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Education and Earnings Inequality in Ghana

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Abstract

The paper investigates the effects of education on earnings distribution of urban workers in the Ghanaian labour market between 1998/99 and 2005/6 by using the fourth and fifth rounds of the Ghana Living Standards Survey. To this end, quantile regression technique is applied to examine returns to education across the earnings spectrum to identify whether some workers benefit more from education with its implication on earnings inequality. Estimated returns to education along the earnings distribution point to a change in the pattern of returns between 1998/9 and 2004/5 along the earnings spectrum. Results indicate earnings inequalities have widened with education across the two periods. Specifically, in 1998/99, earnings inequality reducing trend of education observed has changed overtime. These results are robust when the labour market is disaggregated by sector.

Keywords

Education, Earnings, Employment, Labour Market, Inequality

1. Introduction

Several empirical reviews on returns to education have been undertaken in an attempt to establish a pattern of returns to investment in education. Among them, Psacharopoulos' long but contested[1] history of analysis on returns to education has shown returns to education are highest at the primary level [2]-[7]. In Sub-Saharan Africa (SSA), the latest rate of returns (RORE) estimates indicate primary education still has both the highest social and private rates of return. Private rate of return includes only private benefits and costs while social rate of return differs by the inclusion of direct cost of education to the government as well as benefits in terms of higher taxes and other externalities that accrue to society.

Guidetti and Rehbein [8] ascribe different factors that account for income (earnings) inequality, paramount among them include human capital, skill biased technological change, internationalization of production and la-

[1]See Bennell (1996) [1].

bour market institutions. Human capital as a source of earnings differentials dates back to neoclassical economists who argue that individuals invest years in education to enjoy higher returns than any other possible financial investment. The individual's income consequently is based on this investment holding the individual's ability and background characteristics such as gender and parental background constant.

In general, studies on returns to education in Ghana point to the reduction in private returns to education particularly at higher levels. Psacharopoulos and Patrinos [7] for instance found a significant drop in private returns to higher education since 1967. This suggests the increase in the number of people graduating at these levels has not been matched with an increase in the availability of waged jobs and/or that there is a decline in the quality of education.[2]

Other quantitative estimates for returns to education based on the Mincerian model point to the importance of post-basic levels of schooling. Appleton, Hoddinott and Mackinnon [11] show there is a pattern of higher private returns to education for higher levels of education across SSA[3]. Evidence from research on Ghana confirms the increasing trend of returns to higher education [12] [14] [15].

In an extensive paper on education, incomes, poverty and inequality in Ghana, Teal [16] estimates returns to education using four waves of data from 1988 to 1999. The study estimates returns to education in wage, agriculture and self-employment to reflect the structure of the Ghanaian economy and demonstrates how availability of data over time can be used to learn about the poverty-reducing potential of education. Other recent empirical evidence on Ghana [17] [18] point to the importance of the distinction between wage employment and self-employment and the impact of education on earnings.

Ghana has over the years experienced high growth rates averaging 7.2 percent between 2000 and 2013 and hitting its highest of 14.4 percent in 2011. This acceleration in growth moved Ghana to the level of a lower middle income country with poverty reducing by 50 percent as at 2006 [19]. Incomes however have been disproportionately distributed due mainly to the varying levels of growth observed in different sector of the economy with its attendant ramifications on earnings inequality.

The paper adds value to existing literature on earnings and education in Ghana by applying quantile regressions to investigate returns to education across the earnings spectrum in examining whether some workers benefit more from education than others and its implication on inequality. While OLS captures the effect of education and other covariates on mean earnings, quantile regression looks at the determinants at some other points of the earnings distribution. Consequently, the study focuses on quantile treatment effects of education and other covariates on earnings rather than on the average treatment effect. As Buchinsky (1994) indicates, this technique is important due to the differential effects of education on earnings among individuals with implications on income distribution and inequality.

2. Methodology

Standard OLS techniques concentrate on estimating the mean of the dependent variable subject to values of the independent variables where variables are included as uncentred regressors. As an alternative to OLS, quantile regression is based on the entire sample available and allows the estimation of return to education within different quantiles of the earnings distribution (Buchinsky, 1994). In particular, while OLS captures the effect of education and other covariates on the mean earnings, quantile regression looks at the determinants at some other points of the earnings distribution. The study therefore focuses on quantile treatment effects of education and other covariates on earnings rather than on the average treatment effect which add value to estimation results. Following Buchinsky (1994), this technique is adopted since effects of education on earnings may be different for individuals at different points in the earnings distribution.

The estimation of the model at different quantiles makes it possible to trace the entire conditional distribution of earnings given the set of regressors. Afterwards, comparing the estimated returns across the whole earnings distribution, the study can infer the extent to which education exacerbates or reduces underlying inequalities. Particularly, how the different levels of education affect earnings differently at different points of the conditional distribution of earnings. An additional advantage of employing this estimation method is that the regression coefficient vector is not sensitive to outlying values of the dependent variable, as the quantile regression objec-

[2]The World Bank's participatory assessments of the 1990s attribute this to a sharp decline in the quality of basic education [9] [10].

[3]Studies which find increasing returns to higher levels of education include van der Gaag and Vijverberg [12] for Côte d'Ivoire, and Söderbom, Teal, Wambugu & Kahyarara (2003) for Kenya and Tanzania [13].

tive function is a weighted sum of absolute deviations. Provided error terms are homoscedastic, according to Koenker and Bassett (1982) and Rogers (1992), this method would be adequate to calculate the variance—covariance matrix. Rogers (1992), shows in the presence of heteroscedastic errors, this method understates the standard errors. The study consequently adopts bootstrapped estimator of standard errors as suggested by Roger to cater for any such under estimated standard errors. This method however requires that, there is adequate dispersion of the independent variables over the earnings distribution to enable identification of coefficients for each quartile. The Ghana living standard survey is satisfactory in this regard.

According to Koenker and Bassett (1978), quantile regression estimation is by minimising the following equation:

$$\min_{\beta\in R^k}\sum_{t\in(t:y_t\geq x_t\beta)}\theta\left|y_t-x_t\beta\right|+\sum_{t\in(t:y_t<x_t\beta)}(1-\theta)\left|y_t-x_t\beta\right| \tag{1}$$

where y_t is the dependent variable, x_t is the k by 1 vector of explanatory variables, β is the coefficient vector and 1 is the quantile to be estimated.

Following Bushnisky (1994, 1998), the quantile regression model of the earnings function is specified as follows;

$$\ln w_i = x_i'\beta + u_{\theta_i} \tag{2}$$

$$Quant_\theta\left(\ln w_i\middle|x_i\right)=x_i'\beta_\theta;Quant_\theta\left(u_{\theta_i}\middle|x_i\right)=0 \tag{3}$$

where w denotes monthly earnings, x is a vector of explanatory variables and u_θ is a random error term. The $i=1,\cdots,n$, is the index for individual worker and n is the number of workers in the sample. The parameter vector denoted by β_θ and $Quant_\theta\left(\ln w_i\middle|x_i\right)$ is the θ^{th} conditional quantile of ln$w$ given x_i. Given that, quantile regression parameters minimise the absolute sum of the errors from a particular quantile of the log earnings across individuals, the problem is to obtain the θ^{th} quantile regression parameter to

$$\text{Min}\left\{\sum_{i:\ln w_i\geq x_i'\beta_\theta}\theta\left|\ln w_i-x_i'\beta_\theta\right|+\sum_{i:\ln w_i<x_i'\beta_\theta}(1-\theta)\left|\ln w_i-x_i'\beta_\theta\right|\right\}. \tag{4}$$

The median regression or least absolute deviation (LAD) is when θ = 0.50. Other quantile regressions are estimated through the weighting of the absolute sum of the errors. In essence, if $\ln w_i \geq x_i'\beta_\theta$, then the deviation is positive and θ is the weight used. On the other hand, when $\ln w_i < x_i'\beta_\theta$, the deviation is negative and the weight used is $1-\theta$. By estimating earnings functions at different quantiles simultaneously, we are able to conduct a hypothesis testing of cross quantiles restrictions.

The estimation strategy adopted in this study is by using quantile regressions (QR) to investigate how earnings vary with levels of schooling at the 25th (low), 50th (median) and 75th (upper) percentiles of the earnings distribution. This is necessitated to shed light on who benefits most from education in Ghana and whether the pattern has changed between 1998/99 and 2005/06. To the extent that which observations close to 75th percentile can be interpreted to be indicative of higher 'ability' than at the lower percentiles based on the presumption that such observation typically earn more given their characteristics, quantile regressions are informative of the effect of education on earnings across individuals with varying ability.

3. Data

The study uses the fourth and fifth rounds of the Ghana Living Standards Surveys (GLSS) conducted in 1998/99 and 2005/6 respectively. Both surveys were carried out over a one-year period following a two-stage sampling strategy to arrive at a nationally representative sample. GLSS4 consists of about 26,000 individuals living in 5998 households surveyed between April 1998 and March 1999. In GLSS5, 37,128 individuals living in 8687 households were surveyed between September 2005 and September 2006. The GLSS data is a multidimensional household survey data that collects information on a wide range of household and individual level characteristics with a labour market module which makes is suitable for this study.

The sample in this study consists of urban dwellers in the labour force aged 15 to 64, out of which consist of 3232 individuals in GlSS4 and 5, 643 in GLSS5. To ensure comparability between the two data sets, individuals are categorised by labour market status as formal wage employment in either the public (government jobs) or the

private sector, informal non-agricultural self-employment either as an employer with employees or without employees (own account worker), agricultural workers, unpaid domestic/family workers and the unemployed. In GLSS4, these classifications are obtained from elicited response to the question "for whom do you work for", the options are detailed which enables the situation of each individual in an employment category. A similar procedure is adopted in GLSS5 with the same question posed. Unemployment is defined by applying a search criterion from response to the question "have you made any effort within the last twelve months to find work" in both data sets. **Table 3** presents the percentage distribution of individuals by labour market status in the two periods. These distinctions in terms of employment status are important since they are indicative of the structure of employment in the economy.

Income from employment generally referred to as employee compensation is based on elicited responses on jobs undertaken in the past twelve months in the surveys. For the purpose of this study, compensation from primary occupation for individuals whose primary occupation for the past twelve months involved working in an enterprise or as an employee of a non-household business are used. Incomes received in cash, in kind and as bonuses are calculated and converted into monthly earnings.

Table 1 presents the distribution of the working population across different labour market status for the two periods (1998/9 and 2005/6). Formal employment accounts for a small share of total employment in Ghana across the two periods. Formal wage employment in both public and private sectors accounted for 13.3% in 1998/9 and 15.5% in 2005/6 of employment with the increase due mainly to the rise in employment share in the private sector. Agriculture continues to remain a dominant part of the Ghanaian economy contributing over 50% to total employment in the labour market. This is followed by the informal sector (a combination of non-agricultural self-employed without employees or own account workers and self-employed with employees) which contributed slightly above a quarter to total employment between the two periods. Across the two periods, we observe increases in the contribution of formal private wage employment, self-employment with employees' category and unemployment whiles at the same time formal public sector employment, own account workers, agriculture and unpaid family worker categories decreased in their contribution to the labour force in Ghana.

Decomposition of the labour market by sex across the two periods (**Table 2**) highlights the marginal contribution of the formal sector towards employment of women in Ghana (3.4% in 1998/99 and 4.3% in 2005/6) and the importance of non-agricultural informal self-employment among women in Ghana. Own account workers constitute the vast majority of self-employment, an indication that most women in Ghana are own account and agricultural workers. More women are also found in unpaid family work and unemployment compared to men particularly in 2005/6. This highlights the differences inherent in labour market status by sex in the country. Although formal employment represents a small segment of total employment, most of these jobs are taken up by men who are less than women in the overall labour force.

The employment pattern in the labour market of Ghana overtime is a reflection of the changing structure of the economy. The expectation with development is that, workers are to be drawn from primary economic activity into secondary and tertiary employment in succession. Since the structural change which is an integral part of economic development involves shift in output from agricultural sector to industry (mostly manufacturing) and ultimately a stage of service dominance, the expectation is that employment will move from agriculture into industry and then services. Informal sector covers a spectrum of economic activities including manufacturing, commerce and construction among others. In Ghana, growing informality is partly explained by the low educational attainment of the population although overall educational attainment has increased over the years. In 2006, about 31 percent of Ghanaians aged 15 years and above had never attended school. More than 50 percent of Ghanaians had attained only basic education and 16.2 percent had attained secondary education or higher [20] [21].

Table 3 presents the distribution of labour market status by years of education and age across the two periods. Overall, average years of schooling increased by about 10.4% between 1998/99 and 2005/6. Across the two periods, public sector workers are observed to be much older and more educated, in addition together with private sector workers, wage employees are on average more educated than all other categories. This is followed by the unemployed and the informal self-employed although it is important to note the entrepreneurial group within the informal sector are on average more educated than the own account workers and have average years of schooling close to formal wage employees particularly in 2005/6. The least category in terms of education is the agricultural worker. In terms of age, with the exception of the public sector, the self-employed with employees (entrepreneurial group) within the informal sector are much older, followed by agricultural workers with the least category being family worker in both periods.

Table 1. Distribution of labour market population (15+).

Status	1998/99	2005/06
Formal public sector employment	6.66	5.15
Formal private sector employment	6.59	10.34
Self-employed (non-agriculture) with employees	0.69	2.32
Self-employed (non-agriculture) without employees	27.37	23.95
Agriculture	53.07	52.73
Unpaid family workers	3.01	1.16
Unemployed	2.61	4.36
Total	100	100

Source: Calculations from Ghana Living Standards Surveys; 1998/9 and 2005/6.

Table 2. Distribution of Labour market population by sex, 1998/99 and 2005/6.

	1998/99		2005/06	
	Men	Women	Men	Women
Formal public sector employment	4.80	1.87	3.54	1.61
Formal private sector employment	5.08	1.51	7.63	2.71
Self-employed (non-agriculture) with employees	0.43	0.26	1.15	1.17
Self-employed (non-agriculture) without employees	6.93	20.44	6.32	17.64
Agriculture	25.03	28.04	25.62	27.11
Unpaid family workers	0.80	2.13	0.22	0.94
Unemployed	1.35	1.26	2.05	2.31
Total	44.93	55.51	46.53	53.47

Source: Author's calculation from GLSS4 and GLSS5.

Table 3. Labour market status by years of education and age, 1998/99 and 2005/6.

Status	Education		Age	
	1998/99	2005/6	1998/99	2005/06
Formal wage employment	12.3	13.1	38.4	36.8
Formal public sector employment	13.0	15.0	42.3	41.6
Formal private sector employment	11.5	12.0	34.5	34.5
A. Self-employed (non-agriculture) with employees	10.3	12.0	41.2	38.3
B. Self-employed (non-agriculture) without employees	9.8	10.4	36.0	36.1
Self-employment (A + B)	9.8	10.6	36.1	36.3
Agriculture	8.7	9.4	37.8	36.4
Unpaid family workers	8.8	9.8	25.9	26.1
Unemployed	11.2	11.8	29.6	29.6
Overall	**9.6**	**10.6**	**32.7**	**32.6**

Source: Calculations from GLSS4 and GLSS5.

In general, average years of schooling in all labour market statuses increased between the two periods, re-enforcing the overall increase in years of education in Ghana between the two periods. What emerges from **Table 3** is the fact that in Ghana although the unemployed are young, they are not the least educated as they possess mean years of education comparable to those in formal wage employment.

Estimates of monthly earnings by employment status across the two survey periods are presented in **Table 4**. Overall in 1998/99, average monthly earnings amounted to 13.90 Ghana equivalent to $43.41 (US dollars)

Table 4. Monthly earnings by employment status.

Status	1998/99		2005/06	
	Mean	Median	Mean	Median
Wage employment	27.59	14.40	134.64	70.00
Formal Public Sector Employment	38.96	17.00	216.34	112.30
Formal Private Sector Employment	16.03	10.8	94.28	55.10
A. Self-employment (non-agricultural) with employees	27.04	14.00	282.66	80.00
B. Self-employment (non-agricultural) without employees	17.72	8.00	76.11	35.00
Informal Non-agricultural Self-employment (A + B)	17.96	8.00	95.58	40
Agricultural employment	5.38	2.23	43.37	16.77
Total	**13.90**	**5.0**	**83.48**	**30.00**

Source: Calculations from Ghana Living Standards Surveys, 1998/9 and 2005/06; Note: Earnings are at current prices in new Ghana Cedis.

shown in **Table A1** in **Appendix**. This increased to 83.48 Ghana Cedis equivalent to $85.19 (US dollars) in 2005/6. With respect to earnings by occupation, estimated monthly earnings reflect a hierarchy in earnings across type of occupation. Formal wage employment is at the top of this hierarchy followed by informal self-employment with agricultural employment at the bottom. There are however heterogeneities within the formal and informal sector categories. Particularly in 2005/6, average earnings to the entrepreneurial group within the informal sector are more than earnings in all other occupations, in addition, public sector workers earn more on average than those in the private sector. For international comparison, earnings are converted into dollars with the average annual exchange rate for the respective years in **Table A1** and **Table A2** in **Appendix**.

Since the mean can be a misleading measure of central tendency due to the skewed nature of earnings distributions, the tables also show median earnings which further confirm patterns found using the mean. **Figure 1** and **Figure 2** show the distribution of the log of earnings in 1998/99 and 2005/6. The patterns confirm the hierarchical nature of earnings by employment status with formal wage employment at the top and agriculture at the bottom. The figures in both periods have similar patterns; in addition, they indicate the narrow distribution of earnings in wage employment relative to self-employment and agricultural earnings. The earnings distribution for 2005/6 is more compressed relative to that of 1998/99, although the distribution for wage employment is still skewed to the right of the other distributions, this indicates the lessening of earnings differences in the country over time as expected with growth.

The tables and figures discussed above suggest the existence of a hierarchy in occupation with respect to earnings and education, similar to Teal (2001) [16] with formal wage employment at the top followed by self-employment and agriculture respectively. A suggestion of the important role education plays in occupational attainment in the Ghanaian labour market.

Due to the dominance of urban non-agricultural employment in Ghana, the paper focuses on the urban labour market. **Table 5** and **Table 6** present a summary of the urban sample for GLSS5 and GLSS4 respectively by age, years of schooling and monthly earnings. Overall, informal self-employment is the dominant sector in urban employment contributing over 50% of urban employment in the country across the two periods. However, within this sector, the self-employed with employees form only a small segment which indicates own account self-employment is the major source of urban employment in the country. The public sector is the least in terms of formal urban employment, between 1998/99 and 2005/6, across the two periods, we observe an increase in private sector share of urban employment.

The estimates indicate the average public sector worker is much older with more years of schooling and higher earnings although less than the entrepreneurial group in the informal sector. The private sector follows with more years of schooling and earnings, while the average informal self-employed (self-employed with employees and own account workers) is older. Overall, this is an indication of the existence of a possible hierarchy in the use of education in Ghana with the public sector at the top and self-employment at the bottom in urban Ghana. In addition, across the two periods, we observe that although the unemployed in the urban labour market are relatively younger, their average years of schooling are above those in self-employment (own account) and close to formal wage workers particularly the private sector.

Figure 1. Earnings distribution for 1998/9.

Figure 2. Earnings distribution for 2005/6.

Table 5. Distribution of urban non-agriculture labour market population; 2005/6.

Status	% Share	Age	Years of schooling	Mean earnings ($)
Formal Public Sector employed	12.7	41.7	15.2	248.38
Formal Private Sector employed	23.6	34.8	12.4	116.47
A. Self-employed with employees	5.5	38.5	12.5	354.29
B. Self-employed without employees	44.8	36.2	10.9	85.96
Informal Non-agricultural Self-employed (A + B)	50.3	36.4	11.1	104.08
Unpaid family workers	1.6	25.8	10.5	-
Unemployed	11.8	30.1	12.0	-
Total number	**(4979)**	**35.8**	**12.1**	**133.10**

Source: Calculations from Ghana Living Standards Survey, 2005/2006.

Table 6. Distribution of urban non-agriculture labour market population; 1998/99.

Status	% Share	Age	Years of schooling	Mean earnings ($)
Formal Public Sector employed	14.7	42.3	13.1	168.63
Formal Private Sector employed	15.4	35.7	11.9	56.24
A. Self-employed with employees	1.7	41.5	11.6	113.56
B. Self-employed without employees	56.3	36.6	10.3	72.11
Informal Non-agricultural Self-employed (A + B)	58.0	36.7	10.4	73.33
Unpaid family workers	4.6	24.5	9.6	-
Unemployed	7.3	30.3	11.4	-
Total	**(2645)**	**30.9**	**10.7**	**84.36**

Source: Calculations from Ghana Living Standards Survey, 1998/9.

Test of earnings differences in occupations for 2005/6 and 1998/99 are presented in **Table A3** and **Table A4** in **Appendix**. The results confirm earnings differences exist in the urban labour market in Ghana with the public sector at the top, although the self-employed with employees on average earn more than those in the public sector, there is no statistical difference between the earnings. In addition, higher earnings in the private sector are not statistically different from those in self-employment mainly due to the entrepreneurial group within this sector. However, since the mean can be a misleading measure of central tendency due to the skewed nature of earnings distribution, the **Figure A1** and **Figure A2** in **Appendix** show the distribution of log of earnings for urban non-agricultural employment for the two periods.

Overall, public sector earnings are observed to dominate private and self-employment earnings although there are overlaps in the distributions. As found using the overall sample in **Figure 1** and **Figure 2**, the distribution for 2005/6 is more compressed relative to that of 1998/99. Between 1998/99 and 2005/06, the pattern of distribution has narrowed in all employments with the public sector distribution more skewed to the right in 2005/06.

4. Empirical Results

OLS estimation of the Mincerian earnings equation is based on a restrictive assumption that the marginal return to education and other earnings determinants are the same for all individuals. Empirically, economic returns to education can vary among individuals due to unobserved factors such as ability, motivation and ambition in addition to differences in interest rates faced by different individuals based on for example assets/wealth (Card 2001). The heterogeneity of returns to education across individuals has implications on the inequality-reducing role of education. To this end, the study examines heterogeneity in earnings determinants particularly on returns to the different levels of education to determine whether some workers benefit more from education than others and its implications for inequality and educational policy. This contributes to earnings and education literature on Ghana since there is no existing study that investigates returns to education across spectrums of the earnings distribution at the two different time periods (1998/99 and 2005/6) on the Ghanaian labour market.

The literature on pattern of returns to education using quantile regressions suggests returns to education increase with quantiles in developed countries, mixed evidence in middle income countries and in very few developing countries where evidence exist, returns decrease with quantiles. In the case of developed countries, the increase in returns as one goes from the lower to the higher end of the earnings distribution is interpreted as an indication that ability and education are complements with able workers benefiting more from additional investment in education. A negative relationship between ability and returns to education (decreasing returns with earnings quantile) on the other hand suggests substitutability between education and ability. Finally, lack of a distinct pattern indicates in the absence of biases in the estimation, average returns capture the overall profitability of education.

Table 7 reports quantile regression estimates at three different quartiles, 25^{th}, 50^{th} (median) and 75^{th} of the earnings distribution for 2005/6 and 1998/9 respectively. Test statistics of equality of education level variables across different points of the conditional earnings distribution in both periods generally indicate a consistent pattern of differential education effect on earnings at different points in the conditional earnings distribution.

Table 7. Quantile regression results.

	1998/99			2005/6		
	25%	**50%**	**75%**	**25%**	**50%**	**75%**
Log of hours	0.272***	0.297***	0.299***	0.400***	0.161***	0.152***
	(0.060)	(0.047)	(0.058)	(0.080)	(0.032)	(0.019)
Sex	0.451***	0.400***	0.330***	0.278***	0.336***	0.345***
	(0.061)	(0.047)	(0.068)	(0.049)	(0.043)	(0.058)
Secondary	0.321***	0.383***	0.399***	0.136***	0.170***	0.246***
	(0.058)	(0.070)	(0.060)	(0.044)	(0.060)	(0.067)
Post-secondary	0.349***	0.404***	0.261***	0.518***	0.680***	0.796***
	(0.050)	(0.053)	(0.078)	(0.061)	(0.070)	(0.103)
University	0.833***	0.890***	0.780***	0.996***	1.005***	1.264***
	(0.083)	(0.100)	(0.070)	(0.059)	(0.090)	(0.125)
Tenure	0.050***	0.063***	0.051***	0.041***	0.040***	0.049***
	(0.007)	(0.010)	(0.011)	(0.005)	(0.005)	(0.008)
$Tenure^2$	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm size	0.295***	0.232***	0.226***	0.244***	0.252***	0.214**
	(0.071)	(0.075)	(0.079)	(0.054)	(0.057)	(0.085)
Private	−0.454***	−0.276***	−0.194**	−0.490***	−0.394***	−0.301***
	(0.047)	(0.076)	(0.078)	(0.049)	(0.045)	(0.070)
Self	−0.414***	−0.162**	0.010	−0.780***	−0.403***	−0.106
	(0.058)	(0.072)	(0.059)	(0.062)	(0.063)	(0.085)
Accra	0.315***	0.306***	0.294***	0.228***	0.200***	0.153***
	(0.058)	(0.061)	(0.044)	(0.040)	(0.040)	(0.032)
Constant	−0.174	−0.080	0.452	1.163**	2.687***	2.961***
	(0.313)	(0.205)	(0.342)	(0.453)	(0.224)	(0.147)
Observations	1,866			3, 556		
Pseudo R^2	0.173	0.146	0.112	0.187	0.156	0.147
Test of equality of education coefficients: F-stat (Prob > F)						
Secondary 25% (1, 1860)		0.64 (0.424)	0.66 (0.418)		0.60 (0.440)	2.62 (0.106)
Secondary 50%			0.07 (0.793)			1.90 (0.168)
Post-secondary 25%		0.71 (0.399)	0.86 (0.355)		16.28 (0.0001)	20.93 (0.00)
Post-secondary 50%			4.07 (0.044)			2.70 (0.100)
University 25%		0.25 (0.617)	0.20 (0.653)		0.02 (0.884)	6.04 (0.014)
University 50%			1.58 (0.210)			11.61 (0.001)

Notes: Dependent variable is the log of monthly earnings. Bootstrap standard errors in parenthesis ***p < 0.01, **p < 0.05, *p < 0.1. The F-stat tests the null hypothesis of equal coefficients (probability of rejecting the null in parenthesis).

Results indicate in 1998/99, with the exception of secondary education, premiums to post-secondary and university education relative to primary are highest at the second quartile (median) of the conditional earnings distribution. Similarly, returns to post-secondary and university education are lowest at the top quartile of the earnings distribution whiles secondary education has lowest returns at the bottom quartile. Other earnings differences along the earnings distribution such as sex, sector and location all decrease along the earnings distribution. In 2005/6 however, the results suggest a consistent pattern with higher premiums to all levels of education at the

top (75th percentile) quartile of the earnings distribution. In addition, returns are observed to increase consistently from the bottom to the top quartile. Other earnings differences along the earnings distribution including sex, firm size, sector dummies and residence in Accra decrease along the earnings distribution.

Results from quantile regressions indicate in 1998/99, secondary education inequality increasing but s no distinct pattern is found for post-secondary and university education. In 2005/6 on the other hand, all levels of education relative to primary education are observed to be inequality-increasing since higher returns are associated with the high ability individuals (in the top quartile of the earnings distribution). As noted by Hallock *et al*. [22], due to lack of ability measure to control for endogeneity, these results are interpreted with caution because findings of heterogeneous returns may be a reflection of a variable ability based bias. Consequently, these results suggest that in Ghana, particularly in 2005/6, ability and education are complements with able ability type workers benefiting more from additional investment in education.

In order to identify the pattern of returns to education within sectors, quantile regressions are further estimated for public, private and self-employment separately. In 1998/99, the highest returns to all levels of education within the public sector are at the bottom of the earnings distribution similar to post-secondary and university education in the private sector. Within self-employment, the results show lack of a pattern in returns in 1998/99. These results are consistent with earlier findings using the full sample where returns to the various levels of education are observed not to be highest among the high ability types in Ghana during this period.

Within sector quantile regression results for 2005/6 presented in **Table 8** confirm findings using the full sample. Across all sectors, the highest returns to all levels of education with the exception of secondary in self-employment are at the top quartile of the earnings distribution. This is an indication of the earnings inequality increasing role of education and the complementarity that exist between ability and education in Ghana.

Table 8. Earnings by level of education within sectors.

	1998/99			2005/6		
	Public	**Private**	**Self**	**Public**	**Private**	**Self**
25th percentile						
Secondary	0.603***	0.256**	0.289**	0.253**	0.286***	0.075
	(0.125)	(0.100)	(0.120)	(0.104)	(0.090)	(0.090)
Post-secondary	0.527***	0.302**	0.110	0.557***	0.646***	0.235***
	(0.117)	(0.149)	(0.137)	(0.056)	(0.112)	(0.084)
University	1.104***	1.049***	0.626	0.978***	1.304***	0.834***
	(0.122)	(0.168)	(0.532)	(0.066)	(0.113)	(0.187)
50th percentile						
Secondary	0.594***	0.344**	0.397***	0.205*	0.208***	0.160**
	(0.100)	(0.169)	(0.093)	(0.104)	(0.067)	(0.081)
Post-secondary	0.447***	0.149	0.330***	0.648***	0.601***	0.296
	(0.089)	(0.147)	(0.111)	(0.111)	(0.101)	(0.197)
University	1.004***	0.716***	0.417	0.945***	1.297***	0.724*
	(0.152)	(0.181)	(0.429)	(0.113)	(0.183)	(0.382)
75th percentile						
Secondary	0.385***	0.290***	0.453***	0.398***	0.391***	0.023
	(0.092)	(0.092)	(0.142)	(0.083)	(0.077)	(0.104)
Post-secondary	0.255***	0.148	0.126	0.849***	0.728***	0.443***
	(0.084)	(0.181)	(0.156)	(0.116)	(0.156)	(0.138)
University	1.015***	0.750***	0.535*	1.175***	1.622***	1.178***
	(0.259)	(0.220)	(0.290)	(0.134)	(0.148)	(0.299)
N	369	370	1126	607	1012	1863

Notes: Dependent variable is the logarithm of monthly earnings. Bootstrap standard errors in parenthesis $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Regressions include all other variables used in earlier models.

5. Conclusions

The paper investigated the differential impact of education on earnings of urban workers in Ghana between 1998/9 and 2005/6 by using the fourth and fifth rounds of the Ghana Living Standards Survey. To the end, quantile regression technique was adopted to investigate returns to education across the entire earnings spectrum to examine whether some workers benefit more from education than others with its attendant implication on inequality. As Buchinsky (1994) indicates, this technique is important because the effects of education on earnings may be different for different individuals, which has implications on income distribution that results in inequality.

Overall, estimated returns along the earnings distribution indicate a change in the pattern of returns between the two periods. Earnings inequality reducing trend of education observed in 1998/99 has changed overtime in the Ghanaian labour market. Results for 2005/6 are indicative of inequality increasing with education. These results are robust when the sample is disaggregated by sector, particularly for 2005/6. This is an indication of the earnings inequality increasing role of education and the complementarity between ability and education in Ghana where higher returns accrue to high ability types in 2005/6 and the reverse in 1998/99. In addition, overall earnings in the informal sector are lower compared to the formal sector.

Although the lack of an adequate ability measure in the data may suggest findings of heterogeneous returns are simply a reflection of variable ability bias, conclusions are therefore drawn with caution. Nonetheless, it can be concluded that in Ghana, particularly in 2005/6, ability and education are complements with high ability workers benefiting more from additional investment in education relative to the substitutability relationship between ability and education observed in 1998/99.

The main implication for these findings is that it may signal a weak economic incentive for schooling among low ability types and the majority of the workforce in the informal sector. Specifically, in terms of returns to individuals at the bottom quartile of the earnings distribution, given findings of previous studies that have shown a significant indirect effect of education in promoting entry into lucrative jobs in Ghana, added to the numerous positive externalities of education, these findings are not expected to discourage investment in education by such individuals. Likewise, public policy should target the informal sector where majority of the labour force are employed in the form of assistance by training and financial inclusion to make the sector more productive to increase returns thereafter.

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Appendix

Table A1. Monthly earnings by employment status.

Status	1998/99		2005/2006	
	Mean	Median	Mean	Median
Wage employment	86.20	45	137.39	71.43
Formal Public Sector Employment	121.74	53.13	220.75	114.90
Formal Private Sector Employment	50.07	33.75	96.20	56.23
A. Self-employment (non-agricultural) with employees	84.49	43.75	288.42	81.63
B. Self-employment (non-agricultural) without employees	55.39	25.00	77.66	35.71
Informal Non-agricultural Self-employment (A + B)	56.11	25.00	97.53	40.82
Agricultural employment	16.81	6.78	44.25	17.00
All	**43.41**	**15.63**	**85.19**	**30.61**

Source: Calculations from Ghana Living Standards Survey, 1998/1999 and 2005/2006; Note: Earnings are converted into US dollars with respective average annual exchange rates for the two periods.

Table A2. Average monthly earnings by sex.

Status	1998/99		2005/2006	
	Men	Women	Men	Women
Wage employment	100.76	43.69	152.68	98.02
Formal public sector employment	148.66	52.77	249.00	159.08
Formal private sector employment	55.33	32.36	108.41	61.97
A. Self-employed (non-agricultural) with employees	75.46	99.42	440.76	129.08
B. Self-employed (non-agricultural) without employees	88.05	44.25	111.41	66.29
Informal Non-agricultural Self-employed (A + B)	87.31	44.95	168.83	70.29
Agricultural employed	21.40	10.76	52.79	30.97
All	**55.76**	**31.68**	**107.71**	**61.07**

Source: Calculations from Ghana Living Standards Survey, 1998/1999 and 2005/2006; Note: Earnings are converted into US dollars using average annual exchange rates for the respective years.

Table A3. Test for difference in average earnings among type of occupation; 2005/6.

Sector	Public (Mean = 248.38)				
	Difference	t-statistic	Pr (|T| > |t|)	Pr (T < t)	Pr (T > t)
Private	131.91	2.616	0.009	0.996	0.005
Self-employed with employees	−105.91	−0.720	0.472	0.236	0.764
Self-employed (own account)	162.42	4.153	0.000	1.000	0.000
Self	144.30	2.827	0.005	0.998	0.002
	Private (Mean = 116.47)				
Self-employed with employees	−237.82	−2.591	0.010	0.005	0.995
Self-employed (own account)	30.51	1.494	0.135	0.932	0.068
Self	12.39	0.627	0.531	0.735	0.265

Table A4. Test for difference in average urban earnings among sectors; 1998/99.

Sector	Public (Mean =168.63)				
	Difference	t-statistic	Pr (|T| > |t|)	Pr (T < t)	Pr (T > t)
Private	112.39	1.821	0.069	0.966	0.035
Self-employed with employees	55.07	0.294	0.769	0.616	0.384
Self-employed (own account)	96.5	2.543	0.011	0.995	0.006
Self	95.32	2.547	0.011	0.995	0.006
	Private (Mean = 56.24)				
Self-employed with employees	−57.32	−3.110	0.002	0.001	0.999
Self-employed (own account)	−15.89	−0.799	0.424	0.212	0.788
Self	−17.07	−0.869	0.385	0.193	0.807

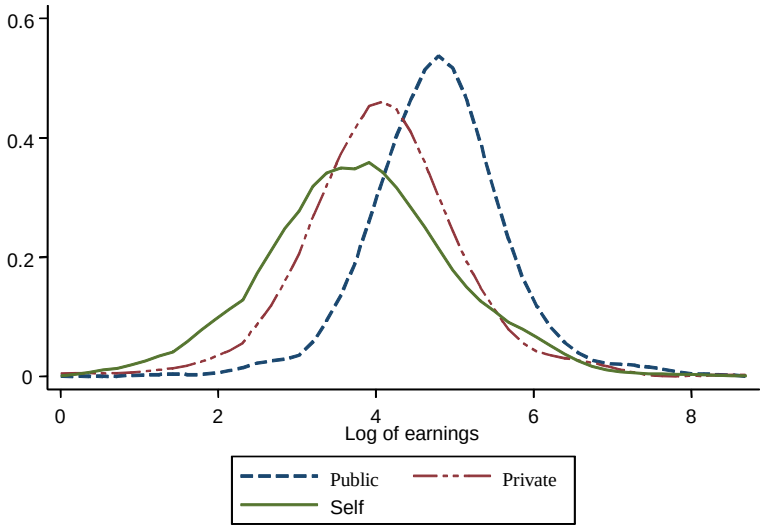

Figure A1. Urban earnings distribution: 2005/6.

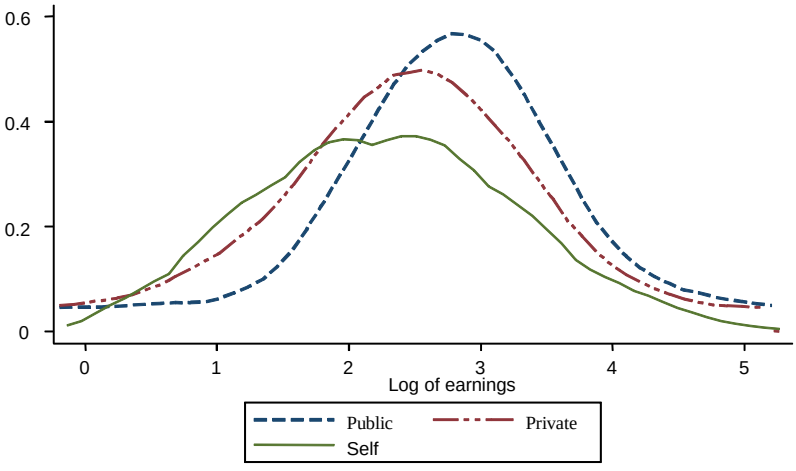

Figure A2. Urban earnings distribution: 1998/9.