Gender Wage Gap in Ghana: Evidence from Employer-Employee Data

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Abstract

This paper investigates the sources of the gender wage gap in Ghanaian manufacturing firms using demand and supply side determinants of individual wage. We find that men's wages are markedly higher than women's wages across the entire wage distributions. However, the gender pay gap is pervasive at the bottom quantile, suggesting that poor women are more disadvantaged. Women are disproportionately sorting into low-paying job, which accounts for 38.8% of the raw gender wage gap at the 10th quantile while its effect is nil at the 90th quantile. Even after controlling for gender difference in individuals' endowments and sorting effects, firms pay different wage premium for females and males, and this widen the within firm gender wage gap. Firms' wage policies (firm effect) in Ghana increase the gender wage gap, with the effect pronounced at the top quantiles. Firms that increase within the wage gap include those having decentralized wage bargaining, firms established long ago in 1985, less labour-intensive firms, those without fierce competition, firms with inadequate supervision and those located in Cape Coast. Gender difference in observed labour market experience alone explains 12% of the gender pay gap in the 10th quantile and about 7% in all other quantiles. Firms effect, gender sorting and labour market experience are the most important sources of gender wage gap across the wages distribution though their total effect is substantial for the poor women.

Keywords: *Gender; wage gap; quantile regression; Ghana.*

1 Introduction

Gender equality is instrumental for achieving the sustainable development goals, and it has implications for poverty reduction and women empowerment in decision making. For instance, a point decrease in gender wage gap has been found to result in an increase in women's empowerment and welfare by 0.048 and 0.086 respectively in Ghana (Danquah et al., 2021). Empirical studies for Sub-Sahara African (SSA) countries also suggest strong linkages between gender inequality and economic growth, while the impacts of gender wage gap on productivity and political participation have been well documented in the labour economics literature (see Amin et al.,2015; Stosky,2006; Hakura et al., 2016). If Sub-Saharan African countries succeed in reducing their income and gender inequality gaps to the level observed in fast growing economies, then their annual economic growth could be higher by about 0.9 percentage point (Hakura et al.,2016). Thus, gender equality is a key priority for sustainable development.

Governments of African countries are trying to break the glass walls and barriers facing women. Ghana is seen as a good example for Sub-Saharan African countries as it provides two years of free universal preschool education for boys and girls at their early childhood. Burkina Faso and Republic of Congo offer occupation training and access to information technology for girls and women. Benin and Nigeria promote women's participation in the construction and other key sectors. There are also civil code reforms and access to credit for women in several African countries (World Bank

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JEL Classifications:J31, J38, J08, D22.

Group, 2019). Though there has been significant improvement in narrowing the gender disparity in education, health and political participation in the past 25 years, earning gaps between genders remain pervasive in Sub-Sharan Africa. Improvement in females' labour force participation and human capital are not proportionally translated into improvement in their labour market outcomes (wage and income). Thus, it is crucial to examine the extent and causes of gender wage- gap as it has impacts on economic growth, poverty and welfare.

According to the International Labour Organization (ILO, 2018) in Sub-Saharan Africa, the median monthly income of men is more than twice that of the median income of women. Similarly, female entrepreneurs earn about two-thirds of the incomes of male entrepreneurs. The unadjusted average gender wage gap for Sub-Saharan Africa is estimated to be 30%, which is higher than the 10-30% for both developed and developing countries (World Economic Forum, 2017). Based on the 2022 annual household income and expenditure survey, the Ghana Statistical Service (GSS) computed the gender wage gap among paid workers to be 34.2%. Women earn just only 10.5% less than men in the public sector but women significantly earn low wage in private sector (58.7% in the informal and 29.9% in the formal). The gender wage gap among paid workers with basic education is about 60% while it is 12.2% with tertiary education.

The labour market dynamics in Ghana shows an increase in the share of informal employment and a decrease in the formal employment (Aryeetey and Baah-Boateng, 2016). An impressive economic growth performance in Ghana is not translated into labour market outcome (Sparreboom and Gomis, 2015; Aryeetey and Baah-Boateng, 2016). For instance, the firm's growth in the manufacturing sector over the period 1987-2003 is characterized by a dominance of the small and the share of employment for firms with less than 10 employees is 80% (Francis, 2023). There are high entry barriers and restrictions for high paying jobs and if it is gender specific, it will contribute to gender wage gap. Some workers are willing to take part in the informal jobs, but others are working here involuntarily (Nimoh et al, 2020). The implication for the Ghanaian labour market dynamics on gender wage/earning gap is not clear. An increasing proportion of employment is found in the low productivity part of the size spectrum (Francis, 202; Francis et al. 2009). If females are disproportionally placed in this sector, then it exacerbates the gender wage gap.

Previous studies used household level data to analyze gender wage gap in Ghana. This paper is a radical departure from the norm as it employs the employer-employee data to examine the sources of gender pay gap to properly account for firms' heterogeneity in wage differentials. Firms often pay premium to their workers but if females are less likely to work in firms that pay high premium, it will contribute to the wage gap. To this end, market policies must be designed based on the characteristics of firms that narrow gender wage gaps. Although the employer-employee data may not represent the population of interest in the country, it is ideal if firms' characteristics matter for the wage differential as shown by some studies suggesting that manufacturing firms have determined the wage formation process and gender pay gap in Sub-Saharan African countries (Fafchamps et al, 2009; Nordman and Wolff, 2009).

The matched employer-employee data that we use in this study is well suited for providing appropriate empirical insights and evidence regarding labour market discrimination. Workplace characteristics as demand side determinants of individual wages have received modest attention in gender pay gap analysis in the past, although they are believed to affect wages through several channels such as knowledge spillovers and peer effects. This paper uses quantile regression that considers the full range of wage distributions to analyze the sources of the gender wage gap in Ghanaian manufacturing firms, and both the demand and supply side determinants of individual wages are taken together in the quantile regression. The paper contributes to the existing literature in four different ways.

First, we use an extended version of the quantile regression decomposition method, and the Re-centered Influence Function (RIF), due to its several attractive features. One attractive feature is that RIF allows for clustering and stratification. This enables us to use bootstrap standard errors (se) pairs clustering method in RIF quantile regression to produce reliable standard errors for inference. Moreover, RIF is robust to outliers and heteroscedasticity. In addition, it allows us to examine the effect of covariates on unconditional quantiles and as a result, the contribution of each explanatory variable to the gender wage gap can be retrieved at each quantile of interest. The RIF decomposition method is more flexible if one has an interest in knowing the percentage of the gender wage gap explained, for instance, by education at a given quantile.

Second, analyzing the impact of observed and unobserved firm characteristics on the gender wage gap across the entire wage distribution, to the best of our knowledge, has not yet been explored in Ghana. We identify the size of firm fixed effect in gender wage gap across quantiles of the wage distribution. Further, we study the characteristics of firms that reduce the within firm gender wage gap. In doing so, the problem of stratification and clustering has been corrected, which otherwise inflates the standard error (see the discussion on the data).

Third, we consider the problem of detailed decomposition following Yun (2005). The original Oaxaca and Blinder (1973) method and the RIF decomposition methods were sensitive to this problem because the impact of a categorical variable (e.g., no education, some education, among others) on the gender wage gap depends on the choice of the reference group. Yun (2005) proposes a method to solve the problem of identification in detailed wage decomposition proposed by Oaxaca and Blinder (1973). We extend Yun's (2005) method in the RIF decomposition so that our result is not sensitive to the choice of reference group for dummy variables.

Our fourth contribution is to provide statistical evidence on whether sample weights for causal inference should be used or not. We follow Solon, Haider and Wooldridge (2015) and Winship and Radbill (1994) as they explain the situation when to use weighting for estimation.

We find that gender segregation into low paying firms accounts for significant portion of the gender wage gap at the bottom of the wage distribution. Poor women are sorting into low paying firms. Not only sorting across firms affect the gap, but also firm wage policies in Ghana increase the gender wage gap. The remainder of the paper is organized as follows. Related literature is presented in section 2. Section 3 provides the data. The econometric methodology is presented in section 4. Section 5 discusses the estimation results, and section 6 concludes.

2 Literature Review

Our review of the literature was designed to shed light on the explanations for the gender wage gap. The possible explanations can be broadly classified into four strands. First, productivity differences from the traditional human capital factors (education and experience). Second, sorting workers into different industries, occupations, and firms (Blau and Khan,2017; Fafchamps et al., 2009; Card et al.,2016; Isabelle et al. 2017). This may be due to preferences to competition, social norms and fertility decisions. Third, differences in bargaining ability with respect to rent sharing (Card et al., 2016, Blau and Khan,2017). Fourth, discrimination emanates from tastes or judgments about expected productivity. Knowing the features of the Ghanian labour market can highlight some possible reasons for the earning gap. The informality of employment and employment relationships are the main features of the labour market. Over half of all Ghanaian adults are self-employed or own-account workers.

Another feature of the Ghanaian labour market is the low levels of wages. There exists a daily minimum wage law in Ghana. But only 24% of urban employees receive the minimum wage or above in 2016(Anuwa-Amarh,2016). Since the informal sectors comprise the main economic activities in the country, it is difficult to enforce the minimum wage law. In addition, the labour Act in Ghana prohibits excessive compulsory overtime, and this allows employers to take advantage of the labour law and pay little for extra hours worked (DTDA,2020). If women are less protected by the minimum wage law because they are sorted into this sector, then the gender wage gap would be higher. A typical study from Ghana suggests that female owned enterprises are more constrained by the demand problem compared to male owned enterprises because of norm- based attitude (Hardy and Kagy,2020). Social norms and culture are contributing to wage disparity between genders. According to the Ghanaian Statistical Survey (2015), women often accept self-employment and own account works. Self-employment gives women flexibility at times of giving birth and at times they want to take care of their children and other family members. Gender norms can affect work efforts (workforce commitments), and career ambitions. In addition to the social norms, customary laws also restrict women's access to land which adversely affects their right to own as well as the size of farmlands they want to cultivate. It is only 31% of indigenous firms are owned by women (DTDA,2020). Therefore, the prevailing social norms and customary laws, labour Act, and informality contribute to gender disparity, which is also an important feature of Ghana's labour market.

However, the government of Ghana and other institutions are relentlessly putting efforts to reduce gender disparity in income because it has an implication on poverty and welfare. Danquah

et al. (2021) find that a reduction in gender wage gap has a substantial positive impact on women's welfare and empowerment in Ghana. A point decrease in gender wage gap within the household is found to be associated with an increase in women's empowerment and welfare by 0.048 and 0.086 respectively. Thus, a decrease in gender wage gap enhances women's bargaining and decision-making abilities so that women can make independent decisions on productive resources and economic opportunity within the household. These structural estimates are significant, and the empirical findings give a good reason to analyze gender wage gap in Ghana. But empirical studies on the underlying causes for gender wage gap are limited in Ghana.

Addai (2019) finds that the average raw gender wage gap is log (0.63) for Ghana, which is quite high. Gender difference in skills explains 22% of the gap and the rest is due to discrimination (unexplained factors). They apply the traditional Oaxaca decomposition to the living standard survey. The main critique of this study is omitting -variable bias. If relevant variables are omitted, which also include sample selection, then wage gap can be inflated. In addition, the cause of the gap is mistakenly attributed to discrimination.

Boahen and Opoku (2021) use the Ghanaian living standard survey and show how the average gender wage gap varies with the sample selection correction specification. They find that the gender wage gap is positive and significant irrespective of the sample selection correction methods. They apply decomposition at the mean which fails capture the entire wage distributions. On top of this, they find that unexplained factors (statistical discrimination) are the reasons for the gender wage gap. This finding has little importance for policy makers as the wage gap is due to unobserved factors. Our paper specifies the wage model to examine how gender specific individual endowments and firm level information explain the gender wage gap.

None of the previous studies in Ghana use the matched employer - employee data to examine the size of gender wage gap attributable to within firm characteristics. Our matched administrative data identify the worker's precise occupation in the firm, and record wages and income with less measurement error as compared with data from labour force surveys. Employer–employee data, which consists of both individual and firm level information, is ideal for the analysis of wage differentials between genders (Fafchamps et al., 2009; Nordman and Wolff, 2009). Both individual and firm characteristics, which are indicated by workplace characteristics, can influence an individual's wage. Several studies have shown that firm-specific pay premiums are important sources of wage gaps. Card et al. (2016) find that these premiums are gender specific in Portugal and as a result, they contributed to one -fifth of the gender wage gap. Out of this one-fifth, gender sorting is the main reason followed by the wage bargaining differentials between genders. They find that women are sorted into firms that pay less premium, and the effect is strong for low and middle skilled workers. Using Linked Employer-Employee Database from New Zealand, to examine different explanations for this gender wage gap, Isabelle et al. (2017) also find that gender difference in sorting across industries and firms explain less than one -fifth (17.5%) of the overall gender wage gap. Unlike Card et al. (2016) they find that employers' taste discrimination is more important than gender difference in bargaining because they find that the gender wage-productivity gap depends on how it is easy to hire workers.

Fafchamps et al. (2009) empirically examine the gender impact on wages and provide comparative evidence in a few African countries using survey data from manufacturing firms. Nordman and Wolf (2009) examine the within firm gender wage gap using a matched employer-employee data collected in 2005 as part of Regional Program on Enterprise Development (hereafter denoted by RPED) surveys for Madagascar and Mauritius. The questionnaires and sample design are generally the same for all RPED data.

Yet, these previous studies in Africa did not apply quantile regression and hence, firm effects across quantiles were not computed. Decomposing wages across the entire distribution has received more attention when designing and implementing public policy on labour demand and supply. The assumption of equal returns to the same observable attributes of male and female is restrictive. Constant gender wage gap across distributions does not hold in many literature (Albrecht et al.,2003; Mata and Mechado, 2005).

Using fixed effect regression at the mean, Nordman and Wolf (2009) find that there is no firm effect in gender wage gap for Madagascar and Mauritius. Fafchamp et al. (2009) apply clustering and weighting to quantify the level of unexplained wage gap between genders for eleven African countries using RPED data. They find that women are placed in low paying jobs and firms,

and this takes the large proportion of gender wage gap. However, their weight is questionable according to Solon, Haider and Wooldridge (2015). In an OLS specification that controls individual characteristics, they re-estimate the model with and without firm fixed effect. They find the effect of both education and gender sorting across firms. Nordman and Wolf (2010) apply a quantile regression for wage decomposition using RPED data for Morocco. They find a glass ceiling effect in Morocco; gender wage gap is higher at the top quantiles than at lower quantiles. However, they use the standard quantile regression method proposed by Machado and Mata's (2005) where detail wage decomposition is not possible. This method also does not allow clustering to the standard errors. As a result, the efficiency of the estimators in the Nordman and Wolf (2009) decomposition is questionable There are three different approaches proposed in the literature that allow for detailed decomposition using quantile regression: the Re-centered Influence Function by Firpo et al. (2009) and Fortin et al., (2011); sequential wage decomposition by Antonczyk et al. (2010) and another method by Heinze and Wolf (2010). Our paper applies the Re-centered Influence function for quantile regression. The standard quantile regression methods proposed by Machado and Mata (2005) and Melly (2005,2006) also do not allow for clustering the standard error.

From the perspective of methodology, unlike other studies in Africa which use the RPED data (example Nordman and Wolf (2010,2009)), our paper extends the standard quantile regression wage decomposition to include detail decomposition and clustered bootstrap standard error in the RIF decomposition. This allows us to identify the size of firm effect across quantiles.

Similarly, Nordman et al. (2011) analyze the size and sources of gender and ethnic wage gap in 7 West African cities using urban household survey data conducted in 2001 to 2002. This data has information on employment status of individuals (both employed and unemployed) that allows for correcting for the possibility of sample selection. They identify three sectors: public, formal private and informal private First, they apply the multi-nominal logit model to determine the probability of employment in each sector for male, female and pooled sample separately. Second, they estimate 6 wage models distinguished by gender and sectors, in which the selection correcting inverse mills ratio derived from multi-nominal logit is added as additional covariate. They use the pooled wage structure rather than the male wage structure as a competitive norm. Using all the estimated parameters, they decompose the wage gap into sectoral earning gaps and gender difference in the distribution of workers across sectors. This is essentially an accounting approach which does not account for the role of firms in wage determination.

They find that more than 60%, depending on the cities considered, of the gender wage gap is accounted for by the within-sector difference in earnings. Less than 40% is due to disproportionate distribution of genders across sectors and that the sectoral location is in favor of males. An interesting study emerges from Van Biesebroeck (2011) who directly compares wages with productivity using RPED, a data like ours in sampling design, collected in 1991 and 1995 for three African countries, namely Kenya, Tanzania, and Zimbabwe. They find that equality strongly holds in Zimbabwe, but not at all in Tanzania. Wage also equals productivity in Ghanaian manufacturing firms (Francis et al., 2009). Several previous studies use individual level characteristics to identify the sources of gender wage gap in Sub-Saharan Africa based on distributional analysis or at the mean while they fail to disentangle the wage gap explained by firm characteristics across quantiles.

3 Data

As part of the regional program for enterprise development (RPED), data for Ghanaian manufacturing firms were collected by the Center for the Study of African Economies (CSAE) at Oxford University, Ghana Statistical Office and University of Ghana. We choose the manufacturing firms for the analysis of the gender wage gap because most of them are privately owned, having a profit maximizing motive. Private firms are more likely to pay workers according to their marginal productivity compared to publicly owned firms. The public sector in Africa is characterized by over-staffing and nepotism, and thus wage rewards do not intrinsically reflect the true returns to productive characteristics (Fafchamps et al.,2009). Those who are defending the politics of the current regime are more favored in terms of job promotion and entitlement to new senior positions as well as unfettered access to the country's resources.

The employer–employee data consists of information for both workers and firms spanning 1992-2003 in 7 main waves. We use 6 waves, omitting the year 1992. The survey is conducted in 1992,

1993, 1994,1996, 1998, 2000 and 2003. Workers' data were collected during the time firms were surveyed, making the data rich and more informative for comprehensive analysis of gender wage differentials in the country. Workers' data started in 1992, while firm data in 1991. Having a one-year lag between workers' wages and firm level characteristics may reduce the possible endogeneity bias in the individual earnings specification (Fafchamps et al., 2009) because firm characteristics are pre-determined variables. The data covers all types of firm size (small and large) and all locations in a country, and thus the sample is representative of manufacturing firms in Ghana. Firms were asked to provide information about their previous year's performance such as sales, wage bills, profits, production, number of total workers, investment in building and equipment and ownership structure of firms. We have seen consistency in the main questions asked during the survey. Concerning workers' data, the survey consists of information on wages, education and labour market. The data set is a panel for firms but not for workers.

The matched employer-employee data helps control firm heterogeneity in the process of wage determination. Most previous studies have emphasized supply side determinants of wages such as education and experience and give less attention to demand side factors, probably due to the paucity of data in developing countries in general and in Africa in particular. Individuals are asked about the hours worked in a week and the usual pay period and earnings. This information has been used to compute the hourly wages of the respondents. The GDP deflator has been used to convert the nominal hourly earnings to real wages. The hourly real wage is the dependent variable.

Table 1 recaps the development of real earnings and the gender wage gap. The average wage for males is higher than the average wage for females in all years. The gender wage gap, expressed as percentage of the female wage, peaks and troughs respectively in 1993 and 1996, but remains stable for the rest of the period.

Table 1: Development of real earnings from 1993 to 2003 for women and men

	1993	1994	1996	1998	2000	2003	overall
Male average wage	257.99	302.48	664.91	1292.02	1894.03	3485.34	1150
Female average wage	168.06	225.54	537.63	944.69	1376.38	2680.49	873
Difference of means	89.93	76.94	127.28	347.33	517.65	804.85	277
Pay gap as % female wage	0.5351	0.3411	0.2367	0.3676	0.3760	0.3003	31.7
Ratio of female wage to male wage at different wage spectrum							
Q10	0.5236	0.6667	0.4940	0.5445	0.5177	0.8696	
Q25	0.5563	0.6508	0.7012	0.5556	0.6475	0.9162	
Q50	0.7554	0.7625	0.7306	0.6797	0.7703	0.9511	
Q75	0.7908	0.8448	0.7828	0.7469	0.5902	0.8672	
Q90	0.5968	0.7011	0.7870	0.7059	0.7887	0.7980	
Median values							
Median male wage	192.52	227.39	455.47	858.85	1193.58	2463.43	
Median female wage	145.43	173.38	332.75	583.74	919.45	2342.99	
Wage gap as % female wage	0.324	0.312	0.369	0.471	0.298	0.052	

This pattern suggests that the country has done little in eliminating gender disparity in earnings even though international donors, domestic private and government actors have in the same period put in place a myriad of reforms including universal access to basic education, equal pay for equal work, legislation aiming at promoting gender equality in the wealth distribution and access to credit, health and public utilities.

Using GDP deflators (year 1995 as base line for purchasing power parity), the nominal earnings are converted into real earnings. A comparison of the earnings gap across time by quantiles suggests that, except in 2003, the wage gap is highest among disadvantaged men and women. At the 10th quantile, for instance, female wage is 52% and 50% of male wage in 1993 and 1996 respectively. Based on the median values, the gender wage gap as the percentage of female wage is small in 2003 suggesting a high-income inequality among males. Hourly average real earnings for female and male are respectively, Ghanaian cedi 873 (0.276 dollars) and 1150 (0.364 dollars) (averaged over the entire period).

Table 2 offers information on establishment and individual level workforce composition and

their labour market attributes used in the empirical earning specification. Hence, both demand and supply side determinants of the wage settings are fully covered. Individual characteristics include human capital variables (level of education, worker experience, and on-the-job training), marital status, and the seven occupational categories.

Establishment characteristics include sales per employee, female proportion, firm size, union density, firm ownership, location, and sectors. Summary statistics for weighted and unweighted data is offered in table 2. The matched employer-employee data has information on the actual experience of workers which is computed as the sum of experience at the current firm (tenure) and previous experiences obtained outside the current firm. Obtaining the actual labour market experience of a worker from the data is more relevant than using potential experience (age minus 6 minus years of education). Potential experience is defined as age minus 6 minus years of education, and a crude measure of labour market experience because it often overestimates the actual experience if a person faces prolonged and intermittent layoff from the labour market for some reasons such as war or unemployment, which are more likely in African countries. Women have quite low market experience (9 years) compared to men (14 years). This may be because they are more involved in-home production, caring for older parents and children, protracted detachment from the labourl market owing to frequent childbearing and pregnancy. The gender education gap, however, is meager (1 year), suggesting that Ghana has been promoting female education in the last two decades, almost achieving one of the key objectives of the millennium development agenda.

Table 2: Descriptive summary for establishment and individual characteristics by gender

	Unweighted statistics			Weighted statistics		
Variables	Full	Male	Female	Full	Male	Female
Individual level characteristic						
Real hourly log-wage	6.3653	6.4293	6.0801	6.6572	6.6685	6.5522
Education level	11.1160	11.2025	10.7303	11.3973	11.3969	11.4012
Experience	13.4867	14.4278	9.2937	15.0894	15.5069	11.1822
Experience square (1/100)	2.8432	3.1532	1.4619	3.2746	3.4285	1.8349
age	36.4125	37.4927	31.5995	38.4068	38.8698	34.0736
Age square (1/100)	14.4648	15.2792	10.8365	15.7412	16.1098	12.2914
On job training (yes =1)	0.4109	0.4093	0.4180	0.3453	0.3454	0.3440
Married (married=1)	0.6889	0.7334	0.4906	0.7987	0.8287	0.5183
Family ties to manger	0.1071	0.0947	0.1627	0.0398	0.0381	0.0556
Production worker	0.5921	0.6005	0.5545	0.3450	0.3438	0.3571
Professional workers	0.0801	0.0843	0.0613	0.1120	0.1135	0.0981
Manager/proprietor	0.0486	0.0539	0.0250	0.0266	0.0273	0.0203
masters	0.1145	0.1126	0.1227	0.0240	0.0227	0.0357
Sales/commercial worker	0.1351	0.0992	0.2954	0.0497	0.0346	0.1912
supervisors	0.1087	0.1244	0.0388	0.0320	0.0344	0.0100
Firm level characteristics						
Technicians	0.1051	0.1261	0.0113	0.1007	0.1113	0.0017
Union (fraction of employee)	48.8091	51.8393	35.3079	74.8028	75.9469	64.0962
Female proportion	0.1426	0.0907	0.3738	0.0859	0.0644	0.2875
Sales per employee	3.6155	3.6208	3.5919	5.0891	5.0207	5.7289
Firm age	0.4010	0.4138	0.3442	0.3666	0.3572	0.4552
Investment in equipment	0.5877	0.5961	0.5507	0.7345	0.7371	0.7108
Total employees /firm size	3.9376	4.0160	3.5883	5.2944	5.3319	4.9428
Owned by Ghana	0.0268	0.0301	0.0125	0.0558	0.0613	0.0048
Owned by foreign	0.0344	0.0362	0.0263	0.0731	0.0637	0.1608
Metal/machinery	0.2955	0.3264	0.1577	0.2680	0.2826	0.1307
Textile/garments	0.1360	0.1225	0.1965	0.1242	0.1206	0.1584
Wood/furniture	0.3239	0.3545	0.1877	0.3890	0.4065	0.2260
Beverage/drinking	0.0108	0.0110	0.0100	0.0239	0.0233	0.0294
Firm Location: Takoradi	0.0964	0.1034	0.0651	0.2342	0.2543	0.0457
Firm location: Kumasi	0.2482	0.2576	0.2065	0.1436	0.1438	0.1420
Firm location: Cape Coast	0.0202	0.0202	0.0200	0.0128	0.0134	0.0070
Sex(female=1)	0.1833					
N	4,359	3,560	799	4,359	3,560	799

Table 2 shows the relative distribution of men and women across occupation and sectors and highlights the size of gender segregation in employment. About 29% of women and 10 percent of men have been placed in sales and commercial jobs. Women are working disproportionately (46%) in the food and bakery sector, whereas men (67%) are segregated in the metal, wood and furniture sub-sectors. Females are employed in small firms having average employment size of 88 workers. The average firm size is 115 workers in male working places. Women are also working in firms with less union coverage compared to union coverage in male working places. The female proportion is constructed as the ratio of female workers to total workers in each firm. In a sample of firms that hire at least one female, on average, 40 percent of the total work force are female workers. Knowing that women represent on average 18 percent in manufacturing, the female proportion variable illustrates that women to a larger extent are disproportionately placed in certain types of firms.

The sample was initially designed to interview approximately 200 manufacturing firms using random sampling, and firms which were unavailable or dropped out would be replaced by new firms to maintain the representativeness of the data at the firm level. The sampling design made it possible to interview up to 10 workers from each firm if size allows. However, this sampling technique offers workers unequal chances of being sampled when firm size varies remarkably. About 10 individuals were interviewed from each firm, suggesting that large firms are underrepresented (Fafchamps et al., 2009), suggesting that individuals in all firms do not have equal probability of selection. This calls for the use of weighting.

In the presence of homoscedastic errors, Solon, Haider and Wooldridge (2015) demonstrate that weighting gave rise to heteroscedasticity. Thus, testing rather than assuming heteroscedasticity is important. Their main advice is to bear in mind carefully what we are weighing for and then apply relevant diagnostic tests that help identify the correct estimation method. We provide three empirical pieces of evidence with respect to the decision to apply weights or not in our regression (detailed procedures and results are available upon request). First, following DuMouchel and Duncan (1983) and Winship and Radbill (1994), the earnings specification is estimated using OLS and weighted least square. Second, we apply the Breusch Pagan test for the null hypothesis of homoscedastic errors. Third, the weight variable interacts with all covariates in the earnings function, and the OLS model is re-estimated using these additional variables. All these methods suggest that weighting does not add any information and thus, the paper concludes that weighting is unnecessary.

Firm level variables are used to predict individual earnings. As individuals in the same firm may share similar observed and unobserved characteristics, two sources of within-firm correlations may emerge: within-firm correlations in the error terms and correlations between observed covariates. We pooled observations across survey waves and pooling makes the results more robust to shocks affecting the economy and attenuates the problems of sample selection.

The paper addresses the possible within-firm correlations in the disturbance terms which otherwise inflate the statistical significance of the estimated parameters (Cameron et al., 2008; Mackinnon and Webb, 2013). We apply the standard error pair cluster bootstrap method for RIF quantile regression wage decomposition. To the extent of my knowledge, there is no stand-alone built-in computer program used to cluster the standard error in RIF wage decomposition. By clustering the standard error, we can make the findings more reliable for practical policy recommendation.

4 Decomposition method based on quantile regression.

Detailed decomposition is not possible in quantile regression as originally proposed by Mechado and Meta (2005) for wage decomposition. Firpo, Fortin and Lemieux (hereafter called FFL, 2009) have proposed the detailed decomposition method, which is called Re-centered Influence Function (RIF). This method is like Oaxaca and Blinder (denoted by OB) (1973) decomposition method, but now estimation is based on quantiles of the unconditional wage distributions rather than on the mean. The underlying departure from the standard regression is that the outcome variable is now replaced by the re-centered function of the statistics of interest (Fortin et al., 2011; Firpo et al., 2018). The dependent variable is replaced by the proportion for each quantile of interest. Thus, decomposing proportions is easier than decomposing quantiles.

Let τ represent the percentile that lies between 0 and 1. Suppose Y denotes the unconditional log hourly wage. Q_τ is the quantile τ^{th} of Y. $f_\tau(Q_\tau)$ is the Epanechnikov kernel density estimator

of the unconditional distribution of Y where the density is evaluated at each percentile of Y. The Kernel function assigns greater weight to the nearest neighbors and less weight to the more distant neighbors. Following FFL, the Influence function $IF(Y, Q_\tau)$ is given by $IY > Q_\tau / f_{(Q_\tau)}$, where I() is an indicator function indicating whether the dependent variable, is greater than or equal to the Q_τ.

Define $c_\tau = Q_\tau + \frac{\tau - 1}{f_\tau(Q_\tau)}$. $RIF(Y, Q_\tau)$ is equal to $= c_\tau + IF(Y, Q_\tau)$ and can be represented as:

$$RIF(Y, Q_\tau) = Q_\tau + \frac{\tau - 1 + I(Y > Q_\tau)}{f_\tau(Q_\tau)} \tag{1}$$

The indicator function, $I(Y > Q_\tau)$ resembles the linear probability model so that regressing the indicator on a set of regressors is just a distributional regression. By considering $RIF(Y, Q_\tau)$ as a dependent variable, one can carry out the standard regression by regressing the outcome variable on covariates to obtain the estimated coefficients for each male and female sub samples separately. Finally, the OB type decomposition is carried out at the unconditional quantile function.

The presence of firm level data allows us to disentangle the firms' impact from unobserved individual characteristics on the gender pay gap and it requires, however, at least two male and two female workers in each firm (Meng, 2004). The idea is that two individuals (say male and female) employed in a particular firm share the same firm characteristics: they may work in an exporting firm or in a firm that disproportionately hires females. Even after controlling for individual characteristics, a firm may pay higher wages for females than for males.

Thus, it is important to control for the firm fixed effect and then disentangle gender wage gap accounted for by firm heterogeneity. After computing the gender wage gap attributable to firm fixed effect, we ask why different firms pay different wages for men and women even after netting out the wage gap attributable to the observed and unobserved individual characteristics. What are the characteristics (wage policies) of firms that reduce the within-firm gender wage gap? Does firm effect vary across the wage distribution? To answer these questions, we first estimate the within-firm gender wage gap following Meng (2004). Our approach, however, differs from Meng (2004). He uses a fixed effect OLS model. This paper uses fixed effect quantile regression and then applies the RIF wage decomposition method. Meng (2004) does not compute the standard errors of estimated coefficients. This paper offers the clustered bootstrap standard error. In addition, this paper controls time dummies and examines their effect on the gender wage. Perceptions towards female and male may vary overtime. With a tendency of increasing globalization, gender bias may decline over time. Just for ease of understanding (for readers), I just drop the quantiles of interest in presenting the equations here. The earnings model is estimated separately for male and female workers as follow.

$$\omega_{ij}^m = \eta^m + \alpha^m + \beta^m \chi_{ij}^m + \gamma_j^m + \epsilon_{ij}^m \tag{2}$$

$$\omega_{ij}^f = \eta^f + \alpha^f + \beta^f \chi_{ij}^f + \gamma_j^f + \epsilon_{ij}^f \tag{3}$$

β^f andβ^m are vectors of estimated regression coefficients for individual characteristics at a given quantiles of theta for the observed characteristics of females and males respectively.

γ_j captures the wage premium associated to firm's j characteristics (observed and unobserved). The wage premium for female and male workers hired in firm j is given by γ_j^f and γ_j^mrespectively. They are also called firm fixed effect.χ_{ij}^f and χ_{ij}^m capture individual specific characteristics of each gender in firm j. We pool the data overtime and time is a control variable. The year dummies are represented by η^f and η^m in female and male sub-samples respectively. ϵ_{ij} is an idiosyncratic white noise error term.

Given the competitive male wage coefficients, the counter-factual female wage, $RIF(\overline{\omega}_f, Q_{m,\tau}) = \beta_\tau^m \overline{\chi}_f' + \eta_\tau^m + \gamma_{j,\tau}^m$,represents the wage level female would receive had she been rewarded the male premium at firm j , the price the market pays for observed male attributes but retained her own characteristics. The firm fixed effect would be zero if male and female enjoy the same firm premium. The raw gender wage gap is decomposed into 4 parts: a part due to differential individual endowments; a part due to unexplained factors; a part due to gender difference in the firm premium; a part due to time effect. The wage decomposition equation can be written as follows:

$$RIF(\overline{\omega}_m, Q_{m,\tau}) - RIF(\overline{\omega}_f, Q_{f,\tau}) = \overline{\chi}'_f(\beta^m_\tau - \beta^f_\tau) + \beta^m_\tau(\overline{\chi}'_m - \overline{\chi}'_f) + (\eta^m_\tau - \eta^f_\tau) + (\gamma^M_{j,\tau} - \eta^f_{j,\tau}) \quad (4)$$

The first term denotes the coefficient effect, the wage gap resulting from differential treatment for comparable male and female observed individual characteristics. The second term represents the endowment or characteristics effect. The third is the time effect and the last term represents the firm effect (differences in firm premium between genders). The firm / price effect captures the differential firm wage policies as well as labour market segmentation with respect to gender.

5 Estimation results

5.1 Effects of gender sorting and firms wage policies

One caveat is that women may self-select into labour markets based on their expected wage, implying that those entering the labour market may have different characteristics compared to the average characteristics of the whole female population in the country. Properly accounting for this problem would require individual level data for both individuals in wage employment and non-wage employment (self–employed and non-employed individuals). The manufacturing survey contains earnings information only on salary employed individuals and we do not have data on unemployed people and their characteristics and are unable to address the potential sample selection. This is the limitation of the paper. However, RPED data have been extensively used for the same topic in African countries as discussed in the literature.

Estimation result is reported in table 3. The gender wage gaps in Ghana are positive and significant across the entire wage distributions (also at the mean). As the dependent variable is in log wage, results have been reported in logarithmic scale, which can be transformed back into the original scale in level. The log wage difference between genders is 0.44 at the mean, which implies that women are paid 36% less than men. According to the Ghana Statistical Service (GSS,2022), women are also get paid 34% less than men, which is almost the same as the gender wage gap in the Ghanaian manufacturing firms in this study. Similarly, female entrepreneurs earn about two-thirds of the incomes of male entrepreneurs for Sub-Saharan African countries (ILO,2018). The unadjusted average gender wage gap for Sub-Saharan African (SSA) is estimated to be 30% (World Economic Forum,2017). The average raw gender wage gap from Ghanian manufacturing firms mimics the average gender wage for SSA. But gender wage gap is not constant across the wage distributions.

At the 10th quantile, the log of real wage difference (log (male wage)-log (female wage)) is 0.52, which mean that females' log wage is 59% of males' log wage ($e^(- 0.52) = 0.59$). It means that women are paid 41% less compared to the log wages of their male counterpart (i.e. by how much female earns less in reference to the males' wage). Similarly, women earn 35% less than men at 25th and 75th quantiles whereas they earn 19% less at 90th quantile. Women's log wage is lower than men's log wage by about one- third except at the 90th quantile. Alternatively, we can also express the wage gap in terms of absolute difference, which is the wage premium men earn relative to women's wage. At the 10th quantile, the log of wage difference log (male wage)-log(female wage)) is 0.52 which means that the absolute real wage for male is higher than that of female by a factor of $1.68(e^0.52 = 1.68,)$, which is the ratio of male's wage to female's wage. This implies that male earns 68% more than what female earns. The higher the log wage difference, the higher the gender wag gap.

Using the Oaxaca wage decomposition method, Boahen and Opoku (2021) examined the gender wage gap in Ghana and found that the wage gaps were different depending on the sample selection correction method used. The gap is log (0.41) with no correction; log (0.37) with univariate sample selection correction while it is log (0.499) with bivariate sample selection correction. Our Oaxaca decomposition without sample selection correction shows that the gender wage gap is log (0.44) for the Ghanaian manufacturing firms. The main difference between these two studies is the causes of gender wag gap. Boahen and Opoku (2021) found that gender wage gaps were explained by just differences in returns (almost all), not because of differences in observable individual characteristics. We find the opposite: the wage gap which is due to returns to observables are very small and returns are also in favor of male. We find that about one third of the wage gap is due to differences in observable individual characteristics (0.1464 out of 0.44) whereas the coefficient effect is negligible.

Unlike Boahen and Opoku (2021), our study considers firms' characteristics in the regression and hence the unexplained gender wage gap disappears.at the mean. Applying quantile regression is also important as the impacts of returns to observables vary across the wage distributions.

Table 3: Wage differential between gender: decomposition result

	Oaxaca	Q10	Q25	Q50	Q75	Q90
Characteristics effect	0.1464***	0.0995**	0.1125***	0.1166**	0.1707***	0.2355***
	(0.0361)	(0.0453)	(0.0368)	(0.0429)	(0.0538)	(0.0637)
Coefficient effect	-0.0144	0.0599	0.0714	0.1464***	-0.1119	-0.2580**
	(0.0351)	(0.1013)	(0.0665)	(0.0606)	(0.0821)	(0.0969)
Firm effect	0.2635***	0.3128**	0.2050**	0.2456***	0.3269***	0.1637**
	(0.0585)	(0.1271)	(0.0809)	(0.0673)	(0.0812)	(0.0825)
Time effect	0.0446	0.0495	0.0477	0.0295	0.0517	0.0694
	(0.0403)	(0.0478)	(0.0463)	(0.0553)	(0.0494)	(0.0543)
Wage gap	0.4402***	0.5218**	0.4366***	0.5382***	0.4374***	0.2108**
	(0.110)	(0.1474)	(0.0947)	(0.0785)	(0.1001)	(0.0958)

Note: *** denotes 1% significance level: ** 5% significance level

The gender wage gap at the 10th quantile is 2.5 times larger compared to the gender wage gap at 90th quantile. Gender wage gap declines across quantiles except at 50th quantile. The widening gap at the bottom of the wage distributions implies that poor women are more disadvantaged than poor men. They are less endowed with human capital, and disproportionately segregated into less paying firms. Firm premium is in favor of males (discrimination by employers). This result is consistent with the labour market condition in Ghana. Based on the Ghanaian manufacturing firms covering the period 1987-2003, 80% of the employment comes from small firms having less than 9 employees. Poor women are disproportionally placed in low productivity firms and hence as shown in table 3, about 60% (0.31/0.52*100) of the log wage difference between genders at 10th quantile is explained by the workplace characteristics (firm effect). Several studies in Ghana have found that gender earning/wage gap is higher in the informal than formal sector. Firm's ownership also matters for gender wage gap (less wage gap in the public owed firms.

Why does this pattern exist in the Ghanaian labour market? We understand that social norms and culture, labour law (minimum wage; compensation for extra hours -worked) and entry restrictions for high-paid jobs can generally contribute to differences in wage gaps between sectors.

However, for poor men and women in low productivity firms, who have similar observed individual characteristics and other things remain constant, the observed firm characteristics (firm effect) are in favor of poor men than poor women. The implication of this result is that labour policies must target low paying firms to narrow their gender wage gap. Firms' characteristics (observed and unobserved) significantly affect gender wage gaps at all quantiles, for instance 30% and 60% of the gender wage gap are respectively at the top and bottom quantiles.

The positive sign for the firm effect suggests the presence of a positive correlation between firms' wage policies and the gender wage gap. Firm effect explains more than 50% of the gender wage gap. Women receive low firm premia irrespective of their location in the wage distributions. Hence, manufacturing firms in Ghana do not make a substantial effort to mitigate gender difference in wages, rather increase the gap. Time effect (5%) is found to be insignificant. The log wage difference between men and women due to observed individual compositions is lower at the 10th decile (0.099) but higher at the 90th (0.2355). The raw gender wage gap is found to be higher at the bottom decile than at the top decile, suggesting evidence of a sticky floor effect. Poor women are more disadvantaged than men.

How much is the gender wage gap due to female segregation into specific firms (Volume effect)? We use female proportion variable in the quantile regression and then we find the wage gap adjusted for this variable. For example, women highly dominate the food and beverage sector while more men are in the construction industry. Because the firm effect in table 3 could be partly due to segregation effect, which is gender sorting across firms by employers, rather than firms wage policies. It may be due to labour market segmentation in the sense that females are disproportionately placed in low paying firms. We remove sorting effects and re-estimate the model. First, we estimate the wage model for each gender using a full set of individuals' observable establishment characteristics

and the proportion of female employees in a firm. Second, individual earning is adjusted for by the effect of female proportion. Using the adjusted individual wage as a dependent variable, the earning function is re-estimated using individual characteristics and firm fixed effect.

Fafchamps et al. (2009), for African manufacturing firms, find that a large share of the gender wage gap is explained by selection into low wage firms and occupations which is consistent with our finding. Card et al. (2016) for Portugal find that women are sorted into firms that pay less premium, and the effect is strong for low and middle skilled workers. In addition, gender sorting across industries and firms contributes to about one -fifth of the overall gender wage gap in New Zealand (Isabelle et al. ,2017) Our result in table 4 supports the findings in the literature.

The gender wage gap (in log) at the mean decreases from 0.44 to 0.358 after controlling the effect of gender sorting. Thus, gender wage gap (in log) accounted for by just the pure effect of gender sorting is about 18.6% (0.44-0.358)/0.44) at the mean. This is the portion of gender wage gap (in log) resulting from the disproportionate presence of women in low paying firms. In other words, the absolute men's wage is 20.4% ($e^0.186 - 1$) higher relative to the women's wage just because of gender sorting. Yet, the effect varies substantially across quantiles. Wage gap (in log) decreases from 0.5218 to 0.3195 at 10th quantile after removing the effect of female proportion (or sorting effect). This means that more than one third (38.7%) of the log gender wage gap at the bottom quantile is just due to gender segmentation (also partly competitive) in the labour market. Poor women are disproportionally placed in low paying firms. The effect of sorting decreases across the conditional wage distributions. There is no gender sorting at 90th quantile implying that high earning women and men are proportionally placed in firms.

Table 4: The within-gender wage gap after removing the effect of female proportion.

	Without firm effect	With firm effect					
	Oaxaca	Oaxaca	Q10	Q25	Q50	Q75	Q90
Characteristics effect	0.1937	0.1458	0.1257	0.1178	0.1103	0.1754	0.2296
Coefficient effect	0.1283	-0.0160	-0.0476	0.0094	0.0547	-0.1235	-0.1959
Firm effect		0.1829	0.1761	0.1459	0.2230	0.2390	0.1226
Time effect	0.0295	0.0452	0.0654	0.0592	0.0285	0.0532	0.0631
Wage gap	0.3579	0.3579	0.3195	0.3324	0.4166	0.3440	0.2194

Putting these into perspective, gender sorting accounts for one- fourth of the observed gender log wage gap at 25th and 50th quantiles while it is one- fifth at 75th quantile and with no effect at 90th quantile. The result suggests that gender sorting is pervasive for poor women. It is one of the main reasons for the gender wage gap.

The remaining gender wage gap (i.e., adjusted gender wage gap) after deducting the effect of gender sorting is further decomposed into firm effect, time effect, individual endowment, and coefficient effects as shown in table 4. Firm effect captures the firms' wage policies, which include observed (such as firm size, exporting firm, wage bargain, firm ownership, and location etc.) and unobserved firm specific characteristics. Even after controlling for female segregation (female proportion variable in a firm), firm effect is still substantial across the entire wage distributions suggesting that firms' wage policies cause the gender wage gap in Ghana manufacturing firms.

Table 4 shows the adjusted gender wage gap (the gap after removing effect of gender segregation). As shown in table 4, the adjusted gender wage gap (in log) is 0.3195 at the bottom quantile while the absolute gender wage gap is $0.376(e^0.3195 - 1)$. This implies that men's wage exceeds women's by 37.6% compared to women's wage. However, the absolute gender wage gap is just 24 .5% at the top quantile ($e^0.2194 - 1$). As per equation 4 in the methodology section, the gender wage gap (in log) is decomposed into four different parts: characteristics, coefficient, firm and time effects. For instance, firm effect contributes a significant part of the wage gap at the bottom quantile (0.176 out of 0.3195).

The signs of the coefficient effect are negative except at 25Th and 75th quantiles implying that males are discriminated against females as the returns for their endowments are valued differently. At 75th and 90th quantiles, males are rewarded less for the same observed individual characteristics compared to the reward for females and this causes the wage gap to be lower. The gender wage gap would have been higher had not been the coefficient effect at the end of the wage distributions. Normalizing these coefficients to zero will help determine the contribution of firms' effect (from

100%) to the positive adjusted gender wage gap. How much firms' effect causes higher wage for males compared to females? Almost half of the positive wage gap (in log) comes from firms' premium between genders at all quantiles except at 90th quantile (which is only about 30%). Similarly, about one third of the adjusted gender wage gap comes from the characteristic effect at all quantiles except at 90th where the effect is more pronounced (about 54%). From table 4, one can see that firms' attributes (observed and unobserved establishment characteristics) and individuals' endowment are the main causes for upward bias in wages for male than female.

How much is the contribution of firms' effect from an unadjusted gender wage gap (from total gender log wage gap)? We have noticed that gender sorting accounts for 35%, 24.4%, 24.9% , 20% of unadjusted gender log wage gap respectively at 10th ,25th , 50th and ,75th , and with no effect at 90th quantile. The firms' effect tends to be 31%, 34%, 45.6% 42.7% and 29.5% of the total gender log wage gap respectively at 10th ,25th , 50th and ,75th , and 90th quantile. On the other hand, the characteristic effect accounts for 22%,31%,27.6% 22.6% and 55% of the total log wage gap at the respective quantiles. The remaining gender wage gap is filled with the time effect as the coefficient effect is normalized to zero. Firm effects and gender sorting explain the largest portion of the observed gender wage gap, which is between 50% and 70.5% depending on the quantiles being considered.

The unexplained gender wage gap disappears after controlling for firm fixed effect except at higher quantiles. We have noted that once controlling for the firm effect, the returns to education decline, suggesting that high paying firms attract educated individuals. In this case, this finding is consistent with Fafchamps et al. (2009) who find that African manufacturing firms value education.

Table 5 reports the detailed decomposition result based on table 4. Note that the Oaxaca decomposition based on OLS should be used only as a benchmark, not the final model of interest. The contributions of the control variables to the total gender wage gap are presented in table 5. The difference in labour market experience between male and female is an important contributor to the gender wage gap. After controlling firm heterogeneity, education and experience explain 20% , 14% and 19% of the adjusted gender wag gap respectively at the 10th, 50th and 75th quantiles. Out of this, the effect of labour market experience is substantial (about 80%). Women's low labour market experience remains a serious impediment to wage equality. Females are not fully integrated in the labour market. Poor women have low labour market experiences compared to men. Gender difference in experience accounts for 19% of the adjusted gender wage gap at 10th quantile. Occupational segregation by sex is thus a reason for gender wage gap. As shown in table 5, women are placed in low paid occupation firm though they have similar education and experiences as men. The occupation effects are more pronounced at higher income groups. A sizable literature indicates that female occupations pay less than male occupations for workers with similar measured attributes (Blau and Khan,2020; Fafchamps et al. 2009)

Table 5: The contribution of composition effect to total gender wage gap (%)

	education	experience	training	occupation	other	overall
OLS	4.41	6.10	-0.35	13.99	16.71	40.86
Q10	0.88	18.93	2.75	5.60	11.31	39.47
Q20	2.17	11.03	1.04	7.23	17.86	39.32
Q30	1.19	12.38	0.94	7.44	12.03	33.98
Q40	2.59	7.79	-0.59	4.1	18.78	32.67
Q50	2.78	11.53	-1.03	7.52	6.02	26.82
Q60	2.90	11.34	-1.29	9.33	7.97	30.25
Q70	5.20	16.42	-2.29	15.75	6.70	41.78
Q75	6.87	12.46	-1.13	25.96	6.99	51.15

Note: other in the table represents age, age squared, marital status, and whether the manager is a relative of the worker

5.2 Firms' wage policies: what kind of firms reduce within-firm gender pay gaps?

We ask what causes firms to pay different premia for women and men. γ_j^m and γ_j^f are firm fixed effects respectively for males and females at firm j (retrieved from eq (1) and eq (2)). Individually,

γ_j^m and γ_j^f are not zero. The within-firm gender wage gap, which is given by $\gamma_j^m - \gamma_j^f$, is statistically different from zero. We take the within-firm gender pay gap as the dependent variable $(\gamma_j^m - \gamma_j^f)$ and regress it on the observed firm characteristics. The estimation results are reported in table 6. We find that observed firm characteristics explain 44.7% (R-squared=0.4468) of the within-firm gender earning differential, which is considerably large compared to the finding established in Meng and Meurs (2004) for Australian labour market (0.068) and for France (0.039). Thus, the data plausibly fits the model.

Table 6 allows us to test some hypotheses and contentious thoughts and ideas which have been widely asserted in economics of discrimination and labour economics in the last couple of decades. Becker (1957) and Arrow (1973) describe discrimination as something related to personal prejudice against a specific group. They argue that discrimination in a competitive environment brings considerably large costs to discriminatory employers because non-discriminatory firms can get cheap labour and consequently drive the discriminatory firms out of the market. Expensive workers are retained in discriminatory firms, not just by their better productivity but by personal taste of employers. Two dummy variables have been included in the model as a measure of market competition facing a firm. The first is a dummy variable indicating whether a firm declares itself under high competition or not.

Table 6: The effect of observed firm characteristics on within-firm earning premium.

Variables	Coefficients	Standard error
Fraction of workers covered in labour union (union density)	-0.0030***	0.0011
Female proportion	-0.2133	0.1997
Sales per worker	-0.0030	0.0081
Business established after 1985	-0.3487***	0.0887
Investment in equipment and plant	-0.1064	0.1258
Firm size	-0.0282	0.0402
Firm facing strong competition	-0.1645	0.1160
Labour intensive firms	-0.8077**	0.4106
Percentages of raw material imported	-0.0038**	0.0015
Share of managers in total workers	-2.1815**	0.6354
expect improved credit availability/no credit constraint	0.2276**	0.1148
Ghanian ownership	0.4263***	0.1394
Foreign ownership	-0.1268	0.2248
Metal/machinery	-0.0269	0.1219
Textile/garments	-0.2572**	0.1170
Wood/furniture	-0.1344	0.1249
Beverage/drinking	0.0711	0.1828
Business Location: Takoradi	-0.0859	0.1241
Business Location: Kumasi	-0.0999	0.1029
Business Location: Cape Coast	0.1676**	0.0822
Constant	1.2383***	0.2123
R squared	0.4468	

Firms were asked whether the rise in the number of competitors the major concern or not. The second variable represents the percentage of raw materials imported from abroad. We expect that the higher the import contents in firms' product, the more likely they are to engage in tough competition. Consequently, a firm facing world competition is more likely to pay its workers for their marginal product and thus act in a less discriminatory way. The estimation result is reported in table 6. As expected, strongly import dependent firms are more involved in narrowing the wage gap. Competition in product markets is seen to be a panacea against employers' personal taste and prejudice in labour market. This finding is in line with a recent study by Black and Brainerd (2004) who find a negative relationship between globalization and employment discrimination, using increased volume of import as an indicator of high market competition. As shown in table 6, firms that are involved in a high competition are less discriminatory. Firms, which are more likely opened to international trade reduce the gender wage gap. As shown in the table, foreign owned

firms and firms with high import content narrow the gender wag gap. Technology can reduce the demand for physical tasks and as a result, women may have improved bargaining position on wages. In addition, women are benefited from foreign direct investment in terms of higher employment shares and better working conditions (Kodama et al. 2018). In line with our finding, Brussevich(2018) confirms that manufacturing firms with increased import competition offer lower wage for males than females in USA. The author argues that the wage gain from trade is less for males than for females as the manufacturing firms are more labour intensive which increases the cost of exit more for males than females.

In contrast to the above findings, Van Rensburg et al. (2020) finds that globalization tends to increase gender wage gap for South African manufacturing firms. Firms that operate only in the domestic market (with no import and export contents) have experienced less wage inequality between genders. On the other hand, trading manufacturing firms have a higher gender wage gap. They argue that males are more flexible to travel than females because males are more willing to take long business travel and unusual business hours which causes them to earn higher wage premium whereas females are constrained by household responsibility (for instance, child-rearing). Their finding is, however, inconclusive because they assume that women at higher end of the wage distributions (women having school -age- children) are less flexible and thus, the finding may be different if young cohort are taken.

We look at the impact of the percentage of workers under union membership on the gender wage gap. Firms with a high union density reduce the within-firm gender pay gap. This reflects the importance of labour market institutions in wage determination. Decentralized wage bargaining system brings unwanted prejudice. The imperfect information hypothesis is another relevant aspect in discrimination literature. Firms having reliable information about workers' productivity are less likely to discriminate than those with little or no information concerning objective measures of worker performance and productivity. Lack of accurate information about worker productivity is another source of the gender wage gap (Arnott and Stiglitz,1985). Two variables have been incorporated as additional covariates to account for the role of information on the gender wage gap. One variable is the share of labour costs in the aggregate costs and another variable is the share of managers in total workers in each firm.

Worker productivity in labour intensive firms can be measured easily and thus remuneration is determined based on their objective performance. As expected, labour intensive firms narrow within-firm gender pay gap (see table 6). Had firms not been labour intensive, then the raw gender wage gap would have been about 8% higher. Similarly, the coefficient associated with the share of managers is negative and statistically significant, suggesting that firms with high supervision do have better information on workers' productivity and are less likely to discriminate between genders.

Firm ownership is also crucial in the determination of wages. The positive and significant impact of domestic ownership suggests that Ghanaian owned firms are more discriminatory than other types of ownership. Finally, we have seen no industry effect except that textile/garment activity reduces the within-firm gender pay gap. In addition, strategic location of business is deemed to be an important determinant of within-firm gender premia. Firms located at the Cape Coast have a higher within-gender wage gap. Firms that expect improved access to credit raise the gender earnings gap.

According to Becker's (1971) personal taste hypothesis, firms that hire more women are more likely to have less prejudice against women and may have equal pay policy. To test this hypothesis, the proportion of women in total employment is incorporated in the regression model. The variable has maintained the expected sign but is statistically insignificant. In general, union density, young firms, labour intensive firms, firms facing high competition (firms with low market power), firms with high mentors and supervisions and importing firms are those that strive to reduce the earning differential between genders. On the other hand, fully domestic owned firms escalate gender wage gap. Finally, we must note that the estimation result reflects association, no causal interpretation should be enshrined in.

6 Conclusion

This study investigates the role of individual and establishment characteristics in determining the gender wage gap across the entire wage distribution in Ghana using the re-centered influence

quantile regression approach. By accounting for these two types of characteristics, it offers new insights regarding the sources of the gender wage gap.

The wage gap is decomposed into 4 components: firm effect, time effect, individual endowment and coefficient effects. Poor women earn 59% of the men's wage at 10 quantiles or women earn 41% less than men. Gender wage gap at the bottom of the income distribution is 2.5 times larger than the gender wage gap at the top quantile. The larger gap at the bottom quantile suggests that poor women are more disadvantaged than poor men. Gender sorting across firms (38.8%) and labour market experiences (12%) are the main causes of the wage gap at bottom quantile. Gender sorting has no effect at 90th quantile but the observed individual characteristics explain the larger portion of the gap (55%). Firms effect explains more than 30% of the wage gap across the entire wage distributions.

Firm wage polices increase the gender wage gap in Ghana. After controlling gender differences in observed and unobserved individual characteristics, there exist firms that reduce gender wage gaps. Firms that reduce the within-firm gender wage gap include those having centralized wage bargaining, young firms, labour intensive firms, firms facing high competition (firms with low market power), firms with high mentors and supervisions and importing firms. On the other hand, fully domestically owned firms escalate the earnings differential between genders. Firms wage policies matter for the gender wage gap.

By disproportionately sorting into low paying firms, poor women earn low wage. They also have a record of low experience, making them earn less. This calls for policy makers to pay attention to the poorest of the poor through several policy avenues, especially targeting those observed characteristics. Intervention to promote their earning should be in place by increasing the poor women's labour market participation (example sick leave with pay during pregnancy) and mitigate the constraints facing women during pregnancy, and maternity leave. It is one way to decrease poverty as well as the social cost of poverty. Poor women are also disproportionately working in less paying firms, which are often small and inefficient. Another way of decreasing poverty is therefore to increase the capacity and productivity of those firms, in particular the female dominant firms that hire poor women. Introducing better management system (e.g skill enhancements through training within and between firms) as well as access to credit are important policy instruments to promote the competitiveness of the female dominant but inefficient firms.

Declaration

Availability of data and materials: The data is a free source and available at the following website: https://www.csae.ox.ac.uk/regional-project-on-enterprise-development-ghana-manufacturing-enterprise-survey-rounds-ivii-12-year. As part of the regional program for enterprise development (RPED), data for Ghanaian manufacturing firms has been collected by the Center for the Study of African Economies (CSAE) at the Oxford University (see the data section in the manuscript). My own programming codes to produce the result will be available upon request.

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