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Education, Motivation and Pay of UK Graduates: are they different for women?

ARNAUD CHEVALIER

Introduction

Women are outperforming men in education in the UK from age seven up to university. They are also more likely to remain in education after compulsory school age (DfES, 2002). Their share in higher education has increased dramatically in the last two decades and they represented 55% of the students in 2001/2002. These trends are rather recent and a similar evolution can be observed in most OECD countries (Ono, 2002). This reflects a reduction in discrimination, but also gender differences in attitudes towards education and non-cognitive skills, such as attention, organisation, and the aptitude to seek help (Jacob, 2002).

Segregation by gender is important. Montmarquette *et al*. (2002) and Averett and Burton (1996), both using North American data, found that, for men but not for women, the choice of a university major is affected by the returns to this subject. Hence, more men tend to be found in subjects that offer higher earnings. Furthermore, the chances of obtaining a distinction and the probability of unemployment or of being over-educated are affected by the choice of majors, with 'female' subjects entailing the highest risk in the labour market.

Gender differences in educational and labour market attainments also stem from differences in preferences. Women prefer to work in the public sector, which is seen as more family friendly, but also have character traits that may put them at a disadvantage compared to men. One of the datasets used in this study is unique, as it includes questions on long-term values. There are great gender differentials in the importance of financial rewards, ambition, workaholism and preferences for a socially useful job.

This article studies various aspects of the higher education experience before focusing on the wage differential. While at all levels of education, women's earnings are lower than men's, the financial returns to each year of schooling,[1] i.e. the earning differential between someone with schooling S and someone with schooling S-1, is higher for women (Chevalier & Walker, 2001). These higher returns to education for women are not specific to the UK. They can also be observed in most European countries (Harmon *et al*., 2001) and the US (Card, 1999). However, a higher return does not mean that the gender wage gap disappears for graduates.[2] Ono (2002) shows that, despite a larger rate of returns to higher education, the wages of women graduates in the US only match with men high school graduates. Thus, the gender wage gap is reduced but not

eliminated for the most educated. This could stem from employers' discrimination against women or cultural attitude (Polachek, 1981) where women choose careers that allow them to accommodate their family responsibilities.

Traditionally, the pay gap is decomposed between the differences in observed characteristics between men and women and in the returns to characteristics by gender, the latter reflecting the unexplained part of the differential. Much of the wage gap is usually left unexplained.[3] We argue that gender differences in educational choices (majors) and career expectations (character traits), typically not included in the decomposition, should account for the variation in wages. Hence, their inclusion allows for the share of the gender wage gap originating from employers' discrimination to be identified.

The empirical evidence is based on three cohorts of UK graduates. The datasets are described in the next section. We then document the gender disparities in choice of major and their consequences for attainment in education and in the labour market. The gender wage gap for graduates ranges from 11% to 15%. Accounting for various characteristics of the graduates, such as credential, work experience and family background, as well as their choice of major, reduces the wage gap to between 1% and 5%, with university majors explaining up to 20% of the pay differential. If the men and women's characteristics were identical and if the same subject-mix was chosen, men would be paid 1% to 5% more than women. Furthermore, if there was no character traits difference, another 30% of the wage gap would disappear, so there is little discrimination against women graduates, at least early on in their career. Finally, despite lower wages, women have fewer regrets, possibly because of gender differences in the selection of a subject and higher education expectations. We conclude by discussing the role education could play to reduce gender differences in character traits.

Data

The First Destination Survey (FDS) is an annual dataset that surveys UK graduates 6 months after graduation. It provides information on graduation, institution and the current labour market situation, but lacks information on earnings and only provides a snapshot of the situation soon after leaving university, which may be different from the career achievement.

We also used two other surveys of UK graduates. Both are similar in their design (postal survey relying on the Alumni Offices of a selected group of tertiary institutions), but differ in the details, thus preventing a direct comparison of the cohorts over time. The first studies the cohorts of 1985 and 1990 graduates who were contacted in the autumn of 1996 (Belfield *et al.*, 1997). A selection of each type of UK tertiary institutions was invited to participate.[4] The second studies the 1995 cohort for its first 42 months after graduations (Elias *et al.*, 1999). The 1995 cohort questionnaire also includes questions on personal traits, such as ambition and motivation. Both surveys provide detailed information on higher education achievement and early career progression and report annual earnings by categories. For the 1985–90 survey, it is possible to construct hourly pay using the category midpoints and the weekly hours worked. However, as hours worked are not reported in the 1995 cohort, the analysis has to be conducted on annual wage.

The selected sample includes first-degree graduates in paid employment.[5] Students aged 30 or more on graduation are not included, as pre-university

experience would affect their current outcomes, nor are respondents with health problems in order to keep a homogeneous population. These restrictions lead to raw samples of 2,324, 3,981, 5,755 observations for the 1985, 1990 and 1995 cohorts respectively.

Gender Differences

Here, we make a distinction between two areas where men and women differ in their choices: the choice of a university major and career preferences, and personal traits. The two may not be independent, but this issue is not investigated here.

Effects of Subject

The human capital theory suggests that investment in education is carried on until the current value of the future earnings associated with the level S of education equals the cost of that year of education. The cost can be split between the direct cost of education (fees) and the foregone earnings (wages that could have been earned during that extra year of education).[6] In addition to differences in subject preferences by gender, differences in the returns to education, the preference and time spent in employment could explain the attainment gap by gender. Women's greater participation in higher education is consistent with higher returns to education for women, but this positive effect is weakened by a shorter working life and possibly a higher discount rate.

A similar model can explain the choice of major. Students choose the major for which their financial returns should be the highest. This model would also incorporate the probability of graduating, as well as interest in the subject. Finally, if financial returns to education are less important for women than for men when making their educational choice, then differences in returns, time spent in employment and the discount rate would be less relevant.

While participation in higher education is nearly at parity for the cohorts under study, there are marked differences in the choice of subjects (see Table I). The most popular with women are Languages and Social Sciences, whereas with men they are Physics, Social Sciences and Engineering. Apart from Social Sciences and Business, the differences in the choice of subject by gender are always statistically significant. The imbalance is highest in Engineering, Languages, Maths and Physics for the three cohorts. Scientific subjects are male dominated, whilst Arts/Humanities have a higher female participation. The Duncan index suggests that some 30% of women would have to change subjects to make the distribution of majors identical between both genders.[7] Despite great changes in attendance in higher education and gender mix, there is no evidence that subject segregation by gender has decreased over the 1985-95 period, as the indices of segregation are of similar magnitude.

The subjects that are most popular with women, such as Languages, Humanities, and some disciplines in Social Sciences, are associated with lower grades and rather lower pay than Engineering, Mathematics or Medicine (see Belfield *et al*., 1997, for a breakdown of wages by subject of graduation). A First class honours leads to a 10% pay increase compared to an average grade (2/2) (Chevalier & Conlon, 2002). Graduates in Maths, Physics and Engineering are much more likely to be awarded a top grade than any other graduates. As these

TABLE I. Distribution of subject by gender

Year	1985/86			1990/91			1993/94		
	Men	Women	Diff	Men	Women	Diff	Men	Women	Diff
Medicine and dentistry	7.03	6.88	0.15	6.04	6.45	0.41	5.33	5.51	0.18
Studies allied to medicine	1.51	4.35	2.84	1.65	4.67	3.02	1.76	5.29	3.54
Biological sciences	6.04	9.80	3.76	6.20	10.02	3.82	6.45	10.70	4.25
Veterinary science, agriculture and related studies	1.95	1.90	0.05	1.43	1.51	0.08	1.13	1.41	0.29
Physical sciences	13.03	5.83	7.20	11.55	5.76	5.79	11.46	6.35	5.10
Mathematical sciences	8.19	4.33	3.86	9.35	3.92	5.43	9.28	3.61	5.66
Engineering and technology	18.64	2.25	16.38	17.93	3.07	14.86	16.99	3.34	13.65
Architecture and related studies	1.67	0.76	0.91	1.67	0.67	0.99	1.98	0.63	1.35
Social sciences	14.19	16.55	2.36	14.12	16.03	1.91	14.39	15.26	0.87
Business and financial studies	4.66	3.87	0.79	5.53	4.64	0.90	5.21	4.33	0.88
Librarianship and information science	0.05	0.34	0.28	0.11	0.27	0.16	0.22	0.43	0.21
Languages and related studies	5.64	18.92	13.28	5.41	16.43	11.03	6.18	16.94	10.76
Humanities	6.23	7.89	1.66	6.42	7.31	0.89	7.27	8.40	1.14
Creative arts	1.27	2.27	1.00	1.21	2.29	1.08	1.18	2.24	1.06
Education	0.57	2.62	2.05	0.76	3.18	2.41	0.69	3.10	2.41
Multi-disciplinary studies	9.31	11.44	2.13	10.62	13.79	3.17	10.48	12.42	1.94
Total	100	100		100	100		100	100	
Duncan index			29.36			27.97			26.649

Source: First Destination Survey.

majors are male-dominated, this bias may increase the earnings differential in favour of men. McNabb *et al*. (2002), using the FDS, estimate that women are 50% less likely to obtain First class honours but cannot positively conclude that this difference stems from subject choice.

The subject of the degree also affects the probability of obtaining and retaining a job. Figure 1 reports the participation in the labour market of 1993–94 graduates.[8] Under 50% are in permanent employment six months after graduation and no gender difference is observed overall. However, in some subjects, men and women graduates fare quite differently. A 13 percentage points difference in favour of women is observed for those graduating in studies allied to medicine. This could be due to the aggregation of the subject; a majority of women graduated in nursing, whilst men mostly majored in Pharmacy or Physiology. A significant employment gap is also observed for Education graduates. The highest unemployment rate for men may stem from a larger number deciding not to go into teaching upon graduation.

The proportion of graduates in employment six months after graduation merely reflects the speed of integration in the labour market, but subject effects

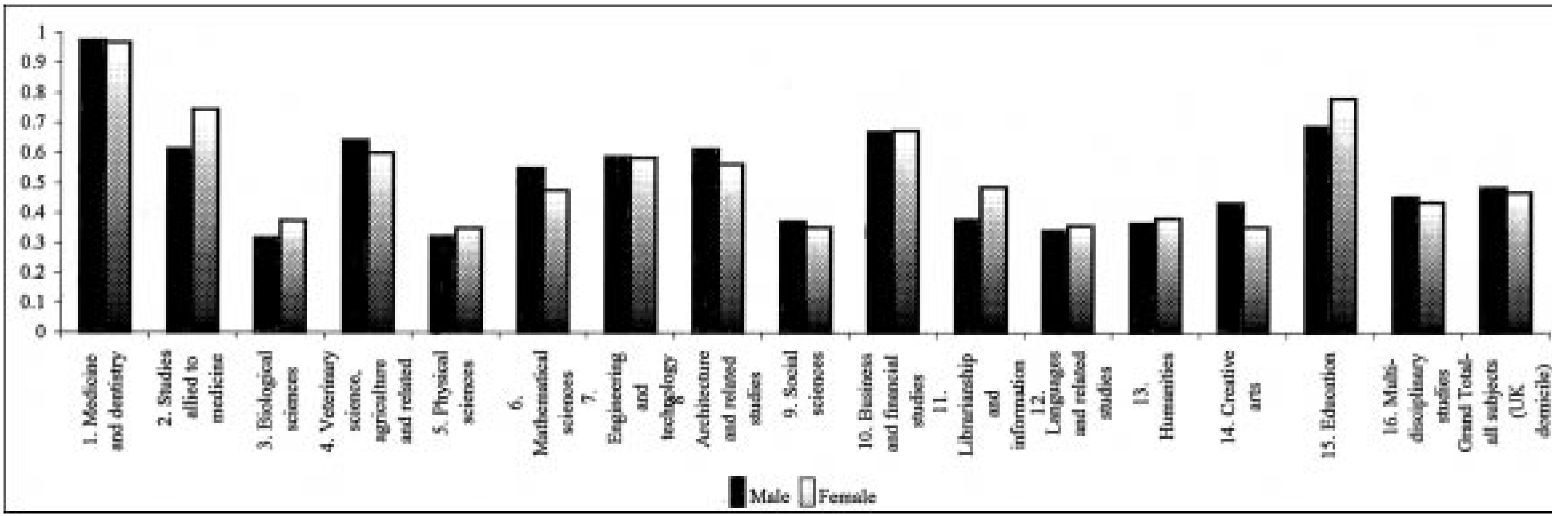

FIGURE 1: Permanent employment by subject and gender

Source: First Destination Survey 1993/94

are again observed. Since typically Medicine and Education graduates are employed during their last years of studies, almost all have a job upon graduation. Those in less vocational subjects are slower in integrating the labour market: six months after graduation, between 30% and 70% are in permanent employment. The probability of employment is lowest for graduates in Biology, Physics, Social Sciences, Languages and Humanities. Apart from Physics, these subjects are characterised by a high feminisation. The quality and speed of integration in the labour market have long-term consequences on career development and earnings. An initial unemployment spell has long-term scarring effects (Margolis *et al.*, 2001).

Graduate unemployment is rather low and in the long run there is no difference in the propensity of unemployment by subject (Chevalier *et al.*, 2002a). But with the surge in the number of graduates in most Western countries, the literature has focused on whether graduates obtain jobs for which their skills are required or whether they are found in less skill-demanding jobs. Over-education is associated with a pay penalty ranging from 8% to 26%, high enough to potentially wipe out the financial returns to a degree (Chevalier, 2002). As the demand for graduates is not homogeneous, those in some majors are more at risk of facing over-education than others. Graduates in Medicine, Mathematics and Education are between 6 and 19 percentage points less likely to be over-educated than those in Social Science, whilst those in Biology, Languages and Humanities are 3 to 5 percentage points more at risk. Again, graduates in the most feminised majors face greater risks.

Moreover, women choose different types of occupation and sectors of activity. Figure 2 shows the number of graduates employed in the public sector six months after graduation. Almost all graduates in Medicine and to a lesser extent in Education work in this sector. What is more remarkable is the statistically significant difference in the number by gender. Overall and for most subjects, women are more likely than men to be public sector employees. The greatest differences are found for graduates in studies allied to Medicine, Education, Librarianship and Social Sciences. Preference for working in the public sector and thus encountering a pay penalty may be due to character traits (see below) or, in the case of women, a belief that this sector offers a more family friendly environment.[9]

As seen above, the choice of university major impacts on earnings. The UK literature on the returns to higher education by subject is limited through lack of appropriate data.[10] The various studies are difficult to compare, since the subject decomposition is *ad hoc* and dictated by the dataset. To summarise the main studies:[11] Harkness and Machin (1999), using the General Household Survey and decomposing in four subjects, find that, over the 1980–1995 period, returns to higher education compared to A-levels have increased for all subjects for men. Returns to an Arts degree for men are significantly lower than for other subjects (at least 10 percentage points). For women, returns to Arts and Science degrees increased by 12 to 15 percentage points over the period, whilst for Social Science and Others no clear trend can be observed.

Walker and Zhu (2001) pooled 7 years of the Quarterly Labour Force Survey from 1993 to 1999 and distinguish between 13 majors. Compared to adults whose highest qualification is A-levels, university graduates earn substantially more (+15% for men, +19% for women), with the exception of men graduating in

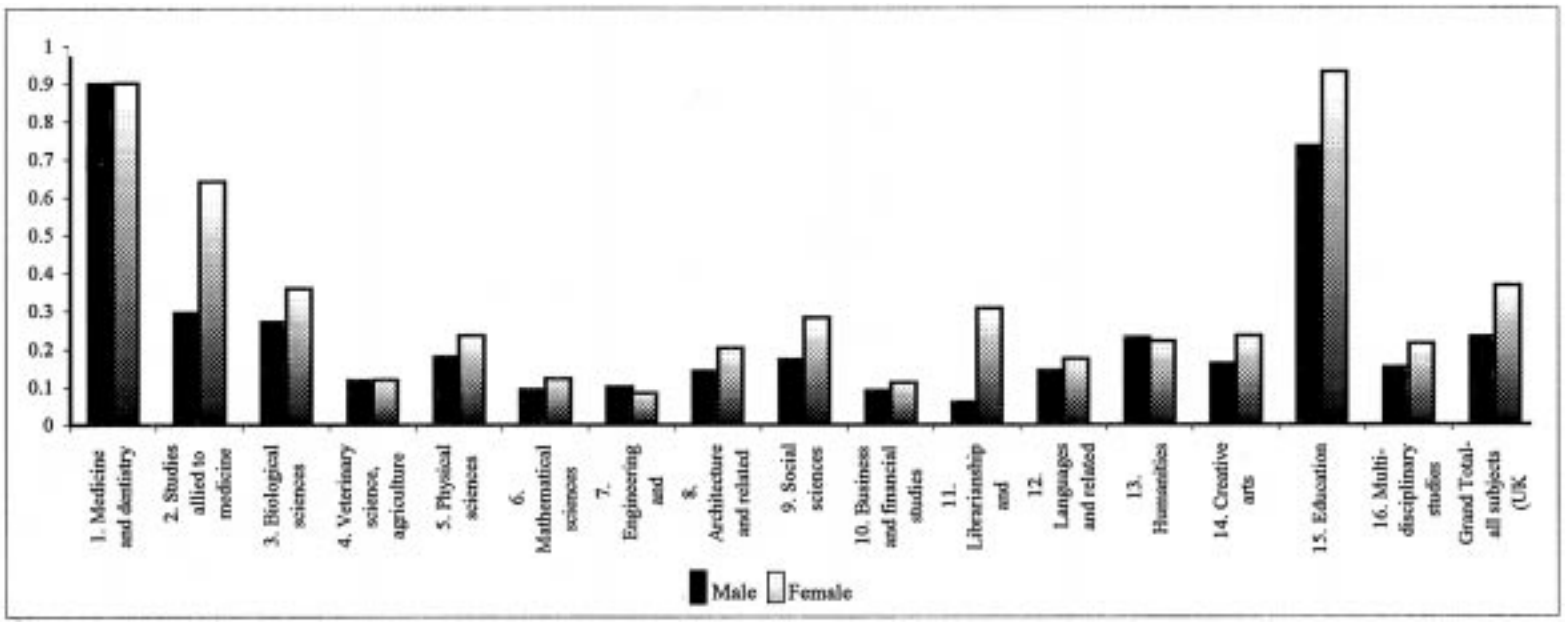

FIGURE 2: Employment in public sector by subject and gender

Source: First Destination Survey 1993/94

Arts (−3%) or Education (0%). Although the estimated returns by subjects varies, the ranking of returns over time is stable. Health, Law, Economics and Mathematics provide the highest returns for all graduates, whilst Arts and Education provide the lowest. For all majors, the returns are substantially higher for women than for men. The difference is at least 10 percentage points in Science and Economics and more than 20 points in Arts and Architecture.

Finally, Naylor *et al.* (2000) map the 1993 First Destination Survey with the student's university records. As the FDS does not include earnings, occupational earnings based on the New Earnings Survey are imputed, assuming that graduates are in their life-time career six months after graduation.[12] Since the survey only includes graduates, the reference category is no longer respondents with A-levels, but graduates in Social Sciences. The disparity in earnings between majors is great. For both genders, Medical, Law, Computing and Business degrees are associated with the highest earnings, whilst Agriculture, Humanities or Classics are associated with the lowest. As in the LFS evidence, returns to a degree are higher for women than for men in all subjects. The difference is greatest for Education, Computing and Communication, where it ranges between 11 and 15 points.

The UK literature consistently finds large returns to a first degree compared to employees with an A-level as their highest qualification. However, these estimates hide a large variation in the returns by subjects, with scientific majors usually at the top and Arts, Languages and Social Sciences towards the bottom. For all majors, the returns are higher for women than for men and the difference is greatest for Arts and Education graduates. This does not mean that women graduates earn more than their male counterparts but that higher education reduces the gender wage gap.

Table II reports the mean pay by subject of graduation by gender for the three cohorts of graduates. For the 1985 and 1990 cohort, log hourly pay is reported, whilst for the 1995 cohort, only the log of annual earnings is available.[13]The cohorts are not directly comparable, as the choices of major available in the two surveys were different. Overall, the raw gender pay differential ranges from 8% to 13% but the penalty is as high as 25% for women graduates in Medicine and Business (1985 cohort). For most subjects, women are paid less then men, but there are a few exceptions in the 1985 and 1990 cohorts. Thus, most of the gender wage gap is observed within rather than between subjects. Neither the scientific content nor the feminisation of a subject impacts on it.

Character Traits

The 1995 cohort is unique, as it includes a section on character traits. The following are used for this study: financially motivated and socially motivated. These concepts are respectively defined as the answers to the following questions: 'as far as long-term values are concerned, how important to you are the following: i) high financial rewards, ii) doing socially useful work'? The answers are coded on a 5-point scale from very important (1) to unimportant (5). To clarify the exposition, we recode the answers in a dichotomous format, 1 for important and very important and zero otherwise. Similarly, we rely on another set of questions on self- description: 'How far do you agree with the following statement: i) I'm extremely ambitious, ii) I live to work, to define ambition and workaholism'? The

TABLE II. Gender pay gap by subject and cohort

	Cohort 1985			Cohort 1990			Cohort 1995		
	women	men	Δ	women	men	Δ	women	men	Δ
Ar							7.87	7.93	−0.06
Humanities							7.87	7.96	−0.09⋆
Natural science							7.9	8.02	−0.12⋆
Social science	2.49	2.57	−0.08	2.2	2.24	−0.04	7.93	8.04	−0.11⋆
Inter-disciplinary							7.93	8.02	−0.09
Other voc							7.94	8	−0.06
Law							7.95	8.09	−0.14
Education	2.23	2.19	0.04	2.1	2.01	0.09	7.96	7.98	−0.02
Languages	2.38	2.52	−0.14⋆	2.09	2.28	−0.19⋆	8.02	8.1	−0.08
Business	2.4	2.64	−0.24⋆	2.21	2.32	−0.11⋆	8.07	8.14	−0.07⋆
Engineering	2.52	2.59	0.07	2.31	2.31	0	8.12	8.16	−0.04
Maths	2.54	2.64	−0.1	2.36	2.37	0.01	8.13	8.29	−0.16⋆
Medicine	2.42	2.66	−0.24⋆	2.26	2.28	−0.02	8.14	8.26	−0.12⋆
Biology	2.37	2.4	−0.03	2.14	2.13	0.01			
Arts & Humanities	2.29	2.42	−0.12⋆	2.07	2.09	−0.02			
Agriculture	2.41	2.35	0.06	2.14	1.91	0.22⋆			
Physics	2.45	2.52	−0.07⋆	2.17	2.23	−0.06			
Architecture	2.68	2.35	0.33⋆	2.07	2.12	−0.05			
All	2.41	2.54	−0.13⋆	2.17	2.25	−.08⋆	7.97	8.1	−0.13⋆

Note:
Log pay per hour for 1985 and 1990 cohorts; log annual earning for 1995 cohort.
⋆ denotes a difference statistically significant at the 5% level.

TABLE III. Character traits by gender – 1995 cohort

	Value financial reward	Value socially useful work	Ambition	Workaholic
Women	0.726	0.556	0.702	0.134
Men	0.804	0.352	0.784	0.171
Raw difference	0.079	−0.204	0.081	0.037
	(0.010)	(0.014)	(0.010)	(0.009)
Estimated difference	0.046	−0.134	0.068	0.036
	(0.011)	(0.013)	(0.011)	(0.009)

Note: Estimated differences report the coefficient on a gender dummy (male = 1) and the associated standard error. The probit model also included age, ethnicity, father's occupation, type of higher education institution attended, A-level score, degree results and subject of degree.

first two rows of Table III report, by gender, the proportion of graduates agreeing with each statement. Between 70% and 80% qualify themselves as ambitious and financially motivated. Fewer than 1 in 5 agree with the statement that they live to work. By contrast, a third to a half reckon that having a socially useful job is important. The differences by gender are statistically significant, with men being more likely to describe themselves as ambitious, workaholic and financially motivated but attaching less importance to the social relevance of their job.

The gender differential could also be due to other differences between men and women. However, a multivariate analysis where controls for age, ethnicity, paternal occupation, type of tertiary institution, A-level score, degree results and majors were

included, reduces the gender differential in character traits by 40%. The largest disparity is observed for the type of job. Men are 13% less likely than women to agree that they want to do a socially useful job. For the other traits, men are between 4 and 7 percentage points more likely to be ambitious, workaholic or financially motivated. The other main determinants of character traits are ethnicity and university majors. Non-white graduates are more workaholic, ambitious and financially motivated than white graduates. This is probably due to some self-selection effects. As UK universities are still mostly white, graduates from minorities may have to be more ambitious and work harder in order to succeed. Majors are also correlated with character traits. Graduates in Law, Business and Engineering are more ambitious and motivated by money, whereas those in Medicine, Humanities and Education value the social component of their job.[14]

To summarise, conforming to the stereotypes, men are more likely to graduate from more scientific subjects where there is a greater chance of obtaining a first class honour and less risk of over-education. Furthermore, they prefer working in the public sector, are more ambitious, workaholic and value financial rewards and are less concerned about the social value of their job. These variations in the higher education experience and labour market expectations have a large impact on earnings, as we shall see in the next section.

The Gender Wage Gap

There is much literature on the gender wage gap (Altonji & Blank, 1999; Blau & Kahn, 2000). For the UK, a 20% gap is typically found (Harkness, 1996; Blackaby *et al*. 1997; Lissenburgh, 2000). Weichselbaumer and Winter-Ebmer (2001) have summarised the international literature on the subject relying on a meta-analysis.[15] They find that the gender wage gap is reduced by 4% in the public sector and by 13% for graduates compared to estimates for the whole population. However only a few studies have included variations in university majors as a determinant of the gap and, to our knowledge, no other research has investigated the consequences of character traits.[16]

Various variables determine the wages of individuals independently from their gender. These are typically age, work experience, education and other personal or job characteristics. Men and women do generally differ in these characteristics and the simple raw pay differential by gender therefore also includes the effects of women's lesser work experience or preference for public sector job, for example. Thus, in order to estimate the determinants of wages, it is necessary to rely on a multivariate analysis which identifies the effect of all these covariates (or controls). Since Oaxaca's seminal paper (1973), it is traditional to decompose the wage gap into an explained and an unexplained component (see Appendix). Basically, the determinants of wages are estimated separately for men and women, then the gender wage gap is separated into a component due to differences in the observed characteristics of men and women and another due to the differential in the estimated return to these characteristics by gender. For example, the first component measures the proportion of the wage gap originating from the fact that women have less experience of the labour market, while the second component, the unexplained part of the gender wage gap, reflects the differences in the returns to experience by gender. The lower returns to observable characteristics can potentially be interpreted as a sign of discrimination against women.

University Majors

Table IV shows the effect of university majors on the gender wage gap for 5 countries at different periods of time. With the exception of the Canadian evidence, these papers deal with university graduates only. The estimated wage gap for the other countries ranges from 21% to 37%, the lowest being observed for young American graduates and in the UK, while the highest differential is in the US (all population) and Taiwan. It is difficult to compare the studies as the data sets are different and the period of observation varies. But it is worth noting that, in all countries, the differences in the choice of majors are a substantial determinant of the gender wage gap. Their inclusion increases the explained component of the gender wage gap by 6 to 35 percentage points.[17]

The estimated pay equation includes educational variables, such as A-level score, degree grade and type of institution attended, a quadratic in work experience since graduation, characteristics of the current job such as the employer's size, the type of contract and sector, and controls for the region of residence. These variables are the main determinants of wages in a Mincerian framework. Additionally, the proportion of women in the respondent's occupation is included.[18]The feminisation of an occupation is a proxy for unobserved characteristics of the occupation that one gender values.[19]

Some descriptive statistics for these variables are reported in the Appendix by gender and cohort. Due to differences in the datasets, inter-cohort comparisons are not always possible. For the 1985 and 1990 cohorts, earnings are reported in two formats: hourly and annually. The use of annual earnings increases the gender wage gap, since women work less per week. The differences in the raw wage gap between hourly and yearly earnings range from 6 to 12 percentage points. Thus, the gender wage gap is biased upwards in the 1995 cohort. The A-level score is based on the results of the best three exams.[20] The trend in the gender differential conforms to the national evidence, with women trailing behind men by 3% in the 1985 cohort but outperforming them by 4% in the last cohort. Other marked differences by gender are in the sector of employment and feminisation of the occupation. Women graduates are concentrated in the public sector and in female-dominated occupations. Women are between 15 and 22 percentage points more likely to be working in the public sector than men. One in two co-workers of a female graduate is a woman, but this proportion is only one in three for men. Thus, men and women graduates are segregated in different sectors of the labour market.

Moving on to the multivariate analysis, we pool the 1985 and 1990 cohorts to increase the precision of our estimates. Focusing on these cohorts, the inclusion of controls in the hourly pay equation reduces the gender wage gap to 11.4%. The covariates have the expected signs: university graduates with better academic credentials, extra qualifications, work experience, who live in London and work in larger firms earn the highest wages. For women but not men, the family background affects current pay. Women with a father in a professional occupation earn 4.6% more than those whose father was in a manual occupation, and those who were brought up on a council estate are penalised by 4%.[21] Other gender differences are observed on the effect of the job contract: men on a permanent contract earn 10% more than other men but no premium is found for women. Finally, the feminisation of an occupation leads to a pay penalty for both genders

TABLE IV. Evidence on the effect of subjects on the gender wage gap

Country Dataset	USA SIPP84	USA NLS72	Canada Census 86	Canada Census 91	UK LFS 96	Germany LFS 96	Taiwan TMUS85	Taiwan TMUS90	Taiwan TMUS95
Wage gap	0.367	0.207	0.434	0.387	0.208	0.280	0.320	0.362	0.303
% explained	46.3	20.3	NA	NA	48.1	26.4	47.7	46.2	
% explained +subjects	63.7	55.0	18.2	16.1	58.6	32.5	59.7	59.1	58.1
Part explained by subjects only	17.4	34.7	43.0*	59.7*	10.5	06.1	12.0	12.9	10.5

Note: US studies by Brown and Corcoran (1997). Survey of Income and Program Participation 1984: College graduate workers aged 22–63, specification includes demographic variables, detailed work experience and 20 majors. National Longitudinal Study of the High School Class of 1972, aged 25–34, specification includes demographic variables, work experience and 15 majors.

Canada: Christie and Shannon (2001). Census: Full time year workers aged 25–65, specification includes educational attainment, demographic variables, quadratic in age.

* Only results including the 13 fields of subjects are included, thus the proportion of the explained gap explained by the majors is calculated.

UK and Germany from Machin and Puhani (2002), Labour Force Survey of 1996 in the UK and in Germany restricted to graduates. The specification for both countries is identical and includes a quadratic in age, control for region, industry, part time and public sector and 11 majors.

Taiwan results from Baraka (1999), Taiwan Manpower Utilization Survey restricted to university graduates. The specification includes quadratic in age and 10 majors.

(Backer & Fortin, 1999, using Canadian data), but this penalty is 50% higher for women than for men. Given that the feminisation of job is 32.7% for men and 47.5% for women, this implies an elasticity of −0.07 for men and −0.16 for women, i.e. increasing the feminisation of an occupation by 10% reduces the earnings of men by 0.7% and those of women by 1.6%.

As shown in the Appendix, the gender wage gap can be decomposed into two components. In Table V, the first column reports the results of this decomposition for the 1985–90 cohorts. Of the estimated 11.4% gap in hourly earnings between men and women, 9.3 percentage points are explained by the differences in the covariates and only 2.1 percentage points or 18.4% of the differential is left unexplained. Including university majors in the wage regression reduces the unexplained part of the wage differential to 11.4%. Differences in the university majors between gender account for nearly 16% of the explained wage gap. If men and women were to have identical characteristics and choose the same university majors then the gender wage gap for graduates would be 1.3%. Therefore, there is little gender discrimination for graduates in the UK.[22]

TABLE V. The gender wage gap

	Cohort 85/90: Hourly pay	Cohort 95: Annual earning
Estimated gap in log pay	11.4	14.8
Unexplained component: **Specification 1**[a]	2.1 18.4%	5.4 36.5%
Unexplained component: **Specification 1 + university majors**[a]	1.3 11.4%	4.6 31.1%
Explained by university majors[b]	1.6 15.8%	2.2 21.6%
Unexplained component: **Specification 1 + majors and personal traits**[a]	Na	2.8 18.9%
Explained by university majors[b]	Na	1.9 15.8%
Explained by financial reward[b]	Na	1.1 9.2%
Explained by value socially useful work[b]	Na	1.6 13.3%
Explained by Ambition[b]	Na	1.0 8.3%
Explained by Workaholic	Na	0.1 0.8%

Note: First line of row is the log wage differential from a Oaxaca decomposition estimated at the female average. The linear model estimated the determinant of earnings; full specification includes A-level result, honours, type of institution, subsequent qualifications, region, a quadratic in experience, employer's size, part-time, type of contract, public sector, feminisation, ethnicity and paternal occupation.

[a] The second line is the percentage of the gender wage gap that remains unexplained.

[b] The second line is the percentage of the gap that is explained by this component.

As observed in the raw data, the gender wage gap is reduced by 33% between the 1985/90 cohorts (using annual earnings) and the 1995 cohort. The reduced differential could either reflect a reduction of the gender wage gap over time or the fact that the gender wage gap is smaller earlier on in one's career; the 1995 cohort is surveyed 42 months after graduations while the 1985 and 1990 cohorts are surveyed respectively 11 years and 6 years after graduation. For the 1995 cohort, more than a third of the gender wage gap is left unexplained with the base specification. Differences in the university majors by gender account for 22% of the explained wage gap, thus the introduction of university majors reduces the unexplained component of the gender wage gap to 31%.

These results compare favourably with the evidence presented in Table IV. Thanks to the richness of the covariates at our disposal, the base specification explains between 63% and 82% of the gender wage gap, while in the surveyed literature the explained component ranges from 20% to 37%. University majors account for 16% to 22% of the explained gender wage gap, while in the surveyed literature this component increases the explained component by 6 to 35 percentage points. Typically, much of the gender pay inequality stems from differences in university majors by gender.

Character Traits

Prospective students tend to apply for subjects for which they have a strong preference and a better chance of success or subjects that will provide them with the highest returns. Thus, the estimated effects of subject on pay are biased as the unobserved characteristics explaining university major choice may also determine pay.[23] For example, Montmarquette *et al*. (2002) estimate the determinants of subject choice using the American 1979 NLSY. Accounting for personal and social characteristics of the teenagers, the authors separate the expected earning effect and the likelihood of graduation effect. They find that males take more risk than women in their choice of subjects, choosing majors for which they have lower odds of graduating but with higher returns. Women do not base the choice of major on the lifetime earnings associated with it, since they expect to take breaks in their career.

Bowles *et al*. (2001) survey the literature on behaviour and wages and note that character traits may have a substantial effect on earnings; leadership (Kuhn and Weinberger, 2002), motivation (Duncan & Dunifon, 1998a), self-esteem (Goldsmith *et al*., 1997), aggression (Osborne, 2001), externality[24] (Andrisanni & Nestel, 1976), but also beauty (Hamersmesh & Biddle, 1994) or cleanness (Duncan & Dunifon, 1998b) also affect wages. Even for traits that appear trivial, the effect of a given trait can be quite great. For example, increasing beauty from below to above average increases the hourly wage of male American lawyers by 14%. The impact of these characteristics also differs by gender; in high occupation status, Osborne (2001), using the UK National Child Development Study, estimates that a one standard deviation change in aggression increases the earnings of men by 20% but reduces those of women by 14%. As stated above, the character traits differ significantly between men and women. Thus their inclusion as controls could substantially affect the gender wage gap.

Following Polachek's argument (1981), we concentrate on character traits relating to the attitude towards work, such as financially or socially motivated,

ambition and workaholism. Introducing these four measures reduces the unexplained component of the gender wage gap from 31% to 19% in the 1995 cohort. While differences in workaholism by gender explain only 1% of the wage gap, the other three traits have a substantial explanatory capacity, each accounting for 8% to 13% of the explained gender wage gap. The character traits are in fact the main explanatory factor of the gender wage gap, with a combined effect of 31.6% of the explained component. If males and females were to have the same character traits then the wage differential between genders would be reduced from 4.6% to 2.8%. As hypothesised by Polachek, a large proportion of the gender wage gap stems from gender differences in attitude towards work. Thus, it is of importance to discover what generates these character differences and whether education could reduce them.[25]

Most of the gender wage gap for UK graduates can be explained.The main determinants are the choice of university majors and character traits. Men graduate in subjects leading to higher paid jobs than those typically chosen by women. Concomitantly, character traits where males have an advantage are rewarded in the labour market, whilst female traits are penalised. For example, ambitious males are paid 12% more than other men; the estimates are 14.5% and 3.5% for financial motivation and workaholism respectively, while a pay penalty of 7.5% is attached to desiring a socially useful job. Thus, it is not surprising that these variables are the main determinants of the gender wage gap. The effect of character traits on the gender wage gap conforms to the view that it originates from differences in cultural attitude rather than employers' discriminatory behaviour.

How these character traits and preferences are formed and whether education has a role to play to reduce gender differences is beyond the scope of this article. While Vella (1994) estimates that attitudes towards work, which affect women's educational choices, labour supply decision and ultimately wages are formed outside education, Kuhn and Weinberger (2002) report that some schooling activities increase leadership skills. Could some schooling activities boost ambition? It can be noted that the introduction of the character traits reduces the explanatory power of university majors from 2.2 percentage points to 1.9, which indicates that character traits and majors are not independent. However, this dataset is not appropriate to investigate whether character traits influence the choice of subjects or whether majors have an effect on these character traits.

Regrets

Finally, since women get fewer financial rewards from their investment in higher education than men, they may be more prone to regret their choice of major. One in five graduates would, with hindsight, do a very different course or not enter higher education. The determinants of regret are difficult to identify; a better university grade reduces regret which is compatible with a sorting model where employers rank candidates on some easily observable characteristics such as university grade and offer jobs to the graduates at the top of the ranking. As shown in Chevalier (2002), graduates with lower grades rank at the bottom of the graduate job queue and obtain jobs that do not require graduate skills, thus generating regret. According to a Mincer model, where educational decisions are based on the expected financial returns, current wage should be the main

TABLE VI. Regret in higher education: 1995 cohort

	Specification 1	Spec 1 + subject	Spec 1 + subject and traits	Separately for men and women
Log wage	−0.107 (0.013)	−0.093 (0.014)	−0.103 (0.014)	0.002[a]
Men	0.030 (0.011)	0.029 (0.011)	0.027 (0.011)	0.021[b]

Note: Regret is coded as one for respondents answering 'Do a very different course or not enter higher education' to the following question: "With hindsight, if you could choose the course for your qualification again, do you think you would?" and zero for those claiming they would do the same course or a slightly different course.
The reported coefficients are the marginal effects from a probit where the full specification included A-level result, honours, type of institution, subsequent qualifications, region, a quadratic in experience, employer's size, part-time, type of contract, public sector, feminisation, ethnicity and paternal occupation.
[a] effect of the differences in log wages between men and women on the probability of expressing regret: $(\Phi(\bar{x}_f b_f) - \Phi(\bar{x}_m b_m))$
[b] effect of the differences in all determinants on the probability of expressing regret: $(\Phi(\bar{X}_f \beta_f) - \Phi(\bar{X}_m \beta_m))$.

determinant of regret, with graduates earning less than they had expected experiencing the highest regret. As we do not observe the expected earnings of each individual graduate, we rely on the observed wage only.[26] The major choice is not a prime determinant of regret and only graduates in Law, Natural Science and Interdisciplinary Studies experience significantly more regret than Arts graduate. So regret is mostly within subjects rather than between subjects. Despite lower wages, women are 3 percentage points less likely to regret their higher education choice. Adding controls for majors and character traits reduces this differential to 2.7. Workaholic and socially motivated graduates are respectively 5 and 3.5 percentage points less likely to regret their educational choice while those financially motivated are 4 percentage points more likely to experience regret. When the effects of the determinants are allowed to differ between men and women, the gender gap in regret is further reduced to 2 percentage points.

The lesser dissatisfaction of women with their educational choice is consistent with gender differences in the determination of majors. Men may not choose the major they prefer but the one that brings the highest financial return, thus leading to some dissatisfaction later on in life, while according to Montmarquette *et al.* (2002), women's choice is not affected by the financial returns, and thus less likely to bring disappointment. Alternatively, graduates may not compare across gender, but with non-graduates. The reduction of the gender wage gap associated with their education would lead women graduates to experience less regret.

Conclusion

Women and men have a different experience of higher education. This starts from the choice of major and carries on with the probability of honours, sector of employment and earnings. Women are less likely to graduate with a first class honours, more likely to work in the public sector and earn 11% to 15% less than men. However, a substantial part of these differences is due to gender differences in choice of university majors and character traits. These two

components account for almost 50% of the explained gender wage gap. Choices of subject and character traits have usually been neglected as determinants of the gender wage gap; their introduction reduces the unexplained component of the gap in earnings to between 1.3% and 2.8%. Taking the unexplained component of the gender wage gap as a measure of discrimination against women, gender discrimination appears to be rather small for UK graduates and as hypothesised by Polachek (1981) most of the gap in earnings stems from attitudinal differences. Furthermore, despite lower wages, women experience less regret about their educational choice than men. This is consistent with previous findings, where men take subjects with the highest financial returns and women subjects for which they have the highest probability of graduation.

In order to implement a policy that reduces the gender wage gap, one must study the determinants of character traits formation and whether education could affect it or whether character traits are the outcomes of social pressures forcing men and women to behave according to stereotypes.

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NOTES

1. The method to calculate these returns has been formalised by Mincer (1974). In its simplest form, the following linear model is estimated: $\ln w_i = rS_i + g(X_i) + e_i$, where for each individual i, $\ln w$ is the log wage, S is the level of schooling (in years) and $g(X)$ is a non-linear function of the labour experience and e is an error term, capturing non-observable determinants of the individual's wage. The return to education is then simply the estimated coefficient r; see Card (1999) for further details.
2. Women's higher returns to education only reflect that the differences in pay between little and highly educated people is greater for women than for men. This mainly stems from the large gender pay gap at low level of education.
3. Whether the unexplained component of the gender wage gap reflects discrimination or simply a mis-specification of the wage equation is debatable, but will not be addressed in this article (see Altonji & Blank (1999) for a detailed discussion).
4. The sample includes institutions in England, Wales, Scotland and Northern Ireland. Traditional universities, but also former polytechnics, monotechnic colleges and colleges of higher education were selected. The sample was completed with the participation of the Open University and a private institution: the University of Buckingham, both of which were discarded from the sample used in this analysis.
5. As over 90% of men and women are in paid employment, we do not take into account the selection effect associated with this restricted sample.

6. Formally, the optimal schooling decision is the value of S for which the net present value of the stream of income (w) associated with educational level s equals the total cost of an extra year of education (cost of education, C plus foregone earnings, $w(s-1)$):

$$\sum_{t=s+1}^{T} \frac{w(s)-w(s-1)}{(1+r(s))^{t}} = w(s-1)+c(s) \qquad (1)$$

where r(s) is the discount rate of an individual with education level S and T is the expected duration on the labour market.

7. The Duncan index (Duncan and Duncan, 1955) is simply defined as

$$D + 1/2^{*} \sum_{i=1}^{k} |p_{mi} - p_{fi}|,$$

where $p_{mi}(p_{fi})$ is the share of the male (female) sample observed in subject i, and k is the number of subjects.

8. For trends over the last two decades, see Chevalier *et al*. (2002a).
9. The pay penalty for graduates working in the public sector in the UK is 7% for women and 12% for men (Chevalier *et al*., 2002b).
10. see Chevalier *et al*. (2002a) for a more extensive analysis.
11. Blundell *et al*. (2000) also estimate returns to higher education by subject, but surprisingly, almost none of the estimated coefficients are statistically significant from the omitted category (subject of degree missing).
12. This procedure is problematic since only 60% of graduates are in a job 6 months after graduation and there are great variations by subject. Furthermore, while employed graduates in medicine are likely to be in their life time occupation 6 months after graduation, this is not likely to be the case for a large number of subjects.
13. One of the caveats of the 1995 survey is to not include the number of hours worked and only annual gross earning is available, which biases the gender wage gap upwards since women are more likely to work part-time,.
14. Whether the relationship between university majors and character traits is causal (education developing these traits) or endogenous (individuals with given traits select specific subjects) requires further research.
15. A meta-analysis is a statistical method used to summarise previous research by treating it as a new dataset. A trivial example would be to simply calculate the mean of all the available estimates. A more sophisticated analysis would also include information on the type of data and estimation methods.
16. Vella (1994) for Australia and Swaffield (2000) for the UK have used perception of the role of women in society as a determinant of the gender wage gap. Swaffield reports a 5 percentage points reduction in the unexplained wage gap when this measure is included.
17. Machin and Puhani (2002) test whether the aggregation of subjects reduces this explanatory power. The results are ambiguous, increasing the precision from 11 majors to 124 for the UK and 71 for Germany and increase the explained component of the wage gap from 58.6 to 66.8 for the UK and from 32.5 to 35.0 for Germany. However, this finer decomposition undermines the precision of the estimates as the number of observations per subject becomes

small. For this reason, the decomposition below is based on 12 majors rather than on the 96 available.

18. This is constructed at the 2-digit occupational code level from the 1996 Labour Force Survey, quarter 3, for all employees aged 16–59. Backer and Fortin (1999) state that results on the effect of feminisation on the gender wage gap are sensitive to the level of aggregation of the feminisation variable.Two-digit level is the most detailed level of aggregation attainable with the graduate dataset.
19. For example, time out of the labour market may be associated with a higher wage penalty in some occupations than in others. This pay penalty, usually associated with the depreciation of human capital while out of the labour market leads to the sorting by gender in specific occupations (Polachek, 1981). A lower penalty in a specific occupation may be associated with a flatter wage profile and lower wages.
20. Exams are marked from A for the best paper to E for the worst paper. In the calculation of the score, an A counts for 5 points, and an E for 1 point.The maximum score is thus 15. For the 1995 cohort, the score was only available in a categorical variable, so the mid-points of each interval was used.
21. Gender difference in the permanent effect of family background on pay is an interesting issue that cannot be investigated in this article.
22. These calculations can be repeated using annual earnings rather than hourly wage in order to make them more comparable with the 1990 cohort. As expected, the gender wage gap increases, since women work less than men, and doubles to reach 21.6 percent; the complete results are not presented here.
23. To purge the subject estimates of this selection bias, one would have to rely on sophisticated econometric strategies (IV or Heckman selection models) requiring exclusion variables, i.e. determinants of the choice of subject that are independent of earnings. In the absence of a suitable exclusion variable, another strategy is to control as many of the characteristics explaining both choice of subjects and earnings as possible. This is the strategy followed, since we rely on character traits.
24. Externality is the degree to which individuals believe that they have an influence on outcomes that affect them rather than the outcomes being due to sheer luck.
25. The character trait variables suffer from a drawback. Since they are assessed concomitantly to other labour market outcomes, they are not independent of them. For example, more successful individuals may define themselves as more ambitious. This endogeneity problem cannot be solved with the current data set.
26. This simplification therefore implies that all graduates had identical wage expectations.

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Appendix 1: The gender wage gap decomposition

Formally, a Mincer equation is estimated separately for both genders.

$$\ln w_{ig} = X_{ig}\beta_g + \varepsilon_{ig} \tag{A1}$$

The left-hand side of (A1) is the log wage of individual i of gender g, the determinants of which are included in a vector X_{ig}. β_g is the estimated vector of the returns to characteristics X_{ig} and ε_{ig} is an individual error term. The average gender gap in earning is decomposed between the mean difference in observed characteristics and the difference in the returns to these characteristics.

$$\Delta = \overline{\ln w_m} - \overline{\ln w_f} = (\overline{X_m} - \overline{X_f})\beta_f + (\beta_m - \beta_f)\overline{X_m} \tag{A2}$$

(A2) can be expressed as the mean characteristics of men (m) or women (f).[a1] The first term of (A2) is the part of the gender pay gap that can be explained by the differences in the observed characteristics of both groups. The second part, the unexplained component, is the portion of the gap that is due to differences in the returns to characteristics between the two groups. If all the determinants of earnings were observed in (A1) this would be equivalent to a discrimination effect;[a2] i.e. Gender differences in the returns to observed characteristics are due to the discriminatory behaviour of employers. As typically not all the determinants of (A1) are observable, we will refer to the second term of (A2) as the unexplained component. Introducing extra variables in the vector X reduces the unexplained part of the gender wage gap.

NOTES

a1. The choice of gender to decompose (A2) is not without effects on the results and alternative decomposition avoiding the bias of choosing one group rather than the other has been proposed (see Cotton, 1988). This debate is beyond the scope of thisarticle , and we only report results estimated at the mean characteristics of the female population.

a2. Omitted variables in (A1) bias the estimated β_g differently for both gender, leading to a perceived differential between genders in the returns to the observed characteristics.

TABLE A1: summary statistics

	1985				1990				1995			
	Female		Male		Female		Male		Female		Male	
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Hourly pay	12.23	5.68	13.82	6.18	9.41	3.83	10.18	3.99	NA		NA	
Annual pay	24682	11615	32159	13223	19993	7763	23130	9217	17745	6562	20812	8215
Hours	39.42	10.15	45.17	7.57	41.61	8.12	44.16	7.74	NA		NA	
A-levels	9.33	3.83	9.85	4.06	8.05	4.02	8.16	4.66	9.14	3.82	8.48	4.40
No A-level	0.04	0.19	0.06	0.24	0.07	0.25	0.13	0.33	NA		NA	
Prof. Qual	0.30	0.46	0.30	0.46	0.24	0.42	0.24	0.43	0.14	0.35	0.15	0.36
Master	0.15	0.35	0.16	0.36	0.11	0.31	0.15	0.36	0.10	0.30	0.12	0.32
Phd	0.03	0.17	0.06	0.23	0.03	0.17	0.04	0.19	0.02	0.14	0.03	0.17
Honour: first	0.05	0.22	0.08	0.27	0.07	0.25	0.09	0.29	0.07	0.25	0.08	0.27
Honour 2/1	0.34	0.47	0.33	0.47	0.42	0.49	0.37	0.48	0.52	0.50	0.44	0.50
Honour 2/2	0.10	0.30	0.08	0.26	0.05	0.21	0.05	0.21	0.34	0.47	0.36	0.48
University	0.81	0.40	0.89	0.32	0.50	0.50	0.52	0.50	0.53	0.50	0.54	0.50
Employment	120.03	14.85	122.70	14.42	61.89	12.86	62.36	13.60	16.14	13.13	18.00	13.69
Size <25	0.15	0.36	0.10	0.30	0.18	0.39	0.11	0.31	0.17	0.38	0.22	0.31
Size 25–99[a]	0.23	0.42	0.17	0.37	0.21	0.41	0.17	0.37	0.29	0.45	0.26	0.44
Size 100–500[a]	0.18	0.38	0.23	0.42	0.20	0.40	0.24	0.43	0.07	0.25	0.08	0.27
% female	46.96	19.31	33.45	19.73	47.85	20.66	32.23	21.51	51.30	23.89	35.04	23.82
Permanent	0.90	0.31	0.94	0.25	0.89	0.31	0.89	0.32	0.77	0.42	0.80	0.40
Public sector	0.39	3.26	0.17	2.87	0.50	0.50	0.28	0.45	0.27	0.45	0.13	0.34
White	0.96	0.19	0.96	0.19	0.95	0.22	0.94	0.24	0.95	0.22	0.92	0.26
Dad associate	0.06	0.24	0.05	0.23	0.05	0.22	0.05	0.23	0.27	0.44	0.27	0.44
Dad manager	0.17	0.38	0.19	0.39	0.17	0.38	0.19	0.39	0.13	0.34	0.13	0.34
Dad professional	0.31	0.46	0.29	0.45	0.32	0.47	0.27	0.44	0.23	0.42	0.23	0.42
Dad entrepreneur	0.10	0.30	0.09	0.28	0.09	0.29	0.09	0.28	NA		NA	
Dad other	0.36	0.48	0.38	0.49	0.37	0.48	0.40	0.49	0.37	0.48	0.37	0.48
Council estate	0.07	0.25	0.08	0.27	0.05	0.21	0.06	0.23	NA		NA	
Observation	952		1221		1863		1752		3468		2526	

Note: [a] for the 1995 cohort, employers size is 25–249 and 250–499.