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POSITIVE ACTION TOWARDS GENDER EQUALITY? EVIDENCE FROM THE ATHENA SWAN CHARTER IN UK MEDICAL SCHOOLS

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Abstract

This paper provides evidence on the effectiveness of voluntary positive action in addressing inequality between female and male careers. The setting is UK medical schools where two natural experiments are exploited. The first is the introduction of the Athena SWAN charter in 2005, whereby 12 UK universities signed up to the principles of the charter. The second is the announcement in 2011 by the National Institute for Health Research (NIHR), to only shortlist medical schools with a 'silver' Athena SWAN award for certain research grants. This second change potentially impacts schools that are further away from silver status more than those that were already close in 2011. While there is a marked improvement of women succeeding in medical schools between 2004 and 2013, early Athena SWAN adopters have not increased female participation by more than other schools whose institution signed up later. In addition, tying funding to Athena SWAN silver status has yet to have an impact on female careers, although medical schools have invested in efforts to achieve silver status. Together, these results emphasise the challenges associated with addressing gender equality through voluntary self-regulation.

Key Words: Athena SWAN; gender; equality; employment; positive action

1. Introduction

Inequality between women and men is prevalent in modern market economies. In the UK, women earn 80p for every pound earned by men (Government Equalities Unit, 2015), in the US, the latest estimates are 77c in the dollar (Goldin, 2014). Unequal pay for equal work has been illegal in these countries for over 40 years suggesting that gender pay gaps are rooted, not just (if at all) in bad pay practices, but in the micro structure of these economies. Panel datasets with matched firms and employees have shown that the gender pay gap widens over the working life cycle, with men dominating senior, highly paid positions (Gregory-Smith et al., 2014). By tracking men and women over their careers, women have been seen to exit the workforce at a faster rate than men; a phenomenon described as the 'glass floor' (Guvenen et al., 2014) or the 'leaky pipeline' (Blickenstaff, 2005).

In considering potential mechanisms to address inequality, an important distinction exists between positive discrimination, which is unlawful in the UK[1], and positive action which is permitted. Positive action helps employers attract and retain employees from under-represented demographics without discriminating against other employees. Where quotas are not a feasible policy option, positive action becomes the only viable mechanism to address inequalities. Consequently, the UK government has adopted a policy of advertising the ways in which employers can use and benefit from positive action (Government Equalities Unit, 2010). Yet, there is little evidence on the effectiveness of positive action in addressing economic inequality.

This paper will examine the impact of the "Athena SWAN Charter" on the employment of female clinical academics in the UK medical schools which was initially adopted by twelve medical schools in 2005. Athena SWAN does not set targets for female employment or mandate specific policies. Instead, the charter establishes guiding principles and requires participating institutions to identify key obstacles to gender equality and implement their own policies to overcome them. The obvious concern with self-initiated reform is whether or not the internally selected policies work. Progressive policies that contain significant costs, even if those costs are short-lived, might be rejected internally. So whether the positive actions of Athena SWAN translate into higher representation of females in clinical academic positions is an open empirical question.

Participation in Athena SWAN is voluntary and while compliant schools may use the scheme and their level of award as a marketing asset, until recently there have been no formal penalties for non-compliance. However, in 2011, the NIHR, a major source of research funding for UK medical schools announced that it would only short-list medical schools with a 'silver' award for its Biomedical Research Centers (BRCs) and Biomedical Research Units (BRUs). A silver award is a demanding requirement. At the time of the announcement in July 2011, there were only four medical departments with a silver award. Together, these two events in 2005 and 2011 provide a promising natural setting to test the impact of Athena SWAN.

The main result of the paper is that while there has been a high uptake of the principles of the Athena SWAN charter amongst UK medical schools, together with a marked improvement in female careers over the period, there is no evidence that this is a particular consequence of the Athena SWAN initiative itself. The adoption of Athena SWAN and the 2011 funding announcement has yet to translate in greater employment of female academic clinicians, either as professors (the most senior position) or as lecturers.

Beyond the implications for policy setting in UK medical schools, these findings contribute to the literature in industrial relations and labour economics concerned with the equality of opportunity of female employment in high skilled professions. Athena SWAN is a pioneering and comprehensive programme of positive action and as such the paper speaks to the debate over how best to address equality shortcomings in the labour markets. It is not difficult to imagine that the Athena SWAN model could be adopted in other sectors where women are under-represented at the top, such as Manufacturing and Finance. Indeed, since the beginning of this project, the programme has already expanded to consider non-STEM subjects in Higher Education and the obstacles facing transgender and ethnic minorities. While a programme of positive actions could yield important benefits for minorities in these sectors, the evidence from this paper suggests that one should be cautious about expecting immediate increases in employment.

1.1. *Policy Background*

Female careers appear to be particularly vulnerable in high skilled, scientific, technical and medical professions (British Medical Association, 2009; Carrell et al., 2010; Reichenbach and Brown, 2004). A recent report by the Medical Schools Council (2014) records that although 54% of entrants to UK medical schools are women, 42% of clinical academic lecturers are women, 32% of senior lecturers are women and 17% of professors are women. The most recent UK government investigation into the careers of women in science and medicine by the House of Commons Science and Technology Committee 2014, identified specific obstacles for women to overcome in academic medicine. These include i) 'family responsibilities and the impact of pregnancy and childcare, ii) a lack of female role-models, and iii) indirect discrimination through a gender-biased conception of merit' (Medical Schools Council, 2014). This is consistent with the experience of women trying to climb the corporate ladder outside of the medical profession. Across the EU, women make up 40% of the labour force but hold only of 13.7% of the boardroom positions (European Union, 2012). The introduction of a mandatory quota of 40% female representation in Norwegian company boardrooms has added to the evidence base on how best to address gender inequalities (Ahern and Dittmar, 2012; Bertrand et al., 2014). In the UK, while reform of company boardrooms has been voluntary, success has been underpinned by the threat of mandatory quotas if progress towards gender equality was not forthcoming (Davies, 2011, 2015).

Athena SWAN is an example of voluntary self-regulation and does not mandate quotas. Examples of positive actions emerging from Athena SWAN include monitoring of the gender balance by in-house human resource teams, scheduling meetings to accommodate part-time staff, or staff with childcare responsibilities, increased female presence on promotion committees, the development of mentoring programmes and the introduction of female specific networking and leadership training events. Theoretical papers have emphasised self-regulation as a potential complement to government intervention (Gupta and Lad, 1983), while empirical papers are sometimes more sceptical (De Jong et al., 2005). The model of self-regulation is also attractive to policymakers, perhaps because it is a convenient middle ground between laissez-faire market discipline (a la Becker (1957)) and direct positive discrimination.

In general, positive actions rely on the employer to voluntarily implement them. However, Athena SWAN is a unique example because while institutions themselves identify the actions required to improve female careers, formal certification is provided by an independent non-governmental body (the Equalities Challenge Unit (ECU)). As such Athena SWAN brings meaningful challenges for human resource departments to manage. Not least because some actions place burdens on women. For example, requiring gender balance on strategically important committees inevitably means the same women spend a lot of time on committees. However, the burden is thought to be mitigated by the self-regulatory nature of the initiatives. The motivation underlying this approach is that there is no 'one-size fits all' solution to improving gender equality and the barriers to female progression are likely to be institutionally-specific. As such, Athena SWAN represents self-regulation but with oversight and accreditation from the ECU.

The industrial relations (IR) literature has considered the role of trade unions in facilitating equality. It is without doubt that promoting equality has been part of the trade union agenda (Heery, 2005). However, while papers have shown that equal opportunities practices occur more frequently in unionised than non-unionised organisations (Bacon and Hoque, 2012), the identification of the causal mechanism at play has proved elusive. For example, Walsh (2007) uses the Workplace Employment Relations Survey (2004) and finds a positive correlation between a unionised workforce and equality practices but adds the caveat that the majority (72%) of workplaces did not negotiate, consult or inform union representatives about equality opportunity issues at all. More broadly, there is debate within the human resource management (HRM) literature as to whether promoting equal opportunity by appealing to the 'business case' for diversity is likely to be successful (Dickens, 1998, 1999). Thus neither the

HRM or IR literature has been able to identify a robust effect on equality from positive action. This is, in part, because the voluntary nature of positive action presents challenges when estimating its effects. In particular, it is difficult to isolate the causal effect of positive action, from unobserved characteristics that allow positive action to be adopted within organisations. It is this challenge that the paper focuses upon.

2. Data

There are 35 academic institutions with a medical school in the UK (see appendix), employing 3,133 full time equivalent (FTE) clinical academics (3,453 individuals). The data on clinical academic employment was provided by the UK Medical Schools Council (MSC). Each UK academic institution with a medical school returned anonymised individual-level data on all its clinical academics[2] in post on the census date of the 31st July in each year from 2004 to 2013. For each individual, information is provided on their gender, position, Full Time Equivalent, speciality, how the post is funded (e.g. by the NHS or a funding council), their age group (e.g. 26-35) and ethnicity. The data were then aggregated by the author at the level of the medical school, resulting in a panel dataset at the level of the school.

Participation in the Athena SWAN charter is voluntary and schools (and sub-departments within the school) may be awarded a 'bronze', 'silver' or 'gold' award after being assessed by the Athena SWAN panel. A silver award amounts to a 'significant record of achievement and progress' towards gender equality, while a bronze award represents a 'solid foundation of policies and practices to eliminate gender bias and an inclusive culture that values female staff'. This paper examines whether these gender policies caused an increase in female representation among clinical academics (during the sample period, no medical school held a Gold award). Information relating to the medical schools' Athena SWAN status was provided by the Equality Challenge Unit, postcodes and geographical coordinates for the medical schools were collected by the author from public sources and information pertaining to current NIHR award holders of BRUs and BRCs was obtained from the NIHR website.

Panel A of Table 1 presents trends in the employment of clinical academics in UK medical schools. Employment increases over this period by 137 FTEs with female employees occupying an increasingly greater proportion of the available positions. From 2004 to 2013, the percentage of clinical academic positions occupied by females increased by 6.33 percentage points, or 32.42% in relative terms. The growth in female participation rates is a similar size in absolute terms at each level of seniority. Indeed, in relative terms, it is the percentage of female professors that has increased the most over the period. However, reading across the table from left to right reveals that in each year one observes a decline in average female representation as the level of seniority increases. In 2013, women are still significantly under represented in senior positions. While more females are making the transition to professor in 2013 than in 2004, the descriptive statistics remain consistent with the 'leaky pipeline'.

Panel B shows the adoption Athena SWAN by UK medical schools and their associated academic institution. Contemporaneously with the increase in female participation there has been selection into Athena SWAN. However, to what extent the observed increases in female participation can be attributed to Athena SWAN is the central objective of this study. From the formation of the Charter in 2005 to the last census in July 2013, all 35 UK universities with a medical school signed up to the Charter. The first medical schools achieved bronze

Table 1: Trends in Clinical Academic Employment and Athena SWAN

Panel A: Female share of clinical academic positions

		% Female			
Year	FTE	All Females	Lecturers	Senior Lecturers	Professors
2004	2997	19.52%	32.72%	22.35%	11.01%
2005	2955	20.12%	35.42%	24.16%	10.53%
2006	2930	20.92%	36.37%	25.57%	11.10%
2007	2997	21.72%	35.55%	26.83%	11.88%
2008	3048	22.19%	38.12%	26.28%	12.84%
2009	3106	23.02%	37.04%	26.96%	14.15%
2010	3175	23.53%	39.21%	26.29%	14.37%
2011	3162	24.65%	39.17%	28.41%	14.95%
2012	3126	25.77%	40.32%	29.68%	15.85%
2013	3134	25.85%	38.55%	29.92%	16.69%
Growth	137	6.33%	5.83%	7.57%	5.67%
% Growth	4.56%	32.41%	17.81%	33.88%	51.49%

Panel B: Participation in Athena SWAN

		Institution		Medical School	
Year	Participant	Bronze Award	Silver Award	Bronze Award	Silver Award
2004	0	0	0	0	0
2005	12	0	0	0	0
2006	14	5	1	0	0
2007	17	6	2	0	0
2008	20	9	2	0	0
2009	23	18	2	1	1
2010	24	20	2	3	2
2011	34	24	2	9	4
2012	34	26	3	16	7
2013	35	30	5	27	17

1. FTE is the number of full time equivalents, both female and male. $\%Female$ is the percentage of FTEs that are women (rather than a simple head-count of women). Participant is a count of institutions signed up to the Charter's principles.
2. The medical school's governing institution (i.e. the associated University) must sign up to Athena SWAN and hold an institutional award, before the medical school can apply for an award.
3. School awards are credited to medical departments. There can be more than one medical department per institution and hence the number of awards can exceed the number of institutions (35). In such cases, the date of award to the department whose description most closely resembled a medical school was included in the table above. Where this was ambiguous, the earliest award date was assigned to the institution's medical school.

status in 2009. In 2011, the NIHR announced funding for biomedical research centres will be conditional on achieving silver status. At this time, nine medical schools had achieved bronze status and only four had achieved silver status. By the end of the sample period in 2013, the number of medical schools with a bronze award increased to 27 and those with a silver award increased to 17. This acceleration in medical school accreditation post 2011, suggests that the funding announcement significantly changed the incentives for schools to participate in Athena SWAN.

Table 2: Female Employment: Treated by Athena SWAN in 2005 vs Control

	% Female		% Female Lecturer		% Female SL		% Female Prof.	
Year	Treated	Control	Treated	Control	Treated	Control	Treated	Control
2004	19.56%	19.49%	33.48%	32.02%	23.05%	21.70%	9.65%	12.20%
2005	20.25%	20.00%	34.42%	36.16%	25.82%	22.56%	9.53%	11.41%
2006	21.38%	20.50%	36.76%	36.07%	27.52%	23.72%	10.16%	11.92%
2007	21.77%	21.67%	36.71%	34.60%	27.31%	26.38%	11.13%	12.54%
2008	21.51%	22.82%	34.73%	41.35%	25.92%	26.63%	12.39%	13.23%
2009	22.45%	23.55%	34.13%	40.21%	26.72%	27.20%	13.47%	14.75%
2010	22.83%	24.17%	36.01%	42.00%	26.05%	26.52%	13.97%	14.72%
2011	24.20%	25.07%	36.54%	41.33%	28.94%	27.87%	14.21%	15.59%
2012	25.05%	26.46%	38.24%	42.14%	29.36%	30.00%	15.14%	16.49%
2013	25.13%	26.54%	37.10%	40.10%	28.93%	30.88%	15.93%	17.37%

1. Treatment is whether the medical's school's governing institution (i.e. the associated University) signed up to the Athena SWAN Charter in 2005.
2. None of the differences in means between the treated and control groups are statistically different from each other at conventional levels (and in several rows female representation is nominally higher in the control group.)
3. The treated and control groups are similar to each other in terms of other observable variables including the size of the school (as measured by FTE employees), average age, proportion of part time employees, or the school's location (inside or outside London) see appendix.

Table 2 shows differences in female employment between treated and control medical schools. Treated schools (N=12) are those whose governing academic institution (i.e. the associated University) signed up to the Athena SWAN Charter in 2005. Note that it is the governing academic institution, not the school that is selecting into Athena SWAN in 2005. This is an important distinction because it means that it is plausible that the 2005 introduction of the Athena SWAN was an exogenous event for the School. It is also noteworthy that differences in female employment between the treated and control schools are very small at all levels of employment both before and after 2005. Indeed, none of the differences are statistically significant at conventional levels. As the treated and control schools appear to be indistinguishable from each other in these raw descriptives, it may prove difficult to attribute the trend towards greater female employment to Athena SWAN. The econometric sections below, which introduce the difference-in-differences tests, will seek to formally confirm or refute this hypothesis.

3. Methods

Two difference-in-differences (DiD) experiments were conducted in order to assess the impact of Athena SWAN on female careers in UK medical schools. The first relates to the introduction of the Athena SWAN charter in 2005. The second relates to the announcement by NIHR in 2011. With respect to the first DiD, an important assumption is that the medical school has autonomy over hiring and promotion decisions inside the school but does not have influence over the university's selection into Athena SWAN. This is plausible because while hiring decisions are made at the level of the school, the decision for the institution to sign up to Athena SWAN is made at a higher level of authority, i.e. by the University's governing body. If this holds, one can consider the university's selection into the Athena SWAN Charter as an exogenous event for the medical school. With respect to the announcement by NIHR, an important assumption will be that some medical schools are more affected by the announcement than other medical schools. There are two sources of variation here. The first is that some schools were closer to silver status than other schools at the time of the announcement. The second is that some schools are more reliant on research funding from the NIHR than others.

3.1. *The introduction of Athena SWAN in 2005*

The first DiD considers the difference in the change in the share of female employment between those schools whose institution signed up for Athena SWAN in 2005 and those that did not. Using notation from Cameron and Trivedi (2005) let a dummy variable D_i equal 1 if the medical school is treated and 0 otherwise. The model to be estimated is a fixed effects model sorted at the level of the medical school:

$$y_{it} = \phi D_{it} + \delta_t + \alpha_i + \mathbf{x}'_{it}\beta + \varepsilon_{it} \quad (1)$$

where y_{it} is the proportion of female clinical staff in school i and time t, $\mathbf{x}'_{it}\beta$ is a vector of observable control variables and associated coefficients, δ_t is a time-specific fixed effect and α_i is a school specific fixed effect. The control variables are constructed from individual level data on age bands, ethnicity, medical speciality, grade (e.g. professor) and contract type (e.g. NHS consultant). These variables are aggregated to produce school-level control variables. Additionally, at the level of the school there is geographical location and level of biomedical research funding. Unfortunately, information on the schools' budget position is not publicly available. Although α_i is unobserved (and potentially correlated with $\mathbf{x}_{it}$), it is eliminated by the within-average transformation:

$$y_{it} - \bar{y}_i = (D_{it} - \bar{D}_i)\phi + (\delta_t - \bar{\delta}) + (\mathbf{x}_{it} - \bar{\mathbf{x}}_i)'\beta + (\varepsilon_{it} - \bar{\varepsilon}_{it}) \quad (2)$$

OLS estimation of ϕ identifies the treatment effect. When there are only two time periods (before and after the treatment), estimation of ϕ equals the difference in the sample average of Δy between the treated and non-treated medical schools (hence Difference-in-Differences). With more than two periods estimation of ϕ is achieved by interacting the treatment identifier with time dummies. Athena Swan awards are valid for three years and policies are expected to be implemented during this period. The DiD is able to capture this time lag.

A necessary assumption for consistent estimation of ϕ requires $(\delta_t - \bar{\delta})$ to be equal for both the treated and untreated groups (the 'common trends' assumption). In this case, the assumption will hold unless the treated schools share an unobservable characteristic that the untreated schools do not share and that this characteristic causes a change in female employment over the period of the DiD[3]. For example, if some medical schools and their associated university were already pursuing a progressive gender policy, and this led the university to select into Athena SWAN and cause a higher *change* in y_i over the DiD period, then estimation of ϕ would be biased upwards. To examine if this is the case, one can test for common trends over the two years of data prior to the Athena SWAN treatment. Two years of data is the minimum required to test for common trends and ideally a longer series should be inspected. However, when estimated, ϕ is not positive, hence upward bias from uncommon trends is unlikely to be driving the result here.

A more relevant assumption for consistent estimation of ϕ in this case requires the treatment from Athena SWAN adoption not to spillover into the schools that did not adopt Athena SWAN in 2005. For example, treated schools could have shared their 'best practice' with schools that were untreated. This would bias the estimation of ϕ downwards and in the absence of a positive estimate for ϕ, together with observing an increase in diversity for all schools, this is potentially a concern for the validity of this DiD. However, there is a literature in economics that argues knowledge spillovers are often well approximated by geographical distance (Audretsch and Feldman, 1996). As the postcode of the schools is known, the Euclidian distance between each school can be calculated by applying Pythagoras's theorem to the geographical coordinates between the schools. Therefore, if best practice spillovers are contaminating the estimation of ϕ, this should be observed in the data. By interacting this distance with female participation at the school's peers over time, one can potentially control for the influence of each treated schools' best practice on each untreated school. This is not a perfect solution as it remains possible that spillovers could arise through non-geographical closeness, such as performance or shared research expertise in a particular field. Yet in the absence of detailed measures of such variables, geographical closeness is the best available proxy for knowledge spillovers.

3.2. *The funding announcement in 2011*

The second DiD experiment assesses the impact of the announcement by NIHR in 2011 to tie future funding of its Biomedical Research Units (BRUs) and its Biomedical Research Centres (BRCs) to Athena SWAN status. Specifically, no medical school will be short-listed for a NIHR research award unless the school itself has obtained an Athena SWAN silver award. Anecdotal evidence, together with the timing of many of the medical school bronze and silver awards shown in Table 1 suggests that this announcement has galvanised many medical schools to the task of obtaining silver status. While this is potentially a much stronger treatment, with direct consequences for the future revenue and life of the school, it is harder to identify the appropriate control group. However, as the Athena SWAN charter was adopted at different points in time, some schools were further away from silver status at the time of the announcement than other schools. As schools further away from silver status are more constrained by the announcement, a larger reaction to the announcement is expected from these schools.

To proxy distance to silver status at the time of the announcement there are three variables available: whether the institution holds a bronze award, whether the institution holds a silver award and whether the school holds a bronze award at the time of the announcement. The simplest method of introducing these variables is to consider each as a treatment, estimate equation 1 three times and remember to expect a larger reaction from the non-treated schools.

While this may be sufficient, one concern with incorporating the variables directly into equation 1 is that they are, to some extent, choices of the school concerned. If the school, actively manages both the trend in female employment and its distance from silver status for unobservable reasons not related to Athena SWAN then the distance of silver status itself could be determined by the trend in female employment.

A more sophisticated approach is to instrument these variables with another variable that is correlated with these measures of distance from silver status but unrelated to the managerial choices on employment in 2011 (the IV approach). An obvious candidate for the instrument is the treatment from the first experiment - i.e. whether or not the school's governing institution signed up to Athena SWAN in 2005. Recall, that this was not a decision made by the school, rather the school's governing academic institution. This variable correlates well with the proxies for distance from silver status and given that it is very unlikely to be related to the school's decisions on female employment in 2011 (other than through the specific mechanism of being part of Athena SWAN), this instrument is plausibly 'valid'. This econometric strategy of exploiting pre-treatment variation to identify the causal impact of a gender policy that affects the population has previously been used to examine the 40% quota in Norwegian boardrooms (Ahern and Dittmar, 2012) and female high-school athletic participation rates after US legislation in the 1970s (Stevenson, 2010).

The simplest method of incorporating the IV approach is two-stage least squares regression. This can easily be adapted to the DiD set up. Recall the fixed-effects DiD equation from before:

$$y_{it} = \phi D_{it} + \delta_t + \alpha_i + \mathbf{x}'_{it}\beta + \varepsilon_{it}$$

but now the concern is that D_{it} is endogenous and hence OLS estimation of ϕ, the treatment effect, will be inconsistent (even after the within transformation to eliminate α_i). Introducing an instrument z_{it} for D_{it} leads to estimation of the first stage equation:

$$D_{it} = \gamma z_{it} + \delta_t + \mathbf{x}'_{it}\beta + \upsilon_{it} \quad (3)$$

which allows the predicted values $\hat{D}_{it}$ to enter the second stage regression:

$$y_{it} = \phi \hat{D}_{it} + \delta_t + \alpha_i + \mathbf{x}'_{it}\beta + \varepsilon_{it} \quad (4)$$

So long as $\hat{D}_{it}$ is asymptotically uncorrelated with the error term, which is the case if z_{it} is a valid instrument for D_{it}, estimation of the treatment effect ϕ by the within (fixed effects) estimator will be consistent (see Cameron and Trivedi (2005, p.189)). The cost of using the IV approach is efficiency; that is estimates of ϕ will be less precise (the standard errors will be larger than under OLS).

One further source of variation that can help to distinguish treated and less treated schools is that the funding announcement could be more relevant for those already in possession of a BRC or BRU. The important identifying assumption in this case is common trends between award holders and non-award holders. In addition, the announcement must be unanticipated by both groups. If this is not the case, award holders could manage their share of female employment more actively before the 2011 announcement, in anticipation of such an announcement, and hence the estimate of the reaction to the announcement would be downward biased. However, the ECU (who manage Athena SWAN) confirmed that the announcement was a surprise to them so it is not unreasonable to assume that the announcement was also a surprise to UK Medical Schools. Nevertheless, the time series prior to 2011 in the data allows one to test for any anticipation effects.

4. Results

Table 3 shows the results of the first DiD experiment, estimated with school fixed effects. In the first three columns, the dependent variable is the percentage of all female clinicians employed in UK medical schools. In the fourth column, the dependent variable becomes the percentage of Professors employed who are women. The estimated coefficients by year under *All Schools* identify the general increase in female employment identified in the descriptive section above. The estimated coefficients in columns (2) and (3) by year under *Treated Year Interactions* identify the additional impact on female employment if the school's governing institution signed up to Athena SWAN in 2005. The absence of statistical significance on the 2005 year coefficient indicates no major difference in trends prior to the treatment i.e. the common trends assumption is supported. The 2006 year coefficient identifies the two period difference-in-differences. This estimate is less than 1 percentage point and is not statistically significant. Each subsequent year explores whether there are any longer term effects from the treatment in 2005, with the caveat that there could be other time-varying drivers of female employment in these years. Nevertheless, there are no results that are statistically significant at conventional levels. The similarity between the treated and untreated schools with respect to female employment is evident in Figure 1. While the point estimates for female employment on the treated group are very marginally higher after 2008, the 95% confidence range estimates overlap each other.

The third column includes the variable *Distance to treated.* This takes the value zero for a treated school and for a non-treated school equals the level of female employment in each treated school, weighted by the log of geographical distance in kilometers to each treated school. The absence of a negative relationship between distance and female employment suggests that it is not the case that non-treated schools that are geographically close to the treated schools increased their female employment. There is no evidence here that knowledge spillovers have compromised the difference-in-differences experiment, noting that spillovers could occur through non-geographical closeness and that this possibility can not be ruled out.

Table 4 shows the results of the second DiD experiment. In all columns, the dependent variable is the percentage of all female academic clinicians employed in UK medical schools. Again, the estimated coefficients by year under *All Schools* identify the general increase in female employment. The estimated coefficients under *Treated Year Interactions* seek to identify the additional impact that can be attributed to the funding announcement by NIHR in 2011, which tied future funding to silver status. Reading across the columns, different sources of pre-announcement variation are exploited. These are: a) whether the school's institution has a bronze award; b) whether the school's institution has a silver award; c) whether the school

Table 3: The impact of 2005 Institutional Athena SWAN sign-up on Medical School Gender Diversity

		% Female		% Female Prof.
	(1)	(2)	(3)	(4)
All Schools				
2005	0.0035	0.0028	0.0017	-0.0094
	(0.48)	(0.26)	(0.16)	(-1.43)
2006	0.012	0.0097	0.0059	-0.0086
	(1.36)	(0.73)	(0.42)	(-0.99)
2007	0.032**	0.034	0.028	0.020
	(2.07)	(1.52)	(1.08)	(0.66)
2008	0.021**	0.020*	0.015	0.012
	(2.30)	(1.82)	(0.92)	(0.91)
2009	0.030**	0.027	0.019	0.040*
	(2.15)	(1.36)	(0.56)	(1.84)
2010	0.036**	0.034*	0.024	0.041*
	(2.66)	(1.92)	(0.70)	(1.71)
2011	0.057***	0.056***	0.043	0.052**
	(4.61)	(3.60)	(1.05)	(2.14)
2012	0.068***	0.067***	0.052	0.054**
	(5.10)	(3.71)	(1.06)	(2.17)
2013	0.064***	0.062***	0.048	0.045
	(4.58)	(3.03)	(0.93)	(1.42)
Treated Schools				
2005		0.0017	0.0029	0.0047
		(0.14)	(0.23)	(0.56)
2006		0.0057	0.0094	0.011
		(0.38)	(0.60)	(0.83)
2007		-0.0079	-0.0017	-0.025
		(-0.30)	(-0.058)	(-0.71)
2008		0.00087	0.0059	-0.0025
		(0.046)	(0.26)	(-0.097)
2009		0.0080	0.016	-0.022
		(0.31)	(0.42)	(-0.78)
2010		0.0059	0.015	-0.0028
		(0.21)	(0.37)	(-0.10)
2011		0.0012	0.014	-0.012
		(0.047)	(0.31)	(-0.44)
2012		0.0029	0.018	-0.015
		(0.11)	(0.34)	(-0.52)
2013		0.0048	0.019	0.0064
		(0.19)	(0.37)	(0.19)
Distance to treated			1.04	
			(0.45)	
School FE	Yes	Yes	Yes	Yes
N	337	337	337	337
R-squared	0.172	0.173	0.116	0.174
No. Schools	35	35	35	35
Treated Schools	12	12	12	12

Cluster-robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

1. The estimated coefficients identify the marginal effect on the percentage of female employment, relative to the baseline year of 2004. For example, in 2013, the percentage of clinical positions in UK medical schools that were occupied by women was, on average, 6.5 percentage points higher than in 2004.
2. The treated group are comprises the schools whose governing institution signed up to Athena SWAN in 2005.
3. The coefficients after 2005 on the treated group identify the difference in differences. Although these coefficients are positive (other than 2007), the treated and untreated groups are not statistically different from each other. Therefore, while there is a trend towards a greater share of female employment in UK medical Schools, this trend was not more pronounced among those schools whose institution signed up to Athena SWAN in 2005.

Table 4: The impact of 2011 NIHR funding announcement on Medical School Gender Diversity

	ID Bronze		ID Silver		School Bronze	
	FE	IV	FE	IV	FE	IV
	(1)	(2)	(3)	(4)	(5)	(6)
All schools						
2005	-0.0096	0.00081	0.0018	0.0028	0.0038	-0.0028
	(-0.61)	(0.032)	(0.23)	(0.27)	(0.40)	(-0.062)
2006	-0.0083	0.0024	0.011	0.0097	0.015	-0.0058
	(-0.50)	(0.082)	(1.15)	(0.77)	(1.24)	(-0.090)
2007	0.057	0.044	0.033*	0.034	0.042**	0.049
	(1.21)	(0.88)	(1.97)	(1.59)	(2.06)	(0.63)
2008	0.0036	0.019	0.020**	0.020*	0.021*	0.016
	(0.24)	(0.64)	(2.06)	(1.90)	(1.88)	(0.27)
2009	0.024	0.018	0.030*	0.027	0.030	0.0080
	(0.65)	(0.37)	(2.00)	(1.42)	(1.59)	(0.087)
2010	0.028	0.027	0.036**	0.034**	0.038**	0.019
	(0.82)	(0.59)	(2.50)	(2.01)	(2.07)	(0.21)
2011	0.078***	0.055	0.058***	0.056***	0.066***	0.051
	(3.25)	(1.32)	(4.34)	(3.75)	(4.05)	(0.64)
2012	0.093***	0.064	0.068***	0.067***	0.078***	0.059
	(3.01)	(1.40)	(4.70)	(3.87)	(4.50)	(0.67)
2013	0.079*	0.057	0.063***	0.062***	0.067***	0.050
	(1.96)	(1.18)	(4.19)	(3.16)	(3.55)	(0.57)
Treated Year Interactions						
2005	0.018	0.0038	0.028***	0.010	-0.00069	0.022
	(1.02)	(0.14)	(3.24)	(0.15)	(-0.055)	(0.15)
2006	0.028	0.013	0.018	0.034	-0.0094	0.063
	(1.42)	(0.41)	(1.38)	(0.40)	(-0.65)	(0.30)
2007	-0.036	-0.017	-0.013	-0.048	-0.038	-0.068
	(-0.75)	(-0.31)	(-0.80)	(-0.31)	(-1.57)	(-0.27)
2008	0.024	0.0019	0.012	0.0052	-0.0022	0.014
	(1.33)	(0.048)	(0.98)	(0.048)	(-0.12)	(0.067)
2009	0.0093	0.018	-0.0021	0.048	0.00056	0.082
	(0.24)	(0.31)	(-0.13)	(0.31)	(0.026)	(0.25)
2010	0.011	0.013	-0.0094	0.035	-0.0062	0.061
	(0.29)	(0.22)	(-0.60)	(0.22)	(-0.30)	(0.19)
2011	-0.030	0.0027	-0.015	0.0073	-0.036*	0.018
	(-1.08)	(0.048)	(-1.02)	(0.049)	(-1.91)	(0.061)
2012	-0.035	0.0065	0.0062	0.018	-0.035	0.034
	(-1.03)	(0.11)	(0.43)	(0.12)	(-1.50)	(0.11)
2013	-0.021	0.011	0.015	0.029	-0.0099	0.052
	(-0.50)	(0.19)	(0.93)	(0.20)	(-0.44)	(0.17)
School FE	Yes	Yes	Yes	Yes	Yes	Yes
N	337	336	337	336	337	336
R-squared	0.210	0.180	0.176	0.164	0.187	0.108
No. Schools	35	34	35	34	35	34

Cluster-robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

1. The estimated coefficients identify the marginal effect on the percentage of female employment, relative to the baseline year of 2004. The Id prefix in columns (1) - (4) consider the treatment of whether the schools governing institition holds a bronze or silver award at the time of the announcement in 2011. Columns (5) and (6) consider whether the medical school itself held a bronze award at the time of the announcement.
2. The IV columns instrument the holding of an award in 2011, with the school's governing institution decision to sign up to Athena SWAN in 2005. In the first stage, signing up in 2005 is highly correlated with holding an institutional bronze award and an institutional silver award (partial R^2 ranges from 0.1145 to 0.2313), but not well correlated with the school holding a bronze award in 2011 (R^2 0.01). Therefore the results in column (6) are less reliable but are consistent with the findings from the other experiments.

Figure 1: No impact of Athena SWAN on female employment

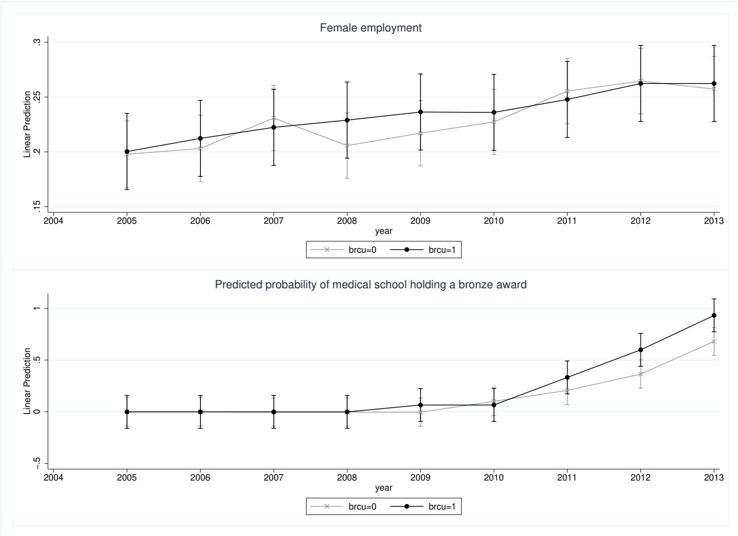
The graph shows that while the trend in female employment is positive over the period in which Athena SWAN has been introduced, there is no substantive difference between the school's whose governing institution signed up for Athena SWAN in 2005 and those that did not. The graph was produced using *marginsplot* in Stata 13.1 after *xtreg, fe* and *margins*. The linear prediction is recovered under the constraint $\sum_{i=1}^{N} \alpha_i = 0$. The cluster-robust standard error bars capture the 95% confidence interval around the point estimate.

itself has a bronze award. Each of these measures is instrumented with the 2005 treatment from the first experiment in the adjacent column (under IV).

The coefficients on 2012 and 2013 under *Treated Year Interactions* identify the post 2011 announcement effect on female employment. Consistent with the results of the first experiment, the treated schools did not react to the announcement in 2011 differently to the untreated schools. The negative coefficient on 2012 column (5) could suggest some reaction to the announcement among schools that had not already been awarded a bronze award. However, the result is not statistically significant and the years prior to the treatment are also negative suggesting that the schools that have a bronze award had a marginally smaller share of female employment in these years also. Therefore, it is very difficult to attribute the general increase in female employment post 2011 to the announcement itself. Rather, the increase appears to be a continuation of a trend experienced by all schools that has been constant over the last ten years.

The top panel of Figure 2 shows that the trend in female employment in institutions holding a BRU or BRC is no different to those institutions that do not. However, the bottom panel identifies that post 2011 all institutions were more likely to have a medical school with a bronze award, but that those with a BRU or BRC were more likely than the others. By 2013, the difference between the BRU / BRC institutions and the others is statistically significant. A reasonable interpretation of these findings is that the NIHR announcement has stimulated affected schools to pursue a bronze award in the knowledge that by 2016 they will need a silver award. However, pursuit of the bronze award has yet to translate into tangible gains in female employment. Several further specifications were estimated to help establish the robustness of

Figure 2: Current Biomedical Research Centre and Unit Holders



the findings above including count models of female FTEs and breakdowns of the analysis by various categories such as age, medical speciality, part-time employment, NHS funded posts and London vs the rest of the UK. Details are given in an appendix available on the author's website.

One interesting feature of the data emerged from running robustness checks on the trend in part time employment over the sample period[4]. It is possible that part time leadership positions for both men and women became more feasible over the sample period. Table 5 shows the increase in percentage of professorial positions that were performed part time from 5.12% in 2004 to 11.60% by 2013. So while the majority (88.4%) of professors remain full time, there is movement towards more part time leadership positions. Surprisingly, Table 5 shows it is male professors that have driven this increase. The percentage of professors who are male and part time increases from 4.35% to 9.48% by 2013. The percentage of professors who are female and part time also increased but in smaller numbers, from 0.76% to 2.12%. It would appear in these simple statistics that if management bias against having part time leadership positions is diminishing, it is senior men that are taking advantage. However, the trend could reflect an increase in competition over high profile research outputs as schools could submit partial contracts under the UK government's research funding competition (known as RAE or REF). If so, then Athena SWAN policies are unlikely to be driving the trend in part time professors. Indeed, Table 5 shows there are no differences in part time professors between the institutions treated by Athena SWAN in 2005 and those that were not.

5. Discussion

The main conclusion from the analysis in this paper is that despite a general increase in female employment and widespread adoption of the standards of Athena SWAN amongst UK medical schools there is no evidence yet to suggest that either the introduction of the Athena SWAN

Table 5: Professorial part time positions

	Part time Professors				
Year	All	Female	Male	Treated	Control
	(1)	(2)	(3)	(4)	(5)
2004	5.13%	0.77%	4.36%	5.50%	4.95%
2005	4.58%	0.96%	3.61%	4.80%	4.24%
2006	5.72%	1.18%	4.55%	6.35%	5.72%
2007	5.52%	1.15%	4.37%	6.37%	6.52%
2008	5.74%	1.18%	4.56%	7.62%	7.15%
2009	6.74%	1.59%	5.14%	7.53%	7.18%
2010	7.23%	1.46%	5.77%	7.94%	7.49%
2011	9.06%	1.97%	7.09%	9.94%	9.40%
2012	10.54%	2.18%	8.36%	11.84%	11.44%
2013	11.61%	2.12%	9.48%	12.59%	12.37%

1. Column 1 shows the increase in the percentage of professorial positions held by male and female employees who work part time. Columns 2 and 3 seperates column 1 by male and female employees. Columns 4 and 5 separates column 1 by those employed in treated and control institutions, where the treatment is whether the medical's school's governing institution (i.e. the associated University) signed up to the Athena SWAN Charter in 2005.

charter or the announcement by NIHR to tie future funding to Athena SWAN silver status has led to a measurable improvement in the careers of females employed in UK medical schools. Taking this result at face value implies that the either the progressive policies voluntarily introduced by the Athena SWAN adopters are insufficient to change female employment patterns (at least in the period under observation), or that Athena SWAN adopters are falling short in their application of the Charter's principles. To distinguish between these two possibilities requires an in depth evaluation of the practices within Athena SWAN adopters. However, either way, true equality for clinical academics in medicine is unlikely without continued oversight and action from the ECU.

Given the current regulatory position in the UK (and elsewhere) with respect to gender inequalities predominately favours self-reforming positive action over formal legislative quotas, it is disappointing that there appears to be no identifiable gain in female employment from the positive action in this setting. Indeed, had an effect been found, one would perhaps worry that this was a 'cherry-picked' setting. Athena SWAN is remarkable, both in terms of the detail of the progressive policies that have been implemented and the breadth of their adoption. Moreover, they are policies that are designed by the institutions themselves and so tailored to the particular challenges facing each school. If an effect of positive action is to be found anywhere, one would think that it should have been found in the adoption of Athena SWAN by Medical Schools.

That Athena SWAN was a potentially a promising case to find a positive effect of self regulation is brought out by the report commissioned by the ECU into higher education in 2013 (Munir et al., 2013). The report surveyed 114 UK departments from Science, Technology, Engineering, Mathematics and Medicine (STEMM) to assess the impact of Athena SWAN on institutional practices by asking respondents a battery of questions such as 'I was satisfied with my career performance/development review'. Answers were then compared between departments with silver awards, bronze awards, a bronze award at the institutional level and no award. The survey data were reinforced by nine case studies where face to face interviews were conducted. The report found evidence that Athena SWAN was having a positive impact on female careers in STEMM subjects but also noted that there was an issue in relation to the supply of female workers, particularly in smaller departments.

This paper adopted a substantially different approach. First, the focus here was exclusively on medical schools, a setting where it was known ex-ante that female participation is increasing and one with widespread adoption of Athena SWAN. Second, the key variable of interest here is female employment whereas Munir et al. (2013) record the (subjective) responses of survey participants on their experiences inside their organisation. Certainly, information pertaining to the perception of fairness and equality inside organisations is informative but the acid test is whether voluntary initiatives such as Athena SWAN can deliver measurable improvements to the employment prospects of women. Third, the difficulty arising from descriptive comparisons is attributing the reported differences to Athena SWAN itself. As participation in Athena SWAN is voluntary, selection into Athena SWAN is very likely to be endogenous to the quality of practices undertaken in the institution. The econometric methods used here are designed specifically to isolate the causal effect of the intervention. The exploitation of the two natural experiments affecting UK medical schools provides a potentially cleaner assessment of the success of Athena SWAN and fails to find a causal effect on employment.

In the absence of an effect on employment, one possible response could be to refocus the positive actions of Athena SWAN towards measures that directly target female labour supply. Although there is substantial heterogeneity, many of the current Athena SWAN actions focus on support (e.g. flexible working arrangements around childcare). Such actions may be desirable but they do not seem to increase female labour supply. Harder measures, such as the elimination of any pay disparity between men and women could provide more robust incentives for women to enter and remain in this sector of the labour market[5].

One aspect of the data that is more encouraging from a progressive perspective is the trend in female employment. The proportion of professors who are female increases steadily in nine out of the ten years in the sample. So what could be driving the trend if not Athena SWAN? One possibility is that this trend reflects cohort effects resulting from increases in female representation at lower positions prior to the commencement of the sample in 2004. It is known that female undergraduate entry into medical schools increased during the 1990s and hence the pool of potential clinical academics schools draw from is increasing each year before the sample starts. That female representation increases at each level of seniority during the sample period is consistent with these cohorts of graduates working their way up the organisational hierarchy. One can be hopeful that some of the new appointments to lecturing positions observed during the sample period will make full professors in the future. However, whether or not these new lecturers convert at a faster rate than previous is unclear. Indeed, an important caveat to the findings herein is that the long term impact of Athena SWAN on UK medical schools can not be fully identified until further time elapses. The first round of funding to be awarded by the NIHR, with the requirement of Athena SWAN silver status took place in 2016. That all UK medical schools have now signed up to the Charter indicates at least there is some perceived value in belonging to the Athena SWAN. Moreover, assuming that the Athena SWAN assessments are accurate, it can be said that the majority of medical schools now have at least one department that can demonstrate a 'significant record of achievement and progress' towards gender equality, that being the definition of silver status.

A second caveat is that there are likely to be other pressures driving equality in this sector and these pressures could be changing over time. As noted in the introduction, trade unions potentially play an important role in promoting female careers. For example, the British Medical Association have recently established a less-than full-time forum which promotes flexibility for part-time workers in the NHS. Charities such as the Fawcett Society also seek to promote female careers and work with trade unions to this end. The interactions between these organisations are unexplored in this study and represent an opportunity for future research.

A third caveat is that the precision of the estimates is constrained by the number of medical schools that exist in the UK (35). Although this is the population and the panel dimension of the dataset increases the number of observations to 337, a greater number of separate schools would have allowed for more precise estimates. Finally, it should be stressed that the absence of a clear impact on female employment is not a comment on the success or otherwise of Athena SWAN. There are surely consequences of adopting Athena SWAN other than on the impact on the female share of employment. These could include perceptions and experiences of fair access to senior positions and treatment once in post, an impact on wage differentials, the generation of recognisable role models with positive consequences for female career aspirations amongst others. Indeed, the qualitative evidence (Munir et al., 2013) suggests that the perception of the equality of opportunity has improved since the introduction of Athena SWAN. However, whether or not this perception eventually translates into a higher share of female employment in the top academic medical positions remains to be seen.

Notes

[1]Positive discrimination is unlawful under the Equality Act (2010), aside from a few exceptions such as when the nature of the job requires a person of a particular sex. An example given by the Equality and Human Rights Commission is if an assistant is required to assist a person in washing or going to the toilet it is lawful to require the assistant to be the same sex as this person.

[2]A clinical academic is defined as someone who has full registration with the General Medical Council and holds a substantiative contract of employment with the university and holds an honorary clinical contract with the NHS or a formal GMC / university contract; or for public health academics holds an honorary contract with a nominated body such as Public Health England or a Local Authority.

[3]If such a characteristic exists and it is observable, consistent estimation of ϕ holds, so long as it is included as a covariate and that covariate was not affected by the treatment itself. The observable variables such as the size of the school, age of employees, the proportion of non-white employees are shown in the appendix (available from the author) to neither affect the selection of the institution into Athena SWAN nor the level of female employment.

[4]The author thanks an anonymous referee for this suggestion.

[5]See *www.essex.ac.uk/news/event.aspx?e_id=10552* for a recent example of this policy.

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