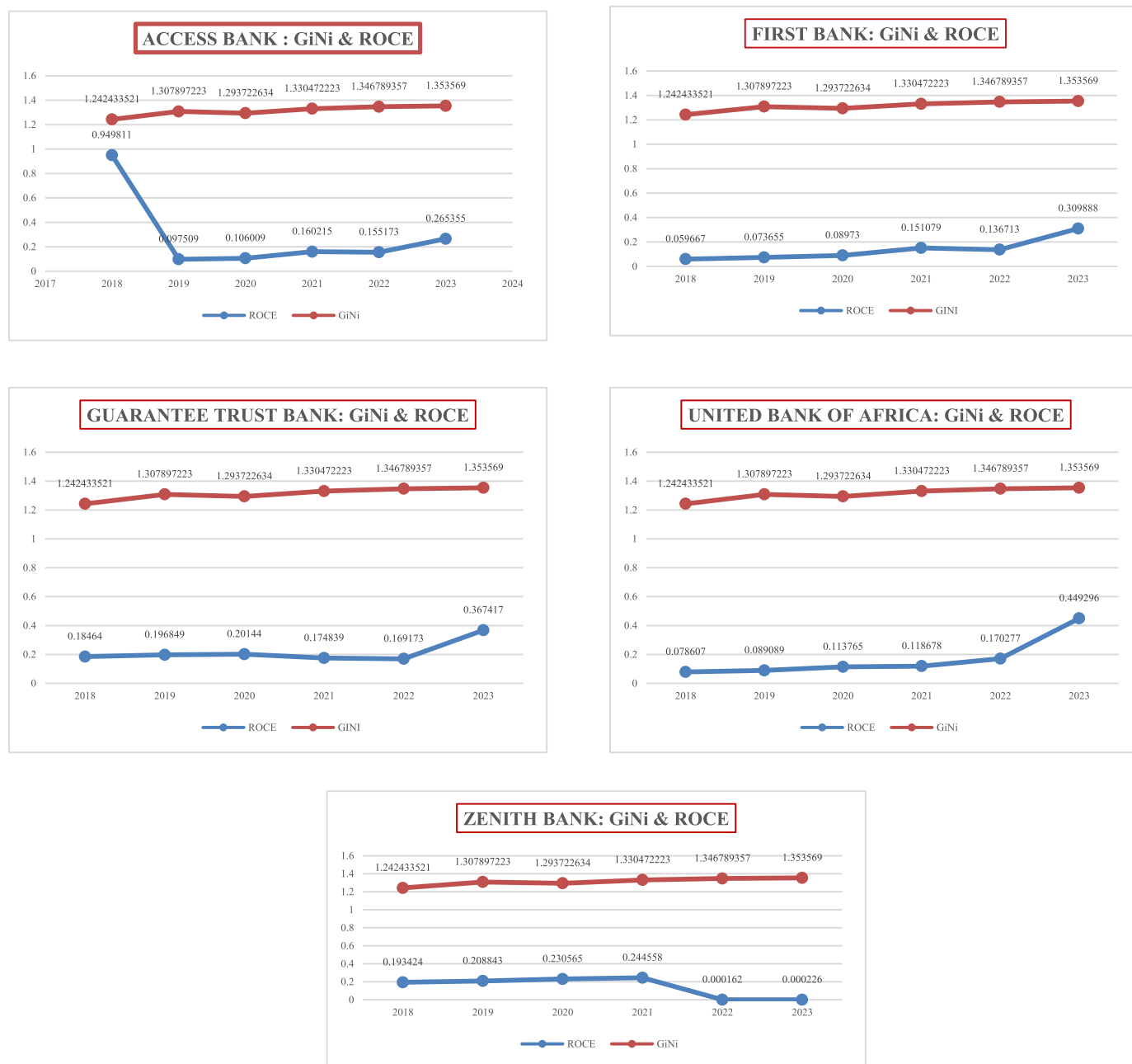**Fig. 3.** Multivariate window with confidence ellipses.

contradict the studies that documented that there is no relationship between economic growth and bank profitability (Mashamba et al., 2023).

In addition, the fully modified ordinary least square was used to estimate the coefficients and prevent the biases of OLS, the result suggests a negative relationship between income inequality and banks' profitability, implying that income inequality has an adverse effect on banks' profit; this finding is in line with the study of Mdingi (2023). The result also suggests a negative relationship between per capita income and bank profit; this contradicts the study of Miroshnichenko et al. (2022), who documented that increasing family income improves the banking sector's return on assets. However, this result is not surprising since the banks in Nigeria still make considerable profit despite the low per capita income of the majority in Nigeria.

Lastly, the panel GMM buttresses the findings of FMOLS; the result

confirms a negative relationship between income inequality and return on capital employed. Although, contrary to FMOLS, the GMM result suggests a positive relationship between PCI and bank profitability; this is in line with the study of Miroshnichenko et al. (2022), who found a positive relationship between family income and banking sector's return on assets. For both FMOLS and GMM results, gross saving rate and direct investment have a positive effect on bank profitability; this finding aligns with the study of Kjosevski (2024) and Oyewole et al. (2023), who found that the savings rate has a positive and significant impact on the economy. Lastly, the FMOL and GMM results confirm that exchange rate and inflation rate negatively affect bank profitability; this is in line with the study of Lilian et al. (2022) and Keshtgar et al. (2020).

The findings in this study revealed that increasing income inequality will not help boost sustainable growth over time since it has adverse effect on the profit of deposit money banks in Nigeria; even though per

Fig. 4. Trends of Income Inequality (GiNi) and the 5 Banks Profitability (ROCE) **In Nigeria**
ROCE is in N'million.
Source: Author's Computation Using data from World Bank, 2024 & Websites of the 5 banks considered in this study; Note:

Table 11
Confidence intervals and probability value estimates.

Variables	Coefficient	90 % CI		Probability
		Low	High	
L_GINI	−1.6179	−83.6131	80.3772	0.0733**
L_PCI	4.0087	−14.0399	22.0573	0.0773**
L_DINV	0.2258	−0.7496	1.2011	0.6956
L_GSR	1.6584	−7.2888	10.6056	0.0539**
L_REXR	−3.1961	22.7973	16.4052	0.0727**
L_INFR	−1.1941	9.2354	6.8471	0.8016

Notes: ** Indicate significant at 10 % significant level respectively.

capita income, gross saving rate, and direct investment have positive effect on bank profitability in Nigeria at some point but the ability to sustain increasing banks profitability is limited without addressing the issue of income inequality in Nigeria. This study contradicts the study of Adegboye (2019), who found a positive relationship between income inequality and productivity growth in Nigeria. But in line with the studies of Nwosa (2019), Bağlıtaş (2021), and Mo (2000) on income inequality and economic growth.

The outcome of this study has policy implications for the achievement of SDG 2 (Zero Hunger), SDG 9 (industry, innovation and infrastructure), and SDG 10 (Reduced Inequalities). First, reducing income inequality is critical to attaining SDG 2, as more fair income distribution allows for improved access to financial services for productive sectors. When banks are profitable and operate in a more inclusive economic

environment, they are more likely to provide loans and financial services to these sectors. Conversely, rising inequality diminishes banks' ability to support these vital sectors, impeding progress toward poverty reduction. Second, regarding SDG 9, deposit money banks' ability to fund industrial expansion, innovation, and infrastructure development is contingent on long-term profitability. Income inequality undermines a bank's financial stability, reducing its willingness and ability to invest in large-scale industrial and infrastructure projects. Addressing inequality will help financial institutions engage in activities that promote national development. Finally, the findings directly support SDG 10's goals (reduced inequalities). The negative impact of income inequality on bank profitability emphasizes the need for inclusive economic policies. Hence, tackling income inequality is not only a social imperative but also an economic necessity for Nigeria's banking sector and broader sustainable development.

5. Conclusion and recommendations

This study investigates the effect of income inequality on the profitability of five Nigerian deposit money banks using panel data analysis. Profitability is measured by return on capital employed, while income inequality is represented by the Gini coefficient. Other variables considered include per capita income, gross saving rate, and direct investment. The study confirms variable stationarity through panel unit root tests and establishes a long-run relationship via panel cointegration. Using FMOLS and GMM methods, the findings show that income inequality, along with the other variables, has a significant long-term effect on bank profitability.

The FMOLS results show that return on capital employed (bank profitability) has a negative and significant relationship with the Gini coefficient (income inequality) and per capita income, while it has a positive relationship with gross saving rate and direct investment. Despite the positive effects of saving and investment on profitability, they have not helped reduce income inequality, which in turn negatively affects bank profits in the long run. The panel GMM analysis supports these findings, showing that while per capita income, gross saving rate, and direct investment positively affect bank profitability, this effect remains insignificant due to increasing income inequality.

Following the findings in this study, there is a need for policy implementation to address the negative effect of income inequality on bank profitability in Nigeria. The country-wide inequality gap has worsened susceptibilities in the financial sector. The regulatory authorities and policymakers should initiate and implement more pragmatic investment strategies to reduce poverty, facilitate wealth creation and reduce income inequality. Regulators should facilitate the alignment of banking sector policies with Sustainable Development Goals (SDGs); the government should encourage collaborative strategies with banks to invest in initiatives that drive poverty reduction and reduce inequality, thereby supporting sustainable profitability through social responsibility. The government should prioritize policies that encourage household savings by maintaining macroeconomic stability, whether through a stable exchange rate or controlled inflation. Strengthening household savings in this manner will enhance overall financial stability, ultimately contributing to improved bank profitability. Additionally, promoting policy synergy amongst financial regulators, fiscal policymakers, and development agencies to implement holistic policies targeted towards macroeconomic stability will enhance income equality and bank profitability.

These recommendations are in line with the United Nations Sustainable Development Goals (SDGs), especially SDG 1 (No Poverty), SDG 9 (Indusry, Innovation, and Infracstructure), and SDG 10 (Reduced Inequality), and support Africa's Union Agenda 2063 by offering insights for economic prosperity and income equality, which are crucial for achieving sustainable economic transformation and raising bank profitability in the country. The study emphasizes the need to address these policy gaps, as doing so will promote income equality, enhance

bank profitability, and contribute to building economic resilience.

5.1. Limitations and directions for Future research

While this study found a strong relationship between income inequality and bank profitability, it is crucial to highlight that causality cannot be demonstrated using the regression approaches adopted in this study. These methods identify correlations and long-run relationships but do not show cause and effect. Future studies could employ causal inference techniques, like structural equation modelling, to better assess the direction and intensity of causal relationships. Also, the study focuses on only five deposit money banks, which may affect the generalizability of the results to the entire banking industry in Nigeria. Future research is encouraged to expand the sample size to enhance broader applicability of the findings.

Ethical statements for social sciences and humanities open journal

1. This material has not been published in whole or part elsewhere
2. This manuscript is not currently being considered for publication in another journal
3. The author has been personally and actively involved in substantive work leading to the manuscript and will hold herself responsible for its content

Declaration of competing interest

I have read and understood the policies on the declaration of interest of your reputable journal (Social Sciences and Humanities Open), and I declare that I have no conflict of interest. None.

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