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IMPACT OF GLOBALIZATION ON INCOME INEQUALITY IN SOUTH AFRICA

Abstract

Income inequality has been a major issue in South Africa. The 1994 transition from apartheid to democracy and global economic integration presented opportunities and challenges, fostering economic development while exacerbating existing inequalities. Therefore, this study aims to analyze how globalization affects income inequality in the South African economy. It utilizes the autoregressive distributed lag (ARDL) approach on a set of chosen variables. These variables include the Gini index, the Konjunkturforschungsstelle (KOF) globalization index, Gross Domestic Product (GDP) per capita, unemployment rate, inflation rate, and government expenditure. The study covers the period from 1980 to 2022, allowing for a comprehensive examination of the relationship between globalization and income inequality over time. The results obtained from the ARDL bounds test indicate that globalization has a positive long-run equilibrium relationship with income inequality. This means that as globalization progresses, it tends to be associated with higher levels of income inequality. In the short run, globalization exhibits a positive and statistically significant relationship with income inequality. The results of the Granger causality test indicate a unidirectional relationship between globalization and income inequality. This suggests that changes in globalization directly influence income inequality. Consequently, it is crucial to implement short- and long-term policies that address the adverse effects of globalization on income distribution. Policies could include providing support and retraining for workers in vulnerable industries, implementing social safety nets to protect those adversely affected by rapid economic changes, and ensuring equitable access to opportunities created by globalization.

Keywords globalization, income inequality, autoregressive distributed lag, time series

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INTRODUCTION

Globalization has profoundly reshaped economies around the world, including South Africa, bringing with it both opportunities and challenges. In the South African context, globalization has played a dual role: it has stimulated economic growth through increased trade, investment, and access to international markets, while simultaneously exposing deep-rooted inequalities. Income inequality, a longstanding issue in South Africa due to its history of apartheid and socio-economic segregation, has been exacerbated by the unequal distribution of the benefits of globalization.

South Africa is classified as a middle-income country, yet it remains one of the most unequal nations in the world (World Bank, 2022). This inequality is rooted in the country's history, shaped by the deep social and economic disparities created during colonialism and apartheid. Under apartheid, systemic policies favored the white minority in areas such as employment, education, and healthcare, entrenching inequality across society. While strides have been made since 1994 to address these imbalances, significant inequality persists. The South African economy remains marked by stark contrasts, where wealth and pov-

erty often exist side by side (Woolard & Klassen, 2002). Such high levels of income inequality are widely viewed as barriers to economic growth and social cohesion, posing ongoing challenges to the nation's development.

In the 1980s, the Gini index in South Africa was consistently high, hovering around 60%. This high level of income inequality was largely due to the apartheid-era policies that distributed income along racial lines, marginalizing the majority of the population (Mdingi & Ho, 2023). A significant spike occurred in 1985 when the Gini index reached 64%, attributable to the 1985 debt crisis. From 2008 to 2009, the Gini index increased from 63% to 64%. These changes were influenced by the 2008/2009 global financial crisis, which led to a reduction in international economic interactions and trade. The crisis caused widespread economic disruption, known as the "great trade collapse," and resulted in a recession that disproportionately affected lower and middle-income groups, exacerbating income inequality (Ghironi & Levchenko, 2018). Between 2019 and 2020, the Gini index remained consistently at 63%. This persistently high level of income inequality can be attributed to several factors, including unequal access to opportunities, the lingering effects of apartheid-era segregation, and the ongoing electricity crisis in South Africa.

Inequality is deeply embedded in South Africa's economic structures, as apartheid policies established a framework for growth that continues to reinforce disparities. The legacy of these policies has shaped the economy in ways that favor certain groups, perpetuating unequal access to wealth, opportunities, and resources. Consequently, despite efforts by the post-apartheid democratic government to address inequality, there remains a persistent problem of rising inequality that is difficult to reverse. The South African government has employed various tactics, such as the Reconstruction and Development Programme (RDP) and National Development Plan (NDP), to address the long-standing inequality in the country. Although these initiatives improved racial inequality, income inequality remains high. This study has been undertaken due to the persistent challenge of income inequality in South Africa despite numerous policies and initiatives implemented by the government.

1. LITERATURE REVIEW

Globalization is the growing interconnectedness of economies throughout the world, driven by the escalating magnitude and diversity of cross-border exchanges involving goods and services. There has been a plethora of literature (Atif et al., 2012; Zahra et al., 2022; Ibrahim, 2022; Munir & Bukhari, 2020) over the years on the nexus between globalization and income inequality. The study of the relationship between globalization and income inequality persists as an enduring subject, sparking divergent perspectives and theoretical frameworks. One such perspective is the Stolper-Samuelson theorem that anticipates a negative relationship between globalization and income inequality within developing nations (Stolper & Samuelson, 1941). As per the theorem, trade openness tends to support the production factor that a country possesses in abundance. This is because specialization in trade often advantages sectors that heavily utilize the abundant factor. Developing nations typically have a surplus of unskilled labor relative to other countries. Kremer and Maskin (2003) cited the Stolper-Samuelson theorem by stating that international trade should drive up the demand for unskilled workers in developing countries, resulting in higher real wages and a decline in domestic income inequality (Stolper & Samuelson, 1941).

Tian et al. (2008) examined the effects of globalization on income inequality in China from 1979 to 2006 using the Gini coefficient, per capita GDP growth, total trade as a percentage of GDP, FDI flows as a percentage of GDP, and the percentage of government spending on social insurance. The ADF unit-root test and Johansen and Juselius multivariate cointegration technique were also utilized. According to the findings, trade, FDI, and government spending all boosted the level of income distribution. Secondly, there were other causes of income inequality in China other than globalization. Lastly, the empirical findings also suggested that

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government spending on social insurance tends to decrease income inequality, whereas economic growth has not shown a positive contribution to reducing income inequality.

Atif et al. (2012) studied the influence of globalization on the distribution of income. They investigated the relationship using dynamic panel data econometric techniques to examine the globalization index and income inequality index of 68 developing countries between 1990 and 2010. Variables such as the Gini index, KOF globalization index, education level, and urbanization index (percentage of the population living in urban areas) were included in the analysis. The findings confirmed that an increase in globalization led to a higher level of income inequality.

Zahra et al. (2022) examined the impact of globalization on income inequality from 1991 to 2019, utilizing the time-series ARDL approach. The findings of the ARDL Bounds test demonstrated a long-run positive relationship between globalization and income inequality.

Bergh and Nilsson (2010) investigated the relationship between globalization and income inequality. They used a substantial panel data sample of 80 countries from 1970 to 2005. According to the findings, there is a positive relationship between globalization and income inequality.

Using meta-analysis and meta-regression methods, an attempt to quantitatively evaluate the econometric literature on a global scale and investigate the impact of globalization on global income inequality was offered by Heimberger (2020). This approach involved assembling a comprehensive dataset comprising 1,254 observations extracted from 123 distinct peer-reviewed papers. The study found that when considering the overall estimates for the total population, globalization tends to have a small-to-moderate positive effect on income inequality.

Using panel data and random coefficients, Atanasova and Tsvetkov (2021) investigated how globalization affected income inequality in developed and developing economies across Europe. The study explored both horizontal and vertical dimensions of income inequality dynamics, employing statistical tests such as the Levin, Lin & Chu test, ADF – Fisher Chi-square test, and PP – Fisher Chi-square test for data analysis. Following the implementation of the generalized panel test for stationarity, the impact of globalization on developing countries was insignificant, with an index of –0.03841 and a probability of 75%. Therefore, it was noted that the impact of globalization had no interaction with income inequality in European developing countries.

To establish and assess the relationship between globalization and income inequality in the United States from 1961 to 1991, Borjas and Ramey (1994) used the Engle and Granger cointegration approaches. The study included various explanatory variables, such as net imports of durable goods as a percentage of GDP, unemployment rate, percentage of immigrants in the population, and the ratio of college graduates to high school graduates. The findings revealed a positive correlation between inequality and globalization, with trade serving as a proxy for globalization.

Cassette et al. (2012) established a distinction between the short-term and long-term effects of globalization on income inequalities from 1980 to 2005. The study used data from 10 advanced countries over 26 years, employing panel cointegration and error correction mechanisms, as well as dynamic ordinary least squares. The findings revealed a positive correlation between globalization and income inequality.

Silva and Leichenko (2004) investigated the impact of globalization on income inequality in various regions of the United States. The study used ordinary least-squares methods to estimate the panel data and concluded that from 1992 to 1994, globalization had a positive relationship with income inequality, leading to increased inequality both between and within the United States. Their analysis clarified that trade policy alone cannot effectively manage regional income inequality. The scholars emphasized the necessity of social policy to counteract the inequality-enhancing impacts of globalization.

Examining the relationship between globalization and income disparities across 140 countries from 1970 to 2014, Dorn et al. (2018) employed

an instrumental variable (IV) approach. They observed variations in this relationship among different countries. Notably, they identified a strong positive correlation between globalization and inequality in developing countries, including China, as well as in a majority of nations in Eastern Europe and the Middle East. However, within the subset of the most advanced countries, results from both ordinary least squares (OLS) and two-stage least squares (2SLS) approaches failed to reveal any significant positive relationship between globalization and income inequality.

In evaluating the impact of globalization on income inequality distribution across 60 countries (including advanced, transitioning, and developing nations), Zhou et al. (2011) employed principal component analysis (PCA) and data from Kearney (2002, 2003, and 2004) to construct two globalization indices. Their contribution was discovering an inverse association between both globalization indices and the Gini coefficient across all 60 countries examined.

By encompassing the various dimensions of globalization, Ibrahim (2022) investigated the impact of globalization on income inequality across 66 developing countries from 1990 to 2017. Employing the system generalized method of moments (system GMM) estimator, this study quantified the influence of globalization on income inequality. The empirical findings indicated that, overall, globalization leads to a reduction in income inequality in the developing world. Furthermore, the scholars found that the interconnectedness and integration of economies and societies on an economic and social level contribute to increased income inequality, whilst global interconnectedness and integration in political spheres do not appear to exert a significant influence on the dynamics of income inequality in developing nations.

Georgantopoulos and Tsamis (2011) investigate how the effects of globalization have been reflected in Hungary's income distribution from 1990 to 2009. The study applied ordinary least squares (OLS). According to the findings, there was a negative relationship, as an improvement in the distribution of income was established, when there was an increase in globalization and the penetration of foreign capital.

Similarly, Munir and Bukhari (2020) analyzed the possible link between globalization and income inequality in 11 Asian countries from 1990 to 2014. The study utilized both pooled least squares (POLS) and instrumental variable least squares (IVLS) estimation techniques, but it favored the results obtained through IVLS over POLS due to identified issues of omitted variable bias and endogeneity in the POLS estimation results. The results indicated that globalization played a significant role in reducing income inequality in the chosen Asian economies.

Based on the findings of these empirical studies, it is clear that a consensus has yet to be achieved regarding the subject matter. This lack of consensus has created an opportunity for this study to clarify the various types of relationships and the direction of causality between globalization and income inequality. Thus, this study aims to explore the impacts of globalization on income inequality in South Africa from 1980 to 2022.

2. METHODOLOGY

The selection of this timeframe (1980–2022) is deliberate, as it corresponds to a period when globalization significantly intensified within the country, while the current period denotes the year for which annual data are accessible. The paper is specifically quantitative and is based on time-series data. The World Bank and World Inequality Database serve as the secondary data sources utilized.

2.1. Model specification

This study adheres to the methodological framework developed by Zahra et al. (2022), who investigated the relationship between globalization and income inequality in Pakistan from 1991 to 2019, using annual time series analysis. The model is modified to incorporate key aspects that reflect the distinctive features of the South African economy. to help assess the relationship between globalization and income inequality. The empirical model is specified as:

$$InGini = f\begin{pmatrix} InKOF, InGDPpc, Inunemp, \\ Ininf, InGovExp \end{pmatrix}, \quad (1)$$

where *InGini* is the natural logarithm of the Gini index; *InKOF* is the natural logarithm of the KOF

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globalization index; *InGDPpc* is the natural logarithm of GDP per capita; *Inunemp* is the natural logarithm of the unemployment rate; *Ininf* is the natural logarithm of the inflation rate, and *InGovExp* is the natural logarithm of government expenditure.

The empirical model above is formulated as:

$$\begin{aligned} Ingini_t &= \alpha_0 + \alpha_1 \cdot InKOF_t \\ &+\alpha_2 \cdot InGDPpc_t + \alpha_3 \cdot Inunemp_t \\ &+\alpha_4\, Ininf_t + \alpha_5 \cdot InGovExp_t + u_t, \end{aligned} \tag{2}$$

where α_0 is the intercept term; α_{1-5} are the partial slopes of the dependent variables; u is the error term.

The a priori expectations for the specified model mentioned above are as follows:

$$\begin{aligned} &\alpha_1 > 0; \quad \alpha_1 < 0; \quad \alpha_2 > 0; \\ &\alpha_3 > 0; \quad \alpha_4 > 0; \quad \alpha_5 > 0. \end{aligned} \tag{3}$$

Therefore, this indicates that globalization will be expected to have a positive or a negative impact on income inequality. GDP per capita, unemployment rate, inflation rate and government expenditure are expected to have a positive relationship with income inequality.

2.2. Estimation technique

The study uses the Auto Regressive Distributed Lag (ARDL) approach to establish the relationship between globalization and income inequality. The ARDL bounds test is applicable irrespective of whether the predictors in the model are entirely integrated of order I(0), entirely integrated of order I(1), or mutually cointegrated. Secondly, the efficiency of the test is notably higher, especially when confronted with small or finite sample sizes, a circumstance that aligns with the conditions of this study. However, this procedure is not suitable in the presence of I(2) series, as it may encounter limitations in such cases. Thirdly, the ARDL bounds test method not only provides unbiased results but remains robust even when confronted with endogeneity, as demonstrated by Harris and Sollis (2003). This characteristic underscores the reliability and versatility of the ARDL bounds test technique in offering accurate estimations and statistical inferences, even in situations where endogeneity – potential correlations between the independent variables and the error term – could pose challenges to the validity of results.

The specification for ARDL bound testing is outlined as follows:

$$\begin{aligned} &\Delta LNGINI_t = \beta_0 + \beta_1 \cdot \Delta LNGINI_{t-1} \\ &+\beta_2 \cdot \Delta LNKOF_{t-1} + \beta_3 \cdot LNGDPpc_{t-1} \\ &+\beta_4 \cdot LNUNEMP_{t-1} + \beta_5 \cdot LNINF_{t-1} \\ &+\beta_6 \cdot LNGOVEXP_{t-1} + \sum_{j=1}^{p} \alpha_{1j} \cdot \Delta LNGINI_{t-j} \\ &+\sum_{j=0}^{q1} \alpha_{2j} \cdot \Delta LNKOF_{t-j} + \sum_{j=0}^{q2} \alpha_{3j} \cdot \Delta LNGDPpc_{t-j} \\ &+\sum_{j=1}^{q3} \alpha_{4j} \cdot \Delta LNUNEMP_{t-j} + \sum_{j=0}^{q4} \alpha_{5j} \cdot \Delta LNINF_{t-j} \\ &+\sum_{j=0}^{q5} \alpha_{6j} \cdot \Delta LNGOVEXP_{t-j} + \vartheta_t, \end{aligned} \tag{4}$$

where β_0 is the intercept, ϑ_t is the error term, Δ represents the first-difference operator, and p and q represent the optimal lag length.

The bounds test for cointegration is carried out by employing the F test. This test is designed to assess the collective significance of the lagged levels of the variables, operating under the null hypothesis that asserts the absence of cointegration. In mathematical terms, the null hypothesis is articulated as follows:

$$H_0: \quad \alpha_1 = \alpha_2 = \alpha_3; \; H_0: \quad \beta_1 = \beta_2 = \beta_3;$$

And the alternative hypothesis is denoted as:

$$H_1: \quad \alpha_1 \neq \alpha_2 \neq \alpha_3; \; H_1: \quad \beta_1 \neq \beta_2 \neq \beta_3;$$

where α_1, α_2, α_3; β_1, β_2, β_3 represent the coefficients associated with the lagged levels of the variables in the model. This hypothesis posits that there is no long-term relationship among the variables, indicating that they do not move together over time. The F test serves as a statistical tool to scrutinize whether the inclusion of these lagged levels collectively contributes significant explanatory power to the model. A rejection of the null hypothesis would suggest the presence of cointegration, im-

plying a shared stochastic trend among the variables that persists over time.

The long-term ARDL model is:

$$\begin{aligned}\Delta LNGINI_t &= \beta_0 + \sum_{j=1}^{p}\beta_{1j}\cdot\Delta LNGINI_{t-j} \\ &+\sum_{j=0}^{q1}\beta_{2j}\cdot\Delta LNKOF_{t-j} + \sum_{j=0}^{q2}\beta_{3j}\cdot\Delta LNGDPpc_{t-j} \\ &+\sum_{j=0}^{q3}\beta_{4j}\cdot\Delta LNUNEMP_{t-j} + \sum_{j=0}^{q4}\beta_{5j}\cdot\Delta LNINF_{t-j} \\ &+\sum_{j=0}^{q5}\beta_{6j}\cdot\Delta LNGOVEXP_{t-j}.\end{aligned} \quad (5)$$

The short-term dynamic parameters are determined through the estimation of error correction models, defined as follows:

$$\begin{aligned}\Delta LNGINI_t &= \vartheta + \sum_{j=1}^{p}\beta_{1j}\cdot\Delta LNGINI_{t-j} \\ &+\sum_{j=0}^{q1}\beta_{2j}\cdot\Delta LNKOF_{t-j} + \sum_{j=0}^{q2}\beta_{3j}\cdot\Delta LNGDPpc_{t-j} \\ &+\sum_{j=0}^{q3}\beta_{4j}\cdot\Delta LNUNEMP_{t-j} + \sum_{j=0}^{q4}\beta_{5j}\cdot\Delta LNINF_{t-j} \\ &+\sum_{j=0}^{q5}\beta_{6j}\cdot\Delta LNGOVEXP_{t-j} + \pi\cdot ECM_{t-1} + u_t,\end{aligned} \quad (6)$$

where β are the short-run dynamic coefficients in the model; π is linked to error-correction terms that are lagged once.

2.3. Granger causality

Engle and Granger (1987) and Granger (1988) have shown that the presence of Granger causality is a prerequisite in an error-correction model (ECM). If two variables, y_t and x_t, are cointegrated, one of the following three relationships may exist: x_t influences y_t, y_t influences x_t, and x_t and y_t influence each other. The links between the first two exhibit a one-way (unidirectional relationship), whereas the relationship involving the third is characterized by a two-way link (bidirectional relationship). In cases where two variables are not cointegrated, indicating their independence, there is no influence from one variable to the other. Granger (1969) devised the causality test method to elucidate the nature of such relationships.

To explain the Granger test: does income inequality cause globalization ($LNGINI_t \rightarrow LNKOF_t$)? Or is it income inequality that causes globalization ($LNGINI_t \rightarrow LNKOF_t$)? (Note that the arrow indicates the direction of causality.) The Granger causality test operates on the assumption that the information crucial for predicting the respective variables, $LNGINI_t$ and $LNKOF_t$, is exclusively found in the time series data pertaining to these variables. The test entails estimating the following pair of regressions:

$$\begin{aligned}LNGINI_t &= \sum_{i=1}^{n}\alpha_i LNKOF_{t-i} \\ &+\sum_{j=1}^{n}\beta_j LNGINI_{t-j} + u_{1t},\end{aligned} \quad (7)$$

$$\begin{aligned}LNKOF_t &= \sum_{i=1}^{n}\lambda_i\cdot LNKOF_{t-i} \\ &+\sum_{j=1}^{n}\delta_j\cdot LNGINI_{t-j} + u_{2t},\end{aligned} \quad (8)$$

where it is assumed that the disturbances u_{1t} and u_{2t} are uncorrelated. (7) asserts a connection between current $LNGINI_t$ and its past values, as well as the past values of $LNKOF_t$. Similarly, (8) posits a comparable relationship for $LNGINI_t$.

3. RESULTS AND DISCUSSION

Table 1 illustrates the descriptive analysis results consisting of the mean, median, maximum, minimum, standard deviation, skewness, kurtosis, Jarque-Bera (and the probability), and number of observations. The standard deviation values are 0.035232, 0.164632, 0.423229, 0.248735, 0.571106, and 0.100775 for the Gini index, KOF globalization index, GDP per capita, unemployment, inflation, and government expenditure, respectively. Inflation has the largest variance between the data sets as compared to the other variables, suggesting that fluctuations in the inflation variable are high.

The values of skewness of *LNGINI*, *LNKOF*, *LNGDPpc*, *LNINF* and *LNGovExp* are slightly skewed as they lie between –0.862365 and 0.276053 (the values are not less than –1, and not greater than +1). However, the values of *LNUNEMP* are

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Table 1. Descriptive analysis

	LNGINI	LNKOF	LNGDPpc	LNUNEMP	LNINF	LNGovExp
Mean	4.114228	3.874507	8.371475	2.967328	1.999924	2.849815
Median	4.094345	3.871201	8.224539	3.020425	1.951608	2.856470
Maximum	4.189655	4.189655	9.075322	3.394508	2.925846	3.034472
Minimum	4.056989	3.526361	7.554701	2.219203	0.566666	2.549445
Std. Dev.	0.035232	0.164632	0.423229	0.248735	0.571106	0.100775
Skewness	0.291027	–0.260956	0.035876	–1.374500	–0.356317	–0.862365
Kurtosis	1.645994	2.371389	1.653427	4.999625	2.641990	4.151479
Jarque-Bera	3.891714	1.196017	3.257982	20.70361	1.139530	7.705236
Probability	0.142865	0.054990	0.196127	0.000032	0.056565	0.021224
Observations	43	43	43	43	43	43

Note: InGini is the natural logarithm of the Gini index; *InKOF* is the natural logarithm of the KOF globalization index; *InGDPpc* is the natural logarithm of GDP per capita; *Inunemp* is the natural logarithm of the unemployment rate; *Ininf* is the natural logarithm of the inflation rate, and *InGovExp* is the natural logarithm of government expenditure.

highly skewed as the value exceeds 1. In addition, the Gini index and GDP per capita squared are positively skewed, whilst the KOF globalization index, unemployment, inflation, and government expenditure are negatively skewed. The kurtosis for unemployment and government expenditure is greater than 3; therefore, the variables are characterized by a leptokurtic distribution, which means the tail is longer and wider than that of a normal distribution. Meanwhile, the kurtosis for the rest of the variables (Gini index, KOF, GDP per capita, and inflation) is less than 3, which means these variables have platykurtic distributions. These are characterized by tails that are shorter and thinner than those of a normal distribution. The result shows that the Jarque-Bera probabilities for the variables reject the null hypothesis of no normal distribution. Thus, these variables are normally distributed.

Similar to various other econometric methodologies, the initial step in ARDL analysis involves conducting a unit root analysis. This essential stage helps set the foundation for the broader econometric examination. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are employed to analyze whether a time series is non-stationary or stationary at levels. The findings indicate a combination of integration orders (I(0) and I(1)) for globalization, income inequality, and the control variables. This mixed integration pattern validates the application of the ARDL model.

Table 2 illustrates the ADF unit root test results. The natural logarithm of the Gini index (*LNGINI*), logged KOF globalization index (*LNKOF*), and logged GDP per capita (*LNGDPpc*) are stationary at first difference with the intercept only I(1) at a 5% significance level. However, the natural logarithm of unemployment as a percentage of the total labor force (*LNUNEMP*) and government expenditure (*LNGovExp*) is stationary at a level with intercept only I(0) at a 5% significance level. The natural logarithm of inflation (*LNINF*) is stationary at a level with both intercept and trend at a 5% significance level. Table 3 illustrates the Phillip

Table 2. Augmented Dickey-Fuller results of South Africa

Variables	Level I(0)				First Difference I(1)		Integration order
	Intercept		Intercept and trend		Intercept		
	T-statistics	P-value	T-statistics	P-value	T-statistics	P-value	
LNGINI	–1.579337	0.4841	–2.681719	0.2490	–9.032891	0.0000	I(1)
LNKOF	–1.433570	0.5568	–3.143590	0.1099	–5.567260	0.0000	I(1)
LNDGPpc	–0.882092	0.7842	–2.923448	0.1660	–5.100336	0.0001	I(1)
LNUNEMP	–3.466522	0.0140	–	–	–	–	I(0)
LNINF	–2.902127	0.0540	–4.467722	0.0051	–	–	I(0)
LNGovExp	–3.058045	0.0377	–	–	–	–	I(0)

Note: InGini is the natural logarithm of the Gini index; *InKOF* is the natural logarithm of the KOF globalization index; *InGDPpc* is the natural logarithm of GDP per capita; *Inunemp* is the natural logarithm of the unemployment rate; *Ininf* is the natural logarithm of the inflation rate, and *InGovExp* is the natural logarithm of government expenditure.

Table 3. Phillip Perron unit root test results

Variables	Level I(0)				First Difference I(1)		Integration order
	Intercept		Intercept and trend		Intercept		
	T-statistics	P-value	T-statistics	P-value	T-statistics	P-value	
LNGINI	–1.420688	0.5632	–2.744381	0.2251	–9.047037	0.0000	I(1)
LNKOF	–1.460234	0.5437	–3.078817	0.1245	–5.602439	0.0000	I(1)
LNGDPpc	–0.995401	0.7464	–2.253716	0.4489	–5.007076	0.0002	I(1)
LNUNEMP	–3.332822	0.0195	–	–	–	–	I(0)
LNINF	–2.901114	0.0541	–4.467213	0.0051	–	–	I(0)
LNGovExp	–3.093681	0.0347	–	–	–	–	I(0)

Note: InGini is the natural logarithm of the Gini index; *InKOF* is the natural logarithm of the KOF globalization index; *InGDPpc* is the natural logarithm of GDP per capita; *Inunemp* is the natural logarithm of the unemployment rate; *Ininf* is the natural logarithm of the inflation rate, and *InGovExp* is the natural logarithm of government expenditure.

Perron unit root test results. The *LNGINI*, *LNKOF*, and *LNGDPpc* are stationary at first difference with intercept only I(1) at the 5% significance level. *LNUNEMP* and *LNGE* are stationary at a level with intercept only I(0) at the 5% significance level. The natural logarithm of inflation (*LNINF*) is stationary at a level with both intercept and trend at a 5% significance level. The Phillip Perron unit root test results correspond with the ADF results, as stated in theory.

The optimal lag duration is identified through the automatic model selection feature of Eviews 12 software. The study used a variety of criteria: Likelihood-ratio test statistic (LR), Final Prediction Error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criterion (HQ). Consequently, the chosen model for this study is the Autoregressive Distributed Lag (ARDL) model specified as (1.1.1.1.1), given its selection based on the lowest AIC value, signifying superior fit and performance within the specified lag length. Therefore, Table 4 shows the lag length criterion outcomes.

Table 5 displays significant findings as the computed F-value for the ARDL model registers at 4.0930, surpassing the critical value bounds established at the 5% significance level for both the lower and upper bounds. This outcome leads to the rejection of the null hypothesis that postulates no long-run impact. Several other studies show a long-run relationship between globalization and income inequality (Cheong et al., 2021; Nissanke & Thorbecke, 2010; Demirguc-Kunt & Levine, 2009; Dorn et al., 2018; Bukhari & Munir, 2016; de Haan & Sturm, 2017; Anderson, 2005; Mills, 2009; Harrison et al., 2011). This suggests a sustained influence or long-term impact originating from globalization that extends to income inequality within the South African economy. As such, this is an indication that rapid globalization leads to an increase in income inequality in the South African economy over the long run. The result does not align with the Stolper-Samuelson theorem, as globalization is expected to decrease income inequality in developing countries (Stolper & Samuelson, 1941).

Several theories concerning international trade have delineated various pathways through which globalization could adversely affect income inequality. These theories offer distinct perspectives on how the interconnectedness of global markets may exacerbate disparities in income distribution. For instance, some theories suggest that globalization might lead to greater income inequality

Table 4. Lag length criterion

Lag	LogL	Likelihood-Ratio (LR)	Final Prediction Error (FPE)	Akaike information criterion (AIC)	Schwarz information criterion (SC)	Hannan-Quinn information criterion (HQ)
0	199.6052	NA	2.52e-12	–9.680259	–9.426977	–9.588662
1	369.1660	279.7754*	3.24e-15*	–16.59321*	–14.58498*	–15.71712*
2	405.9929	49.71624	3.52e-15	–16.35830	–13.10633	–15.20889
3	445.8642	41.86490	4.12e-15	–-16.39964	–11.77990	–14.85287

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Table 5. ARDL Bounds test results

ARDL Model	Estimated F-value	
ARDL Model (1,1,1,1,1)	4.092958	
	Critical Value Bounds	
Significance levels	Lower Bound I(0)	Upper Bound I(1)
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Note: Long run equation:
$LNGINI = 2.6346 + 0.0896 \cdot LNKOF + 0.0511 \cdot LNGDPpc + 0.0243 \cdot LNUNEMP + 0.0090 \cdot LNINF - 0.0324 \cdot LNGovExp$. lnGini is the natural logarithm of the Gini index; lnKOF is the natural logarithm of the KOF globalization index; lnGDPpc is the natural logarithm of GDP per capita; lnunemp is the natural logarithm of the unemployment rate; lninf is the natural logarithm of the inflation rate, and lnGovExp is the natural logarithm of government expenditure.

by favoring skilled workers over unskilled ones or by increasing the bargaining power of multinational corporations at the expense of labor wages. Additionally, globalization could exacerbate income inequality by facilitating tax avoidance and capital flight, thereby reducing government revenues available for redistributive policies.

Table 6 shows the long-run relationship between globalization, income inequality, and the control variables. The results suggest that, in the long run, there is a positive relationship between *LNGINI* and *LNKOF*. However, this finding is not in line with the Stolper-Samuelson theorem (Stolper & Samuelson, 1941). Nevertheless, multiple theories pertaining to international trade and investment have outlined alternative pathways through which globalization could impact income inequality. In general, economic theory does not provide unambiguous predictions regarding the impact of globalization on inequality. The connection between globalization and income inequality has been the subject of scrutiny in numerous empirical studies conducted during the 1990s (Barham & Boucher, 1998; Borjas et al., 1997; Feenstra & Hanson, 2001; Cragg & Eppelbaum, 1996; Edwards, 1997; Leamer, 1998). In addition, this topic has been revisited by several scholars in the last decade (Figini & Görg, 2011; Dreher & Gaston, 2008; Goldberg & Pavcnik, 2007; Roine et al., 2009; Gozgor & Ranjan, 2017; Bergh & Nilsson, 2010; Jaumotte et al., 2013; Dorn & Schinke, 2018; Dabla-Norris et al., 2015). *LNGINI* and *LNGDPpc* have a positive long-run relationship. *LNGINI* and *LNUNEMP* have a positive long-run relationship. *LNGINI* and *LNINF* have a positive long-run relationship. *LNGINI* and *LNGovExp* have a negative long-run relationship. Therefore, the long-run equation for the study can be depicted as:

$$LNGINI_t = 2.635 + 0.0896 \cdot LNKOF_t + 0.0511 \cdot LNGDPpc_t + 0.0243 \cdot LNUNEMP_t + 0.0090 \cdot LNINF - 0.0310 \cdot LNGovExp_t, \quad (9)$$

where *LNGINI*, *LNKOF*, *LNGDPpc*, *LNUNEMP*, and *LNGovExp* are the natural logarithms of the Gini index, *KOF* globalization index, *GDP* per capita, unemployment rate as a percentage of total labor force, and government expenditure.

According to the results in Table 6, the absolute t-statistic for the regressors *LNKOF* and *LNGDPpc* are greater than 2; therefore, the variables are considered to be statistically significant. However, *LNUNEMP* and *LNGovExp* are statistically insignificant as the absolute *t*-statistics are less than 2. Government expenditure is pivotal in addressing income inequality in the long run, although statistically insignificant since the corresponding *t*-statistic is below absolute 2. GDP per capita statistically significantly adversely affects income inequality, as evidenced by the *t*-statistic value that is greater than 2, suggesting a lack of inclusive economic growth efforts within South Africa. In the long run, unemployment should be addressed since it worsens income inequality, although it is statistically insignificant (*t*-statistic is less than 2).

Table 7 shows the short-run relationship of the variables. The *t*-statistic absolute value for the ECT is 5.3799, which is greater than 2; therefore, according to the rule of thumb, it can be deduced that it is statistically significant. Consequently, the null

Table 6. Long run relationships

Dependent variable: D(LNGINI)				
Variable	**Coefficient**	**Standard error**	**t-statistic**	**Probability**
LNKOF	0.089625	0.030629	2.926183	0.0067**
LNGDPpc	0.051058	0.013547	3.769081	0.0008**
LNUNEMP	0.024273	0.045745	0.744094	0.5999
LNINF	0.009027	0.012132	0.744094	0.4630
LNGovExp	–0.031041	0.095800	–0.324015	0.7483

Note: InGini is the natural logarithm of the Gini index; *InKOF* is the natural logarithm of the KOF globalization index; *InGDPpc* is the natural logarithm of GDP per capita; *Inunemp* is the natural logarithm of the unemployment rate; *Ininf* is the natural logarithm of the inflation rate, and *InGovExp* is the natural logarithm of government expenditure.

hypothesis positing the absence of cointegration is rejected. This implies that if the variables being analyzed deviate from equilibrium in the short term, they are expected to return to the equilibrium point in the long term. Therefore, the model would deviate at a speed of 78.99% back to the equilibrium point. In other words, it takes roughly a year and two months (1.266) (1/0.789969) for any change in globalization to have an impact on income inequality in the South African economy.

In the short run, *LNKOF* would positively affect *LNGINI*. Globalization is considered to affect income inequality in South Africa, as the variable is statistically significant in the short run at the 5% significance level, as globalization has a *t*-statistic of 2.8419. Therefore, income inequality in South Africa responds rapidly to oscillations in globalization. Heimberger (2020) found that globalization has a moderate positive relationship with income inequality. *LNGDPpc* would positively affect *LNGINI* in the short run. In the short run, the statistical significance of the relationship between GDP per capita and income inequality is established at the 5% significance level, evident from the *t*-statistic value of 3.9137, surpassing the critical threshold of 2. This signifies a positive relationship, indicating that fluctuations in GDP per capita are associated with corresponding shifts in income inequality. *LNUNEMP* would negatively affect *LNGINI*. The relationship is statistically insignificant at a 5% significance level in the short run because the absolute *t*-statistic is 0.158762, less than 2. Therefore, the link between income inequality and unemployment is negative in the short run, and income inequality does not determine unemployment. *LNINF* positively affects *LNGINI*. Inflation does not determine income inequality in South Africa as the coefficient is statistically insignificant at a 5% significance level, and the t-statistic is less than 2. *LNGovExp* would positively affect *LNGINI*. Government expenditure does not determine income inequality in South Africa as the coefficient is statistically insignificant in the short run as the *t*-statistic value is less than 2. This aligns with the assertion that the advantages derived from government spending are frequently enjoyed or accrued by the middle class instead of the lower class. Therefore, the income inequality problem is not addressed effectively in South Africa (Tanzi, 1974; Milanovic, 1994; Odusola, 2017; Alesina, 1998; Davoodi et al., 2003).

The latter observation indicates that causality, in the long run, traverses through the Error Correction Term (ECT) from globalization to income inequality. This substantiates the assertion that globalization exerts a sustained influence on income inequality in the South African economy over an extended period. Moreover, the short-run coefficient for income inequality is observed to be negative and statistically significant at the 5% significance level. This implies that, in the short run as well, causality flows from globalization to income inequality. Consequently, globalization has a clear and quick effect on income inequality in the South African economy within this limited timeframe. The combination of both short- and long-run effects emphasizes the multifaceted influence of globalization on income inequality, providing a nuanced understanding of the temporal dimensions of this complex relationship.

As shown in Table 8, the results show a unidirectional causality from income inequality to globalization. Other studies concur on this finding (Moheddine & Marwa, 2018; Örnek & Elveren, 2010). Hartwell (2022), however, states that there

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Table 7. Short run coefficients

Variable	Coefficient	Standard error	t-statistic	Probability
D(LNKOF)	0.081576	0.028704	2.841929	0.0083*
D(LNGDPpc)	0.071546	0.018281	3.913729	0.0005*
D(LNUNEMP)	–0.006229	0.039236	–0.158762	0.8750
D(LNINF)	0.001411	0.008491	0.166177	0.8692
D(LNGE)	0.095020	0.058573	1.622265	0.1160
ECT(–1)*	–0.789969	0.146838	–5.379876	0.0000*

Note: InGini is the natural logarithm of the Gini index; *InKOF* is the natural logarithm of the KOF globalization index; *InGDPpc* is the natural logarithm of GDP per capita; *Inunemp* is the natural logarithm of the unemployment rate; *Ininf* is the natural logarithm of the inflation rate, and *InGovExp* is the natural logarithm of government expenditure.

is a two-way Granger causality. Inflation directly Granger causes income inequality, and indirectly, Granger causes globalization through income inequality. Unemployment and inflation both directly Granger cause globalization. Interestingly, income inequality directly Granger causes GDP per capita. These relationships are statistically supported by the probability values that are significant at a 5% level.

Government expenditure Granger causes unemployment. Corresponding with this finding, Shigwedha (2020) found a unidirectional relationship between government expenditure and unem-

Table 8. Granger causality results

Null hypothesis	Observations	F-statistic	Probability	Decision
LNKOF does not Granger cause LNGINI	42	1.23729	0.2728	No causality
LNGINI does not Granger cause LNKOF		3.80538	0.0483	Causality
LNGDPpc does not Granger cause LNGINI	42	2.68509	0.1093	No causality
LNGINI does not Granger cause LNGDPpc		7.70480	0.0084	Causality
LNUNEMP does not Granger cause LNGINI	42	1.08182	0.3047	No causality
LNGINI does not Granger cause LNUNEMP		0.82470	0.3694	No causality
LNINF does not Granger cause LNGINI	42	3.75885	0.0598	Causality
LNGINI does not Granger cause LNINF		1.38511	0.2464	No causality
LNGovExp does not Granger cause LNGINI	42	0.08429	0.7731	No causality
LNGINI does not Granger cause LNGovExp		2.67575	0.1099	No causality
LNGDPpc does not Granger cause LNKOF	42	9.85571	0.0032	Causality
LNKOF does not Granger cause LNGDPpc		0.32753	0.5704	No causality
LNUNEMP does not Granger cause LNKOF	42	5.91683	0.0197	Causality
LNKOF does not Granger cause LNUNEMP		0.51041	0.4792	No causality
LNINF does not Granger cause LNKOF	42	21.6255	4.E-05	Causality
LNKOF does not Granger cause LNINF		0.01921	0.8905	No causality
LNGovExp does not Granger cause LNKOF	42	2.00356	0.1649	No causality
LNKOF does not Granger cause LNGovExp		3.08423	0.0869	No causality
LNUNEMP does not Granger cause LNGDPpc	42	1.94804	0.1707	No causality
LNGDPpc does not Granger cause LNUNEMP		0.49472	0.4860	No causality
LNINF does not Granger cause LNGDPpc	42	0.39271	0.5345	No causality
LNGDPpc does not Granger cause LNINF		0.80363	0.3755	No causality
LNGovExp does not Granger cause LNGDPpc	42	1.49237	0.2292	No causality
LNGDPpc does not Granger cause LNGovExp		2.78821	0.1030	No causality
LNINF does not Granger cause LNUNEMP	42	0.23260	0.6323	No causality
LNUNEMP does not Granger cause LNINF		2.31270	0.1364	No causality
LNGovExp does not Granger cause LNUNEMP	42	18.2028	0.0001	Causality
LNUNEMP does not Granger cause LNGovExp		0.20745	0.6513	No causality
LNGovExp does not Granger cause LNINF	42	2.18991	0.1470	No causality
LNINF does not Granger cause LNGovExp		1.14368	0.2915	No causality

Note: InGini is the natural logarithm of the Gini index; *InKOF* is the natural logarithm of the KOF globalization index; *InGDPpc* is the natural logarithm of GDP per capita; *Inunemp* is the natural logarithm of the unemployment rate; *Ininf* is the natural logarithm of the inflation rate, and *InGovExp* is the natural logarithm of government expenditure.

Table 9. Residual diagnostic test results

Residual diagnostic tests	Decision rule	Probability value	Decision
Breusch- Godfrey Serial Correlation LM Test	H_0 = No serial correlation = p > 0.05 H_1 = Serial correlation = p < 0.05	0.1352*	Accept null hypothesis of no serial correlation
Breusch-Godfrey Heteroscedasticity Test	H_0 = Homoscedasticity = p > 0.05 H_1 = Heteroscedasticity = p < 0.05	0.4098*	Accept null hypothesis of homoscedasticity
Normality Test	H_0 = Residual terms are normally distributed = p > 0.05 H_1 = Residual terms are not normally distributed = p < 0.05	0.1144*	Accept null hypothesis of normal distribution

Note: (*) Acceptance of null hypothesis at 1%, 5%, or 10% significance level.

Table 10. Ramsey Regression Equation Specification Error Test (RESET) results

	Value	Degrees of freedom (Df)	Probability
t-statistic	0.	31	0.4055
F-statistic	0.015532	(1, 31)	0.4055
Likelihood ratio	0.019182	1	0.3291

ployment. The scholars demonstrate that public spending plays a crucial role in minimizing unemployment in Namibia. However, Ranasinghe (2023) found contradicting results as there was no Granger causal relationship between government spending and unemployment. According to the findings, inflation, income inequality, and GDP per capita Granger cause globalization. Lastly, income inequality Granger causes GDP per capita. According to Satti et al. (2013), there is a bidirectional Granger causal relationship between globalization and inflation. Murshed (2018) found no causal link between globalization and inflation.

The primary objective of performing diagnostic tests is to provide assurance regarding the reliability and authenticity of the outcomes derived from the preceding ARDL model, eliminating concerns of spurious or unreliable findings. Therefore, the results of the residual diagnostic test are presented in Table 9.

Table 9 confirms that the variables integrated into the ARDL model display resilience against non-normality distribution, serial correlation, and heteroscedasticity. Consequently, all the null hypotheses are accepted. Thus, the outcomes derived from the bound tests and Error Correction Model (ECM) produced by the ARDL model are reliable and not spurious and misleading. However, it is still necessary to perform stability tests to further confirm the reliability of these results. Therefore, the Ramsey Regression Equation Specification Error Test (RESET) results are shown in Table 10.

Looking at Table 10, the probability values of the *t*-statistic (0.4055) and the *F*-statistic (0.405) are greater than the significance level of 5%. Therefore, the ARDL model is considered to be well-specified. The mathematical form of this ARDL model is well specified.

CONCLUSION

This paper examines the relationship between globalization and income inequality in South Africa. The objective was accomplished through the application of the ARDL bounds test and the Granger causality test.

The ARDL bounds test findings show that there is a significant long-run relationship between globalization and income inequality. The results indicate that globalization has played a significant role in exacerbating income inequality within South Africa. Nevertheless, the study also reveals that globalization alone cannot account for all the variations observed in income distribution. GDP per capita showed a significant positive long-run relationship with income inequality. This indicates that as GDP per capita increases over an extended period, income inequality tends to rise as well. The implications of the results indicate that understanding this relationship is essential, as it highlights the potential impact of

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economic growth on income distribution. This understanding suggests that to effectively address income inequality, policies should not only focus on promoting economic expansion but also prioritize equitable income distribution. By implementing strategies that ensure the benefits of economic growth are shared more evenly across the population, policymakers can work toward reducing income inequality. However, other variables, namely the unemployment rate, inflation rate, and government expenditure, exhibited an insignificant long-run relationship with income inequality.

The Granger causality results indicate a unidirectional effect between globalization and income inequality. This implies that changes in income inequality directly influence the degree of globalization. In other words, the variations in income inequality precede and potentially cause changes in the level of globalization rather than the reverse. This finding is significant as it suggests that rising income inequality within South Africa can lead to changes in how the country engages with the global economy. For instance, increasing income inequality might drive policy adjustments or influence public opinion toward globalization, affecting trade policies and other aspects of international economic integration. Understanding this causality is crucial for policymakers, as it highlights the importance of addressing income inequality not only as a social and economic issue but also as a factor that can shape South Africa's globalization trajectory. Moreover, this insight indicates the interconnectedness of domestic socio-economic conditions and international economic dynamics, implying that efforts to manage globalization effectively must also consider the internal distribution of income.

For future research studies, when time permits, alternative measures of income inequality, such as the Theil index or actual income figures, can be considered instead of relying solely on the Gini index. The utilization of these different indices may yield varied outcomes, offering a more comprehensive and distinct perspective on income distribution. Exploring diverse measures ensures a thorough examination of income inequality, allowing researchers to capture evidence that may not be fully represented by a single metric.

AUTHOR CONTRIBUTIONS

Conceptualization: Ireen Choga, Lyn Dundu.
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Formal analysis: Lyn Dundu.
Investigation: Lyn Dundu.
Methodology: Lyn Dundu.
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