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The true returns to the choice of occupation and education

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Abstract

Which occupations are best for wellbeing? There is a large literature on earnings differentials, but less attention has been paid to occupational differences in non-pecuniary rewards. However, information on both types of rewards is needed to understand the dispersion of wellbeing across occupations. We analyse subjective wellbeing in a large representative sample of UK workers to construct a measure of “full earnings”, the sum of earnings and the value of non-pecuniary rewards, in 90 different occupations. We first find that the dispersion of earnings underestimates the extent of inequality in the labour market: the dispersion of full earnings is one-third larger than the dispersion of earnings. Equally, the gender and ethnic gaps in the labour market are larger than data on earnings alone would suggest, and the true returns to completed secondary education (though not to a degree) are underestimated by earnings differences on their own. Finally, we show that our main results are similar, and stronger, for a representative sample of US workers.

Key words: occupation, wages, non-pecuniary benefits, inequality

JEL codes: I31; J31

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1 Introduction

The distribution of rewards to labour is a fundamental issue in economics. In the labour market, this corresponds to the distribution of the rewards from the job. While there is an extremely large literature on wages, the focus on monetary earnings misses out the value and distribution of non-pecuniary rewards (Williams and Zhou, 2020). The theory of compensating differentials (Rosen, 1986) suggests that these latter are negatively correlated with wages (so that measuring monetary earnings alone overstates inequality on the labour market). But it is just as likely that workers will prefer to take their labour-market rents partly in monetary form and partly in non-monetary form: in this case the monetary and non-monetary value of jobs will move hand in hand.

Research on wages and non-pecuniary amenities in the labour market has largely been inconclusive (Brown, 1980; Krueger and Summers, 1986, 1988; Carruth et al., 2004; Clark and Senik, 2006; Fehr and Gächter, 2008). One major difficulty is that many of the amenities that workers find important are unobservable or, if observable, measured with error. Even if measurable and accurate, we need to know how important they are to workers in order to make statements about the value of labour-market amenities.

The challenges are therefore substantial. We here propose to capture the job amenities that matter to workers, and to account for the different values that they may put on them, by outsourcing the task to the workers themselves. The wellbeing (net of income) associated with each occupation, as reported by those who work in it, measures the value of its non-pecuniary job amenities. The sum of monetary earnings and the value of non-pecuniary amenities yields a measure of full earnings on the labour market.

We carry out this calculation in large representative samples of the UK population, measuring occupation at the 3-digit level. There is substantial variation in both earnings and the non-pecuniary aspects of occupations, and the two are positively correlated. The standard deviation of full earnings is one third larger than the documented dispersion in wages, so that labour-market inequality calculated from wages only is an underestimate. This general conclusion also applies to the gaps between demographic groups. The full earnings gap by gender and ethnicity is larger than that in wages, and the returns to education are higher. We reproduce these findings in 30 years of American data.

The remainder of the paper is organised as follows. Section 2 describes the data and Section 3 the summary figures for earnings inequality. Section 4 discusses how the ranking of occupations changes as we move from earnings to full earnings, and Section 5 how these rankings depend on education. Section 6 reconsiders the returns to education in the light of full earnings, and Section 7 the gender and ethnic gaps on the labour market. Section 8 discusses the correlation between earnings and job amenities, and Section 9 presents the US results. Last, Section 10 concludes.

2 Data

To measure full-earnings, we require not only data on income from work but also a means of calculating the monetary value of the non-pecuniary aspects of different jobs. We will establish the latter from the relationship between a summary measure of well-being (life satisfaction) and dis-aggregated occupations, holding labour earnings and some exogenous individual characteristics constant.

Our main source of data is the Annual Population Survey (APS)¹, a large representative repeated

¹More information about the APS can be found at <https://www.ons.gov.uk/>.

cross-section survey of the UK population. The APS started in 2004, and its main purpose is to provide information on important social and socio-economic variables at local levels, including on a wide range of labour-market outcomes, as well as housing, ethnicity, religion, health, and education. The APS uses data from the Labour Force Survey (LFS), giving it the largest coverage of any UK household survey. We make use of the five most-recent APS waves (2014-2018), which contain detailed information on all of the questions relevant to our analysis.

Our sample consists of respondents aged 18 to 65 who are in full-time employment. We apply this latter restriction as the earnings distribution has a different significance for full and part-time workers. We also exclude the self-employed, as both the earnings and non-pecuniary amenities of this group are to a large extent within their control. Of the 18-65 age group in employment, 85% are employees, 14% self-employed, and 1% are unpaid family workers or part of a government training scheme. Employees are then divided into 75% full-time and 25% part-time. Finally, we drop those respondents whose reported hourly wage is in the bottom 1% in the distribution of earnings. Our final sample from the five APS waves contains information on roughly 210,000 full-time employees.²

Our key outcome variable is life satisfaction. Following the OECD Guidelines, we use life satisfaction as a summary measure of overall individual well-being. We mostly focus on life satisfaction, as opposed to job satisfaction, because it is the former that matters to individuals when they make choices over their lives, not the satisfaction felt in only one domain of their lives. Since 2011, the UK Office for National Statistics (ONS) has been asking APS respondents four personal wellbeing questions and the answers are considered to be official national statistics. The first of these wellbeing questions refers to life satisfaction. Respondents are asked “Overall, how satisfied are you with your life nowadays?”, with answers on an 11-point scale (0 corresponding to “not at all satisfied” and 10 to “completely satisfied”). Our sample of full-time employees reports an average life satisfaction score of 7.76, with a standard deviation of 1.43.³

Earnings are measured by the logarithm of real hourly earnings. Hourly earnings in the APS are a derived variable, based on responses to gross weekly earnings and to usual hours of work and paid overtime. All earnings figures in this paper are deflated using the UK Consumer Price index to produce real figures. The sample mean value of real log hourly earnings is 2.64 (corresponding to hourly pay of £14.01), with a standard deviation of 0.51. We use a relatively dis-aggregated measure of occupation, at the 3-digit level in the SOC2010 classification. This produces over 90 different occupations. A detailed account of the SOC2010 classification is provided in Appendix C.

The APS also contains information on individual demographics and employment-related variables. Our empirical analysis will focus on gender, age, ethnicity, and education. Gender is a dummy variable taking on the value “1” for women and “0” for men, age will be entered as a quadratic in the empirical analysis, and there are 11 ethnicity categories. One of our main variables of interest here is educational attainment, which we code as follows: (1) respondents with a degree, (2) respondents with other higher education (but not a degree) or A-level qualifications, and (3) respondents with GCSE qualifications or

²There are initially 1,480,000 observations in the five APS waves we use. Restricting the sample by age and to those in employment brings this figure down to 630,000; keeping only full-time employees further reduces the sample to 460,000 observations. The remaining observations are lost due to non-response. Earnings data is missing for about 150,000 people, and another 100,000 have missing values for (mostly) life satisfaction or some of the demographics in Table 1. This produces a final analysis sample of 210,000.

³Slightly above the figure of 7.67 for all ages and labour-market statuses in the UK over the same period: see <https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/methodologies/personalwellbeingquarterlyestimatestechnicalreport#annual-personal-well-being-estimates>.

lower. These three categories broadly correspond to 16 (or more) years of education, 13 years, or 11 years (the minimum amount of compulsory education in the UK, from ages 5 to 16). Additional information on educational classifications in the UK is provided in Appendix B. The descriptive statistics for life satisfaction, demographics and earnings in our APS sample appear in Appendix Table A1.

One limitation of the Annual Population Survey is that it is a cross-section, so that individuals cannot be followed over time. We thus complement our cross-sectional analysis with the analysis of panel data from Understanding Society.⁴ This survey started in 2009, and interviews around 40,000 households per year. We will here make use of all of the nine available waves of Understanding Society.

Understanding Society measures both respondent life satisfaction and job satisfaction, coded on a 7-point scale where an answer of 1 corresponds to "completely dissatisfied" and an answer of 7 to "completely satisfied". The survey also includes information on gender, age, ethnicity and education, as well as occupation, using the ISCO88 classification coded at the 3-digit level.⁵ The logarithm of hourly earnings is calculated from individual monthly labour earnings and hours worked, including paid hours of overtime work, and deflated by the Consumer Price Index. Table A2 lists the descriptive statistics for the key variables in Understanding Society.

3 The Interpersonal Dispersion of Full Earnings

We begin our analysis by asking how individual wellbeing is related to personal characteristics, earnings, and occupation. We estimate the following equation:

$$W_{ij} = \alpha_0 + \alpha_1 X_i + \alpha_2 \text{LogEarnings}_i + \sum_j \alpha_3^j \text{Occupation}_{ij} + \tau_t + \varepsilon_{ij} \quad (1)$$

where W_{ij} is the life satisfaction of the i -th individual in the j -th occupation. X_i is a vector of exogenous control variables (gender, ethnicity, and a quadratic term in age). LogEarnings_i is the logarithm of respondent hourly pay and there is a dummy variable for each occupation j . The α_3^j coefficients capture the non-pecuniary advantage of each occupation j . τ_t is a wave fixed effect.

In order to evaluate the interpersonal dispersion of full earnings across occupations, we combine each respondent's logarithm of hourly earnings with the monetary value of the non-pecuniary advantages of the occupation in which they work. We thus re-write equation (1) as:

$$W_{ij} = \alpha_0 + \alpha_1 X_i + \alpha_2 \text{FullEarnings}_{ij} + \tau_t + \varepsilon_{ij} \quad (2)$$

where full earnings is given by:

$$\text{FullEarnings}_{ij} = (\text{LogEarnings}_i + \sum_j \frac{\alpha_3^j}{\alpha_2} \text{Occupation}_{ij}) \quad (3)$$

⁴More information about Understanding Society can be found at <https://www.understandingsociety.ac.uk/>.

⁵Understanding Society uses dependent interviewing, where for some variables individuals are supplied with the information that they provided at the previous wave: see Lynn and Sala (2006). This is the case for occupation. Perales (2014) calculates occupational-mobility rates in the predecessor of Understanding Society, the British Household Panel Survey, before and after the introduction of dependent interviewing in 2006. He finds a very sharp fall in occupational mobility, suggesting that dependent interviewing reduced measurement error.

Equation (3) shows that the full earnings of each worker are composed of a monetary element and a term capturing the non-pecuniary aspect of occupations. The former is $LogEarnings_i$ and the latter is the coefficient α_3^j for each occupation j transformed into monetary terms when divided by α_2 . Table 1 presents the estimation results for Equation (1), showing how individual life satisfaction is correlated with exogenous personal characteristics, earnings and occupation, with earnings being the logarithm of hourly pay.⁶ To make the interpretation of the coefficients on the occupation dummies easier, and avoid having to interpret each α_3^j relative to some baseline occupation, we follow Krueger and Summers (1988) and express the occupation coefficients as deviations from an employment-share-weighted mean.⁷ This regression explains about 2% of the variation in life satisfaction. This rather low R^2 figure reflects both our frugal set of right-hand variables and that we analyse a homogeneous group: adults aged 18 to 65 in full-time employment.

Table 1: An Equation of Predicted Life Satisfaction

	Life Satisfaction (0-10)
Log Earnings	0.250*** (0.010)
Female	0.057*** (0.010)
Age	-0.050*** (0.003)
Age-squared/100	0.050*** (0.003)
Occupation & Ethnicity	Yes
Wave fixed effects	Yes
R^2	0.02
F-value	21.49
N	209,672
SD dependent	1.43

Source: Annual Population Survey.

Notes. These are OLS regressions. Life satisfaction is measured on an 11-point scale, where 0 corresponds to “not at all satisfied” and 10 to “completely satisfied”. “Log earnings” is the logarithm of hourly earnings. The regression controls for 90 different occupations, at the 3-digit level using the SOC2010 classification. The sample is respondents aged 18 to 65 in full-time employment in five waves of APS data (2014-2018), excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. Heteroskedasticity-adjusted robust standard errors appear in parentheses. The sample is weighted using the *NPWT18* population weights in the Annual Population Survey, designed for performing analysis on the sample completing wellbeing ques-

⁶In unreported robustness checks we also added partner status and education to the list of personal characteristics, and find that the estimated coefficient on earnings becomes somewhat smaller, but remains robust to this alternative specification. Equally, our results remain unchanged by the use of the logarithm of monthly, as opposed to hourly earnings.

⁷One potential issue with this approach is that the standard errors on the occupation dummies may be downward-biased in small samples. Haisken-DeNew and Schmidt (1997) show that this is not a concern in large samples, where the standard errors are virtually equivalent to those estimated by dropping a reference category. Our analysis sample here easily exceeds their definition of a large sample and, as expected, the standard errors using the two methods are very similar.

tions. Significance levels: *** $p < .01$, ** $p < .05$, * $p < .1$.

The estimated coefficient on the logarithm of earnings is 0.250. This is a fairly standard type of figure. It implies that doubling hourly earnings would increase life satisfaction by 0.175 on the 11-point scale (as doubling earnings causes log earnings to rise by 0.7), corresponding to 0.12 of a standard deviation of life satisfaction. Women report higher life satisfaction than do men in the APS data (this is also a common finding), although the estimated coefficient is not large. The estimated age relationship is U-shaped relationship between life satisfaction and age in the APS data, as is very often found in the empirical subjective well-being literature. The size of the age coefficients are such that, holding all else constant, life satisfaction is estimated to drop by just under 0.2 points between the ages of 30 and 50.

The estimated coefficients (α_3^j) on the 90 occupation dummies in Table 1 capture the non-pecuniary aspects of work. We divide these coefficients by the coefficient on the logarithm of earnings α_2 : the resulting coefficient $\frac{\alpha_3^j}{\alpha_2}$ measures the non-pecuniary aspects of occupations in units of log earnings.

Table 2 presents information on the standard deviation of earnings, the non-pecuniary job rewards ($\frac{\alpha_3^j}{\alpha_2}$), and full earnings. The distribution of rewards on the labour market is substantially larger once we take their non-pecuniary element into account. The interpersonal dispersion in terms of earnings is 0.51, but that of full earnings is one third higher, with a standard deviation of 0.68.⁸

Table 2: Important Standard Deviations

	Log earnings	α_3^j/α_2	Full earnings
SD	0.51	0.38	0.68

Source: Annual Population Survey.

Notes. These figures are calculated for respondents aged 18 to 65 in full-time employment in five waves of APS data, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. “Log earnings” is the logarithm of hourly earnings. α_3^j/α_2 are the non-pecuniary work rewards estimated in Equation (1) divided by the coefficient on log earnings. Our measure of full earnings is described in Equation (3).

The source of this substantial difference can easily be understood by noting that:

$$\text{Var}(\text{FullEarnings}) = \text{Var}(\text{LogEarnings}) + \text{Var}(\alpha_3^j/\alpha_2) + 2\text{Cov}(\text{LogEarnings}, \alpha_3^j/\alpha_2)$$

where the covariance is given by

$$\text{Cov}(\text{LogEarnings}, \alpha_3^j/\alpha_2) = \text{SD}(\text{LogEarnings}) \cdot \text{SD}(\alpha_3^j/\alpha_2) \cdot \rho(\text{LogEarnings}, \alpha_3^j/\alpha_2)$$

Since the correlation ρ is equal to 0.14,

$$\text{Var}(\text{FullEarnings}) = 0.51^2 + 0.38^2 + 2 \cdot (0.51) \cdot (0.38) \cdot (0.14) = 0.68^2$$

⁸These figures are more correctly the dispersion of real earnings over both individuals and the five waves of the APS. The single-year figures, which reveal only the dispersion between individuals, are almost identical.

Table 2 underlines that there is greater dispersion in earnings (0.51) in the UK labour market than in non-pecuniary job rewards (0.38). It may not be surprising that the impact of non-pecuniary work attributes on life satisfaction is less than that of earnings. While individuals' earnings affect many domains of their life, and are so relevant outside of work, work amenities may be less important for non-work aspects of life.

The APS survey is cross-sectional, and the above results could be biased if individuals in different occupations have different unobserved personal characteristics. In Figure A1, those with higher ability will take part of their labour-market reward in earnings and part in amenities. This can easily produce a positive correlation between amenities and earnings in cross-section analysis that cannot adequately control for (unobserved) ability.

We address the question of unobserved ability with panel data from Understanding Society. By adding individual fixed effects to Equation (1) we control for any time-invariant unobserved individual characteristics, and identify the occupational coefficients from those individuals who switch occupations over time. For comparison purposes, we adjust the 7-point scale measure of life and job satisfaction in Understanding society to be on an 11-point scale, where 0 corresponds to "not at all satisfied" and 10 corresponds to "completely satisfied".⁹ The first two columns of Table A3 show that the Understanding Society cross-section standard deviations of earnings, of non-pecuniary amenities, and of full earnings are remarkably similar to those in the cross-section APS.

We then ask how these results change when introducing individual fixed effects in Equation (1). Table A3 reveals that the standard deviations of the un-adjusted non-pecuniary attributes α_3^j are actually similar both with and without individual fixed effects (0.15 in the cross-section and 0.17 in the panel), so that individual selection into different occupations is not the main driver of this variation.

Despite the similarity in the standard deviations of the α_3^j 's, the standard deviations of the α_3^j/α_2 's in Table A3 (i.e. the non-pecuniary attributes translated into monetary terms) do differ between the cross-section and the panel (at 0.32 and 0.80, respectively). This reflects the lower value of α_2 in the panel regressions than in the cross-section: smaller earnings coefficients in panel regressions are common in existing research, and may partly reflect greater measurement error in panel data. Consequently, the dispersion in full earnings is also one-third larger in the panel than in the cross-section.

Our main analysis is in terms of life satisfaction. The Understanding Society survey also includes information on job satisfaction, and we suspect non-pecuniary work attributes to be more important in the work than in the life setting. In the analysis of life satisfaction in Table A3, there is greater dispersion in earnings than in non-pecuniary job aspects in both APS and Understanding Society data. On the contrary, the analysis of job satisfaction in columns 4 and 5 of Table A3 produces much larger standard deviations in non-pecuniary work rewards. Notably, in both the cross-section and the panel job satisfaction analysis, the standard deviation of work amenities is substantially larger than that of log earnings.

4 Full Earnings in Different Occupations

We now compare individual occupations in terms of full earnings, and compare this ranking to that obtained using only information on hourly pay. This comparison will indicate the role of non-pecuniary amenities in the well-being experienced by workers in different occupations.

⁹We do so by deducting one from the Understanding Society 1-7 satisfaction score, and then multiplying the resulting number by 10/6.

Figure 1 depicts the earnings and full earnings in a number of occupations: we here only plot the results for occupations employing at least 0.17% of the respondents¹⁰ to deal with potential outliers. To avoid choosing an arbitrary baseline, the non-pecuniary aspects of each occupation are expressed in terms of deviations from the sample mean. Full earnings, which are the sum of hourly earnings and the monetary value of the non-pecuniary amenities in that occupation, are represented by the horizontal bars; hourly earnings are represented by the black crosses. The gap between hourly and full earnings then reveals the monetary value of non-pecuniary amenities in that occupation. A black cross that is to the right of the bar indicates a below average value of amenities in that occupation.

Overall, full earnings are correlated with earnings: there is a broad negative trend in both when reading from the top to the bottom of Figure 1. Some low-paid occupations such as customer service, shop assistants, and low-skilled laborers also have the worst non-pecuniary aspects, resulting in full earnings that are lower than actual earnings. Equally, a number of occupations towards the top of Figure 1 have both high earnings and a positive value of amenities. This reflects our finding in Table 2 that accounting for amenities increases the standard deviation of rewards on the labour market. However, the correlation is far from perfect. For example, some elementary construction and agricultural workers have higher full earnings once the value of amenities is taken into account.

The patterns in Figure 1 underline the importance of carrying out the analysis at the 3-digit level. In the first 1-digit group (Managers, Directors and Senior Officials), full earnings are systematically larger than earnings. But in the second group (Professional Occupations), some 3-digit occupations have full earnings above earnings (Health and Teaching), while for others (in Business), the inequality is opposite. The same point can be made in a number of other 1-digit occupational groups.

As the gap between monetary earnings and full earnings widens when introducing individual fixed effects (as can be seen from columns 2 and 3 in Table A3), Figures A2 and A3 in the appendix replicate Figure 1 in cross-section and panel estimations respectively using Understanding Society data.¹¹ The coefficients in the panel analysis are determined by respondents who switch occupations, and as such can be noisy in occupations where respondents do so only infrequently. Figures A2 and A3 hence illustrate the 30 most-popular occupations in our data. While there are substantial differences between the two figures, the gap between earnings and full earnings is broadly wider in the panel analysis in Figure A3 than in the cross-section analysis in Figure A2, reflecting the larger standard deviation of full earnings in panel as opposed to the cross-section, as seen in Table A3. The correlation coefficient between the α_3^j 's in the cross-section and α_3^j 's in the panel shows the extent to which the “best occupations” in the cross-section remain the “best occupations” in the panel. We find this correlation coefficient to be 0.42 when looking at the 30 most-popular occupations. This figure likely reflects the additional noise in panel estimation, and the fact that those workers who switch occupations are not always representative of the sample.

In Appendix D we evaluate how different job attributes feed into both the monetary and non-monetary components of full earnings, by complementing our sparse set of job characteristics from the APS with richer occupation-level data from the Labour Force Survey (LFS) and the Workplace Employment Relations Study (WERS).

¹⁰This figure refers to the 1st percentile in terms of the share of employment: five occupations fall below this level.

¹¹Understanding Society uses the ISCO88 occupational classification. The occupations listed in Figures A2 and A3 do not then have a one-to-one correspondence with the those in Figure 1. The Understanding Society Figures illustrate how full occupational earnings change once individual fixed effects are taken into account.

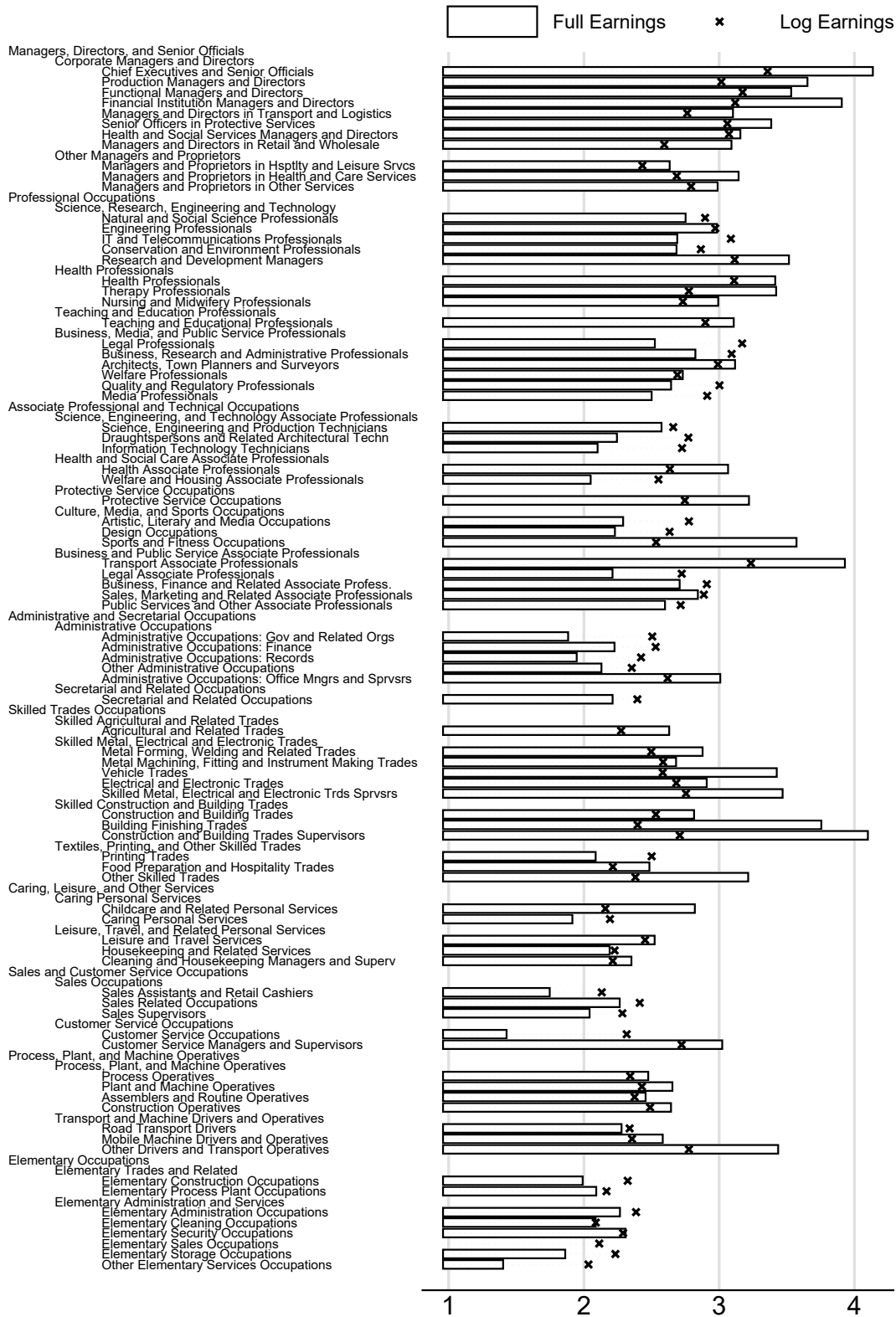


Figure 1: Earnings and Full Earnings in Different Occupations

Source: Annual Population Survey.

Notes. Occupations are listed in the order of the SOC2010 classification: the left-most entries show the 1-digit classification, the first indent the 2-digit classification, and the right-most entries that at the 3-digit level. It is for these latter that log earnings and full earnings are depicted. To avoid outliers, we do not plot occupations under the 1st percentile in terms of share of the population employed. To avoid choosing an arbitrary baseline, the non-pecuniary aspects of each occupation are expressed in terms of deviations from the sample mean. The figure is based on respondents aged 18 to 65 in full-time employment in five waves of APS data, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution.

5 Full Earnings in Different Occupations: by Educational Attainment

While Figure 1 provides insights into how earnings and non-pecuniary amenities differ across occupations, it does not address that not all occupations are equally available to all individuals. In particular, educational attainment plays a large part in determining career trajectories and the jobs that people occupy. Furthermore, even within the same occupation, higher-educated respondents will likely have different roles and responsibilities, access to amenities, and earnings.¹²

We address this heterogeneity by classifying respondents into three educational-attainment categories: those who have tertiary degrees (38%), A-levels or a similar higher-education qualification (35%), and GCSEs, a similar qualification, or less (27%). Table 3 presents a correlation matrix summarising the relationship between life satisfaction, educational attainment, earnings, non-pecuniary amenities, and full earnings.¹³ Education in Table 3 is captured by years of education, with the baseline category of GCSE qualifications or less being set to 0, A-levels to 2, and a degree to 5.¹⁴ Life satisfaction is positively correlated with educational attainment, earnings, non-pecuniary aspects, and full earnings. However, all of these coefficients are only small in size, so that a substantial share of what determines life satisfaction remains unexplained. On the contrary, there is a strong correlation between education and not only earnings, as expected, but also non-pecuniary work aspects, and therefore with full earnings as well.

¹²Appendix Table A4 shows the individual-level correlations between the full earnings calculated using information from all respondents and those calculated using information from low-, medium-, and highly-educated respondents (estimating Equation (1) separately within each education category).

¹³In a more-formal approach, we also estimated Equation (1) separately by education group. The estimated coefficient on log earnings falls with education, such that a certain percentage rise in earnings has a greater impact on the life satisfaction of the least-educated.

¹⁴These numbers correspond to the additional number of years required to attain these qualifications, as compared to a GCSE qualification.

Table 3: Important Correlations

	Life satisfaction	Education	Log earnings	α_3^j/α_2	Full earnings
Life satisfaction	1.000				
Education	0.023	1.000			
Log earnings	0.072	0.408	1.000		
α_3^j/α_2	0.063	0.057	0.135	1.000	
Full earnings	0.090	0.341	0.832	0.663	1.000

Source: Annual Population Survey.

Notes. These correlations are calculated on respondents aged 18 to 65 in full-time employment in five waves of APS data, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. Life satisfaction is measured on an 11-point scale, where 0 corresponds to “not at all satisfied” and 10 to “completely satisfied”. Education is here captured by years of education, with the baseline category of GCSE qualifications or less being set to 0, A-levels to 2, and a degree to 5. “Log earnings” is the logarithm of each hourly earnings. α_3^j/α_2 is the occupational non-pecuniary work aspects estimated from Equation (1) adjusted by the coefficient on log earnings. Our measure of full earnings is described in Equation (3).

While Table 3 indicates that the better-educated enjoy better average labour-market outcomes, it says nothing about the dispersion in these outcomes. Table 4 investigates by comparing the standard deviations of earnings, non-pecuniary amenities, and full earnings across the three different education groups.

Table 4: Important Standard Deviations

	Log earnings	α_3^j/α_2	Full earnings
Degree			
SD	0.51	0.56	0.84
A-levels			
SD	0.46	0.39	0.63
GCSE or less			
SD	0.41	0.29	0.53

Source: Annual Population Survey.

Notes. The standard deviations are calculated for respondents aged 18 to 65 in full-time employment in five waves of the APS, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. “Log earnings” is the logarithm of hourly earnings. α_3^j/α_2 are the non-pecuniary amenities estimated in Equation (1) adjusted by the coefficient on log earnings. Our measure of full earnings is described in Equation (3).

Strikingly, the dispersion of earnings is fairly similar across education categories, with only a slight positive education gradient. However, as we have discussed above, data on earnings alone substantially underestimate the true level of inequality in the labour market. The second and third columns show that there is substantial variation in terms of the non-pecuniary aspects of work and full earnings. The standard deviation of full earnings is 29% larger than that of earnings for the lowest-educated, with analogous figures of 37% for those with A-levels and a striking 65% for respondents with a degree. As a result, the dispersion of full earnings exhibits a far more substantial education gradient than does that of earnings.

This pattern of full-earnings dispersion by education merits further discussion. Appendix Table B1 shows that average life satisfaction varies less for the high-educated, reflecting greater wellbeing inequality for the less-educated. However, we also see that the dispersion of non-pecuniary amenities and full earnings is highest for respondents with a degree. This pattern is not evident in the life-satisfaction figures, and appears only weakly in the earnings figures. The distribution of full earnings that we uncover helps inform how educational decisions affect labour-market outcomes and the true level of labour-market inequality.

Figures A4, A5, and A6 in the Appendix reproduce Figure 1, but now separately for our three education groups. Full earnings (in the bars) are again compared to earnings (the black crosses), but now for the 30 most-populated occupations within each education category. The full earnings figure in some occupations, such as corporate managers, is high regardless of educational attainment, while in others, such as customer service, it is always low. In general, the gap between earnings and full earnings, whether negative or positive, is largest in absolute size for those with a degree and lowest for the least-educated. In line with the figures in Table 4, the dispersion of full earnings and consequently the inequality in labour-market outcomes, is substantially higher for the better-educated.

We can reap additional insights into the ranking of occupations across education by looking at the subset of 13 occupations that appear in the 30 most-popular for all three education categories. There is a clear pattern by education in the Full Earnings gap in these same occupations. The higher-educated tend to experience better amenities in managerial and professional occupations, as compared to the less-well educated in the same occupations, and consequently higher Full Earnings. The reverse pattern is seen in (lower-ranked) administrative occupations, where there is a clear gradient in better amenities for the less-well educated, producing higher Full Earnings for this group. Full earnings then partly reflect the match of education to occupation.

6 The True Rate of Return to Education

We now formally analyse the true returns to education, and how these are related to earnings, full earnings, and respondents' personal characteristics. To do so, we decompose the effect of demographics and educational attainment on full earnings into their effect on (i) earnings and (ii) the non-pecuniary amenities in each occupation. We estimate the following three equations:

$$\text{LogEarnings}_{ik} = \gamma_0 + \gamma_1 X_i + \sum_k \gamma_{2,k} \text{Educ}_{ik} + \tau_i + \nu_{ij} \quad (4)$$

$$(\alpha_3^j / \alpha_2)_{ik} = \delta_0 + \delta_1 X_i + \sum_k \delta_{2,k} \text{Educ}_{ik} + \tau_i + \nu_{ij} \quad (5)$$

$$\text{FullEarnings}_{ik} = \beta_0 + \beta_1 X_i + \sum_k \beta_{2,k} \text{Educ}_{ik} + \tau_i + \eta_{ij} \quad (6)$$

where the coefficient vectors in Equations (4) and (5) by design sum up to the coefficients in Equation (6), so that $\gamma_{2,k} + \delta_{2,k} = \beta_{2,k}$ for all k .

Table 5 shows the resulting estimates of γ_2 , β_2 and δ_2 in Equations (4) to (6).¹⁵ As the α_3^j/α_2 do not vary across individuals and across waves, in Appendix Table A5 we show how our results change if we estimate equation (5) at the occupation-level instead. The results in Table 5 show that earnings rise in education, with those with a degree earning 70% more than those with the lowest education level. These returns to education are found to be even larger when non-pecuniary job amenities are taken into account. The improvement in terms of non-pecuniary amenities is particularly notable for those with A-level or equivalent qualifications. The return to two years more education after the end of compulsory schooling (i.e. A-levels or equivalent) is over one-third larger in terms of full earnings than in terms of earnings alone. The returns to education are then even higher than data on earnings alone suggests.

Table 5: The True Returns to Education

	Log earnings	α_3^j/α_2	Full earnings
Degree	0.247*** (0.002)	0.009*** (0.001)	0.256*** (0.002)
A-levels	-0.086*** (0.002)	0.020*** (0.002)	-0.066*** (0.002)
GCSE or less	-0.281*** (0.002)	-0.041*** (0.002)	-0.322*** (0.003)
Gender	Yes	Yes	Yes
Age quadratic	Yes	Yes	Yes
Ethnicity	Yes	Yes	Yes
Wave fixed effects	Yes	Yes	Yes
R^2	0.31	0.02	0.24
F-value	2671.62	120.63	1766.75
N	198,080	198,080	198,080
SD dependent	0.51	0.38	0.68

Source: Annual Population Survey.

Notes. These are OLS regressions. In column (1) “Log earnings” is the logarithm of hourly earnings. In column (2) α_3^j/α_2 is the value of non-pecuniary work amenities estimated in Equation (1) and adjusted by the coefficient on log earnings. The dependent variable in column (3) is our measure of full earnings. The coefficients on education category are expressed in terms of deviations from the sample mean, using the procedure in Krueger and Summers (1988). The sample covers respondents aged 18 to 65 in full-time employment in five waves of the APS, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. Heteroskedasticity-robust standard errors appear in parentheses. The sample is re-weighted using the *NPWT18* population weights in the Annual Population Survey, designed for performing analysis on the sample completing wellbeing questions. Significance levels: *** $p < .01$, ** $p < .05$, * $p < .1$.

Comparing the coefficients in Table 5 to the dispersion of earnings and full earnings in Table 4 reveals that, while the expected value of a degree is slightly higher in terms of full earnings, it is also a riskier choice: the dispersion of full earnings is substantially larger for the best-educated respondents as compared to their less-educated counterparts, despite there being only a small difference in earnings dispersion. In the data that we analyse here, the full earnings of a respondent with only a GCSE qualification are higher than those of a respondent with a degree in almost half of occupations, and a similar result is

¹⁵We also investigated what happens when we instead include education directly in Equation (1), to ensure that the estimated values of the job amenities, α_3^j , are not capturing part of the effect of education on life satisfaction. The conclusions are similar in this alternative specification, although the magnitude of the coefficients is larger than in Table 5.

found for respondents with A-levels. Taking both earnings and the value of job amenities into account provides a more complete, and perhaps a little unexpected, picture of the true returns to education.

7 The Gender and Ethnic Gaps

We now ask how gender and ethnicity relate to both full earnings and its monetary and non-monetary components. Table 6 shows the estimated coefficients on gender, age and ethnicity from Equations (4), (5) and (6): these are the same equations as those behind the education coefficients displayed in Table 5. In Appendix Table A5 we show how our results change if we estimate Equation (5) at the occupation level.

The gender pay gap is 31% larger when considering full earnings than earnings alone. Appendix Table A6 shows the results without Table 5's education variables, which does not materially affect this conclusion. As our sample is restricted to respondents in full-time employment, the gender gap in Table 6 is not explained by gender differences in the prevalence of part-time work.

Equally, the earnings of ethnic minorities can understate the true gap in terms of full earnings. Almost all ethnic-minority groups fare considerably worse once the non-pecuniary aspects of work are taken into account, suggesting that some disadvantaged groups both earn less and have worse job amenities at the same time. For example, the "Pakistani", "Bangladeshi" and "Black" ethnic groups are paid substantially less than the average respondent, but their full earnings are actually 46%, 47% and 40% lower respectively than the earnings gap alone would suggest. The estimated coefficients in columns 1 and 2 produce this pattern for 8 out of the 11 ethnic groups in the APS, so that the ethnic gap is significantly underestimated without information on job amenities.

Table 6: The True Gender and Ethnic Gaps

	Log earnings	α_3^j/α_2	Full earnings
Female	-0.172*** (0.002)	-0.052*** (0.002)	-0.224*** (0.003)
Age	0.078*** (0.001)	0.018*** (0.001)	0.096*** (0.001)
Age-squared/100	-0.081*** (0.001)	-0.019*** (0.001)	-0.099*** (0.001)
<i>Ethnicity</i>			
White British	0.012*** (0.001)	0.009*** (0.001)	0.021*** (0.001)
White Irish	0.123*** (0.015)	0.044*** (0.016)	0.167*** (0.023)
Other White	-0.061*** (0.005)	-0.020*** (0.004)	-0.081*** (0.007)
Mixed group	0.039** (0.014)	-0.026** (0.013)	0.013 (0.019)
Indian	0.032*** (0.008)	-0.083*** (0.007)	-0.051*** (0.011)
Pakistani	-0.145*** (0.014)	-0.067*** (0.012)	-0.211*** (0.031)
Bangladeshi	-0.141***	-0.067***	-0.208***

	(0.022)	(0.019)	(0.031)
Chinese	0.049***	-0.056***	-0.007
	(0.019)	(0.014)	(0.024)
Other Asian	-0.124***	-0.023**	-0.147***
	(0.015)	(0.012)	(0.020)
Black	-0.132***	-0.052***	-0.183***
	(0.008)	(0.007)	(0.011)
Other group	-0.067***	-0.013	-0.080***
	(0.013)	(0.010)	(0.017)
Education	Yes	Yes	Yes
Wave fixed effects	Yes	Yes	Yes
R^2	0.31	0.02	0.24
F-value	2671.62	120.63	1766.75
N	198,080	198,080	198,080
SD dependent	0.51	0.38	0.68

Source: Annual Population Survey.

Notes: These are OLS regressions. In column (1) “Log earnings” is the logarithm of hourly earnings. In column (2) α_3^i/α_2 is the value of non-pecuniary work amenities estimated in Equation (1) adjusted by the coefficient on log earnings. In column (3) the dependent variable is our measure of full earnings. The ethnicity coefficients are expressed in terms of deviations from the sample mean, using the procedure in Krueger and Summers (1988). The sample covers respondents aged 18 to 65 in full-time employment in five waves of the APS, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. Heteroskedasticity-robust standard errors appear in parentheses. The sample is re-weighted using the *NPWT18* population weights in the Annual Population Survey, designed for performing analysis on the sample completing wellbeing questions. Significance levels: *** $p < .01$, ** $p < .05$, * $p < .1$.

In unreported results, we also estimated the ethnic wage gaps in Table 6 separately for men and women, to allow for different coefficients on the other demographic controls. These show that the ethnic gaps in Table 6 are larger for men, while these gaps were less pronounced (and in some cases entirely absent) for women. As such, the ethnic and gender gaps are intertwined. This gender split also reveals that women are more penalised for not having a degree. Non-degree education is associated with lower wages for both men and women, but for men these are partially compensated through non-pecuniary amenities while they are on the contrary accentuated for women.

8 The Correlation between Earnings and Non-Pecuniary Rewards

We have above considered in detail the correlates of both earnings and non-pecuniary job rewards, which together make up full earnings. A long-running question in Labour Economics is how the two are related. Do the best-paid jobs also have good working conditions? Or instead do higher earnings compensate for bad working conditions, as in the theory of compensating wage differentials? In Section 3, the interpersonal dispersion of full earnings was made up of the dispersion of hourly earnings and that of job amenities, and of the correlation between these two, which was found to be 0.14. This latter figure indicates a positive association between earnings and job amenities on the UK labour market.

To investigate more formally, we estimate the following earnings equation:

$$\text{LogEarnings}_{ij} = \beta_0 + \beta_1 X_i + \sum_j \beta_2^j \text{Occupation}_{ij} + \tau_i + \eta_{ij} \quad (7)$$

where the vector X_i in Equation (7) also includes educational attainment (but the vector X_i in Equation (1) did not). The correlation between the β_2^j coefficients above and the $\frac{\alpha_3^j}{\alpha_2}$ coefficients that show the occupational distribution of well-being conditional on earnings and the X_{ij} variables sheds more light on whether well-paid jobs also offer better amenities.

Table 7 lists the correlations between earnings and amenities, where amenities are given by the $\frac{\alpha_3^j}{\alpha_2}$ coefficients. The first row shows the correlation with individual earnings in the raw data, the second the correlation with individual earnings conditional on demographics (X_i), and the final row the correlation with occupation-level earnings conditional on the same demographics (X_i). There is a positive correlation between the conditional occupational distribution of wages and that of job amenities: occupations with better amenities also have higher wages. Columns 2 and 3 in Table 8 reveal that this positive correlation is entirely driven by the private sector. Again, the differences in labour-market outcomes across individuals are more profound than their earnings alone suggest.

Table 7: Correlation (ρ) of earnings with amenities ($\frac{\alpha_3^j}{\alpha_2}$)

	Overall ρ	Private Sector ρ	Public Sector ρ
Individual Earnings	0.14	0.16	-0.01
Individual Earnings (conditional on X_i)	0.09	0.10	-0.01
Occupation Earnings (conditional on X_i)	0.19	0.23	-0.01

Source: Annual Population Survey.

Notes: These correlations are based on a sample of respondents aged 18 to 65 in full-time employment in five waves of APS data, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. The $\frac{\alpha_3^j}{\alpha_2}$ are the occupational job amenities from Equation (1) and adjusted by the coefficient on log earnings.

The estimation of the correlations in Table 7 using cross-section data may produce biased coefficients due to unobserved individual-level characteristics. We address this issue by including individual fixed effects in an analysis of Understanding Society data. The results in Appendix Table A7 indicate that our cross-section APS findings are robust. The cross-section correlation between occupation earnings and $\frac{\alpha_3^j}{\alpha_2}$ in Understanding Society is positive but larger, at 0.34. The corresponding correlation using job satisfaction as opposed to life satisfaction yields a cross-section correlation coefficient of 0.16.

The individual fixed effects in panel estimation naturally absorb any time-invariant variables. The panel correlation between occupational earnings and $\frac{\alpha_3^j}{\alpha_2}$ in Understanding Society is 0.04 (while the corresponding figure using job satisfaction is 0.17). We conclude that even within-individuals, the correlation between earnings and job amenities as measured using job satisfaction is positive, while that using life satisfaction is close to zero. As such, there is no evidence in panel data from the UK labour market that worse-paid jobs offer better job amenities as compensation. As with any empirical analysis, even in panel data, we cannot entirely exclude the possibility that unobserved time-varying individual-level controls may still play a role in the determination of earnings and amenities. Panel data with more-detailed information on specific job amenities and individual circumstances would likely help contribute

to this debate, as well as providing a better understanding of different types of job even within 3-digit occupations.

9 Results from the United States

Nationally-representative datasets that contain subjective wellbeing questions in combination with detailed information on respondent income and occupation are relatively scarce. This is even more the case for panel surveys. For these data reasons our main analysis above referred to workers in the United Kingdom.

We here complement this UK analysis with cross-section data from the United States. The best data source for this purpose is the General Social Survey (GSS).¹⁶ The GSS is a repeated cross-section survey (but not a panel) that is representative of the US population. This survey started in 1972 and 30 waves of data are currently available. There are two subjective wellbeing questions in the GSS, referring to happiness and job satisfaction: these appear in 29 waves, with 2,300 observations each on average, between 1974 and 2016. Additionally, the GSS records respondents' yearly income as a continuous variable (which is released in constant US Dollars, using 1986 as the base), as well as the occupation of those in employment. Table A8 in the Appendix provides some descriptive statistics on the GSS data.

Occupations are recorded at the 4-digit level, using the 2010 Census Occupational Category. In total, there are over 500 different occupations in the GSS. Given the relatively small sample size resulting from all our restrictions¹⁷ (20,000 observations over 29 waves, with roughly 900 observations per wave on average), we avoid small occupational cells by re-coding this variable into 23 broader categories, in line with the 2-digit classification in the 2010 Census Occupational Category.¹⁸

Table 8 below shows the US results from estimating Equation (1) with General Social Survey data. As in Table 1, the sample is restricted to respondents aged 18 to 65 in full-time employment. The two columns refer to the different wellbeing measures. The first is general happiness on a 3-point scale, where 1 corresponds to “not too happy” and 3 to “very happy”, and the second to job satisfaction on a 4-point scale, where 1 corresponds to “very dissatisfied” and 4 to “very satisfied”. To render the coefficients comparable in size to those for the APS in Table 1, we re-code them to be on an 11-point scale.

Log earnings are the logarithm of annual income in constant US\$. The demographic controls are gender, a quadratic term in age, and race. The coefficient on Log Earnings in Column (1) is 0.374, so that doubling earnings increases happiness by 0.262 on the 11-point scale. The coefficient on Log Earnings in Column (2) is very similar. These are somewhat larger than the APS figure in Table 1.

¹⁶Other well-known data sources with subjective wellbeing information in the United States are the PSID, the BRFSS, and the Gallup World Poll. The PSID survey, which is a panel, included a one-time wellbeing module in 2016, producing only a relatively-small sample (given our requirement of dis-aggregated occupation information) of around 8000 respondents. The income and occupation information in both the BRFSS and the Gallup World Poll is sub-optimal. Income is reported in only eight bands in the BRFSS. The Gallup questionnaire contains a continuous measure of household income, but it provides no measure of individual income, and occupation is only recorded in 11 broad categories. As such, both these data sets provide insufficiently-detailed information, given the level of dis-aggregation required for our analysis. Neither the BRFSS or Gallup is a panel survey.

¹⁷Similar to our analysis of the APS and Understanding Society, we restrict the sample to those aged between 18 and 65, in full-time employment. We also exclude those who are self-employed and those whose earnings are below the 1st percentile in the income distribution.

¹⁸Our results are robust, and stronger, when we instead use the 122 most-popular occupations at the 4-digit level: by most-popular we mean those that are above the 25th percentile in terms of the share of the population employed.

Table 8: How earnings and personal characteristics affect happiness and job satisfaction in the GSS

	Happiness	Job Satisfaction
Log earnings	0.374*** (0.038)	0.329*** (0.032)
Occupation	Yes	Yes
Age polynomial	Yes	Yes
Gender	Yes	Yes
Race	Yes	Yes
Wave fixed effects	Yes	Yes
R^2	0.03	0.05
F-value	7.40	14.40
N	20,475	20,513
SD dependent	2.98	2.56

Source: General Social Survey.

Notes. These are OLS regressions. The sample includes respondents aged 18 to 65 in full-time employment in 29 waves of GSS data, between 1974 and 2016. The regressions exclude those whose yearly real income is in the 1st percentile of the income distribution. “Log earnings” is the logarithm of each respondent’s real yearly income. To be consistent with the results from APS, we stretch both wellbeing measures onto an 11-point scale. The sample is re-weighted using the population weights in the General Social Survey. Significance levels: *** $p < .01$, ** $p < .05$, * $p < .1$.

Table 9 lists the standard deviations in the US data. Earnings are more dispersed in the US than in the UK: in Column 1 the standard deviation of US earnings is 0.75, 50% higher than the UK figure of 0.51 in Table 2. The dispersion in US non-monetary rewards (α_3^j/α_2) is also one half larger than in the UK (0.55 against 0.38). In column 3, the dispersion in Full Earnings in the US (1.01 standard deviations) is one-third higher than that of earnings (0.75 standard deviations), a ratio that is remarkably similar to that found for the United Kingdom. In the United States, the correlation between earnings and amenities is 0.19, a number very much in line with that in the APS.

In line with our UK results, we also find that there is more dispersion in amenities than in earnings when we take job satisfaction as the wellbeing measure, and consequently that the dispersion in Full Earnings is also larger.

Table 9: Important Standard Deviations in the GSS

	Log earnings	α_3^j/α_2	Full earnings
SD (from a regression of Happiness)	0.75	0.55	1.01
SD (from a regression of Job Satisfaction)	0.75	0.92	1.27

Source: General Social Survey.

Notes. These figures are calculated for respondents aged 18 to 65 in full-time employment in 29 waves of GSS data, between 1974 and 2016. The regressions exclude those whose yearly real income is in the 1st percentile of the income distribution. “Log earnings” is the logarithm of each respondent’s real yearly income. α_3^j/α_2 are the non-pecuniary work rewards estimated in Equation (1) divided by the coefficient on log earnings. Our measure of full earnings is described in Equation (3).

Figure A7 in the Appendix illustrates how earnings and Full Earnings compare across different occupations in the GSS. While in the top occupations full earnings are often greater than earnings (revealing above-average non-pecuniary rewards), this does not hold for Computer and Mathematics, nor Legal. Towards the bottom, non-pecuniary rewards are notably lower in Food Preparation, and Buildings and Maintenance.

Finally, Table 10 estimates Equations (4) to (6) to assess the true rate of return to education in the United States. The returns to a degree (16 years or more of education) are largely underestimated when not taking non-monetary rewards into account. Compared to people with 12 years of education, the returns to an undergraduate degree or above are twice as high as earnings data alone would suggest. The returns to a High-School diploma (12 years of education) and below (less than 12 years of education) are largely overestimated without taking data on wellbeing into account: these respondents have significantly lower full earnings as a result of worse job amenities. The underestimation of the returns to a Degree in the US is far larger than that in the UK (in Table 5), as non-pecuniary rewards play a far larger role in the returns to education in the US labour market.

Table 10: The True Returns to Education in the US

	Log earnings	α_3^j/α_2	Full earnings
Completed years of education			
16 years or more	0.363*** (0.009)	0.336*** (0.006)	0.699*** (0.010)
13 to 15 years	0.002 (0.008)	-0.006 (0.006)	-0.005 (0.011)
12 years	-0.149*** (0.007)	-0.163*** (0.005)	-0.312*** (0.009)
Less than 12 years	-0.435*** (0.013)	-0.329*** (0.009)	-0.764*** (0.016)
Gender	Yes	Yes	Yes
Age polynomial	Yes	Yes	Yes
Race	Yes	Yes	Yes
Wave fixed effects	Yes	Yes	Yes
R^2	0.33	0.21	0.37
F-value	198.13	125.88	245.21
N	20,226	20,226	20,226
SD dependent	0.75	0.55	1.01

Source: General Social Survey.

Notes. These are OLS regressions. In column (1) “Log earnings” is the logarithm of real yearly income. In column (2) α_3^j/α_2 is the value of non-pecuniary work amenities estimated in Equation (1) and adjusted by the coefficient on log earnings. The dependent variable in column (3) is our measure of full earnings. The coefficients on education category are expressed in terms of deviations from the sample mean, using the procedure in Krueger and Summers (1988). The sample covers respondents aged 18 to 65 in full-time employment in 29 waves of the GSS, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. Heteroskedasticity-robust standard errors appear in parentheses. The sample is re-weighted using the population weights in the General Social Survey. Significance levels: *** $p < .01$, ** $p < .05$, * $p < .1$.

Appendix Table A9 estimates Equation (1) by education category. We find that, as in the UK, workers with a degree have not only higher full earnings but also a wider dispersion: the true returns to Higher Education are both larger and riskier than data on earnings alone suggest.

Appendix Table A10 presents the true gender and racial gaps in the US labour market. Women earn significantly less than men: the earnings gap is more than twice as large as that for the UK in Table 6. However, unlike in the UK, women are partly compensated through better amenities. As a result, women in the US fare better in terms of Full Earnings than their monetary earnings would suggest, but even so a large gender gap persists and is about one third larger than that in the UK. This difference partially results from our GSS sample spanning a longer time period, and therefore picking up changing trends for women in the labour market. Carrying out the analysis in Table A10 using only data from 2000 onwards produces a true gender gap of 14%, predominantly driven by women seeing a larger compensation through amenities in recent waves (as opposed to the analogous figure of 27% in Table A10).

With respect to race, Black and “Other” racial minorities earn substantially less than Whites and also experience worse non-pecuniary rewards. In line with our UK results, the true racial gaps on the labour market are larger than those revealed by earnings alone. Estimating the true US racial gap using only the post-2000 waves does not significantly alter these conclusions.

10 Conclusion

We have here analyzed the value of different occupations to workers. We consider occupations at the 3-digit level, and calculate the distribution of life satisfaction across occupations conditional on earnings: this provides us with a measure of the value of unobserved job amenities to workers by occupation. These can be converted to monetary values using information on the impact of earnings on life satisfaction. A worker’s full earnings are then her earnings plus the monetary value of the amenities in her occupation.

Our key finding is that the distribution of full earnings is not equivalent to that of earnings, such that amenities are not fully captured in wages. We show that the dispersion of earnings underestimates the extent of inequality in the labour market by a significant margin: the dispersion of full earnings is one-third larger than the dispersion of earnings. In addition, both the gender gap and ethnic gaps on the labour market are substantially larger in terms of full-earnings than in terms of earnings alone.

We carry out a number of exercises to establish the relationship between earnings and the value of job amenities. We consider both cross-section and panel data, and both life satisfaction and job satisfaction as our measure of the hedonic return to work. The gap between earnings and full earnings does not reflect measurement error, as it exhibits strong systematic patterns in the data. In particular, none of our specifications produce a negative correlation between earnings and the value of amenities, and some produce significant positive correlations. In other words, we find no evidence of compensating differentials, even within individuals as they switch occupations.

Occupation is one of the most important decisions that individuals take. Another is education. We first show that earnings alone under-estimate the full-earnings returns to education. Moreover, the ranking of occupations (in terms of their full earnings) is not identical by education. While managerial jobs provide substantial rewards for workers at all levels of education, lower-ranked administrative positions are associated with positive job amenities for the less-educated, but negative amenities for the better-educated. Last, the variance in non-pecuniary amenities is strikingly larger for those with a Degree. While education provides larger rewards on average, it is also more risky in terms of labour-market rewards.

Even though our main results are for the UK, they can be replicated in 30 years of US data. Compared to the UK, US workers experience more dispersion in both earnings and amenities. However,

equivalent to our key finding from the UK, the dispersion of full earnings is one-third larger than the dispersion of earnings. Similarly, the true returns to education are both larger and more unequal, although the differences between people with different educational attainment are starker in the US. Finally, differences in earnings also underestimate the true racial gap in the US, but we find that women are partly compensated through better amenities. Our systematic finding in both countries is that the labour market is more unequal than earnings alone would suggest.

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Appendix

A. Additional Tables and Figures

Table A1: Descriptive Statistics in the Annual Population Survey

	Mean	SD
Life Satisfaction	7.76	1.43
Demographics		
Female	0.45	0.50
Age	43.02	11.37
Ethnicity		
White British	0.84	0.36
White Irish	0.01	0.08
Other White	0.06	0.24
Mixed ethnic	0.01	0.09
Indian	0.02	0.15
Pakistani	0.01	0.09
Bangladeshi	≤ 0.01	0.05
Chinese	≤ 0.01	0.06
Other Asian	0.01	0.09
Black	0.02	0.15
Other ethnic	0.01	0.10
Education		
Degree	0.38	0.49
Other higher	0.12	0.32
A-level	0.23	0.42
GCSE	0.18	0.38
Other qualification	0.06	0.24
No qualification	0.03	0.18
Didn't know	≤ 0.01	0.03
Earnings		
Log hourly pay	2.64	0.51

Source: Annual Population Survey.

Notes. The means and standard deviations are calculated from the sample of respondents aged 18 to 65 in full-time employment in five waves of APS data, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution.

Table A2: Descriptive Statistics in Understanding Society

	Mean	SD
Life Satisfaction	7.03	2.21
Job Satisfaction	7.05	2.33
Demographics		
Female	0.37	0.48
Age	40.95	11.75
Ethnicity		
White British	0.87	0.34
White Irish	0.01	0.11
Gypsy or Irish traveller (white)	≤ 0.01	0.01
Other white	0.04	0.20
White and black Caribbean (mixed)	≤ 0.01	0.06
White and black African (mixed)	≤ 0.01	0.04
White and Asian (mixed)	≤ 0.01	0.05
Other (mixed)	≤ 0.01	0.05
Indian	0.02	0.15
Pakistani	0.01	0.08
Bangladeshi	≤ 0.01	0.05
Chinese	≤ 0.01	0.06
Other Asian	0.01	0.09
Caribbean	0.01	0.08
African	0.01	0.10
Other black	≤ 0.01	0.03
Arab	≤ 0.01	0.04
Other ethnic	≤ 0.01	0.05
Education		
Degree	0.35	0.48
Other higher	0.13	0.34
A-level	0.23	0.42
GCSE	0.19	0.39
Other qualification	0.07	0.25
No qualification	0.03	0.16
Earnings		
Log hourly pay	2.63	0.51

Source: Understanding Society.

Notes. For a more-straightforward comparison with the Annual Population Survey, life satisfaction and job satisfaction in Understanding Society have been adjusted to an 11-point scale, where 0 corresponds to “not at all satisfied” and 10 to “completely satisfied”. The means and standard deviations are calculated from the sample of respondents aged 18 to 65 in full-time employment in nine waves of Understanding Society data, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution.

Table A3: Important Standard Deviations in the APS and Understanding Society

	Life Satis APS Cross-section	Life Satis USoc. Cross-section	Life Satis USoc. Panel	Job Satis USoc. Cross-section	Job Satis USoc. Panel
Log earnings	0.51	0.51	0.51	0.51	0.51
α_3^j	0.10	0.15	0.17	0.26	0.36
α_3^j / α_2	0.38	0.32	0.80	0.88	1.26
Full earnings	0.68	0.66	0.96	1.07	1.43

Source: Annual Population Survey and Understanding Society.

Notes. These standard deviations are restricted to respondents aged 18 to 65 in full-time employment in nine waves of Understanding Society data, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. “Log earnings” is the logarithm of hourly earnings. α_3^j / α_2 are the non-pecuniary work aspects estimated in Equation (1) and adjusted by the coefficient on log earnings. Our measure of full earnings is described in Equation (3). The standard deviation of income and of full earnings capture the dispersion of real earnings over both individuals and the five waves of the APS or of Understanding Society. The single-year figures are almost identical with both datasets.

Table A4: Correlations between Full Earnings in the full sample and Full Earnings by Education in APS

	Life Satisfaction
Corr (FE, FE^{Degree})	0.91
Corr (FE, FE^{ALevel})	0.94
Corr (FE, FE^{GCSE})	0.90

Source: Annual Population Survey.

Notes. These correlations are calculated using a sample of respondents aged 18 to 65 in full-time employment in five waves of APS data, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. Life satisfaction is measured on an 11-point scale, where 0 corresponds to “not at all satisfied” and 10 corresponds to “completely satisfied”. Our measure of full earnings is described in Equation (3).

Table A5: The True Returns to Education and the Gender and Ethnic Gap at the Occupation Level

	α_3^j/α_2
A-levels	0.087* (0.044)
GCSE or less	-0.071** (0.032)
Female	-0.020 (0.023)
Age	0.424* (0.249)
Age-squared	-0.005 (0.003)
White Irish	0.249** (0.108)
Other white	0.006 (0.010)
Mixed group	-0.013 (0.094)
Indian	-0.068*** (0.018)
Pakistani	0.020 (0.055)
Bangladeshi	0.094 (0.124)
Chinese	-0.209 (0.125)
Other Asian	0.117** (0.058)
Black	-0.091*** (0.027)
Other Group	0.197** (0.076)
R^2	0.48
F-value	10.12
N	90
SD dependent	0.38

Source: Annual Population Survey.

Notes. These are OLS regressions, estimated at the occupation level. The coefficients are interpreted as a 10% increase in the occupation-level proportion of females and respondents with each education level, a 1-year increase in the average age in each occupation, and a 1% increase in the occupation-level proportion of each ethnicity. α_3^j/α_2 is the value of non-pecuniary work amenities estimated in Equation (1) and adjusted by the coefficient on log earnings. The sample covers respondents aged 18 to 65 in full-time employment in five waves of the APS, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. Heteroskedasticity-robust standard errors appear in parentheses. Data at the occupation level is collapsed using the *NPWT18* population weights in the Annual Population Survey, designed for performing analysis

on the sample completing wellbeing questions. The regression results are weighted based on the number of respondents in each occupation. Significance levels: *** $p < .01$, ** $p < .05$, * $p < .1$.

Table A6: Decomposition of Full Earnings in the Annual Population Survey, as shown in Table 6, but without Controls for Education

	Log earnings	α_3^j/α_2	Full earnings
Female	-0.146*** (0.003)	-0.052*** (0.002)	-0.197*** (0.004)
Age	0.090*** (0.001)	0.018*** (0.001)	0.108*** (0.001)
Age-squared/100	-0.099*** (0.001)	-0.019*** (0.001)	-0.118*** (0.001)
Ethnicity	Yes	Yes	Yes
Wave fixed effects	Yes	Yes	Yes
R^2	0.15	0.03	0.13
F-value	1271.25	112.30	961.25
N	209,672	209,672	209,672
SD dependent	0.51	0.38	0.68

Source: Annual Population Survey.

Notes. These are OLS regressions. In column (1) “Log earnings” is the logarithm of hourly earnings. In column (2) α_3^j/α_2 is the value of non-pecuniary work amenities estimated in Equation (1) adjusted by the coefficient on log earnings. In column (3) the dependent variable is our measure of full earnings. The sample covers respondents aged 18 to 65 in full-time employment in five waves of the APS, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. Heteroskedasticity-robust standard errors appear in parentheses. The sample is re-weighted using the *NPWT18* population weights in the Annual Population Survey, designed for performing analysis on the sample completing wellbeing questions. Significance levels: *** $p < .01$, ** $p < .05$, * $p < .1$.

Table A7: Correlation (ρ) of earnings with amenities ($\frac{\alpha_3^j}{\alpha_2}$) in Understanding Society

	Correlation (ρ)
Panel A: Life satisfaction	
<i>In the cross-section:</i>	
Individual Earnings	0.22
Individual Earnings (conditional on X_i)	0.15
Occupation Earnings (conditional on X_i)	0.34
<i>In the panel:</i>	
Individual Earnings	0.04
Individual Earnings (conditional on X_i)	0.04
Occupation Earnings (conditional on X_i)	0.01
Panel B: Job satisfaction	
<i>In the cross-section:</i>	
Individual Earnings	0.12
Individual Earnings (conditional on X_i)	0.07
Occupation Earnings (conditional on X_i)	0.16
<i>In the panel:</i>	
Individual Earnings	0.16
Individual Earnings (conditional on X_i)	0.15
Occupation Earnings (conditional on X_i)	0.17

Source: Understanding Society.

Notes. These correlations are based on a sample of respondents aged 18 to 65 in full-time employment in five waves of APS data, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. The α_3^j/α_2 are the occupational job amenities from Equation (1) and adjusted by the coefficient on log earnings.

Table A8: Descriptive Statistics in the General Social Survey

	Mean	SD
Happiness	6.18	2.98
Job Satisfaction	7.71	2.56
Demographics		
Female	0.45	0.50
Age	39.52	11.61
Race		
White	0.81	0.40
Black	0.14	0.34
Other	0.06	0.24
Completed years of education	13.54	2.87
Earnings		
Log real yearly income		

Source: General Social Survey.

Notes. The means and standard deviations are calculated from the sample of respondents aged 18 to 65 in full-time employment in 29 waves of GSS data, excluding those whose earnings are in the 1st percentile of the earnings distribution.

Table A9: Important Standard Deviations in the GSS, by Educational Attainment

	Log earnings	α_3^j/α_2	Full earnings
16 years or more			
SD	0.74	0.91	1.12
13 to 15 years			
SD	0.69	0.72	1.04
12 years			
SD	0.68	0.34	0.73
Less than 12 years			
SD	0.71	0.90	1.15

Source: General Social Survey.

Notes. The standard deviations are calculated for respondents aged 18 to 65 in full-time employment in five waves of the GSS, excluding those whose yearly real income is in the 1st percentile of the earnings distribution. “Log earnings” is the logarithm of hourly earnings. α_3^j/α_2 are the non-pecuniary amenities estimated in Equation (1) adjusted by the coefficient on log earnings. Our measure of full earnings is described in Equation (3).

Table A10: The True Gender and Ethnic Gaps in the GSS

	Log earnings	α_3^j/α_2	Full earnings
Female	-0.439*** (0.010)	0.134*** (0.008)	-0.305*** (0.013)
Age	0.102*** (0.003)	0.015*** (0.002)	0.116*** (0.004)
Age-squared	-0.100*** (0.004)	-0.014*** (0.003)	-0.114*** (0.005)
<i>Race</i>			
White	0.024*** (0.003)	0.008*** (0.002)	0.033*** (0.003)
Black	-0.127*** (0.013)	-0.021** (0.010)	-0.148*** (0.017)
Other	-0.042* (0.023)	-0.062*** (0.015)	-0.104*** (0.029)
Education	Yes	Yes	Yes
Wave fixed effects	Yes	Yes	Yes
R^2	0.33	0.21	0.37
F-value	198.13	125.88	245.21
N	20,226	20,226	20,226
SD dependent	0.75	0.55	1.01

Source: General Social Survey.

Notes: These are OLS regressions. In column (1) “Log earnings” is the logarithm of each respondent’s real yearly income.. In column (2) α_3^j/α_2 is the value of non-pecuniary work amenities estimated in Equation (1) adjusted by the coefficient on log earnings. In column (3) the dependent variable is our measure of full earnings. The race coefficients are expressed in terms of deviations from the sample mean, using the procedure in Krueger and Summers (1988). The sample covers respondents aged 18 to 65 in full-time employment in 29 waves of GSS data, between 1974 and 2016, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. Heteroskedasticity-robust standard errors appear in parentheses. The sample is re-weighted using the population weights in the General Survey. Significance levels: *** $p < .01$, ** $p < .05$, * $p < .1$.

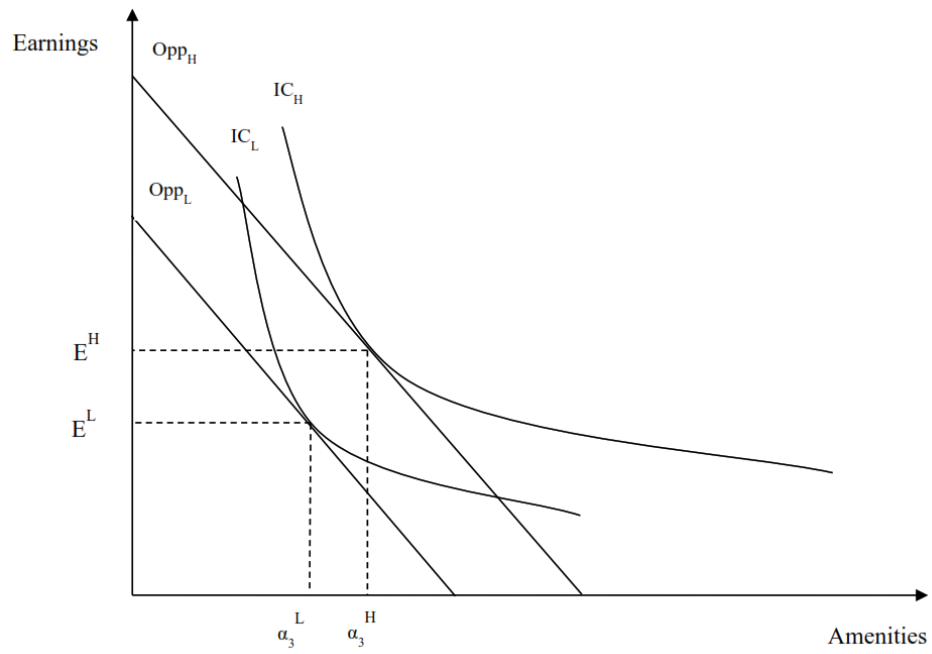


Figure A1: Indifference curves and market opportunities between wages and amenities, for two individuals with different abilities.

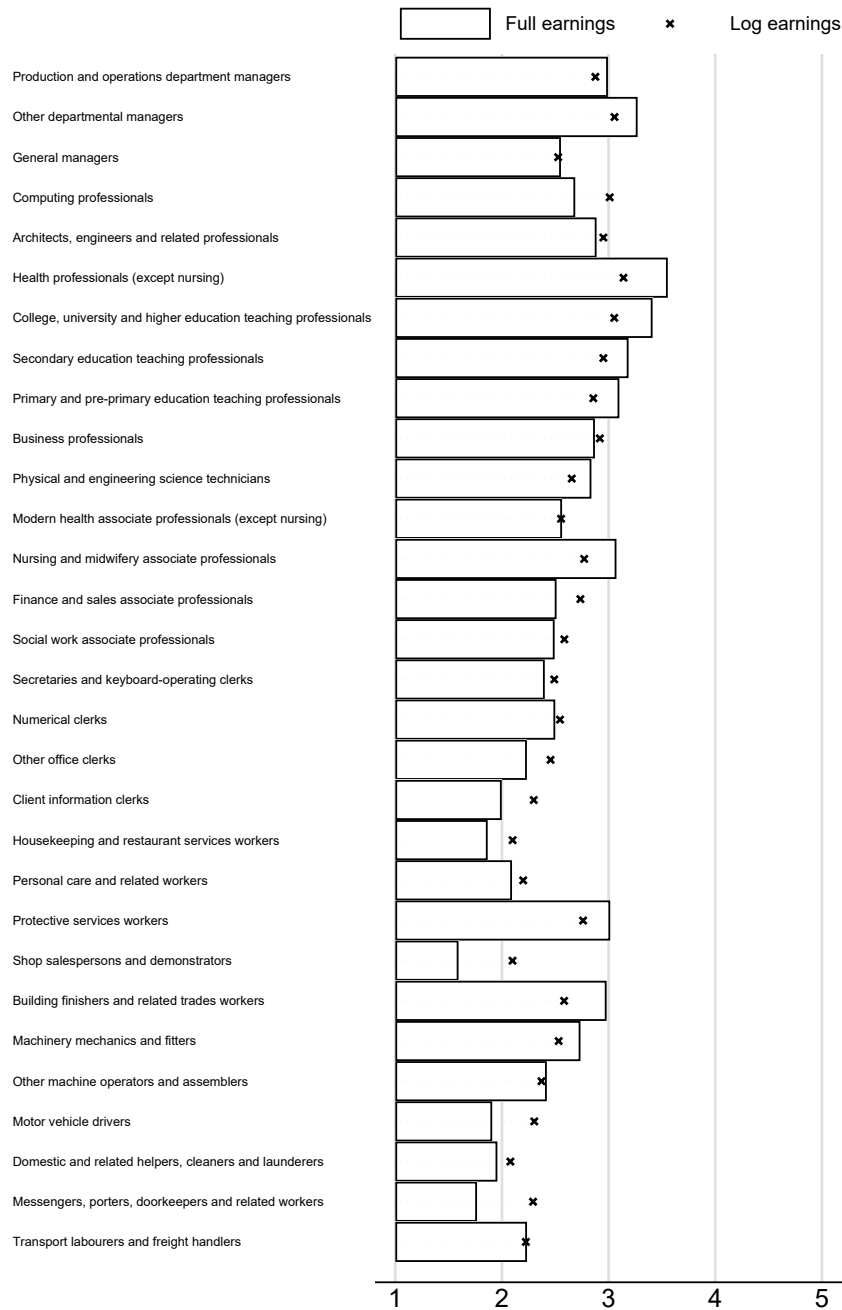


Figure A2: Earnings and Full Earnings in Different Occupations: Cross-Section.

Source: Understanding Society.

Notes. The bars depict full earnings in each occupation, and the black 'x's the logarithm of earnings. Occupations are listed in order of the ISCO88 classification. To avoid outliers, we do not plot occupations under the 1st percentile in terms of share of the population employed. Full earnings in each occupation are expressed in terms of deviations from the sample mean. The figure is based on respondents aged 18 to 65 in full-time employment in nine waves of Understanding Society data.

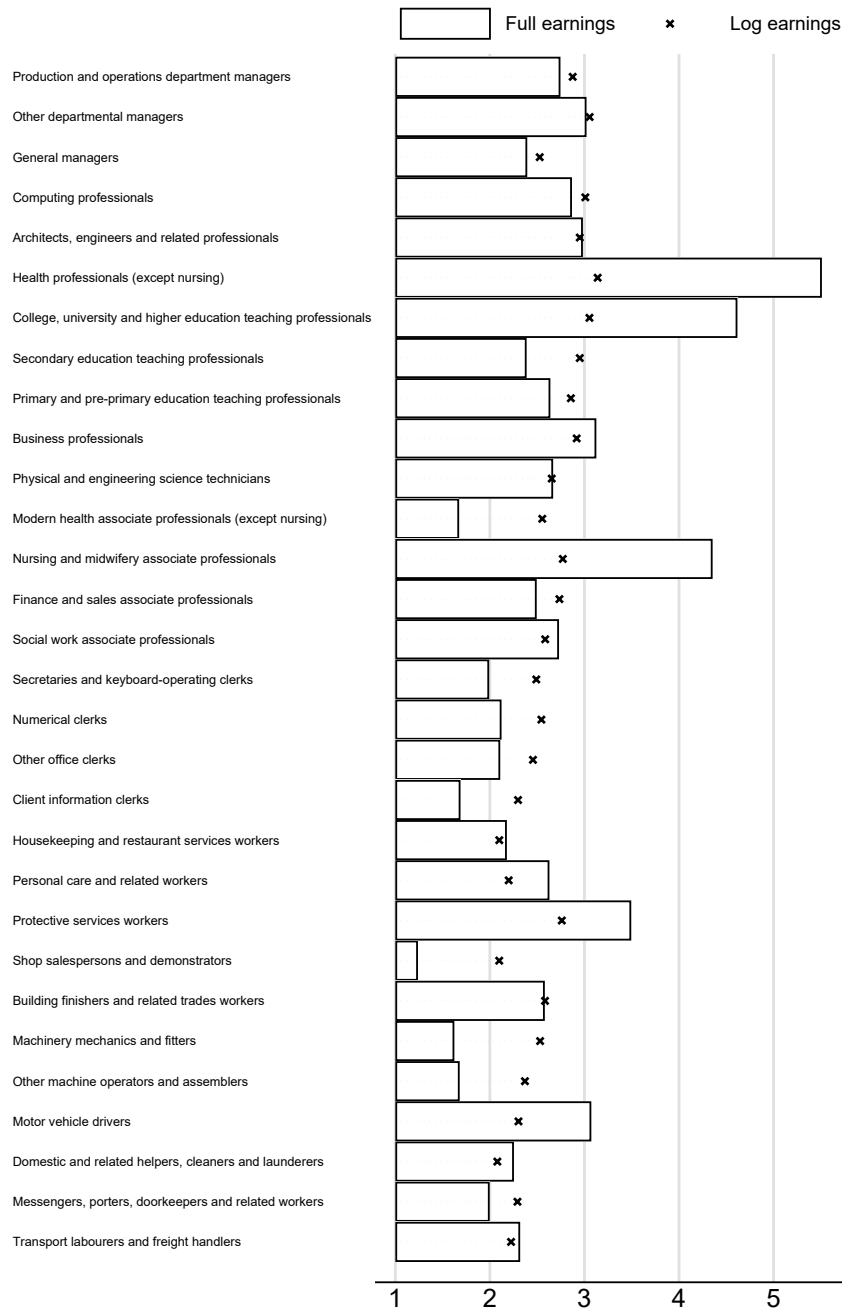


Figure A3: Earnings and Full Earnings in Different Occupations: Panel.

Source: Understanding Society.

Notes. The bars depict full earnings in each occupation, and the black 'x's the logarithm of earnings. Occupations are listed in order of the ISCO88 classification. To avoid outliers, we do not plot occupations under the 1st percentile in terms of share of the population employed. Full earnings in each occupation are expressed in terms of deviations from the sample mean. The figure is based on respondents aged 18 to 65 in full-time employment in nine waves of Understanding Society data.

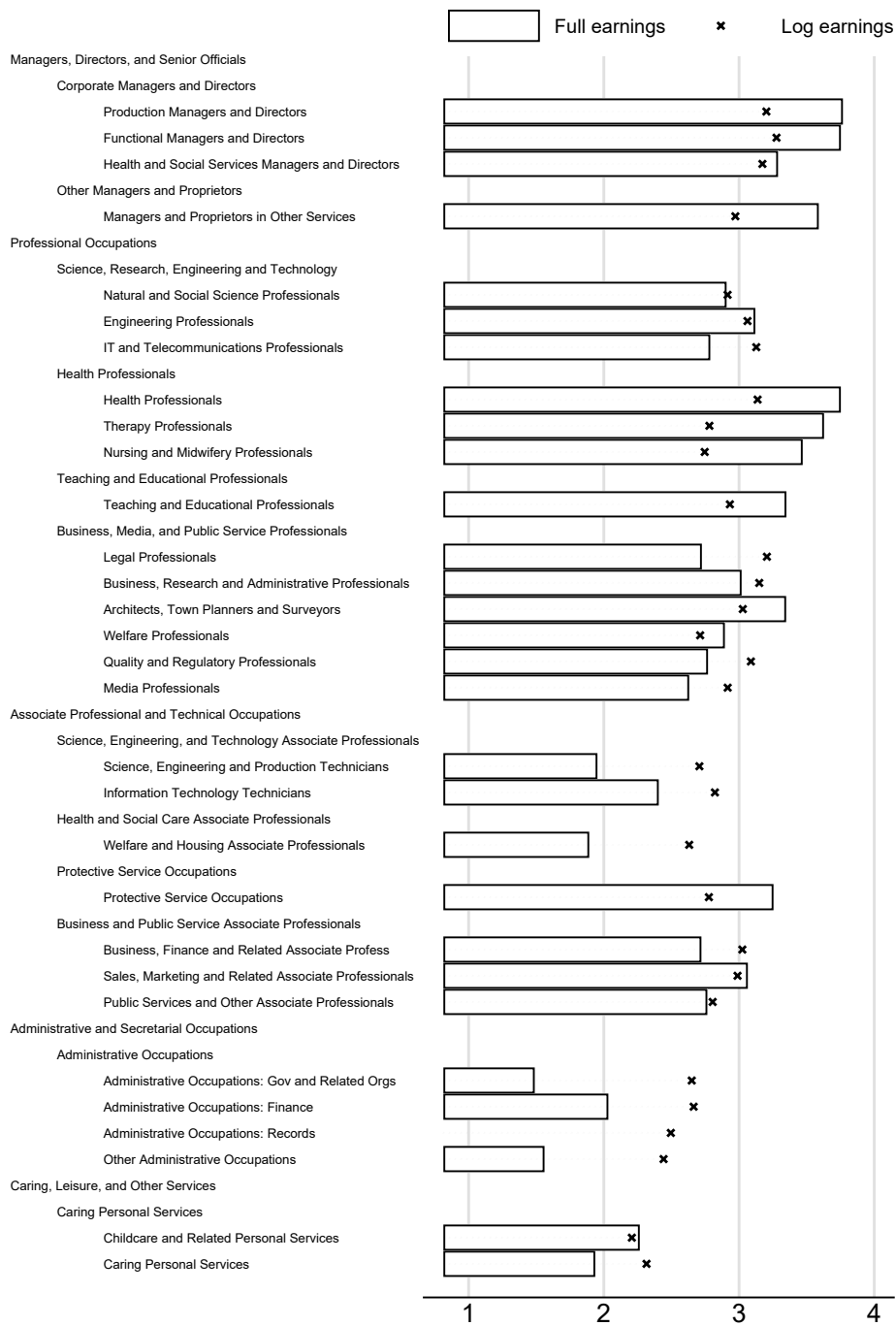


Figure A4: Earnings and Full Earnings across Occupations: Respondents with a Degree.

Source: Understanding Society.

Notes. Occupations are listed in order of the ISCO88 classification. To avoid focusing on outliers, we only plot the 30 most popular occupations. Full earnings in each occupation are expressed in terms of deviations from the sample mean. The figure comes from respondents aged 18 to 65 in full-time employment in five waves of the APS.

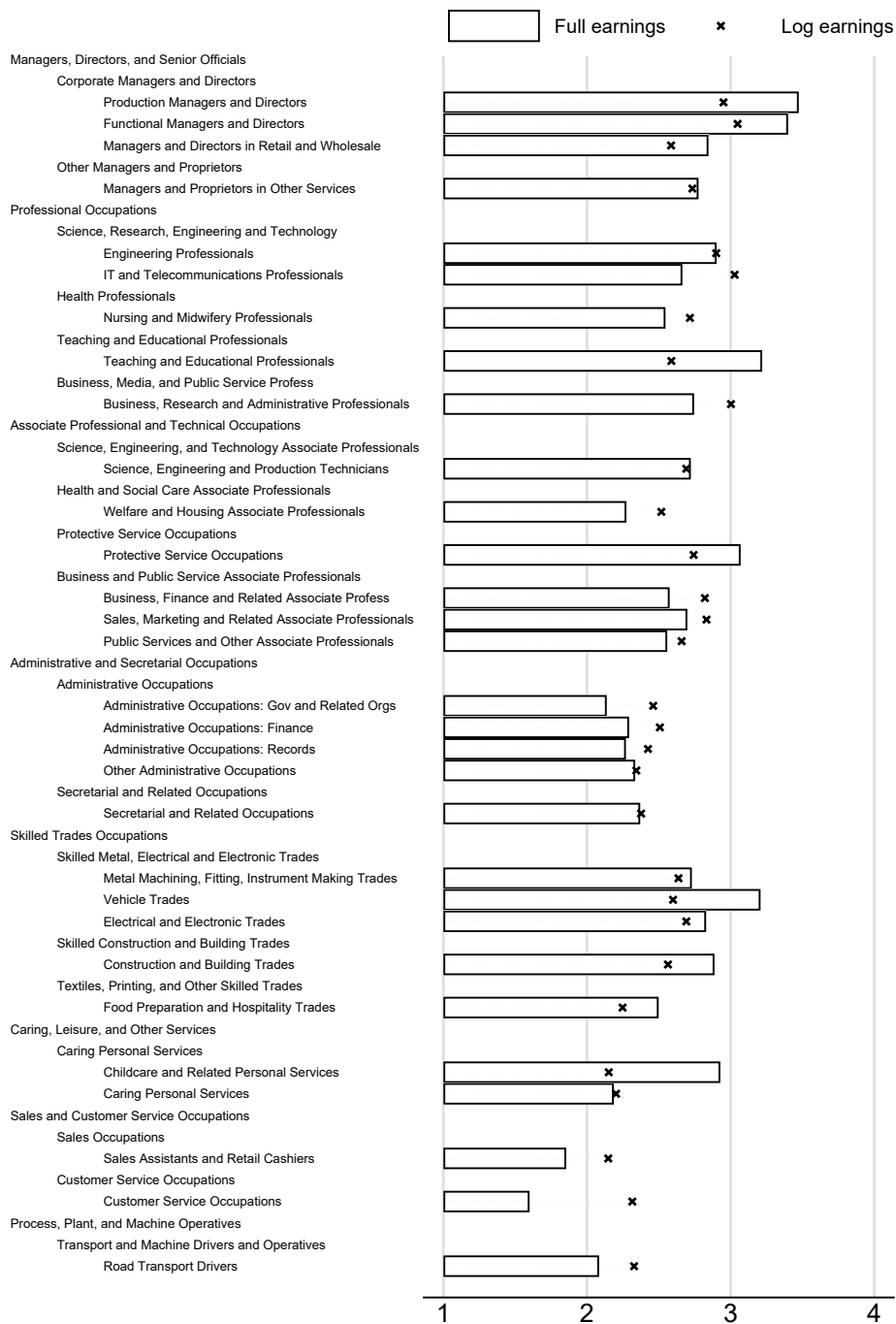


Figure A5: Earnings and Full Earnings across Occupations: Respondents with A-levels.

Source: Annual Population Survey.

Notes. Occupations are listed in order of the SOC2010 classification: the left-most entries show the 1-digit classification, the first indent the 2-digit classification, and the right-most entries that at the 3-digit level. It is for these latter that log earnings and full earnings are depicted. To avoid focusing on outliers, we only plot the 30 most popular occupations. Full earnings in each occupation are expressed in terms of deviations from the sample mean. The figure comes from respondents aged 18 to 65 in full-time employment in five waves of the APS.

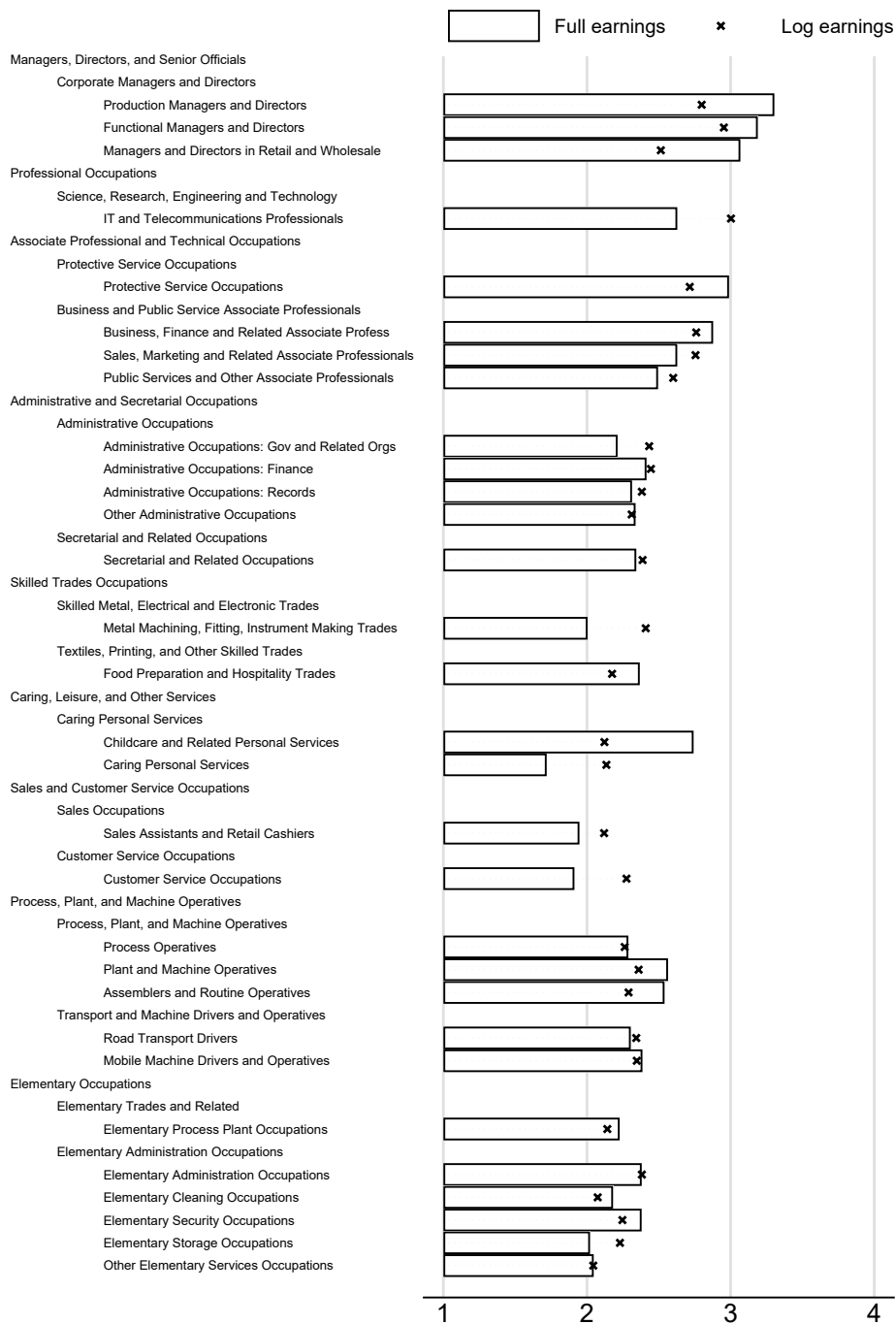


Figure A6: Earnings and Full Earnings across Occupations: Respondents with GCSE or less.

Source: Annual Population Survey.

Notes. Occupations are listed in order of the SOC2010 classification: the left-most entries show the 1-digit classification, the first indent the 2-digit classification, and the right-most entries that at the 3-digit level. It is for these latter that log earnings and full earnings are depicted. To avoid focusing on outliers, we only plot the 30 most popular occupations. Full earnings in each occupation are expressed in terms of deviations from the sample mean. The figure comes from respondents aged 18 to 65 in full-time employment in five waves of the APS.

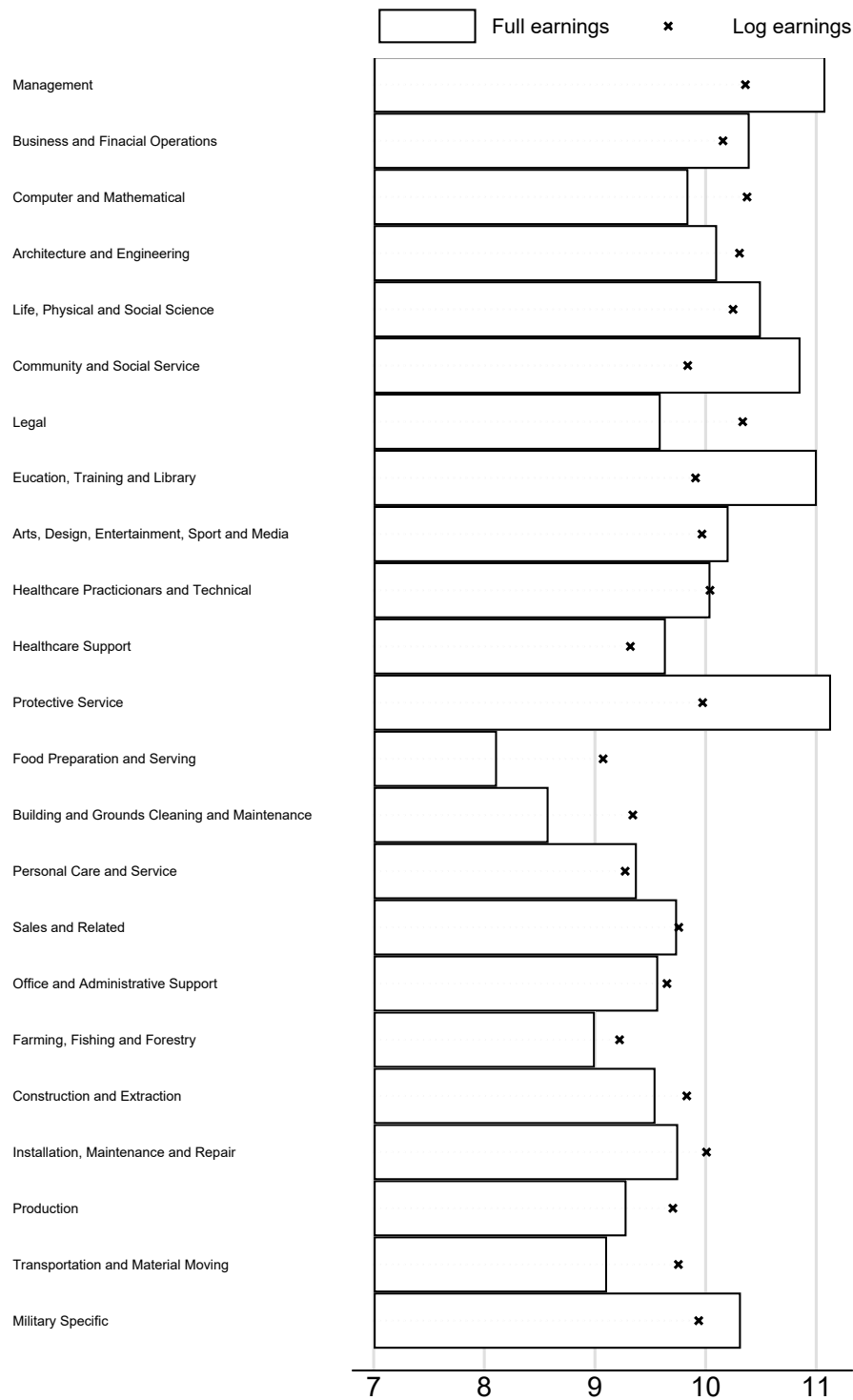


Figure A7: Earnings and Full Earnings in Different Occupations in the General Social Survey.

Source: General Social Survey.

Notes. Occupations are listed in the order of the 2010 Census Occupational Category, aggregated at the 2-digit level. To avoid choosing an arbitrary baseline, the non-pecuniary aspects of each occupation are expressed in terms of deviations from the sample mean. The figure is based on respondents aged 18 to 65 in full-time employment in 29 waves of GSS data, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution.

Appendix B. UK education classifications

The Annual Population Survey classifies educational attainment into six different categories: “Degree”, “Other higher”, “A-levels”, “GCSEs”, “Other qualifications”, and “No qualifications”. Respondents with a “Degree” are those who completed some form of tertiary education. This includes at the very minimum an undergraduate degree, commonly obtained over a period of three years, but also includes those who pursue Graduate degrees. “Other higher” education includes respondents with some post-secondary educational attainment but below the degree level, such as foundational degrees and post-secondary professional education. “A-levels” or Advanced Levels are a non-compulsory school-leaving qualification obtained when leaving secondary education at age 18. A-level courses take two years and the qualification is awarded upon the completion of multiple nationally-standardized examinations at age 18. “GCSE” (General Certificate of Secondary Education) qualifications are obtained at the age of 16, at the end of compulsory education. GCSE courses take between two and three years, depending on the subject and are awarded based on national-level standardized examinations. Respondents with “Other qualifications” generally have different lower-skilled professional qualifications. A small group of respondents in this category have foreign qualifications which were not possible to classify under the UK qualifications system. However, after a major restructuring of the APS classification system in 2011, only a very small share of foreign qualifications remained unclassified in “Other qualifications”. Last, respondents who hold no formal qualifications appear in the “No qualifications” category.

In our analysis, we re-code educational attainment into three broad groups: (i) respondents with a Degree, (ii) respondents with “Other higher” education (but not a Degree) or “A-level” qualifications, and (iii) respondents with “GCSE” qualifications, “Other qualifications” or “No qualifications”. These three categories broadly correspond to 16 (or more) years of education, 13 years of education, and 11 years of education or fewer. In our sample, 38% of respondents are in the first category, 35% in the second and 27% in the third. Table B1 shows how life satisfaction and hourly earnings differ across these three broad educational-attainment categories. In unreported robustness checks we also investigate how our results change if we exclude respondents with “Other qualifications” from the lowest-education category. Our conclusions are virtually unchanged by this exclusion.

Table B1: Descriptive statistics by education

	Mean	SD
Degree (38%)		
Life Satisfaction	7.79	1.30
Log hourly pay	2.88	0.52
A-levels (35%)		
Life Satisfaction	7.77	1.44
Log hourly pay	2.55	0.48
GCSE and below (27%)		
Life Satisfaction	7.71	1.61
Log hourly pay	2.39	0.43

Source: Annual Population Survey.

Notes. The means and standard deviations are calculated from the sample of respondents aged 18 to 65 in full-time employment in five waves of APS data, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution.

Appendix C. SOC2010 Classification by Major Groups (1-digit) and sub-component (2-digit)

1. MANAGERS, DIRECTORS AND SENIOR OFFICIALS

This major group covers occupations whose tasks consist of planning, directing and co-ordinating resources to achieve the efficient functioning of organisations and businesses. Working proprietors in small businesses are included, although allocated to separate minor groups within the major group.

Most occupations in this major group will require a significant amount of knowledge and experience of the production processes, administrative procedures or service requirements associated with the efficient functioning of organisations and businesses.

11. CORPORATE MANAGERS AND DIRECTORS

Job holders in this sub-major group formulate government policy; direct the operations of major organisations, local government, government departments and special interest organisations; organise and direct production, processing, maintenance and construction operations in industry; formulate, implement and advise on specialist functional activities within organisations; direct the operations of branches of financial institutions; organise and co-ordinate the transportation of passengers, the storage and distribution of freight, and the sale of goods; direct the operations of the emergency services, revenue and customs, the prison service and the armed forces; and co-ordinate the provision of health and social services.

12. OTHER MANAGERS AND PROPRIETORS Job holders in this sub-major group, either as employees or proprietors, manage agriculture related services; manage and co-ordinate the operations of health service general practices, residential and day care establishments and domiciliary care services; co-ordinate and direct the activities of businesses such as restaurants, hotels, entertainment establishments, sports and leisure facilities, travel and property agencies, independent shops, garages, waste disposal and environmental services, hairdressing establishments, and agencies providing services outsourced by other organisations.

2. PROFESSIONAL OCCUPATIONS

This major group covers occupations whose main tasks require a high level of knowledge and experience in the natural sciences, engineering, life sciences, social sciences, humanities and related fields. The main tasks consist of the practical application of an extensive body of theoretical knowledge, increasing the stock of knowledge by means of research and communicating such knowledge by teaching methods and other means.

Most occupations in this major group will require a degree or equivalent qualification, with some occupations requiring postgraduate qualifications and/or a formal period of experience-related training.

21. SCIENCE, RESEARCH, ENGINEERING AND TECHNOLOGY PROFESSIONALS

Professionals in this sub-major group undertake research and consultancy activities within the physical and social sciences and in the humanities; technically supervise the development, installation and maintenance of mechanical, chemical, structural and electrical systems; advise upon and direct the technical aspects of production programmes; provide consultancy and development services in the provision and utilisation of information technology and telecommunications; direct and advise upon the conservation and protection of the environment; and direct and advise upon the research and development operations of an organisation.

22. HEALTH PROFESSIONALS

Health professionals provide medical treatments and diagnosis for people and animals, conduct research into treatment and drugs, dispense pharmaceutical compounds, provide therapeutical treatments for medical conditions, and administer nursing and midwifery care.

23. TEACHING AND EDUCATIONAL PROFESSIONALS

Teaching and educational professionals plan, organise and undertake teaching and research activities within educational establishments; plan, organise, direct and co-ordinate the administrative work and financial resources of these establishments; and inspect and advise schools and training establishments.

24. BUSINESS, MEDIA AND PUBLIC SERVICE PROFESSIONALS

Jobholders in this sub-major group advise and act on behalf of clients in legal matters, preside over judicial proceedings, collect and analyse financial information, perform accounting duties, advise on business and management matters, and perform a variety of other professional occupations within the public, welfare, regulatory and voluntary sectors, and within the media.

3. ASSOCIATE PROFESSIONAL AND TECHNICAL OCCUPATIONS

This major group covers occupations whose main tasks require experience and knowledge of principles and practices necessary to assume operational responsibility and to give technical support to Professionals and to Managers, Directors and Senior Officials.

The main tasks involve the operation and maintenance of complex equipment; legal, business, financial and design services; the provision of information technology services; providing skilled support to health and social care professionals; serving in protective service occupations; and managing areas of the natural environment. Culture, media and sports occupations are also included in this major group. Most occupations in this major group will have an associated high-level vocational qualification, often involving a substantial period of full-time training or further study. Some additional task-related training is usually provided through a formal period of induction.

31. SCIENCE, ENGINEERING AND TECHNOLOGY ASSOCIATE PROFESSIONALS

Science, engineering and technology associate professionals perform a variety of technical support functions to scientists, technologists, engineers and architects, prepare technical drawings, undertake building inspections, provide technical support for IT operations and users.

32. HEALTH AND SOCIAL CARE ASSOCIATE PROFESSIONALS

Health and social care associate professionals provide a variety of technical support functions and services for health professionals in the treatment of patients to assist physical and psychological recovery, and provide social care and related community services.

33. PROTECTIVE SERVICE OCCUPATIONS

Workers in protective service occupations serve in the armed forces, the police force, fire service, prison service and perform other protective service roles.

34. CULTURE, MEDIA AND SPORTS OCCUPATIONS

Workers in this sub-major group create and restore artistic works; write, edit and evaluate literary material; perform in acts of entertainment; arrange and perform musical compositions; produce television, film and stage presentations; present television and radio broadcasts; operate camera, sound and lighting equipment; design commercial and industrial products; compete in sporting events for financial reward; and provide training and instruction for sporting and recreational activities.

35. BUSINESS AND PUBLIC SERVICE ASSOCIATE PROFESSIONALS

Business and public service associate professionals command and control the movement of air and sea traffic; organise the administrative work of legal practices; perform specialist financial tasks; purchase goods and materials; provide technical sales advice to clients; undertake market research; arrange for the trading and leasing of property on behalf of clients; organise conferences and related events; undertake recruitment, training and industrial relations activities; promote and maintain areas of the environment; perform administrative functions in government; and undertake statutory inspections of health and safety.

4. ADMINISTRATIVE AND SECRETARIAL OCCUPATIONS

Occupations within this major group undertake general administrative, clerical and secretarial work, and perform a variety of specialist client-orientated administrative duties. The main tasks involve retrieving, updating, classifying and distributing documents, correspondence and other records held electronically and in storage files; typing, word-processing and otherwise preparing documents; operating other office and business machinery; receiving and directing telephone calls to an organisation; and routing information through organisations.

Most job holders in this major group will require a good standard of general education. Certain occupations will require further additional vocational training or professional occupations to a well-defined standard.

41. ADMINISTRATIVE OCCUPATIONS

Workers in this sub-major group undertake administrative and clerical work in national and local government departments and non-governmental organisations; perform specialist clerical tasks in relation to financial records and transactions, the administration of pension and insurance policies, the storage and transportation of freight, the activities of libraries and of human resources operations; and perform other general administrative tasks. They also coordinate and oversee the day-to-day running of offices and supervise office staff.

42. SECRETARIAL AND RELATED OCCUPATIONS

Secretarial occupations perform general secretarial, clerical and organisational duties in support of management and other workers, and provide specialist secretarial support for medical and legal activities.

5. SKILLED TRADES OCCUPATIONS

This major group covers occupations whose tasks involve the performance of complex physical duties that normally require a degree of initiative, manual dexterity and other practical skills. The main tasks of these occupations require experience with, and understanding of, the work situation, the materials worked with and the requirements of the structures, machinery and other items produced.

Most occupations in this major group have a level of skill commensurate with a substantial period of training, often provided by means of a work-based training programme.

51. SKILLED AGRICULTURAL AND RELATED TRADES

Skilled agricultural and related trades cultivate crops, raise animals and catch fish for consumption, grow plants and trees for sale, tend gardens, parks, sports pitches and other recreational areas, and maintain areas of forestry.

52. SKILLED METAL, ELECTRICAL AND ELECTRONIC TRADES

Workers in this sub-major group shape and join metal, erect and maintain metal structures and fixtures; set up and operate metal working machinery and install and repair industrial plant and machinery; assemble parts in the manufacture of metal goods; make and calibrate precision instruments; install, test and repair air conditioning systems; maintain and repair motor vehicles; and install, test and repair industrial, domestic and commercial electrical and electronic equipment.

53. SKILLED CONSTRUCTION AND BUILDING TRADES

Skilled construction and building trades erect steel frames, lay stone, brick and similar materials, construct and repair roofs, install heating, plumbing and ventilating systems, fit windows, doors and other fixtures, and apply coverings and decorative material to walls, floors and ceilings.

54. TEXTILES, PRINTING AND OTHER SKILLED TRADES

Workers in this sub-major group weave fabrics, make articles of clothing, soft furnishings and leather goods, upholster vehicle interiors, set and operate printing machines, prepare meat, poultry and fish, bake bread and flour-based confectionery products, prepare food

and manage catering and bar operations within hotels, restaurants and other establishments, and perform a variety of other skilled trades.

6. CARING, LEISURE AND OTHER SERVICE OCCUPATIONS

This major group covers occupations whose tasks involve the provision of a service to customers, whether in a public protective or personal care capacity. The main tasks associated with these occupations involve the care of the sick, the elderly and infirm; the care and supervision of children; the care of animals; and the provision of travel, personal care and hygiene services.

Most occupations in this major group require a good standard of general education and vocational training. To ensure high levels of integrity, some occupations require professional qualifications or registration with professional bodies or relevant background checks.

61. CARING PERSONAL SERVICE OCCUPATIONS

Workers in this sub-major group assist health professionals in the care of patients; undertake caring personal services within the community; supervise the activities of pre-school age children and assist teachers with non-teaching duties; provide technical assistance to veterinarians and provide other services in the care of animals; provide funeral services; and control pests hazardous to public health.

62. LEISURE, TRAVEL AND RELATED PERSONAL SERVICE OCCUPATIONS

Workers within Leisure, Travel and Related Personal Service Occupations provide services and facilities for sporting and recreational activities; make travel arrangements for clients and provide ancillary services for travellers; provide hairdressing and beauty services; undertake domestic and care-taking duties in private households, public buildings and other establishments.

7. SALES AND CUSTOMER SERVICE OCCUPATIONS

This major group covers occupations whose tasks require the knowledge and experience necessary to sell goods and services, accept payment in respect of sales, replenish stocks of goods in stores, provide information to potential clients and additional services to customers after the point of sale. The main tasks involve knowledge of sales techniques, a degree of knowledge regarding the product or service being sold, familiarity with cash and credit handling procedures and a certain amount of record keeping associated with those tasks.

Most occupations in this major group require a general education and skills in interpersonal communication. Some occupations will require a degree of specific knowledge regarding the product or service being sold, but are included in this major group because the primary task involves selling.

71. SALES OCCUPATIONS

Workers in this sub-major group sell goods and services in retail and wholesale establishments, accept payment in respect of sales, obtain orders and collect payments for goods and services from private households, replenish stocks of goods in stores, create displays of merchandise and perform other sales related occupations.

72. CUSTOMER SERVICE OCCUPATIONS

Customer service occupations receive and respond to enquiries regarding products or services, deal with customer complaints and perform a variety of tasks in the provision of additional services to customers after the point of sale; operate switchboards and receive and direct calls in a variety of establishments; operate telecommunications equipment to transmit and receive messages; conduct market research interviews; and perform other customer service tasks.

8. PROCESS, PLANT AND MACHINE OPERATIVES

This major group covers occupations whose main tasks require the knowledge and experience necessary to operate and monitor industrial plant and equipment; to assemble products from component parts according to strict rules and procedures and to subject assembled parts to routine tests; and to drive and assist in the operation of various transport vehicles and other mobile machinery.

Most occupations in this major group do not specify that a particular standard of education should have been achieved but will usually have a period of formal experience-related training. Some occupations require licences issued by statutory or professional bodies.

81. PROCESS, PLANT AND MACHINE OPERATIVES

Process, plant and machine operatives operate and attend machinery to manufacture, process or otherwise treat foodstuffs, beverages, textiles, chemicals, glass, ceramics, rubber, plastic, metal, synthetic and other products, operate plant and machinery to produce paper, wood and related products, extract coal and other minerals from the earth, attend and operate power generation and water treatment systems, perform routine operations in the manufacture of motor vehicles, metal goods, electrical and electronic products, clothing and other goods, and perform a variety of tasks in relation to the construction and repair of buildings, public highways, underground piping systems, railway tracks and other structures.

82. TRANSPORT AND MOBILE MACHINE DRIVERS AND OPERATIVES

Transport and mobile machine drivers and operatives drive motor vehicles to transport goods and people; drive trains and guide and monitor the movement of rail traffic; operate mechanical equipment on board boats, ships and other marine vessels; assist in the boarding, fuelling and movement of aircraft at airports; operate lifting, earth moving and earth surfacing equipment, agricultural equipment and other mobile machinery.

9. ELEMENTARY OCCUPATIONS

This major group covers occupations which require the knowledge and experience necessary to perform mostly routine tasks, often involving the use of simple hand-held tools and, in some cases, requiring a degree of physical effort.

Most occupations in this major group do not require formal educational qualifications but will usually have an associated short period of formal experience-related training.

91. ELEMENTARY TRADES AND RELATED OCCUPATIONS

Occupations in this sub-major group perform agricultural, fishing and forestry related tasks, undertake general labouring duties, assist building and construction trades workers, and perform a variety of duties in foundry, engineering and other process plant related trades.

92. ELEMENTARY ADMINISTRATION AND SERVICE OCCUPATIONS

Workers in this sub-major group collect, sort and deliver written correspondence, undertake elementary clerical tasks within offices, undertake elementary cleaning tasks, protect and supervise people and property, perform elementary sales related tasks, assist in the storage and transportation of goods, and perform a variety of carrying, preparation and serving tasks within hospitals, catering, domestic and other establishments.

Appendix D. Job Characteristics

We evaluate how different job attributes feed into both the monetary and non-monetary components of full earnings. We first appeal to the Annual Population Survey itself, which contains information on a number of job attributes at the individual level. In a second step, we will complement this analysis with data from the UK Labour Force Survey (LFS) and the Workplace Employment Relations Study (WERS), which contain more-detailed work-related variables that we can match to the Annual Population Survey at the 3-digit occupation level.

We proceed by re-estimating Equations (4) to (6), adding to each a vector of job characteristics Z_i . From the APS data, the Z_i will control for ever working overtime, completing any job-related education or training in the past 13 weeks, working from home, permanent or temporary employment, managerial duties, and whether the job is in the public or private sectors.

We complement the APS job-characteristics information with data from the LFS and WERS. The LFS is a quarterly study of the employment circumstances of the UK population. It is the largest household study in the UK and provides the official measures of employment and unemployment. The LFS includes information on a broad set of job characteristics. We here consider the occupation proportions of apprenticeship and unionization, the average time traveled to work (in minutes; split by the proportion in each quartile), and work times (during the day, the evening, or the night). This information is calculated from the sample of workers aged 18 to 65 in full-time employment in the LFS. While the APS and the LFS cannot be matched at the individual level, we exploit the fact that the two surveys use the same occupational classification to create objective measures of occupational quality at the 3-digit occupational level within each LFS wave. These are then merged at the occupational-wave level to each of our five APS waves.

We have additional occupation-level job characteristic information from WERS. This is a representative sample of workplaces and is the flagship survey of employment relations in Britain. It collects information from employers, employee representatives and employees, and was undertaken six times between 1980 and 2011. WERS is comprised of the Survey of Managers (MQ), the Survey of Employee Representatives (WEQ), the Survey of Employees (SEQ), and the Financial Performance Questionnaire (FPQ). For the purpose of our analysis, we focus on the Survey of Employees. This consists of a self-completion survey filled-in by a representa-

tive group of up to 25 employees, randomly selected in each of the workplaces participating in the survey. We use the most-recent wave of the survey (2011), which includes information from about 22,000 employees who answer a series of questions about their job and their organization. The WERS data provides us with more-subjective information, offering additional insights into the job characteristics that employees find important. These characteristics are: having a job requiring hard work; never having enough time; needing to work long hours to progress; having influence over own tasks; having influence over work pace; having influence over start and finish hours; having flexi-time arrangements in place, having an arrangement for paid leave to care for someone in place, sharing the organization's values, being loyal to the organization, being proud to work in the organization, and having a good relationship with the management. As for the LFS data, the job-characteristic information in WERS is matched to the APS at the 3-digit occupational level. The descriptive statistics on the job attributes measured in the APS, the LFS and WERS are listed in Table D1.

Table D1: Descriptive Statistics for Job Attributes in APS, LFS, and WERS

	Mean	SD
At the individual level (APS)		
Ever overtime (binary)	0.48	0.50
Training last 13 weeks (binary)	0.32	0.47
Works from home(binary)	0.07	0.25
Permanent job (binary)	0.96	0.20
Managerial duties (categorical)		
Manager	0.31	0.46
Foreman or supervisor	0.13	0.33
No duties	0.56	0.50
Public sector (binary)	0.27	0.44
At the occupation level (LFS)		
Tenure (years)	8.60	1.98
Proportion in apprenticeship (%)	0.01	0.01
Proportion in union	0.26	0.21
Travel to work (% 1st quartile)	0.33	0.11
Travel to work (% 2nd quartile)	0.19	0.04
Travel to work (% 3rd quartile)	0.24	0.05
Travel to work (% 4th quartile)	0.24	0.10
Proportion working days (%)	0.75	0.08
Proportion working evenings (%)	0.22	0.12
Proportion working nights (%)	0.08	0.07
Proportion work accidents (%)	0.01	0.03
Proportion bone illness, upper body (%)	0.01	0.00
Proportion bone illness, lower body (%)	< 0.01	< 0.01
Proportion back illness (%)	0.01	0.01
Proportion stress, depression, anxiety (%)	0.02	0.01

At the occupation level (WERS)

Job: requires hard work (1=“strongly disagree”; 5=“strongly agree”)	4.17	0.21
Job: never enough time (1=“strongly disagree”; 5=“strongly agree”)	3.31	0.32
Job: is secure (1=“strongly disagree”; 5=“strongly agree”)	3.52	0.26
Long hours to progress (1=“strongly disagree”; 5=“strongly agree”)	3.28	0.27
Influence over tasks (1=“none; 4=“a lot”)	3.20	0.29
Influence over work pace (1=“none; 4=“a lot”)	3.10	0.26
Influence over start/finish hours (1=“none; 4=“a lot”)	3.39	0.25
Job makes tense (1=“never”; 5=“all the time”)	2.67	0.22
Job makes depressed (1=“never”; 5=“all the time”)	1.83	0.17
Job makes worried (1=“never”; 5=“all the time”)	2.16	0.22
Job makes gloomy (1=“never”; 5=“all the time”)	1.92	0.17
Job makes uneasy (1=“never”; 5=“all the time”)	1.95	0.16
Job makes miserable (1=“never”; 5=“all the time”)	1.76	0.17
Flexi-time arrangement available (1=“no”; 2=“yes, not used” 3=“yes, used”)	1.69	0.34
Paid leave arrangement available (1=“no”; 2=“yes, not used” 3=“yes, used”)	1.34	0.12
Takes initiative (1=“strongly disagree”; 5=“strongly agree”)	3.85	0.23
Shares organization values (1=“strongly disagree”; 5=“strongly agree”)	3.76	0.30
Loyal to organization (1=“strongly disagree”; 5=“strongly agree”)	3.91	0.26
Proud to work in organization (1=“strongly disagree”; 5=“strongly agree”)	3.84	0.29
Good management relations (1=“very poor”; 5=“very good”)	3.66	0.29

Source: Annual Population Survey, Labour Force Survey, and WERS.

Notes. The means and standard deviations are calculated from the sample of respondents aged 18 to 65 in full-time employment in five waves of APS data, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution.

To reduce the high dimensionality of the data in WERS, we create three factors which are defined across three distinct categories: job design, job autonomy, and organization characteristics. The job-design factor includes information on having to work hard to finish tasks, facing time pressure at work, having to work long hours to progress, having flexi-time, and having paid leave. The autonomy factor includes the questions on influence over your own task, the pace of work, and the hours worked. Last, the organizational factor includes questions on taking initiative, sharing the organization’s values, being loyal to the organization, being proud to work for the organization, and good relationships with the management. In addition to these three factors, we separately control for job security.

To see how job attributes affect the monetary and non-monetary aspects of full earnings, Table D2 shows the estimated coefficients from Equations (4) to (6), now with the addition of the APS individual-level job characteristics, and with the occupation-level job attributes from the LFS and WERS respectively. The standard errors are clustered at the occupation level.

Table D2: The Decomposition of Full Earnings by Job Amenities at the Individual (APS) and Occupation (LFS and WERS) Levels

	Earnings	α_3^j/α_2	Full Earnings
Individual-level attributes (APS)			
Ever overtime	0.060*** (0.011)	0.019*** (0.006)	0.079*** (0.013)
Training last 13 wks	0.021*** (0.007)	-0.013 (0.010)	0.008 (0.014)
Works from home	0.015 (0.032)	0.000 (0.013)	0.015 (0.033)
Temporary job	-0.091*** (0.009)	0.026 (0.017)	-0.065*** (0.021)
Manager	0.201*** (0.012)	0.098*** (0.027)	0.299*** (0.034)
Foreman or supervisor	0.040*** (0.010)	0.022 (0.019)	0.062*** (0.022)
Public sector	-0.012 (0.021)	-0.029 (0.025)	-0.042 (0.033)
Occupation-level attributes (LFS)			
Apprenticeship (proportion)	0.012 (0.049)	0.325* (0.182)	0.337 (0.212)
Union (proportion)	0.013** (0.006)	0.069*** (0.023)	0.082*** (0.025)
Travel time (2nd quartile)	0.487*** (0.170)	-1.243* (0.683)	-0.756 (0.699)
Travel time (3rd quartile)	0.978*** (0.159)	-1.633** (0.642)	-0.655 (0.633)
Travel time (4th quartile)	1.547*** (0.123)	-1.106*** (0.399)	0.441 (0.432)
Works days (proportion)	0.073*** (0.027)	0.416*** (0.091)	0.489*** (0.091)
Works evenings (proportion)	-0.016 (0.010)	-0.047 (0.047)	-0.064 (0.048)
Works nights (proportion)	0.032** (0.012)	0.154** (0.063)	0.186*** (0.065)
Occupation-level attributes (WERS)			
Job security	-0.008 (0.040)	0.121 (0.133)	0.113 (0.148)
Job design factors	0.051*** (0.017)	-0.040 (0.064)	0.011 (0.069)
Job autonomy factors	0.019 (0.014)	0.183*** (0.054)	0.203*** (0.058)
Organizational factors	-0.017 (0.017)	0.013 (0.062)	-0.004 (0.067)

Gender	Yes	Yes	Yes
Age	Yes	Yes	Yes
Age-squared/100	Yes	Yes	Yes
Education	Yes	Yes	Yes
Ethnicity	Yes	Yes	Yes
Wave fixed effects	Yes	Yes	Yes
R^2	0.48	0.46	0.50
F	296.13	9.96	59.93
N	197,055	197,055	197,055
SD dependent	0.51	0.38	0.68

Source: Annual Population Survey, Labour Force Survey, and WERS.

Notes. These are OLS regressions. In column (1) “Log earnings” is the logarithm of hourly earnings. In column (2) α_3^j/α_2 is the value of non-pecuniary work amenities estimated in Equation (1) adjusted by the coefficient on log earnings. In column (3) the dependent variable is our measure of full earnings. The APS job attributes are at the individual level. “Ever overtime”, “Training last 13 wks”, “Works from home”, “Temporary job”, and “Public sector” are dummies. “Manager” and “Foreman or supervisor” are relative to the baseline category of “No managerial responsibilities”. The LFS job attributes are at the occupation-year level and are re-weighted accordingly. “Travel time” is in minutes and grouped into quartiles, where those in the first quartile travel the least. The remaining variables are expressed in percentage points and capture the occupational proportions. The WERS factors are constructed from job attributes at the occupation level in 2011, re-weighted accordingly. The variables are mostly measured on Likert scales: the questions appear in Appendix Table D1. The sample covers respondents aged 18 to 65 in full-time employment in five waves of the APS, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. Heteroskedasticity-robust standard errors appear in parentheses. The sample is re-weighted using the *NPWT18* population weights in the Annual Population Survey, designed for performing analysis on the sample completing wellbeing questions. Significance levels: *** $p < .01$, ** $p < .05$, * $p < .1$.

Looking at the APS controls, working overtime, employer-provided training, and managerial responsibilities are all associated with higher earnings, while temporary jobs are associated with lower earnings. Column 2 considers job amenities: these job characteristics exhibit sizable correlations with the non-pecuniary aspects of occupations. As the coefficients in columns (1) and (2) are often of the same sign, the dispersion of full earnings is naturally higher than that of earnings.

A number of the job characteristics from the LFS are significantly correlated with both earnings and amenities. Apprenticeships are not correlated with earnings but are associated with much better amenities. Travelling longer to work is related to a higher earnings but, as expected, not to better amenities such that the overall correlation with full earnings is broadly zero. Union membership increases both earnings and amenities, with a particularly large effect through the latter. Finally, those working during the day have higher full earnings, most of which reflects job amenities. The same is true, although to a smaller extent, for those who work nights.

Our last, more-subjective, job-characteristic variables come from WERS. Job security is not statistically significant, but the coefficient is in the expected direction. Elements of “job design” increase earnings, but not amenities. Autonomy factors increase full earnings substantially,

entirely through the non-pecuniary components. Organization specific factors do not seem to matter, with the coefficients being both small in magnitude and noisily estimated. Table D3 below estimates column (2) in Table D2 at the occupation level.

Table D3: The Decomposition of α_3^j/α_2 , Estimated at the Occupation Level

	α_3^j/α_2
Individual-level attributes (APS)	
Ever overtime (proportion)	0.051 (0.079)
Training last 13 wks (proportion)	0.077 (0.077)
Works from home (proportion)	0.119 (0.093)
Temporary job (proportion)	-0.060 (0.202)
Manager (proportion)	0.066** (0.030)
Foreman or supervisor (proportion)	0.037 (0.065)
Public sector (proportion)	0.006 (0.036)
Occupation-level attributes (LFS)	
Apprenticeship (proportion)	0.453 (0.324)
Union (proportion)	0.079 (0.049)
Travel time (2nd quartile)	-3.484 (2.219)
Travel time (3rd quartile)	-2.050 (1.746)
Travel time (4th quartile)	-1.826* (1.023)
Works days (proportion)	0.516*** (0.168)
Works evenings (proportion)	-0.085 (0.081)
Works nights (proportion)	0.192* (0.108)
Occupation-level attributes (WERS)	
Job security	0.040 (0.199)
Job design factors	-0.043 (0.084)
Job autonomy factors	0.084

	(0.071)
Organizational factors	0.040
	(0.070)
Gender	Yes
Age	Yes
Age-squared/100	Yes
Education	Yes
Ethnicity	Yes
R^2	0.72
F	4.24
N	90
SD dependent	0.38

Source: Annual Population Survey, Labour Force Survey, and WERS.

Notes. These are OLS regressions, estimated at the occupation level. α_3^j/α_2 is the value of non-pecuniary work amenities estimated in Equation (1) adjusted by the coefficient on log earnings. The sample covers respondents aged 18 to 65 in full-time employment in five waves of the APS, excluding those whose hourly earnings are in the 1st percentile of the earnings distribution. Heteroskedasticity-robust standard errors appear in parentheses. Data at the occupation level is collapsed using the NPWT18 population weights in the Annual Population Survey, designed for performing analysis on the sample completing wellbeing questions. The regression results are weighted using weights based on the number of respondents in each occupation. Significance levels: *** $p < .01$, ** $p < .05$, * $p < .1$.

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