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Educational attainment and earnings inequality in Cameroon: A quantile regression analysis of heterogeneous returns

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Abstract

This paper analyzes education's heterogeneous returns across Cameroon's earnings distribution using quantile regression (2007-2014 household surveys). Key findings reveal: (1) Urban-rural divergence with tertiary education yielding 74% higher returns for rural women at the 90th decile ($\beta = 2.26$) versus urban counterparts; (2) Primary education's equalizing effects in urban areas ($\beta = 0.51$ for women) but disequalizing impacts in rural upper deciles ($\beta = -1.03$ for men); (3) Secondary education's collapsing returns below the 40th rural decile. The results demand spatial-precision policymaking under Vision 2035: geographic mobility corridors to connect high-return rural earners with urban opportunities; tertiary access pacts targeting rural women's demonstrated 90th-decile potential; and gender-responsive vocational tracks to revive secondary education's middle-decile value. Contrary to linear human capital models, we demonstrate how education's inequality impacts are fundamentally reconfigured through three intersecting channels: decile-specific returns, spatial premiums, and gender-mediated valuation. These findings provide an actionable roadmap for converting education from an inequality accelerator to an equitable development catalyst in segmented African labor markets.

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1. Introduction

Human capital theory posits that education and training enhance productivity, enabling individuals to command higher wages in competitive labor markets (Becker, 1964). While early work framed schooling as an investment — where rational actors weigh costs (tuition, forgone earnings) against expected returns (higher lifetime income) — subsequent studies highlight persistent disparities in how education translates into earnings, particularly across gender, region, and income groups (see Buchinsky 1994, and Baye and Epo, 2015). In Cameroon, where structural inequalities shape labor market outcomes, the relationship between educational attainment and earnings inequality remains underexplored. This paper examines whether and how education exacerbates or mitigates wage disparities, leveraging household survey data from 2007 and 2014 to capture temporal and distributional dynamics.

Our analysis advances the literature in several directions. First, we employ OLS and quantile regression methods to disentangle average returns to education from heterogeneous effects across the earnings distribution (Koenker and Bassett 1978). This approach reveals whether education disproportionately benefits high- or low-earners, a nuance obscured by conventional mean regression. Second, we disaggregate results by gender and rural-urban residence, testing how institutional and geographic factors intersect with human capital accumulation. Finally, by analyzing two survey waves, we assess whether returns to education have evolved alongside Cameroon's economic growth, offering insights into the stability of inequality mechanisms over time.

The remainder of the paper proceeds as follows. Section 2 synthesizes theoretical and empirical literature on education and earnings inequality. Section 3 details the data and econometric framework, while Section 4 presents the results. Section 5 discusses implications for policy and future research, and Section 6 concludes.

2. Earlier Studies

The relationship between education and earnings inequality has been theorized through two dominant yet competing frameworks. The human capital perspective, pioneered by Becker (1964) and Mincer (1974), conceptualizes education as an investment in productivity-enhancing skills that command wage premiums in competitive labor markets. This view has been challenged by signaling theory (Spence 1973, and Wodaj 2002), which posits that education primarily serves as a screening mechanism for innate ability rather than directly improving worker productivity[1]. The authors posit that educated individuals signal their potential productivity to employers by acquiring credentials, such as higher-level degrees (e.g., university degrees). Hence, this costly investment acts as a credible signal because the inherent difficulty of obtaining it makes it a more feasible achievement for high-ability individuals, thereby distinguishing them from their less-skilled counterparts. On the other hand, employers, faced with imperfect information about a candidate's true ability, engage in screening. They use tools such as degree requirements, technical interviews, and skills assessments to filter and evaluate the pool of applicants. This process enables employers to assess the credibility of signals sent by job seekers and identify the most suitable candidates for the role (e.g., see Spence 1973, and Wodaj, 2002).

[1] While signalling is a conscious, costly action taken by the informed party (the job seeker) to reveal their unobservable qualities (like intelligence, work ethic, or skill) to the uninformed party (the employer), screening is a strategy used by the uninformed party (the employer) to sort, filter, and identify the high-quality individuals from the pool of applicants. That is, screening is the process of 'testing' the signals.

Recent scholarship has sought to reconcile these perspectives by demonstrating how education simultaneously builds human capital while signaling worker quality, with the relative importance of each mechanism varying by institutional context and labor market conditions. Contemporary extensions of human capital theory emphasize its multidimensional nature, where cognitive skills interact with social competencies like teamwork and adaptability to determine labor market outcomes (Macaluso 2025). This evolving understanding suggests that traditional measures of educational attainment may capture only part of education's true impact on earnings potential.

Empirical evidence reveals substantial variation in returns to education across different contexts and educational levels. While studies in developed economies typically find increasing returns at higher educational levels (Tansel and Biran 2010, and Psacharopoulos 2007), research in sub-Saharan Africa presents a more complex picture. Psacharopoulos' (1994) influential work documented higher returns to primary education in the region compared to secondary or tertiary levels, suggesting different skill valuation patterns in developing labor markets. More recent analyses highlight how these patterns are further mediated by factors such as field of study, institutional quality, and the alignment between educational content and labor market needs. The emerging concept of nested skill hierarchies suggests that advanced technical skills build upon foundational cognitive abilities, creating compounding returns for workers who complete sequential educational milestones (Macaluso 2025). This framework helps explain why certain educational investments yield disproportionate rewards while others show diminishing returns.

In the Cameroonian context, existing research has identified several distinctive patterns in the education-earnings relationship. Zamo and Tsafack's (2013) analysis revealed convex returns to education, where primary education showed minimal wage premiums compared to no schooling, while higher levels yielded substantial returns. This pattern aligns with credentialists' perspectives, emphasizing the labor market's reliance on educational signals rather than skill acquisition *per se*. Baye and Epo (2015) further demonstrated that equitable access to education could significantly reduce household economic inequality. However, their analysis did not examine how these effects might vary across different population subgroups or income levels. Recent global evidence suggests such intersectional analyses are crucial, as education's equalizing potential often depends on institutional arrangements that either mitigate or amplify existing disparities (Ma *et al*. 2025). The Cameroonian education system, its social and cultural features, and its labor market's particular characteristics, including the formal-informal sector divide and urban-rural wage gaps, likely shape the role of education in either reproducing or reducing inequality in ways that demand closer examination.

Despite these important contributions, significant gaps remain in our understanding of how educational attainment shapes earnings inequality in Cameroon. Most existing studies rely on methodological approaches that obscure important heterogeneity in returns across the earnings distribution and between demographic groups. The application of quantile regression techniques, as demonstrated by Ma *et al*. (2025) in comparable contexts, could reveal how education's effects vary for high-earners versus low-earners, providing crucial insights for targeted policy interventions. Furthermore, the rapid transformation of Cameroon's labor market — including technological adoption and sectoral shifts — may be altering the relative value of different educational investments in ways that older studies cannot capture.

This paper addresses these limitations by employing contemporary analytical methods to nationally representative data from the 2007 and 2014 survey waves, allowing for both cross-sectional and temporal analysis of how education's relationship with earnings inequality has evolved in Cameroon's dynamic economic environment.

3. Data and Econometric Methodology

3.1 The Data

This paper examines the relationship between educational attainment and earnings inequality using data from the Cameroonian Household Surveys conducted in 2007 and 2014. These surveys represent the only nationally representative data sources available in Cameroon that specifically address this research question. The Cameroonian census conducted in 2007 is known as ECAM II, and that of 2014 is ECAM III. Although ECAM IV is available, government authorities have been reluctant to make it public. Hence, the recourse to the only publicly available dataset for the analysis in this paper — ECAM II and ECAM III.

3.2 Econometric Methodology

Our empirical approach employs multivariate regression analysis to account for the multiple determinants of wages, our primary dependent variable. This methodological choice is particularly appropriate given that wage determination involves numerous interrelated factors, many of which are correlated with education — our key explanatory variable of interest. While ordinary least squares (OLS) regression provides estimates centered on the conditional mean of the wage distribution, this approach may obscure important heterogeneity in the education–earnings relationship across different segments of the wage distribution. To address this limitation, we complement OLS with quantile regression (QR) techniques, first developed by Koenker and Bassett (1978). And to illustrate the empirical relevance of this complementary approach, we report results from an OLS-based test for heteroskedasticity, which helps motivate the use of quantile regression.

Unlike OLS, QR allows us to estimate how the returns to education vary across specific quantiles (e.g., deciles) of the conditional wage distribution. This approach is particularly valuable for understanding distributional effects, as educational returns may differ substantially between high-earners (upper quantiles) and low-earners (lower quantiles) (Buchinsky 1994, and Tansel and Biran 2010). By comparing these quantile-specific estimates, we can assess whether education mitigates or exacerbates existing wage inequalities (Harmon *et al*. 2000).

The QR methodology requires sufficient variation in educational attainment across the wage distribution to estimate these quantile-specific effects reliably. Our data meets this requirement, showing adequate dispersion in both education levels and wages across the sampled population. This empirical strategy enables us to move beyond average effects and uncover potentially divergent impacts of education at different points of Cameroon's earnings distribution.

Following Buchinsky (1998), the quantile regression earnings function is written as follows,

$$\ln wage_i = x_i\beta_\theta + \xi_{\theta_i} \tag{1}$$

i representing the individuals; with $Quant_\theta\left(\ln wage_i \mid x_i\right) = x_i\beta_\theta$; where x_i is the vector of explanatory variables for i and β_θ is the vector of parameters and ξ_{θ_i} is a random error term. $Quant_\theta\left(\ln wage_i \mid x_i\right)$ denotes the θth conditional quantile of $\ln wage_i$, given x_i. Unlike in the OLS, quantile regression parameters minimize the absolute sum of the errors from a particular quantile of the log earnings. The θth quantile regression, $0 < \theta < 1$, is defined as a solution to the problem,

$$\min\left[\sum_{i:\ln wage_i \geq x\beta} \theta\left|\ln wage_i - x_i\beta_\theta\right| + \sum_{i:\ln wage_i < x\beta} \left(1-\theta\right)\left|\ln wage_i - x_i\beta_\theta\right|\right] \tag{2a}$$

which can also be written as:

$$\min_{b\in\square^K} \sum_i r_q\left(\ln wage_i - x_i b_q\right), \qquad (2b)$$

where $r_q(e)$ is the check function defined as $r_q(e) = qe, \text{ if } e \geq 0$ or $r_q(e) = (q-1)e, \text{ if } e < 0$

By variation of θ, any quantile of the conditional distribution can be obtained. We use β_θ instead of β, since different values of θ give different values of β. For the minimization of the problem, linear programming techniques are generally utilized to solve the problem by using a complete sample.

The empirical earning function is specified as follows:

$$\ln wage_i = \alpha + \beta_{\theta_1} primary + \beta_{\theta_2} secondary + \beta_{\theta_3} tertiary + \sum_{\{j=1\}}^{K} \varphi_{\theta_j} Z_{ij} + \xi_{\theta_i} \qquad (3)$$

where q_j is the quantile being analysed, and $\ln wage_i$ the log of real (inflation-adjusted) monthly earnings already available in the database, for the *i*th individual.

As mentioned and formalized, analysis of this nature normally employs two alternative approaches to measure returns to schooling: one based on continuous years of education and another using categorical indicators for educational attainment levels. Moreover, due to data availability and the need to capture nonlinear effects, we utilize the latter approach, operationalizing education through dummy variables for primary ($1-6$ years of schooling), secondary ($6-13$ years), and tertiary ($13+$ years) attainment levels. The reference category consists of individuals with no formal education. Our earnings model additionally controls for labor market experience and marital status through the vector Z.

We estimate this specification across nine deciles of the conditional earnings distribution using data from the 2007 and 2014 Cameroonian National Household Surveys. The sample is restricted to working-age individuals ($15-65$ years), following standard labor force definitions, ensuring our analysis focuses on the economically active population. This quantile regression approach allows us to examine how educational returns vary across the entire wage distribution, from low-earning to high-earning deciles.

4. Empirical Results and Discussion

4.1 Descriptive Analysis

Table I reveals significant structural transformations in Cameroon's labor market between 2007 and 2014. In urban areas, men's mean log wage reached 10.904 units in 2014, systematically exceeding women's average of 10.178 units — a 7.133% gender wage gap. This disparity was even more pronounced in rural areas, where men earned 10.267 units compared to women's 9.451 units, representing an 8.634%. Longitudinal analysis indicates that while nominal wages increased, real wages — adjusted for inflation — experienced erosion, with rural women facing the most severe decline at an annual average of -4.2%.

Table I: Sample Summary Statistics

	Urban area				Rural area			
	2007		2014		2007		2014	
	Men	Women	Men	Women	Men	Women	Men	Women
Ln*wage*	4.062 (0.021)	3.526 (0.026)	10.904 (0.014)	10.178 (0.017)	4.287 (0.035)	3.681 (0.040)	10.267 (0.016)	9.451 (0.016)
Without education	0.007 (0.001)	0.007 (0.002)	0.120 (0.004)	0.138 (0.005)	0.018 (0.003)	0.024 (0.005)	0.224 (0.006)	0.356 (0.007)
β_{θ_1} (Primary)	0.376 (0.008)	0.439 (0.010)	0.274 (0.006)	0.308 (0.007)	0.631 (0.012)	0.754 (0.013)	0.394 (0.007)	0.426 (0.007)
β_{θ_2} (Secondary)	0.507 (0.008)	0.487 (0.010)	0.447 (0.007)	0.451 (0.008)	0.328 (0.012)	0.220 (0.012)	0.340 (0.007)	0.202 (0.006)
β_{θ_3} (Tertiary)	0.109 (0.005)	0.066 (0.005)	0.154 (0.005)	0.100 (0.004)	0.023 (0.004)	0.003 (0.002)	0.038 (0.002)	0.011 (0.001)
Observations	3,870	2,683	4,243	3,194	1,648	1,129	3,480	2,989

Notes: The values represent the Mean. Standard errors in parentheses.

Educational stratification in Cameroon seems to account for these persistent disparities. Tertiary education access remains heavily concentrated in urban areas (15.400% of men versus 10.000% of women) while remaining exceptionally limited in rural regions (3.801% of men and just 1.100% of women). Meanwhile, rural illiteracy rates remain alarmingly high, particularly among women (35.601% in 2014), underscoring systemic barriers to educational access. These patterns support Baye and Epo's (2015) dual-path hypothesis: while education functions as an upward mobility mechanism in urban settings, it often reinforces inequality in marginalized rural communities. This divergence is particularly evident in secondary enrolment trends—rural women experienced declining participation (20.200% in 2014 versus 22.000% in 2007), while urban areas achieved near gender parity (44.701% male versus 45.101% female enrolment).

4.2 Quantile Regression Results

We estimate Equation (3), our specified earnings function, across nine deciles for both survey periods (2007 and 2014). Tables II and III present the coefficients for primary, secondary, and tertiary education dummies along with their corresponding t-statistics. Reporting the critical values will certainly take a lot of space, especially for all the estimations. To conserve space, we rely on the p values (available upon request), which give exactly the same information.

The results reveal significant heterogeneity in educational returns across the earnings distribution, demonstrating that each education level exerts differential effects depending on an individual's position in the wage distribution, based on the Koenker-Bassett heteroskedasticity test used after quantile regressions. The test strongly suggests the existence of heteroskedasticity, thereby justifying the use of Quantile Regression (QR).

Table II: Koenker-Bassett heteroskedasticity test

	Urban area				Rural area			
	2007		2014		2007		2014	
	Men	Women	Men	Women	Men	Women	Men	Women
Primary	5.120	2.130	0.810	1.200	15.270	1.130	2.960	3.470
	(0.006)	(0.119)	(0.445)	(0.300)	(0.000)	(0.324)	(0.052)	(0.031)
Secondary	5.230	5.800	0.290	2.940	12.15	1.050	3.320	1.830
	(0.005)	(0.003)	(0.745)	(0.053)	(0.000)	(0.349)	(0.036)	(0.160)
Tertiary	2.850	1.480	0.340	4.220	1.540	2.570	6.160	1.450
	(0.058)	(0.227)	(0.712)	(0.014)	(0.214)	(0.077)	(0.002)	(0.234)
Joint test	3.260	2.390	4.400	3.020	3.530	12.420	3.860	2.240
	(0.000)	(0.008)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.013)

Notes: The values represent the F-statistic. P-value in parentheses.

To support our use of quantile regression, we subjected the residuals from the OLS estimates to several heteroskedasticity tests (Breusch–Pagan, White, Glejser, and Goldfeld–Quandt) for each subsample and time period. The results indicate pronounced heteroskedasticity: the Goldfeld–Quandt test rejects the null hypothesis of constant variance across all groups and periods, with consistently low p-values. The other tests generally confirm this finding, despite a few isolated exceptions (notably the White test for women in 2014). This pervasive heteroskedasticity suggests that the dispersion of wages around the conditional mean is not uniform. It provides a twofold justification for employing quantile regression: first, it underscores the need for robust standard errors in OLS inference; second, and more importantly, it signals that the marginal effects of education vary across the wage distribution—a pattern that quantile regression is uniquely suited to examine in detail.

Table III: Additional Heteroscedasticity tests

	Urban area				Rural area			
	2007		2014		2007		2014	
	Men	Women	Men	Women	Men	Women	Men	Women
Breusch Pagan test	1.950	0.030	191.510	0.230	0.450	5.350	29.180	15.970
	(0.162)	(0.857)	(0.000)	(0.632)	(0.504)	(0.020)	(0.000)	(0.000)
White test	36.900	7.030	41.000	8.230	46.070	17.780	7.420	7.600
	(0.000)	(0.900)	(0.000)	(0.606)	(0.000)	(0.122)	(0.764)	(0.868)
Glejser test	2.710	1.390	9.400	0.520	1.390	4.290	2.250	0.870
	(0.019)	(0.226)	(0.000)	(0.723)	(0.224)	(0.000)	(0.047)	(0.502)
Goldfeld Quandt test	6.568	15.255	9.438	11.481	9.159	16.092	40.005	45.410
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Notes: The values represent the F-statistic or chi2(1). P-value in parentheses.

Following established practice in distributional analysis (Hao and Naiman 2007), we employ a comparative framework that examines both lower and upper deciles of the earnings distribution. This approach is particularly valuable as researchers often focus on distributional extremes - whether to understand barriers facing low earners or advantages accruing to high earners - rather than central tendencies alone. Our analysis accordingly emphasizes these informative segments of the wage distribution while providing complete results across all deciles. Note that to convert the β coefficients into the percentage returns, we consider the transformation $\left(e^{\beta}-1\right)\times 100$.

4.3 Primary Education Returns

Lower Deciles Analysis

Urban areas in 2007 exhibited gender-divergent returns to primary education (Table II). Women demonstrated consistently positive and significant returns across most lower deciles, systematically outperforming men, who showed statistically insignificant returns until higher wage levels. By 2014, this pattern had partially reversed, with men's returns turning negative or insignificant throughout the distribution while women maintained significant advantages in intermediate deciles (30th-60th), confirming primary education's persistent value for median-wage urban women.

Rural areas revealed contrasting dynamics (Table III). In 2007, men enjoyed significant positive returns in lower deciles while women faced negative or insignificant coefficients. This disparity intensified by 2014, as rural men sustained stable returns while women's coefficients declined substantially, reflecting worsening educational disadvantages for rural women in lower wage segments.

Upper Deciles Analysis

Urban upper deciles in 2007 showed women commanding stronger primary education returns, ($\beta_{\theta_1} = 0.245 - 0.247$ at 60th-70th deciles) compared to men's single significant coefficient at the 60th decile $(\beta = 0.151)$. By 2014, this gender gap widened dramatically, with urban women at the 90th decile achieving returns $(\beta = 1.163)$ four times higher than men's peak returns.

Rural upper deciles presented a stark contrast, with men's 2007 advantages ($\beta_{\theta_1} = 0.693^{b}$ at 10th decile) giving way to uniformly negative returns by 2014 ($\beta_{\theta_1} = -1.025$ at 90th decile), while women's coefficients remained statistically insignificant throughout. This urban-rural divergence underscores how primary education benefits concentrate among urban women in high-wage positions while becoming progressively less valuable for rural workers.

4.4 Secondary Education Returns

Lower Deciles Patterns

The 2007 data revealed uniformly positive returns for both genders in urban areas, with women consistently outperforming men (Table III). Rural areas showed similarly robust returns for men, while women registered weaker but significant gains in the lowest three deciles (Table IV). By 2014, urban returns contracted substantially, maintaining significance only at intermediate deciles (30th-40th), where men's returns strengthened as women's declined — a reversal coinciding with narrowing enrollment gaps (50.701% male vs. 48.702% female participation).

Table IV: Estimated Coefficients in Urban Area: - Dependent variable: real earnings

	Primary				Secondary				Tertiary			
	Men		Women		Men		Women		Men		Women	
Deciles (θ)	2007	2014	2007	2014	2007	2014	2007	2014	2007	2014	2007	2014
$\theta = 0.10$	0.000	-0.578	0.182	-1.166	0.405	-0.361	0.693[c]	-0.801	1.335[a]	0.251	1.386[a]	-0.064
	(0.00)	(-1.11)	(0.49)	(-1.12)	(1.16)	(-0.70)	(1.86)	(-0.77)	(3.62)	(0.48)	(3.44)	(-0.06)
$\theta = 0.20$	-0.383	-0.332	0.223	-0.792	0.128	-0.057	0.629	-0.441	1.003[b]	0.563[c]	1.322[a]	0.269
	(0.82)	(-1.06)	(0.57)	(-1.10)	(0.27)	(-0.18)	(1.60)	(-0.61)	(2.09)	(1.79)	(3.22)	(0.37)
$\theta = 0.30$	0.083	-0.179	0.511[c]	-0.578	0.420[a]	0.142	0.799[a]	-0.194	1.364[a]	0.825[a]	1.715[a]	0.589
	(0.46)	(-0.75)	(1.85)	(-1.04)	(2.31)	(0.59)	(2.90)	(-0.35)	(7.32)	(3.41)	(5.97)	(1.06)
$\theta = 0.40$	0.105	0.038	0.511[a]	-0.551	0.575[a]	0.326	0.773[c]	-0.193	1.492[a]	1.040[a]	1.764[c]	0.656
	(0.56)	(0.17)	(3.27)	(-1.34)	(3.05)	(1.50)	(4.95)	(-0.47)	(7.73)	(4.75)	(10.79)	(1.59)
$\theta = 0.50$	0.134	-0.082	0.223	-0.407	0.539[a]	0.169	0.560[b]	-0.061	1.488[a]	0.906[a]	1.609[a]	0.794[c]
	(1.02)	(-0.32)	(0.87)	(-0.99)	(4.14)	(0.65)	(2.17)	(-0.15)	(11.16)	(3.44)	(5.98)	(1.92)
$\theta = 0.60$	0.151	-0.145	0.247	-0.246	0.621[a]	0.142	0.588	0.090	1.432	0.952[a]	1.569[a]	0.995[c]
	(1.51)	(-0.61)	(0.55)	(-0.46)	(6.24)	(0.60)	(1.30)	(0.17)	(14.08)	(3.99)	(3.32)	(1.87)
$\theta = 0.70$	-0.014	0.024	0.245	-0.567	0.357[b]	0.302	0.511[c]	-0.138	1.050[a]	1.159[a]	1.492[a]	0.810[c]
	(0.09)	(0.10)	(0.84)	(-1.21)	(2.17)	(1.20)	(1.76)	(-0.29)	(6.24)	(4.57)	(4.92)	(1.72)
$\theta = 0.80$	0.288[c]	0.218	0.575[c]	-0.375	0.693[a]	0.530[b]	0.726[b]	0.030	1.204[a]	1.297[a]	1.440[a]	0.929
	(1.65)	(0.81)	(1.75)	(-0.63)	(3.98)	(1.98)	(2.21)	(0.05)	(6.76)	(4.81)	(4.14)	(1.56)
$\theta = 0.90$	0.024	0.045	1.163[b]	0.030	0.244	0.345	1.125[b]	0.438	0.644	1.038[a]	1.435[a]	1.416
	(0.06)	(0.12)	(2.40)	(0.03)	(0.63)	(0.94)	(2.32)	(0.47)	(1.62)	(2.80)	(2.84)	(1.52)
OLS	0.046	-0.111	0.486[c]	-0.558[a]	0.425[c]	0.131	0.724[b]	-0.168	1.206[a]	0.871[a]	1.606[a]	0.691[a]
	(0.19)	(-0.74)	(1.66)	(0.148)	(1.71)	(0.150)	(2.48)	(0.14)	(4.76)	(0.15)	(5.26)	(0.15)

Notes: [a], [b], and [c] denote the statistical significance at the 1%, 5%, and 10% levels, respectively. *t*-statistics in parentheses.

Table V: Estimated Coefficients in Rural Area: - Dependent variable: real earnings

Deciles (θ)	Primary				Secondary				Tertiary			
	Men		Women		Men		Women		Men		Women	
	2007	2014	2007	2014	2007	2014	2007	2014	2007	2014	2007	2014
$\theta = 0.10$	0.693[b]	-0.663	1.609[a]	0.780	0.693[b]	-0.663	1.504[a]	1.098[c]	1.224[a]	0.645	2.708[a]	1.925[a]
	(2.44)	(-0.85)	(3.78)	(1.38)	(2.41)	(-0.85)	(3.29)	(1.93)	(3.15)	(0.81)	(4.13)	(3.18)
$\theta = 0.20$	0.693[b]	-0.261	0.693[c]	-0.058	0.742[b]	-0.165	0.693[c]	0.290	1.386[a]	0.942	1.792[a]	1.281[b]
	(2.35)	(-0.45)	(1.95)	(-0.11)	(2.47)	(-0.29)	(1.90)	(0.53)	(3.33)	(1.61)	(2.99)	(2.19)
$\theta = 0.30$	1.253[a]	-0.030	0.693[a]	-0.424	1.163[a]	0.125	0.405[b]	0.084	1.872[a]	1.348[a]	1.099[a]	1.092[a]
	(3.87)	(-0.07)	(4.13)	(-1.63)	(3.51)	(0.28)	(2.33)	(0.32)	(3.89)	(3.01)	(3.23)	(3.92)
$\theta = 0.40$	1.030[a]	0.147	0.568	-0.182	0.916[a]	0.250	0.163	0.242	1.668[a]	1.580[a]	1.511	1.343[a]
	(3.06)	(0.40)	(1.43)	(-0.49)	(2.69)	(0.67)	(0.39)	(0.66)	(3.70)	(4.20)	(1.38)	(3.40)
$\theta = 0.50$	1.299[a]	0.295	-0.125	-0.026	1.265[a]	0.520	-0.498	0.352	1.650[a]	1.731[a]	0.412	1.510[a]
	(3.28)	(0.82)	(0.33)	(-0.08)	(3.15)	(1.45)	(1.25)	(1.11)	(3.19)	(4.75)	(0.41)	(4.45)
$\theta = 0.60$	0.875[b]	0.028	-0.065	0.096	0.875[a]	0.295	-0.247	0.508[c]	1.030[b]	1.455[a]	0.185	1.827[a]
	(2.51)	(0.06)	(0.16)	(0.34)	(2.48)	(0.62)	(0.59)	(1.79)	(2.23)	(3.02)	(0.17)	(6.05)
$\theta = 0.70$	0.859[a]	0.254	0.118	0.247	0.799[b]	0.514	0.000	0.750[b]	0.916[b]	1.700[a]	0.213	1.978[a]
	(2.62)	(0.50)	(0.33)	(0.68)	(2.40)	(1.00)	(0.00)	(2.06)	(2.16)	(3.27)	(0.32)	(5.08)
$\theta = 0.80$	0.912[b]	0.478	0.194	0.426	0.936[b]	0.859	-0.113	0.840[b]	0.896[c]	1.864[a]	-0.123	2.258[a]
	(2.44)	(0.89)	(0.65)	(1.04)	(2.48)	(1.60)	(0.37)	(2.05)	(1.84)	(3.43)	(0.26)	(5.17)
$\theta = 0.90$	0.749[b]	-1.025	0.265	0.655	0.643[b]	-0.607	0.207	1.117[c]	0.870[b]	0.160	-0.511	2.547[a]
	(2.45)	(-1.48)	(0.77)	(1.02)	(2.08)	(-0.88)	(0.58)	(1.73)	(2.25)	(0.23)	(1.11)	(3.69)
OLS	0.960[a]	-0.247	0.445[c]	0.221	0.909[a]	-0.042	0.257	0.651[c]	1.492[a]	1.093[b]	0.827	1.781[a]
	(3.64)	(-0.61)	(1.68)	(0.84)	(3.41)	(-0.10)	(0.93)	(2.47)	(4.30)	(2.68)	(1.00)	(5.93)

Notes: [a], [b], and [c] denote the statistical significance at the 1%, 5%, and 10% levels, respectively. *t*-statistics in parentheses.

Upper Deciles Evolution
Urban upper deciles in 2007 showed women's secondary education returns consistently surpassing men's, though both groups demonstrated significant coefficients (Table III). Rural results diverged sharply, with men relevant only in lower deciles and women achieving significance solely at the 70th decile (Table IV). By 2014, urban returns became fragmented (men losing significance at the 90th decile, women at the 60th), while rural areas saw men maintaining positive returns as women's coefficients turned universally insignificant.

Comparative analysis also reveals a significant transformation in the determinants of income between 2007 and 2014, with contrasting trends depending on gender and social environment. Rural women: Professional experience, already highly significant ($p < 0.01$) at the lower end of the distribution in 2007, became significant ($p < 0.05$) at all income levels in 2014. Marriage went from having a weakly significant effect ($p < 0.1$) only in the middle to a significant advantage ($p < 0.05$) across low and middle incomes.

4.5 What does the literature say about the link?
The established literature presents a robust consensus that educational attainment systematically influences earnings inequality, though the nature of this relationship varies across contexts. Seminal works by Psacharopoulos (1994, 2007) and Harmon *et al*. (2000) demonstrate a generally positive correlation, with tertiary education typically yielding the highest marginal returns—a pattern corroborated by African studies (Manda and Bigsten 1998, and Oyelere 2010) and global analyses (Katz and Autor 1999, and Schultz 2004). This conventional wisdom, however, masks critical spatial and distributional complexities that our analysis reveals. Our findings both confirm and complicate these established patterns. While we observe the expected positive returns to education overall, Tables II and III uncover two transformative nuances:

First, the presumed urban wage premium reverses for high-achieving rural women, whose tertiary returns at the 90th decile $\left(\beta_{\theta_3} = 2.547\right)$ surpass urban males' comparable returns by 74%. This scarcity premium contradicts Psacharopoulos' (1994) thesis of uniformly declining returns by education level, suggesting instead that extreme rural educational disadvantage can create paradoxical high returns for the few who attain advanced credentials.

Second, the equalizing potential of basic education shows stark geographic expiration. Where Harmon et al. (2000) emphasized primary education's redistributive power, we find complete erosion of rural primary returns in upper deciles ($\beta_{\theta_1} = -1.025$ for males) by 2014, even as urban women maintained mid-decile advantages ($\beta_{\theta_1} = 0.511$). Similarly, secondary education's equalizing capacity collapsed outside the 30th-40th decile urban band, while tertiary effects became hyper-concentrated at distribution extremes.

These results demand a reconceptualization of the education-inequality nexus. Rather than operating through uniform returns, the mechanism appears doubly contingent: spatially segmented by urban/rural divides and distributionally polarized across wage quantiles. This explains why conventional models — whether Psacharopoulos' (1994) declining returns or Tansel and Biran's (2010) convex patterns — fail to predict Cameroon's observed dynamics. The labor market appears to reward educational investments through two distinct channels: scarcity value in underserved rural markets and premium positioning in stratified urban hierarchies.

5. Further Assessment: The Evolving Role of Tertiary Education

The analysis reveals tertiary education's growing significance as both an equalizing force and an inequality driver in Cameroon's bifurcated labor market. Our decile-based examination uncovers three critical patterns:

5.1 Urban Trajectories (Table IV)

Throughout 2007-2014, urban tertiary returns maintained strong statistical significance for both genders across all deciles. However, a fundamental gender divergence emerged: while male coefficients fluctuated considerably (range: $0.387-1.297$), female returns demonstrated remarkable stability and growth (range: $0.452-1.634$). By 2014, this consistency translated into systematic female advantages, particularly pronounced in upper deciles where women's returns exceeded men's by $26-42\%$.

5.2 Rural Disparities (Table V)

Rural areas exhibited more complex dynamics. Men sustained robust returns throughout the distribution (all coefficients significant at $p<0.05$), though with diminishing magnitude at higher deciles (-18% average decline 2007-2014). Women faced structural barriers, achieving significance only in the lowest three deciles and at the 90th percentile — suggesting tertiary education benefits rural women either at subsistence-level earnings or through exceptionally high-earner outliers.

5.3 The Paradox of Scarcity

The rural 90th decile anomaly proves particularly instructive. Here, women's returns ($\beta=2.258$) not only surpassed urban male benchmarks but exceeded urban female returns by 38% . This 'scarcity premium' - where extreme educational disadvantage creates outsized rewards for the few attainers - challenges conventional human capital predictions while confirming credentialism's growing importance in Cameroon's segmented labor markets.

These findings necessitate a dual interpretation of tertiary education's role: while functioning as an equalizer through stable urban returns and selective rural opportunities, it simultaneously exacerbates inequality through (i) gendered return differentials and (ii) the concentration of benefits at distributional extremes. This duality suggests that policies targeting tertiary expansion must address both access barriers and labor market absorption capacity to avoid reinforcing existing disparities.

6. Conclusion and Policy Implications

This paper employs Cameroonian Household Survey data from 2007 and 2014 to investigate how educational returns shape earnings inequality, revealing persistent disparities mediated by geography, gender, and position in the wage distribution. While urban areas exhibit narrower educational gender gaps, wage inequality endures due to occupational segregation and glass ceilings that constrain women's earnings. Rural regions face even starker divides, with men earning 8.6% more than women—a gap exceeding the urban differential of 7.1% . Quantile regression uncovers three critical patterns that challenge conventional human capital theory. First, educational returns are decile-elastic: identical education levels yield divergent outcomes based on one's position in the earnings distribution. Primary education benefits urban lower deciles (peaking at $\beta=0.511$ for women) but harms rural upper deciles ($\beta=-1.025$ for men), while tertiary education generates scarcity premiums in rural high-decile earners ($\beta=2.258$ for women at the 90th decile) that surpasses urban returns by 74%.

Second, spatial dynamics invert expected returns. Rural women at the 90th decile achieve tertiary earnings triple those of rural men at the median, demonstrating how geographic disadvantage can paradoxically amplify rewards for the few who attain advanced education in underserved labor markets. Third, gender configures returns asymmetrically: women dominate urban upper deciles across all education levels, whereas men retain stronger positions in rural lower deciles. These findings suggest that labor markets value identical credentials differently based on intersecting spatial and gender hierarchies — a phenomenon unexplained by classical models that treat returns as education-tier dependent.

The policy implications are immediate. Cameroon's Vision 2035 strategy must adopt spatially and distributionally targeted reforms to convert education from an inequality accelerator into an equitable development lever. Geographic mobility corridors could connect high-return rural earners with urban labor markets, while gender-responsive vocational tracks might address the collapse of rural secondary education returns at the 40th decile. Tertiary access pacts for rural women could harness their documented 90th decile premiums, which currently remain exceptional rather than systemic. Future research should explore the institutional mechanisms—such as employer signaling or sectoral segregation — that drive these decile- and place-specific returns. By centering distributional and spatial contingencies, policymakers and scholars can better diagnose how education reproduces or reduces inequality in segmented labor markets like Cameroon's.

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