"Equal opportunities in science? Evidence on gender pay gaps amongst scientists working in the UK"*

Sara Connolly and Susan Long,
School of Economics,
University of East Anglia,
Norwich,
NR4 7TJ,
UK.
Email sara.connolly@uea.ac.uk (corresponding author) and susan.long@uea.ac.uk
Phone 44+1603 593410

March 2011

Abstract

The groundbreaking MIT report (1999) was the first study to quantify the disadvantages faced by female scientists. This has been followed by studies of gender pay differentials amongst academics working in the humanities (US), economics (UK and US) and the sciences (US). This paper provides the first detailed study of gender pay differentials amongst scientists working in the UK.

Our data allows us to contrast the experiences of scientists working in Higher Education (academic scientists) with those working in Research Institutes (research scientists) We find that there is a gender pay differential of 22% (£6-7,000), most of which can be accounted for in terms of age, grade, subject, research esteem, workplace and domestic responsibilities, but a significant proportion remains unexplained (19% in academic and 30% in research science). Our results suggest that across grades, if female scientists were to receive the same returns as male scientists, the gender pay gap would narrow significantly and would close at the bottom end of the distribution.

Grade accounts for over 40% of gender gap in pay, so we also explore variation in salary within grade and find evidence that, based on characteristics alone, female professors might expect a pay premium but the differences in returns result in an estimated average pay penalty of £4,000. Finally, we consider what the gender pay gaps might be if the promotion process were gender neutral, in the sense of characteristics being equally rewarded, here we find that the unexplained pay gap might be as high as 40%.

Keywords: female employment; occupation; pay; decomposition; institutions.

JEL classification: J16, J31, J44, J71

***The financial support of the Economic and Social research Council is gratefully acknowledged (ESRC Reference: RES-000-22-1724 - Gender and careers in science - do institutions matter?).**

Introduction

The UK has had equality legislation since 1974, but gender pay gaps seem stubbornly persistent. By the time that the 2010 Equality Act came into force, the average gender pay gap between men and women in full-time work in the UK was 15% and the pay gap between male full-timers and women in part-time work was 35% (Source: Annual Survey of Hours and Earnings, 2010). Policy makers are typically interested in measuring and closing average or median gender gaps, however an interesting picture emerges when we examine the tails of the distribution. The National Minimum Wage has contributed towards a narrowing of the gap at the bottom end of the distribution in the UK (to just under 10%) but across Europe we observe a more substantial gender pay gap at the top end of the distribution (between 20-30%)[i].

Differences between men and women, in terms of qualifications, experience and the type of jobs they do, might provide an explanation for the average gender pay gap and why women are more heavily concentrated in lower paid jobs at the lower end of the earnings distribution. However, when attention is focussed upon specialist job markets at the upper end of the distribution, such as the professions, where entry is highly credentialed, professional qualifications are clearly defined and men and women are doing the same jobs, we might expect to observe narrower gender pay gaps. But, in the UK and elsewhere, gender pay gaps in the professions are nonetheless frequently substantial: McNabb and Wass (2006) report that on average female solicitors earn 44% less than male solicitors; a report published by the Equality Commission (2009) showed that women working full-time in the financial sector earn 55% less than men within the same sector; Ward (2001) reports an average salary differential of 15-26% amongst academics; and Blackaby et al. (2005) an average gender pay gap of 18% for academic economists.

The aim of this paper is to investigate the existence of a gender pay gap in the fields of Science, Engineering and Technology. The paper will provide the first detailed empirical study of the gender pay gap amongst UK scientists. Secondly, it will evaluate the impact of institutions, specifically by comparing determinants of pay and the factors influencing gender pay gaps for scientists who are employed by Universities or Higher Education

(academic science) and Research Institutes[ii] (research science). Finally, we examine the role of grade by exploring the extent to which the gender pay gap exists within grade and what pay gap might exist if the promotion process were gender neutral.

Gender pay gaps at the top

Most of the literature has concentrated upon improving our understanding of average pay gaps typically by decomposing the average gender pay gap using the Oaxaca (1973) methodology. More recently, attention has shifted to examining gender pay gaps across the distribution using quantile regression techniques. Arulampalam et al. (2007) report private sector gender pay gaps ranging from 19% in Ireland to 31% in Britain in the top decile of the respective wage distributions. Their work suggests that, even when they control for individual and job characteristics, the proportion of the gender pay gap that is attributable to differences in treatment is larger at the upper end of the distribution, which they take as evidence of glass ceilings across Europe. Chzhen and Mumford (2010), using quantile regression and control for the positive selection of women into full-time employment in the UK, also find evidence of a glass ceiling. They conclude, "In aggregate, our decomposition results suggest that the gender earnings gap would all but disappear in the public sector if women received the same returns to their characteristics as men do. In the private sector the gap would disappear for all but the top earners, for whom the gap would become considerably smaller than currently observed" (Chzhen and Mumford (2010), page 12).

The interest in specialist job markets, e.g. lawyers or academics, arises because there is likely to be a greater degree of homogeneity amongst the workforce within professions. The men and women working in these fields have made the same career choices and tend to have similar levels of productive characteristics - skills are similar, employment rates of graduates are typically high, female graduates tend to take much shorter breaks for family formation. Also, there is greater similarity amongst the organisations in which the professionals work –in terms of the companies, pay structures and the typical career trajectories. These job markets provide interesting case studies for glass ceilings because

despite these similarities in choice, characteristics and organisation, gender pay gaps are observed.

There have been a number of econometric studies of the gender pay gaps amongst academics within subject areas in both the US and the UK: in the US, Ginther and Hayes, (2003) report an average gender pay gap of 10% in the humanities; in the UK, Blackaby et al. (2005) report an average gender pay gap of 18% in economics, while Ward (2001) reports an average gender pay gap of between 15% amongst academics and 26% when she considers both academics and researchers employed in Scottish Universities. These studies have examined the sources of the gender pay gaps – productivity, seniority, tenure – and conclude that these factors explain most, but not all, of the gap in pay. For example, Ward (2001) reports that 23% of the pay gap is unexplained and Blackaby et al. (2005) conclude that female economists are underpaid by about £1,500 per year.

In their study of economists working in the UK, Blackaby et al. (2005) show that male economists are more likely to receive alternative or outside offers of employment than female economists, and, that when they do receive these offers, their employers respond with more generous counter offers than they do for women in the same circumstances. It appears that men and women are behaving differently in the market; men are perhaps more likely to seek alternative offers or are receiving greater encouragement to apply elsewhere. It also seems that even when women have outside job offers, they are being treated differently by their employers. One explanation for this might be that employers find it less credible that women will leave, which Blackaby et al. refer to as the "loyal servant' hypothesis[iii].

Pay gaps in science in the UK

The growing female share of the student body and amongst staff is usually taken as evidence for the increasing 'feminisation' of Higher Education. Whilst the closing of the gender gap in overall employment is to be welcomed, significant gender pay gaps (especially in the sciences) persist, (see Table 1). Across all subjects women are on

average paid £4,953 less than men (just over 13% of average female pay) and women are also less likely to be amongst the higher earners (those earning more than £50,000 per annum), these differences are particularly pronounced within the sciences[iv].

[Table 1]

These figures – collected by the Higher Education Statistics Agency (HESA) – are likely to under-estimate the gender pay gap because they only cover staff in permanent academic jobs. Women are more likely than men to be employed in temporary jobs, on short-term contracts or in post-doctoral positions (a particularly important stage in careers in science), all of which tend to be less well paid. Ward (2001) finds an average gender pay gap of 15% across academics with permanent contracts, but the figure rises to 26% when the sample is extended to include researchers. If we are to assess accurately the position of women in the sciences, we need data that covers all types of employment (across all grades), and that provides details on careers, roles, responsibilities and achievements.

The paper uses exactly this sort of data, obtained from the Athena Survey of Science Engineering and Technology (ASSET) surveys conducted in 2003 and 2004 – total sample size 7,800 (4,282 in Higher Education, 2,444 in Research Institutes and 1,074 in industry)[v]. The ASSET surveys contain data on position, subject, contract, salary, career history and some demographics (age, gender, family status)[vi]. A further advantage is that the ASSET surveys cover scientists working in both academic and research science, which provides us with an opportunity to compare pay gaps across these institution types.

The average gender pay gaps in academic and research science are quite similar at just over 20% - see Table 2. Not only are men better paid because they are employed in more senior positions, they are also more likely to earn more within each grade – see Connolly and Long (2011) for a detailed discussion of gender and promotion using the same data. Most studies find that the gender pay differential is smallest at lower grades, men and women start with parity and differences emerge as their careers progress, here we find

significant gender pay gaps (around 6%) at the starting (post-doctoral) level[vii]. An interesting difference between academic and research science emerges as we compare the gender pay gap at more senior level, in academic science the largest percentage gender pay gap is at the top and this is where the pay gap is narrowest in research science.

[Table 2]

There is a strong gender dimension to employment within scientific disciplines. In academic science, women account for around one-half of all staff employed in medical or biological sciences but under a quarter in mathematics and the physical sciences. There is a similar gender/subject split in employment within research science. Given the very different gender profiles across subjects, we explore the possibility of variation in the size of the gender pay gap across discipline, particularly whether gender pay gaps are lower in subject areas where women have historically been well-represented, see Table 3. Average salaries are lower in research than academic science and there is considerably less variation in salaries across subject. There is no strong evidence that the raw gender pay gaps are lower in the subject areas where women are more heavily represented. The gender pay gaps seem to be highest where average salaries are higher (in medicine and dentistry in academic science (36.7%) and for those working in the MRC funded research institutes (28%)[viii]) and lowest where average salary levels are lower (in subjects allied to medicine in academic science (18%) and for those working in research institutes funded by the CCLRC (16%)).

[Table 3]

Explaining the Gender Pay Gap in Science

We separate our explanatory variables into a number of categories: demographics – age, ethnicity, gender; subject area and type of institution, we indicate scientific discipline, main research council funder and distinguish between types of Universities (Russell Group, pre and post 92 institutions)[ix]; workplace responsibilities indicating managerial or administrative tasks, including sitting on or chairing committees and appointment panels;

contract – we distinguish between permanent and temporary contracts, identify probationary status, in the case of Higher Education indicate whether the contract is teaching and research or teaching/research only; mobility – in order to control for the role and institutional response to outside offers, we include indicator variables to reflect whether a scientist has moved institution to obtain their current post; and finally, consider domestic responsibilities and the impact of interrupted or non-standard careers – age of dependent children, a dummy variable indicating primary care responsibilities, current or an experience of part-time work and having taken a career break.

One key issue is how to control for ability and productivity. Studies have typically used where the respondent obtained their PhD, the ranking of the department in which they work and volume of research produced as proxies for these. We control for the research strength of the department that will capture the research environment and expectations relating to research using department specific peer review data – the RAE scores[x]. In as much as the departments with the strongest reputations aim to recruit and also attract the 'best' researchers, the RAE scores may also provide a very indirect measure of individual research output or potential. The ASSET data does not provide educational background or direct data on productivity (e.g. publications) so we proxy for productivity and research prestige using a range of indicators of research esteem, which whilst not direct measures of productivity, are likely to be consequences of having a strong research reputation and being part of a broader research community: invitations to contribute at various levels at conferences (keynote-plenary speaker, chairing sessions, session speaker), degree of involvement with professional societies, editing journals and performing tasks for outside bodies (consultancy work, assessor for research councils or EU evaluator). Finally, departments were able to select which members of staff were submitted in the departmental RAE return and we are able to observe whether an individual respondent was or was not part of that return. This enables us to capture whether they met their departmental or university criteria of being an 'active' researcher. A full set of means is presented by gender in the Appendix.

Our approach will be to explore the determinants of pay by building up from some very simple models. We shall use these results to provide an indication of the main factors influencing pay and to undertake a Oaxaca (1973) decomposition analysis to establish how much of the gender pay gap is due to differences in characteristics and how much to differences in returns[xi]. As previous studies, Ward (2001) and Blackaby et al. (2005), have established the importance of grade, we consider pay gaps both across and within different grades. This allows us to explore the extent to which differences in treatment arise at different levels or grade. Finally, we explore the size of the gender pay gap if pay were determined by characteristics alone, that is, if the promotions process were gender neutral.

Female scientists are younger, more junior and are more likely to be employed in particular subject areas or types of universities[xii]. Given this, our first step is to identify how much of the overall pay gap is due to these characteristics — see Tables 4a and 4b. The results in Table 4a.1 provide evidence of the importance of grade in explaining differences in earnings within academic science. For example, we see that, across all sciences, professors earn 46% more than lecturers while post-docs earn 15% less. The pay premium for women at the top is slightly lower and the pay penalty at the bottom is slightly larger; female professors earn 43% more and female post-docs are paid 17% less than female lecturers. In research science (Table 4b.1), however, our results suggest that the small number of women who reach the highest grades are well rewarded. For example, female research directors earn 64% more and female post-docs earn 25% less than female senior scientists, while for men the differentials are 55% more and 23% less respectively. Within academic science we find that salary levels are on average 15-20% higher for those working in the pre-92 and Russell Group universities. Having controlled for grade and experience, we find that on average women earn 4% less in academic and 5% less in research science. There are statistically significant gender differentials in all subject areas with the exception of the areas in academic science with the highest and lowest concentration of women – subject allied to medicine and engineering. The largest gender pay gaps arise in medical science - those working medicine and dentistry in

academic science (11%) and those working in research institutes funded by the MRC in research science.

[Tables 4a and 4b]

The results of the initial decomposition analysis by subject are shown in Charts 1a and 1b. We see that grade and age account for almost two-thirds of the pay gap, but around a quarter of the pay gap is due to differences in returns for the same characteristics[xiii].

[Charts 1a and 1b]

These very simple models provide a sense of the extent of the gender pay gaps that cannot be easily accounted for in terms of age, grade and subject. There are many other factors that are likely to be important in explaining the gender pay gap. These include type of contract, workplace responsibilities, research esteem, mobility and domestic responsibilities. We now report on our preferred specifications which allow us to examine the extent to which these factor influence pay within academic and research science (see Tables 5a and 5b).

Salaries are higher in some subject areas – notably, medicine and dentistry in academic science, where the premium over other subject areas for men is 22% but only 13% for women. Similarly, in research science, average salaries are higher for those working in MRC funded Research Institutes and the Sanger Institute, where the premium for men is 19% and 16% respectively but only 12% in each case for women. On average, salaries are higher for those working in Russell Group or other pre-92 institutions than for those working in post-92 Universities. As expected, those on permanent contracts earn more than those on temporary or fixed term contracts – this effect is significant for men. We find that, relative to those on teaching and research appointments, those on teaching only contracts earn less – for men the penalty is 5% compared with 7% for women. Those men who are on research only contracts appear to earn more than men on other types of contracts, whereas women earn less.

We also explore the impact of workplace responsibilities, finding that those with senior administrative positions earn more than those who have no administrative role. Interestingly, women in academic science appear to benefit from a slightly higher pay premium associated with some of these roles (for example, the premium for holding a senior university administrative post is 9% for women compared with 3% for men and the premium for being head of department is 13% for women compared with 11% for men). In research science it is men who appear to benefit from slightly higher pay premiums associated with these administrative roles.

There is evidence that departmental research success and other research esteem measures are rewarded in terms of higher pay. Those working in departments which were rated 5 or 5* in the 2001 RAE earn more than those in departments with lower RAE ratings. There is a 4% pay penalty for women, but not for men, who were not themselves included in the departmental RAE submission. Generally, those working in departments that did not make a return to the 2001 RAE earn less than those who work in departments that did submit. Those with successful research careers who have achieved various measures of research esteem – fellow of a professional organisation, given a keynote address, been editor of a journal, assessor for a research council – earn more. Women in both academic and research science benefit from membership or fellowship of a professional organisation, these may be providing female scientist with professional support (e.g. mentoring and networking opportunities). There is some evidence that those who move can use this to their advantage in pay negotiations – interestingly, the premium is slightly higher for those women moving to take a Chair.

There is mixed evidence on the impact of parenthood. In academic science, there is evidence that pay is higher amongst the parents of young children (a similar premium for men and women), whereas in research science, salaries are lower amongst parents, particularly mothers, of older children (1% lower for men and 5% lower for women). The evidence of the impact or caring responsibilities and disrupted careers is more consistent. There is a penalty in academic science (2% for men and 4% for women) for

those who have the main caring responsibilities and a penalty in research science (7% for men and 2% for women) for those who have worked part-time in the past.

[Tables 5a and 5b]

Grade remains the single most important factor influencing pay (even after we have controlled for subject area, experience, work responsibilities, contract type, research esteem, mobility and domestic responsibilities) and there are important differences in the size of the relative premium for women at the top and penalties for women at the bottom. At the top in academic science, male professors earn 32% more than male lecturers, while female professors earn 26% more than female lecturers, (the pay differentials for readers/senior lecturers is broadly the same for men and women - 14%), whereas in research science, the results suggest that, after controlling for other factors, female research directors earn 42% more than female senior scientists, whereas their male counterparts earn 33% more than male senior scientists. At the bottom, post-docs earn less than lecturers or senior scientists, but the pay differentials for women are larger -12% and -19% in academic and research science respectively compared with -11% and -17% for male post-docs.

The results of the decomposition analysis are shown in Chart 2. Differences in characteristics account for just over 77% of the overall average gender pay gap: the fact that men are generally employed in higher grades accounts for 40% of the average pay gap; that men are older and have more years of experience accounts for 15%. Interestingly the subject mix causes women to be slightly better paid. There is no strong evidence that parenthood in itself has an adverse impact on pay for men or women, but women who have been in part-time work or taken career breaks do earn less (12%). Our various models incorporate proxies for productivity - the research environment and research esteem - which explains about 10% of the gap and differences in work-roles capture a further 5%.

[Chart 2]

However, when we compare the results of our preferred and simplest specifications we find that we have not added very much to our understanding of the unexplained proportion of the pay gap[xiv]. Even when we control for workplace responsibilities and dimensions of performance, we find that around 24% of the pay gap in academic science (just under £1,500 pa) and 29% of the pay gap in research science (just over £1,800 pa) can be attributed to differences in treatment. We illustrate in Charts 3a and 3b how the gender pay gap across the distribution would alter if women were to receive the same returns to their characteristics as men, i.e. received the same treatment. In academic science this would close the gender pay gap completely at the bottom end and it would narrow significantly across the rest of the distribution, in research science, the pay gap would only narrow in the lower half of the distribution.

[Charts 3a and 3b]

All of the results indicate that pay is strongly influenced by grade, so we turn now to exploring the pay differentials within grade[xv]. We saw in Table 2 that the gender pay gap is generally higher at the post-doctoral level in both academic and research science (5.2% and 6.1% respectively), at professorial level in academic science and for principal scientists (7.5% and 6.8% respectively) in research science. We therefore estimate within grade wage equations and apply a decomposition analyses to the associated gender pay gaps (results are presented in Tables A1-A4 in the Appendix) and an interesting picture emerges (see Chart 4). Typically, women are less well paid through a combination of having a lower set of productive characteristics and being rewarded less well for the same productive characteristics. But, here we find that within grade women have a greater stock of certain productive characteristics which are typically <u>well rewarded</u> – they have more responsibilities, are more likely to work in institutions or subjects which pay well and are even more likely to hold certain roles of esteem. Given the same returns and based on characteristics alone, women should be <u>better paid</u> than men. However, this is counter balanced by receiving lower returns for the same characteristics. This difference in treatment is particularly pronounced for post-docs and professors within academic

science – for example, male post-docs receive a return which is 17% points higher in medicine and dentistry and male professors receive a return which is 15% points higher in the Russell Group and 26% higher in pre-92 Institutions.

[Chart 4]

In Table 6 we explore how the average gender pay gap within grade would alter if men and women received the same returns – we present three scenarios: where men and women receive the male returns for their own characteristics, where they both receive the female returns and when they receive the pooled returns. For post-docs and professors within academic science the gender pay gaps of £1,452 and £4,262 would become pay advantages with female post-docs earning up to £451 more and female professors earning up to £4,355 more than men in the same grade. The female post-docs and principal scientists in research science would not earn more, but the gender pay gap within grade would close significantly.

[Table 6]

Grade is a significant determinant of pay and there is significant variation in the gender pay gap within grade. But, if women receive different treatment in terms of the probability of promotion (see Connolly and Long, 2011), then including grade as an explanatory variable may lead us to understate the impact of gender on pay. In order to explore the extent of the gender pay gap if the probability of promotion were gender neutral, we present two sets of decomposition results, those obtained using our preferred specifications (illustrated in Chart 2) and those obtained using the same set of explanatory variables but with the exception of grade (tables may be obtained from the authors upon request) - see Table 7. The purpose of excluding grade is to assess the impact of characteristics alone upon pay, without the possible bias that might arise in the promotion process. Comparing the decomposition results, we find that the impact of characteristics which might also determine promotion – experience, workplace responsibilities and esteem – all rise, and that the effect of having family responsibilities,

taking career breaks or working part-time fall slightly. Interestingly, excluding grade has limited impact upon the unexplained proportion of the gender pay gap in academic science but the unexplained proportion in research science rises from 30-40%. This reflects the sticky floor which seems to prevail in research science (see Connolly and Long, 2011), women form the majority of the workforce at the lowest grade, are less likely to be promoted to senior scientist and therefore, less likely to benefit from the upper two-thirds of the pay scale. Our results give us a range of values of the 'unexplained' gender pay gap in science, the extent of the range providing an indication of the consequences of any bias in promotion upon pay. In the case of academic science, we are left with an 'unexplained' pay gap of 19-20% – roughly £1,500 per year – but in the case of research science we find a much wider range of values between 30-40% – between £1,900 and £2,500 per year[xvi].

[Table 7]

Conclusions

Most studies of gender discrimination compare men and women who are employed in very different occupations and with varying backgrounds in terms of education and employment experience. These studies typically report an "unexplained" gender pay gap of around 25-30%[xvii]. Our study is distinguished by its focus on very highly educated men and women – they are, at the very least, graduates and most have post-graduate qualifications – who have similar career histories, been in continuous mostly full-time employment and work in the same sector/occupation – scientists in Higher Education (academic science) or Research Institutes (research science). Given the similarity of background, qualification and experience we would expect a more equal picture in terms of salary to emerge, however we find a raw gender pay gap of between £6-7,000.

Much of the gender gap in pay (just under 80%) can be explained by differences in age, grade, institution type, workplace responsibilities and research esteem. But, this still leaves a gap of around 20% in academic and up to 30% in research science that we attribute to differences in returns to the same characteristics and may be seen as a

measure of differential treatment or discrimination. These results are consistent with a broad range of studies of the academic job market in the US and the UK.

Our study also provides a comparison between two types of employer of scientists. Women experience lower pay and are less likely to be employed in senior positions in both academic and in research science. But there are interesting differences between the two: in academic science the % gender pay gap is largest for women at the highest grade (7%) whereas, for women in research science is largest at the lowest grade (6%). We explore these differentials in more detail and find that based on characteristics alone, across grades if women received the same treatment as men then the gender pay gap across the distribution would be significantly narrowed, (it would be closed at the lower end of the distribution in academic science) and that within grade female professors and post-docs in academic science would actually be better paid than their male counterparts!

Clearly, grade is a key determinant of pay, it accounts for 40% of the overall gender pay gap. However, other work, (Connolly and Long, 2011) has shown that women face a disadvantage in terms of promotion. We, therefore, examine what the pay gap might be if scientists were rewarded on the basis of characteristics alone, by excluding grade as an explanatory variable. Unsurprisingly, we find that years of experience, workplace responsibilities and esteem become more important. Interestingly, the more gender specific factors, motherhood and part-time employment become less important which suggests that their effect on pay is generated primarily through their impact on reduced probability of promotion. These results, particularly those for research science, serve to reinforce the argument that pay and grade gaps go hand in hand and that we need to address both in order to tackle gender inequality.

Finally, studies such as this make a valuable contribution to the debates on gender inequality and discrimination. They show that differences in treatment persist, even where men and women are equally well qualified and doing the same jobs and illustrate the challenges for equality legislation. That there should be more significant differences in treatment at the top and lower grades is important. These are typically the sections of

the pay scales where there is more room for discretion. This suggests that any move towards decentralised bargaining in UK academe might have a negative impact on the gender pay gap. Our research implies that there isn't a single solution to gender inequality since the cause or root of the gap may be at different points of even very similar careers, the fact that differences in treatment vary with institution implies that employer based pay audits need to play a more significant role in eradicating pay discrimination.

Bibliography

Anderson T, Forth J, Metcalf H, Kirby S. The Gender Pay Gap, Final Report to the Women and Equality Unit. Cabinet Office: London; 2001.

Arulampalam W, Booth A, Bryan M. Is there a glass ceiling over Europe? Exploring the gender pay gap across the wage distribution. Industrial and Labor Relations Review 2007;60 No 2; 163-186.

Blackaby D, Booth A, Frank J. Outside offers and the gender pay gap: empirical evidence from the UK academic labour market. Economic Journal 2005;115 February; 81-107.

Booth A, Francesconi M, Franks J. A sticky floors model of promotion, pay, and gender. European Economic Review 2003;47; 295 - 322.

Booth A. Gender and competition. Labour Economics 2009;16; 599-606.

Chzhen Y, Mumford K. Gender Gaps across the Earnings Distribution in Britain. Are women bossy enough? IZA Discussion Paper 2010; No 4331.

Connolly S, Holdcroft A. The Pay Gap for Women in Medicine and Academic Medicine, British Medical Associate: London; 2009.

Connolly S, and Long S. Glass ceilings – thicker at the top? Evidence on career progression for scientists from the UK. UEA Discussion Paper; 2011.

Equality Commission. Financial Services Inquiry: Sex discrimination and gender pay gap. Equality and Human Rights Commission: London; 2009.

European Commission. SHE Figures 2009: Statistics and Indicators on Gender Equality in Science. European Commission: Brussels; 2009.

Ginther D, Hayes K. Gender differences in salary and promotion in the humanities. American Economic Review 1999; 89; May Papers and Proceedings; 397-402.

Ginther D, Hayes K. Gender differences in salary and promotion for faculty in the humanities, 1977-95. Journal of Human Resources 2003;38; No 1; 34-73.

Ginther, D, Kahn S., "Does science promote women? Evidence from academia 1973 – 2001. NBER Working Papers 2006; No 12691.

Kahn S. Gender differences in academic career paths of economists. American Economic Review 2001;83; No 2; May Papers and Proceedings; 52-56.

McDowell J, Singell L, Ziliak J. Cracks in the glass ceiling: gender and promotion in the economics profession. American Economic Review 1999;89; No 2; May Papers and Proceedings; 392-396.

McDowell J, Singell L, Ziliak J. Gender and promotion in the economics profession. Industrial and Labor Relations Review 2001;54; No 2; January; 224-244.

National Academy of Science. Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering. National Academy of Science:Washington, D.C; 2007.

McNabb R, Wass V. Male-female earnings differentials among lawyers in Britain: a legacy of the law or a current practice? Labour Economics 2006;13; No 2; 219-235.

Massachusetts Institute of Technology. A study on the status of women faculty in science at MIT. 1999; http://web.mit.edu/fnl/women/women.html (accessed March 2011)

Oaxaca R. Male-female wage differentials in urban labour markets. International Economic Review 1973;14; No 3; 693-709.

Walby S, Olsen W. The impact of women's position in the Labour market on pay and the Implications for UK productivity. Women and Equality Research Unit Department of Trade and Industry: London; 2002.

Ward M. The gender salary gap in British academia. Applied Economics 2001;33; 1669-1681.

Chart 1a - Explaining the gender pay gap in academic science - Higher Education

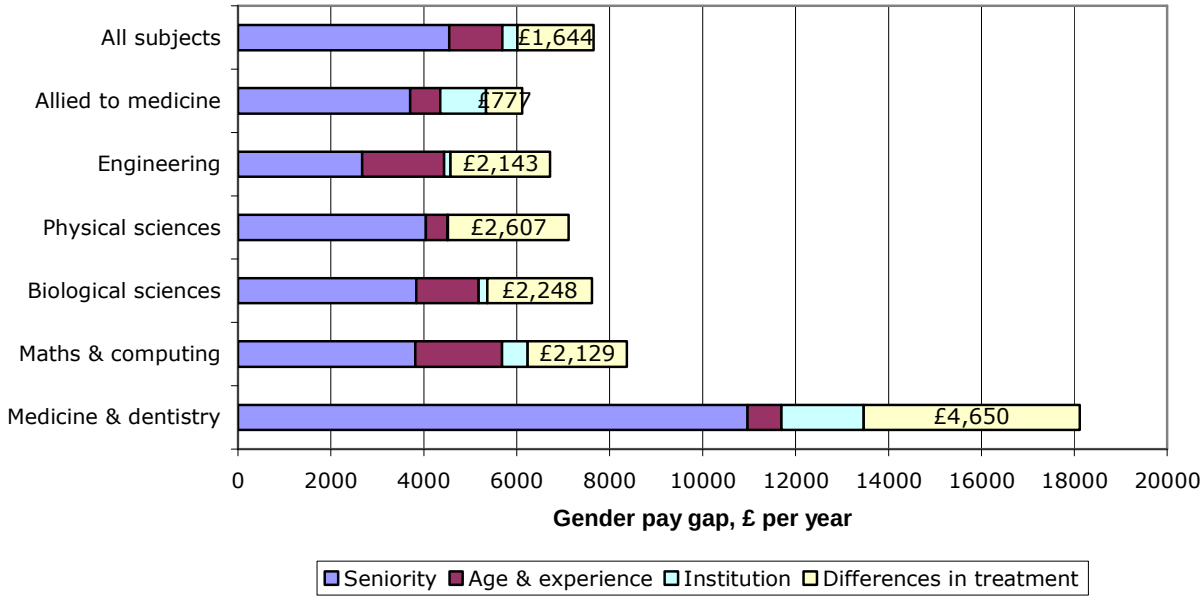

Chart 1b - Explaining the gender pay gap in research science - Research Institutes

Chart 2 - Decompostion of the gender pay gap, all grades

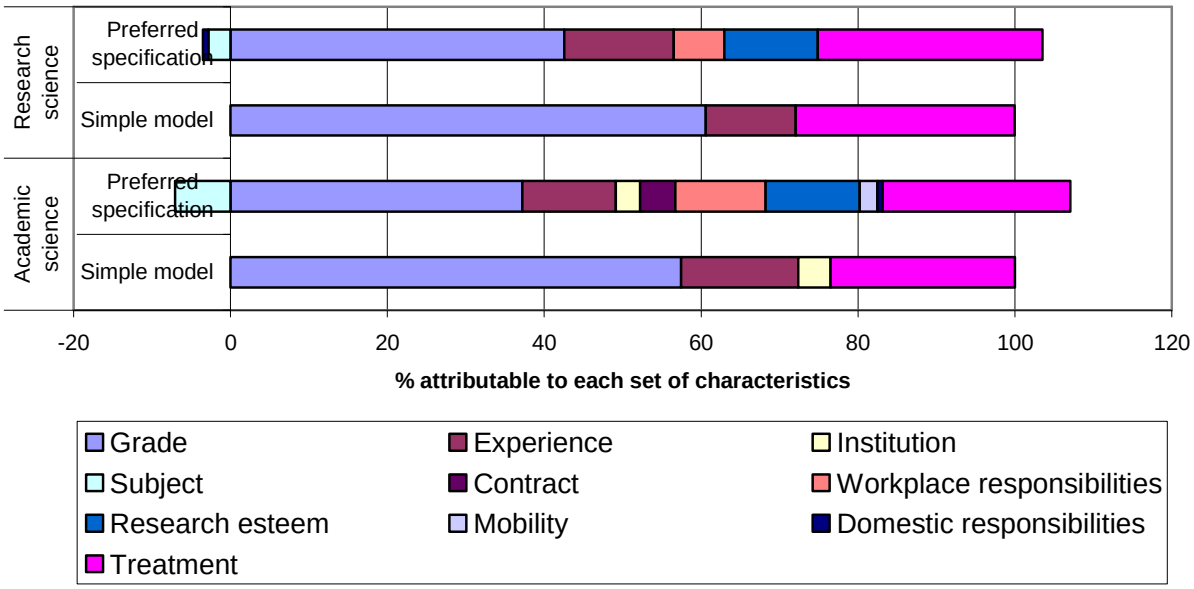

Chart 3a - Distribution of actual and predicted pay, Academic science

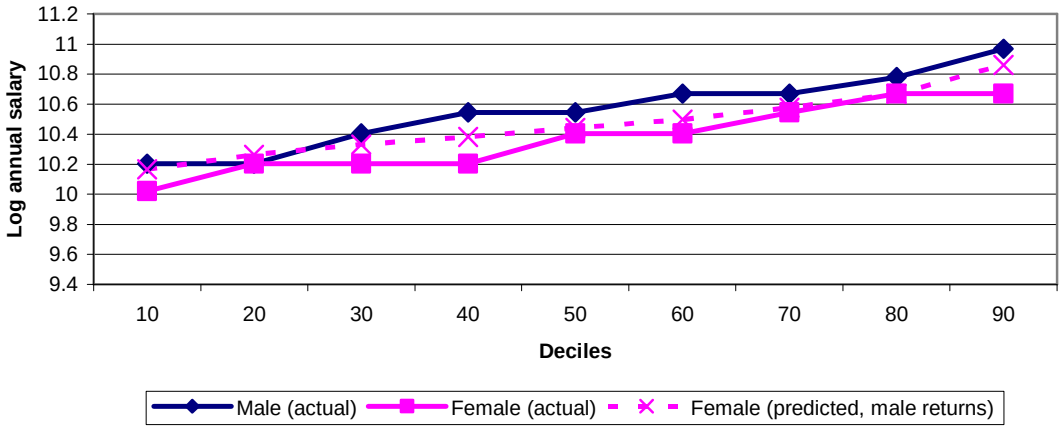

Chart 3b - Distribution of actual and predicted pay, Research Science

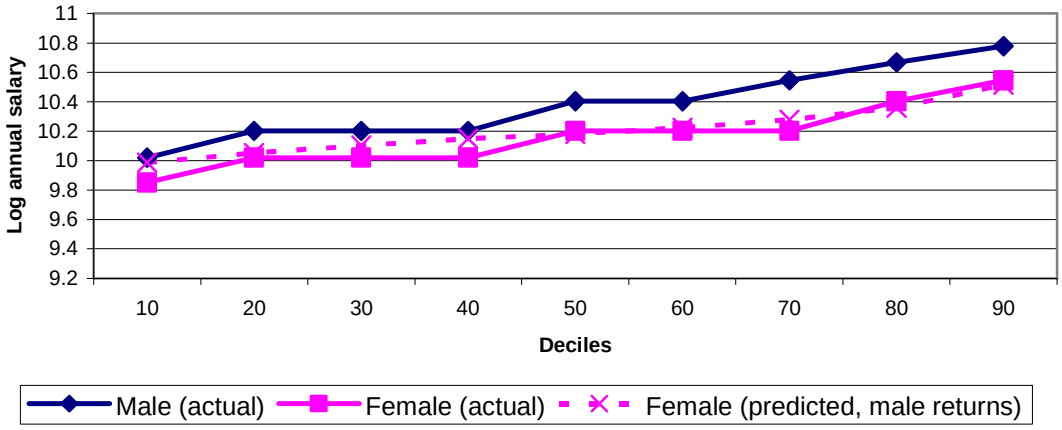

Chart 4 - Decomposition of gender pay gap within grade

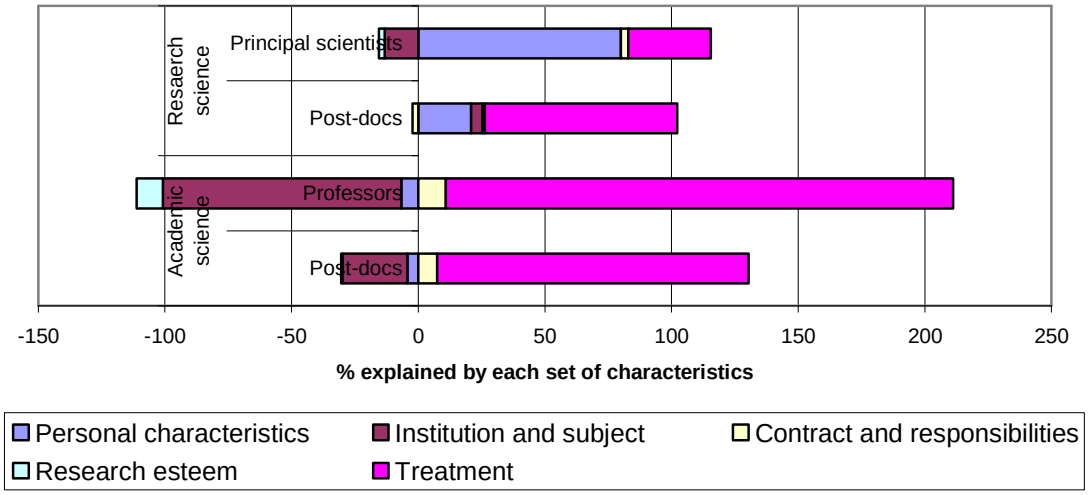

Table 1 - Gender breakdown of salary of permanent academic staff in Higher Education by subject area

	Average salary pa		Gender pay gap % *	% earning more than £50,000 pa	
	Male	Female		Male	Female
All subjects	£42,585	£37,632	13.16	18	6
Subject allied to medicine	£44,862	£37,839	18.56	21	6
Biological sciences	£45,163	£39,245	15.08	25	10
Veterinary sciences	£41,714	£35,151	18.67	14	4
Chemistry	£44,922	£38,571	16.47	25	10
Physics	£45,449	£39,833	14.10	26	9
Other physical sciences	£43,676	£38,286	14.08	21	11
Mathematical sciences	£44,515	£39,275	13.34	24	8
Computer sciences	£38,612	£36,260	6.49	9	3
Engineering	£42,693	£37,706	13.23	17	5

Source: "The higher education workforce in England – a framework for the future", Table 18.
* as % of average female salary.

Table 2 – Average annual salaries within academic and research science

Academic science - HE	*Male*	*Female*	*% gender pay gap*	***Research science - RI***	*Male*	*Female*	*% gender pay gap*
All grades	£41,409	£34,042	21.64	All grades	£33,573	£27,328	22.85
Professor	£59,727	£55,553	7.51	Research Director	£67,405	£66,000	2.13
Senior lecturer or reader	£42,960	£40,957	4.89	Principal scientist	£44,257	£41,424	6.84
Lecturer	£33,628	£32,688	2.88	Senior scientist	£35,017	£33,138	5.67
CRS/postdoc	£28,495	£27,091	5.18	Scientist/postdoc	£25,849	£24,363	6.10

Source: Authors calculations using ASSET 2003/2004. **Note:** CRS = Contract Research Staff

Table 3 – Average annual salaries by subject within academic and research science

Academic science				Research science			
Subject	Male	Female	Gender pay gap	Funder	Male	Female	Gender pay gap
All academic science	£41,409	£34,042	21.64	All research science	£33,573	£27,328	22.85
Allied to medicine (60%)	£39,305	£33,188	18.43	MRC - Medical Research Council (52%)	£36,408	£28,403	28.19
Medicine and Dentistry (50%)	£54,270	£39,689	36.74	BBSRC - Biotechnical and Biological Sciences Research Council (46%)	£32,188	£26,104	23.31
Biological sciences (46%)	£40,398	£32,783	23.23	Sanger Institute - genome research institute (42%)	£32,529	£26,757	21.57
Math. & comp. sciences (25%)	£41,095	£32,731	25.55	NERC - Natural Environment Research Council (33%)	£32,482	£25,958	25.13
Physical sciences (23%)	£39,111	£31,993	22.25	CCLRC - Engineering and Physical Sciences Research Council (17%)	£32,749	£28,322	15.63
Engineering (18%)	£42,041	£35,598	18.10				

Note: Figure in parentheses indicates female share of employment

Table 4a.1: Academic science, determinants of pay – simple model

	Pooled		Male		Female	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Female	-0.04	0.01				
Professor	0.46	0.02	0.46	0.02	0.43	0.03
Senior lecturer	0.20	0.01	0.19	0.02	0.21	0.02
Lecturer						
Post-doc	-0.15	0.01	-0.14	0.02	-0.17	0.02
Other	-0.07	0.02	-0.04	0.03	-0.10	0.03
Age in years	0.04	0.00	0.04	0.01	0.04	0.01
Age in years squared	0.00	0.00	0.00	0.00	0.00	0.00
Russell group	0.20	0.02	0.22	0.03	0.20	0.02
Pre-92 group	0.15	0.02	0.17	0.02	0.16	0.03
Post-92 group						
Constant	9.31	0.09	9.27	0.12	9.31	0.13
Adj R-squared		0.67		0.68		0.58

Table 4a.2: Academic science, determinants of pay by subject – simple model

	Medicine and dentistry		Allied to medicine		Bioscience		Physical science		Maths and computing		Engineering	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Female	-0.11	0.05	-0.02	0.02	-0.05	0.02	-0.05	0.02	-0.05	0.02	-0.02	0.03
Professor	0.52	0.10	0.51	0.05	0.47	0.03	0.42	0.03	0.47	0.03	0.42	0.03
Senior lecturer	0.21	0.08	0.20	0.03	0.15	0.03	0.17	0.03	0.23	0.02	0.19	0.03
Lecturer												
Post-doc	-0.31	0.07	-0.12	0.03	-0.14	0.02	-0.11	0.03	-0.10	0.03	-0.21	0.03
Other	-0.25	0.08	-0.10	0.05	0.00	0.03	-0.15	0.04	0.04	0.05	-0.07	0.04
Age in years	0.04	0.02	0.02	0.01	0.04	0.01	0.03	0.01	0.04	0.01	0.04	0.01
Age in years squared	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Russell group	0.12	0.07	0.20	0.03	0.13	0.03	0.19	0.06	0.12	0.03	0.08	0.05
Pre-92 group			0.22	0.04	0.10	0.04	0.15	0.06	0.11	0.03	0.07	0.05
Post-92 group												
Constant	9.64	0.48	9.60	0.19	9.32	0.15	9.32	0.19	9.35	0.18	9.31	0.22
Adj R-squared		0.59		0.71		0.72		0.76		0.75		0.68

Note: Dependent variable - ln of annual salary.

Table 4b.1: Research science, determinants of pay – simple model

	Pooled		Male		Female	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Female	-0.05	0.01				
Research director	0.57	0.03	0.55	0.03	0.64	0.05
Principal scientist	0.20	0.01	0.19	0.02	0.21	0.03
Senior scientist						
Scientist	-0.24	0.01	-0.23	0.01	-0.25	0.02
Other	-0.23	0.03	-0.22	0.04	-0.26	0.06
Age in years	0.02	0.00	0.02	0.00	0.03	0.00
Age in years squared	0.00	0.00	0.00	0.00	0.00	0.00
Constant	9.86	0.06	9.84	0.09	9.70	0.09
Adj R-squared		0.67		0.66		0.59

Table 4b.2: Research science, determinants of pay by subject – simple model

	BBSRC		CCLRC		MRC		NERC		Sanger	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Female	-0.05	0.01	-0.05	0.02	-0.07	0.01	-0.04	0.02	-0.07	0.04
Research director	0.74	0.04	0.44	0.04	0.58	0.04	0.43	0.15		
Principal scientist	0.26	0.02	0.20	0.02	0.15	0.02	0.26	0.03	0.27	0.09
Senior scientist										
Scientist	-0.21	0.01	-0.20	0.02	-0.35	0.02	-0.22	0.02	-0.20	0.05
Other	-0.30	0.06	-0.16	0.03					-0.05	0.20
Age in years	0.02	0.00	0.02	0.01	0.03	0.00	0.03	0.01	0.10	0.02
Age in years squared	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	9.73	0.10	9.89	0.12	9.87	0.10	9.64	0.18	8.44	0.45
Adj R-squared		0.78		0.66		0.75		0.71		0.57

Note: Dependent variable - ln of annual salary.

Table 5a: Academic science, determinants of pay – preferred specification

	Pooled		Male		Female	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Female	-0.04	0.01				
Professor	0.30	0.02	0.32	0.02	0.26	0.04
Senior lecturer	0.14	0.01	0.14	0.02	0.14	0.02
Lecturer						
Post-doc	-0.12	0.02	-0.11	0.02	-0.12	0.03
Other	-0.06	0.02	-0.02	0.03	-0.09	0.03
Age in years	0.03	0.00	0.03	0.00	0.04	0.01
Age in years squared	0.00	0.00	0.00	0.00	0.00	0.00
Russell group	0.12	0.02	0.12	0.03	0.12	0.03
Pre-92 group	0.10	0.02	0.11	0.02	0.11	0.03
Post-92 group						
Medicine and dentistry	0.16	0.02	0.22	0.02	0.13	0.02
Bioscience	0.04	0.01	0.03	0.01	0.04	0.02
Other subject area						
Permanent contract						
Fixed-term contract	-0.02	0.01	-0.04	0.02	0.01	0.02
Other type of contract	-0.06	0.03	-0.15	0.03	0.03	0.04
Teaching and research contract						
Teaching only contract	-0.05	0.02	-0.05	0.03	-0.07	0.03
Research only contract	-0.01	0.02	0.04	0.02	-0.05	0.02
Holds senior administrative post	0.05	0.02	0.03	0.02	0.09	0.04
Head of department	0.11	0.02	0.11	0.02	0.13	0.05
Administrative role within department	0.02	0.01	0.03	0.01	0.01	0.02
Internal appointment committee	0.03	0.01	0.03	0.01	0.02	0.02
External appointment committee	0.04	0.01	0.04	0.02	0.04	0.03
No administrative role						
Not included in RAE submission	-0.02	0.01	0.00	0.01	-0.04	0.02
Department did not submit in RAE	-0.04	0.01	-0.05	0.02	-0.03	0.02
Department RAE score 1-4						
Department RAE score 5	0.03	0.01	0.05	0.01	0.01	0.02
Department RAE score 5*	0.04	0.01	0.04	0.02	0.04	0.02
Member of a professional organisation	0.02	0.01	-0.01	0.01	0.04	0.01
Fellow of a professional organisation	0.05	0.01	0.03	0.02	0.05	0.03
Member of a research council	0.05	0.02	0.06	0.02	0.04	0.05
Non-executive director of a public company	0.00	0.02	0.05	0.03	-0.09	0.05
Professional consultancy work	0.04	0.01	0.03	0.01	0.04	0.02
Professional representative work	0.05	0.01	0.02	0.01	0.09	0.02
Moved for 1st SL	0.06	0.02	0.06	0.02	0.06	0.03
Moved for 1st Chair	0.09	0.02	0.08	0.02	0.11	0.05
No children						
Has children under the age of 6	0.05	0.01	0.04	0.01	0.05	0.02
Has caring responsibilities	-0.03	0.01	-0.02	0.01	-0.04	0.02
Constant	9.39	0.08	9.35	0.11	9.35	0.13
Adj R-squared		0.73		0.75		0.64

Note: Dependent variable - ln of annual salary.

Table 5b: Research science, determinants of pay – preferred specification

	Pooled		Male		Female	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Female	-0.05	0.01				
Research director	0.35	0.03	0.33	0.03	0.42	0.06
Principal scientist	0.12	0.01	0.12	0.01	0.12	0.02
Senior scientist						
Scientist	-0.17	0.01	-0.17	0.01	-0.19	0.02
Other	-0.14	0.03	-0.14	0.03	-0.15	0.05
Age in years	0.02	0.00	0.02	0.00	0.03	0.00
Age in years squared	0.00	0.00	0.00	0.00	0.00	0.00
BBSRC						
CCLRC	0.07	0.01	0.08	0.01	0.06	0.02
MRC	0.15	0.01	0.19	0.01	0.12	0.01
NERC	0.03	0.01	0.04	0.02	0.01	0.02
Sanger	0.14	0.02	0.16	0.02	0.12	0.03
Has senior administrative responsibility	0.06	0.01	0.06	0.01	0.05	0.02
Has administrative role	0.05	0.01	0.07	0.01	0.04	0.01
Sits on a committee	0.02	0.01	0.02	0.01	0.02	0.02
Internal appointment committee	0.02	0.01	0.02	0.01	0.03	0.01
External appointment committee	0.01	0.01	0.01	0.02	0.01	0.03
Member of a professional organisation	0.02	0.01	0.01	0.01	0.03	0.01
Fellow of a professional organisation	0.06	0.01	0.03	0.02	0.09	0.02
Has chartered status	0.01	0.01	0.04	0.01	-0.07	0.02
Delivered a keynote address	0.03	0.01	0.03	0.01	0.04	0.02
On editorial board of a journal	0.09	0.01	0.10	0.01	0.05	0.03
Member of research council	-0.03	0.03	-0.01	0.03	-0.09	0.05
Member of grant giving body	0.05	0.02	0.05	0.02	0.05	0.03
Assessor for research council	0.03	0.01	0.02	0.01	0.08	0.02
Non-exec director of public company	0.06	0.03	0.09	0.04	-0.02	0.06
Professional consultancy work	0.03	0.01	0.04	0.01	0.02	0.02
Has children over the age of 16	-0.03	0.01	-0.01	0.01	-0.05	0.02
Has been employed part-time	-0.03	0.01	-0.07	0.02	-0.02	0.01
Constant	9.61	0.06	9.61	0.08	9.48	0.08
Adj R-squared		0.76		0.77		0.69

Note: Dependent variable - ln of annual salary.

Table 6 – Gender pay gap within grade compared

Gender pay gaps	Actual	Male returns – own characteristics	Female returns – own characteristics	Pooled returns – own characteristics
Academic science - Post-docs	£1,452	-£451	-£322	-£47
Academic science - Professors	£4,262	-£4,355	-£4,043	-£3,483
Research science – Post-docs	£1,419	£336	£374	£507
Research science – Principal scientists	£2,812	£790	£1,875	£1,109

Table 7 – Gender pay gap across grade compared

Scientists	**Academic**		**Research**	
	With grade	Without grade	With grade	Without grade
Gender pay gap	22%	22%	20%	20%
Reason				
Grade	40%	-	40%	-
Experience	14%	18%	15%	17%
Part-time employment, career breaks or domestic role	7%	5%	0	-1%
Responsibilities	11%	21%	5%	14%
Esteem	13%	28%	15%	28%
Institution, subject	-5%	8%	-5%	2%
Unexplained – differences in treatment	19%	20%	30%	40%

Appendix

Table A1 - Post-docs – Academic Science

	Returns		Means	
	Men	Women	Men	Women
(Constant)	8.9884	9.1864		
White	0.0717	0.0311	0.90	0.90
Age	0.0451	0.0383	35.69	35.00
Square of age	-0.0004	-0.0004	1343.62	1284.87
Russell Group	0.1307	0.1839	0.61	0.73
Pre 92	0.0961	0.1714	0.38	0.24
Not included in last RAE submission	-0.0378	-0.0734	0.57	0.57
Missing info or not applicable	-0.0840	-0.0845	0.29	0.25
Department RAE score 5*	0.0316	0.1031	0.12	0.15
Assessor for research council	0.1223	0.1123	0.10	0.06
Has a senior administrative role within department - not head	0.0641	0.0875	0.16	0.13
Other type of contract	-0.2707	-0.1348	0.02	0.02
Medicine and dentistry	0.1608	-0.0130	0.08	0.15
Subjects allied to medicine	0.0464	-0.0347	0.08	0.16
Biological science	0.0591	-0.0147	0.32	0.46
Physical science	0.0487	-0.0779	0.23	0.11
Engineering	0.0197	-0.1170	0.16	0.04
Technology	-0.0816	-0.1084	0.03	0.01
Architecture	-0.1522	0.0040	0.02	0.00
Other	0.0646	-0.1591	0.01	0.00

Table A2 – Professors – Academic Science

	Returns		Means	
	Men	Women	Men	Women
(Constant)	10.3922	11.3760		
White	-0.0608	0.0882	0.92	0.96
Age	0.0065	-0.0256	52.74	49.91
Square of age	-0.0001	0.0002	2831.25	2546.83
Russell Group	0.2099	0.0648	0.52	0.62
Pre 92	0.1732	-0.0869	0.44	0.30
Medicine and dentistry	0.3151	0.2850	0.06	0.15
Biological science	0.0941	0.0617	0.18	0.38
Research only contract	0.0170	0.0919	0.08	0.13
Holds a senior administrative or managerial post within university - PVC, head of research centre etc	0.0493	0.1104	0.33	0.30
Served on an external appointment committee	0.0746	-0.0185	0.40	0.45
Served on an internal appointment committee	0.0889	-0.0457	0.78	0.77
Has chartered status	-0.0559	-0.0962	0.48	0.34
Editor or on editorial board of an academic journal	0.1033	-0.0274	0.78	0.83
Moved to take up 1st professorship	0.0888	0.1365	0.26	0.26
Fellow of a professional organisation	0.1054	0.0677	0.58	0.49
Subjects allied to medicine	0.0660	0.0518	0.06	0.15
Physical science	0.0332	0.0390	0.20	0.13
Engineering	0.0545	-0.1575	0.25	0.06
Technology	-0.0243	0.1428	0.02	0.04

Table A3 - Post-docs – Research Science

	Returns		Means	
	Men	Women	Men	Women
(Constant)	9.4953	9.2546		
Age	0.0265	0.0378	36.67	35.71
Square of age	-0.0002	-0.0004	1432.08	1354.77
BBSRC	-0.1304	-0.1157	0.26	0.32
CCLRC	-0.0469	-0.0158	0.23	0.06
NERC	-0.1067	-0.0975	0.11	0.09
Has an administrative role within research institute	0.0601	0.0319	0.70	0.74
Served on an internal appointment committee	0.0590	0.0370	0.12	0.12
Full member of a professional organisation	0.0244	0.0300	0.27	0.26
Fellow of a professional organisation	0.0529	0.0467	0.03	0.04
Keynote speaker at conference	0.0439	0.0371	0.03	0.03
Editor or on editorial board of an academic journal	0.1171	0.0931	0.01	0.01
Assessor for research council	0.1251	0.1235	0.01	0.01
Non-executive director of public company	0.2855	-0.0380	0.00	0.00
Professional consultancy work	0.0218	0.0419	0.09	0.05
Ever worked part time	-0.0503	-0.0325	0.03	0.20
Has children aged above 16	-0.0313	-0.0745	0.10	0.11
Sanger	-0.0296	0.0017	0.04	0.04
White	0.0064	0.0222	0.85	0.90

Table A4 – Principal Scientist – Research Science

	Returns		Means	
	Men	Women	Men	Women
(Constant)	9.7827	10.2072		
BBSRC	-0.2112	-0.2094	0.40	0.47
CCLRC	-0.1665	-0.1075	0.23	0.10
NERC	-0.1229	-0.1063	0.16	0.05
Holds a senior administrative or managerial post within RI - Head of research centre etc	0.0412	0.0388	0.47	0.42
Sits on a RI committee	0.0349	0.0101	0.46	0.46
Keynote speaker at conference	0.0670	0.0905	0.51	0.61
Member of research council committee	0.0436	0.1435	0.16	0.14
Non-executive director of public company	-0.1408	-0.2088	0.01	0.03
Professional consultancy work	0.0426	0.0200	0.43	0.46
Has children under the age of 6	0.0743	0.0396	0.12	0.20
Sanger	-0.0079	0.0459	0.02	0.02
White	0.0009	-0.0062	0.91	0.95
Age	0.0287	0.0061	49.38	45.03
Square of age	-0.0002	0.0001	2494.32	2073.92

Table A5 - Means – Academic science (Higher Education)

	All	Men	Women
Professor	0.19	0.24	0.08
Reader or senior lecturer	0.32	0.35	0.28
Lecturer	0.27	0.25	0.31
CRS/post-doc	0.15	0.11	0.23
Other	0.07	0.05	0.10
Age	43.42	44.92	40.76
Russell Group	0.60	0.58	0.62
Pre 92	0.30	0.34	0.24
Post 92	0.10	0.08	0.14
Working part time	0.08	0.03	0.15
Ever worked part time	0.14	0.06	0.29
Taken a career break	0.15	0.05	0.31
Has children under the age of 6	0.20	0.20	0.20
Has children aged 6 to 16	0.27	0.28	0.24
Has children aged above 16	0.12	0.13	0.09
White	0.89	0.88	0.90
Black	0.01	0.00	0.01
Asian	0.04	0.04	0.04
Other ethnicity	0.01	0.01	0.01
Missing info on ethnicity	0.05	0.06	0.03
Has main or shared care responsibilities for child/parent/partner	0.39	0.38	0.42
Yrs for current employer	9.31	10.45	7.29
Career in HE plus industry, research institute or public sector	0.69	0.66	0.73
Medicine and dentistry	0.11	0.09	0.16
Subjects allied to medicine	0.12	0.07	0.20
Biological science	0.25	0.21	0.31
Veterinary science	0.02	0.02	0.02
Physical science	0.17	0.20	0.10
Math & computing	0.15	0.18	0.10
Engineering	0.15	0.19	0.08
Technology	0.02	0.02	0.01
Architecture	0.01	0.01	0.01
Other	0.01	0.01	0.01
Permanent or indefinite contract	0.71	0.78	0.58
Probationer	0.01	0.01	0.01
Temporary or fixed term contract	0.27	0.20	0.39
Other type of contract	0.02	0.01	0.02
Teaching only contract	0.06	0.04	0.09
Research only contract	0.19	0.14	0.29
Teaching and research contract	0.75	0.82	0.62
Included in last RAE submission	0.59	0.66	0.46
Not included in last RAE submission	0.30	0.26	0.38
Missing info on RAE or not applicable	0.11	0.09	0.16
Departmental RAE score missing	0.06	0.05	0.06

Departmental RAE score 2	0.01	0.01	0.01
Departmental RAE score 3b	0.03	0.02	0.05
Departmental RAE score 3	0.01	0.00	0.01
Departmental RAE score 3a	0.11	0.09	0.13
Departmental RAE score 4	0.16	0.17	0.13
Departmental RAE score 5	0.41	0.42	0.39
Departmental RAE score 5*	0.22	0.23	0.21
Holds a senior administrative or managerial post within university – PVC, head of research centre etc	0.10	0.13	0.06
Head of department	0.09	0.12	0.04
Has an administrative role within department – not head - admissions, teaching, research etc	0.61	0.65	0.55
Sits on a university committee	0.34	0.39	0.26
Sits on a departmental committee	0.66	0.72	0.54
Chairs a departmental committee	0.21	0.25	0.13
Served on an internal appointment committee	0.42	0.46	0.35
Served on an external appointment committee	0.13	0.15	0.10
Not a member of a professional organisation	0.23	0.21	0.25
Associate or affiliate member of a professional organisation	0.04	0.04	0.04
Full member of a professional organisation	0.51	0.49	0.56
Fellow of a professional organisation	0.22	0.26	0.13
Chartered status not available	0.25	0.24	0.29
Not chartered, but chartered status is available	0.15	0.15	0.13
Has chartered status	0.23	0.28	0.15
Keynote speaker at conference	0.32	0.37	0.23
Editor or on editorial board of an academic journal	0.32	0.37	0.22
Member of research council	0.04	0.05	0.03
Member of research council committee	0.13	0.16	0.08
Member of grant giving body	0.20	0.23	0.15
Assessor for research council	0.42	0.50	0.28
EU evaluator	0.08	0.10	0.04
Non-executive director of public company	0.04	0.05	0.02
Trustee/governor/member of public body	0.09	0.10	0.07
Professional consultancy work	0.48	0.56	0.34
Professional representative work	0.18	0.19	0.16

Table A6 - Means – Research science (Research Institutes)

	All	Male	Female
Research Director	0.02	0.03	0.01
Principal scientist	0.13	0.18	0.07
Senior scientist	0.26	0.32	0.16
Scientist	0.56	0.44	0.75
Other	0.02	0.02	0.01
Age	40.37	42.09	37.78
Working part time	0.06	0.01	0.12
Ever worked part time	0.11	0.04	0.22
Taken a career break	0.15	0.04	0.32
Has children under the age of 6	0.16	0.17	0.14
Has children aged 6 to 16	0.22	0.24	0.18
Has children aged above 16	0.18	0.21	0.13
White	0.87	0.85	0.89
Black	0.01	0.01	0.00
Asian	0.05	0.04	0.06
Other ethnicity	0.01	0.01	0.01
Missing info on ethnicity	0.07	0.09	0.04
Has main or shared care responsibilities for child/parent/partner	0.32	0.31	0.33
Years for current employer	10.19	11.25	8.60
Career in RI only	0.33	0.29	0.38
Career in RI plus industry, higher education or public sector	0.67	0.71	0.62
Permanent or indefinite contract	0.74	0.78	0.67
Temporary or fixed term contract	0.25	0.20	0.32
Other	0.01	0.02	0.01
Holds a senior administrative or managerial post within RI – Head of research centre etc	0.14	0.18	0.08
Has an administrative role within research institute – chairs meetings, line manager, external research etc	0.83	0.86	0.79
Sits on a RI committee	0.16	0.20	0.11
Served on an internal appointment committee	0.30	0.34	0.24
Served on an external appointment committee	0.07	0.08	0.05
Not a member of a professional organisation	0.53	0.50	0.57
Associate or affiliate member of a professional organisation	0.04	0.04	0.05
Full member of a professional organisation	0.36	0.38	0.33
Fellow of a professional organisation	0.09	0.10	0.06
Chartered status not available	0.28	0.28	0.28
Not chartered, but chartered status is available	0.11	0.13	0.09
Has chartered status	0.09	0.11	0.04
Keynote speaker at conference	0.16	0.20	0.10
Editor or on editorial board of an academic journal	0.13	0.17	0.07
Member of research council	0.01	0.02	0.01
Member of research council committee	0.05	0.07	0.02
Member of grant giving body	0.06	0.08	0.04
Assessor for research council	0.14	0.19	0.06

EU evaluator	0.04	0.05	0.02
Non-executive director of public company	0.01	0.02	0.01
Trustee/governor/member of public body	0.03	0.04	0.02
Professional consultancy work	0.18	0.23	0.11
Professional representative work	0.07	0.10	0.04

[i] See Arulampalam et al. 2007.

[ii] We consider scientific Research Institutes which are mostly publicly funded through the various science research councils (Biotechnical and Biological Science, BBSRC, Engineering and Physical Sciences (CCLRC), Medical (MRC) and Natural Environment (NERC) and the Sanger Institute which is funded by the Wellcome Trust. Scientists working in these institutes compete with academic scientists for research grants and publish in the same academic journals, professional success and criteria for promotion would be measured in these terms. Working in a research institute is considered very prestigious for a research orientated scientist, they would usually have no teaching responsibilities, except for PhD students, and more limited administrative roles. Some case study evidence from the US has found that women's progress is easier in Research Institutes as the goals are clearer and family life can be managed more easily as there are fewer diverse tasks to manage.

[iii] Similar (qualitative) evidence is reported by Connolly and Holdcroft (2009), page 19: "The willingness to apply for jobs elsewhere is clearly used as a bargaining tool for promotion or higher salaries "Getting a job elsewhere and using it to trade with" but for women, their perceived lack of mobility is identified by some as weakening their bargaining strength "Being in a position to threaten to leave seems to work for those staff who can be believed. This is not possible for those who are known to be constrained by their partner's job."".

[iv] See MIT (1999), National Academy of Science (2007) and EU (2009) for further international evidence on the gender gap in science.

[v] The authors undertook a benchmarking exercise to ensure that the sample was representative of the population of scientists as a whole, details are available from the authors upon request.

[vi] The Athena Project was launched in 1999 with the aim of advancing the position of women in science. It works with UK Universities, research organisations and professional bodies in Science, Engineering and Technology. Further details on this and the ASSET data may be found at http://www.athenaforum.org.uk/ (accessed March 2011).

[vii] These pay gaps are extremely interesting. In the UK most academics have their pay determined by a national pay scale, there are discretionary pay points at the top of the senior lecturer scale and for professors. The pay levels for contract researchers are likely to reflect the allocation for staffing costs made in bids for research funding.

[viii] Many of these would be joint appointments with teaching hospitals in the National Health Service where salaries reflect the clinical pay scales

[ix] These categories give some indication of the main mission of the Universities: Russell Group, these are older research intensive institutions; Pre-92, newer Universities many of which were established in the 1960s, these institutions would expect staff to combine teaching and research; Post-92 these were formerly polytechnics, they are usually less research and more teaching intensive and were established as Universities in the 1990s.

[x] The Research Assessment Exercise (RAE) is undertaken periodically, it uses a process of peer review to assess the quality of research undertaken within departments across Higher Education within the UK. "The main purpose of the Research Assessment Exercise (RAE) is to enable the higher education funding bodies to distribute public funds for research selectively on the basis of quality. Institutions conducting the best research receive a larger proportion of the available grant so that the infrastructure for the top level of research in the UK is protected and developed. The RAE assesses the quality of research in universities and colleges in the UK. It takes place every four to five years … The RAE provides quality ratings for research across all disciplines. Panels use a standard scale to award a rating for each submission. Ratings range from

1 to 5*, according to how much of the work is judged to reach national or international levels of excellence." http://www.rae.ac.uk/ (accessed March 2011)

[xi] Denoting men's and women's pay as w_M and w_F respectively, and their productive characteristics as C_M and C_F, (the logarithm of) average pay for each group can be written as:

$\overline{ln\, w_M} = \hat{\alpha}_M + \hat{\beta}_M \overline{C_M}$ and $\overline{ln\, w_F} = \hat{\alpha}_F + \hat{\beta}_F \overline{C_F}$

Where, $\hat{\beta}_M$ and $\hat{\beta}_F$ denote the estimated pay reward per unit of productive characteristics received by men and women respectively. The average gender pay gap can be written as:

$\overline{ln\, w_M} - \overline{ln\, w_F} = \hat{\alpha}_M - \hat{\alpha}_F + (\hat{\beta}_M - \hat{\beta}_F)\overline{C_M} + \hat{\beta}_F(\overline{C_M} - \overline{C_F})$

$(\overline{C_M} - \overline{C_F})$ gives the differences in the average productive characteristics which men and women bring to the job, and any differences in the net advantages of their jobs. $(\hat{\beta}_M - \hat{\beta}_F)$ measures the differing estimated rewards to these attributes. This formulation allows us to decompose the observed pay gap into the part attributable to the differing characteristics of men and women and their respective jobs, $\hat{\beta}_F(\overline{C_M} - \overline{C_F})$, and the part due to the different pay rewards which they receive for these attributes. The latter part of the pay gap, $(\hat{\alpha}_M - \hat{\alpha}_F)$ and $(\hat{\beta}_M - \hat{\beta}_F)\overline{C_M}$, can be attributed to pure discrimination.

[xii] The workforce in post-92 Universities tends to be more female, which is, in part, a reflection of the subject mix taught in these institutions.

[xiii] This implies annual gender pay differentials which cannot be accounted for in this simple model - in academic science ranging between £777 in subjects allied to medicine to £4,650 in medicine and dentistry and in research science ranging between £1,435 in institutes funded by the BBSRC and £2,647 in institutes funded by the MRC.

[xiv] In our simplest models 'grade' accounted for approximately 60% of the gender pay gap and about 40% in the preferred specification, our proxies for research esteem and workplace responsibilities seem to account for much of the difference between the two and therefore contribute to within grade pay differentials.

[xv] Blackaby et al. (2005) report a within rank gender gap coefficient of 6%, they are constrained by sample size and only find a statistically significant effect for gender amongst lecturers.

[xvi] Ward (2001) also reports that 40% of the gender pay gap is attributable to grade and finds a similar impact on the unexplained pay gap – rising from 23% to 25% - when she excludes rank.

[xvii] See Anderson et al. (2001) or Walby and Olsen (2002) for further evidence on the gender pay gap in the UK.