Gender Equality and Positive Action: Evidence from UK Universities[1]

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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 & Stearn, 2018). 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 25%.

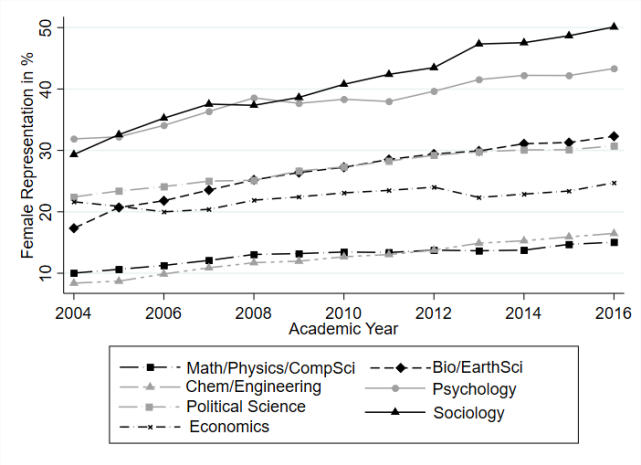
This paper examines the impact of the Athena Scientific Women's Academic Network (SWAN) Charter on the wages and employment trajectories of female faculty. The Athena SWAN Charter is a gender equality initiative that formally recognises good practice towards the representation and career progression 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

[1] 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.

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 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, Labini & Zinovyeva, 2018), single- versus double-blind peer review processes (Tomkins, Zhang, and Heavlin, 2017), mentoring programs (Blau et al., 2010), and the matching of female students to female professors (Carrell et al., 2010) among others. This paper exploits the temporal- and university-level variation in accreditations, and exploits a high-quality administrative panel data to causally evaluate the effects of this unique positive action intervention on individual career trajectories and wages.

Figure 1: Representation of Women across disciplines over time



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

I. 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).

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 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, which are the cornerstone of Athena SWAN: "To address gender inequalities requires commitment and action from everyone, at all levels of the organisation; To tackle the unequal representation of women in science requires changing cultures and attitudes across the organisation; The absence of diversity at management and policy-making levels has broad implications which the organisation will examine; The high loss rate of women in science is an urgent concern which the organisation will address; The system of short-term contracts has particularly negative consequences for the retention and progression of women in science, which the organisation recognises; There are both personal

and structural obstacles to women making the transition from PhD into a sustainable academic career in science, which require the active consideration of 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 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.

[2] Source: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/

II. Analysis

A. Description of 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.

B. Identification strategy

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

$$(1) \qquad Y_{ijt} = \alpha + \lambda D_{jt} + X_{ijt}\gamma + \eta_j + \delta_t + \gamma_j t + \varepsilon_{ijt}$$

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_{tj} 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.

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 I, the initial application to Bronze accreditation does not require the implementation of any action to address gender equality.

[3] These are age, age squared, ethnicity, highest qualification held, professor dummy, years at current university, senior management position, and university dummy (See Appendix B Table B2 for Summary Statistics).

Secondly, the focus of the Athena SWAN Charter is on career progression and representation and not necessarily on pay. Further robustness checks for our findings and identification strategy are found in Appendix E. We test for the parallel trend assumption and rule out that women's wages were becoming closer to those of men's before Athena SWAN accreditation. We also find that there is no differential effect of Athena SWAN accreditation on female wages relative to male wages in non-STEMM disciplines, suggesting that our findings are not the result from other policy changes favouring female faculty.

C. Results

Panel A in Table 1 shows the regression coefficient on the Athena SWAN accreditation dummy D_{tj} for men and women in our sample. Athena SWAN accreditation seems to bring about 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 £500 pounds in favour of women across all ranks.[4]

[4] 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.

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 1 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 (Appendix D).

Panel C in Table 1 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 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.

TABLE 1.— PAY, PROMOTION AND MOVES

	(1)	(2)	(3)	(4)	(5)	(6)
	Men		Women		Women-Men	
	Professor	Non-Professors	Professor	Non-Professors	Professor	Non-Professors
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		
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%		
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	2,600	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.

D. 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, 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. HESA data do not contain information about the academic rank below professorial level.

We cannot rule out that there are positive spill over 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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