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**Deciphering the Endowment and
Price Effects of Education on
Changes in Inequality in
Post-Apartheid Namibia**

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Keyword: Consumption inequality, Education, Endowment effect, Price effect, FFL decomposition, Namibia

JEL Classification: D63 D31, I24

Deciphering the Endowment and Price Effects of Education on Changes in Inequality in Post-Apartheid Namibia

By

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Abstract

The transition from apartheid to a democratic government in Namibia in 1990 promises equal opportunity and an overall improvement in living standards for all Namibians. However, Namibia continues to struggle with one of the highest levels of inequality in the world, currently ranked second globally in terms of inequality. Using the 1993/94, 2003/04, 2009/10, and 2015/16 waves of the Namibia Income and Expenditure Surveys, this paper examines changes in consumption inequality by deciphering the role of education in terms of both the endowment effect and the price effect over the period 1993-2016. To achieve this objective, the study employs the FFL decomposition with reweighting to analyze changes in the Gini coefficient during this period. Our findings suggest that, over the period 1993-2016, Gini consumption inequality decreases by 0.17 points. The endowment effects of secondary and tertiary education significantly reduce inequality, while the price effects of secondary and tertiary education are associated with increased inequality. Although the price effect of primary education contributes to lowering inequality, the rising returns to higher education levels exacerbate income disparities.

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1. Introduction

Over the past three decades, the world has witnessed substantial improvements in various indicators of material prosperity. Notably, since 1990, the gross domestic product (GDP) per capita in low- and middle-income countries has more than doubled in real terms (Mishra and Bhardwaj 2021). However, this growing prosperity has been accompanied by increasing inequality globally (Deaton 2013). Inequality in Africa has been notably high and persistent compared to other developing regions. Previous efforts to understand the dynamics and causes of inequality in Africa have offered limited guidance for policy (Milanovic 2003; Morsy et al. 2023).

Education has traditionally been regarded as a great equalizer. However, inequality remains persistently high and has even worsened globally, despite the universal increase in years of schooling over the past decades. To investigate this paradox, we examine the role of education in contributing to household consumption expenditure inequality, particularly focusing on recent changes. The rapid expansion of education in Namibia in recent years offers an ideal context for this research. We explore how education has influenced recent reductions in inequality in Namibia. Namibia is widely recognized as one of the most unequal countries in the world. Whether measured in terms of income distribution, wealth concentration, or living standards, a significant portion of the country's economic benefits is concentrated among a small percentage of the population.

Education is a critical factor influencing income inequality. However, it remains inconclusive whether the educational expansion widens or narrows household inequality. On the one hand, expanding education will shift the distribution of educational attainment. Specifically, the share of individuals with advanced qualifications will grow, while the proportion of those with lower levels of education will diminish. Assuming a constant rate of return to education, shifts in the distribution of educational qualifications will lead to changes in overall household consumption expenditure inequality. This phenomenon can be referred to as the endowment effect of education expansion on consumer expenditure inequality. On the other hand, shifts in the rate of return to education will influence income inequality, given that the distribution of qualifications remains unchanged. An increase in the rate of return to higher education will further widen income inequality among different groups. The return on higher education is shaped by the balance between supply and demand for skilled labor in the job market. Factors such as skill-biased technological advancements, international trade, and industrial reforms boost the demand for high-

skilled workers. However, the expansion of higher education is likely to result in a surplus of high-skilled workers compared to low-skilled workers, which is expected to lower the returns to higher education. As such, income inequality is influenced by the rate of change in the demand for and supply of high-skilled workers. This phenomenon can be termed the price effect of education expansion on inequality.

Empirical studies have examined the decomposition of inequality across countries, highlighting the roles of endowments and returns effects. For example, Wang et al. (2016) show that in Brazil, both skill composition and returns contributed to shifts in the male wage distribution, with education expansion reducing inequality at lower percentiles. Firpo et al. (2018) decomposes changes in wage inequality in the US while deciphering the roles of education, de-unionization, and industry shifts on U.S. male wages. Davies et al. (2017) apply Gini and P-shares RIF regressions to Canadian wealth data, illustrating how socio-demographic factors, including human capital and family formation, shape wealth inequality. In Palestine, Jemmali et al. (2022) find that both composition effects and unequal returns explain the rise in wage inequality from 2009–2016, with gender discrimination affecting the upper quintiles. In Nigeria, Orji et al. (2024) use RIF-based Oaxaca-Blinder decomposition to reveal persistent gender wage gaps across the distribution, with sticky-floor effects more pronounced than glass ceilings. In Cameroon, Wirba et al. (2024) show that education reduces wealth inequality, with composition effects accounting for a meaningful portion of the Gini reduction. Despite these insights, there is a notable lack of country-specific empirical evidence on the decomposition of wage and wealth inequality in post-apartheid Namibia. This study addresses that gap by applying RIF and Oaxaca-Blinder decomposition techniques to Namibian household survey data, providing novel insights into how education in terms of endowments, and returns shape inequality across the entire income distribution. Decomposing the impact of education into the endowment effect and the price effect is crucial for developing effective policies. The endowment effect reveals how shifts in the distribution of educational qualifications affect income inequality, which helps policymakers design interventions that address skill disparities and promote fair income distribution. The price effect, meanwhile, highlights how changes in the returns to education influence income gaps, guiding strategies to ensure that educational expansion aligns with labour market needs and does not exacerbate inequality. The findings will inform targeted policy interventions to reduce inequality in both wage and self-employment sectors.

Results show that income inequality in Namibia declined notably between 1993 and 2015/16, as confirmed by the Gini coefficient and alternative measures such as the Atkinson index, Generalized Entropy, and interquantile ranges. Endowment effects, particularly improvements in secondary and tertiary education, contributed modestly to this reduction. However, changes in the returns to individual characteristics were the main driver, with substantial compression in wages accounting for most of the decline. Despite this overall equalization, rising returns to tertiary education indicate that high-skilled individuals continued to benefit disproportionately, highlighting the persistent structural nature of inequality in post-independence Namibia and the need for policies promoting equitable labor market rewards.

The remainder of the manuscript is structured as follows: Section 2 outlines the empirical strategy, methodology, and data sources used in the study. Section 3 presents empirical results, including detailed decomposition analyses of inequality. Finally, Section 4 offers concluding remarks and discusses the policies derived from the findings.

2. Empirical Strategy and Data

2.1 Inequality Decomposition using Oaxaca-Blinder and Recentered Influence Function (RIF) Methods

To analyze changes in expenditure inequality over the period 1993 to 2016, we adopt the Recentered Influence Function (RIF) regression-based decomposition framework, which generalizes the traditional Oaxaca-Blinder approach as developed by Firpo, Fortin, and Lemieux (2009, 2018). Letting periods 0 and 1 represent the years 1993 and 2016, respectively, the conditional cumulative distribution function (CDF) of expenditure, given covariates T , is expressed as:

$$F^T_W(w) = \int_{-\infty}^{\infty} f^T_{w|X}(w|X) dF^T_X(X) \quad (1)$$

$T \in \{0, 1\}$ denote the survey year Indicator, where $T = 1$ corresponds to data from the 2016 survey and $T = 0$ corresponds to data from the 1993 survey.

The conditional cumulative distribution function of expenditure (W) given the time-period indicator T , forms the basis for decomposing intertemporal differences in the Gini coefficient. The

Oaxaca-Blinder decomposition framework is employed to quantify the change in the inequality measure, denoted as $\Delta\vartheta$ between the two periods.

$$\Delta\vartheta = [\vartheta(F^1_w) - \vartheta(F^c_w)] + [\vartheta(F^c_w) - \vartheta(F^0_w)] \quad (2)$$

The identification of the counterfactual parameter $\vartheta(F^c_w)$ is a challenging issue based on the lack of observed joint realizations of covariates and outcomes under the counterfactual distribution. The Oaxaca-Blinder decomposition approach, grounded in linear regression models and local linear approximations of conditional expectations, may yield inconsistent or biased estimates if the model is misspecified or if the extrapolation of the Recentered Influence Function (RIF) regressions violates the assumptions of linearity and mean independence. These econometric limitations pose challenges for valid inference in counterfactual decomposition analyses. An alternative strategy involves employing a semiparametric reweighting estimator, as developed by DiNardo, Fortin, and Lemieux (1996), to construct the counterfactual distribution from the observed data. This approach circumvents parametric model restrictions by reweighting the empirical distribution of covariates, enabling a more flexible and data-driven approximation of the counterfactual scenario. This involves scaling the observed distribution of characteristics, $dF^0_x(X)$, by a scaling factor $\psi(X)$ to align it with the distribution $dF^1_x(X)$:

$$F^c_w = \int F^0_{w|X}(W|X) dF^1_x(X) \cong \int F^0_{w|X}(W|X) dF^0_x(X) \psi(X) \quad (3)$$

By employing Bayes' rule, the reweighting factor $\psi(X)$ can be determined as follows:

$$\psi(X) = \frac{dF^1_x(X)}{dF^0_x(X)} = \frac{1-p}{p} \frac{\Pr(T=1|X)}{1-\Pr(T=1|X)} \quad (4)$$

In this context, p denotes the proportion of households observed in period $T=1$, while $\Pr(T=1|X)$ represents the conditional probability that a household with characteristics X belongs to period 1. Following Firpo et al. (2018), this conditional probability is typically estimated using a binary choice model such as probit or logit. The counterfactual distribution is then constructed by applying the corresponding reweighting factor, defined as:

$$\vartheta_T = E[RIF(w_i; \vartheta(F^T_w))] = \bar{X}^{T'} \hat{\beta}_T \quad (5)$$

$$\vartheta_c = E[RIF(w_i; \vartheta(F^c_w))] = \bar{X}^{c'} \hat{\beta}_c \quad (6)$$

By performing some algebraic transformations and incorporating the semiparametric reweighting adjustments, the Oaxaca-Blinder decomposition of the change in Gini inequality measure between periods $T=0$ and $T=1$ can be formally decomposed into composition and structure components. The composition effect captures the impact of shifts in the distribution of covariates over time, while the structure effect isolates changes in the conditional distribution of expenditure given covariates. This reweighting-based approach facilitates consistent estimation of counterfactual distributions, thereby improving the identification of inequality dynamics across periods.

$$\Delta\vartheta = [(\bar{X}^c - \bar{X}^0)' \hat{\beta}_0 + \bar{X}^{c'}(\hat{\beta}_c - \hat{\beta}_0)] + [\bar{X}^{1'}(\hat{\beta}_1 - \hat{\beta}_c) + (\bar{X}^1 - \bar{X}^c)' \hat{\beta}_c] \quad (7)$$

The reweighted Oaxaca-Blinder decomposition separates the total change in inequality into two broad components: the aggregate composition effect and the aggregate structure effect. The aggregate composition effect is given by $[(\bar{X}^c - \bar{X}^0)' \hat{\beta}_0 + \bar{X}^{c'}(\hat{\beta}_c - \hat{\beta}_0)]$, capturing the impact of shifts in the distribution of covariates—such as the educational attainment—between the baseline and counterfactual periods. In contrast, the aggregate structure effect is represented by $[\bar{X}^{1'}(\hat{\beta}_1 - \hat{\beta}_c) + (\bar{X}^1 - \bar{X}^c)' \hat{\beta}_c]$, reflecting changes in the returns (or prices) to these covariates over time. These components can be further disaggregated into the pure composition effect, $(\bar{X}^c - \bar{X}^0)' \hat{\beta}_0$, which isolates the effect of changes in educational endowments—i.e., how differences in the level and distribution of education across time contribute to inequality—and the pure structure effect, $\bar{X}^{1'}(\hat{\beta}_1 - \hat{\beta}_c)$, which captures changes in the price of education—i.e., how the marginal returns to different levels of education (such as primary, secondary, or tertiary) have evolved and contributed to inequality dynamics. Additionally, two residual terms help assess model specification. The specification error, $\bar{X}^{c'}(\hat{\beta}_c - \hat{\beta}_0)$, accounts for potential deviations from linearity or approximation errors in the RIF regression, while the reweighting error, $(\bar{X}^1 - \bar{X}^c)' \hat{\beta}_c$, evaluates the adequacy of the reweighting procedure, expected to diminish asymptotically as the sample size increases.

2.2 Data Description

The Namibia Household Income and Expenditure Survey (NHIES) 1993/1994 was conducted by the Central Bureau of Statistics and the National Planning Commission, with funding from the Government of the Republic of Namibia and the United Nations Development Program. The survey ran from September 1993 to August 1994. Its primary objective was to analyze household

income and expenditure patterns to assess living standards and poverty levels. The sample included 6,888 households across 362 primary sampling units (PSUs). The sampling procedure involved a stratified two-stage cluster design, where PSUs were selected using probability proportional to size and households were systematically sampled from lists prepared just before the interviews. The sampling frame was stratified by region and urban-rural areas.

The NHIES 2003/2004, also conducted by the Central Bureau of Statistics and National Planning Commission, received financial support from the Government of Namibia and the United Nations Development Program. The survey took place from September 2003 to August 2004. Its objective was to gather comprehensive data on income and expenditure for evaluating poverty and living standards. The sample comprised 10,920 households across 546 PSUs. The sampling procedure used a stratified two-stage cluster sampling design. PSUs were selected from a sampling frame using probability proportional to size, with households selected systematically from updated lists. The design included both urban and rural strata to capture seasonal variations.

The NHIES 2009/2010 was conducted by the Namibia Statistics Agency, with funding from the Government of Namibia, the United Nations Development Program, and the Grand Duchy of Luxembourg. Data collection occurred from June 2009 to July 2010. The survey aimed to provide updated data on income, consumption, and expenditure patterns for policy making and poverty measurement. The sample included 10,660 households across 533 PSUs. The sampling procedure involved a stratified two-stage cluster design with updated urban and rural sampling frames. Households were selected systematically from lists created during fieldwork, and the sampling frame was stratified by region and urban-rural areas.

The NHIES 2015/2016 was carried out by the Namibia Statistics Agency, with funding from the Government of Namibia, the World Bank, USAID, and the United States Census Bureau. The survey spanned from March 27, 2015, to March 21, 2016. Its objective was to assess living standards and provide data for policy making aligned with national and international development goals. The sample included 10,368 households across 864 PSUs. The sampling procedure employed a stratified two-stage cluster design, with 12 households selected per PSU from updated lists. The sampling frame was stratified by region and further by urban and rural areas, including communal and commercial farming areas in rural strata. This design aimed to improve precision and coverage.

Table 1: Descriptive Statistics

Variables	1993/94	2003/04	2009/10	2015/16
Log total consumption expenditure	9.058 (1.076)	9.980 (0.992)	10.498 (0.961)	10.961 (0.973)
Gini coefficient	0.749 (0.205)	0.613 (0.259)	0.566 (0.478)	0.579 (0.729)
Atkinson coefficient ($\varepsilon = 0.5$)	0.460 (0.219)	0.307 (0.250)	0.261 (0.517)	0.277 (0.808)
Generalised Entropy ($\alpha=0$)	1.247 (0.801)	0.679 (0.684)	0.557 (1.170)	0.652 (1.77)
Coefficient of variation	0.188 (0.123)	0.106 (0.062)	0.094 (0.062)	0.105 (0.080)
Interquantile range 90-10	4.832 (3.163)	2.698 (2.528)	2.428 (2.366)	2.879 (2.819)
Interquantile range 90-50	1.910 (1.051)	1.663 (1.686)	1.461 (2.192)	1.404 (2.711)
Interquantile range 50-10	2.922 (2.896)	1.035 (2.173)	0.967 (1.582)	1.475 (1.265)
No education	0.043 (0.204)	0.237 (0.425)	0.204 (0.403)	0.194 (0.396)
Primary education	0.553 (0.497)	0.312 (0.463)	0.278 (0.448)	0.278 (0.448)
Secondary education	0.361 (0.480)	0.360 (0.480)	0.422 (0.494)	0.425 (0.494)
Tertiary education	0.042 (0.202)	0.091 (0.288)	0.097 (0.296)	0.097 (0.295)
Male headed household	0.585 (0.493)	0.600 (0.490)	0.569 (0.495)	0.545 (0.498)
Urban residency	0.404 (0.491)	0.442 (0.497)	0.424 (0.494)	0.443 (0.497)
Age group 15-29	0.109 (0.311)	0.167 (0.373)	0.158 (0.365)	0.148 (0.356)
Age group 30-39	0.485 (0.500)	0.482 (0.500)	0.468 (0.499)	0.456 (0.498)
Age group 40-49	0.407 (0.491)	0.351 (0.477)	0.374 (0.484)	0.396 (0.489)

Source: Computed by authors using Stata 17, NHIES 1993, NHIES 2003/04, NHIES 2009/10, and NHIES 2015/16.

Table 1 presents summary statistics on some variables used in the analysis for the years 1993, 2003/04, 2009/10, and 2015/16. These statistics provide a preliminary overview of trends in

welfare and distributional outcomes in Namibia over the post-independence period. The mean of log total consumption expenditure increased steadily from 9.058 in 1993 to 10.961 in 2015/16, suggesting significant improvement in average household welfare over the two-decade period. This upward trend is also accompanied by a gradual reduction in the standard deviation of log consumption, indicating a mild compression of the consumption distribution.

Regarding inequality, all measures point to a decline between 1993 and 2009/10, followed by a slight resurgence in 2015/16. The Gini coefficient decreased from a high of 0.749 in 1993 to 0.566 in 2009/10, before rising modestly to 0.579 in 2015/16. The Atkinson index (with inequality aversion parameter $\varepsilon = 0.5$) exhibits a similar trend, falling from 0.460 in 1993 to 0.261 in 2009/10, then edging upward to 0.277 in 2015/16. The Generalized Entropy index (GE(0)) mirrors this pattern, declining from 1.247 to 0.557 before rising again to 0.652 in the final period. These trends suggest that while Namibia experienced substantial improvements in average consumption and reductions in inequality during the early post-apartheid period, some of these gains may have been partially reversed by 2015/16. The modest rise in inequality in the latter period could reflect structural shifts in the economy, such as sectoral changes in employment, access to education, or urban-rural disparities.

Table 1 also presents the evolution of educational attainment among Namibian households from 1993 to 2015/16. The distribution reveals notable progress in the population's educational profile over the post-apartheid period. In 1993, the majority of individuals (55.3%) had completed only primary education, and 4.3% reported having no formal education. By 2015/16, these proportions had declined substantially to 27.8% and 1.9%, respectively. This shift suggests significant strides in improving basic educational access in the decades following independence. Conversely, the share of the population with secondary education rose consistently, from 36.1% in 1993 to 42.5% in 2015/16, indicating steady improvements in educational progression and retention beyond the primary level. The proportion of individuals with tertiary education, while still modest, more than doubled over the period, increasing from 4.2% in 1993 to 9.7% in both 2009/10 and 2015/16. This expansion at the upper end of the education spectrum is indicative of increased access to higher education opportunities, partly reflecting public investment in universities and technical training institutions, as well as targeted equity-enhancing policies.

These shifts in educational attainment are consistent with Namibia's post-independence policy

focus on equitable access to education as a mechanism for structural transformation. The steady decline in the proportion of individuals with no or only primary education, coupled with rising shares at secondary and tertiary levels, has likely contributed to improvements in labor market outcomes and reductions in income inequality. Within a decomposition framework, such shifts in education are captured through the endowment effect, reflecting how improvements in human capital distribution influence the overall distribution of consumption or income.

In addition, the demographic composition of households has also evolved substantially over the period under review. As shown in Table 1, the proportion of male-headed households remained dominant but exhibited a modest decline from 58.5% in 1993 to 54.5% in 2015/16. This trend may be indicative of gradual shifts in household formation patterns and increasing recognition of female-headed households, which could carry implications for intra-household consumption and inequality dynamics, particularly in contexts where gender differentials in economic opportunities persist. Urbanization patterns also reflect gradual change, with the share of urban residents increasing from 40.4% in 1993 to 44.3% by 2015/16. Although the increase is relatively modest, this urban drift suggests improved access to services, infrastructure, and labour market opportunities that typically characterize urban settings. Given the rural-urban divide in income and consumption, this demographic transition may have contributed to narrowing spatial inequality over time.

The age structure of the population further highlights demographic shifts relevant to inequality analysis. The share of individuals aged 15–29 increased between 1993 and 2003/04, before slightly declining in subsequent years—settling at 14.8% in 2015/16. In contrast, the 30–39 age group remained the most prominent throughout the period, though its share gradually declined. Meanwhile, the 40–49 cohort showed a reverse trend, increasing in proportion over time. Together, these demographic transitions—alongside rising educational attainment—are integral to understanding the structural drivers of inequality in post-apartheid Namibia. They enter the decomposition analysis as part of the endowment vector, capturing how the evolving composition of the population contributes to observed shifts in consumption inequality. In subsequent sections, the decomposition framework will distinguish between the effects of these demographic changes (endowment effects) and the differential returns to these characteristics (price or structural effects), providing a better account of inequality evolution between 1993 and 2016.

3. Results and Discussion

3.1 Effect of Education on Inequality measures

Table 2 reports the estimated associations between educational attainment and multiple measures of consumption inequality, controlling for a range of demographic and household characteristics. The coefficients highlight how different levels of education correlate with the distributional shape of consumption in Namibia. Primary education exhibits a complex pattern. While its association with aggregate inequality measures such as the Gini, Atkinson, and GE(0.5) indices is statistically insignificant, it has significant effects on the interquantile range measures. Specifically, primary education is negatively associated with the 50–90 percentile gap, suggesting a narrowing of inequality in the upper-middle portion of the distribution. However, it is positively associated with the 90–10 and 10–50 percentile gaps, as well as the coefficient of variation (Cvar), indicating a widening of inequality between the top and bottom deciles and in the lower part of the distribution. These results imply that while primary education may compress differences among middle-income households, it does not significantly reduce disparities between the poorest and richest households.

Secondary education is linked to wider inequality, particularly in the tails of the distribution. While aggregate inequality indices show modest or insignificant associations, the strong positive coefficients on the 90–10 and 10–50 interquantile ranges suggest that secondary schooling is associated with a more unequal distribution of consumption, potentially due to labor market segmentation or variation in school quality. Tertiary education shows the strongest and most consistent association with inequality. All inequality indices—including the Gini, Atkinson, Generalized Entropy, and interquantile ranges—exhibit large and statistically significant positive coefficients. This implies that households with tertiary-educated heads are concentrated at the top end of the distribution, reflecting the high returns to advanced education and its limited accessibility. Overall, the findings suggest that while expansion of primary education may have modest equalizing effects, the rising returns to higher education—particularly tertiary—are a significant contributor to consumption inequality in Namibia. These results hold even after accounting for other household-level covariates, highlighting the structural role of education in shaping the distribution of economic well-being.

Table 2: Determinants of Inequality measures

VARIABLES	(1) Gini	(2) Atkinson	(3) GE (0.5)	(4) Cvar	(5) iqr50 90	(6) iqr90 10	(7) iqr10 50
Primary education	-0.0037 (0.0054)	-0.0026 (0.0063)	0.0144 (0.0136)	0.0044*** (0.0010)	-0.0696** (0.0310)	0.1076*** (0.0390)	0.1773*** (0.0306)
Secondary education	0.0038 (0.0074)	0.0021 (0.0071)	0.0425*** (0.0151)	0.0059*** (0.0011)	0.0113 (0.0329)	0.2761*** (0.0363)	0.2648*** (0.0299)
Tertiary education	0.2625*** (0.0222)	0.2542*** (0.0231)	0.7573*** (0.0498)	0.0538*** (0.0023)	1.1943*** (0.0684)	1.8373*** (0.0631)	0.6430*** (0.0401)
Male	0.0502*** (0.0054)	0.0485*** (0.0054)	0.1239*** (0.0117)	0.0055*** (0.0008)	0.2427*** (0.0241)	0.2358*** (0.0316)	-0.0068 (0.0190)
Urban residency	-0.0061 (0.0058)	-0.0112* (0.0058)	-0.0023 (0.0154)	0.0001 (0.0009)	0.1091*** (0.0249)	0.1580*** (0.0338)	0.0489** (0.0231)
Age group 30_49	0.0316*** (0.0058)	0.0309*** (0.0061)	0.1007*** (0.0145)	0.0079*** (0.0011)	0.1299*** (0.0329)	0.2977*** (0.0353)	0.1678*** (0.0301)
Age group 50_above	0.0603*** (0.0068)	0.0589*** (0.0068)	0.1911*** (0.0174)	0.0158*** (0.0012)	0.2846*** (0.0335)	0.6079*** (0.0388)	0.3233*** (0.0278)
D2003	-0.1466*** (0.0049)	-0.1636*** (0.0055)	-0.5926*** (0.0168)	-0.0828*** (0.0025)	-0.3133*** (0.0261)	-2.1725*** (0.0610)	-1.8592*** (0.0589)
D2009	-0.1952*** (0.0073)	-0.2105*** (0.0064)	-0.7194*** (0.0197)	-0.0960*** (0.0025)	-0.5207*** (0.0273)	-2.4656*** (0.0626)	-1.9449*** (0.0559)
D2016	-0.1811*** (0.0082)	-0.1943*** (0.0083)	-0.6249*** (0.0245)	-0.0849*** (0.0024)	-0.5785*** (0.0335)	-2.0223*** (0.0622)	-1.4438*** (0.0558)
Constant	0.6717*** (0.0108)	0.3873*** (0.0101)	0.9936*** (0.0270)	0.1679*** (0.0029)	1.5290*** (0.0484)	4.0017*** (0.0745)	2.4727*** (0.0661)
Observations	32,289	32,289	32,289	32,289	32,289	32,289	32,289
R-squared	0.0360	0.0303	0.0542	0.1436	0.0384	0.0997	0.0925

Computed by authors using Stata 17, NHIES 1993, NHIES 2003/04, NHIES 2009/10, and NHIES 2015/16.bootstrapped Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The regression estimates in Table 2 further reveal the contributions of key demographic and structural factors to inequality in Namibia over the study period. Male-headed households are consistently associated with higher levels of inequality across almost all metrics. The positive and statistically significant coefficients on the Gini, Atkinson, GE(0.5), Cvar, and upper interquartile range (IQR 50–90 and IQR 90–10) suggest that male-headed households are linked to a more unequal distribution of consumption expenditure, particularly at the top of the distribution. However, the coefficient for the lower-tail IQR (10–50) is statistically insignificant, indicating

minimal impact on inequality among the lower-income group. Urban residency presents a nuanced relationship with inequality. Although it is weakly negatively associated with the Atkinson index—suggesting slightly more equitable consumption among the poor—urban residence is significantly and positively associated with upper interquantile gaps (IQR 90–10 and 50–90), implying greater disparity between the top and median or lower-income earners in urban areas. This supports the stylized fact that urban areas in developing economies often house both affluent and poor households in close proximity, contributing to within-area inequality.

Age is also a significant determinant. Relative to the base category (age 15–29), individuals aged 30–49 and 50+ are strongly associated with higher consumption inequality. The positive and significant coefficients across all inequality measures indicate that older age cohorts are linked to a wider dispersion in consumption, with especially large effects among those aged 50 and above. These patterns may reflect life-cycle income dynamics, savings accumulation, and heterogeneity in labor market opportunities across age groups. Finally, the time dummies (D2003, D2009, and D2016) capture the evolution of inequality over time, relative to the base year 1993. All three periods show statistically significant and negative coefficients across all inequality indices, confirming a consistent decline in overall consumption inequality in the post-apartheid era. The largest declines are observed in 2009, particularly in the Generalized Entropy index and interquantile ranges, suggesting a more compressed distribution of consumption during that period. These results reinforce the descriptive findings and highlight a structural shift toward reduced inequality, likely influenced by policy reforms, expansion in education, and improved access to services during the post-apartheid transformation.

3.2 Role of Education in Explaining Changes in Wealth Inequality

The results from the Oaxaca-Blinder RIF decomposition of the Gini coefficient over the structural period 1993–2015/16 provide important insights into the underlying drivers of inequality dynamics in Namibia. Table 3 reveals that overall inequality, as measured by the Gini index, declined significantly by 0.1694 points over the period, indicating a marked reduction in income disparities in the post-independence era.

This total change in inequality is decomposed into several components. The pure endowment effect accounts for a reduction of 0.0253 points in the Gini index, suggesting that improvements in the distribution of individual characteristics—particularly education—contributed modestly to inequality reduction. In contrast, the pure price effect, which captures changes in the returns to these characteristics, accounts for a much larger share of the decline, reducing the Gini index by 0.1508 points. This finding implies that a substantial portion of the reduction in inequality during this period is attributable not to changes in the population's characteristics per se, but rather to a compression in the returns to those characteristics, especially educational attainment.

Table 3: Summary of Oaxaca Blinder-RIF Decomposition of the Gini Index

	(1) 2015/16-1993	(2) 2009/10-1993	(3) 2003/04-1993
Components	Gini	Gini	Gini
Total Change in Inequality	-0.1694*** (0.0085)	-0.1831*** (0.0065)	-0.1358*** (0.0048)
Pure endowment Effect	-0.0253*** (0.0046)	-0.0263*** (0.0045)	-0.0355*** (0.0054)
Specification error	-0.0004 (0.0007)	-0.0003 (0.0009)	-0.0026* (0.0015)
Pure Price effect	-0.1508*** (0.0088)	-0.1657*** (0.0078)	-0.1164*** (0.0054)
Reweighting error	0.0070*** (0.0020)	0.0092*** (0.0020)	0.0188*** (0.0027)
Endowment effect of primary education	-0.0044 (0.0043)	-0.0044 (0.0041)	-0.0041 (0.0039)
Endowment effect of secondary education	-0.0021** (0.0010)	-0.0018** (0.0008)	0.0008 (0.0006)
Endowment effect of tertiary education	-0.0081*** (0.0021)	-0.0079*** (0.0018)	-0.0072*** (0.0021)
Price effect of primary education	-0.0126** (0.0059)	-0.0090* (0.0047)	-0.0058 (0.0055)
Price effect of secondary education	0.0399*** (0.0101)	0.0063 (0.0076)	0.0114* (0.0068)
Price effect of tertiary education	0.0696*** (0.0060)	0.0372*** (0.0045)	0.0127*** (0.0039)
Observations	12,867	12,722	12,832

Source: Computed by authors using Stata 17, NHIES 1993, NHIES 2003/04, NHIES 2009/10, and NHIES 2015/16. Bootstrapped standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The specification error is statistically insignificant and near zero, indicating that the model specification is stable and robust across counterfactual comparisons. The reweighting error is positive (0.0070) and statistically significant, although its magnitude is small, reflecting slight imperfections in the reweighting algorithm used to construct the counterfactual distribution.

Further decomposition by education level highlights differential contributions to the endowment and price effects. On the endowment side, increases in the share of individuals with tertiary education significantly reduced inequality by 0.0081 points, followed by smaller effects from secondary education (-0.0021). Changes in primary education attainment did not contribute significantly to inequality reduction, as the estimated coefficient is statistically insignificant.

Turning to the price effects, we observe that changes in the returns to primary education were associated with a reduction in inequality (-0.0126, $p < 0.05$), suggesting that falling wage differentials at the lower end of the education spectrum had an equalizing effect. However, returns to secondary and tertiary education rose substantially, contributing positively to inequality: 0.0399 and 0.0696, respectively. These results indicate that, while average returns to education declined overall, high-skilled individuals (especially those with tertiary education) continued to command disproportionate income advantages, thereby exerting an inequality-enhancing effect.

Overall, the decomposition results for the 1993–2015/16 period suggest that inequality reduction in Namibia was primarily driven by changes in the structure of returns to individual characteristics, rather than changes in the distribution of those characteristics themselves. The rising returns to higher education partially offset the equalizing gains from broader educational attainment, pointing to the persistent role of skill premiums in shaping post-apartheid income inequality.

3.3 Robustness Check using other Inequality Measures

To validate the consistency and robustness of the main findings, we re-estimate the Firpo, Fortin, and Lemieux (FFL) decomposition using alternative measures of inequality beyond the Gini coefficient. The results, presented in Table 4, show a consistent and statistically significant decline in inequality across all measures between 1993 and 2015/16. Specifically, the Atkinson index declined by 0.184, the Generalized Entropy index by 0.595, while the IQR 90–10 and IQR 50–10 fell by 1.953 and 1.447 respectively, all at the 1% level. These results confirm that the observed reduction in inequality is not sensitive to the choice of inequality index and is evident across both the tails and the lower end of the income distribution.

Table 4: Summary of FFL Decomposition with reweighting

Components	(1)	(2)	(3)	(4)
	Atkinson	Entropy	iqr_90_10	iqr_50-10
Total Change in Inequality	-0.184*** (0.008)	-0.595*** (0.021)	-1.953*** (0.056)	-1.447*** (0.056)
Pure endowment Effect	-0.027*** (0.005)	-0.091*** (0.015)	-0.260*** (0.053)	-0.213*** (0.052)
Specification error	-0.0001 (0.001)	-0.0001 (0.003)	-0.013 (0.011)	-0.004 (0.011)
Pure Price effect	-0.164*** (0.009)	-0.531*** (0.024)	-1.775*** (0.064)	-1.304*** (0.067)
Reweighting error	0.008*** (0.002)	0.026*** (0.006)	0.095*** (0.024)	0.074*** (0.018)
Endowment effect of primary education	-0.004 (0.005)	-0.004 (0.018)	0.069 (0.054)	0.046 (0.059)
Endowment effect of secondary education	-0.003*** (0.001)	-0.013*** (0.005)	-0.061*** (0.017)	-0.051*** (0.018)
Endowment effect of tertiary education	-0.009*** (0.002)	-0.029*** (0.007)	-0.095*** (0.018)	-0.066*** (0.015)
Price effect of primary education	-0.013** (0.006)	-0.015 (0.022)	0.092 (0.059)	0.102* (0.060)
Price effect of secondary education	0.041*** (0.011)	0.196*** (0.035)	0.798*** (0.103)	0.606*** (0.089)
Price effect of tertiary education	0.070*** (0.007)	0.204*** (0.018)	0.486*** (0.035)	0.198*** (0.026)
Observations	12,867	12,867	12,867	12,867

Source: Computed by authors using Stata 17, NHIES 1993 and NHIES 2015/16.

Decomposing the change further, the pure endowment effect remains negative and statistically significant across all specifications, contributing modestly to the decline in inequality. This suggests that improvements in the distribution of individual characteristics, particularly educational attainment, played a role in promoting equity. However, the pure price effect continues to dominate, accounting for the bulk of the decline in inequality across all alternative measures. This finding reinforces the conclusion that changes in the structure of returns to observed

characteristics, rather than their distribution, were the primary drivers of inequality reduction over the period.

The reweighting error is small but positive and statistically significant in each case, indicating minor discrepancies in the construction of the counterfactual distribution. The specification error remains negligible and statistically insignificant, which supports the stability and internal consistency of the decomposition framework. Further disaggregation by education level reveals that the endowment effects of secondary and tertiary education contributed significantly to the reduction in inequality, whereas the contribution of primary education was statistically insignificant or even slightly regressive in some cases. In contrast, the price effects of secondary and tertiary education are consistently positive and large, suggesting that rising returns to higher education have exerted upward pressure on inequality, particularly at the upper end of the income distribution. For instance, the price effect of secondary education accounts for an increase of 0.798 in the IQR 90–10, while that of tertiary education contributed 0.486, both significant at the 1% level. These findings indicate that while educational expansion contributed to inequality reduction, the continued high returns to upper-tier education moderated these gains and reinforced income concentration at the top.

Overall, the robustness check confirms the central result of our analysis: the decline in inequality in Namibia over the period 1993–2015/16 was primarily driven by a compression in returns to education and other characteristics. The findings remain consistent across a range of inequality indices, suggesting that policies aimed solely at expanding access to education may be insufficient to sustain inclusive growth unless accompanied by reforms that address the distribution of economic returns across skill levels.

4. Conclusion and Policy Implications

This study examined the evolution and drivers of income inequality in Namibia over the period 1993–2015/16 using distributional decomposition techniques, including the Oaxaca-Blinder RIF and Firpo-Fortin-Lemieux (FFL) methods. The analysis revealed a significant decline in income inequality, as measured by the Gini coefficient and corroborated by alternative inequality measures such as the Atkinson index, Generalized Entropy, and interquantile ranges. Decomposition results consistently indicated that this reduction was driven primarily by changes in the structure of returns

to characteristics—particularly education—rather than changes in the distribution of those characteristics themselves.

Endowment effects, especially improvements in secondary and tertiary education attainment, contributed modestly to reducing inequality. However, the pure price effects were the dominant force, with a substantial compression in returns to individual attributes explaining most of the observed decline. Despite this general equalizing trend, the persistent and rising returns to tertiary education suggest that gains were unevenly distributed, with high-skilled individuals continuing to benefit disproportionately. The robustness of these results across various inequality indices underscores the structural nature of inequality dynamics in post-independence Namibia.

These findings carry several important policy implications. First, while improving access to education remains a necessary condition for reducing long-term inequality, it is not sufficient in isolation. Policymakers should also focus on reducing excessive skill premiums and ensuring equitable labor market returns, particularly by supporting inclusive job creation in both formal and informal sectors. Second, targeted investments in secondary and vocational education, especially for women and disadvantaged groups, could help narrow the earnings gap and promote upward mobility. Third, active labor market policies that improve wage-setting mechanisms, strengthen labor market institutions, and regulate high-wage dispersion may further compress inequality and enhance social cohesion.

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Data availability statement

The data that support the findings of this study are available from the corresponding author or the Namibia Statistics Agency (NSA) upon request.

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