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Research Paper

Examining Household Heads Annual Gender Earnings GapUsingTheGhana Living Standards Survey Round Seven: A Median Regression Approach

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Abstract
Research on gender earnings gap in Ghana is relatively a very new area of social research,and one is therefore not in a position to tell how acute the earnings differential is in the Ghanaian economy. This paper uses the median regression to model the Oaxaca (1973) Decomposition Methodology to estimate the Households Heads annual gender earnings gap using data of the Ghana Living Standards Survey 7 (GLSS7) to contribute to designing effective measures for reducing gender earnings discrimination in the sub-Saharan Africa. Findings suggests that males Household Heads in Ghana from the GLSS 7 with sample average female characteristics earn 61% more than female Household Heads in Ghana from the GLSS 7 data with matching level of characteristics, ceteris paribus.Considering the fact that in 2020, the Global Gender Earnings Gap score, based on the population-weighted average, stands at 68.6 percent, Ghana gender earnings gap is nearer to the global threshold and while the global remaining gap to close is 31.4percent that of Ghana's remainingearnings gap to close from the GLSS 7 data is now 39 percent.
Keywords: *Household Heads, Median Regression, Gender Earnings Gap, Ghana Livings Standards Survey 7*

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I. INTRODUCTION

The gender earnings gap is a measurable indicator of inequality between women and men. Most governments have legislated to guarantee equality of treatment between men and women in remuneration. The ILO Equal Remuneration Convention (No. 100, 1951) is one of the most highly ratified conventions (ILO 2017). Yet, the gender earnings gap persists and the World Economic Forum (WEF) estimates it will take 202 years to close the global gender earnings gap, based on the trend observed over the past 12 years. (World Economic Forum: The Global Gender Gap Report 2020). Research on gender earnings gap in Ghana is relatively a very new area of social research (Addai, 2011). One is not therefore in a position to tell how acute the earnings differential is in the Ghanaian economy. But empirical evidence abounds that shows that gender earnings gap exists in both the developed and developing countries (Addai, 2019). The Global Gender Earnings Gap Index was first introduced by the WEF in 2006 as a framework for capturing the magnitude of gender-based disparities and tracking their progress over time. The index benchmarks national gender gaps on economic, education, health and political criteria, and provides country rankings that allow for effective comparisons across regions and income groups. The rankings are designed to create global awareness of the challenges posed by gender gaps and the opportunities created by reducing it. The WEF Global Gender Gap Report (2020) groups countries into eight broad geographical groupings: East Asia and the Pacific; Eastern Europe and Central Asia; Latin America and the Caribbean; Middle East and North Africa; North America; South Asia; Sub-Saharan Africa; and Western Europe, (World Economic Report 2020). In 2020, the

WEFGlobal Gender Earnings Gap score (based on the population-weighted average) stands at 68.6%. This means that, on average, the earnings gap is narrower, and the remainingearnings gap to close is now 31.4%, (World Economic Report 2020). In2020, the progress has not only been larger than in the previous edition, but also more widespread. 149 countries and economies out of 153 covered have improved their score and 48 have seen their performance unchanged or reduced. The top 10th percentile consists of 16 countries that have improved their score by more than 3.3% year-on-year. No country to date has yet achieved full gender earnings parity. All the top five countries have closed at least 80% of their gaps, and the best performer (Iceland) has closed 82% of its earnings gap so far. The global top ten features four Nordic countries (Iceland, 1st, Norway 2nd, Finland 3rd and Sweden 4th), one Latin American country (Nicaragua, 5th), one country from the East Asia and the Pacific region (New Zealand, 6th), three other countries from Western Europe (Ireland, 7th, Spain, 8th and Germany, 10th) and one country from Sub-Saharan Africa (Rwanda, 9th), (World Economic Report 2020).

Unfortunately, analyzing and estimating gender earnings gap is plagued with methodological and statistical issues. The various methodologies and statistical analyses behind the estimations are intended to serve as a basis for designing effective measures for reducing gender earningsgaps. For example, the OECD's gender earnings gap is defined as the difference between male and female median earnings divided by male median earnings. The ILO's gender earnings gapis computed either as the difference between the average earnings of men and women. The World Economic Forum's earnings equality for similar work is derived from the Executive Opinion Survey, a questionnaire answered by business leaders in over 140 countries. The respondents are asked: "In your country, for similar work, to what extent are earnings for women equal to those of men?" (1 = not at all, significantly below those of men; 7 = fully, equal to those of men) (World Economic Forum, Executive Opinion Survey 2019). These individual answers are then aggregated, and the resulting figures are converted into 0–1 scores, where 1 stands for equal earnings between women and men, working in a similar position. Each approach has advantages and disadvantages and also does not absolutely capture the earning differentials.

This paper uses the median regression (OECD approach) unlike the mean regression (ILO approach) to model the gender earnings gap using the most widely adopted Oaxaca (1973) decomposition methodology in the literature to estimate the Households Heads annual gender earnings gap using data of the Ghana Living Standards Survey 7 (GLSS7) to contribute to designing effective measures for reducing gender earnings discrimination in the sub-Saharan Africa.The structure of the paper is now outlined. The next section describes the data source. The third section of the paper deals with the statistical methodology, followed by the description of the variables used in the study. The penultimate section deals with the empirical results. A final section offers a summary and some policy conclusions.

II. DATA

TheGLSS7 data was obtained from the Ghana Statistical Service (GSS). The GLSS 7 data comprise household-level and/or individual-level data which was more nationally representative and adopted a similar sampling methodology to that of the Ghana Living Standards Survey Six(GLSS6). It was designed to provide indicators which are nationally and regionally representative. The sampling employed a two-stage stratified sampling design. One thousand (1,000) enumeration areas (EAs) were selected to form the Primary Sampling Units (PSUs). The PSUs were allocated into the 10 administrative regions using probability proportional to population size (PPS). The list of EAs from which the samples were drawn was based on the 2010 Population and Housing Census. The EAs were further divided into urban and rural localities of residence. A complete listing of households in the selected PSUs was undertaken to form the Secondary Sampling Units (SSUs). At the second stage, 15 households from each PSU were systematically selected. The total sample size came to 15,000 households nationwide, which provide 14,009 respondents. The set of individual-level variables that can be constructed from the survey responses include, inter alia, age, gender, marital status, health status, educational level achieved, and current employment status. The set of household-level variables from the data comprise the demographic structure and welfare status of the household—that is, household size and the age structure of dependent children within the household, and total household consumption expenditure per capita. Given the structure of the GLSS7, a rich array of individual and household data is available to us.

III. STATISTICAL METHODOLOGY

Following the seminal work of (Mincer 1974), it is conventional to specify log earnings as a function of a set of earnings determining characteristics. The specification is then augmented to capture other variables interpreted as important to the earnings determination process. In the empirical literature on the gender earnings gap, the separation of the data points by gender is widely adopted in undertaking gender earnings gap decomposition analysis using the Oaxaca (1973) decomposition model. The gender-specific earnings equations for the i^{th} individual are specified as follows:

$$W_m = X'_m\beta_m + \mu_m \quad (1)$$

$$W_f = X'_f\beta_f + \mu_f \quad (2)$$

Where X_J is a $(k \times n)$ matrix of characteristics (age,… etc) and j is the gender subscript; β is a $(k \times 1)$vector of unknown parameters representing the effect of various covariates on the log earnings (W); (n x 1) vector of random error terms; and m and f denote male and female sub-samples, respectively.

The Oaxaca (1973) methodology has been widely used to decompose the average gender earnings gap between men and women using the Ordinary Least Squares (OLS) estimation of gender-specific earnings equations. The mean gender difference in log earnings is conventionally given by:

$$\hat{W}_m - \hat{W}_f = [\overline{\mathbf{X}}_\mathbf{m} - \overline{\mathbf{X}}_\mathbf{f}]'\hat{\boldsymbol{\beta}}_\mathrm{m} + \overline{\mathbf{X}}_\mathbf{f}'[\hat{\boldsymbol{\beta}}_\mathrm{m} - \hat{\boldsymbol{\beta}}_\mathrm{f}] \quad (3)$$

where the 'bars' denote mean values and 'hats' denote the OLS coefficient estimates in this case. This allows the overall average differential in earnings between the two gender groups to be decomposed into a part attributable to differences in characteristics (known as the 'explained' or 'endowment' effect) and a part attributable to differences in the estimated relationship between men and women (alternatively defined as the 'unexplained', 'treatment' or 'residual' effect). The latter part of expression (3) is sometimes taken to capture the effect of unequal treatment (or discrimination) in the labour market.The foregoing decomposition is situated within a mean regression framework. An exclusive focus on the average, however, provides an incomplete account of the gender earnings gap. **U**sing mean characteristics in the computation of expressions may provide misleading realizations for the basket of characteristics at points other than the conditional mean earnings to which they actually relate. Therefore, it is necessary to use realizations for a basket of gender-specific characteristics that more accurately reflect the relevant points on the conditional earnings distribution. The quantile regression approach allows the gender earnings gap to be estimated at particular quantiles of the conditional earnings distribution as opposed to simply the mean. The estimation of a set of conditional quantile functions allows for a more detailed portrait of the relationship between the conditional distribution of the earnings and selected covariates than provided by a mean regression. In contrast to the OLS approach, the quantile regression procedure is less sensitive to outliers and provides a more robust estimator in the face of departures from normality (Koenker, 2005; Koenker& Bassett, 1978). In addition, Deaton (1997, pp. 80–85) notes that quantile regression models may also have better properties than OLS in the presence of heteroscedasticity. Using this methodology, the log earnings equation may be estimated conditional on a given specification and then calculated at various percentiles of the residuals (e.g., 10th, 25th, 50th 75th or 90th.

The quantile regression for the male sub-sample can be defined as:

$$W_m = X'_m\beta_{\theta m} + \mu_{\theta m} \quad (4)$$

$Q_\theta(W_m|W_m) = X'_m\beta_{\theta m}$ and $Q_\theta(\mu_{\theta m}|X_m) = 0$, $\beta_{\theta m}$ denotes the unknown male parameter vector for the Θ^{th}quantile, and Θ denotes the chosen quantile. Similarly, the quantile regression for the female sub-sample can also be defined as:

$$W_f = X'_f\beta_{\theta f} + \mu_{\theta f} \text{ with } Q_\theta(W_f|W_f) = X'_f\beta_{\theta f} \text{ and } Q_\theta(\mu_{\theta f}|X_f) = 0. \quad (5)$$

From eqns. (4) and (5)

$$Q_\theta(W_m) = E(X_m|W_m) = Q_\theta(W_m))'\hat{\beta}_{\theta m} + E(\mu_{\theta m}|W_m) = Q_\theta(W_m)) \quad (6)$$

and

$$Q_\theta(W_f) = E(X_f|W_f) = Q_\theta(W_f))'\hat{\beta}_{\theta f} + E(\mu_{\theta f}|W_f) = Q_\theta(W_f)) \quad (7)$$

In these expressions, characteristics are evaluated conditionally at the unconditional quantile log earnings value and not unconditionally as in the case of the mean regression approach. This paper analyses the gender earnings gap using the median, the 50^{th}quantile, which is less sensitive to outliers than the mean under the statistical assumption that the two expressions $E(\mu_{\theta m}|W_m) = Q_\theta(W_m)$ and $E(\mu_{\theta f}|W_f) = Q_\theta(W_f)$ are non-zero.Median regression estimates the median of the dependent variable, conditional on the values of the independent variable. This is similar to least-squares regression, which estimates the mean of the dependent variable. Said differently, median regression finds the regression plane that minimizes the sum of the absolute residuals rather than the sum of the squared residuals.

Earnings specification issues

Total nominal annual household head expenditure used as a proxy of totalnominal annual household head earnings are used in the median regression analysis undertaken in this study. The natural logarithms of these nominal annual household head earnings are then used in the augmented Mincer (1974) earnings equations, which control for inter alia, human capital, gender, household size, economic activity, marital status, whether the household head lives in the urban or rural area, and ownership of household. It should be noted that the inclusion of an age variable does not fully capture the effect of labour market experience on earnings, but it avoids potential problems that could be introduced into our analysis if a potential labour force experience measure was actually used in its place. The use of age and its quadratic to proxy for actual labour force experience is clearly more problematic and is obviously less accurate for females than males. Its use in preference to an actual measure may over-state the magnitude of the unequal treatment effect as Wright and Ermisch (1991) detected when comparing discrimination effects based on potential and actual labour force measures using data for the United Kingdom. This measurement issue is acknowledged as a constraint in the current application but data limitations prevent use of a more accurate variable.

IV. DESCRIPTION OF VARIABLES USED IN THE STUDY

A variety of explanatory variables used to analyze the household heads annual earnings gap using the GLSS 7 are now described in turn in Table 1.

Table 1 Description of the Gender EarningsVariables Used in the GLSS 7 Study

Variable	Description
LogExp	Natural log of nominal total expenditure in Cedis, as a proxy for nominal earnings
Sex	Gender of household head = 1 if male, 2 if female
hhsize	Number of persons in a household
OWNTYPE	=1 if household head owns house, =2 if Renting, =3 if Rent-free, = 4 if Perching,= 5 if Perching, = 6 if Squatting
age	Age of household head
age2	Age of household head squared
marts	Marital status of household head =1 if Married, 2 Consensual Union, 3 Separated, 4 Divorced, 5 Widowed, 6 Never married
urbrur	A dummy =1, if household head lives in the urban area, 2 if rural area
econat	Economic activity of household head =1 if employed, 2 if unemployed, 3 if not in labour force

V. EMPIRICAL RESULTS

The mean and median statistics obtained are presented in Table 2.

Table 2: Median and Mean Statistics of Gender EarningsVariables Used for the GLSS 7Study

variable	N	mean	p50	min	max
age	14009	46.24056	44	15	99
hhsize	14009	4.200443	4	1	28
OWNTYPE	14009	1.758512	1	1	5
marts	14009	2.502177	1	1	6
urbrur	14009	1.570419	2	1	2
econat	14009	1.331287	1	1	3
age2	14009	2391.365	1936	225	9801
LOGTEXP	14009	8.91505	8.960601	4.395683	12.35714

Source: Computed using STATA 14

The median age of Household Heads from the GLSS 7 is 44 years. The Household Heads ages ranged from 15 years to 99 years. The median household size from the GLSS 7 is 4. The household size ranged from 1 person to 28 persons. The median Household Head ownership of household type is Household Head owning the house from the GLSS 7. The median Household Heads have marriedas the marital status from the GLSS 7. The median Household Heads resides at the rural areas from the GLSS 7 data. The median Household Heads are employed.

The reported median pooled model, the median male sub-sample and the median female sub-sample statistics are presented in Table 3.

Table 3 Pooled and Sub-Samples Median Statistics of Household Heads Gender Earnings Variables from the GLSS 7 Study

Variable	Pooled Sample	Male Sub-Sample Z_m^{median}	Female Sub-Sample Z_f^{median}	$(Z_m^{median} - Z_f^{median})$
LogExp	8.960601	9.005558	8.870571	0.134987
Sex	1	1	2	-1
hhsize	4	4	3	1
OWNTYPE	1	1	2	-1
age	44	1764	2304	-540
age2	1936	1764	2304	-540
marts	1	1	4	-3
urbrur	2	2	2	0
econat	1	1	1	0

VI.MEDIAN REGRESSION ESTIMATES OF THE OAXACA DECOMPOSITION MODEL

A Mincerian (1974) earnings function with the log total nominal earnings as the dependent variable estimation procedure is adopted in estimating the GLSS7 Ghanaian Household Heads gender earnings function. The median regression analysis was performed separately for the pooled sample, male and female sub samples respectively using the STATA (version 14) statistical software package. The reported pooled median regression model, the male sub-sample median regression and the female sub-sample median regression estimates are presented in Table 4.

Table 4 Median Regression Estimates of Household Heads Gender Earnings from the GLSS 7

Variable	Pooled Sample	Male Sub-Sample β_m^{median}	Female Sub-Sample β_f^{median}	$\beta_m^{median} - \beta_f^{median} = \Delta\beta^{median}$
Sex	-.0012851 (.0182036)	-	-	
hhsize	.0842043* (.0030379)	.0710993* (.0034004)	.1236619* (.0062396)	-0.0525626
OWNTYPE	.0543174* (.009356)	.0646352* (.0113868)	.0315841* (.0149508)	0.0330511
age	.0232406* (.002851)	.0245759* (.0034761)	.0173579* (.0045832)	0.007218
age2	-.0002499* (.0000278)	-.0002501* (.0000341)	-.0002242* (.0000441)	0.0001983
marts	-.0361588* (.0047966)	-.052912* (.0060565)	-.0178879* (.0075485)	-0.0350241
urbrur	-.6453271* (.0156923)	-.6732834* (.0187872)	-.5881365*(.0258004)	-0.0851469
econat	-.1280038* (.0117807)	-.1503694* (.0144954)	-.0823654* (.0183435)	-0.068004
constant	9.288777	9.374451	9.200579	0.173872
Pseudo R^2	0.16	0.1577	0.1779	
Sample Size	14,009	9,643	4,366	

*denote statistical significance at the 0.05 level respectively using two-tailed tests. White(1980) Standard errors in parentheses.

Table 5 OaxacaTreatment Effect Based on GLSS 7 Male Household Head MedianEarnings Structure

Variable	Median Female Characteristics	Gender Differences in Coefficients	[Median Female Characteristics]× [Gender Differences in Coefficients] + change in constant
change in constant			0.173872
hhsize	3	-0.0525626	-0.1576878
OWNTYPE	2	0.0330511	0.0661022
age	48	0.007218	0.346464
age2	2304	0.0001983	0.4568832
marts	4	-0.0350241	-0.1400964
urbrur	2	-0.0851469	-0.1702938
econat	1	-0.068004	-0.068004
Total			0.5072394

From Table 5, the estimate of 0.51 is the total earnings differential due to discrimination and is explained as the female Household Head sample average unequal treatment or discrimination in earnings. It suggests that males Household Heads in Ghana from the GLSS 7 with sample average female characteristics earn $[e^{0.51} - 1] \times 100 = 61\%$ earnings more than female Household Heads in Ghana from the GLSS 7 data with matching level of characteristics, *ceteris paribus.*

Table 6Oaxaca Endowment Effect Based on GLSS 7 Male Household Heads MedianEarnings Structure

Variable	Median Gender Difference in Characteristics	Male Household Heads Median Regression Coefficients	Median Gender Difference in Characteristics]× [Male Household Heads Median Regression Coefficients]
hhsize	1	.0710993	0.0710993
OWNTYPE	-1	.0646352	-0.0646352
age	-540	.0245759	-13.270986
age2	-540	-.0002501	0.135054
marts	-3	-.052912	0.158736
urbrur	0	-.6732834	0
econat	0	-.1503694	0
Total			-12.9707319

From Table 6, the total earnings differential due to skill is $[e^{0\text{-}.13} - 1] \times 100 = 8$percent. That is males Household Heads who have sample average female characteristics earn 8% on average and *ceteris paribus* from the GLSS 7.

VII. CONCLUSION AND RECOMMENDATIONS

The questions addressed by this paper are important from a policy perspective in Ghana. The paper using the median regression approach (OECD method) has established the prevalence of gender earnings discrimination of 61 percent among Ghanaian Household heads using data from the GLSS 7, just like the mean approach (ILO) by Addai (2019) using data from the Ghana Living Standards Survey 6 (GLSS6) that also established gender earnings discriminationgap of 63 percent. Both approaches point to the social fact that gender earnings gap still prevails in Ghana. This makes gender earnings gap a social fact and strenuous effort, policy-wise must be embarked upon to at least narrow the gap as a socio-economic canker in the Ghanaian society. A broader consultation must therefore be made by the Ghana statistical Service (GSS) to Social scientists, in choosing variables for subsequent GLSS surveys that are distinct to the socio-economic characteristics of the Ghanaian economy so as to get more measured variables to estimate the gender earnings gap in future. Considering the fact that in 2020, the Global Gender Gap score (based on the population-weighted average) stands at 68.6%., Ghana gender earnings gap is nearer to the global threshold and while the global remaining gap to close is now 31.4%, that of Ghana's remaining gap to close is now 39 percent from the GLSS 7 data.

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