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ABSTRACT

Gender Equality and Positive Action: Evidence from UK Universities*

This paper examines the impact of the Athena Scientific Women's Academic Network (SWAN) Charter on the wages and employment trajectories of female faculty. The Athena SWAN Charter is a gender equality initiative that formally recognises good practice towards the representation and career progression of women in Science, Technology, Engineer, Mathematics, and Medicine (STEMM) through an accreditation process. We find that the gender wage gap closes after Athena SWAN accreditation. However, female faculty at the non-professorial level are not more likely to being promoted to professor after accreditation, or to move to an Athena SWAN accredited university. Taken together these results suggest that the higher wage growth experienced by female non-professorial faculty after Athena SWAN accreditation is likely to come from pay rises within a particular rank.

JEL Classification: I23, J16, J31, J44

Keywords: gender equality, positive action, gender pay gap, Athena SWAN

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* We thank comments from discussant, Kelly Bendard, at AEA meeting. All statistics in this paper follow a level of aggregation to maintain anonymity of individuals and ensures no personal data or personal sensitive data are identifiable. We follow Higher Education Statistic Agency (HESA) standard rounding methodology to comply with HESA agreement. This implies that (1) Counts of individuals are rounded to the nearest multiple of 5, (2) Percentages based on fewer than 22.5 individuals are suppressed, (3) Averages based on 7 or fewer individuals are suppressed.

1 Introduction

Despite increasing female representation among all faculty ranks in the US between 2002 and 2012, the share of female faculty remained the lowest among hard science and economics departments (Lundberg and Stearns, 2019). In the UK the picture is similarly disheartening. Figure 1 uses administrative-level data from the UK Higher Education Statistics Agency (HESA) to show the female faculty composition in the Russell Group top research universities in the UK over the last decade. Whereas the percentage of female faculty increased over this period, in 2016 only 15% of faculty were women in hard science departments compared to 50% in some social sciences departments such as Sociology. Trends in female representation in economics departments over this period remained stubbornly flat at about 22%.

This paper examines the impact of the Athena Scientific Women's Academic Network (SWAN) Charter on the wages and employment trajectories of female faculty. The Athena SWAN Charter is a gender equality initiative that formally recognises good practice towards the representation and career progression of women in Science, Technology, Engineer, Mathematics, and Medicine (STEMM) through an accreditation process. Understanding the effects of the Charter on gender equality in STEMM is particularly relevant at a time when the Charter's scope is being widened to cover gender equality in the disciplines of arts, humanities, and social sciences, including economics.

Our paper contributes to a growing literature that aims to evaluate the causal impact of practices and interventions leading to greater gender equality in academia (see Buckles, 2019 for a recent review). Such practices and interventions include gender-neutral tenure clock stopping policies (Antecol et al., 2018), the gender composition of evaluation committees (Bagues et al., 2017), single- versus double-blind peer review processes (Tomkins et al., 2017), mentoring programs (Blau et al., 2010), and the matching of female students to female professors (Carrell et al., 2010) among others. Our contribution comes from the nature of the intervention and the richness of the data. Here we causally evaluate the effects of a unique

positive action intervention in the UK using high-quality administrative panel data., with information on the entire population of academics in the UK. The panel nature of the data allows us to look at career trajectories and wage growth.

The remainder of the paper is organised as follows. Section 2, presents a description of the Athena SWAN charter. Section 3, outlines the data and the empirical strategy used in this study. Section 4, the main results and identification and robustness checks. Finally, in section 5, we conclude.

2 The Athena SWAN Equality Charter

The UK Equality Challenge Unit (ECU) officially launched the Athena SWAN Charter in 2005, with the first accreditation awards conferred in 2006. The charter evolved from work between the Athena Project and the Scientific Women's Academic Network (SWAN), and its aim was to provide recognition to universities in their work toward the advancement in gender equality and diversity of women in science, technology, engineering, medicine and mathematics (STEMM).[1]

The Athena Swan Charter does not set any targets for female employment or wages, nor does it dictate specific interventions that universities need to put into place. Instead, it requires universities to undertake a quantitative and qualitative assessment of gender equality in the university and to propose policies and interventions to overcome gender equality challenges. Examples of these interventions include the design of more transparent process for appointing heads of departments, career track schemes to help women to move from fix-term contracts to permanent contracts, and the set up staff review and development groups where women are encouraged to submit their CV for advice that helps them in career progression and new career prospects.

The accreditation process is a two-step process. First, in order to be eligible to apply for

[1]Some research councils have recommended Athena SWAN accreditation to gain funding Research (see https://www.ukri.org/files/legacy/skills/equalitystatement-pdf/ and Gregory-Smith, 2018)

Athena SWAN accreditation a university has to gain membership by joining the Charter. In particular, vice-chancellors or principals must indicate that their institution will take action to address the areas recognized in six key principles related to the representation and career progression of female academics in STEMM, such as that in order "to address gender inequalities requires commitment and action from everyone, at all levels of the organisation", and that "to tackle the unequal representation of women in science requires changing cultures and attitudes across the organisation.[2]

After gaining Athena SWAN Charter membership, universities can apply for Athena SWAN Charter accreditation through a bi-annual application process that takes place in April and November. Award panels make accreditation decisions during a 6-hour assessment panel meeting, and review up to five applications in each meeting. Panel members are individuals who work in the university sector (faculty and administration), as well as individuals from the industry or professional societies, and need to register in advance and complete a 1-hour online panellist training. There are around 1500 registered potential panellists, and around 225 spaces per panel round.

There are three possible levels of accreditation, from Bronze being the lowest level of commitment towards gender equality to Silver, and ultimately Gold accreditation. In this paper we focus on Bronze accreditation, which is the level of accreditation that universities apply for when applying for the first time. Compared to Silver and Gold accreditation, which require that the university shows evidence of successful policies and interventions towards the promotion of gender equality, success in getting Bronze accreditation does not require the university to have implemented any specific policy, but rather that the university elaborates an assessment of gender equality in the institution, alongside a four-year plan building on this assessment. There is also a requirement that the university develops an appropriate organisational structure, which may include a self-assessment team, to carry proposed actions

[2]The full list of charters principles can be found at https://www.ecu.ac.uk/equality-charters/athena-swan/about-athena-swan/history-of-athena-swan/. In May 2015 these principles were expanded to other disciplines: https://www.ecu.ac.uk/equality-charters/athena-swan/about-athena-swan/)

forward. Once the accreditation status is awarded, it is valid for a period of three years. Renewal of Athena SWAN accredited status is conditional on the university having made sufficient progress towards addressing gender equality since the previous application was made.

3 Data

The analysis is based on two sources of data. We first construct a data set containing information at the university level with the dates of Athena SWAN Charter membership, and if applicable, the date of first Bronze accreditation obtained (See Appendix B.1 for a detailed explanation of how this data set is constructed). We link the university-level information about Athena SWAN membership and accreditation status to the 2009-2012 UK HESA data set (See Appendix B.2 for a description of HESA data).

Our main sample is restricted to full-time faculty members with permanent contracts in STEMM disciplines engaged in teaching and research at universities that had signed the Athena SWAN Charter between 2005 and before 2015 (the year other disciplines were added to the charter). We are thus restricting the analysis to universities that have self-selected into the program. HESA only records information about professorial ranking after 2009, so we further restrict the sample to the years 2009-2016. Our final sample consists of 177,465 observation of 35,035 male faculty and 76,230 observations of 16,910 female faculty in 91 universities over a period of 8 years. During this period the number of universities with Athena SWAN Charter accreditation increased monotonically, from 23 in 2009 to all but eight universities in our sample.

3.1 Methodology

We estimate fixed effect models separately for men and women as follows:

$$Y_{ijt} = \alpha + \lambda D_{jt} + X_{ijt}\gamma + \eta_j + \delta_t + \gamma_j t + \epsilon_{ijt} \tag{1}$$

where Y_{iji} is the real log salary (using 2016 as the base year) for individual i in university j and year t. Our key regressor D_{jt} is a dummy variable that takes value 1 if the individual works in a university j that holds Athena Swan accreditation in year t, and 0 otherwise. X_{ijt} is a vector of socio-demographic characteristics that are known to be correlated with wages.[3] We also include university dummies η_j and a time trend δ_t. The university fixed-effect addresses unobserved and time-invariant university-specific characteristics potentially correlated with wages and not necessarily related to Athena SWAN accreditation, such as the fact that higher ranked universities pay higher salaries. The time trend accounts for aggregate level shocks potentially impacting wages in academia, as could have been the case with the 2008–2009 downturn. University-specific time trends ($\gamma_j t$) capture a variety of unobserved time-varying university-level traits that might remain unaccounted for. Whereas professor wages are individually negotiated, a sector-wide collective bargaining process between the unions and universities determines the pay of non-professorial staff (see Appendix C). We thus estimate equation (1) separately for professors and non-professors.

We employ a diff-in-diff approach where and look at the within-individual changes in wages of female faculty in STEMM before and after Athena SWAN accreditation status. Because the evolution of wages may be determined by other factors unrelated to Athena SWAN accreditation, we compare female faculty (our treatment group) wages to the wages of male faculty (our control group) in STEMM.[4]

4 Results

4.1 Main Findings

Panel A in Table 6 shows the regression coefficient on the Athena SWAN accreditation dummy D_{jt} for men and women in our sample. Athena SWAN accreditation seems to bring about

[3] These are age, age squared, ethnicity, disability, highest qualification held, UK citizen, senior management position held and years at current university (see online Appendix Table B2.1 for summary statistics).

[4] We also estimate a pooled OLS regression with a female dummy and Athena SWAN accreditation interaction. The method and results are reported in Appendix D

lower real wages for professorial staff, and higher real wages for non-professorial staff (Columns 1 and 3). However, changes in wages after Athena SWAN accreditation can be confounded by other unobservable trends common to female and male wages. To net out the effect of Athena SWAN we compare the effect on female wages relative to men. We find that women are better off in terms on wages relative to men after Athena SWAN accreditation. Results from Columns (5) and (6) suggest that women's wages are relatively higher than men's after Athena SWAN accreditation. Whereas the wages of professors decline after Athena SWAN accreditation, they do so less for female wages. Similarly, whereas the wages of non-professors increased after Athena SWAN accreditation, they did so more for women's. Overall, Athena SWAN accreditation closes the gap between female and male faculty by around £480 for non-professor and £800 for professors in favour of women.[5]

In order to further investigate the channels behind gender differences in pay after Athena SWAN accreditation we exploit the panel nature of the data and look at whether there are any differences in employment and promotion probabilities among men and women in our sample. Panel B in Table 6 shows the results of estimating Equation (1) when the dependent variable is a dummy variable that takes value 1 if an individual i in university z moves to university j in year t. We find that the probability of moving to an Athena SWAN accredited university increases for faculty at the professorial level, both men and women. However the differences in the coefficients are not statistically significant. There does not seem to be any movement into Athena SWAN accredited universities for junior faculty. These results are consistent with the lack of increase in female representation after Athena SWAN accreditation found in gender representation estimate in Table 7 and in literature (see Gregory-Smith, 2018).

Panel C in Table 6 shows the results of estimating Equation (1) where the dependent variable is a dummy variable that takes value 1 if individual i is promoted from non-professor to professor in year t and university j. Results show that junior male faculty have a higher

[5]The wages of men professors goes down by 2.3 per cent from £82,158 to £80,268. The wages of women professors goes down by 1.40 per cent from £77,733 to £76,645. The wages of men non-professors goes up by 0.72 per cent from £53,432 to £53,817. The wages of women non-professors goes up by 1.70 from £50,940 to £51,806.

probability of being promoted to professor after Athena SWAN accreditation. The probability of promotion increases by 0.4 percentage points. This is a 23 percent increase over the average promotion probability of 1.7 percent. We do not observe similar increases in the probability of promotion for female faculty. Having more male professors at the bottom of the pay scale resulting from junior male faculty being promoted to professors in Athena SWAN accredited universities may explain why the wages of female professors did not decrease as much as those of men in universities with Athena SWAN accreditation.

4.2 Identification Concerns

Parallel Trends Assumption

The validity of our identification strategy depends on the assumption that the relative trends in women's wages with respect to men's in STEMM prior to Athena SWAN accreditation were the same in universities with and without Athena SWAN accreditation. The design of the accreditation process makes it unlikely that anticipation effects took place, whereby universities who expected to get accreditation raised wages of their female faculty before accreditation. Firstly, as described in Section 2, the initial application to Bronze accreditation does not require the implementation of any action to address gender equality. Secondly, the focus of the Athena SWAN Charter is on career progression and representation and not necessarily on pay. We formally test the parallel trends assumption by estimating equation 2, with full set of time dummies going from four years before and four years after initial Athena SWAN accreditation. In particular:

$$Y_{ijt} = \alpha + \sum_{t=4}^{-4} \lambda_t D_{jt} + X_{ijt}\gamma + \eta_j + \delta_t + \gamma_j t + \epsilon_{ijt} \tag{2}$$

where D_{jt} is a vector of time dummies four years before and four years after Athena SWAN accreditation. Y_{ijt} is the real log salary (using 2016 as the base year) for individual i in university j and year t. We also control the specification for socio-demographic characteristics(X_{it}

), university fixed effects (η_j), time trends (δ_t) and university-specific time trends ($\gamma_j t$). Note that, since universities are accredited at different points in time, we standardised the years before and after accreditation. For example D_{0j} corresponds to 2012 for some universities $j$while, 2010 for another. In the absence of pre-existing trends, we should expect to see no difference in pay inequality over the years prior accreditation.

Table 8 shows the results of our main specification using a fixed effect estimate for men and women professors and non-professors. These results are also graphically presented by Figure 2. Whereas prior to Athena SWAN accreditation the differences between men and women's wages were statistically significant, after Athena SWAN accreditation they are no longer so, indicating that men and women's wages converge after Athena SWAN accreditation.

Test for alternative Explanations

Another concern is that some other factor, for example, a change in university-wide policy unrelated to Athena SWAN, deferentially impacted the wages of men and women during the same time as Athena SWAN accreditation. Such policies would satisfy the parallel trend assumption, but the main results could potentially be explained by university-wide policies changes rather than Athena SWAN accreditation. We explore this issue by estimating equation 1 using a sample of academics in non-STEMM departments.[6] In the absence of other university-wide policy changes, we would expect the impact of Athena SWAN accreditation on non-STEMM departments to be statistically insignificant.

Table 9 presents the results for Non-STEMM departments. There are decreases in the wages of professorial faculty, and increases in the wages of non-professorial faculty in non-STEMM disciplines after Athena SWAN accreditation. However, unlike the results in Table 6, the differences between men and women wages are not statistically significant. We also do not find a differential effect on promotion probabilities after Athena SWAN accreditation.

[6]The sample of non-STEMM academics are restricted to full-time faculty members with permanent contracts engaged in teaching and research at universities that had signed the Athena SWAN Charter between 2005 and before 2015. Refer tables 3, 4 and 5 for summary statistics

Female professors and male non-professors experience a higher probability of moving to an Athena SWAN accredited university, however, differences are not statistically significant for professors but weakly significant for non-professors with more probability of employment for male non-professors. We find no effect of Athena SWAN accreditation on the promotion probabilities of either men or women in non-STEMM disciplines. These results seem to suggest that our main findings are not the result from other policy changes favouring female faculty.

5 Discussion

We find that the gender wage gap closes after Athena SWAN accreditation. Female faculty at the non-professorial level are not more likely to being promoted to professor after accreditation, neither are they more likely to move to an Athena SWAN accredited university. Taken together these results suggest that the higher wage growth experienced by female non-professorial faculty after Athena SWAN accreditation is likely to come from pay rises within a particular rank. Unfortunately, HESA data do not contain information about the academic rank below professorial level.

We cannot rule out the presence of positive spillover effects for men and non-STEMM faculty members as a result from university-wide practices implemented after Athena SWAN accreditation. However, there are also concerns that women bare the burden from implementing the organizational changes necessary to meet Athena SWAN accreditation standards. Given the negative long-run career impact identified in the literature from female faculty taking on too many administrative responsibilities (Babcock et al., 2017), closer attention should be paid to how the costs to a particular group play against the positive externalities to the wider academic community.

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Table 1: Summary Statistics of Main Variables STEMM by Gender for Professors

	Men					Women				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Observations	Mean	SD	Min	Max	Observations	Mean	SD	Min	Max
Main Dependent Variables										
Salary (£ 2016 prices)	55,524	£82,158	19123	£23,207	£323828	11,424	£77,733	16703	£10,479	£245,955
Inflow of Academics	55,524	1.1%	0.102	0	1	11,424	1.51%	0.122	0	1
Independent Variables										
Disability	55,524	2.2%	0.148	0	1	11,424	0.0295	0.169	0	1
Age	55,524	52.48	6.972	30	75	11,424	51.87	6.505	30	72
Years in Current Tenure	55,524	15.25	9.366	0	48	11,424	13.81	8.455	0	46
British Nationals	55,524	82.9%	0.376	0	1	11,424	81.70%	0.387	0	1
Ethnicity										
White	55,524	90.8%	0.288	0	1	11,424	92.70%	0.26	0	1
Black	55,524	0.4%	0.062	0	1	11,424	0.42%	0.0647	0	1
Asian	55,524	6.7%	0.25	0	1	11,424	4.90%	0.216	0	1
Other	55,524	2.1%	0.142	0	1	11,424	1.99%	0.14	0	1
Highest Qualification held										
Doctorate	55,524	93.2%	0.251	0	1	11,424	91.10%	0.285	0	1
Postgraduate Qualification or Equivalent	55,524	4.2%	0.201	0	1	11,424	6.62%	0.249	0	1
First Degree or Equivalent	55,524	2.0%	0.14	0	1	11,424	1.87%	0.136	0	1
Below first degree	55,524	0.1%	0.0377	0	1	11,424	0.25%	0.0503	0	1
Other qualification	55,524	0.4%	0.0638	0	1	11,424	0.18%	0.0418	0	1
Senior Management Positions	55,524	5.0%	0.218	0	1	11,424	4.44%	0.206	0	1

Notes: Source HESA dataset. Sample consists of full time permeant academics employed under teaching and research contracts over a period of 8 years (2009-2016) in 91 universities.

Table 2: Summary Statistics of Main Dependent Variables STEMM by Gender for Non-Professors

	Men					Women				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Observations	Mean	SD	Min	Max	Observations	Mean	SD	Min	Max
Main Dependent Variables										
Salary (£ 2016 prices)	121,939	£53,432	12189	£11,843	£182,006	64,806	£50,940	10750	£13,945	£170,621
Inflow of Academics	121,939	1.4%	0.118	0	1	64,806	1.57	0.124	0	1
Independent Variables										
Disability	121,939	2.8%	0.165	0	1	64,806	4.0%	0.195	0	1
Age	121,939	45.38	8.691	20	75	64,806	45.06	8.465	22	74
Years in Current Tenure	121,939	11.06	8.417	0	50	64,806	9.375	7.011	0	48
British Nationals	121,939	74.5%	0.436	0	1	64,806	77.7%	0.416	0	1
Ethnicity										
White	121,939	85.9%	0.348	0	1	64,806	89.8%	0.303	0	1
Black	121,939	1.5%	0.12	0	1	64,806	1.3%	0.114	0	1
Asian	121,939	9.5%	0.293	0	1	64,806	6.5%	0.247	0	1
Other	121,939	3.1%	0.174	0	1	64,806	2.4%	0.152	0	1
Highest Qualification held										
Doctoral Education	121,939	77.4%	0.418	0	1	64,806	59.4%	0.491	0	1
Postgraduate Qualification or Equivalent	121,939	16.0%	0.366	0	1	64,806	31.0%	0.463	0	1
First Degree or Equivalent	121,939	5.8%	0.234	0	1	64,806	8.7%	0.282	0	1
Below first degree	121,939	0.5%	0.0706	0	1	64,806	0.5%	0.0713	0	1
Other qualification	121,939	0.3%	0.057	0	1	64,806	0.3%	0.0588	0	1
Senior Management Positions	121,939	0.8%	0.0896	0	1	64,806	0.8%	0.089	0	1

Notes: Source HESA dataset. Sample consists of full time permeant academics employed under teaching and research contracts over a period of 8 years (2009-2016) in 91 universities.

Table 3: Summary Statistics of Main Dependent Variables Non-STEMM by Gender for Professors

	Men					Women				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Observations	Mean	SD	Min	Max	Observations	Mean	SD	Min	Max
Salary (£ 2016 prices)	28,167	£79,836	19906	£12,906	£383,600	10,300	£74,688	14477	£26,073	£241,262
Inflow of Academics	28,167	1.8%	0.132	0	1	10,300	2.3%	0.150	0	1
Independent Variables										
Disability	28,167	2.9%	0.168	0	1	10,300	4.0%	0.196	0	1
Age	28,167	53.01	7.712	27	75	10,300	52.31	7.13	27	75
Years in Current Tenure	28,167	13.51	10.12	0	50	10,300	12.22	8.806	0	50
British Nationals	28,167	80.5%	0.396	0	1	10,300	77.0%	0.421	0	1
Ethnicity										
White	28,167	93.1%	0.253	0	1	10,300	93.4%	0.248	0	1
Black	28,167	0.8%	0.0886	0	1	10,300	0.4%	0.0637	0	1
Asian	28,167	3.9%	0.193	0	1	10,300	3.5%	0.185	0	1
Other	28,167	2.2%	0.147	0	1	10,300	2.6%	0.16	0	1
Highest Qualification held										
Doctoral Education	28,167	85.6%	0.351	0	1	10,300	85.7%	0.35	0	1
Postgraduate Qualification or Equivalent	28,167	10.6%	0.307	0	1	10,300	10.3%	0.305	0	1
First Degree or Equivalent	28,167	3.4%	0.182	0	1	10,300	3.2%	0.177	0	1
Below first degree	28,167	0.2%	0.0408	0	1	10,300	0.2%	0.0492	0	1
Other qualification	28,167	0.3%	0.0519	0	1	10,300	0.5%	0.0702	0	1
Senior Management Positions	28,167	5.8%	0.235	0	1	10,300	5.2%	0.222	0	1

Notes: Source HESA dataset. Sample consists of full time permeant academics employed under teaching and research contracts over a period of 8 years (2009-2016) in 91 universities.

Table 4: Summary Statistics of Main Dependent Variables Non-STEMM by Gender for Non-Professors

	Men					Women				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Observations	Mean	SD	Min	Max	Observations	Mean	SD	Min	Max
Main Dependent Variables										
Salary (£ 2016 prices)	85,182	£50,433	9498	£14,844	£265,511	68,161	£48,847	8417	£19,220	£199,969
Inflow of Academics	85,182	1.8%	0.132	0	1	68,161	2.0%	0.124	0	1
Promotions	113,349	1.5%	0.122	0	1	78,461	1.3%	0.111	0	1
Independent Variables										
Disability	85,182	3.5%	0.184	0	1	68,161	4.1%	0.199	0	1
Age	85,182	45.18	9.421	16	71	68,161	44.09	9.043	21	72
Years in Current Tenure	85,182	9.621	8.019	0	47	68,161	8.424	6.788	0	44
British Nationals	85,182	74.4%	0.437	0	1	68,161	70.7%	0.455	0	1
Ethnicity										
White	85,182	88.9%	0.314	0	1	68,161	88.4%	0.32	0	1
Black	85,182	1.9%	0.138	0	1	68,161	1.3%	0.115	0	1
Asian	85,182	6.2%	0.242	0	1	68,161	6.8%	0.252	0	1
Other	85,182	2.9%	0.168	0	1	68,161	3.4%	0.181	0	1
Highest Qualification held										
Doctorate	85,182	62.0%	0.485	0	1	68,161	58.4%	0.493	0	1
Postgraduate Qualification or Equivalent	85,182	29.7%	0.457	0	1	68,161	33.0%	0.47	0	1
First Degree or Equivalent	85,182	7.5%	0.263	0	1	68,161	7.7%	0.267	0	1
Below first degree	85,182	0.4%	0.0659	0	1	68,161	0.5%	0.0711	0	1
Other qualification	85,182	0.3%	0.056	0	1	68,161	0.4%	0.0621	0	1
Senior Management Positions	85,182	1.2%	0.107	0	1	68,161	0.9%	0.0923	0	1

Notes: Source HESA dataset. Sample consists of full time permeant academics employed under teaching and research contracts over a period of 8 years (2009-2016) in 91 universities.

Table 5: Summary Statistics of Promotion Rate for STEMM and Non-STEMM by Gender

	Men					Women				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Observations	Mean	SD	Min	Max	Observations	Mean	SD	Min	Max
Main Dependent Variables										
Promotion Rate for STEM	177,463	1.8%	0.133	0	1	76,230	1.44	0.119	0	1
Promotions Rate for Non-STEM	113,349	1.5%	0.122	0	1	78,461	1.3%	0.111	0	1

Notes: Source HESA dataset. Sample consists of full time permeant academics employed under teaching and research contracts over a period of 8 years (2009-2016) in 91 universities.

Table 6: Pay Promotion and Moves

	(1)	(2)	(3)	(4)	(5)	(6)
	Men		Women		Women-Men	
	Professor	Non-Professors	Professor	Non-Professors	Professor	Non-Professors
Panel A						
Log Salary	-2.28***	0.72***	-1.40***	1.70***	0.88	0.97
	(0.00187)	(0.000789)	(0.0037)	(0.001)	P<0.05	P<0.01
R- Squared	0.129	0.21	0.206	0.201		
Mean	£82,158	£53,432	£77,733	£50,940		
Panel B						
P(Move)	1.32***	0.082	1.70**	0.28	0.38	0.20
	(0.00345)	(0.00218)	(0.0086)	(0.0028)	[0.65]	[0.58]]
R- Squared	0.098	0.058	0.148	0.069		
Mean	1.06%	1.40%	1.51%	1.57%		
Panel C						
P(Promotion)		0.36**		0.09		-0.27
		(0.00177)		(0.00203)		[0.37]
R- Squared		0.006		0.008		
Mean		1.80%		1.44%		
Observations	55,520	121,940	11,425	64,810		
Individuals	11,200	26,910	15,325	15,325		

Notes: Full-time permanent academics on teaching and research contracts from 2009-2016 in 91 universities. Athena SWAN dummy coefficients from Equation (1). All coefficients are multiplied by 100. Log salary is in 2016 prices. Standard errors in parentheses () clustered at the individual level. [] denotes p-value. ***p¡0.1, **0¡0.05 * p ¡.01.

Table 7: Female Representation and Athena SWAN Accreditation

	STEMM		Non-STEMM	
	Professor	Below Professor Level	Professor	Below Professor Level
Athena Accreditation (D)	0.123	0.244	0.951	-0.853***
	(0.00473)	(0.00287)	(0.00677)	(0.00324)
Observations	66,948	186,745	38,467	153,343
Individuals oindindividuals	13,790	42,205	8,720	35,340
Universities universities	91	91	91	91
Years	8	8	8	8

Notes: Sample: Full time permanent academics on teaching and research contracts observed over a period of 8 years from 2009-2016. Standard errors in parentheses clustered by individual. Linear probability model estimates are shown in all columns, divided between Science, Technology, Engineering, Mathematics, and Medicine (STEMM) disciplines and other disciplines (Non-STEMM) and further by professors and non-professors. The main dependent variable in all columns is female dummy, variable taking value 1 if the individual is a female. Variable of interest is Athena SWAN accreditation variable, a dummy variable taking value 1 once the institution receives an accreditation. All estimates are controlled for individual level characteristics (age, age square, ethnicity, education, years in current tenure, senior post holder, disability, nationality), time trends, university fixed effects and time and university interactions. The coefficient indicate the average probability of the individual being a female in an Athena Accredited university. For example for STEMM junior staff, we can interpret the coefficient as 0.7 percentage point increase in the female representation in Athena Accredited University. ***p¡0.1, **0¡0.05 * p ¡.01.

Table 8: Pay and Athena SWAN Accreditation (STEMM): Parallel Trends Assumption

	Men		Women		Women-Men	
	(1) Professor	(2) Non-Professors	(3) Professor	(4) Non-Professors	(5) Professor	(6) Non-Professors
Year (t-4)	3.43***	-2.41***	2.16***	-3.24***	-1.27	-0.83
	(0.00363)	(0.000823)	(0.00617)	(0.000975)	P<0.1	P<0.01
Year (t-3)	2.24***	-3.96***	0.70	-4.84***	-1.54	-0.88
	(0.00362)	(0.000962)	(0.00623)	(0.00116)	P<0.05	P<0.01
Year (t-2)	0.75**	-5.13***	-0.80	-6.06***	-1.56	-0.93
	(0.00323)	(0.00109)	(0.00602)	(0.00135)	P<0.05	P<0.01
Year (t-1)	0.06	-5.54***	-1.00*	-6.26***	-1.06	-0.72
	(0.00294)	(0.00117)	(0.00574)	(0.00158)	P<0.1	P<0.01
Year (t)	0.40	-4.55***	-0.47	-5.23***	-0.87	-0.68
	(0.00268)	(0.00132)	(0.00558)	(0.00182)	P<0.1	P<0.01
Year (t+1)	-0.66**	-3.63***	-0.57	-4.17***	0.10	-0.54
	(0.00294)	(0.00137)	(0.00603)	(0.00202)	[0.89]	P<0.01
Year (t+2)	-0.51***	-2.91***	-0.3	-3.16***	0.21	-0.25
	(0.00194)	(0.00130)	(0.00446)	(0.00195)	[0.66]	[0.27]
Year (t+3)	0.54***	-1.01***	0.98**	-1.09***	0.44	-0.08
	(0.00159)	(0.00120)	(0.00384)	(0.00189)	[0.26]	[0.71]
Year (t+4)	0.08	-1.00***	0.20	-1.02***	0.11	-0.03
	(0.00112)	(0.000948)	(0.00282)	(0.00151)	[0.68]	[0.88]
R- Squared	0.129	0.243	0.209	0.255		
Observations	54,268	114,168	11,126	59,683		
Individuals	10,945	25,160	2,525	14,130		

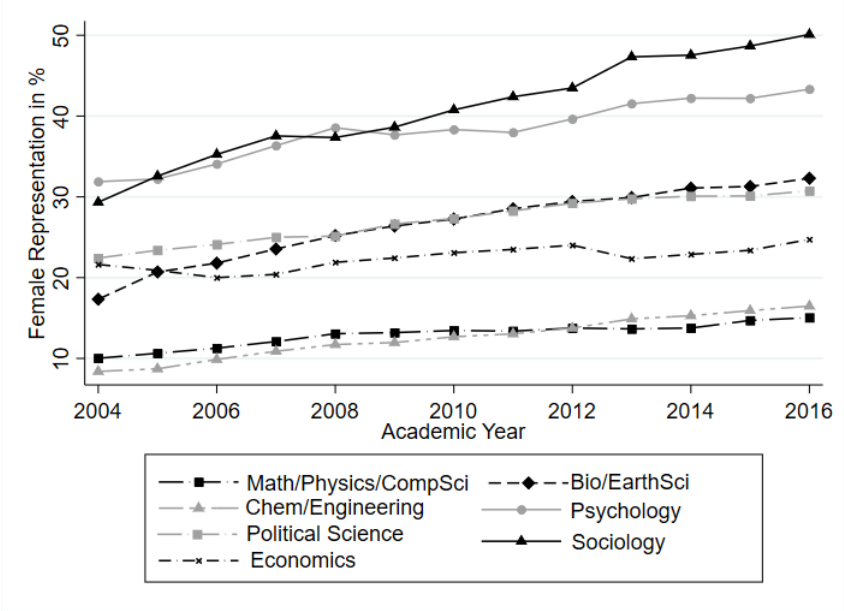
Notes: Sample: Full time permanent academics on teaching and research contracts observed over a period of 8 years from 2009-2016 in 91 universities. Standard errors in parentheses () clustered by individual level. [] denoted the p-value. All coefficients are multiplied by 100. Fixed effect regression estimates are used in all estimates. Dependent variable for gender pay-gap specification is log salaries in 2016 prices. Last two column shows the difference between male and female coefficients among professors and non-professors. ***p¡0.1, **0¡0.05 * p ¡.01.

Table 9: Pay Promotion and Movement In/Into Athena SWAN Accredited University (Non-STEMM)

	(1)	(2)	(3)	(4)	(5)	(6)
	Men		Women		Women-Men	
	Professor	Non-Professors	Professor	Non-Professors	Professor	Non-Professors
Panel A						
Log Salaries	-1.06***	1.16***	-1.46***	1.21***	-0.40	0.05
	(0.00227)	(0.000885)	(0.00377)	(0.000965)	[0.36]	[0.67]
R- Squared	0.171	0.265	0.246	0.283		
Mean	£79,836	£50,433	£74,688	£48,847		
Panel B						
P(Move)	0.82	0.48*	1.80*	-0.04	0.98	-0.52
	(0.00565)	(0.00254)	(0.00946)	(0.00291)	[0.37]	P<0.1
R- Squared	0.099	0.068	0.138	0.083		
Mean	1.78%	1.76%	2.29%	1.98%		
Panel C						
P(Promotion)		-0.10		0.04	0.14	
		(0.00184)		(0.00197)	[0.61]	
R- Squared		0.009		0.012		
Mean		1.50%		1.25%		
Observations	28,170	85,180	10,300	68,160		
No. of Individuals	6,245	19,470	2,490	15,910		

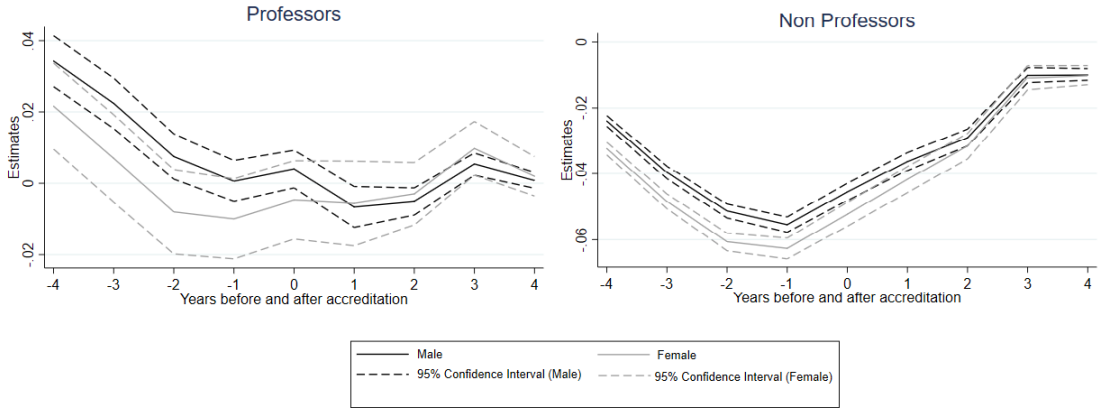
Notes: Sample: Full time permanent academics on teaching and research contracts observed over a period of 8 years from 2009-2016 in 91 universities. Standard errors in parentheses () clustered by individual level. [] denotes p-value. All coefficients are multiplied by 100. Last two columns show the difference between female and male coefficients among professors and non-professors, respectively. ***p¡0.1, **0¡0.05 * p ¡.01.

Figure 1: Representation of women across disciplines over time



Source: 2004-2016 HESA dataset (see Appendix A).

Figure 2: Representation of women across disciplines over time



Source: 2004-2016 HESA dataset (see Appendix A).

Appendix A Data Description for Figure 1

We use an administrative data set that collected and managed by the Higher Education and Statistics Agency (HESA), which records socio-economic information on the entire population of individuals in the higher education sector. The purpose of the data collection is to meet the requirements of the 1992 Further and Higher Education Act and the White Paper 'Higher Education: A new framework'. HESA collects annual data from all the Higher Education Institutes, which includes all publicly and privately funded institutions, and also other organisations that offer Higher Education courses, including those that are not publicly funded. The agency holds all aspects of information of these institutes such as students, staff and graduates, finance and estates, academic department and course and public engagement and commercial enterprise.[7]

We use only the information of HESA data that includes all the academic professionals.

Our main sample consists of full-time academics in permanent contracts in 24 Russell group universities in selected departments. Russell Group is an association of 24 self-selected public research universities regarded as the most prestigious research universities in the UK.[8] These are: University of Birmingham, University of Bristol, University of Cambridge, Cardiff University, Durham University, University of Edinburgh, University of Exeter, University of Glasgow, Imperial College London, King's College London, University of Leeds, University of Liverpool, London School of Economics, University of Manchester, Newcastle University, University of Nottingham, University of Oxford, Queen Mary University of London, Queen's University Belfast, University of Sheffield, University of Southampton, University College London, University of Warwick and University of York.

We select departments that are comparable to the US evidence presented in Lundberg and Stearns, 2019. The selected hard Science departments are, 'chemistry', 'civil engineering', 'electrical, electronics and computer science', (aggregated as 'Chem/Engineering'), 'bio-

[7]Refer: https://www.hesa.ac.uk/collection/c17025/introduction

[8]Refer: https://russellgroup.ac.uk/about/our-universities/ for further informatino on the Russell Group

science, 'earth, marine and environmental sciences' (identifies as 'Bio/EarthSci'), 'Mathematics', 'IT, Systems sciences computer software engineering' and 'physics' (aggregated as 'maths/physics/CompSci') and 'psycology and behavioural science'. The selected social science departments are 'economics', 'political science' and 'sociology'.

HESA data do not indicate the department or the school the individuals belong to, hence we use the cost centres as a proxy to departments. Cost centres are defined groups used by university finance departments to allocate budgets. All hard sciences mentioned above have their own cost centre in HESA, therefore we assume that individuals belonging to these cost centre must be from their corresponding department. Social science departments are grouped under a common cost centre 'Social Studies' until 2012, and as separate cost centres after that. In order to identify the social science department of an individual between 2004-2012 we use information about the main academic discipline in addition to the cost centre. Main academic discipline is a variable in HESA that captures the main area of study, and we use it alongside cost centre information to assign individuals with a department. For example an individual is assigned to a sociology department if he or she is employed under 'Social Studies' cost centre with a main academic discipline as "sociology". Table A.1 shows the numbers underlying Figure 1. We see a jump in sociology and a drop in economics after re-classification of cost centres (year 2013 onwards). No such jump/drop is observed among hard science departments, suggesting that the jump in social sciences department is likely to be due to our department imputation method.

Table A1: Average Female Representation across Discipline by professor and non-professor since 2004

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Year	Math/Physics/Comp Sci	Bio/Earth Sci	Chem/ Engineering	Psychology	Political Science	Economics	Sociology
Panel A: Non Professors							
2009	15.67%	31.25%	14.29%	42.34%	30.95%	28.37%	41.51%
2010	15.87%	31.83%	14.98%	42.72%	30.99%	29.03%	44.23%
2011	15.77%	33.40%	15.13%	41.49%	32.06%	28.64%	45.27%
2012	16.06%	34.39%	15.99%	44.35%	33.58%	29.79%	46.53%
2013	16.03%	34.89%	17.38%	46.65%	34.97%	25.95%	49.49%
2014	15.81%	35.98%	17.64%	47.89%	33.80%	27.27%	50.98%
2015	16.79%	36.34%	18.16%	46.60%	33.24%	27.64%	52.24%
2016	16.96%	36.97%	18.44%	47.33%	33.29%	29.63%	52.65%
Average	16.12%	34.38%	16.50%	44.92%	32.86%	28.29%	47.86%
Growth	1.29%	5.71%	4.15%	4.99%	2.34%	1.26%	11.14%
Panel B: Non Professors							
2009	7.14%	11.55%	5.57%	22.11%	15.92%	9.85%	33.03%
2010	7.18%	12.11%	6.09%	23.81%	17.01%	10.22%	33.96%
2011	7.18%	11.72%	6.74%	26.32%	17.57%	12.56%	36.63%
2012	8.38%	13.91%	7.24%	25.71%	17.95%	13.10%	37.11%
2013	8.19%	14.92%	7.78%	26.09%	16.67%	15.14%	41.74%
2014	9.04%	16.35%	8.58%	25.46%	20.63%	14.03%	40.14%
2015	9.84%	16.30%	9.10%	27.94%	21.37%	14.29%	40.71%
2016	10.62%	18.04%	10.34%	29.13%	23.55%	14.44%	43.28%
Average	8.45%	14.36%	7.68%	25.82%	18.83%	12.95%	38.33%
Growth	3.47%	6.49%	4.76%	7.02%	7.63%	4.59%	10.26%

Source: HESA dataset. Sample: All full time and permanent academics between 2009-2016 in 24 Russell group Universities. Russell group universities are classified as top research-intensive universities in the UK.

Table A2: Average Female Representation across Discipline since 2004

Year	(1) Math/Physics/Comp Sci	(2) Bio/Earth Sci	(3) Chem/ Engineering	(4) Psychology	(5) Political Science	(6) Economics	(7) Sociology
2004	10.02%	17.33%	8.39%	31.88%	22.42%	21.63%	29.33%
2005	10.64%	20.70%	8.71%	32.21%	23.39%	20.91%	32.57%
2006	11.27%	21.80%	9.88%	34.07%	24.11%	20.00%	35.25%
2007	12.09%	23.55%	10.89%	36.34%	25.00%	20.40%	37.54%
2008	13.06%	25.20%	11.72%	38.56%	25.14%	21.90%	37.34%
2009	13.20%	26.39%	11.97%	37.67%	26.64%	22.43%	38.63%
2010	13.46%	27.26%	12.68%	38.33%	27.32%	23.09%	40.76%
2011	13.38%	28.53%	13.04%	37.97%	28.27%	23.49%	42.38%
2012	13.76%	29.43%	13.75%	39.64%	29.21%	24.02%	43.48%
2013	13.66%	29.92%	14.89%	41.54%	29.77%	22.34%	47.33%
2014	13.76%	31.09%	15.29%	42.22%	30.08%	22.88%	47.54%
2015	14.70%	31.29%	15.92%	42.20%	30.11%	23.39%	48.67%
2016	15.05%	32.30%	16.48%	43.33%	30.75%	24.73%	50.10%
Average	12.93%	26.52%	12.59%	38.15%	27.09%	22.40%	40.84%
Growth	5.03%	14.97%	8.09%	11.45%	8.32%	3.10%	20.77%

Source: HESA dataset. Sample: All full time and permanent academics between 2009-2016 in 24 Russell group Universities. Russell group universities are classified as top research-intensive universities in the UK.

Appendix B Data

B.1 Athena SWAN Data Construction

ECU publishes the latest list of charter members on their website.[9] At the time of writing this paper there were 112 higher education institutions who had signed up to the charter. Below we outline the stages of how we constructed the Athena SWAN data set.

From 112 universities, we first obtain the date when the university signed the charter as well as the date of first accreditation by going through the awards booklets. Booklets are published from 2011 onwards for every round of accreditation, and thus this information is limited to universities that got accredited for the first time or renewed their accreditation during this period. These booklets contain the list of universities that received Athena SWAN accreditation and when these universities first signed the charter. The booklets also feature additional information about the accreditation process such as content submitted by winners and good practice examples highlighted by accreditation panels.[10]

For 95 universities of 112 we found the year they signed the charter and the year they first got accredited using the booklets, for those universities who got accredited for the first time or renewed the accreditation between 2011-2017. In the case of first accreditation, for example, university of West Scotland received their first accreditation in 2015 and we found the year they signed the charter (2011) using the November 2015 booklet. In the case of renewal, we also find the information about the year they signed the charter and year they first got accredited on the award booklet corresponding to their respective renewal round. For example, University of Southampton renewed their accreditation in 2012, and we found the year they signed the charter (2005) and the year they got first accredited (2006) from the November 2012 booklet.

There were 17 universities for which we could not find the year they signed the charter using the booklets. These universities either never got accredited, or got accredited before

[9] https://www.ecu.ac.uk/equality-charters/athena-swan/athena-swan-members/

[10] The booklets can be found at the webpage: https://www.ecu.ac.uk/equality-charters/athena-swan/athena-swan-members/

2011 and never renewed. We contacted these universities directly and through email/call correspondence, and checked their websites directly. We obtained information of when they signed the charter for 10 universities (7 directly and 3 using online information). Making the total of 105 universities with confirmed signature year. These 10 universities signed the charter after 2011, therefore if any were to receive an accreditation, it would have been captured in the award booklets. Therefore, we can confirm that these 10 universities did not received an accreditation between 2011 and 2016.

7 universities did not respond to our correspondence, and we were unable to find the year they signed the charter. We eliminated them from the sample since we cannot establish the year of signature. These 7 universities make up only 6.3% of our sample of universities. This leaves us with 105 universities.

Of these 105 we have 10 universities that signed the charter in 2015 or later, which we excluded from our sample. That leaves us with 95 universities.

Of these 95, there were 4 universities that did not include non-STEMM department which are eliminated from the sample. This leaves us with 91 universities that have signed the charter. This leaves us with 91 universities. We further observe an additional 8 universities of the 91 universities that have signed and never received an accreditation in the period 2011-2017, or never renewed in the period 2011-2017. These 8 universities all signed the charter post 2010, and thus we can rule out that they got accredited before 2010. We can thus confirm that they never received an accreditation.

B.2 Construction of Main Variables in HESA Data Set

Table B.2.1 presents the constructions of the rest of the variables used in Equation (1). Promotion probability relies in the professor market. After 2012 HESA data did not record a professor marker, but instead the highest occupational level, with the following categories: senior management, head of school/ senior functional head, professors, function head, senior lecturer/reader, lecturer/senior lecturer/senior research fellow, lecturer/research fellow/teaching

Table B.1.1: Number of Universities Signed and Got Accredited over the Years

Year	(1) No. of Universities signed the charter each year	(2) Cumulative No. of Universities signed the charter	(3) No. of accreditations per year	(4) Cumulative No. of Accreditations
2005	20	20	0	0
2006	2	22	12	12
2007	4	26	1	13
2008	6	32	3	16
2009	9	41	7	23
2010	6	47	5	28
2011	15	62	1	29
2012	18	80	11	40
2013	5	85	16	56
2014	6	91	10	66
2015	N/A	N/A	11	77
2016	N/A	N/A	6	83
Total	91		83	

Notes: Source: Self constructed Athena SWAN dataset.

fellow and research assistant/teaching assistant that is related to academics. After 2012 we assume that an individual is a professor if the occupational category is professor or if they were identified as professors in the professor marker prior 2012. Comparisons of the proportion of professors over time suggest this variable is reliable.

Table B.2.1: Definitions of Key Variables

Name	Definition
Treatment Variables	
Athena Marker	Dummy variable taking value 1 if the institution has ever had an Athena SWAN accreditation and 0 otherwise.
Main Dependent Variables	
Female	Dummy variable. =1 if female.
Salary	Real log salary converted to year 2016 prices using the 2016 CPI using the nominal salary variable in HESA.[11]
Promotion	Dummy variable taking value 1 if promoted to a professor level and 0 otherwise.
Inflow	Dummy variable taking value 1 in year t for individual i if at year t the university of individual i was different to the university of individual i in year t-1.
Personal Characteristics	
Age	Age in number of years
Disability Flag	Dummy Variable. = 1 if the individual is disabled
Education	Categorical Variable recording the highest level of qualification. Classified into 6 categories.
UK Citizen	Dummy variable. =1 if UK citizen
Ethnicity	Categorical variable recording ethnic origins of the individual. Classified into White, Black, Asia and other
Employment Characteristics	
Years in current tenure	Continuous variable showing the number of years in the current tenure
Institution	Categorical variable for university
Professor Marker	Dummy Variable. =1 if professor.
Senior Management Indicator	A dummy variable =1 if senior management post holder
Mode of Employment	Categorical Variable taking values: 1 - full time, 2- Full-time, term-time only, 3- Part-time, 4-Part-time, term-time only
Terms of Employment	Categorical Variable taking values 1 for open-ended/permanent contracts and 2 for fixed-term contracts
Academic Employment Function	Categorical Variable taking values: 1- Teaching only, 2- Research only, 3 Teaching and Research

Notes: We use Terms of Employment, Mode of Employment and Academic Employment Function for our sample selection. Therefore we do not include them as controls in our specifications.

Appendix C UK Pay SPINE System

Individuals and universities negotiate the wages of professorial staff on a one-to-one basis. Pay for non-professorial staff is determined by a multi-employer bargaining process undertaken by the Joint Negotiating Committee for Higher Education Staff (JNCHES). This is a sector-wide collective bargaining agreement, identified as the framework agreement for the modernisation of pay structure. The framework agreement builds a common pay structure known as the pay spine system to fit a diverse range of institutions. The focus of the agreement is to introduce a pay structure that addresses equal pay for equal value, promote staff retention and rewards staff for their contribution to the national university pension scheme. The agreement is negotiated between the main university unions and the employers and became affective in August 2006. If a university agrees to the framework and does not comply, the trade unions may take industrial action. As of 2018, 147 universities have implemented this pay spine structure.[12] 3 out of the 91 universities in our sample have either opted out or have not agreed to the SPINE system in our sample of universities, and an additional 4 universities do not participate for all staff. The pay spine system is only applicable to posts below professorial level.

The proposed system identified as the pay spine system introduces 51 pay spine points. Each 51 spine point is matched to a salary amount with 3% difference between the proceeding spine point.[13] For example, spine point 1 is matched with a salary of £10,250 and spine point 2 is matched with a salary £10,558, making the different of 3% between the two (UCU, 2013). Every year the spine point salaries are updated depending on the general pay reward, which is typically negotiated every year between the trade unions (University and College Union, UNISON – the public service union, Unite the Union and GMB- Britain's General Union) and the Universities and Colleges Employer Association (UCEA). There is no set criteria for the

[12]Refer: https://www.ucu.org.uk/article/9611/List-of-institutions-included-in-the-ballot for a full list of universities.

[13]Refer: https://www.ucu.org.uk/he_singlepayspine, for full list of spine points and their respective salary since 2014/2015 academic year.

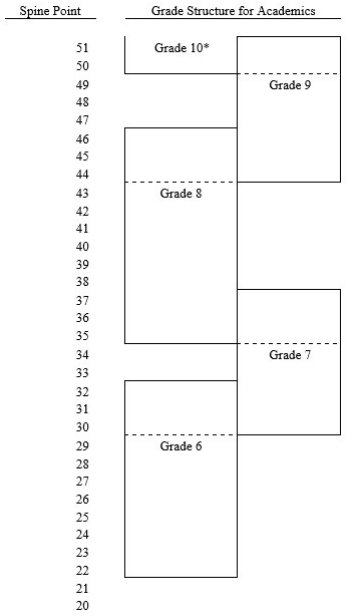
pay reward negotiation, and since 2009 the pay reward was below inflation, which was heavily criticised. [14] Over the past, couple of years the salaries in the pay spine points have increased by 1.6% in 2016/2017, 1.1% in 2017/2018, and 2% for 2018/2019 (still under negotiation).

Spine points are matched with university employment grade on a many-to-one basis. Figure C1 provides a recommended match between the university grade and pay spine system for academics by JNCHES in 2004. For example, according to the guidance, 'grade 6' refers to a post that involve in assisting teaching/research activity (UCU, (2013)). This corresponds to a salary scale of £19,068 (spine point 22) - £25,626 (spine point 32) under 2003/2004 spine point system. Every year the post holder moves up the spine point system until they reach the spine point 29 (a salary of £23,395)- this the maximum annual automatic increment. However, the same post holder can achieve a spine point 30-32 (identified as contribution point) in some instances, such as a performance related increments. These contribution increments criteria is subjective and is at the discretion of the pay evaluator. All grade consist of a maximum automatic increment threshold (depicted by the dash line) and the contribution (above the dash line and below the solid line) as shown in Figure C1. This proposed structure is a mere guidance and universities can deviate from this structure and implement their own as long as it is agreed with the union. However, the grade system varies across different universities. For example Royal Holloway University of London; consist of 10-tier grade system while Queen Mary University of London consists of only 7-tier grade system.[15] Given the heterogeneous nature of the grade system, it is difficult to compare grade system and pay across universities. Each university matches their idiosyncratic grade classification to university titles in a different way. For example, Assistant professor at Queen Mary University London starts at Grade 5 and associate professor is a grade 7. In Royal Holloway however, assistant professor starts at Grade 8 and asocial professor at grade 9.

[14] Refer: https://www.ucu.org.uk/media/9412/Pay–equality-matters—leaflet/pdf/ucu$_pay$ – $equality$ – $matters_leaflet_jun18.pdf for a criticism on pay reward.$

[15] Refer: https://intranet.royalholloway.ac.uk/staff/assets/docs/pdf/human-resources/rhul-single-pay-spine-01.08.2018.pdf for full classification of pay grade and spine point at Royal Holloway, University of London. And refer: http://hr.qmul.ac.uk/workqm/paygradingrewards/pay/scales/ for full classification of the pay grade at Queen Mary University of London.

Figure C1: Representation of women across disciplines over time



Source: for Higher Education Staff (JNCHES), 2003.*represent the minimum only. The dotted line represents the maximum pay spine point achieved based on annual automatic increment. The difference between the dotted line and the ceiling point for a particular grade is the contribution pay.

Appendix D Pooled OLS Regression

In this section we estimate our results using a pooled OLS regression (as opposed to Fixed Effect estimate separately for men and women) to examine the impact on pay, movement and promotion of females in Athena SWAN accredited universities as an alternative to our main methodology specification. In particular, we estimate equation 3.

$$Y_{ijt} = \alpha + \lambda_{D_{jt}} + \rho(D_{tj} \times F_i) + X_{ijt}\gamma + \eta_j + \delta_t + \gamma_j t + \epsilon_{ijt} \tag{3}$$

where $Y_{ijt}$is log real annual salaries (using 2016 as the base year) for an individual i in university j and year t. Our key regressor is $(D_{jt}F_i)$ interaction term taking value 1 if the individual i is a female and works in an institution that holds Athena Swan accreditation in year t, and 0 otherwise. Any positively statistically significant coefficient indicates an improvement in the pay gap favouring women in Athena SWAN accredited university. We also control for socio-demographic characteristics (X_{ijt}), university dummies (η_j) and a time trend $\delta_t)$ and university-specific time trend $(\gamma_j t)$, similar to our main specification in the paper.

We also estimate equation 3 with the dependent variable as a dummy variable taking value 1 if individual i in university z moves to university j in year t to estimate the impact on the movement differentials into Athena SWAN accredited universities between men and women. Furthermore, we estimate equation 3 with the dependent variable as a dummy variable taking value 1 if individual i is promoted from non-professor to professor in year t and university j to estimate the differential impact of Athena SWAN accreditation on the promotions between men and women.

Table D.1 presents the estimates of the OLS regression for our STEMM sample. The results are similar to our main estimates. The wage equation shows a higher wage growth in females in Athena SWAN accredited universities compared to males among professors and non-professors (columns 1 and 3, respectively). We find statistically insignificant differences in

males and females in movement into Athena SWAN accredited universities among professors and non-professors (column 2 and 4, respectively) and in promotion (column 5). This confirms that our estimates are robust.

Table D.1: Pay Promotion and Movement In/Into Athena SWAN Accredited University (Non-STEMM)

	Professors		Non Professors		All
	(1)	(2)	(3)	(4)	(5)
	Log Salaries	P(Move)	Log Salaries	P(Move)	P(Promotion)
Athena Marker	-2.40***	3.06***	0.87***	2.58***	0.31*
	(0.00202)	(0.00259)	(0.000883)	(0.00126)	(0.00172)
Athena Accreditation X Female	1.57***	0.18	0.58***	0.18	-0.10
	(0.00392)	(0.00466)	(0.00139)	(0.00148)	(0.00196)
Observations	66,948	66,948	186,745	186,745	253,693
No. of Individuals	13,790	13,790	42,205	42,205	51,903
R-squared	0.931	0.379	0.957	0.462	0.169

Notes: Sample: Full time permanent academics on teaching and research contracts observed over a period of 8 years from 2009-2016 in 91 universities. Standard errors in parentheses () clustered by individual level. All coefficients are multiplied by 100. Last two columns show the difference between female and male coefficients among professors and non-professors, respectively. ***p¡0.1, **0¡0.05 * p ¡.01.