

# Effects of International Trade on Wage Inequality in the SADC Region

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## Abstract

The study analyzes the effect of international trade on wage inequality in the Southern African Development Community region using quantile regression. The findings indicate a positive relationship between international trade and average wage, with international trade contributing to increased wage inequality by widening the gap between high and low-income earners. The results suggest that international trade raises wages for skilled labor while reducing wages for unskilled labor, further increasing inequality. The results also highlight the role of skill-biased technological change, which favors skilled workers, thereby reinforcing wage inequalities in the region. Contrary to the Stolper-Samuelson theorem, which suggests that international trade benefits the abundant factor of production, this study finds that international trade in the SADC region contributes to rising wage inequality. The results suggest that the Stolper-Samuelson framework does not hold in the context of the SADC region. The study concludes that international trade, coupled with technological change, increases wage inequality and, therefore, calls for policy measures to address the unequal distribution of trade benefits in the SADC region.

## Keywords

International Trade, Wage Inequality, Skilled Labour, Unskilled Labour, Quantile Regression, Panel Econometrics

## 1. Introduction

Countries in the SADC region have continuously pursued trade liberalization through bilateral and multilateral trade agreements, leading to potential economic growth. However, the region has simultaneously experienced a decline in labor productivity in recent years due to a shortage of skilled labor. This shortage is largely attributed to limited access to higher education, particularly for those

living in rural areas, which exacerbates wage inequality. The relationship between labor productivity and wage inequality is evident, as the benefits of increased productivity predominantly accrue to skilled workers, widening the gap between skilled and unskilled labor and deepening wage inequality.

Contrary to the HO model, which predicts that trade liberalization will reduce wage inequality by increasing demand for unskilled labor in developing economies, reality repeatedly diverges from this expectation. As developing economies integrate with developed nations, production shifts toward unskilled labor-intensive industries. However, this shift does not translate into increased demand for unskilled labor (Verhoogen, 2008). Therefore, this study seeks to examine the relationship between international trade and wage inequality in the SADC region, contributing to the existing literature on the subject.

Despite the adoption of minimum wage laws by most SADC countries, the region remains categorized among those with the lowest minimum wages globally. The Democratic Republic of Congo has the lowest minimum wage in the region, at US\$66.58 per month, while Seychelles tops the scale with US\$432 (Hill & Kohler, 2021). Minimum wage levels across the region vary based on geographic location and income levels, with coastal countries such as Seychelles, South Africa, and Mozambique having relatively higher minimum wages compared to landlocked nations like Malawi, Congo, and Zambia. Furthermore, due to high illiteracy rates and the prevalence of unskilled labor, 58% of workers in the region earn below the legislated minimum wage (Stanwix & Paper, 2015). Wage inequality remains a significant issue, though there is a gap in the literature specifically addressing this problem within the SADC context.

Despite the extensive literature on trade and wage inequality globally (Dai, 2022: pp. 1636-1659; Lee & Wie, 2015: pp. 238-250; Rigby & Breaux, 2008: pp. 920-940; Ritter, 2012: pp. 1902-1916; Machin & van Reenen, 2007) there is limited research that specifically focuses on the SADC region. The region's unique economic structure, characterized by high levels of unskilled labor and low educational attainment, provides a different context that challenges widely accepted economic theories such as the Stolper-Samuelson theorem. Existing studies do not adequately address how international trade affects wage distribution between skilled and unskilled labor within this region. Therefore, this study aims to fill this gap by analyzing the effects of international trade on wage inequality in the SADC region, providing empirical evidence on the distributional impact of international trade.

This study makes several significant contributions to the literature on international trade and wage inequality. The study provides robust empirical evidence demonstrating that international trade worsens wage inequality in the SADC region, specifically by increasing wages for skilled labor while reducing wages for unskilled labor. Through the results, the study challenges the widely accepted Stolper-Samuelson theorem, which suggests that international trade should benefit unskilled labor in developing countries. While this study provides significant results, it acknowledges limitations, such as the availability and accuracy of labor

market data across different SADC countries, which may affect the robustness of the findings. However, this study contributes to the existing literature by filling a crucial research gap on the effects of international trade on wage inequality in the SADC region.

The remainder of the paper is structured as follows: Section 2 reviews the relevant literature on trade and wage inequality; Section 3 presents the data and methodology used in the analysis; Section 4 discusses the empirical results and their implications for the SADC region; and Section 5 concludes the study by summarizing key findings and policy implications.

## 2. Literature Review

### 2.1. Effects of International Trade on Wage Inequality

Empirically, studies have tried to examine the impact of trade on wage inequality; however, the results remain inconclusive and controversial, leaving room for more research. Afonso and Gil (2013: pp. 481-492) build a north-south technological knowledge diffusion model connects that wage inequality is attributed to skill-biased technological change and international trade. Based on their results, he concludes that market size is the main factor in wage inequality due to the price channel under international trade. Rigby and Breau (2008: pp. 920-940) challenge the claim that international trade plays a subordinate role in explaining the changes in relative wages and skill-biased technology is the primary driver of inequality. Based on their findings, they argue that imports do not affect high-skilled laborers' relative wages. Instead, exports positively affect them, reducing the wages of less skilled laborers. The study findings, therefore, endorse the theoretical prediction of the Stolper-Samuelson theorem. However, these findings have largely focused on developed economies, leaving a significant research gap when it comes to understanding how these dynamics affect the SADC region.

Several studies have linked trade to wage inequality, finding a positive relationship between trade and wage inequality (Rigby & Breau, 2008: pp. 920-940; Ritter, 2012: pp. 1902-1916; Machin & van Reenen, 2007). In their study on the effect of trade on wage inequality in Los Angeles, Rigby & Breau (2008: pp. 920-940) proved a positive significant relationship between international trade and wage inequality rather than skill-biased technology and trade. The study provides strong support for the link between trade and inequality while emphasizing high-quality labor for developing nations. According to (Ritter, 2012: pp. 1902-1916), which offers evidence supporting the link between trade and inequality, the industry is more affected by trade through the distribution of workers, which increases inequality. Large companies have an advantage due to their increased demand for highly skilled workers, which has a knock-on effect on smaller and medium-sized companies, forcing them to recruit workers with lower skill levels. Therefore, it reduces inequality among highly skilled workers while increasing inequality among workers with lower skill levels. Although (Rigby & Breau, 2008: pp. 920-940; Ritter, 2012: pp. 1902-1916; Machin & van Reenen, 2007) emphasize

the positive relationship between international trade and wage inequality, these studies largely examine developed or industrialized regions. This presents a gap in understanding how similar mechanisms might play out in less industrialized and less skill-intensive regions like Southern Africa, where the majority of the workforce is unskilled.

However, Machin & van Reenen (2007) did find a small link between international trade and wage inequality. In their study, they argued that technological change, and not international trade, has led to the demand for skills, which has increased the wage gap, thereby enhancing wage inequality. Nevertheless, they did find this link. Using a heterogeneous-firm model in a linked employer-employee data for Brazil (Cheong & Jung, 2021; Helpman et al., 2016: pp. 357-405) finds supporting evidence on the effects of trade on wage inequality. Once a closed economy is open for trade, a standard deviation for worker wages rises by 10 percent. These findings support the theoretical predictions of (Helpman et al., 2010: pp. 1239-1283), which derives that trade openness increases sectoral wage inequality due to the rising of firm revenue dispersion that turnout to increase firm wages dispersion, thus increasing wage inequality upon trade openness. Hence, we can conclude that there is a non-monotonic relationship between wage inequality and trade liberalization in instances where trade liberalization raises and sometimes reduces wage inequality. The contrasting findings by (Cheong & Jung, 2021; Helpman et al., 2010: pp. 1239-1283; Stone & Cavazos Cepeda, 2012) suggest a need for more context-specific research in the SADC region to explore how trade affects wage inequality in industries dominated by unskilled labor.

Evaluating the relationship between trade and wage inequality using industry-level data (Stone & Cavazos Cepeda, 2012) argued that an increase in trade results in a decrease in wage differentials, supporting the evidence that trades, specifically imports, positively affect wages. (Attanasio Pinelopi Goldberg Nina Pavcnik et al., 2002; Galiani & Sanguinetti, 2003: pp. 497-513; Goldberg & Pavcnik, 2005: pp. 75-105; Goldberg & Pavcnik, 2007) supports evidence that trade liberalization positively impacts wage premiums due to skill-biased technological change in the industry. However, they also agree on the small effect of trade on wage inequality in the industry, which suggests that wage premiums might be affected by other channels, not only trade, which perpetually leads to wage inequality in the industry. Argues that trade-induced skill upgrading in productive firms with a large capacity will increase the demand for skilled workers in a given industry. Therefore, it will increase industry skill premiums. Murakami (2021: pp. 407-438), using industry-level panel data, found evidence that reduction output tariffs increase wages for the average in the given industry. The reductions significantly affect the increase of industry wage premiums for skilled workers, thereby increasing wage inequality between the skilled and unskilled in the industry. However, Murakami (2021: pp. 407-438) fails to account for regions with higher illiteracy rates and fewer skilled workers, leaving a gap in comprehending the full effect of international trade on wage inequality in SADC countries.

## 2.2. International Trade and Skill Premium

Several studies (Dai, 2022: pp. 1636-1659; Lee & Wie, 2015: pp. 238-250) argue that the failure of the Stolper-Samuelson theorem to solve the international trade puzzle in the empirical literature. Prediction of the SS on the raising of skill premium for the developed nations and the reduction of the skill premium for the developing nations still seems to have inconsistent results. Most studies have shown positive correlations between international trade and the skilled premium in both developed and developing countries. Dai (2022: pp. 1636-1659) argues the link between firm heterogeneity and skill premium can best be addressed using skill-biased technology. Thus, skill-intensive firms are likely to turn the tables as relative demand will rise for skills once nations are open to trade. The SS is considered to raise skill premium in countries that have abundant skill and is likely to reduce skill premium in countries that have high unskilled labor (Burstein et al., 2020: pp. 1071-1112), and hence trade liberalization helps in resource allocation in both nations (Melitz, 2003: pp. 1695-1725). There is limited empirical research specifically addressing the failure of this theory in the SADC region, where unskilled labor is more abundant, and skilled labor is scarce.

Bustos examines the impact of trade liberalization on skill upgrading. Evidence from the Argentina results suggests that trade liberalization influence on skills will vary depending on the demand for the skills available. The aggregate effect of industry skill demand was positive, thus showing that firms that have skilled labor have higher labor demands than those with less skill. Firms are, therefore, encouraged to employ a diversity of skills according to technological changes to fit the market size. Dai (2022: pp. 1636-1659) argues that quality is a channel that international trade uses to increase skill premiums in different nations, leading to inequality. High quality will differentiate skilled and unskilled labour as consumers in developed nations are inclined to pay for quality; hence the demand for skilled labour is relatively high and this increases wage inequality in the labor market (Dai, 2022: pp. 1636-1659). Verhoogen (2008) employs a difference-in-difference approach to compare the outcome variations of high-productivity and low-productivity firms prior to and following the devaluation. The results suggest that the devaluation increased exports and encouraged quality enhancement, and this led to firms having high productivity, which increased compensations for skilled and unskilled workers but was more favorable for skilled laborers. This increased wage inequality between skilled and unskilled labor in Mexican firms (Verhoogen, 2008). This study, therefore, fills the research gaps by providing robust, region-specific empirical evidence on the effects of international trade on wage inequality in the SADC region.

## 3. Methodology

### 3.1. Data

The study uses unbalanced panel data from 1990-2021 to examine the effects of

international trade on wage inequality in the Southern African Development Community. We used data from World Development Indicators, the International Labour Organization, and a collection of Labour surveys from National Statistics Websites of the 15 SADC countries. The combined panel data is unbalanced because the SADC countries have gaps in their labor data. Most countries in the region conduct labor surveys every 4 or 5 years, depending on the availability of funding for such surveys. Therefore, we decided to use the readily available in the National Statistics offices. The data that was collected and combined included pooled labour survey data from the 15 SADC countries: Angola, Botswana, Comoros, the Democratic Republic of the Congo, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, United Republic of Tanzania, Zambia and Zimbabwe. Seychelles was dropped from the list due to the unavailability of labour data in the country, and the efforts to contact the National Statistics for information proved futile, hence dropping the country from this study.

The labor survey data, sourced from National Statistics Offices, encompasses national-level information. Ideally, this data would include earnings, weekly hours worked, and various demographic characteristics such as age, gender, marital status, family background, educational attainment, literacy, occupation, job type, and employment sector. However, due to inconsistencies in some of the survey data, variables like weekly hours worked, family background, marital status, and job type were excluded. Instead, the analysis focused on age, gender (female), educational attainment, and employment sector. Educational attainment was categorized based on whether individuals completed or dropped out at different levels in their education, resulting in three education indicators: Primary education, Secondary education, and Tertiary education. Employment sectors were grouped into three categories: the Agricultural sector, the industry sector (non-traded), and the combined Manufacturing and Mining sector (traded).

### Variable Description

**Average Wage:** Average wage, which is the study's dependent variable, measure actual average labor earnings from employment. The study uses the average wage collected from the International Labor Organization, which covers various sectors and occupations. Several other studies have also used average wages to measure wage inequality (Cheong & Jung, 2021; Han et al., 2012: pp. 288-297). The study failed to use the Theil index as a measure of wage inequality due to the unavailability of data in the SADC region, hence the use of average wage.

**International Trade:** International trade, the study's independent variable, is measured by the total number of exports and imports as a percentage of GDP. The study uses International Trade data from the World Development Indicators (2022) and the Economic Commission for Africa (2022). For Malawi, data was unavailable on the two websites; therefore, it was collected from the National Statistics Office.

**Control Variables:** The study includes Years of Schooling as a control variable, measuring the total number of years spent in school. Data for this control variable

was collected from the Economic Commission for Africa 2022. Experience is also included as a control variable, constructed using the Mincerian wage equation. Mincer's wage equation links individual income to the individual's years of schooling. According to Mincer, a proportional income increase is related to additional years of education. Therefore, using the wage equation, experience is calculated as (age-years of schooling-6). Kras argues that the equation can apply to all educational systems, implying that 'experience' is comparable across countries and remains relatively constant, even as educational systems evolve. Other variables considered from the labor survey data in the 15 SADC countries collected from the National Statistics Offices include age, gender (female), and the employed population that has attained a certain level of education, such as primary, secondary, and tertiary education. The labor force data is also included from sectors like Agriculture, Industry, Manufacturing, and mining since these are the main employment sectors in the region apart from the public sector and local government. This was also collected from the National Statistics Offices of the 15 Countries.

## 3.2. Model Specifications

### 3.2.1. Quantile Regression Model

The quantile regression model is an econometric method that is more comprehensive in explaining the relationship between the outcome of the dependent variable and independent variable at different percentiles in the conditional distribution of the dependent variable. Quantile regression models the conditional quantile functions with a conditional distributional effect of the dependent variable; thus, observed covariates are expressed as functions. This method is a model that extends the classical least square estimation of mean and has the potential of offering different solutions at distinct levels as the emerging quantiles can be inferred as other estimations of the dependent variable to changes in the regressor at different points on the conditional distribution of the dependent variable. Thus, the quantile regression optimization problem can be estimated as follows:

$$\min_{\beta} \sum_{i=0}^n \sigma_i (y_i - x_i^j \beta) \quad (1)$$

where  $y_i$  is the vector of the dependent variable while  $x_i$  is the independent variable,  $\beta$  is the vector of estimated parameters and  $\sigma_i$  is the absolute value function that yields the sample quantile as the solution. Linear regression model assumes the error term to be independent of the variable's value when variances are homogenous. In quantile regression, the error terms vary with no assumptions of the variance structure, taking the quantiles stable against the dependent variable values. Thus, the determination of heteroscedasticity is allowed in quantile regression.

### 3.2.2. Model Estimation

To examine the effects of international trade on wage inequality in the Southern

African Development Community (SADC), the study employs quantile regressions for panel data. The study's baseline model is estimated as follows:

$$W_{i,t} = \alpha_i + \beta_1 Trade_{i,t} + \varphi X_{i,t} + \delta Y_{i,t} + \varepsilon_{i,t} \quad (2)$$

where  $W_{i,t}$  is labor earnings (Wages),  $Trade_{i,t}$  is an international trade measure of exports and imports as a percentage of GDP. In the regression  $\varphi X_{i,t}$ , we control for vectors observed individual characteristics by including years of schooling, age, experience, experience square, and female. To control for factors that affect wages due to education, we have primary education, secondary education, and tertiary education, and for factors that affect wages due to sector of employment, we include agriculture, industry, manufacturing and mining, and  $\alpha_i$  and  $\delta Y_{i,t}$ . To control for time-invariant country characteristics and year-fixed effects to possess for secular shocks each year, respectively.

To achieve the desired results, the study's baseline model is extended. The study employs the panel quantile analysis using to examine whether international trade's distributional effect on wage inequality varies across quantiles. Thus, our estimation considers the conditional distribution of quantiles  $Q_{lnWages} \left( \frac{\tau}{X_{i,t}} \right)$  in a panel data setting of  $\{(Wages, X_{i,t})\}$  in which  $X_{i,t}$  is the vector of trade and all other independent variables of this study.

Therefore, we estimate the extended model as follows:

$$Wages_{i,t} = \alpha_i + \beta X_{i,t}^j + (n_1 + Z_{i,t}^j) U_{i,t} \quad (3)$$

where by  $\alpha_i + n_1$  are the country and year fixed effects and  $Z_{i,t}^j$  is the vector of the known different transformation of our explanatory variable  $X_{i,t}$  international trade, while  $U_{i,t}$  is the unobservable random effect. In fitting the above model to the quantile regression used for this study, our model is estimated as follows:

$$Q_{Wages} \left( \frac{\tau}{X_{i,t}} \right) = \alpha_i(\tau) + \beta_\tau X_{i,t} + Z_{i,t}^j q(\tau) \quad (4)$$

where  $\alpha_i(\tau)$  is the quantile  $\tau$  which are the fixed effects of country  $i$ . Therefore, our quantile estimation can be written as follows:

$$Q_{Wages} \left( \frac{\tau}{X_{i,t}} \right) = \alpha_i(\tau) + \beta_\tau Trade_{i,t} + Z_{i,t}^j q(\tau) \quad (5)$$

In which  $Q_{Wages}$  is labor earnings (Wages),  $\beta Trade_{i,t}$  is an international trade measure of exports and imports as a percentage of GDP.

## 4. Results

### 4.1. Descriptive Results

**Table 1** presents the descriptive statistics for key variables in the analysis of wage inequality and international trade in the Southern African Development Community (SADC) from 1990 to 2021. Average wage had a mean of 41.51%,

ranging from a minimum of 6% to a maximum of 85.87%, indicating a general upward trend in wages over the period. International trade had a mean of 85%, with a minimum of 20.4% and a maximum of 217.2%, illustrating significant variation in trade openness across countries in the region.

**Table 1.** Descriptive statistics.

| Variable                        | Definition   | Obs | Mean    | Std. dev. | Min     | Max     |
|---------------------------------|--|-----|---------|-----------|---------|---------|
| Average Wage                    | Measure of actual average labor earnings from employment                                       | 448 | 41.5195 | 26.0663   | 6.38    | 85.87   |
| International Trade             | The measure of Exports and Imports as a % of GDP   | 480 | 85.069  | 42.5941   | 20.4309 | 217.291 |
| Years of Schooling              | Total number of years in school  | 387 | 5.54354 | 1.90686   | 0.83    | 10.1    |
| Age                             | The demographic variable of the Employed population between ages 15 - 65                       | 385 | 80.1952 | 17.1089   | 41.2929 | 104.855 |
| Experience                      | Mincerian wage equation for experience   | 387 | 70.5497 | 17.1862   | 26.1608 | 94.5047 |
| Experience Square               | Experience Squared   | 387 | 5271.86 | 2153.19   | 684.388 | 8931.14 |
| Female                          | Total number of females employed in various sectors  | 95  | 65.1148 | 16.3398   | 31.92   | 88.84   |
| Primary Education               | Total number of the employed labor force that completed and dropped out of primary education   | 95  | 56.5735 | 15.6196   | 23.37   | 95.19   |
| Secondary Education             | Total number of the employed labor force that completed and dropped out of Secondary education | 95  | 67.0052 | 11.0336   | 21.67   | 100     |
| Tertiary Education              | Total number of employed labor force completed tertiary education                              | 94  | 78.7723 | 10.7969   | 29.63   | 100     |
| Agriculture Sector              | Total number of the employed labor force in the Agricultural sector                            | 95  | 49.5591 | 25.6299   | 4.6     | 84.67   |
| Industry Sector                 | Total number of the employed labor force in the industry sector                                | 95  | 28.4193 | 12.309    | 4.24161 | 73.67   |
| Manufacturing and Mining Sector | Total number of the employed labor force in the Manufacturing and Mining sector                | 95  | 12.7291 | 7.44272   | 2.93    | 36.1    |

Source: Authors regression results, from The World Bank, ILO, ECOWAS, NSO, 2024.

Years of schooling averaged 5.54 years, with a minimum of 0.83 years and a maximum of 10.1 years, reflecting relatively low levels of educational attainment, contributing to a high proportion of unskilled labor in the region. Demographic variables also showed notable trends. The mean age of the working-age population (15 - 65 years) was 80.19%, with a range from 41.29% to 104.8%, signaling an increasing population in this age group. Experience, another key variable, averaged 70.54%, while experience squared had a wide range, indicating diversity in labor market experience across the region.

Educational attainment variables showed that primary, secondary, and tertiary education levels had means of 56.57%, 67%, and 78.77%, respectively. However, a significant proportion of the labor force had not progressed beyond primary

education, reinforcing the region's reliance on unskilled labor.

Sectoral data revealed that agriculture dominated the labor market, with a mean of 49.55%, compared to 28.41% in industry and 12.72% in manufacturing and mining. The high percentage in agriculture reflects the region's dependence on this sector, while the lower figures in manufacturing and mining point to limited industrialization. This highlights the region's reliance on imports, particularly for essential goods, and underscores the low contribution of manufacturing and mining despite the presence of rich natural resources.

## 4.2. Baseline Results

The study examines the relationship between international trade and wage inequality within the Southern African Development Community, utilizing both Ordinary Least Squares (OLS) and Quantile Regression models. The results in **Table 2**, where average wage serves as the dependent variable, indicate that international trade significantly impacts wage inequality across several quantiles in the regression. The results show there is a statistically significant positive relationship between international trade and wage inequality at the 1st percentile in OLS and in the 10th, 25th, and 50th quantiles, as well as at the 90th percentile, suggesting that increases in trade worsen wage inequality across most income distributions. However, the 75th quantile does not show a statistically significant relationship.

The positive coefficients across OLS and quantile regressions suggest that international trade tends to increase average wages, but this rise is not uniform across the labor force. A 1 percent increase in international trade is linked with a wage inequality increase of 10.17%, 5.62%, 1.51%, and 0.53% for the 10th, 25th, 50th, and 90th percentiles, respectively. This widening wage gap indicates that the benefits of trade are shared disproportionately with higher-income workers, especially in the lower percentiles; as a result, unskilled workers face greater inequality.

The results in **Table 2** challenge traditional trade theories, particularly the Heckscher-Ohlin and Stolper-Samuelson theorems, which argue that international trade should reduce wage inequality by raising the wages of unskilled labor in developing regions like SADC. Contrary to these arguments, our findings align with a growing body of literature that shows international trade is a significant driver of rising wage inequality in developing economies (Asteriou et al., 2014: pp. 592-599; Goldberg & Pavcnik, 2005: pp. 75-105; Jaumotte et al., 2008).

Control variables, such as years of schooling, experience, and age, show other factors influencing wage inequality in the SADC region. Years of schooling have a negative relationship with average wage, suggesting that an increase in education reduces wage inequality by narrowing the wage gap between skilled and unskilled workers. Similarly, work experience has a negative impact on wage inequality, thus reflecting the region's evolving labor market, where the increasing availability of skilled workers narrows the wage inequalities. Experience squared shows mixed results, suggesting a positive relationship with wage inequality in the 25th and 75th percentiles but an insignificant effect at the median and higher quantiles.

Age, as a demographic variable, is positively correlated with average wage, therefore widening the wage gap as older workers tend to earn more. Meanwhile, the female labor force variable is negatively correlated with wage inequality, indicating that an increase in female labor force participation reduces wage inequality.

**Table 2.** International trade and wage inequality—Baseline estimations (OLS and Quantile).

| Variable            | FE                    | 10 <sup>th</sup> Percentile | 25 <sup>th</sup> Percentile | 50 <sup>th</sup> Percentile | 75 <sup>th</sup> Percentile | 90 <sup>th</sup> Percentile |
|---------------------|-----------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
|                     | (1)                   | (2)                         | (3)                         | (4)                         | (5)                         | (6)                         |
| International Trade | 10.80***<br>(1.354)   | 10.17***<br>(0.0659)        | 5.622***<br>(0.382)         | 1.516***<br>(0.216)         | 0.821<br>(0.675)            | 0.530**<br>(0.229)          |
| Years of Schooling  | -27.65***<br>(5.780)  | -21.33***<br>(0.399)        | -26.86***<br>(3.995)        | -22.26***<br>(0.417)        | -24.27***<br>(1.077)        | -55.12***<br>(1.383)        |
| Age                 | 8.462***<br>(1.313)   | 6.423***<br>(0.0698)        | 10.20***<br>(1.268)         | 7.237***<br>(0.0819)        | 6.982***<br>(0.608)         | 13.36***<br>(0.290)         |
| Experience          | -8.722***<br>(1.259)  | -6.892***<br>(0.0744)       | -10.56***<br>(1.429)        | -7.170***<br>(0.0836)       | -7.015***<br>(0.612)        | -13.23***<br>(0.321)        |
| Experience Squared  | 0.0002<br>(0.0021)    | -0.0015***<br>(9.23e-05)    | 0.0013<br>(0.0022)          | -0.0015***<br>(0.0003)      | 0.0008***<br>(0.0002)       | -0.0002<br>(0.0003)         |
| Female              | -1.023***<br>(0.0482) | -0.568***<br>(0.0018)       | -0.814***<br>(0.0493)       | -1.349***<br>(0.0058)       | -1.473***<br>(0.0183)       | -1.345***<br>(0.0058)       |
| Constant            | 28.04*<br>(15.07)     |                             |                             |                             |                             |                             |
| Countries           | 15                    | 15                          | 15                          | 15                          | 15                          | 15                          |
| Observations        | 385                   | 385                         | 385                         | 385                         | 385                         | 385                         |

Notes: OLS and Panel Quantile Regression estimations are based on 32 years of balanced data from 1990-2022. The estimates use robust standard errors in parentheses. The significance levels; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Source: Authors regression results, from The World Bank, ECOWAS, ILO, NSO, 2024.

#### 4.2.1. Effects of International Trade on Wage Inequality

The baseline results in Section 4.2, **Table 2**, reveal that international trade positively affects average wage in the SADC region, leading to increased wage inequality. Despite these findings contradicting the predictions of the H-O theorem, which posits that international trade should reduce wage inequality in labor-abundant regions, the results align with existing research that highlights the role of international trade in increasing wage inequalities in developing economies (Asteriou et al., 2014: pp. 592-599; Barro, 1999; Cornia, 2009; Faustino & Vali, 2011: pp. 1-23; Goldberg & Pavcnik, 2007; Han et al., 2012: pp. 288-297; Jaumotte et al., 2008; Lim & Mcnelis, 2014: pp. 1-31; Lundberg & Squire, 2003: pp. 326-344; Mah, 2013: pp. 653-658; Mahesh, 2016: pp. 1751-1761).

To further the analysis, **Table 3** incorporates skilled and unskilled labor as control variables in the baseline model. The results show a significant and positive relationship between international trade and wage inequality. The results suggest that a 1 percent increase in international trade leads to substantial increases in average wages across both OLS and quantile regressions, with wage growth more

pronounced in the higher quantiles (10th to 90th percentiles). This result further supports the concept that international trade worsens wage inequality in the SADC region by benefiting a specific segment of the labor force, namely skilled workers.

The control variables in **Table 3** are robust, maintaining their signs and significance levels across OLS and quantile regressions. Skilled labor shows a positive correlation with average wage, contributing to widening wage inequality. A 1 percent increase in skilled workers results in a 0.28% and 0.57% increase in wages in the OLS and 10th percentile quantile regressions, respectively. This suggests that the SADC region's labor market is influenced by skilled-biased technological change, which favors skilled workers, thus increasing wage inequalities. The findings are consistent with existing literature that links international trade to the adoption of advanced technologies and a subsequent rise in demand for skilled labor. In the SADC region, where skilled workers are scarce, this dynamic leads to higher wages for skilled labor, contributing to increased inequality.

**Table 3.** Effects of international trade on wage inequality—skilled vs unskilled labor.

| Variable            | FE                    | 10th Percentile       | 25th Percentile       | 50th Percentile         | 75th Percentile         | 90th Percentile         |
|---------------------|-----------------------|-----------------------|-----------------------|-------------------------|-------------------------|-------------------------|
|                     | (1)                   | (2)                   | (3)                   | (4)                     | (5)                     | (6)                     |
| International Trade | 19.42***<br>(3.979)   | 20.64***<br>(4.278)   | 12.76**<br>(4.927)    | 13.08***<br>(4.659)     | 11.96***<br>(2.782)     | 10.06***<br>(2.658)     |
| Years of Schooling  | -49.01*<br>(27.92)    | -41.49<br>(30.01)     | 23.66<br>(34.57)      | -65.72**<br>(32.69)     | -120.3***<br>(19.52)    | -118.6***<br>(18.65)    |
| Age                 | 10.90**<br>(4.209)    | 9.393**<br>(4.525)    | -0.404<br>(5.211)     | 12.42**<br>(4.928)      | 20.01***<br>(2.942)     | 19.05***<br>(2.811)     |
| Experience          | -10.59**<br>(3.987)   | -9.230**<br>(4.286)   | 0.959<br>(4.936)      | -11.14**<br>(4.668)     | -18.92***<br>(2.787)    | -18.03***<br>(2.663)    |
| Experience Squared  | -0.00655<br>(0.00451) | -0.00681<br>(0.00485) | -0.0100*<br>(0.00559) | -0.0148***<br>(0.00528) | -0.0106***<br>(0.00316) | -0.0103***<br>(0.00301) |
| Female              | -0.586***<br>(0.206)  | -0.611***<br>(0.221)  | -0.538**<br>(0.254)   | -0.770***<br>(0.241)    | -1.242***<br>(0.144)    | -1.179***<br>(0.137)    |
| Skilled Workers     | 0.280**<br>(0.132)    | 0.576***<br>(0.142)   | 0.272<br>(0.163)      | 0.0631<br>(0.155)       | 0.0884<br>(0.0923)      | 0.0650<br>(0.0882)      |
| Unskilled Workers   | -0.211<br>(0.129)     | -0.0905<br>(0.138)    | -0.346**<br>(0.159)   | -0.292*<br>(0.151)      | -0.145<br>(0.0900)      | -0.204**<br>(0.0860)    |
| Constant            | -43.95<br>(32.04)     | -72.38**<br>(34.44)   | -6.794<br>(39.67)     | 4.536<br>(37.51)        | 31.95<br>(22.40)        | 54.78**<br>(21.40)      |
| Countries           | 15                    | 15                    | 15                    | 15                      | 15                      | 15                      |
| Observations        | 69                    | 69                    | 69                    | 69                      | 69                      | 69                      |

Notes: OLS and Panel Quantile Regression estimations are based on 32 years of unbalanced data from 1990-2022. The estimates use robust standard errors in parentheses. The significance levels; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Source: Authors regression results, from The World Bank, ILO, ECOWAS, NSO, 2024.

Unskilled labor has a negative coefficient, with significant results at the 25th, 50th, and 90th percentiles of the quantile regressions, suggesting that an increase in unskilled labor reduces average wages. A 1 percent increase in unskilled workers leads to wage decreases of 0.34%, 0.29%, and 0.20% at these respective percentiles. This reflects the oversupply of unskilled labor in the SADC region, where industries can easily substitute unskilled labor with automation or reduce the workforce, leading to wage suppression. As a result, unskilled workers experience diminishing returns, which further widens the wage gap between skilled and unskilled labor. The negative coefficients for unskilled workers and the varying levels of significance across quantiles illustrate that there is an interplay between labor supply, substitutability, and wage outcomes in the SADC region. With limited alternative job opportunities and the dominance of industries that do not reward unskilled labor, wage inequality continues to rise, especially as skilled workers command a skill premium.

#### 4.2.2. The Role of Education in the SADC Region

In examining the role of education in wage inequality across the Southern African Development Community (SADC) region, this study incorporates primary, secondary, and tertiary education levels as control variables to further explore the relationship between international trade and wage disparities. The results, shown in **Table 4**, reveal that international trade leads to an increase in average wages, thereby contributing to wage inequality in the SADC region. This effect is particularly significant at the lower percentiles of wage distribution (10th, 25th, and 50th) but diminishes in the higher percentiles (75th and 90th).

Years of schooling exhibit a negative relationship with average wages, reducing wage inequality across the region. However, this variable remains insignificant in most regressions, with the exception of the 10th percentile, where it is significant at a 1% confidence level. Experience and experience squared also demonstrate a consistent negative effect on wages, contributing to reduced wage inequality, particularly in the lower percentiles.

When education is considered, the impact of primary, secondary, and tertiary education on wage inequality becomes evident. The findings for primary education indicate a negative relationship with wages, significantly reducing average wages across the OLS and lower percentiles of the quantile regression. A 1% increase in the labor force with primary education correlates with a notable decrease in average wages, underscoring the large proportion of workers in the region with only primary education, which depresses labor market prices and mitigates wage inequality.

Secondary education, on the other hand, shows a positive relationship with wages, significantly increasing average wages in the lower and middle percentiles, but this effect is not significant in the upper percentiles. The limited attainment of secondary education in the SADC region contributes to higher labor market prices for those with this level of education, thereby exacerbating wage inequality. This is likely due to the scarcity of workers with secondary education, making them more valuable in the labor market.

Tertiary education also exhibits a positive association with wages, especially in the lower and middle percentiles, though this effect becomes negative at the higher percentiles (75th and 90th). The results suggest that an increase in the labor force with tertiary education leads to wage increases, thereby widening wage inequality. This is attributable to the high demand for skilled workers, coupled with the relatively low proportion of the population able to attain tertiary education, largely due to pervasive poverty in the region.

#### 4.2.3. The Role of the Employment Sector in the SADC Region

To analyze the role of the employment sector in influencing wage inequality in the SADC region, we incorporated four key employment sectors, namely, agriculture, industry, manufacturing, and mining, into the baseline model. These sectors serve as control variables to further examine the effect of international trade on wage inequality. Our findings, presented in **Table 5**, indicate that international trade mainly contributes to an increase in average wages, increasing wage inequality across the region, with the exception of one model (column 6), which shows a reduction in average wage and, thus, a decrease in wage inequality.

**Table 4.** Effects of international trade on wage inequality—education (OLS and Quantile).

| Variable            | FE                   | 10th Percentile        | 25th Percentile        | 50th Percentile        | 75th Percentile     | 90th Percentile               |
|---------------------|----------------------|------------------------|------------------------|------------------------|---------------------|-------------------------------|
|                     | (1)                  | (2)                    | (3)                    | (4)                    | (5)                 | (6)                           |
| International Trade | 19.72***<br>(3.655)  | 29.63***<br>(1.960)    | 17.87***<br>(1.072)    | 15.52***<br>(0.455)    | 9.960<br>(12.14)    | 157,702<br>(404,841)          |
| Years of Schooling  | -34.23<br>(25.22)    | -58.45***<br>(15.10)   | 9.541<br>(6.076)       | -0.456<br>(2.025)      | -344.8<br>(343.5)   | -1.781e + 06<br>(4.598e + 06) |
| Age                 | 8.614**<br>(3.869)   | 13.00***<br>(2.392)    | 2.078**<br>(1.007)     | 4.008***<br>(0.347)    | 30.55*<br>(16.61)   | 230,156<br>(595,601)          |
| Experience          | -8.200**<br>(3.677)  | -11.67***<br>(2.183)   | -1.356<br>(0.947)      | -3.165***<br>(0.323)   | -25.45**<br>(11.22) | -211,116<br>(546,822)         |
| Experience Squared  | -0.00672<br>(0.0041) | -0.0170***<br>(0.0017) | -0.0094***<br>(0.0006) | -0.0095***<br>(0.0003) | -0.0585<br>(0.0740) | -118.8<br>(303.6)             |
| Female              | -0.700***<br>(0.178) | -0.288**<br>(0.128)    | -0.774***<br>(0.0420)  | -0.877***<br>(0.0494)  | 0.237<br>(2.057)    | -5,221<br>(13,457)            |
| Primary Education   | -0.365***<br>(0.129) | -0.562***<br>(0.125)   | -0.484***<br>(0.0182)  | -0.493***<br>(0.0171)  | -1.132<br>(1.512)   | 246.2<br>(741.9)              |
| Secondary Education | 0.333***<br>(0.123)  | 0.646***<br>(0.154)    | 0.422***<br>(0.0328)   | 0.476***<br>(0.0168)   | 0.143<br>(0.243)    | 1.704<br>(4.263)              |
| Tertiary Education  | 0.251**<br>(0.118)   | 0.320***<br>(0.0876)   | 0.244***<br>(0.0205)   | 0.0682**<br>(0.0276)   | -1.597<br>(2.819)   | -7.496<br>(19.287)            |
| Constant            | -52.95*<br>(29.92)   |                        |                        |                        |                     |                               |

**Continued**

|              |    |    |    |    |    |    |
|--------------|----|----|----|----|----|----|
| Countries    | 15 | 15 | 15 | 15 | 15 | 15 |
| Observations | 69 | 69 | 69 | 69 | 69 | 69 |

Notes: OLS and Panel Quantile Regression estimations are based on 32 years of unbalanced data from 1990-2022. The estimates use robust standard errors in parentheses. The significance levels; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Source: Authors regression results, from The World Bank, ECOWAS, ILO, NSO, 2024.

The results suggest a significant relationship between international trade and wage inequality at a 1% confidence level in the Ordinary Least Squares (OLS) and across the 10th, 25th, 50th, and 75th percentiles of the quantile regressions. However, the impact of international trade becomes insignificant at the highest quantile (90th percentile), suggesting trade influences wage inequality less in the upper-income distribution.

We further observe that years of schooling are correlated with wage suppression in the lower percentiles, which helps in reducing wage inequality. This variable retains significance at the 1% confidence level in the lower to middle percentiles but becomes positively correlated with wages in the 90th percentile, reflecting its key role in different wage brackets. Similarly, experience has a negative correlation with average wages in the lower percentiles but loses significance in the upper end of the wage distribution.

The results for sector-specific variables reveal distinct patterns across the SADC region. The agricultural sector shows a consistent negative association with wages, significantly reducing wage inequality. Given agriculture's role as the largest employer in the region, an increase in agricultural employment leads to reduced labor prices and, consequently, reduced wage disparities. This outcome aligns with the region's economic reliance on agriculture and its relatively low wage levels compared to other sectors.

In contrast, the industrial sector displays a mixed effect on wages. While industrial employment is associated with wage reductions in some percentiles, particularly the 50th and 75th, it increases wage inequality in the lower and upper percentiles, suggesting that industrial expansion benefits a narrower segment of the workforce, contributing to wage polarization.

Manufacturing and mining, meanwhile, exhibit a positive correlation with wages, except at the 90th percentile, where the relationship turns negative. These sectors, which are known to pay higher wages, particularly for skilled labor, significantly increase wage inequality in the SADC region. As manufacturing and mining jobs tend to offer higher salaries than those in agriculture or industry, the expansion of these sectors exacerbates wage gaps, particularly in the middle-income brackets.

### 4.3. Heterogenous Treatment Effect

The analysis in the SADC region, as presented in **Table 2**, **Table 3**, and **Table 4**, reveals that international trade significantly increases the average wage, thereby exacerbating wage inequality. To investigate this effect further, the study incorporates

interaction terms with occupational skill and employment sector, providing deeper insights into how these factors shape wage inequality in response to trade. The results, presented in (Appendix A), demonstrate that international trade continues to drive up average wages across the region, contributing to increased wage inequality.

The interaction between international trade and skilled labor indicates a significant positive relationship, with the effect of international trade on wage inequality being most pronounced among skilled workers. The results are consistent with the literature, which suggests that trade liberalization often benefits skilled labor, leading to a widening wage gap between skilled and unskilled workers (Di Comite et al., 2018: pp. 75-115; Mazorodze, 2021). This is attributed to the demand for skilled workers by firms that are better positioned to take advantage of trade opportunities and advanced technology, which drives up wages for skilled labor.

Conversely, the interaction between international trade and unskilled labor reveals a negative relationship, with significant reductions in wage inequality observed when trade benefits unskilled workers. The findings suggest that international trade reduces wage disparities for unskilled labor, potentially due to the downward pressure on wages in sectors that predominantly employ unskilled workers.

Similarly, the interaction of international trade with the employment sector shows a consistent pattern of increasing average wages, which leads to greater wage inequality. The results indicate that trade-driven wage increases are not uniform across sectors, with significant variations in the extent of wage inequality depending on the employment sector.

#### 4.4. Robustness Checks

To ensure the robustness of the baseline results, we conducted several additional tests to examine the effect of international trade on the average wage in the SADC region, employing various control variables. The findings consistently indicate that international trade increases average wage, which in turn exacerbates wage inequality across the region. In **Table 3**, we introduced skilled and unskilled labor variables into the baseline model, followed by the inclusion of education and employment sector variables in **Table 4** and **Table 5**. Despite these modifications, the results reaffirm the positive relationship between international trade and wage inequality, confirming the robustness of the initial findings.

The consistency of the results across these different models provides confidence in the validity of our baseline estimates presented in **Table 2**, which can be reliably used to interpret the impact of international trade on wage inequality in the SADC region. This suggests that international trade continues to play a critical role in shaping wage dynamics, with a clear tendency to widen income disparities, especially as it disproportionately benefits certain labor segments and sectors. The robustness checks strengthen the argument that the increase in wage inequality due to trade liberalization is a persistent and significant issue in the SADC region.

**Table 5.** Effects of international trade on wage inequality—employment sector (OLS and Quantile).

| Variable               | FE                    | 10th Percentile        | 25th Percentile        | 50th Percentile        | 75th Percentile        | 90th Percentile   |
|------------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|-------------------|
| International Trade    | 24.19***<br>(4.689)   | 17.37***<br>(1.694)    | 12.85***<br>(0.147)    | 14.08***<br>(0.627)    | 20.07***<br>(2.275)    | -91.78<br>(285.3) |
| Years of Schooling     | -54.55**<br>(25.44)   | -180.4***<br>(25.98)   | -57.17***<br>(1.021)   | -32.79***<br>(5.064)   | -121.0***<br>(12.20)   | 5.905<br>(18.688) |
| Age                    | 13.15***<br>(3.928)   | 28.42***<br>(3.642)    | 9.047***<br>(0.139)    | 7.464***<br>(0.529)    | 20.55***<br>(1.768)    | -514.6<br>(1.760) |
| Experience             | -12.12***<br>(3.720)  | -27.07***<br>(3.550)   | -8.006***<br>(0.133)   | -6.140***<br>(0.470)   | -18.62***<br>(1.906)   | 348.7<br>(1.279)  |
| Experience Squared     | -0.00772*<br>(0.0039) | -0.0214***<br>(0.0023) | -0.0146***<br>(0.0002) | -0.0133***<br>(0.0007) | -0.0151***<br>(0.0014) | 1.395<br>(3.989)  |
| Female                 | -0.587***<br>(0.177)  | 0.451**<br>(0.212)     | -0.206***<br>(0.00917) | -0.300***<br>(0.0393)  | -0.785***<br>(0.0348)  | -25.99<br>(70.57) |
| Primary Education      | -0.401**<br>(0.170)   | 0.137***<br>(0.0503)   | -0.172***<br>(0.00619) | -0.169***<br>(0.0205)  | -0.206***<br>(0.0476)  | 7.895<br>(26.49)  |
| Secondary Education    | 0.477***<br>(0.149)   | -0.0637<br>(0.0540)    | 0.222***<br>(0.0056)   | 0.117***<br>(0.0191)   | 0.117**<br>(0.0481)    | -9.772<br>(34.01) |
| Tertiary Education     | 0.0999<br>(0.121)     | 0.133**<br>(0.0545)    | 0.256***<br>(0.00353)  | 0.0791***<br>(0.0159)  | -0.0340<br>(0.0368)    | 10.78<br>(37.65)  |
| Agriculture            | -0.256<br>(0.180)     | -0.521***<br>(0.0607)  | -0.406***<br>(0.0080)  | -0.465***<br>(0.0246)  | -0.330***<br>(0.0523)  | 42.54<br>(123.1)  |
| Industry               | -0.436**<br>(0.214)   | 0.273***<br>(0.0436)   | 0.239***<br>(0.0079)   | -0.00212<br>(0.0540)   | -0.352***<br>(0.108)   | 26.90<br>(78.66)  |
| Manufacturing & Mining | 0.687***<br>(0.235)   | 0.333*<br>(0.192)      | 0.158***<br>(0.0191)   | 0.316***<br>(0.0136)   | 0.646***<br>(0.0741)   | -34.58<br>(119.9) |
| Constant               | -113.8***<br>(38.35)  |                        |                        |                        |                        |                   |
| Countries              | 15                    | 15                     | 15                     | 15                     | 15                     | 15                |
| Observations           | 369                   | 369                    | 369                    | 369                    | 369                    | 369               |

Notes: OLS and Panel Quantile Regression estimations are based on 32 years of unbalanced data from 1990-2022. The estimates use robust standard errors in parentheses. The significance levels; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Source: Authors regression results, from The World Bank, ILO, ECOWAS, NSO, 2024.

## 5. Conclusions

This study provides evidence of the relationship between international trade and wage inequality in the SADC region. Using quantile regression analysis on pooled data from labor surveys, World Development Indicators, and the International Labour Organization (ILO) from 1990 to 2022, we found that trade liberalization significantly increases average wages while simultaneously exacerbating wage disparities. Contrary to the predictions of the Stolper-Samuelson theorem, which suggests that trade should reduce wage inequality, our findings align with research

indicating that trade primarily benefits skilled labor, thereby widening the wage gap between skilled and unskilled workers.

The analysis reveals that skilled workers experience wage increases at lower quantiles, leaving unskilled workers at a disadvantage. This dynamic is intensified by skill-biased technological change, which is prevalent in the region due to a shortage of skilled labor. Our results emphasize the importance of considering control variables such as education, age, and experience, which further enhance the robustness of our findings.

Given the significant implications of these results, policymakers in the SADC region need to develop targeted interventions. Investments in education and vocational training are crucial to equip the workforce with the skills required in a competitive global market. Also, policies that promote inclusive growth, such as social protection measures for unskilled labor and support for industries that provide equitable employment opportunities, are essential to mitigate the adverse effects of international trade on wage inequality.

### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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## Appendix A

Heterogeneous treatment effects—international trade on wage inequality.

| Variable                 | OLS                   | 10th Percentile       | 25th Percentile       | 50th Percentile        | 75th Percentile        | 90th Percentile        |
|--------------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|
|                          | (1)                   | (2)                   | (3)                   | (4)                    | (5)                    | (6)                    |
| International Trade      | 17.37***<br>(5.215)   | 14.06**<br>(6.093)    | 13.34*<br>(7.341)     | 15.70**<br>(6.210)     | 12.31***<br>(3.698)    | 11.78***<br>(3.585)    |
| Trade*                   |                       |                       |                       |                        |                        |                        |
| Occupational Skill       |                       |                       |                       |                        |                        |                        |
| Trade*Skilled            | 0.0644**<br>(0.0306)  | 0.147***<br>(0.0358)  | 0.0570<br>(0.0431)    | 0.0164<br>(0.0365)     | 0.0199<br>(0.0217)     | 0.0150<br>(0.0211)     |
| Trade*Unskilled          | -0.0538*<br>(0.0305)  | -0.0822**<br>(0.0357) | -0.0877**<br>(0.0430) | -0.0687*<br>(0.0363)   | -0.0349<br>(0.0216)    | -0.0474**<br>(0.0210)  |
| Years of Schooling       | -49.38*<br>(28.14)    | -45.10<br>(32.88)     | 22.47<br>(39.61)      | -64.77*<br>(33.51)     | -118.3***<br>(19.96)   | -119.0***<br>(19.35)   |
| Age                      | 10.83**<br>(4.250)    | 7.414<br>(4.965)      | -0.351<br>(5.982)     | 12.32**<br>(5.061)     | 19.78***<br>(3.014)    | 19.18***<br>(2.922)    |
| Experience               | -10.53**<br>(4.017)   | -6.894<br>(4.693)     | 0.921<br>(5.655)      | -11.05**<br>(4.784)    | -18.70***<br>(2.849)   | -18.16***<br>(2.762)   |
| Experience Squared       | -0.0065<br>(0.0045)   | -0.0131**<br>(0.0053) | -0.0102<br>(0.0064)   | -0.0145***<br>(0.0054) | -0.0103***<br>(0.0032) | -0.0101***<br>(0.0031) |
| Female                   | -0.579***<br>(0.196)  | -0.285<br>(0.230)     | -0.535*<br>(0.277)    | -0.804***<br>(0.234)   | -1.265***<br>(0.139)   | -1.212***<br>(0.135)   |
| Constant                 | -31.83<br>(32.89)     | -17.68<br>(38.42)     | -4.044<br>(46.29)     | -5.785<br>(39.16)      | 31.37<br>(23.32)       | 47.90**<br>(22.61)     |
| Countries                | 15                    | 15                    | 15                    | 15                     | 15                     | 15                     |
| Observations             | 69                    | 69                    | 69                    | 69                     | 69                     | 69                     |
| International Trade      | 13.97***<br>(1.909)   | 12.21***<br>(1.908)   | 13.75***<br>(1.795)   | 14.64***<br>(1.933)    | 8.789**<br>(4.074)     | 6.759***<br>(2.047)    |
| Trade*                   |                       |                       |                       |                        |                        |                        |
| Employment Sector        |                       |                       |                       |                        |                        |                        |
| Trade*                   |                       |                       |                       |                        |                        |                        |
| Agricultural Sector      | -0.145***<br>(0.0127) | -0.144***<br>(0.0127) | -0.160***<br>(0.0119) | -0.179***<br>(0.0128)  | -0.112***<br>(0.0271)  | -0.0632***<br>(0.0136) |
| Trade*Industrial Sector  | -0.0360**<br>(0.0153) | 0.0255*<br>(0.0153)   | 0.00624<br>(0.0144)   | -0.0230<br>(0.0155)    | -0.0192<br>(0.0327)    | -0.0512***<br>(0.0164) |
| Trade*                   |                       |                       |                       |                        |                        |                        |
| Manufacturing and Mining | 0.0644***<br>(0.0158) | 0.0354**<br>(0.0158)  | 0.0189<br>(0.0148)    | 0.0756***<br>(0.0160)  | 0.0334<br>(0.0336)     | -0.0389**<br>(0.0169)  |
| Years of Schooling       | -20.14***             | -12.48**              | -20.12***             | -15.59***              | -19.02*                | -56.99***              |

## Continued

|                    |           |           |            |            |           |           |
|--------------------|-----------|-----------|------------|------------|-----------|-----------|
|                    | (5.252)   | (5.247)   | (4.936)    | (5.317)    | (11.21)   | (5.630)   |
| Age                | 5.796***  | 1.915     | 5.315***   | 5.140***   | 6.280**   | 11.95***  |
|                    | (1.200)   | (1.199)   | (1.128)    | (1.215)    | (2.561)   | (1.287)   |
| Experience         | -5.401*** | -1.749    | -4.394***  | -3.908***  | -5.331**  | -11.49*** |
|                    | (1.169)   | (1.167)   | (1.098)    | (1.183)    | (2.494)   | (1.253)   |
| Experience Squared | -0.00309* | -0.0045** | -0.0095*** | -0.0103*** | -0.0065*  | -0.0025   |
|                    | (0.0017)  | (0.0017)  | (0.0016)   | (0.0018)   | (0.0038)  | (0.0019)  |
| Female             | -0.367*** | -0.210*** | -0.158***  | -0.118*    | -0.824*** | -1.105*** |
|                    | (0.0628)  | (0.0628)  | (0.0591)   | (0.0636)   | (0.134)   | (0.0674)  |
| Constant           | -7.973    | 29.59**   | -24.10*    | -45.06***  | 12.45     | 57.09***  |
|                    | (14.64)   | (14.63)   | (13.76)    | (14.82)    | (31.25)   | (15.70)   |
| Countries          | 15        | 15        | 15         | 15         | 15        | 15        |
| Observations       | 385       | 385       | 385        | 385        | 385       | 385       |

Notes: All specifications for the heterogeneous treatment effect include the baseline control variables: Years of Schooling, Age, Experience, Experience Squared, and Female. OLS and Panel Quantile Regression estimations are based on 32 years of unbalanced data from 1990-2022. Robust standard errors in parentheses accompany estimations. The significance levels; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Source: Authors regression results, from The World Bank, ILO, ECOWAS, NSO, 2024.