

## MACROECONOMIC VARIABLES AND INCOME INEQUALITY IN SELECTED AFRICAN COUNTRIES

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### Abstract

This study examined the relationship between macroeconomic variables and income inequality in selected African countries over the period 1981 to 2023. The main objectives were to investigate the impact of national income and gross domestic product on income inequality. Using the autoregressive distributed lag (ARDL) model, the study analysed key macroeconomic indicators, including exchange rates, interest rates, employment levels, inflation, national income, gross domestic product, macroeconomic volatility, and global economic policy uncertainty. The findings indicate that stabilising exchange rates and maintaining consistent interest rates are critical for reducing income inequality, as they enhance trade competitiveness and market fairness. Employment quality and availability were found to be important determinants, with low-quality or insufficient employment contributing to rising income disparities. Inflation and global economic policy uncertainty were shown to exacerbate income inequality, disproportionately affecting poorer populations while wealthier individuals are better able to absorb economic shocks. The results underscore the importance of improving overall macroeconomic conditions and addressing systemic issues such as corruption to ensure equitable distribution of resources. The study concludes that effective macroeconomic management, combined with strategies to enhance employment, diversify economies, and promote social policies, is essential for reducing income inequality and fostering sustainable economic development across African countries.

**Keywords:** Income Inequality, Macroeconomic Variables

### 1. Introduction

Income inequality has become a global issue which withheld efforts towards achieving economic growth over the years, since it can lead to reduced overall consumption by lowering overall household income, and hinder investment in human capital, resulting in a lack of access to education, skill acquisition and reducing the overall productivity and innovation potential of the economy (Bartak & Jablonski, 2020). Income inequality has multifaceted and significant consequences on the economy. It can impede economic growth, reduce social mobility, increase social and political instability, exacerbate public health issues, and lead to higher crime rates. Income inequality often translates into unequal access to opportunities such as education,

healthcare, and employment. This can limit social mobility, perpetuating poverty across generations and reducing the potential for upward economic movement (Yildirim & Dibo, 2021). Furthermore, persistent inequality can lead to skill gaps in the labour force, when a significant portion of the population cannot afford education and training, the economy may suffer from a shortage of skilled workers (Yildirim & Dibo, 2021). Income inequality often correlates with disparities in health outcomes, mental health, and high crime rates, resulting in higher costs for policing, judicial processes, and incarceration. However, while exploring the means of addressing the high rate of income inequality, improvement in the macroeconomic variables such as exchange rate, interest rate, employment, inflation rate, national income, macroeconomic volatility and global economic policy uncertainty shouldn't be neglected (Berg et al. 2018).

Furthermore, the exchange rates can significantly influence income inequality of a country (Calvo 2001). Exchange rates influence income inequality through their effects on inflation, employment, asset values, government revenues, trade policies, foreign debt, remittances, and consumption patterns, but this depends on the specific economic context and the ability of different income groups to adapt to economic changes (Seo et al. 2020). Exchange rate changes can alter consumption patterns by affecting the relative prices of domestic and foreign goods. Higher-income households may be more capable of adjusting their spending habits and maintaining consumption levels, while lower-income households might struggle with increased costs, further widening income inequality (Shen & Zho 2022). Furthermore, since exchange rates are volatile, their volatility can make imports more expensive, leading to higher overall inflation and this would in turn make lower-income households spend a larger proportion of their income on imported goods and necessities leading to disproportionate rising prices, and high-income inequality (Shen & Zho 2022). Moreover, the rise in the exchange rate worsens the living conditions of the households, makes household decisions uncertain and deteriorates overall people's well-being (Keshin 2017) and this has led scholars to delve into enquiries into the effects of exchange rates on income inequality in their respective studies.

Furthermore, the interest rate as a key tool of monetary policy, have significant effects on income inequality, which can be direct or indirect, impacting various economic factors and sectors differently (Din et al. 2017). Interest rates have complex and multifaceted impacts on income inequality. While lower interest rates can stimulate economic activity and improve access to credit, they also tend to disproportionately benefit wealthier individuals through asset price appreciation and better access to investment opportunities (Reisinzhad 2018). Higher interest rates can increase borrowing costs for low- and middle-income individuals, making it harder for them to access credit for essential expenses like housing, education, and healthcare (Binder 2019). It can widen income inequality by increasing debt servicing costs for low- and middle-income individuals, reduce disposable income for essential expenses, lead to reduced consumer spending which results in low demand for goods and services, benefit wealthier individuals who hold more assets, widen the wealth gap between the rich and the poor, exacerbates income inequality, make it harder for low- and middle-income individuals to access

credit, exerts negative impact on businesses, leading to reduced hiring and increased unemployment, and cause low economic growth and development (Binder 2019).

In addition to this, the rate of employment in the economy can determine the rate of income inequality to a great extent. Employment provides individuals with a steady income, enabling them to meet their basic needs and improve their economic status, but lack of employment can have a wide range of effects on income inequality and the welfare of the people (Fischer et al. 2021). According to (Dolado et al. 2018), stagnant wages can lead to income inequality, as low- and middle-income individuals struggle to make ends meet. When people are gainfully employed, they can take care of their needs, save and participate in other economic activities. Furthermore, the national income has a complex relationship with income inequality, while economic growth can reduce poverty and increase social mobility, it can also exacerbate income inequality if not managed effectively (Rabiol 2017). Often, when income or wealth distribution is uneven, it can exacerbate income inequality in the country. Progressive taxation, social safety nets, labour laws, income distribution structure, economic policy and political instability are some of the highlighted factors that may result in income inequality in Africa (Merrino, 2022).

Similarly, the inflation rate is another macroeconomic variable that has several effects on income inequality. It disproportionately impacts lower-income households by eroding purchasing power, reducing the real value of savings, increasing living costs, and limiting access to credit and investment opportunities (Dolado et al. 2018). Inflation erodes the purchasing power of money, disproportionately affecting lower-income households who spend a larger portion of their income on necessities such as food, housing, and utilities, as prices rise, these households struggle more to afford basic goods and services, widening the income gap (Muhibullala & Das 2019). As such, individuals on fixed incomes, such as retirees receiving pensions or social security, may find their real income declining as inflation increases, exacerbating inequality (Galli & vander Hoes, 2000). In addition, high inflation can lead to economic uncertainty and reduced business investment, potentially increasing unemployment rates. Also, it can reduce the real value of savings, affecting lower-income households more significantly as they typically have fewer assets and rely more on savings for future security (Balcilar et al. 2018). When inflation worsens, the rate of income inequality increases as the government may introduce "bracket creep" – a progressive tax system, where individuals are pushed into higher tax brackets without a real increase in income to improve economic growth and this may be consequential to low- and middle-income earners, thereby leading to increased income inequality in the country (Dolado et al. 2018). Inflation can lead to changes in consumer behaviour, with lower-income households cutting back on discretionary spending to afford necessities, while high-income households may maintain their lifestyle by adjusting their spending patterns.

Given the above discussions, there is a great need for this timely study. According to recent stylized facts, Africa stands out as an extremely income inequality region by international standards. Africa has the highest gap between average incomes of the top 10% and incomes of the bottom 50%: average incomes of the top 10% are about 30 times higher than those of the bottom 50%, well above the value found in other extreme inequality regions (the gap is around

20x in other extreme inequality regions such as the Middle East, India or Brazil). This sheds light on the dual nature of the pan-African income distribution, with extremely low incomes at the bottom and relatively high incomes at the top (Chancel, et al. 2019). This shows that income inequality in Africa needs to be effectively investigated and this is the sole objective of this study. However, despite being widely researched by scholars such as (Adinde & Stepannie, 2017, Ali 2023, Esquivais et al. 2021, Bennani 2005, Berisha et al. 2020, Althunbas & Thornton 2022, Law & Soon 2020) among others in their respective studies, income inequality in Africa is still worsening. We examined macroeconomic variables and income inequality in Africa in this study, but our study departed from the existing knowledge in the following ways.

Firstly, this study investigates the impact of the exchange rate on income inequality given that the exchange rate could indirectly exert an influence on the level of income inequality within a country since the exchange rate changes can influence income distribution due to depreciation leading to inflation, which can affect lower-income households as essential goods become more expensive. The rationale for choosing the exchange rate as one of the macroeconomic variables stems from the fact that the exchange rate plays a crucial role in international market and investment by affecting the import and export prices of goods and services, determining the competitiveness of domestic industries, influencing the balance of trade and current accounts, determining the cost of borrowing in the international markets, determine the economic health and stability of a country, enabling the value of conversion of currency and value of transactions. Therefore, given the importance of exchange rates in addressing income inequality, we examine the effects of exchange rates on income inequality in this study.

Secondly, this study investigates the impact of interest rates on income inequality in selected African countries since it greatly determines the rate of income inequality in Africa. Interest rates can exacerbate income inequality by favouring wealthier individuals and corporations, who tend to benefit more from interest income and asset price appreciation. Conversely, lower interest rates can help reduce income inequality by making credit more accessible and boosting employment and wages for lower-income individuals. In addition, higher interest rates benefit savers and creditors, who tend to be wealthier, by increasing their interest income. It can also increase borrowing costs for consumers and businesses, disproportionately affecting lower-income individuals and small businesses, leading to higher unemployment and lower wages, and lead to lower asset prices (e.g., stocks, real estate). However, these formed the basis with which we examined the influence of interest rates on income inequality in Africa. Thirdly, this study assesses the influence of employment on income inequality given that different occupations and industries have varying wage scales, leading to income disparities. Employment factors significantly influence income inequality by creating disparities in wages, benefits, job security, and access to opportunities. Also, discrimination based on gender, racial, and ethnic segregation into lower-paying or higher-paying occupations perpetuates income inequality and can result in unequal pay for equal work (Fengler 2005) and this shows that there is a great need to study the influence of employment on income inequality.

Fourthly, this study also explores the impacts of the inflation rate on income inequality in Africa given that inflation can exacerbate income inequality by redistributing wealth, affecting price increases, wage growth, and wealth inequality, and influencing monetary policy decisions. Inflation rates cause a wide range of economic problems and worsen income inequality. It can also worsen income inequality through its effects on purchasing power, wages, savings, debt, government policies, housing affordability, consumer behaviour, business dynamics, and global economic conditions. In addition, inflation can typically raise the prices of necessities like food, housing, and utilities which makes it untenable for low-income households worsening their well-being and exposing them to economic hardship this fathomed the need to study the influence of the inflation rate on income inequality in Africa.

Fifthly, this study investigated the impacts of national income and gross domestic product on income inequality in Africa because when economic growth leads to job creation across various sectors, including agriculture and manufacturing, it can help reduce income inequality. In addition, diversified economic growth that includes improvements in education and health can have a more equitable impact on income distribution. However, while higher national income and GDP growth have the potential to reduce income inequality in Africa, the actual impact depends on the nature of the growth, sectoral contributions, labour market dynamics, public investment, and governance structures. Inclusive and equitable policies are crucial to ensuring that the benefits of economic growth are broadly shared across all segments of the population to mitigate income inequality.

Sixth, different from previous studies, this study estimated the relationship that exists between the macroeconomic variables and income inequality in selected African countries using the panel dynamic autoregressive distributed lag (ARDL) model as proposed by Pesaran et al. (2001), which is consistent with estimating both long-run and short-run impacts simultaneously. In addition, we robustly checked the findings from the ARDL model using the panel dynamic fully modified ordinary least squares (FMOLS) and panel dynamic ordinary least squares (DOLS) estimation techniques. The essence of combining these estimation techniques stems from the fact that while the ARDL estimated the long-run and short-run impacts, the FMOLS and DOLS models measure the long-run effects and also deal with some estimation issues, such as the endogeneity problem, cross-sectional dependency problem, country-specific effects, panel heterogeneity, and time invariants, using the lead and lags of the models.

## **2. Review of Related Literature**

### **Theoretical Review**

#### **2.1.1 General Theories of Income Distribution**

A theory of income distribution needs a theory that explains the prices of factors of production and factor shares that would explain the factorial distribution of income. "Most theories conceive the central problem of income distribution as the determination of the level of employment and remuneration of the factors of production, usually grouped into capital and labour. They differ

mainly in their assumptions about market behaviour and how wages and product prices are determined" (Ahluwalia and Chenery, 1983, p. 43). A theory of size income distribution needs to explain also the distribution of the ownership of factors among households (Knight, 1976). Some theories fail to go further than the functional distribution of incomes.

The classical period was characterised by focusing only on functional distribution. Adam Smith devoted his work to the causes of wealth and discussed the division of what was produced between wages, rent, and profit, but he did not develop a theory about the determinants of such distribution. David Ricardo was the one who placed the distribution of income at the centre of his thought. According to Ricardo, the Political Economy was aimed at determining the laws that rule the distribution of income (Bigsten, 1983; Ferrán, 1997). "He was the first economist to derive a meaningful income distribution theory" (Bigsten, 1983). The productive factors are land, capital and labour, and total income is distributed according to rent, profits and wages. The basic idea in Ricardian thought is that a differential rent is produced only when less fertile lands are exploited requiring more capital and/or labour leading to a rise in the price of agricultural products. As a consequence, the owners of the more fertile lands receive an increased rent. This is why Ricardo insisted that the rent increase is not a cause but a consequence of wealth (Ferrán, 1997). In the Ricardian system, distribution is before the exchange, thus income distribution does not depend on demand for final products (Bigsten, 1983).

The distribution of total income works as follows: the surplus over the production costs (output value) constitutes the rent, and the rest is distributed between profits and wages. "The Ricardian system accepts a Malthusian unlimited supply of labour at the subsistence wage in the long run; it assigns to 'profits' the residual between the marginal product of labour at a point in time and the subsistence (or institutional) wage and attributes to landlord rent the remaining residual in total output value" (Cline 1975, p. 360). Since land is not unlimited and not equally fertile, in the long run, according to this theory, the share of profits tends to fall while rent and wage shares tend to rise (more labour is required), although the real wage is kept at the subsistence level.

## 2.2 Empirical Review

In an extensive study by Bartak and Jablonski (2020), they discussed the impact of what comes from income inequality. They were primarily concerned with whether or not income inequality hurts a country's growth using the panel analysis technique. This study focused on OECD countries mainly. In this study, they found that various measures of inequality have consequences on economic growth in a nation. This study indicates that there is a negative impact of income inequality on a nation's GDP growth.

Similarly, Chang, Gupta, and Miller (2018) also look at this topic but focus just on the US from the years 1917 to 2012. Using a wavelet analysis, this study ended up finding that there is a correlation between income inequality and GDP growth. Moreover, Yıldırım and Dibo (2021) investigated the impact of income inequality on the gross domestic product under direct taxation in emerging market economies using panel data analysis. Empirical results reveal a negative long-run relationship between variables in some countries in line with the literature, despite a

positive relationship in others. Moreover, the results exhibit the negative impact of income inequality after direct taxation on the gross domestic product decreases.

To measure the effects of inflation rates on income inequality using ordinary least squares (OLS), Merrino (2022) examined wage inequality during the IT period in South Africa based on monetary policy shocks and found that the inflation rate has negative effects on equal inequality in South Africa. Similarly, Dolado et al. (2018) find that strict inflation targeting is more successful in stabilizing the economy and limiting variations in relative income shares compared to other monetary policy rules.

In another study, Zheng et al. (2023) find mixed results indicating a negative, positive, and U-shaped effect of inflation on income inequality, which explains the empirical inconsistency. The relationship between inflation and income inequality arises when the relative dominance of wealth heterogeneity to skill heterogeneity and the ratio of interest income to labour income react to prevailing inflation.

Similarly, Dilber and Hatipoğlu (2022) investigated the causality relationship between inflation and income distribution using Dumitrescu-Hurlin panel causality tests for 8 developing OECD countries spanning from 2007 to 2019. The results revealed the absence of any causal relationship in either direction between inflation and income distribution within the considered group of countries. Aktaş and Dokuzoğlu (2022) employed a panel threshold value model for 40 developed and developing countries for the years 1993-2019, highlighting that the effect of inflation on income distribution changes based on threshold values. The authors emphasised that inflation has a negative effect when below the threshold inflation level and a positive effect when above it.

More so, Emek (2019) demonstrated the negative direction of the relationship between income inequality, inflation rate, and public expenditures in a study focusing on 17 developing countries for the period 1991-2015. Goh and Law (2021) studied the same subject matter in Brazil using an NARDL model. Their results show that, in the long run, reducing income inequality will lead to a decrease in the crime rate with a greater deviation, whereas an increase in income inequality tends to lead to an increase in the crime rate with a lower deviation. Their result supports the literature that believes in a positive relationship between income inequality and crime rates.

Zandi, Rehan, Hye, Mubeen, & Abbas (2022) investigated the influence of corruption, inflation, and unemployment on income inequality using 15 years of balanced panel data from 2006 to 2020 of 12 developing Asian countries, the Random Effect Model (REM) and Generalised Method of Moments (GMM). The results reveal that corruption, inflation, and unemployment have a significant positive relationship with the GINI index; hence, they are core factors that increase the income inequality level in developing Asian countries. Odhiambo (2022) explores income inequality in Sub-Saharan African countries by using data from 2004 to 2014. This study employs GMM estimators to investigate a significant relationship among information technology (IT), economic development, and the GINI coefficient. In particular, Odhiambo (2022) considers GINI as a dependent variable which represents income inequality in the selected countries. The

results suggest a positive and significant relationship between IT and income inequality, i.e. the Gini coefficient.

Similarly, Chambers and O'Reilly (2022) select GINI to measure income inequality in the USA. The panel data from 1997 to 2015 is used to identify the relationship between income inequality and other independent variables. By using a fixed effects model, this study designates a robust relationship between the studied variables and income inequality. In the same manner, Samarina and Nguyen (2019) studied the relationship between monetary policy (including the interest rate factor) and income inequality in European countries. According to the findings, an expansionary monetary policy decreases income inequality, especially in peripheral countries. The decomposition of income equality in France was then examined by Berisha. et al. (2020) by taking the impact of interest rates into account. The analysis found a significant increase in middle-class income inequality in France. Similarly, the distribution of interest rate changes is also varied.

Furthermore, Nguyen et al. (2020) examined the relationship between corruption and income inequality in Vietnam using Ordinary Least Squares (OLS). The seven-year data from 2011 to 2018 is examined to find the relationship among selected variables. Thus, the results concluded that there is a strong relationship between corruption and income inequality. Similarly, Uzar (2020) also examined the relationship between income inequality and corruption in OECD (Organisation for Economic Cooperation and Development) countries. The results indicate a positive relationship between corruption and income inequality. The findings of Nguyen et al. (2020) and Uzar (2020) are similar to previous research by Sulemana and Kpienbaareh (2018), who explain that corruption promotes poverty by reducing the number of social services provided to the poor by the government. Bašná (2019) also examines the relationship between corruption and income inequality in 39 selected European countries. The results of the study show a positive and significant relationship between corruption and income inequality.

Esquivias, Sethi, and Iswanti (2021) investigate the relationship between unemployment and income inequality in 30 European countries. The large-scale data of 18 years i.e. from 1990 to 2008, is used to examine the relationship. The results reveal that unemployment has impact on income inequality levels in the investigated European countries. However, unemployment is the main reason that increases corruption in these countries. Similarly, Anser et al. (2020) explore the relationship between poverty (outcome of unemployment) and income inequality in the selected sixteen countries. The data set of 24 years from 1990 to 2014 is examined by employing the Generalised Method of Moments (GMM) estimator. The results show that there is no relationship between per capita income and crime rate and a U-shaped relationship between poverty and per capita income. Moreover, they explain an inverted U-shaped relationship between income inequality and economic development. Monfort et al. (2018) discuss the income inequality and unemployment patterns in Europe. The findings reveal an insignificant relationship between unemployment and income inequality. However, they suggested that the monetary policy of the country plays a vital role in increasing and decreasing income inequality levels in the country.

In another study, Ullah et al. (2022) investigated the relationship between income inequality and capital openness in selected 28 Asian countries during the period of 1970 to 2018. By employing the random effects model and GMM estimator, the results specify a significant relationship of income inequality with inflation and unemployment. Similarly, Altunbaş and Thornton (2022) investigate income inequality and its impact on inflation. The findings concluded that policymakers must adopt taxation, social safety and structural reforms to strengthen labour bargaining power.

Using state-level data, Androniceanu and Georgescu (2023) examined the dynamic relationship between income inequality and economic growth using multiple regression analysis and found that inequality shocks result in higher economic growth, lending credence to the idea that higher inequality is beneficial to economic growth in low-income nations. Talan et al. (2023) analysed data on inequality and discovered a large and significant negative correlation between inequality and economic growth in democracies. This study used panel vector autoregressive (VAR) models and annual data on income inequality at the US state level to show that changes in the Gini index have a sizable and detrimental influence on per capita income.

### 3.1 Nature and Sources of Data

To carry out the stated research objectives, this study focused mainly on examining macroeconomic variables and income inequality in selected African countries from 1981 to 2023. After reviewing the theoretical and empirical literature, we considered the following variables exchange rate (EXR), interest rate (INTR), employment (EMP), inflation rate (INFR), national income (NAI) and gross domestic product (GDP) as the measures of macroeconomic variables, while income inequality (INEQ) was measured with Gini index and we controlled for macroeconomic volatility (MEV), and global economic policy uncertainty (GEPU). The dataset is secondary data, which covers the period of 1981-2023 due to the availability of data. We sourced these data from the following sources: the World Bank’s World Development Indicators (WDI), and the global economic policy uncertainty was sourced from the economic policy uncertainty database, while macroeconomic volatility was measured by taking the standard deviation of quarterly real GDP growth for each year under study.

### 3.2 Definition of the Variables of the Model

**Table 2: Variable Meaning and Sources.**

S/N	Acronym	Description	Variable Type	Source	Apriori Expectation
1	INEQ	Income Inequality	Dependent variable	World Bank’s World Development Indicator (WDI)	To be determined
2.	EXR	Exchange Rate	Explanatory Variable	World Bank’s World Development Indicator (WDI)	Positive
3	INTR	Interest Rate	Explanatory Variable	World Bank’s World Development Indicator (WDI)	Positive
4	EMP	Employment	Explanatory Variable	World Bank’s World Development Indicator (WDI)	Positive

5	INFR	Inflation Rate	Explanatory Variable	World Bank's World Development Indicator (WDI)	Negative
6	NAI	National Income	Explanatory Variable	World Bank's World Development Indicator (WDI)	Positive
7	GDP	Gross Domestic Product	Explanatory Variable	World Bank's World Development Indicator (WDI)	Positive
8	MEV	Macroeconomic Volatility	Control Variable	Derived by taking the standard deviation of the gross domestic product (GDP)	Negative
9	GEPU	Global Economic Policy Uncertainty.	Control Variable	The Global Economic Policy Uncertainty database	Negative

Source: Author's Concept

### 3.3 Model Specifications

The baseline model – autoregressive distributed lag (ARDL) model was adopted following similar study by (Goh, Law, & Trinugroho 2022). In their study titled the “Human capital development and income inequality in Indonesia: Evidence from a nonlinear autoregressive distributed lag (NARDL) analysis”, they specified their model as follows

$$EI = f(HC, CPI, RGDP, EMP, TO, UBR) \text{----- (1)}$$

where IE stands for income inequality, HC stands for human capital, CPI stands for consumer price index, RGDP stands for real GDP per capita, EMP stands for employment, and TO and UBR stand for trade openness and urbanisation rate, respectively.

We therefore extended this model to suit our study. However, since this study aims at investigating the impact of macroeconomic variables on income inequality, we extended the Goh, Law, & Trinugroho (2022) model by measuring the income inequality with Gini index for each of the selected countries. The macroeconomic variables were measured with indicators such as with indicators such variables exchange rate (EXR), interest rate (INTR), employment (EMP), inflation rate (INFR), national income (NAI) and gross domestic product (GDP), while we controlled for macroeconomic volatility (MEV), and global economic policy uncertainty (GEPU). However, haven stated the variables; we captured the relationship that exists between the model variables in the equation below.

$$InINEQ_{t,i} = \beta_0 + \beta_1 InEXR_{t,i} + \beta_2 InINTR_{t,i} + \beta_3 InEMP_{t,i} + \beta_4 InINFR_{t,i} + \beta_5 InNAI_{t,i} + \beta_6 InGL$$

Where *In* entails that the variables are in natural logarithm,  $\beta_0$  is the constant,  $\beta_1$  to  $\beta_8$  represents the coefficients, INEQ represents the income inequality, EXR represents the exchange rate, INTR is the interest rate, EMP is the employment, INFR is the inflation rate, NAI is the national income, GDP is the gross domestic product, MEV is the macroeconomic volatility, and GEPU is

the global economic policy uncertainty. Also,  $t$  represents time, while  $\varepsilon_t$  represents the white noise error term. Specifically, the hypotheses stated in section one was modelled in a log-linear equation as follows.

**Hypothesis One** states that “there is no significant relationship between the exchange rate and income inequality in selected African countries”. Thus, the relevant linear equation that explained this relationship is expressed as follows

$$InINEQ_{t,i} = \beta_0 + \beta_1 EXR_{t,i} + \beta_2 MEV_{t,i} + \beta_3 GEP_{t,i} + \varepsilon_{t,i} \text{-----} (3)$$

**Hypothesis Two** states that “there is no significant relationship between the interest rate and income inequality in selected African countries”. Thus, the relevant linear equation that explained this relationship is expressed as follows

$$InINEQ_{t,i} = \beta_0 + \beta_1 INTR_{t,i} + \beta_2 MEV_{t,i} + \beta_3 GEP_{t,i} + \varepsilon_{t,i} \text{-----} (4)$$

**Hypothesis Three** states that “there is no significant relationship between employment and income inequality in selected African countries”. Thus, the relevant linear equation that explained this relationship is expressed as follows

$$InINEQ_{t,i} = \beta_0 + \beta_1 EMP_{t,i} + \beta_2 MEV_{t,i} + \beta_3 GEP_{t,i} + \varepsilon_{t,i} \text{-----} (5)$$

**Hypothesis Four** states that “there is no significant relationship between inflation rate and income inequality in selected African countries”. Thus, the relevant linear equation that explained this relationship is expressed as follows

$$InINEQ_{t,i} = \beta_0 + \beta_1 INFR_{t,i} + \beta_2 MEV_{t,i} + \beta_3 GEP_{t,i} + \varepsilon_{t,i} \text{-----} (6)$$

**Hypothesis Five** states that “there is no significant relationship between the national income and income inequality in selected African countries”. Thus, the relevant linear equation that explained this relationship is expressed as follows

$$InINEQ_{t,i} = \beta_0 + \beta_1 NAI_{t,i} + \beta_2 MEV_{t,i} + \beta_3 GEP_{t,i} + \varepsilon_{t,i} \text{-----} (7)$$

**Hypothesis Six** states that “there is no significant relationship between gross domestic product and income inequality in selected African countries”. Thus, the relevant linear equation that explained this relationship is expressed as follows

$$InINEQ_{t,i} = \beta_0 + \beta_1 NAI_{t,i} + \beta_2 MEV_{t,i} + \beta_3 GEP_{t,i} + \varepsilon_{t,i} \text{-----} (8)$$

Based on equations (3, 4, 5, 6, 7 and 8) above, the estimated general equation for macroeconomic variables and income inequality in selected African countries are modelled as follows

$$InINEQ_{t,i} = \beta_0 + \beta_1 InEXR_{t,i} + \beta_2 InINTR_{t,i} + \beta_3 InEMP_{t,i} + \beta_4 InINFR_{t,i} + \beta_5 InNAI_{t,i} + \beta_6 InGDP_{t,i} + \beta_7 In$$

Equation 9 above captures the general equation for estimation of macroeconomic variables and income inequality in selected African countries.

### 3.4 Technique for Analysis

#### 3.4.1 Baseline Model (Panel Autoregressive Distributed Lag Model (ARDL))

The analysis in this study was carried out by analyzing macroeconomic variables and income inequality in selected African countries using the autoregressive distributed lag (ARDL) model as the baseline model and the panel system generalized method of moment (GMM) as the robustness check model. The ARDL model was proposed by Pesaran and Shin (1995), further extended by Pesaran et al. (2001). The model for the relationships that exist between macroeconomic variables and income inequality was specified as follows.

$$InINEQ_{t,i} = \beta_0 + \beta_1 InEXR_{t,i} + \beta_2 InINTR_{t,i} + \beta_3 InEMP_{t,i} + \beta_4 InINFR_{t,i} + \beta_5 InNAI_{t,i} + \beta_6 InGDP_{t,i} + \beta_7 In$$

Where *In* entails that the variables are in natural logarithm,  $\beta_0$  is the constant,  $\beta_1$  to  $\beta_8$  represents the coefficients, INEQ represents the income inequality, EXR represents the exchange rate, INTR is the interest rate, EMP is the employment, INFR is the inflation rate, NAI is the national income, GDP is the gross domestic product, MEV is the macroeconomic volatility, and GEPU is the global economic policy uncertainty. Also, *t* represents time, while  $\epsilon_t$  represents the white noise error term. Furthermore, to investigate the cointegration between macroeconomic variables and income inequality in selected African countries, in equation 10, the researcher formulated the ARDL model framework as follows:

$$\Delta InINEQ = \beta_{01} + \sum_{t=1}^{n1} \beta_{11} \Delta InINEQ_{t-1} + \sum_{t=1}^{n2} \beta_{12} \Delta InEXR_{t-1} + \sum_{t=1}^{n3} \beta_{13} \Delta InINTR_{t-1} + \sum_{t=1}^{n4} \beta_{14} \Delta InEMP_{t-1} -$$

Where *In* entails that the variables are expressed in natural logarithm,  $\Delta$  is the first difference operator, INEQ denotes the income inequality, all other variables are as defined earlier,  $\beta_{01}$  is the constant,  $\beta_{11}$  to  $\beta_{19}$  represents short-run coefficients,  $\alpha_{11}$  to  $\alpha_{19}$  represents the long-run coefficients,  $n_1$  to  $n_{19}$  represents the lag length and  $\epsilon_{t-1}$  represents the stochastic error term in the model.

If equation 11 holds, we will estimate the existence of long-run cointegration between macroeconomic variables and income inequality in selected African countries. Thus, to estimate this relationship, tests like bounds test – a likelihood test will be utilized under the following null hypothesis:

Null Hypotheses:  $H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = \alpha_7 = \alpha_8 = \alpha_9 = 0$

Alternative Hypotheses:  $H_1: \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq \alpha_7 \neq \alpha_8 \neq \alpha_9 \neq 0$

These hypotheses were best explained by Pesaran et al. (2001). As recommended by Pesaran et al. (2001), once the existence of cointegration is established among the variables, the next step will be to estimate the error correction model (ECM). Hence, we present the error correction model from the successive long-run component of the equation as follows:

$$\Delta \ln INEQ = \beta_{01} + \sum_{t=1}^{n1} \beta_{11} \Delta \ln INEQ_{t-1} + \sum_{t=1}^{n2} \beta_{12} \Delta \ln EXR_{t-1} + \sum_{t=1}^{n3} \beta_{13} \Delta \ln INTR_{t-1} + \sum_{t=1}^{n4} \beta_{14} \Delta \ln EMP_{t-1} -$$

Where all variables are defined in the previous equations above,  $\partial$  is the coefficient of the error correction model, while  $ECT_{t-1}$  is the error correction term. In theory, it is assumed that the coefficient of the error correction model has a negative sign and is statistically significant to measure the speed of adjustment from the short-run to the long-run after a short-run disequilibrium.

To ensure that assumptions of ARDL are satisfied for the specified models, various econometric diagnostics like the normality test, Breusch-Pagan LM test, Ramsey Reset test, and White Heteroscedasticity test were carried out for the specified models. As noted by Pesaran et al. (2001) stability tests (CUSUMQ and CUSUM) are useful in checking the stability of the coefficients of the regression. The tests are updated recursively and plotted against the breakpoints. If the plot lies within the critical bounds of a 5% level of significance, then the null hypothesis of all coefficients in the given regression is stable over the period the research is being carried out.

### 3.4.2 Robustness Checks Models – FMOLS and DOLS

We further robustly checked the results from the ARDL model by using the panel fully modified ordinary least squares (FM-OLS) and panel dynamic ordinary least squares (DOLS) (McCoskey and Kao, 1998; Chiang, 2000, Phillips & Moon, 1999; and Pedroni, 2000). The FMOLS and DOLS models can take care of cross-sectional dependency as well as country-specific and heterogeneity issues. The FMOLS and DOLS are specified as follows:

$$\beta^*_{NT} - \beta_{FMOLS} = \left[ \sum_{i=1}^N L_{22t}^{-1} \sum_{t=1}^T (x_{it} - x_{it})^2 \right] \sum_{t=1}^N L_{11t}^{-1} L_{22t}^{-1} \left[ \left( \sum_{t=1}^T (x_{it} - x_t) \mu_{it}^* - T \hat{\gamma}_1 \right) \right] \text{---- (13)}$$

Note that the Dynamic OLS estimator had the same asymptotic distribution as that of the panel FMOLS estimation derived by Pedroni (1996). Both the DOLS and FMOLS estimations were performed as shown to confirm the consistency of the outcome. However, following Stock & Watson (1993), we specified the DOLS model below.

$$Y_t = \alpha + bX_t + \sum_{i=-k}^{i=k} \phi_i \Delta X_{t+i} + \varepsilon_t \text{----- (14)}$$

This model assumes that adding the lags and leads of the differenced regressors soaks up all of the long-run correlation covariance matrices of the residuals and that the least-squares estimates have the same asymptotic distribution as those obtained from FMOLS and CCR.

### 3.5 The Panel Data Estimation

In this study, the choice between fixed effects (FE) and random effects (RE) will be determined using a likelihood test—the Hausman test.

## 4. Empirical Results and Discussion of Findings

### 4.1 Descriptive Statistics

From the results, the values of the mean, median, standard deviation, Skewness and Kurtosis do not drift too much from each other. Also, the total variations in the series moved from -14.30484 to 10.61805, which represent the minimum and maximum values in the series, and the probability values of the Jarque-Bera statistics are less than 0.05, implying that the errors of the variables are normally distributed and suitable for the analysis of the relationships that are being tested in the study. Furthermore, findings also entailed that the probability value of Jarque-Bera statistics is less than 0.05, and this implies that the errors of the variables are normally distributed, which makes them suitable for estimation of the relationship between macroeconomic variables and income inequality in Africa.

**Table 2: Results of Descriptive Statistics**

	INEQ	EXR	INTR	EMP	INFR	NAI	GDP	MEV	GEPU
Mean	-4.679126	-4.440698	0.453335	0.670083	-0.121962	-0.157309	0.519522	2.413450	-1.246391
Median	-3.794946	-3.616873	0.649042	0.223892	0.046534	0.000000	0.689610	3.663359	-0.915411
Maximum	3.710258	2.956166	3.782302	10.61805	4.148717	4.944287	6.611017	6.182474	0.201797
Minimum	-14.30484	-12.05143	-5.630171	-7.397082	-8.271970	-5.763951	-6.295953	-6.295953	-8.745165
Std. Dev.	2.692982	1.735884	1.327281	2.749679	1.364100	1.188603	2.334780	2.741641	1.300543
Skewness	-0.688892	-0.274476	-0.805236	0.356170	-0.889617	-1.037948	-0.354779	-0.898141	-1.541851
Kurtosis	3.284512	3.212474	4.235515	3.143011	5.723724	6.074680	2.492135	2.689283	6.551198
Jarque-Bera	157.1018	27.04092	173.7316	37.08354	568.0268	911.2255	58.40574	261.4228	341.0202
Probability	0.000000	0.000001	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	1905	1873	1012	1686	1288	1589	1841	1888	370

Source: Conceived by the Researcher. Note: INEQ=income inequality, EXR=exchange rate, INTR=interest rate, EMP=employment, INFR=inflation rate, NAI=national income, GDP=gross domestic product, MEV=macroeconomic volatility, and GEPU=global economic policy uncertainty.

### 4.2 Testing for Correlations

The guiding principle for this test is that if the rank is between 0 to  $\pm 0.20$  there is no correlation, if the rank is between  $\pm 0.21$  to  $\pm 0.40$  there is weak, if the ranking is between  $\pm 0.41$  to  $\pm 0.60$  we say the correlation is moderate, if the rank is between  $\pm 0.61$  to  $0.80$  there is strong correlation, and if the rank is between  $\pm 0.81$  to  $\pm 1.00$  is considered very strong correlation.

Findings from the results of the correlation test revealed that the exchange rate (EXR) had strong negative correlations with the income inequality in Africa. Similarly, the interest rate (INTR) and the employment (EMP) had moderate and strong negative correlations with the income inequality in Africa. On the contrary, we found that inflation rate (INFR) has strong positive correlations with the income inequality in Africa. Findings also shows that the national income (NAI) has moderate negative correlations with the income inequality in Africa and this is similar to the gross domestic product (GDP) which has strong negative correlations with the income inequality in Africa, while the results also revealed that macroeconomic volatility (MEV), and global economic policy uncertainty (GEPU) have strong and moderate negative correlations respectively with the income inequality in Africa.

**Table 3: Results of Spearman’s Correlation Test**

	INEQ	EXR	INTR	EMP	INFR	NAI	GDP	MEV	GEPU
INEQ	1								
EXR	-0.756037	1							
INTR	-0.578631	-0.950446	1						
EMP	-0.750352	0.067280	-0.007594	1					
INFR	0.641464	-0.782869	0.006922	-0.030073	1				
NAI	-0.577228	0.000719	-0.055713	-0.003560	0.311992	1			
GDP	-0.732815	0.924201	-0.022711	-0.028349	-0.051635	-0.041641	1		
MEV	-0.713636	0.742601	-0.010818	0.694291	-0.477933	-0.010389	-0.189609	1	
GEPU	-0.580406	-0.763758	-0.280520	0.077771	-0.801044	0.053348	-0.032790	-0.118742	1

Source: Conceived by the Researcher. Note: INEQ=income inequality, EXR=exchange rate, INTR=interest rate, EMP=employment, INFR=inflation rate, NAI=national income, GDP=gross domestic product, MEV=macroeconomic volatility, and GEPU=global economic policy uncertainty.

### 4.3 Testing for Stationarity

To test for stationarity, the researcher employed four panel unit root tests, namely, Levine, Lin and Chu (2002) – LLC test, Im, Pesaran and Shin (2003) – IPS unit root tests, Fisher-ADF and Fisher-PP unit root tests.

**Table 4: Results of Unit Root Tests**

Variable	LLC	IPS	Fisher-ADF	Fisher-PP	Order of Integration	
					Level	First Diff.
INEQ	-40.6873*** (0.0000)	-37.5208*** (0.0000)	1142.72*** (0.0000)	1169.36*** (0.0000)	–	I(1)
EXR	-8.09175*** (0.0000)	-12.6059*** (0.0000)	374.741*** (0.0000)	359.524*** (0.0000)	I(0)	–
INTR	-66.3607*** (0.0000)	-62.3118*** (0.0000)	1791.83*** (0.0000)	1191.24*** (0.0000)	I(0)	–
EMP	-2.61565** (0.0045)	-6.91967*** (0.0000)	253.084*** (0.0000)	271.546*** (0.0000)	I(0)	–
INFR	-8.38475*** (0.0000)	-13.5190*** (0.0000)	407.886*** (0.0000)	426.999*** (0.0000)	I(0)	–
NAI	-14.3110*** (0.0000)	-17.0242*** (0.0000)	497.049*** (0.0000)	494.963*** (0.0000)	I(0)	–

GDP	-3.75910*** (0.0001)	-5.87192*** (0.0000)	206.637*** (0.0000)	212.843*** (0.0000)	I(0)	–
MEV	-48.4634*** (0.0000)	-46.0505*** (0.0000)	1410.37*** (0.0000)	1421.05*** (0.0000)	–	I(1)
GEPU	-45.1587*** (0.0000)	-43.6924*** (0.0000)	1330.43*** (0.0000)	1360.00*** (0.0000)	–	I(1)

Source: Conceived by the Researcher. Note: \*\*\*, \*\* and \* represents 1%, 5% and 10% level of significance, while (.) is the probability value

Findings from the results of the estimated unit root tests shows that there is no evidence of unit root in the series since the probability values of the estimated unit root tests for LLC, IPS, Fisher-ADF, and Fisher-PP. Also, we discovered that while some of the variables are integrated of order I(0) – (Level), other variables are integrated of order I(1) – (first difference), but no variable was found to integrate at integration order – I(2) and above.

#### 4.4 Testing for Cointegration

We furthered our investigations by employing two panel cointegration tests – Pedroni (2004) for test for cointegration and Kao (1999) for robustness check for the purpose of investigating the existence of cointegration between macroeconomic variables and income inequality in selected African countries. The Pedroni Cointegration test was built under the null hypothesis of “no cointegration” and decision rule was to “reject the null hypothesis if the probability value is less than 0.05 otherwise do not reject”. However, below in Table 5 are the estimated results of both Pedroni and Kao Cointegration tests.

From the results of the estimated Pedroni Cointegration test, we found that 6 out of 7 Pedroni tests of Between-Dimension and Within-Dimension have probability values less than 0.05 in all the estimated models. This implies that the null hypothesis “no cointegration” be rejected and therefore we conclude that there is existence of cointegration between macroeconomic variables and income inequality in Africa. In addition, we robust checked these results by conducting Kao (1999) cointegration test and discovered existence of cointegration between macroeconomic variables and income inequality since the probability values of the ADF-Statistic for all estimated models are less than 0.05, therefore we conclude that there is existence of cointegration between macroeconomic variables and income inequality in Africa.

**Table 5: Results of Cointegration Tests**

Test	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<b>Within Dimension</b>						
Panel v-Statistic	4.371732*** (0.0000)	4.907055*** (0.0000)	5.971240*** (0.0000)	5.132138*** (0.0000)	5.279503*** (0.0000)	3.679914*** (0.0001)
Panel rho-Statistic	-2.902271*** (0.0019)	-2.390459*** (0.0084)	-2.815303*** (0.0024)	-2.961140*** (0.0015)	-2.635422*** (0.0042)	-1.948322** (0.0257)
Panel PP-Statistic	-4.097904*** (0.0000)	-3.720070*** (0.0001)	-4.244508*** (0.0000)	-4.758355*** (0.0000)	-3.938348*** (0.0000)	-3.141514*** (0.0008)
Panel ADF-Statistic	-1.331387** (0.0315)	-2.868731*** (0.0021)	-3.357416*** (0.0004)	-1.972126** (0.0243)	-3.113513*** (0.0009)	0.249411 (0.5985)
<b>Between Dimension</b>						
Group rho-Statistic	2.220845***	4.421764***	2.225268	2.391690***	2.444401***	2.674705***

	(0.0068)	(0.0000)	(0.9870)	(0.0016)	(0.0027)	(0.0063)
Group PP-Statistic	-0.107672 (0.4571)	3.001593*** (0.0007)	-6.407614*** (0.0000)	0.051990 (0.5207)	19.43245*** (0.0000)	6.654328*** (0.0000)
Group ADF-Statistic	3.104675*** (0.0017)	3.497115*** (0.0004)	8.304845*** (0.0000)	2.804047*** (0.0005)	0.935578 (0.8253)	3.339136** (0.0106)
Robustness Checks – KAO Cointegration Test						
ADF-Statistics	-2.304265** (0.0106)	9.216669*** (0.0000)	-7.732953*** (0.0000)	-2.619178*** (0.0044)	-2.301961*** (0.0007)	-11.23816*** (0.0000)

Source: Conceived by the Researcher. Note: \*\*\*, \*\* and \* represents 1%, 5% and 10% level of significance, while (.) is the probability value

#### 4.5 Baseline ARDL (p, q, ..., q) Analysis

To explore the impacts of macroeconomic variables on income inequality in Africa, we employed the panel autoregressive distributed lag model (ARDL) which is efficient in measuring long-run and short-run impacts simultaneously. Before the estimations, we ensured that each of the specified models passed through some basic econometric tests such as the normality test, Breusch-Godfrey Serial Correlation LM Test, Ramsey Reset test and White Heteroscedasticity test to fulfill the basic assumptions of econometric model. Findings from the results revealed that the errors of the models are normally distributed, serially uncorrelated and homoscedastic, while the results of the Ramsey model specification test for the specified models shows that the models are specified correctly (See Table 6). Furthermore, to choose the most suitable model for the analysis between the fixed effects model and random effects model for the specified models, we employed a likelihood test – the Hausman test. The Hausman’s test guiding principle states that if the probability value is less than 0.05, it implies that the fixed effects (FE) model is suitable for the analysis, on the other hand, if the probability value of the hausman test is greater than 0.05, we select the random effects (RE) model as the suitable model for the analysis. Thus, from the estimated Hausman test results for the specified models, it suggests that since the probability value for models 1 – 5 are greater than 0.05, random effects (RE) models are suitable for their estimations, while the fixed effects (FE) is suitable for estimation of model 6. Worthy to note that the researcher employed various macroeconomic variables such as the exchange rate (EXR), interest rate (INTR), employment (EMP), inflation rate (INFR), national income (NAI) and gross domestic product (GDP) to effectively capture the effects of macroeconomic variables. Furthermore, to avert the problem of multicollinearity in the model, we ensured that the macroeconomic variables did not enter into the models at once and this gave birth to models 1 to 6 as presented in Table 6 below.

Evidence from the result findings of model 1 revealed that the past value of income inequality (INEQ) negatively contributed to the current values of income inequality in Africa. Furthermore, the researcher discovered that the exchange rate (EXR) had a negative and significant impact of -0.238548 on the income inequality in Africa and this implies that a unit rise in the exchange rate (EXR) would lead to about -0.238548 decreases in the income inequality in Africa. Relatedly, macroeconomic volatility (MEV) has significant negative impacts of -0.034653 on the income

inequality in Africa and this implied that when there is a rise in the macroeconomic volatility, it would lead to decreasing the income inequality in Africa by -0.034653 magnitudes; but the global economic policy uncertainty (GEPU) had a positive and significant impact of 1.113090 on the income inequality in Africa which implies that a unit rise in the global economic policy uncertainty would cause the income inequality to increase by the magnitude of 1.113090 in Africa.

From model 2, it was discovered that the past values of the income inequality (INEQ) has significant negative impacts on the current values of income inequality (INEQ) in Africa. It was further discovered that the interest rate (INTR) had insignificant negative impacts of -0.018592 and this implies that a unit increase in the interest rate (INTR) will not have significant impact on the income inequality in Africa. We further discovered that the macroeconomic volatility (MEV) has significant negative impact of -0.025874 on the income inequality in Africa. This shows that a unit rise in the macroeconomic volatility would lead to decrease in the income inequality by -0.025874 magnitudes in Africa. Similarly, we found that the global economic policy uncertainty (GEPU) has significant negative impact of -0.809195 on the income inequality in Africa. This means that a unit increase in the global economic policy uncertainty (GEPU) would lead to decreasing the income inequality in Africa by -0.809195 magnitudes.

From the perspectives of model 3 findings, the researcher discovered that the past values of income inequality (INEQ) has a significant negative contribution to the current values of income inequality in Africa. Contrary to this, it was discovered that the employment (EMP) has a positive and significant impact of 0.256826 on the income inequality and this means that a unit rise in the employment (EMP) would lead to about 0.256826 increases in the income inequality in Africa. Different findings were made from the macroeconomic volatility (MEV) which portrayed a negative and significant impact of -0.035833 on the income inequality in Africa. And this implied that a unit rise in the macroeconomic volatility (MEV) would lead to decreasing the income inequality by -0.035833 magnitudes in Africa, while global economic policy uncertainty (GEPU) has significant positive impact of 0.902123 on the income inequality in Africa and this implies that a unit rise in the global economic policy uncertainty (GEPU) would lead to decreasing the income inequality by 0.902123 magnitudes in Africa.

Evidence from the estimated results of model 4 revealed that the past value of income inequality (INEQ) has negative but insignificant impacts on the current values of income inequality in Africa. Similarly, we found that the inflation rate (INFR) has positive and insignificant impacts of 0.164829 on the income inequality in Africa. This implied that a unit rise in the inflation rate will not have significant impact on the income inequality in Africa. Contrary, we discovered that the macroeconomic volatility (MEV) had significant negative impacts of -0.036731 on the income inequality in Africa. This means that a unit rise in the macroeconomic policy uncertainty would cause about -0.036731 decrease in the income inequality in Africa. Similarly, the results revealed that the global economic policy uncertainty (GEPU) had significant negative impacts of -2.262023 on the income inequality and this means that a unit rise in the global economic policy

uncertainty (GEPU) would lead to decreasing the income inequality by -2.262023 magnitudes in Africa.

Findings from model 5 shows that the past values of the income inequality (INEQ) negatively and significantly contributed to the current values of income inequality in Africa. Furthermore, it was found that the national income (NAI) has significant positive impacts of 0.571012 on the income inequality in Africa. However, this implies that a unit rise in the national income (NAI) would lead to increasing the income inequality by 0.571012 magnitudes in Africa. Furthermore, the macroeconomic volatility (MEV) had significant negative impact of -0.032467 on the income inequality in Africa and this means that a unit rise in the macroeconomic volatility would cause about -0.032467 decreases in the income inequality in Africa. It was also discovered that the global economic policy uncertainty (GEPU) had significant positive impact of 0.542073 on the income inequality in Africa. This implies that a unit rise in the global economic policy uncertainty (GEPU) would cause about 0.542073 increases in the income inequality in Africa.

From model 6, we found that the past values of the income inequality (INEQ) has significant negative impacts on the current values of income inequality in Africa. This shows that it caused a decreasing impact of -0.014875 on the current values in Africa. We further discovered that the gross domestic product (GDP) has a significant positive impact of 0.111494 on the income inequality in Africa and this implied that a unit rise in the gross domestic product (GDP) would lead to about 0.111494 increases in the income inequality in Africa. Similarly, we found that macroeconomic volatility has significant positive impact of 0.009412 on the income inequality in Africa. This shows that a unit rise in the macroeconomic volatility (MEV) would lead to about 0.009412 increases in the income inequality in Africa. On the contrary, we also discovered that the global economic policy uncertainty (GEPU) had significant negative impact of -0.000823 on the income inequality in Africa. This implies that a unit rise in the global economic policy uncertainty (GEPU) would lead to about -0.000823 decreases in the income inequality in Africa. These findings are in correspondence with the prior findings from previous findings from scholars such as (Banfak & Jablonki 2020, Dwiputri et al. 2018, Esquivias et al. 2021, Calvo 2001, Bannani 2005, Klein 2013, Galli & Hoeven 2001, Law & Soon 2020, Yildirim & Dibo 2021, Berg et al. 2018, Rabiol 2017, Merrino 2022, Chang et al. 2018, Adindu & Chisom, 2017, Keshin, 2017).

**Table 6: Estimated ARDL Results**

Variable	1	2	3	4	5	6
INEQ (-1)	-33.80675*** (0.0000)	-91.16428*** (0.0000)	-37.14633*** (0.0000)	-0.775667 (0.1397)	-82.23949*** (0.0000)	-0.014875*** (0.0093)
EXR	-0.238548*** (0.0014)					
INTR		-0.018592 (0.7984)				
EMP			0.256826*** (0.0000)			
INFR				0.164829 (0.0856)		

NAI					0.571012*** (0.0029)	
GDP						0.111494*** (0.0000)
MEV	-0.034653*** (0.0000)	-0.025874*** (0.0001)	-0.035833*** (0.0000)	-0.036731*** (0.0000)	-0.032467*** (0.0000)	0.009412*** (0.0000)
GEPU	1.113090*** (0.0006)	-0.809195*** (0.0003)	0.902123** (0.0148)	-2.262023*** (0.0000)	0.542073** (0.0398)	-0.000823** (0.0171)
No of Obs.	1801	1801	1801	1801	1801	1801
Normality	38.5118 (0.000)	269.2418 (0.0000)	266.3596 (0.0000)	62.37232 (0.0000)	49.27036 (0.0000)	138.7478 (0.0000)
Serial Corr	0.441123 (0.5473)	0.055994 (0.4587)	0.431413 (0.5642)	0.915287 (0.4497)	7.601188 (0.5772)	0.035341 (0.7589)
Ramsey	0.160328 (0.0000)	-0.062154 (0.0055)	0.160800 (0.0000)	0.160307 (0.0000)	0.158896 (0.0000)	0.135290 (0.0000)
Het.	1.244384 (0.4721)	0.221803 (0.8779)	2.693138 (0.5589)	0.773303 (0.8874)	1.906141 (0.8700)	0.457243 (0.6657)
Hausman	3.135864 (0.5354)	7.284023 (0.1216)	8.041133 (0.0901)	7.706738 (0.1029)	7.935255 (0.0940)	12.817704 (0.0122)

Source: Conceived by the Researcher. Note: \*\*\*, \*\* and \* represent 1%, 5% and 10% levels of significance, while (.) represent the probability values

#### 4.6 Short-Run Dynamics

The long-run successive component of the ARDL model was estimated haven found that there is existence of long-run relationship between macroeconomic variables and income inequality in Africa and the results were presented in Table 7. However, according to Pesaran et al. (2001) it is assumed that in the short-run, the coefficient of the error correction model (ECM) must possess negative signs and are statistically significant to be able to measure the dynamics of the short-run dynamics. Thus, we estimated the ARDL error correction model according to country’s income classes as in the previous sections. Findings suggests that the coefficients of the error correction model (ECM) across the models 1 – 6 measured the speed of adjustments from the long-run at various pace respectively in Africa. These findings are synonymous with previous findings of (Banfak & Jablonki 2020, Dwiputri et al. 2018, Esquivias et al. 2021, Calvo 2001, Bannani 2005, Klein 2013, Galli & Hoeven 2001, Law & Soon 2020, Yildirim & Dibo 2021, Berg et al. 2018, Rabiol 2017, Merrino 2022, Chang et al. 2018, Adindu & Chisom, 2017, Keshin, 2017) among others.

**Table 7: Estimated Results of Short-Run Impacts**

Variable	1	2	3	4	5	6
ECM (-1)	-0.036400** (0.0451)	-0.024612*** (0.0043)	-0.034539** (0.0375)	-0.133839*** (0.0083)	-0.024983** (0.0154)	-0.114279*** (0.0003)
EXR	-164.4667 (0.1194)					
INTR		-181.7185 (0.1477)				
EMP			-135.2510 (0.1293)			
INFR				-129.3079 (0.1065)		

NAI					-154.6206 (0.1203)	
GDP						-77.92813 (0.1299)
MEV	0.186114*** (0.0000)	-0.001581 (0.7558)	-0.002953** (0.0219)	0.063029*** (0.0018)	0.345015*** (0.0000)	-0.577996*** (0.0003)
GEPU	-0.055382 (0.1564)	-0.049285 (0.2264)	-0.439578*** (0.0000)	0.036788 (0.3390)	0.016479 (0.1173)	-0.057316 (0.1521)

Source: Conceived by the Researcher. Note: \*\*\*, \*\* and \* represent 1%, 5% and 10% levels of significance, while (.) represent the probability values

#### 4.7 Robustness Check – FMOLS and DOLS

After estimating the ARDL results and discovering that there is existence of a significant relationship between macroeconomic variables and income inequality in Africa, we re-estimated the specified models using the panel fully modified ordinary least squares (FMOLS) and panel dynamic ordinary least squares (DOLS). However, the FMOLS and DOLS are consistent in taking care of endogeneity issues, cross-sectional dependency issues, country-specific effects, and country heterogeneity which would lead to obtaining inconsistent results if not properly handled. However, having seen that the ARDL model was incapacitated in addressing the above-mentioned issues, the FMOLS and DOLS can take of the above issues to give consistent results. In addition, the robustness check was also carried out to ascertain if there could be any further changes in the relationship that exists between macroeconomic variables and income inequality in Africa. To avoid ambiguity, we presented each of the FMOLS and DOLS results in separate tables and carry out their analysis differently in the preceding sections.

##### 4.7.1 Analysis for Panel Fully Modified Ordinary Least Squares (FMOLS)

Deepening our analysis to further ascertain if there are further changes macroeconomic variables would bring on the income inequality in Africa, we employed the panel fully modified ordinary least squares (FMOLS) and the results are presented in Table 8 below. From the results of model 1, it was discovered that the past of the income inequality positively and significantly contributed to the current values of income inequality in Africa. Further findings show that the exchange rate (EXR) has significant negative effects of 0.271207 on the income inequality in Africa, but the macroeconomic volatility (MEV) had positive and significant effects of 0.028429 on the income inequality in Africa, while the global economic policy uncertainty (GEPU) portrayed significant positive effects of 1.772915 on the income inequality in Africa.

Findings from model 2 shows that the past values of income inequality positively contributed to the past values of income inequality in Africa. On the contrary, it was discovered that the interest rate (INTR) had a significant effect of -0.438483 on the income inequality in Africa and this means that an increase in the interest rate (INTR) would lead to about -0.438483 decreases in the income inequality in Africa. Moreover, the coefficient of macroeconomic volatility (-0.003149) shows that it does not have significant effects on the income inequality in Africa, but the global economic policy uncertainty (GEPU) has significant negative effects of -0.534687 on the income

inequality in Africa. This implies that a unit rise in the global economic policy uncertainty (GEPU) would lead to about -0.534687 decreases in the income inequality in Africa.

Furthermore, excerpt from model 3 results revealed that the past values of the income inequality has significant positive effects on the current values of income inequality in Africa. In addition, we found that employment (EMP) has significant effects of -0.056210 on the income inequality in Africa. This implied that a unit rise in the employment (EMP) would result to about -0.056210 in income inequality in Africa. Similarly, we found that the macroeconomic volatility (MEV) has significant negative effects of -0.027920 on the income inequality in Africa and this further entails that a unit rise in the macroeconomic volatility (MEV) would lead to about -0.027920 decreases in the income inequality in Africa all things being equal, but the global economic policy uncertainty (GEPU) had positive and significant effects of 1.799667 on the income inequality in Africa and this means that a unit rise in the global economic policy uncertainty (GEPU) would lead to about 1.799667 increases in the income inequality in Africa.

As found from model 4, the past values of income inequality (INEQ) positively and significantly contributed to the current values of the income inequality in Africa. Findings also shows that inflation rate (INFR) has significant negative effects of -0.128458 on the income inequality in Africa. This implied that a rise in the inflation rate (INFR) would lead to about -0.128458 decreases in the income inequality in Africa. Furthermore, it was discovered that the macroeconomic volatility (MEV) showed significant negative effects of -0.027235 on the income inequality in Africa. And this implies that a unit rise in the macroeconomic volatility (MEV) would lead about -0.027235 decreases in the income inequality in Africa. On the contrary, we found that the global economic policy uncertainty (GEPU) has significant positive effects of 1.607885 on the income inequality in Africa, which implies that a unit rise in the global economic policy uncertainty (GEPU) result to about 1.607885 increases in the income inequality in Africa.

In addition, we found that the past value of income inequality positively and significantly contributed to the current values of income inequality in Africa in mode 5. We also found that the national income (NAI) has significant negative effects of -0.167138 on the income inequality in Africa, and this suggest that a unit increase in the national income (NAI) would lead to about -0.167138 decreases in the income inequality in Africa. More so, the researcher found that macroeconomic volatility (MEV) had significant negative effects of -0.027630 on the income inequality in Africa and this implies that a unit rise in the macroeconomic volatility (MEV) would lead to about -0.027630 decreases on the income inequality in Africa, while the global economic policy uncertainty (GEPU) portrayed significant positive effects of 1.733548 on the income inequality in Africa and this shows that a unit rise in the global economic policy uncertainty (GEPU) would lead to about 1.733548 increases in the income inequality in Africa.

Lastly, from model 6, we found that the past values of income inequality positively and significantly contributed to the current values of income inequality in Africa. It was further discovered from the results that gross domestic product (GDP) has negative and significant

effects of -0.034624 on the income inequality in Africa, thus, this shows that a unit rise in gross domestic product (GDP) would lead to decreasing the income inequality with about -0.034624 magnitudes in Africa. Furthermore, the macroeconomic policy uncertainty (GEPU) portrayed significant negative effects of -0.028914 on the income inequality in Africa, which means that a unit rise in the global economic policy uncertainty (GEPU) will lead to about -0.028914 decreases in the income inequality in Africa.

Furthermore, the R-squared – measure of goodness of fit for all the models shows that over 50% of the total variation in the income inequality were explained by the explanatory variables (macroeconomic variables and control variables) for model 1 – 6. However, these findings are in line with previous finding made by scholars such as (Banfak & Jablonki 2020, Dwiputri et al. 2018, Esquivias et al. 2021, Calvo 2001, Bannani 2005, Klein 2013, Galli & Hoeven 2001, Law & Soon 2020, Yildirim & Dibo 2021, Berg et al. 2018, Rabiol 2017, Merrino 2022, Chang et al. 2018, Adindu & Chisom, 2017, Keshin, 2017) among others.

**Table 8: Estimated FMOLS Results**

Variable	1	2	3	4	5	6
INEQ (-1)	0.271207*** (0.0001)	0.350008*** (0.0000)	0.270786*** (0.0001)	0.238352*** (0.0007)	0.273559*** (0.0001)	0.266251*** (0.0001)
EXR	-0.438542*** (0.0000)					
INTR		-0.438483*** (0.0000)				
EMP			-0.056210*** (0.0000)			
INFR				-0.128458*** (0.0051)		
NAI					-0.167138*** (0.0000)	
GDP						-0.034624*** (0.0000)
MEV	0.028429*** (0.0000)	-0.003149 (0.1729)	-0.027920*** (0.0000)	-0.027235*** (0.0000)	-0.027630*** (0.0000)	-0.028914*** (0.0000)
GEPU	1.772915*** (0.0000)	-0.534687*** (0.0000)	1.799667*** (0.0000)	1.607885*** (0.0000)	1.733548*** (0.0000)	1.492381*** (0.0000)
No of Obs.	1860	1860	1860	1860	1860	1860
R-squared	0.588202	0.506308	0.872963	0.843086	0.872585	0.511676

Source: Conceived by the Researcher. Note: \*\*\*, \*\* and \* represent 1%, 5% and 10% levels of significance, while the probability values

#### 4.7.2 Analysis for Panel Dynamic Ordinary Least Squares (DOLS)

From the DOLS perspective, the specified models were estimated and the results were presented in Table 9 below. Findings from model 1 shows that the past values of income inequality (INEQ) positively and significantly influence the current values of income inequality in Africa. On the contrary, the exchange rate (EXR) was found to portray significant negative effects of -0.002947 on the income inequality in Africa. This shows that a unit rise in the exchange rate (EXR) caused about -0.002947 decreases in the income inequality in Africa. In addition, we found that

macroeconomic volatility (MEV) has significant negative effects of -0.027634 on the income inequality in Africa. This shows that a unit rise in the macroeconomic volatility (MEV) would lead to decreasing the income inequality by -0.027634 magnitudes in Africa, while on the contrary, the global economic policy uncertainty (GEPU) portrayed significant positive effects of 1.649984 on the income inequality and this means that unit rise in the global economic policy uncertainty (GEPU) would result to increasing income inequality of Africa by 1.649984 magnitudes.

From model 2, we discovered that the past values of income inequality showed a positive and significant effects on the current values of income inequality in Africa. It was further discovered that the interest rate (INTR) has a significant negative effect of -0.004074 which means that a unit rise in the interest rate (INTR) would lead to decreasing the income inequality in Africa by -0.004074 magnitudes in Africa. Further findings revealed that macroeconomic volatility (MEV) has an insignificant effect on the income inequality in Africa and this means that increasing macroeconomic policy uncertainty by one unit would not bring any significant effects on the income inequality in Africa; while the global economic policy uncertainty (GEPU) has significant negative effects of -0.438483 on the income inequality in Africa. This shows that a unit rise in the global economic policy uncertainty (GEPU) would bring about -0.438483 decreases on the income inequality in Africa.

Findings from model 3 shows that the past value of income inequality has a significant and positive effects on the current values of income inequality in Africa. We also found that employment (EMP) has significant negative effects of -1.852178 on the income inequality in Africa. And this means that a unit rise in the employment would result in decreasing the income inequality in Africa by -1.852178 magnitudes. This is similar to macroeconomic volatility (MEV) which portrayed a negative and significant effect of -0.027249 on the income inequality in Africa. This means that a unit rise in the macroeconomic volatility (MEV) brought about -0.027249 decreases in the income inequality in Africa. Furthermore, the researcher discovered that the global economic policy uncertainty (GEPU) has significant positive effects of 1.668220 on the income inequality in Africa and this shows that a unit rise in the global economic policy uncertainty (GEPU) would lead to increasing the income inequality by 1.668220 magnitudes in Africa.

Model 4 results shows that the past value of income equality (INEQ) had significant positive effects on the current value of income inequality in Africa. Furthermore, the inflation rate (INFR) was found to portray significant negative effects of -0.172016 on the income inequality in Africa, implying that a rise in the inflation rate would lead to decreasing the income inequality by -0.172016 magnitudes in Africa. We also found that macroeconomic volatility (MEV) has significant negative effects of -0.027885 on the income inequality in Africa, which means that increasing the macroeconomic volatility (MEV) by one unit would result to about -0.027885 decreases in the income inequality in Africa. In addition, the global economic policy uncertainty (GEPU) has significant positive effects of 1.718272 on the income inequality in Africa, implying that a unit rise in the global economic policy uncertainty (GEPU) would lead to increasing the income inequality by 1.718272 magnitudes in Africa.

Findings from model 5 shows that the past value of income inequality positively and significantly contributed to the current values of income inequality in Africa. We further found that the national income (NAI) and macroeconomic policy uncertainty (MEV) have significant negative effects of -0.100975 and -0.027161 on the income inequality in Africa and this means that rises in the national income (NAI) and macroeconomic policy uncertainty (MEV) would lead to decreasing the income inequality by -0.100975 and -0.027161 magnitudes in Africa, while the global economic policy uncertainty (GEPU) had significant effects of 1.625439 on the income inequality in Africa implying the increase in the global economic policy uncertainty (GEPU) would lead to increasing income inequality in Africa by 1.625439 in Africa.

Lastly, from the results of model 6, the researcher discovered that the past value of the income inequality (INEQ) positively and significant contributed to the current values of income inequality in Africa. However, it was discovered that gross domestic product (GDP) had significant negative effects of -0.024783 on the income inequality in Africa and this means that a unit rise in gross domestic product (GDP) would lead to decreasing the income inequality in Africa by -0.024783 magnitudes. More so, we found that macroeconomic volatility (MEV) has significant negative effects of -0.027900 on the income inequality in Africa and this means that a unit rise in the macroeconomic volatility (MEV) led to decreasing the income inequality in Africa by -0.027900 magnitudes. In like manner, we found that global economic policy uncertainty (GEPU) has significant negative effects of -1.462220 on the income inequality in Africa. And this means that a unit rise in the global economic policy uncertainty (GEPU) would lead to decreasing the income inequality in Africa.

From the results of the R-squared which measures the goodness of fit for all the models shows that over 50% of the total variation in the income inequality were explained by the explanatory variables (macroeconomic variables and control variables) for model 1 – 6. However, these findings corroborate with previous finding made by scholars such as (Banfak & Jablonki 2020, Dwiputri et al. 2018, Esquivias et al. 2021, Calvo 2001, Bannani 2005, Klein 2013, Galli & Hoeven 2001, Law & Soon 2020, Yildirim & Dibo 2021, Berg et al. 2018, Rabiol 2017, Merrino 2022, Chang et al. 2018, Adindu & Chisom, 2017, Keshin, 2017) among others.

**Table 9: Estimated Results of DOLS**

Variable	1	2	3	4	5	6
INEQ (-1)	0.208528*** (0.0031)	0.257617*** (0.0000)	0.208325*** (0.0030)	0.329335*** (0.0000)	0.209328*** (0.0027)	0.205822*** (0.0029)
EXR	-0.002947** (0.0222)					
INTR		-0.004074*** (0.0008)				
EMP			-1.852178*** (0.0000)			
INFR				-0.172016*** (0.0002)		
NAI					-0.100975*** (0.0082)	
GDP						-0.024783*** (0.0001)

MEV	-0.027634*** (0.0000)	-0.002957 (0.2014)	-0.027249*** (0.0000)	-0.027885*** (0.0000)	-0.027161*** (0.0000)	-0.027900*** (0.0000)
GEPU	1.649984*** (0.0000)	-0.438483*** (0.0006)	1.668220*** (0.0000)	1.718272*** (0.0000)	1.625439*** (0.0000)	-1.462220*** (0.0000)
No of Obs.	1860	1860	1860	1860	1860	1860
R-squared	0.738069	0.511469	0.858875	0.655230	0.646560	0.714189

Source: Conceived by the Researcher. Note: \*\*\*, \*\* and \* represent 1%, 5% and 10% levels of significance, while (.) represent the probability values

### 5. Conclusion and Policy Recommendations

The findings of the study highlight several policy implications for addressing income inequality in Africa. Stabilising the exchange rate is critical, as it can improve both domestic and international trade competitiveness, ensuring that wealth is not disproportionately concentrated among the rich. Similarly, maintaining stable interest rates can enhance market competition and reduce opportunities for the wealthy to gain undue advantages, which often exacerbate income disparities. The results also indicate that employment in Africa is generally insufficient and of low quality, contributing to rising income inequality. In addition, higher inflation rates negatively affect income distribution, as wealthier individuals are better able to withstand economic shocks, further marginalising poorer populations. These findings suggest that governments must prioritise improving overall macroeconomic conditions by implementing policies that stabilise key economic indicators, enhance employment opportunities, and reduce the effects of inflation. Tackling systemic issues such as corruption is also essential to ensure equitable distribution of resources, improve poverty levels, and enhance overall well-being across the continent. Effective policy interventions in these areas can reduce economic disparities and create a more inclusive growth environment in Africa.

Reducing income inequality is critical for fostering economic growth and improving living standards across Africa. Governments should focus on improving macroeconomic stability through policies that stabilise exchange rates, manage inflation, and ensure consistent interest rates, while promoting economic diversification, increasing employment, and enhancing national income. Investment in education is also vital, as providing access to quality education and vocational training equips individuals with the skills needed to secure higher-paying jobs and compete effectively in the global economy. Supporting small and medium enterprises (SMEs) through finance access, business development services, and market linkages can create jobs and wealth opportunities, particularly for marginalised groups. Infrastructure development—including roads, electricity, and internet connectivity—can unlock economic potential in rural areas, facilitate trade, and attract investment. Agricultural reforms that increase productivity and market access for smallholder farmers are essential for improving rural incomes and reducing poverty. Implementing progressive taxation and social policies such as cash transfers, food subsidies, and healthcare access can further alleviate income disparities. Promoting gender equality, expanding access to finance, strengthening governance and transparency, and fostering regional economic integration are additional measures that can ensure inclusive growth. Collectively, these strategies can address systemic inequalities, empower disadvantaged populations, and promote sustainable economic development across Africa.

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