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THE EXTENT OF WAGE DISCRIMINATION FOR WOMEN IN THE UK LABOUR MARKET: EVIDENCE FROM BRITISH HOUSEHOLD PANEL SURVEY

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ABSTRACT

The study was conducted at the School of Economics, University of Nottingham, October 2008 in Economic Data analysis module to examine the extent of wage differentials for the women who have actively participated in the UK labour market from 1991 to 2001 from British household panel survey. The extent of wage discrimination decreases with level of academic qualification. The wage differential is found to be higher in case of first degree than it is in case of Master's degree. At workplace the women are discriminated more in case of part- time job compare to full time job. The discrimination for women declines with their association with labour union. But the women of different races including white are discriminated to the same degree against male with equal level of qualification and performance.

Keywords: Wage discrimination and Labour market.

INTRODUCTION

Wage discrimination takes place when the price of equivalent labor is discriminated among different groups of workers. This may be seen as just one kind of price discrimination or as an example of its inverse, one buyer buying identical goods at different rates (Borjas, 2004) Wage differentials by race, ethnicity and gender can arise even if employers are not prejudiced. When firms do not have complete information on a particular worker's productivity, they might use aggregate characteristics of the group as an indicator of the worker's productivity. The impact of discrimination on the wage structure is measured by comparing the wages of workers who have the same observable skills, such as educational attainment and labour market experience, but who belong to different racial or gender groups. According to Blau *et al.* (1992) to understand changes in the gender pay gap fully in the US, it is important to examine the impact of changes in wage structure. Bertrand and Hallock (2001) examined the gender compensation gap among high level executives in the US from 1992-1997. Women, who represented about the 2.5% of the sample, earned about 45% less than men. According to Gneezy *et al.* (2003) women are less effective than men in competitive environments, even if they are able to perform similarly in non competitive environments. This paper investigates the extent of Wage differential for women in the British Labour market.

METHODOLOGY

The study was conducted at the Nottingham school of Economics, UK and submitted as a research paper in the Economic data Analysis module as per the requirement in October 2008. The data set were comprised three waves of the British household panel survey of 1991, 1996 and 2001. There are total of 44 variables, most of the variables are 'categorical' (qualitative) type and there are also some 'real valued' (quantitative) variables. The data set is modified by dropping the 'missing values' of the variable 'paygu' which represents the monthly gross pay, because primarily 'wage' will be considered as the major outcome of the labour market in the UK, to examine the discrimination. Second some values of the variable 'age' have been dropped, since the age range in our regression analysis is 17- 60 because , under the age of 17 and the above the age of 60, the frequency of the active labour force participation is quite low. The tabulation of the data shows that the proportion of male and female the sample is 49.21% and 50.79% respectively.

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Table 1. Proportion of male and female in the sample.

Sex	Frequency	Percentage	Cum. frequency
Male	6808	49.21	49.21
Female	7027	50.79	100.00

So the sample is equally divided between the sexes and it is observed that quite a small proportion of the sample corresponds to the female ethnic group, where the actual proportion of the female ethnic group in the UK, is also quite low. So the sample is a random sample, where male and female and all the categories of race had the equal chance to be included in the sample. Since the data comprise three waves (1991, 1996 and 2001). Regression equation will be run for each year. The table 2 presents the mean value of Logarithm of monthly gross pay (ln paygu) and mean age across gender for the three years.

Table 2. The mean value of Logarithm of monthly gross pay (ln paygu) and mean age across gender for each year.

Year	Mean lnpaygu male	Mean lnpaygu female	Mean of male age	Mean of female age
1991	6.97	6.22	36.4	36.8
1996	7.13	6.46	36.2	36.5
2001	7.35	6.74	37.0	37.4

FINDINGS AND DISCUSSION

The regressions consider both real -valued and categorical variables and an interaction term between the two types of variables. So the model is:

$$\text{lnpaygu} = \beta + \beta_o \text{ age} + \beta_1 \text{female} + \mu \text{ age female} + \text{error term} \ldots\ldots\ldots\ldots\ldots (1)$$

lnpaygu is the natural logarithm of usual gross pay per month from current job. Age refers to person's age at the date of interview (real valued variable) and female is the dummy variable (categorical variable) that takes value = 1 if the person is female and '0' otherwise. 'Age female' is the interaction term of age and female. The regression results are presented in the table 3.

Table 3. Regression results of equation (I).

Year	Estimated coefficients of (constant term)	Estimated coefficients of β_o	Estimated coefficients of β_1	Estimated coefficients of μ	R Squared & F statistic
1991	6.37 t = 77.46 p =0.00	.022 t = 9.87 p =0.00	.22 t = 2.00 p =.046	-.023 t = -7.68 p =0.00	0.20 F=159
1996	6.73 t = 66.46 p =0.00	.017 t =6.52 p =0.00	-.04 t =-.31 p =.754	-.014 t = -4.27 p =0.00	0.18 F=128
2001	7.04 t = 71.49 p =0.00	.012 t = 5.10 p =0.00	-1.48 t = -2.82 p =.139	-.009 t = -2.95 p =0.003	0.17 F=123

Table 3 shows that except the estimated coefficients of β_1 for the year 1996 and 2001 all the estimated coefficients are statistically 'significant from zero' [high t ratio and p value = 0] except, where the high p values indicate that those estimates are not statistically 'different from zero' at 1% or 5% level of significance. The predicted sign of estimated μ is negative for all the three years, imply that the proportional wage differential between the male (the base group) and the female. Women earn 2.3% less than the male counterpart in 1991, but gradually the wage differential decreases to 1.4% in 1996 and in 2001 it is .9%.The signs of estimated β_o for all three years are positive, the size decreased in 1996 (.017) which implies that given other factors constant in the model, an additional increase in age increases the monthly gross pay by 1.7% and this number decreased in 2001 (1.2%). The sign of the estimated β_1 is

positive for1991 and negative for successive two years, which imply that this reduces the intercept term of the estimated regression for female in 1996 and 2001. That is holding other factors constant being female reduces the monthly pay compare to male by 4% (1996) this coefficient is precisely determined in 2001. R squared value (the percent variation of the log pay due to variation in the control variables) has declined from 20% (1991) to 17% (2001). All the estimated coefficients are jointly statistically different from zero in all years, indicated by quite high values of the 'F' statistic for all the years.

The extent of gender discrimination in the labour market with respect to higher education

The discrimination against the female in the job market could be examined when both have equal level of highest academic qualification. The data set shows that the variable qfachi is a binary variable which shows academic qualification of the person, using the appropriate command in STATA gives us the fact that the category 'first degree' as numbered '2', here first degree is considered as higher academic qualification That proportion of the sample is considered where male and female have achieved higher academic qualification (First degree). The regression equation is:

$$\text{lnpaygu} = \beta + \beta_1 \text{female} + \text{error term} \ldots\ldots\ldots\ldots\ldots\ldots (1a)$$

Where the base group is male with first degree.

Table 4. Regression results of equation (Ia).

Year	Estimated coefficients of (constant term)	Estimated coefficients of β_1	Number of observation	R Squared & F statistic
1991	7.33 t = 183 p =0.00	-.43 t = -7.34 p =0.00	421	R Squared:0.11 F=53
1996	7.42 t =203 p =0.00	-.27 t= -5.10 p =0.00	535	R Squared 0. 04 F=26
2001	7.68 t =226 p =0.00	-.44 t =-9.45 p =0.00	678	R Squared 0.11 F=89

From the a table 4 it is observed that all the estimated coefficients are statistically different from zero at1% and 5% level of significance, because of high t ratio and small p values in all the years. The percent variation in the logarithm of monthly gross pay due to change in the control variables, remained unchanged (around11%) All the estimated coefficients are jointly statistically different from zero because of high values of the F statistic in all the years. The estimated coefficients of $\beta_1$is negative in all the years, the female earn 43% less than the male counterpart in 1991, this percentage decreased to 27% in the 1996 and increased in 2001(44%).

Discrimination against the female in the job market when both have equal level of highest (rather than higher) academic qualification

The data set shows that the variable which captures the categories of highest academic qualification of the person, using the command appropriate command in STATA gives us the fact that the category 'higher degree' as numbered '1', higher degree beyond the first degree is considered as highest academic qualification. That proportion of the sample is considered where male and female have achieved highest academic qualification (higher degree).

$$\text{The model is lnpaygu} = \beta + \beta_1 \text{female} + \text{error term} \ldots\ldots\ldots\ldots\ldots\ldots (1b)$$

With the base group 'male with higher degree', that proportion of the sample is considered for each year where both sexes have higher degree. So the estimated coefficient of β_1 represents the wage differential (in percentage) across the gender when they have the same level of highest educational qualification. The regression results are summarised in the table 5.

Table 5. Regression results of equation (Ib).

Year	Estimated coefficient of β	Estimated coefficient of of β_1	Number of observation	R Squared & F statistic
1991	7.55 t= 120 p= 0.000	-.30 t= -2.71 p= 0.008 Standard error = .06	82	R Squared .08 F = 7.35
1996	7.68 t= 115 p= 0.000	-.34 t=-3.31 p=0.001 Standard error=.06	123	R Squared .08 F = 10.96
2001	7.83 t= 112 p= 0.000	-.39 t= -3.74 p=0.000 Standard error=.10	157	R Squared .08 F = 13.97

All the estimated coefficients are statistically different from zero, because of high t ratio and small p values in all the years. The percent variation in the lnpaygu due to change in the control variables, remained unchanged (around 8%). All the estimated coefficients are jointly statistically different from zero because of high values of the F statistic in all the years. The percentage wage differential between the male and female where both have the highest academic qualification is -.30, which means women earn 30% less than the male counterpart in 1991 and this difference increased in 2001, around 40%. The corresponding t statistics are quite high , (p values, the smallest probability at which the null hypothesis is rejected are also quite low) which means that these estimated coefficients are statistically different from zero both at 1% and 5% level of significance.

The extent of gender discrimination in the labour market on the basis of full-time and part-time job

In the data set the variable 'jbft' is a qualitative variable indicates whether the job is a part-time or fulltime. According to 'label list' the variable '1' indicates full-time job and 2 indicates part-time job.

In the regression, $\text{lnpaygu} = \beta + \beta_1 \text{female} + \text{error term}$……(II)

where both male and female has the full time job (Base group: male full-time job).

$$\text{lnpaygu} = \eta + \eta_1 \text{female} + \text{error term}$$

where both male and female has the part time job (base group: male part-time job).

The regression results are summarized in the table 6.

Table 6. Regression results of equation (II).

Year	No. of observation	Full-time job			Part-time job		
		Estimated coefficient of β	Estimated coefficient of β_1	R squared & F statistic	Estimated coefficient of η	Estimated coefficient of η_1	R Squared & F statistic
1991	Full-time= 3738 Part-time= 950	7.03 t=649 p =0.00	-.36 t= -21 p = 0.00	R Squared .10 F = 457	5.6 t=71 P=0.00	-.15 t= -1.83 p =.06	R Squared .0035 F = 3.34
1996	Full-time=3488 Part-time=942	7.21 t=629 p =0.00	-.32 t=-18 p =0.00	R Squared .08 F =330	5.88 t= 81 P=0.00	-.16 t=-2.16 p =.03	R Squared .0049 F = 4.46
2001	Full-time=3625 Part-time=953	7.41 t= 671 p =0.00	-.29 t= -17 p =0.00	R Squared .07 F =302	6.46 t=93 P= 0.00	-.39 t=-5.31 p = 0.00	R Squared .0288 F = 28.25

All the estimated coefficients of β_1 are precisely determined, since the t ratios are quite high and p values are quite small. From these estimates there is evidence that over time the proportional wage differential between the male and female in case of full-time job has declined from 36% (1991) to 29% (2001). The gap between the log wages over time has narrowed down. The percent variation in the log pay due to fluctuation of the explanatory variable has declined from 10% (1991) to 7% (2001) in case of full-time job. In case of part-time job the estimated coefficient of η_1 for the year 1991is not statistically different from zero at 1% level of significance. But the estimated coefficients are statistically different from zero at 1% and 5% level of significance for the years 1996 and 2001.The estimated coefficient for the gap between the log wage has increased substantially over time in favour of the male, as there is evidence that the women earn almost 39% less than men in 2001 in case of part-time job. It can be concluded that in case of part-time job the women are discriminated severely than the full-time job.

The extent of gender discrimination in case of staff association with the labour union at workplace

The categorical variable (dummy variable) 'tuin1' captures whether the particular employee has the membership with the staff association or labour union. In the data set there is 'yes' response of the employee's membership with the staff association and this has been labelled as '1' So regression will be run of that segment of the sample for each year where both sexes have the membership with the association. Thus the estimated coefficient of female (α_1) again gives us the proportional wage differential with male (the base group with membership). The model is the following:

$$\text{lnpaygu} = \alpha + \alpha_1 \text{female} + \text{error term} \ldots\ldots\ldots\ldots\ldots\ldots\text{(IIa)}$$

Table 7. Regression results of equation (IIa)

Year	No. of observation	Estimated coefficient of α	Estimated coefficient of α_1	R squared & F statistic
1991	No. of observation=1755	7.10 t = 446 p=0.00	-.49 t = -20.78 p=0.00	R^2=0.20 F=431
1996	No. of observation=1378	7.30 t = p=0.00	-.46 t = -16.62 p=0.00	R^2=0.17 F=276
2001	No. of observation=1352	7.44 t = p=0.00	-.36 t =-12.64 p=0.00	R^2=0.10 F=159

All the estimated coefficients of α_1 are precisely determined. Thus it is observed that despite the membership in the staff association women earn 49% less than the men in1991 and the gap reduced to 36% in 2001. One of the reasons of this is probably the active participation of the women in the association to reduce the wage discrimination against them. All the estimated coefficients are jointly statistically different from zero because of High values of the F statistic in all the years. R squared value shows that the percent variation of the dependent variable (natural log of pay) has declined over time (from 20% in 1991 to 10% in 2001).

The discrimination against gender and race

In an attempt to address the 'race issue' in the model, an interaction term will be generated of two binary variables one, is 'sex' and the other one is 'race'. Thus there are four groups of interactive binary variables that have been summarized in the table 8.

Table 8. Binary variables and their interaction terms.

Sex	Race	Interaction term of sex and race
Male	White	Male white
Male	Non-white	Male non white
Female	White	Femwhite
Female	Non-white	Femnonwhite

The ethnic minority group in the UK has been referred to as "Non- white" in the above table. Since there are total of four categories, our base group is the 'Male white', so we the model is the following which includes '3' of the remaining categorical variables.

$$\text{lnpaygu} = \delta + \gamma_1 \text{ femnonwhite} + \gamma_2 \text{ femwhite} + \gamma_3 \text{ malenonwhite} + \text{error term}\ldots\ldots\ldots\ldots(III)$$

Before estimated the above model three interaction terms of two types of binary variables 'sex' and 'race' have been generated. So the estimated coefficients indicate the percentage wage differential between the base group (male white) and the corresponding group in the model.

Table 9. Regression results of equation (III).

Year	Number of observation	Estimated coefficient of δ	Estimated coefficient of γ_1	Estimated coefficient of γ_2	Estimated coefficient of γ_3	R squared & F statistic
1991	N=2527	7.04 t= 414 p=0.00	-.48 t= -5.75 p=0.00	-.59 t= -24 p=0.00	-.04 t= -.52 p=.60	R^2=.19 F= 197
1996	N=2146	7.24 t=360 p=0.00	-.56 t=-5.66 p=0.00	-.56 t=-20 p=0.00	-.06 t=-.55 p=.58	R^2=.16 F=144
2001	N=2197	7.40 t=380 p=0.00	-.43 t=-4.62 p=0.00	-.48 t= 18 p=0.00	-.03 t=-.26 p=.79	R^2=.13 F=113

All the estimated coefficients are simultaneously statistically different from zero, at 1% and 5% level of significance. The percent variation in the logpay due to variation in the independent variable has declined from 19% (1991) to 13% (2001). Estimated coefficients of γ_1, γ_2 and γ_3 represent the percentage wage differential between the base group (which is the malewhite group) and the group associated with the particular coefficient. It is observed that the femalenonwhite group earns 48% less than the malewhite and the gap has not reduced substantially until 2001 where the proportional wage differential is 43% between the two groups. The 'femalewhite' group also earns less than their male counterpart in all the three years, and this gap is no less than the gap with femalenonwhite group .All the estimated coefficients for γ_1 and γ_2 are precisely determined. The estimated coefficients of γ_3 are not statistically different from zero since the t ratios are small enough to accept the null hypothesis that H_o: γ_3=0.

CONCLUSION

The analysis gives emphasis on the 'gender aspect' rather than the 'race aspect'. On the basis of the findings it can be concluded that the extent of 'gender discrimination' in the UK labour market has varied because the choice of the control variables vary from model to model in the regression analysis. The analysis reveals that there is very little evidence that the situation is improving in favour of the women, in most of the cases the situation remained more or less unchanged or slightly deteriorated over the time period 1991 to 2001. For 'unionisation aspect' a favourable result has been obtained for the women. The extent of discrimination is found to be higher in case of first degree compare to higher degree. In case of full-time job the situation has slightly improved compare to the part –time job. The result of the final regression is striking; both the white and non-white women have approximately same

degree of discrimination compare to the malewhite group. Several studies have shown that several minority groups including Black men and women, Hispanic men and women, and white women, suffer from decreased wage earning for the same job with the same performance levels and responsibilities as white males. Numbers vary wildly from study to study, but most indicate a gap from 5 to 15% lower earnings on average, between a white male worker and a black or Hispanic man or a woman of any race with equivalent educational background and qualifications.

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