

The Impact of International Trade on Income Inequality in the SADC Region

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Abstract

This study examines the influence of international trade on income inequality within the Southern African Development Community (SADC) by employing the Ordinary Least Squares (OLS) Panel Fixed Effects and the Two-Stage Least Squares (2SLS) Panel Instrumental Variable Approach. The findings indicate an inverse correlation between international trade and income inequality, suggesting that trade can contribute to equitable income distribution in the SADC region. However, the study also reveals that the impact of trade on inequality varies across income groups, with trade generally increasing inequality in countries outside the least developed nations. The results further highlight the role of resource endowment in shaping income inequality, showing that trade tends to increase inequalities in resource-rich economies due to the uneven distribution of economic gains. These findings challenge the universality of conventional trade theories, particularly the Stolper-Samuelson theorem, in the context of the SADC region. The study contributes to the growing body of literature by providing region-specific insights and recommending targeted policy interventions to ensure that trade benefits are more equitably distributed.

Keywords

International Trade, Income Inequality, Income Levels, Instrumental Variable Approach, FE, Panel Econometrics

1. Introduction

International trade has historically been a fundamental driver of economic growth, yet its role in shaping income inequality remains contentious (Anderson, 2005; Borrs & Knauth, 2021; Harrison et al., 2011; Lee & Wie, 2015; Nigai, 2022). This debate is particularly pronounced in Africa, which continues to experience

some of the highest levels of inequality and absolute poverty worldwide (Kolawole, 2016). Within the Southern African Development Community (SADC), income inequality persists despite decades of trade liberalization, raising concerns about whether trade has contributed to or mitigated disparities in wealth distribution (Jauch, 2011; Martin, 2022).

According to traditional trade theories, particularly the Stolper-Samuelson theorem, trade should reduce inequality in developing economies by benefiting their abundant factor typically unskilled labor (Lin & Fu, 2016). However, SADC countries show diverse factor endowments. While trade reduces inequality in labor-abundant nations like Malawi and Mozambique by increasing low-skilled employment (Jaumotte et al., 2008), it also increases inequality in resource-rich economies like Botswana and Angola, where resource rents are highly concentrated among elites (Cerdeiro & Komaromi, 2021). This divergence highlights the need for country-specific trade policies rather than relying solely on conventional trade theories.

While extensive research has explored the relationship between trade and inequality, much of this work has focused on global or cross-regional analyses, with limited emphasis on Africa, and particularly the SADC region. Most existing studies fail to account for the role of resource endowment in shaping income distribution within trade-dependent economies. This study addresses these gaps by hypothesizing that international trade reduces income inequality in resource-poor SADC countries but increases it in resource-rich nations due to wealth concentration among elites.

This study makes three key contributions to the literature on trade and inequality. First, it provides empirical evidence specific to the SADC region, offering insights that challenge the applicability of traditional trade theories such as the Stolper-Samuelson theorem in resource-rich developing economies. Secondly, by employing an instrumental variable approach, it strengthens causal inferences regarding trade's impact on inequality, addressing endogeneity concerns that have often undermined previous studies. Third, the study highlights the importance of tailored policy interventions, advocating for differentiated trade policies that consider income levels and resource distribution within the region.

The paper is structured as follows: Section 2 reviews the literature, Section 3 outlines the methodology, Section 4 presents and discusses the results, and Section 5 concludes with policy recommendations.

2. Literature Review

2.1. International Trade on Income Inequality-Factor Endowment

International trade theory highlights factor endowment as a key determinant of trade's impact on income inequality. In labor-abundant developing countries, trade is expected to reduce inequality by boosting employment for low-skilled workers, whereas in capital- and skill-abundant nations, trade tends to widen income disparities by increasing returns to these factors (Calderón et al., 2020; de

Melo et al., 2011).

However, in resource-rich countries, resource rents often concentrate among elites, increasing inequality (Basu & Chau, 2018). In contrast, resource-poor countries tend to experience more equitable outcomes from trade, as it promotes employment and inclusive growth (Jacoby, 2020; Roser & Cuaresma, 2016). SADC countries with mixed endowments do not neatly fit this framework. South Africa and Namibia, for example, exhibit both labor- and capital-intensive industries, leading to ambiguous trade-inequality relationships (Basu & Chau, 2018).

While the Heckscher-Ohlin theorem posits that trade reduces inequality in labor-abundant countries, the Stolper-Samuelson theorem often fails in resource-rich SADC nations due to the concentrated benefits of resource wealth (Munir & Bukhari, 2020). This study investigates how resource endowments mediate trade's effects on inequality in the SADC region.

2.2. Effects of International Trade on Income Inequality

Income inequality in the Southern African Development Community is shaped by globalization, technological advancements, and international trade (Acemoglu, 2003; Goldberg & Pavcnik, 2007; Jaumotte et al., 2008). Trade liberalization influences inequality differently across SADC countries, depending on their economic structures and factor endowments. In labor-abundant economies, lowering trade barriers can enhance employment and wages for low-skilled workers, leading to a reduction in income inequality (Ganaie et al., 2018; Jonathan Gimba et al., 2021). However, in resource-rich countries, trade openness tends to reinforce disparities, as wealth from natural resource exports is often concentrated among political and economic elites, leaving low-income groups with limited gains (Cerdeiro & Komaromi, 2021; Silva, 2007).

The effect of international trade on inequality also varies based on the nature of exports and imports. Many SADC countries rely heavily on primary commodity exports, such as minerals, oil, and agricultural products, which tend to generate concentrated profits rather than widespread economic benefits (Baldwin, 2016; Milanovic, 2016). The resource sector is capital-intensive, employing a small fraction of the workforce, which limits the trickle-down effect to lower-income groups (Mayer & Wood, 2001). This dynamic leads to the so-called resource curse, where natural wealth exacerbates inequality rather than promoting inclusive development (Ross, 2001; Collier & Goderis, 2012).

On the import side, trade liberalization often leads to a surge in foreign-manufactured goods, which can benefit low-income consumers through reduced prices but may also negatively impact domestic industries and employment (Topalova, 2010; Pavcnik, 2017). In some SADC countries, increased imports of manufactured goods have displaced local industries that rely on semi-skilled labor, further widening income disparities (McMillan & Rodrik, 2011).

Foreign direct investment (FDI), facilitated by trade liberalization, plays a crucial role in shaping inequality within SADC economies. Some studies suggest that FDI, particularly in labor-intensive sectors such as manufacturing and services,

can reduce inequality by creating jobs and improving wages for lower-income workers (Choi, 2006; Dollar & Kraay, 2004). However, other findings indicate that FDI inflows are often directed toward capital-intensive industries, which primarily benefit higher-skilled workers and multinational corporations, exacerbating wage gaps (Herzer & Nunnenkamp, 2013; Jaumotte et al., 2008).

Trade policies, including tariff structures, regional trade agreements, and export promotion strategies, also influence inequality outcomes. Some SADC countries have pursued industrialization policies aimed at diversifying exports beyond primary commodities to promote more equitable economic growth (Te Velde, 2017; UNCTAD, 2020). However, the success of such policies depends on complementary measures, such as investment in education, infrastructure, and social protection programs, to ensure broader participation in trade-related economic gains (Goldberg & Pavcnik, 2016).

2.3. Literature Gap and Contribution

While previous studies have examined the relationship between trade liberalization and income inequality in developing economies (Goldberg & Pavcnik, 2007; Milanovic, 2016; Jaumotte et al., 2008), there remains a limited body of research focusing specifically on the SADC region. Existing literature often generalizes the effects of trade on inequality across Africa or broader developing regions without accounting for the unique economic structures and policy environments of SADC nations.

Furthermore, while many studies highlight the resource curse and its implications for inequality (Collier & Goderis, 2012; Ross, 2001), few of them have provided empirical analysis linking trade liberalization, export dependency, and sectoral employment patterns in the SADC context. Most research on trade and inequality in the region tends to focus on country-level aggregate measures, overlooking the distributional effects across different income groups, sectors, and geographic regions.

This paper fills this gap by offering a SADC-specific analysis of how trade openness affects income distribution, distinguishing between the impacts of export structures, import penetration, and FDI inflows. By incorporating cross-country panel data evidence, this study provides new insights into the trade-inequality relationship in the SADC region.

3. Methodology

3.1. Data

This study examines the impact of international trade on income inequality in the Southern African Development Community (SADC) region, covering a period of 33 years (1990-2023). The dataset integrates macroeconomic data from multiple sources, including the World Development Indicators (World Bank), the Standardized World Income Inequality Database (SWIID v9.3), the World Income Inequality Database (WIID), the Economic Commission for Africa Database, and

National Statistics Offices. The SADC region consists of 16 member countries: Angola, Botswana, Comoros, the Democratic Republic of Congo, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Tanzania, Zambia, and Zimbabwe.

Variable Description

Dependent Variable: Income inequality is measured using the Gini index, sourced from the WIID and SWIID (v9.3). The study employs the Gini index due to its widespread use and cross-country comparability (Solt, 2020). However, alternative measures such as the Palma ratio and Theil index were considered. The Palma ratio provides insights into inequality by focusing on disparities between the richest 10% and poorest 40% (Cobham & Sumner, 2013). The Theil index, while useful in capturing inequality decomposition, is less widely available for SADC countries.

Independent Variable: International trade, the primary explanatory variable, is measured as the sum of exports and imports as a percentage of GDP. Data are sourced from the World Development Indicators (2024) and the Economic Commission for Africa (2024). For Malawi, data were obtained from the National Statistics Office due to availability issues. This measure captures the dual effects of trade liberalization, which may reduce or exacerbate inequality depending on economic structure (Lin & Fu, 2016; Mahesh, 2016).

Control Variables: To address confounding factors, the following variables are included: Natural Resources Measured as resource rents (% of GDP), to account for the role of resource dependence in economic outcomes. Resource wealth can increase inequality by concentrating wealth among elites. GDP Per Capita Controls for income distribution effects at different income levels (Dorn et al., 2021). Foreign Direct Investment (FDI) is measured as FDI inflows (% of GDP), capturing the globalization-inequality nexus (Felbermayr et al., 2011). Human Development Index (HDI): Used as a proxy for productivity and development, as HDI correlates with income inequality (Odusola et al., 2017). Household Consumption Expenditure: Reflects residents' expenditures, which are positively linked to income inequality (Zakaria & Fida, 2016). Population: Included to capture demographic influences on trade and inequality. Geographical Distribution: Accounts for spatial differences across the SADC region.

Robustness Check Variables: Additional controls include ICT exports (% of GDP) and government final consumption expenditure (% of GDP). ICT exports proxy for technological factors, while government expenditure accounts for redistributive policies affecting income inequality (Dorn et al., 2021; Jaumotte et al., 2008).

3.2. Model Specification

3.2.1. Panel Fixed Effects

The baseline panel model for this research is estimated by ordinary least square (OLS) adopted from (Dorn et al., 2021). In this research, countries are described

by i and annual periods by t , which differs from (Dorn et al., 2021) in which they group t into five-year periods. Therefore, our baseline line model is as follows:

$$Gini_{i,t} = \beta \times Trade_{i,t} + \Theta \times X_{i,t} + v_i + v_t + \varepsilon_{i,t} \quad (3.1)$$

$Gini_{i,t}$ describing the measure of income inequality of a country (i) in a period (t). In this research, the explanatory variable is $Trade_{i,t}$ describing the ratio of imports and exports of the country (i) in a period (t). $X_{i,t}$ Vector of control variables, including GDP per capita, HDI, household consumption expenditure, and FDI. v_i intends to describe the country's fixed effects, v_t describes the fixed period effects, and $\varepsilon_{i,t}$ It is the error term. Standard errors are clustered by country to account for heteroscedasticity and serial correlation, following Dorn et al. (2021).

3.2.2. Panel Instrumental Variable Approach (2SLS)

To address potential endogeneity in the relationship between trade and income inequality, a two-stage least squares (2SLS) approach is employed. Endogeneity may arise due to omitted variables or reverse causality (Dorn et al., 2021). The 2SLS model consists of the following stages:

$$\text{First Stage: } Trade_{i,t} = \beta_0 + \beta_1 AREA_{i,t} + \beta_2 POP_{i,t} + \beta_3 X_{i,t} + u_{it} + \varepsilon_{it} \quad (3.2)$$

where AREA and POP represent geographical size and population, respectively.

Second Stage: Uses predicted trade values to estimate their effect on inequality:

$$Gini_{i,t} = \alpha + \beta_1 Trade_{i,t} + \beta_2 X_{i,t} + u_{it} + \varepsilon_{it} \quad (3.3)$$

Third Stage: Introduces resource endowment to explore differential effects for resource-rich and resource-poor countries:

$$Gini_{i,t} = \beta_0 + \beta_1 Trade_{i,t} + \beta_2 X_{i,t} + \beta_3 Trade_{Endowment,t} + u_i + u_t + \varepsilon_{it} \quad (3.4)$$

3.2.3. Construction of Instruments

The study constructs instruments using geographical variables (area and population) based on their exogenous relationship with trade. Larger areas and populations are negatively correlated with trade openness due to increased domestic market size (Aradhyula et al., 2007). These instruments are valid under the exclusion restriction, which assumes that geographical factors influence income inequality only through trade.

4. Results

4.1. Summary Statistics

This section presents key descriptive statistics highlighting economic and structural diversity across the SADC region. The Gini index, measuring income inequality before taxes and transfers, has a mean of 50.2%, ranging from 37.4% to 65.4%, indicating high inequality levels. The Palma ratio further emphasizes income disparities, with a mean of 10.57%. International trade, measured as the sum of exports and imports as a percentage of GDP, varies widely, with an average of 85% and a maximum of 217.2%. Natural resource rents, a proxy for resource

wealth, range from near zero to 55.8%, with a mean of 7.75%, reflecting uneven resource distribution across countries.

Economic indicators reveal that GDP per capita averages \$1.78 (ranging from -\$6.1 to \$8.4), placing most countries in the low- or lower-middle-income category. Human Development Index (HDI) values reinforce low development levels, while FDI inflows exhibit high variance, reflecting systemic barriers to investment. Household consumption expenditure also varies significantly across countries. These statistics underscore the region's heterogeneity, necessitating tailored policy approaches (Table 1).

Table 1. Descriptive statistics.

Variable	Definition	Obs	Mean	Std. dev.	Min	Max
Gini Index	The measure of Income Inequality before tax and transfers	429	50.2105	7.60145	37.4	65.4
Palma Ratio	The measure of the Income share of the top 10% divided by bottom 40%	489	10.5774	5.13372	4.39205	24.85759
International Trade	The measure of Exports/Imports % of GDP	480	85.069	42.5941	20.4309	217.2914
Natural Resources	Natural Resource Rents % of GDP	492	7.75536	9.52045	0.00117	55.87479
GDP Per Capita	The sum of gross value added by residents' producers of the economy	512	178.148	734.648	-26.4118	4527.565
Human Development Ind.	The measure of expected productivity	452	1.78965	0.53899	0.449	2.938816
Foreign Direct Investment	Net inflows FDI % of GDP	496	3.63083	5.76797	-10.725	57.87738
Human Consumption Exp.	The measure of expenditure incurred by the household	448	8.39622	1.42074	5.06725	12.42137
Population	Total number of people in a country	450	60.1761	15.6016	36.46	87.8
Area	The countries area measured in Sq.km	496	10.9519	2.82449	2.70805	13.79658

Source: Author's regression results, 2024.

4.2. Baseline Results (Gini Index)

Table 2 presents the baseline estimations of international trade's effect on income inequality in the SADC region. The findings suggest that trade significantly impacts inequality in resource-rich countries, while the effect is negligible in resource-poor nations. These results support traditional trade theories, such as Heckscher-Ohlin and Stolper-Samuelson, which predict that trade benefits the abundant factor of production. However, the resource curse appears to limit trade's inequality-reducing effects in resource-rich contexts.

Key control variables such as natural resources correlate positively with ine-

quality, confirming that resource rents are often concentrated among elites. GDP per capita, household consumption, and FDI are also positively correlated with inequality, suggesting that economic growth does not necessarily lead to equitable income distribution. Larger populations and land areas tend to correlate negatively with inequality, indicating structural factors that promote economic opportunities.

Table 2. International trade and income inequality—baseline estimations (OLS and 2SLS).

	OLS			2SLS		
	<i>Full</i>	<i>Res.</i>	<i>Low-Res.</i>	<i>Full</i>	<i>Res.</i>	<i>Low-Res</i>
	(1)	(2)	(3)	(4)	(5)	(6)
International Trade (log)	0.790** (0.361)	1.195** (0.505)	0.0528 (0.485)	-2.458*** (0.838)	-5.094* (2.760)	-0.964 (0.633)
Natural Resources	-0.0429*** (0.0152)	-0.0345* (0.0186)	-0.114** (0.0450)	0.0237 (0.0211)	0.0828 (0.0529)	-0.102** (0.0441)
GDP Per Capita	0.0007*** (0.0002)	-0.0389** (0.0193)	0.0005** (0.0002)	0.0005** (0.0002)	-0.0165 (0.0285)	0.0006*** (0.0002)
Human Development Index	0.601 (0.567)	0.876 (0.794)	-0.675 (0.718)	1.058* (0.638)	2.155* (1.131)	-0.358 (0.809)
Foreign Direct Investment	-0.0103 (0.0154)	-0.00108 (0.0195)	-0.0246 (0.0320)	0.0670*** (0.0211)	0.124** (0.0515)	-0.0405 (0.0364)
Household Consumption Exp. (log)	0.385** (0.159)	0.727*** (0.247)	0.201 (0.208)	0.0377 (0.164)	0.0018 (0.267)	0.0565 (0.230)
Population (log)	-5.097*** (1.477)	-4.072** (1.931)	-13.88*** (2.824)			
Area (log)	-7.160*** (1.323)	-11.12*** (2.546)	-4.655*** (1.446)			
constant	146.4*** (15.80)	198.6*** (33.32)	150.7*** (16.03)			
Fixed Effects						
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Countries	15	8	7	15	8	7
No. Observations	365	196	169	365	196	169
R-Squared	0.165	0.180	0.388	-0.090	-0.581	0.207
Endogeneity Test				14.222		
				0.0002		
Sargan Statistic Test				18.543		
				0.0000		

To address endogeneity concerns, a two-stage least squares (2SLS) approach confirms the findings, reinforcing the role of resource endowment in shaping inequality outcomes (Figure 1, Table 2).

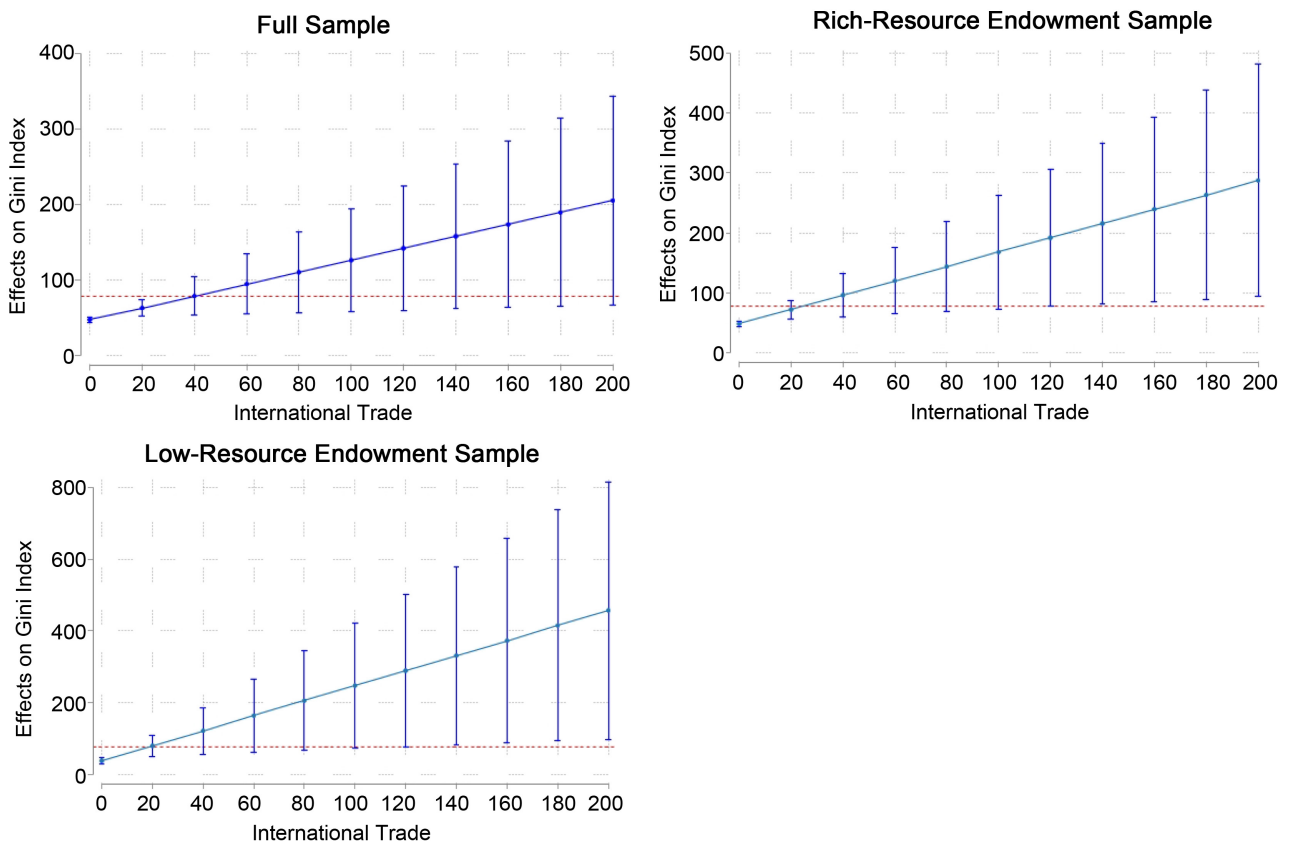


Figure 1. Non-Monotonic relationship of international trade and income inequality (Gini Index)-OLS.

The above graph illustrates the marginal effects of international trade on income inequality as a function of trade volume. The model using OLS panel fixed effects and clustered robust standard errors estimates the impact of international Trade on income inequality using Gini Index to measure income inequality. The points on the graph represent the marginal effects of a 1 percent increase in international trade on income inequality, according to the level of international trade indicated on the x-axis. The lines represent confidence intervals at 95 percent.

4.3. The Role of Income Levels in Trade-Inequality Nexus

The impact of international trade on income inequality in the SADC region varies significantly depending on a country's income level. The analysis groups countries into upper-middle, lower-middle, and low-income categories, revealing distinct patterns. In upper-middle-income countries, trade generally reduces inequality, particularly through imports that lower consumer prices and increase access to goods. However, these effects weaken in the 2SLS estimations, indicating that the long-term benefits of trade on inequality reduction may be limited in these econ-

omies.

For lower-middle-income countries, the relationship between trade and inequality is less consistent. Structural challenges, such as limited economic diversification and unequal access to trade benefits, may explain the weaker outcomes observed in this group. While trade may contribute to reducing inequality in some instances, the results lack robustness across different specifications.

In contrast, low-income countries demonstrate the most robust and consistent inequality-reducing effects of trade. Both OLS and 2SLS estimations indicate that trade significantly reduces inequality, with exports playing a particularly strong role by creating employment opportunities and fostering economic growth among marginalized populations. Also, imports in low-income economies help lower the cost of essential goods, further contributing to inequality reduction.

These findings suggest the importance of targeted trade policies that account for structural differences among SADC countries. Policymakers should prioritize strategies that enhance labor-intensive industries in lower-income nations while ensuring that trade benefits are more evenly distributed across different economic segments.

The analysis also reveals distinct dynamics between exports and imports. While exports show mixed effects, sometimes positively associated with inequality, imports consistently reduce inequality across most specifications. This suggests that imports may have a more direct impact on improving welfare by lowering prices and increasing access to essential goods, particularly in lower-income contexts. The different results across the three income level groups shows that labor policies, governance structures, and institutional strength significantly influence trade’s impact on inequality (Goldberg & Pavcnik, 2007) (Table 3).

Table 3. Income levels in the SADC region-estimations.

	Gini	Palma	Gini	Palma	Gini	Palma	Gini	Palma	Gini	Palma	Gini	Palma
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>(a) Full Sample</i>												
International Trade	0.790**	-2.87***					-2.4***	-6.57***				
	(0.361)	(0.862)					(0.838)	(1.708)				
Exports			0.212	-3.07***					-1.67**	-3.99**		
			(0.289)	(0.640)					(0.802)	(1.618)		
Imports					0.390	-1.84**					-3.36***	-8.96***
					(0.301)	(0.711)					(0.908)	(1.855)
Countries	15	15	15	15	15	15	15	15	15	15	15	15
No. Observations	365	371	365	371	365	371	365	371	365	371	365	371
R-Squared	0.165	0.241	0.155	0.265	0.158	0.231	-0.090	0.105	-0.022	0.143	-0.260	-0.054

Continued*(b) Benchmark
Sample*

International Trade	1.747***	-3.67***					0.940	-15.5***				
	(0.309)	(0.962)					(1.163)	(2.723)				
Exports			1.909***	-4.01***					4.434***	-17.8***		
			(0.318)	(0.954)					(1.494)	(4.237)		
Imports					0.851***	-1.652*					-1.514*	-10.8***
					(0.303)	(0.890)					(0.800)	(1.671)
Countries	6	6	6	6	6	6	6	6	6	6	6	6
No. Observations	154	144	154	144	154	144	154	144	154	144	154	144
R-Squared	0.657	0.692	0.664	0.699	0.601	0.667	0.529	0.254	0.434	0.073	0.330	0.340

*(c) Upper
Middle-Income*

International Trade	1.290***	-0.985					-0.762	-39.8***				
	(0.382)	(1.396)					(1.093)	(11.85)				
Exports			0.896**	-1.889					-0.867	-38.1***		
			(0.436)	-1.386					(1.243)	(12.26)		
Imports					0.978***	-0.142					-0.610	-34.3***
					(0.282)	(1.050)					(0.893)	(11.27)
Countries	4	4	4	4	4	4	4	4	4	4	4	4
No. Observations	105	90	105	90	105	90	105	90	105	90	105	90
R-Squared	0.698	0.797	0.676	0.801	0.700	0.796	0.597	-1.248	0.611	-1.050	0.590	-1.979

*(d) Lower
Middle-Income*

International Trade	0.971	-0.759					-0.0461	0.260				
	(0.769)	(1.304)					(1.431)	(2.358)				
Exports			-1.106*	-5.28***					3.095	-0.618		
			(0.587)	(0.887)					(1.983)	(2.810)		
Imports					1.007	0.426					-1.024	0.494
					(0.635)	(1.081)					(1.320)	(2.137)
Countries	6	6	6	6	6	6	6	6	6	6	6	6
No. Observations	142	146	142	146	142	146	142	146	142	146	142	146
R-Squared	0.143	0.104	0.155	0.292	0.149	0.102	0.088	0.098	-0.203	0.142	0.042	0.102

Continued

(e) *Low Income*

International Trade	0.567 (0.457)	1.372 (1.508)						-3.1*** (0.637)	-14.8*** (2.311)				
Exports			1.291*** (0.286)	1.069 (0.968)						-2.98*** (0.904)	-14.0*** (2.864)		
Imports					-0.457 (0.393)	0.587 (1.284)						-3.82*** (0.742)	-17.3*** (3.101)
Countries	5	5	5	5	5	5	5	5	5	5	5	5	5
No. Observations	118	135	118	135	118	135	118	135	118	135	118	135	135
R-Squared	0.510	0.568	0.583	0.569	0.509	0.565	0.146	0.143	-0.405	-0.333	0.132	-0.142	

4.4. Heterogeneous Treatment Effects

The study further investigates how resource endowment influences trade’s impact on inequality. Using an interaction term between trade and resource endowment, the findings indicate that in resource-rich countries, international trade increases inequality, as resource rents remain concentrated among elites. In contrast, resource-poor countries experience more equitable outcomes. These findings emphasize the need for effective resource governance and economic diversification to prevent trade from reinforcing existing disparities (Table 4).

Table 4. Heterogeneous treatment effects.

	1	2	3	4
International Trade (log)	0.158 (0.518)	-5.280*** (1.183)	18.19*** (2.230)	6.684*** (1.395)
International Trade*Endowment	1.048* (0.619)	4.125*** (1.405)	2.801*** (0.238)	1.511*** (0.144)
Natural Resources	-0.0496*** (0.0157)	0.0140 (0.0368)	-0.643*** (0.0629)	-0.252*** (0.0404)
GDP Per Capita	0.0006*** (0.0002)	-0.0027*** (0.0005)	0.00132** (0.0006)	-8.97e-05 (0.0003)
Human Development Index	0.607 (0.565)	-0.0702 (1.413)	-14.04*** (1.846)	-3.186*** (1.132)
Foreign Direct Investment	-0.0142 (0.0155)	-0.0308 (0.0360)	-0.610*** (0.0969)	-0.172*** (0.0621)

Continued

Household Consumption Exp. (log)	0.372** (0.159)	0.0791 (0.355)	3.327*** (0.549)	-0.940** (0.388)
Population (log)	-4.940*** (1.476)	-19.33*** (3.267)		
Area (log)	-6.577*** (1.363)	-10.78*** (3.109)		
constant	139.5*** (16.27)	227.1*** (36.67)	-29.63*** (10.28)	-4.589 (6.704)
Fixed Effects				
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Countries	15	15	15	15
No. Observations	368	371	368	371
R-Squared	0.172	0.259	0.047	0.252

4.5. Robustness Check

Several robustness checks confirm the validity of the findings. First, substituting the Gini index with the Palma ratio yields consistent results, demonstrating that trade reduces inequality in resource-poor economies while increasing it in resource-rich ones. Second, including ICT exports as a proxy for technological development reveals that technology does not significantly alter the relationship between trade and inequality. Finally, incorporating government expenditure as a control variable highlights the role of public spending in mitigating inequality, further reinforcing the primary conclusions.

5. Conclusion and Policy Implications

This study examines the relationship between international trade and income inequality in the SADC region from 1990 to 2023, contributing to the ongoing discourse on trade liberalization and its distributional effects. The findings reveal that while trade openness has the potential to reduce income inequality, its impact is highly dependent on a country's resource endowment and economic structure. Specifically, resource-rich countries in SADC tend to experience worsening inequality due to the concentration of resource rents among economic and political elites, while resource-poor nations benefit from more equitable income distribution through labor-intensive trade expansion.

To maximize the benefits of trade and mitigate inequality, resource-rich SADC countries should prioritize value addition, industrialization, and inclusive governance frameworks. The case of Norway's sovereign wealth fund, which redistributes oil revenues to ensure long-term economic stability, serves as a successful model that could be adapted to the SADC context (Cerdeiro & Komaromi, 2021).

Similarly, Botswana's strategic diamond revenue management has contributed to better inequality outcomes compared to other resource-rich SADC nations (Acemoglu, Robinson & Johnson, 2003). Implementing transparent and accountable resource governance mechanisms can help ensure that trade-driven economic growth translates into broader societal benefits.

For lower-income SADC countries, targeted trade strategies that emphasize labor-intensive industries and manufacturing are critical in reducing inequality. The experiences of Malaysia and Vietnam provide valuable lessons. Malaysia's export-driven industrialization policy prioritized manufacturing-led job creation, significantly reducing income disparities (Jacoby, 2020). Similarly, Vietnam's trade policies focused on developing labor-intensive industries and investing in workforce upskilling, ensuring that trade liberalization fostered inclusive economic growth (Franco & Gerussi, 2013). Adopting similar approaches in SADC can enhance the region's participation in global trade while promoting equitable economic opportunities.

Beyond trade policies, investments in human capital education, healthcare, and infrastructure are essential to ensuring that trade benefits are accessible to a broader population. Strengthening intra-regional trade within SADC can also help mitigate the negative effects of global trade by diversifying export markets and fostering economic resilience.

In conclusion, while international trade has the potential to reduce inequality, its benefits are not automatic. Without complementary policies, trade openness can exacerbate pre-existing disparities, particularly in resource-rich economies. To harness trade as a tool for inclusive growth, SADC countries must implement comprehensive industrial policies, equitable resource management strategies, and social investments. These measures will ensure that trade-driven growth is sustainable and inclusive, and contributes to long-term economic development in the region.

Availability of Data and Materials

Data and relevant files are available upon reasonable request.

Conflicts of Interest

We declare no competing or conflict of interest.

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Appendix

Appendix A. Categorization of SADC Countries

Rich Resource Endowments	Low Resource Endowments
South Africa: <i>Coal, Diamonds, Iron ore, Chromium</i>	Comoros
Botswana: <i>Diamonds</i>	Eswatini
Angola: <i>Diamonds</i>	Lesotho
Congo, DRC: <i>Gold, Diamonds, Cobalt, Copper</i>	Madagascar
Mozambique: <i>Aluminum</i>	Malawi
Namibia: <i>Uranium, Diamonds, Zinc, Salt, Copper, Lead</i>	Mauritius
Tanzania: <i>Tanzanite, Gold, Diamond, Silver</i>	Seychelles
Zambia: <i>Copper, Cobalt</i>	
Zimbabwe: <i>Platinum, Chrome, Gold, Coal, Diamonds</i>	

Appendix B. Robustness Checks-International Trade on Income Inequality, 1990-2021

	OLS		2SLS	
	<i>Full</i>	<i>Full</i>	<i>Full</i>	<i>Full</i>
	(1)	(2)	(3)	(4)
International Trade	0.738*** (0.266)	0.668** (0.261)	-2.166*** (0.761)	-2.459*** (0.784)
ICT Exports	-0.0289 (0.0200)	-0.0269 (0.0196)	-0.0192 (0.0262)	-0.0148 (0.0265)
Government Final Consumption		0.0003*** (0.0001)		0.0005*** (0.0001)
Natural Resources	0.0542*** (0.0188)	0.0580*** (0.0185)	0.126*** (0.0307)	0.136*** (0.0314)
GDP Per Capita	0.0004*** (0.0001)	0.0005*** (0.0001)	-0.0001 (0.0002)	-0.0001 (0.0002)
Human Development Index	1.726*** (0.425)	1.497*** (0.422)	2.274*** (0.549)	1.986*** (0.556)
Foreign Direct Investment	-0.0102 (0.0123)	-0.0070 (0.0121)	0.0474*** (0.0147)	0.0507*** (0.0149)
Household Consumption Exp. (log)	-0.0478 (0.134)	-0.104 (0.133)	-0.214 (0.166)	-0.274 (0.167)
Population (log)	-4.205*** (1.000)	-3.900*** (0.984)		
Area (log)	-6.802*** (1.146)	-6.825*** (1.122)		

Continued

constant	139.4*** (14.20)	139.5*** (13.90)		
Other Controls	Yes	Yes	Yes	Yes
Countries	15	15	15	15
No. Observations	220	220	220	220
R-Squared	0.332	0.363	-0.148	-0.166
	<i>Res</i>	<i>Res</i>	<i>Res</i>	<i>Res</i>
International Trade	1.316*** (0.387)	1.202*** (0.378)	-6.924** (2.948)	-6.815** (2.808)
ICT Exports	-0.0356 (0.101)	-0.0201 (0.0987)	0.169 (0.242)	0.191 (0.235)
Government Final Consumption		0.0003*** (0.0001)		0.0007** (0.0003)
Natural Resources	0.0447** (0.0140)	0.0505** (0.0164)	0.240*** (0.0858)	0.243*** (0.0828)
GDP Per Capita	-0.0037 (0.0079)	0.0003 (0.0086)	0.0052 (0.0292)	0.0129 (0.0285)
Human Development Index	1.174 (1.013)	1.054 (0.792)	-0.0661 (1.708)	-0.194 (1.654)
Foreign Direct Investment	-0.0076 (0.0164)	-0.0017 (0.0171)	0.0950*** (0.0359)	0.0963*** (0.0346)
Household Consumption Exp. (log)	0.372 (0.627)	0.223 (0.602)	0.877 (0.687)	0.594 (0.640)
Population (log)	-4.227*** (0.962)	-3.746*** (1.036)		
Area (log)	-12.44** (3.839)	-11.96** (3.507)		
constant	217.5*** (25.95)	211.5*** (25.31)		
Other Controls	Yes	Yes	Yes	Yes
Countries	8	8	8	8
No. Observations	115	115	115	115
R-Squared	0.448	0.485	-2.136	-1.917
	<i>Low-Res</i>	<i>Low-Res</i>	<i>Low-Res</i>	<i>Low-Res</i>
International Trade	-0.133 (0.327)	0.0102 (0.304)	-0.180 (0.548)	0.293 (0.697)
ICT Exports	-0.0272* (0.0162)	-0.0349** (0.0151)	-0.0272 (0.0170)	-0.0313* (0.0170)

Continued

Government Final Consumption		-0.0027*** (0.0006)		-0.0014* (0.0008)
Natural Resources	0.0285 (0.0689)	-0.0469 (0.0626)	-0.0112 (0.0472)	-0.0688 (0.0589)
GDP Per Capita	0.0003* (0.0001)	0.0003* (0.0001)	0.0003 (0.0001)	0.0004* (0.0002)
Human Development Index	1.569 (0.901)	2.692** (1.037)	2.252*** (0.582)	2.817*** (0.605)
Foreign Direct Investment	-0.0349 (0.0257)	-0.0210 (0.0205)	-0.0343 (0.0213)	-0.0329 (0.0210)
Household Consumption Exp. (log)	-0.128 (0.444)	-0.218 (0.315)	-0.280** (0.139)	-0.356** (0.144)
Population (log)	-7.439 (4.682)	-11.22** (3.045)		
Area (log)	-2.589 (3.143)	-1.529 (2.683)		
constant	102.2*** (15.55)	105.7*** (14.39)		
Other Controls	Yes	Yes	Yes	Yes
Countries	7	7	7	7
No. Observations	105	105	105	105
R-Squared	0.418	0.509	0.312	0.335