

Equality Act 2010 Effects on Incomes of Ethnic Minorities



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Introduction

Discrimination in the workplace is a problem for a business as the person who is being discriminated against could be under-employed, resulting in a reduced talent pool for the business if they promote someone who is less able to do the job. At the same time inequality in the workplace has a negative effect on social well-being of those who are discriminated against and a much wider effect on the national economy. According to [ONS analysis](#) on pay gaps by ethnicity, many ethnic groups including Bangladeshi, Pakistani and Arab, consistently earned less during 2012 to 2019 than those of White British ethnicity over the same time period.

To reduce inequalities in the workplace and protect people from discrimination, the government issued *The Equality Act 2010* which states that discrimination or unfair treatment based on certain personal characteristics is against the law in almost all cases. The *Equality Act 2010* applies to discrimination at work based on age, race, sex, gender reassignment, disability, religion or belief, sexual orientation, marriage or civil partnership, pregnancy, and maternity.

This report is designed to present an analysis of incomes of ethnic minorities and how they changed after the *Equality Act 2010* came into force. Included in this report are outcomes of a regression analysis aiming to estimate *The Equality Act 2010* effects by comparing the change in differences in observed incomes between people from ethnic minorities and people of other ethnicities across time periods before and after 2010.

The sections of the report explain the methodology and scope of the analysis, outlines the data and subsets of data used, presents the regression model, the model's variables and their estimated coefficients, interprets the estimates obtained and draws a conclusion.

Key findings

- Net monthly income of an average person of an ethnic minority before the Equality Act 2010 was introduced (specifically, in 2009-2010) was 7.07% lower than incomes of people of any other ethnicity.
- Incomes of ethnic minorities increased on average by 9.53% after the Equality Act was introduced, while the rest of the population saw their incomes increase by 5.33%. This is suggested to be the effect of the Equality Act 2010 under the assumption that incomes of ethnic minorities and other people did not change at different rates for other reasons.
- Women earned less than men by 21.2%, and people with a degree earned 18.09% more than people without a degree on average, given the same amount of education, ethnicity, gender and occupation.
- Incomes vary greatly between occupations. SOC Major Group 7 "Sales and customer service occupations" earn 51.6% less than managerial positions of Group 1 "Managers, directors and senior officials", followed by SOC Major Group 9 "Elementary occupations" with 50.52% income gap with management positions and SOC Major Group 6 "Caring, leisure and other service occupations" with the income gap of 40.73%.
- The estimates of this analysis should be treated with caution as being accompanied by low accuracy and broad confidence intervals being caused by high variability of self-reported data.

Methodology

Pooled Cross Section analysis deployed here is based on a natural experiment. A natural experiment occurs when some exogenous event - often a change in government policy - changes the environment in which individuals, families, firms, or cities operate. A natural experiment always has a control group, which is not affected by the policy change, and a treatment group, which is thought to be affected by the policy change. Unlike a true experiment, in which treatment and control groups are randomly and explicitly chosen, the control and treatment groups in natural experiments arise from the particular policy change. To control for systematic differences between the control and

treatment groups, we need two time periods of data, one before the policy change and one after the change. Thus, the sample is usefully broken down into four groups:

- the control group before the change,
- the control group after the change,
- the treatment group before the change, and
- the treatment group after the change.

Data

As a baseline dataset we used the Understanding Society Survey¹, particularly Wave 01 and Wave 03. The choice of waves was determined by the design of the analysis as field work for Wave 01 happened in 2009-10 and reflects the situation *before* the Equality Act 2010 was introduced while Wave 03 with data collected in 2011-2013 reflects the situation *after* the Equality Act 2010. The actual regression analysis was run on a subset of Understanding Society survey data which included employed respondents between 16 and 60 years old.

The question to be answered

We are seeking to determine effects of Equality Act 2010 on personal incomes of ethnic minorities. The hypothesis is that the personal incomes of people from ethnic minorities will rise after Equality Act 2010 because of reduced discrimination they face in workplaces e.g. more jobs and/or promotions available due to reduced discrimination. So, the question is: *How did personal incomes of ethnic minorities change after the Equality Act 2010?*

Analysis

The model contains variables of interest 'Wave 03', 'Ethnicity' and their interaction term as well as other controls:

$$\text{Model: } \text{LOGMI} = \beta_0 + \delta_0 \cdot \text{W03} + \delta_1 \cdot \text{EMIN} + \delta_2 \cdot \text{W03} \cdot \text{EMIN} + \beta_1 \cdot \text{SOC}_9 + \beta_2 \cdot \text{DEGREE} + \beta_3 \cdot \text{FEMALE} + \beta_4 \cdot \text{WM} + u,$$

where the variables are as follows: *LOGMI* – logarithm of personal monthly net income; *W03* – dummy binary variable for Wave 03; *EMIN* – dummy binary variable indicating if person's ethnicity² is either African, Any other black background, Pakistani, Bangladeshi, Arab, Caribbean or Indian; *W03 · EMIN* – is the interaction term between *EMIN* and *W03*; *SOC₉* – is a categorical variable for nine SOC Major Groups; *DEGREE* – dummy binary variable indicating if a person has degree or higher qualification; *FEMALE* – dummy binary variable indicating if person is female; *WM* – dummy binary variable indicating West Midlands; *u* – error term.

The above controls being included in the model as they are considered to be influential factors of people's income:

¹ Understanding Society, the UK Household Longitudinal Study supporting social and economic research. Its sample size is 40,000 households from the United Kingdom or approximately 100,000 individuals. More information about Understanding Society Survey is available [here](#).

²The variable of 'Ethnicity' is based on Ethnic group variable of Understanding Society Survey. Ethnic group was derived from multiple sources in the Survey (self-reported as adult, self-reported as youth, reported by household member, ethnic group of biological parents), with priority given to self-reported information. Ethnic group includes value labels of British/English/Scottish/Welsh/Northern Irish, any other white background, any other Asian background, African, Irish, Indian, any other mixed background, Caribbean, white and black Caribbean, Pakistani, Bangladeshi, Arab, Chinese, gypsy or Irish traveller, any other ethnic group, white and Asian, any other black background, missing and white and black African.

1. **Gender.** According to the [Office for National Statistics \(ONS\)](#) median pay for all employees was 15.4% less for women than for men in April 2021. Compared with lower-paid employees, higher earners experienced a much larger difference in hourly pay between the sexes. There is a large difference in the gender pay gap between employees aged 40 years and over and those aged below 40 years. The gender pay gap is higher in every English region than in Wales, Scotland and Northern Ireland
2. **Degree.** [Graduate labour market statistics](#) show that 66% of working-age graduates were in high-skilled employment, compared with 78.4% of postgraduates and 24.5% of non-graduates. The median salary for working-age graduates was £35,000 in 2020. This was £9,500 more than non-graduates (£25,500) but £7,000 less than postgraduates (£42,000).
3. **Occupation.** [Gross weekly earnings statistics by Office for National Statistics \(ONS\)](#) show that average (mean) gross weekly earnings vary between occupations from £981 per week for 'Managers, directors and senior officials' (Major group 1 of SOC 2010) to £403 per week for occupations in 'Caring, leisure and other services (Major group 7 of SOC 2010).
4. **Region.** The dummy variables for geographical regions were used in the model to explore differences in incomes in the West Midlands as the region of interest and London as a salient outlier which may potentially cover part of the variation in regional incomes.

Parameters of the model were estimated by regression analysis (OLS) using the data pooled over two waves. The estimates for the model are presented in Table 1 for four iterations of the model where we tried several combinations of various controls.

Table 1 Results table for pooled cross section regression analysis.

Dependent variable: <i>LOGMI</i>	Iteration 1 Basic model	Iteration 2 Standard model	Iteration 3 Standard model +PAY	Iteration 4 Standard model + PAY – outliers, proxies and inapplicable answers
Independent variables	1	2	3	4
Intercept	7.2264	7.6084	7.3057	7.3331
Wave03	0.0500	0.0519	0.0542	0.0297
EMIN	-0.1519	-0.0733	-0.0642	-0.0363
Wave03 * EMIN	0.0346	0.0391	0.0418	0.0330
SOC_9 (Reference group is SOC Major group 1 'Managers, directors and senior officials') for SOC 2010 Major groups:				
T2 'Professional occupations'	X	-0.0423	-0.0414	-0.0104
T3 'Associate professional and technical occupations'	X	-0.1848	-0.1793	-0.0453

T4 'Administrative and secretarial occupations'	X	-0.3891	-0.3776	-0.0680
T5 'Skilled trades occupations'	X	-0.4014	-0.3649	-0.0790
T6 'Caring, leisure and other service occupations.'	X	-0.5232	-0.5013	-0.0415
T7 'Sales and customer service occupations.'	X	-0.7265	-0.6923	-0.1125
T8 'Process, plant and machine operatives'	X	-0.3926	-0.3708	-0.0822
T9 'Elementary occupations'	X	-0.7037	-0.6694	-0.0721
DEGREE	0.3898	0.1663	0.1537	0.0232
FEMALE	-0.2990	-0.2382	-0.2460	-0.0323
LONDON*	X	X	X	0.0272
WM	X	-0.0313	-0.0339	X
MARRIED	X	X	X	0.0162
LOGPAY	X	X	0.0456	0.7295
GOOD (excludes proxy and inapplicable answers)				-0.1208
R-squared	0.171	0.318	0.343	0.738
Subset used / Filters applied	Aged 16-60, Employed, SOC_9 != 0, MI > 70			

Estimates in **highlighted yellow** are marginally significant.

*LONDON is a dummy binary variable indicating if a person lives in London. *Being included in the model along with dummy for West Midlands, it was showing considerable multicollinearity and was excluded from the model in favour of the West Midlands as the region of interest.*

Interpretations of estimates of Standard Model (Iteration 2, Table 1, col. 2)

To interpret the estimates of the coefficients we need to exponentiate them as dependent variable *MI* of the model is log transformed and exponentiation is the inverse of logarithm function.

The intercept

The intercept, β_0 , is the log of mean personal monthly income when values of all dummy variables included into the model are equal to zero, so for their reference groups. Therefore, the exponentiated value of β_0 is the geometric mean of personal monthly net income in Wave 01, for an average person whose ethnicity *does not* belong to those ethnicities specified in variable *EMIN*, who are males, *without* a degree or any higher qualification, who lives *not* in West Midlands and whose occupation are among SOC Major Group 1 "Managers, Directors and Senior Officials" (as this is the reference group for variable *SOC_9*).

This exponentiated value of β_0 is

$$\exp(\beta_0) = \exp(7.6084) = \text{£ } 2015 \text{ per month}$$

Parameters at W03, EMIN and W03 · EMIN.

The parameter δ_0 at W03 captures changes in all monthly incomes in UK in the period of Wave 03 compared to period of Wave 01. To know what happens to the outcome variable of net monthly personal income *MI* we again need to exponentiate the regression coefficient:

$$\exp(\delta_0) = \exp(0.0519) = 1.0533$$

This says that every one-unit increase in W03 results in a 1.0533 increase of monthly income. In other words, for every one-unit increase in W03, *MI* increases by about 5.33%. (To get 5.33%, we need to subtract 1 from the exponentiated value of the parameter and multiply the result by 100). Which implies that in Wave 03 (“1” for dummy variable W03) monthly net incomes increased on average by 5.33% compared to Wave 01 (“0” for dummy variable W03).

The parameter δ_1 at variable *EMIN* captures differences in net monthly incomes between a person of ethnic minority and the rest of the sample. Again, we need to exponentiate this coefficient to interpret it:

$$\exp(\delta_1) = \exp(-0.0733) = 0.9293$$

which suggests that monthly net income of an average person of ethnic minority in Wave 01 was 7.07% $((0.9293 - 1) \cdot 100\% = -7.07\%)$ lower than incomes of people with any other ethnicity. The coefficient δ_1 measures the ethnicity effect that is *not* due to changes that happened after the Equality Act 2010 was introduced, and it evidences the difference between incomes of ethnic minorities and any other ethnicities in 2009-2010 – at the time when data for Wave 01 was collected.

The parameter of interest is δ_2 at the interaction term *W03 · EMIN* as it captures the growth of incomes of ethnic minority people due to the Equality Act 2010, provided we assume that incomes of ethnic minorities and other people did not change at different rates for other reasons.

To see how incomes of ethnic minorities changed over two waves we will go through some calculations:

1. We set all independent variables at the values of their reference groups so that changes we are looking to estimate will be changes of net monthly income of the average person whose ethnicity belong to those specified by variable *EMIN* and who:
 - a. Has occupation of SOC Major group 1 “Managers, directors and senior officials”, as this is the reference group for variable $SOC_9 = 1$
 - b. Has *no* degree, as this is the reference group for variable $DEGREE = 0$
 - c. Is male, as this is the reference group of variable $FEMALE = 0$
 - d. Does *not* live in the West Midlands – the reference group of variable $WM = 0$
2. Now we rewrite the model with estimated coefficients of *EMIN*, *W03* and *W03 · EMIN* while keeping all other variables at the same values, - in these calculations at the level of their reference groups (however the outcome will be the same as long as levels of other factors are the same):

- a. For Wave 01 with the field work happened in 2009-2010 years where $W03 = 0$ and $EMIN = 1$:

$$\begin{aligned} LOGMI_{Wave01} &= \beta_0 + \delta_0 \cdot (W03 = 0) + \delta_1 \cdot (EMIN = 1) + \delta_2 \cdot (W03 = 0) \cdot (EMIN = 1) + \beta_1 \cdot (SOC_9 \\ &= 0) + \beta_2 \cdot (DEGREE = 0) + \beta_3 \cdot (FEMALE = 0) + \beta_4 \cdot (WM = 0) + (u = 0), \end{aligned}$$

$$\Rightarrow LOGMI_{Wave01} = \beta_0 + \delta_1,$$

- b. For Wave 03 with the field work happened in 2011-2013 years where $W03 = 1$ and $EMIN = 1$:

$$LOGMI_{Wave03} = \beta_0 + \delta_0 \cdot (W03 = 1) + \delta_1 \cdot (EMIN = 1) + \delta_2 \cdot (W03 = 1) \cdot (EMIN = 1) + \beta_1 \cdot (SOC_9 = 0) + \beta_2 \cdot (DEGREE = 0) + \beta_3 \cdot (FEMALE = 0) + \beta_4 \cdot (WM = 0) + (u = 0),$$

$$\Rightarrow LOGMI_{Wave03} = \beta_0 + \delta_0 + \delta_1 + \delta_2$$

3. To work out the difference between $LOGMI_{Wave01}$ and $LOGMI_{Wave03}$ we will subtract the former from the latter:

$$LOGMI_{Wave03} - LOGMI_{Wave01} = (\beta_0 + \delta_0 + \delta_1 + \delta_2) - (\beta_0 + \delta_1),$$

And after β_0 and δ_1 have been cancelled out and remaining coefficients have been substituted with their estimates:

$$\begin{aligned} \Rightarrow LOGMI_{Wave03} - LOGMI_{Wave01} &= \beta_0 + \delta_0 + \delta_1 + \delta_2 - \beta_0 - \delta_1, \\ &= \delta_0 + \delta_2 = 0.0519 + 0.0391 = 0.091 \end{aligned}$$

4. To work out the argument ΔMI of the logarithm we'll exponentiate both sides of the equation:

$$MI_{Wave03} - MI_{Wave01} = \exp(0.091) = 1.0953$$

This means that over two waves, incomes grew on average by 9.53% for an average person of ethnic minority with the occupation of the same SOC Major group, same gender (FEMALE variable), same level of DEGREE variable (meaning that person will have or haven't a degree), and the same value for the region variable WM (the similarity in this case will mean if the person lives in the West Midlands (WM=1) or outside of the West Midlands (WM=0)).

Other independent variables

Categorical variable SOC_9 (Elementary occupations)

While interpreting coefficients at categorical term SOC_9 , we need to bear in mind that the effects on the dependent variable will be shown compared to the reference group which is SOC Major Group 1 "Managers, directors and senior officials" in this model.

In the output table 1, the coefficients are labelled with category names which are numbers of SOC major groups from 2 to 9. The exponentiated values of the coefficients and average percent change in net monthly income are presented in table 2:

Table 2 Estimated coefficients for categorical variable SOC_9 and their exponentiated values as average percent change in monthly income compared to the reference group of SOC Major Group 1 "Managers, directors and senior officials"

Category name	β_1 at category name	Exponentiated β_1	Average percent change in <i>Monthly Income</i> compared to reference group (SOC Major Group 1)
			(Exponentiated $\beta_1 - 1$) * 100%
T2 'Professional occupations'	-0.0423	$\exp(\beta_1) = \exp(-0.0423) = 0.9586$	-4.14%
T3 'Associate professional and technical occupations'	-0.1848	$\exp(\beta_1) = \exp(-0.1848) = 0.8313$	-16.87%

T4 'Administrative and secretarial occupations'	-0.3891	$\exp(\beta_1) = \exp(-0.3891) = 0.6777$	-32.23%
T5 'Skilled trades occupations'	-0.4014	$\exp(\beta_1) = \exp(-0.4014) = 0.6694$	-33.06%
T6 'Caring, leisure and other service occupations.'	-0.5232	$\exp(\beta_1) = \exp(-0.5232) = 0.5926$	-40.73%
T7 'Sales and customer service occupations.'	-0.7265	$\exp(\beta_1) = \exp(-0.7265) = 0.4836$	-51.64%
T8 'Process, plant and machine operatives'	-0.3926	$\exp(\beta_1) = \exp(-0.3926) = 0.6753$	-32.47%
T9 'Elementary occupations'	-0.7037	$\exp(\beta_1) = \exp(-0.7037) = 0.4948$	-50.52%

Estimates of the coefficient β_1 vary greatly between occupations and all estimates are negative, which implies that all occupations earn less than the SOC Major Group 1 "Managers, directors and senior officials" occupations.

The biggest gap is between SOC Major Group 7 "Sales and customer service occupations" – these occupations earn 51.64% less than managerial positions of Group 1. This is followed by SOC Major Group 9 "Elementary occupations" with 50.52% less in net monthly income than otherwise equal management positions and SOC Major Group 6 "Caring, leisure and other service occupations" with the income gap of 40.73%.

Dummy variables *DEGREE*, *FEMALE* and *WM*

Dummy variables are binary variables; their coefficients represent the difference in the intercept between groups.

Gender

Because *FEMALE* = 1 when the person is female, and *FEMALE* = 0 when the person is male, the parameter β_3 has the following interpretation: β_3 is the difference in net monthly income between females and males, given the same amount of education, ethnicity, region, year and occupation (and the same error term u). Thus, the coefficient β_3 determines whether there is discrimination against women: if $\beta_3 < 0$, then for the same level of other factors, women earn less than men on average.

$$\exp(\beta_3) = \exp(-0.2382) = 0.7881$$

and therefore, we conclude that women earn less than men on average by $(0.7881 - 1) \cdot 100\% = -21.2\%^3$.

People with and without a degree

The dummy variable *DEGREE* equals unity when a person has either degree or any higher qualification and equals zero in any other case. The coefficient β_2 therefore represents the difference in net monthly income between these two groups given the same level of all other factors included in the model. After the exponentiation we obtain the absolute value of β_2

$$\exp(\beta_2) = \exp(0.1663) = 1.1809,$$

which implies that people with a degree, on average earn 18.09% more in net monthly income compared to those without a degree.

West Midlands residents

The dummy variable *WM* indicates if a person lives in the West Midlands $WM = 1$, or not, in this case $WM = 0$. The coefficient β_4 represents the regional effect on monthly incomes. Exponentiated value of β_4 is

³ The mode of employment is not factored in in this model. The fact that more females work part-time than men and consequent effects on their incomes are part of the estimated 21.2%.

$$\exp(\beta_4) = \exp(-0.0313) = 0.9692,$$

This implies that West Midlands residents on average earn $(0.9692 - 1) \cdot 100\% = -3.08\%$ less compared to people from other regions.

Conclusions

This analysis sheds light on how the incomes of ethnic minorities changed after the Equality Act 2010 was implemented.

The regression model includes personal net monthly income as a dependent variable and dummy variables for ethnic minority showing if the respondent's ethnicity is either African, Any other black background, Pakistani, Bangladeshi, Arab, Caribbean or Indian and before/after treatment indicator. The model controls for gender, higher education and occupation.

The Understanding Society survey was used as a data source for this analysis. The survey is self-reported data where people provided estimates of their incomes and other information, or in some cases they report on behalf of other household's members. This results in high variability of the data. In terms of regression analysis, high variability of the data implies that in many iterations the obtained estimates came along with low R-squared and wide prediction intervals. Excluding outliers, proxy and inapplicable responses results in significant increase in R-squared (from 0.3 to 0.7) but with residuals jeopardised and consequent violation of normality of residuals and heteroscedasticity assumptions. This makes the estimates insignificant and therefore unreliable. Thus, Iteration #4 returns a high R-squared of 0.738 accompanied by marginally significant coefficient estimates for some predictors.

In view of the above, this report interprets the second iteration of the model with all predictors significant and low R-squared and provides information about the response in the incomes even though data points fall further from the regression line.

The outcomes of regression analysis show that incomes of ethnic minorities increased on average by 9.53% after the Equality Act was introduced, while the rest of the population saw their incomes increase by 5.33%. This is suggested to be the effect of Equality Act 2010 provided that we assume that incomes of ethnic minorities and other people did not change at different rates for other reasons.

Monthly net income of an average person of an ethnic minority before the policy was introduced (in Wave01) was 7.07% lower than incomes of people of any other ethnicity.

Women earned less than men by -21.2% and people with a degree earned 18.09% more than people without a degree on average, given the same amount of education, ethnicity, gender and occupation.

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