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This paper examines the impact of the Athena SWAN initiative on female careers in UK medical schools by exploiting two natural experiments. The first is the introduction of Athena SWAN charter in 2005, whereby twelve UK institutions selected into the charter. The second is the announcement in 2011 by the NIHR, to only shortlist medical schools with a 'silver' Athena SWAN award for certain research grants going forward. This second change potentially impacts schools that are further away from silver status than those that were already close in 2011. While there is a marked improvement of women succeeding in medical schools during the sample period, 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.

JEL codes: J16 J78 I18

Key Words: Athena SWAN; Gender; Labour

1 Introduction

Women have long assumed an essential role in the practice of medicine, albeit predominantly in an informal or unpaid context such as care givers. Historically, employment as medical professionals, such as a physicians or surgeons, was reserved for men. Likewise, the contrast between the fundamental role that women have played in transferring knowledge to the next generation and their success as professional academics is equally as stark. Research, teaching and medicine come together in medical schools, the domain of this paper. While the employment of women as medical academics is certainly a modern achievement[2], severe concerns

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[2]Women were initially banned from entering male medical schools. Women only schools were established in London (1874) and Edinburgh (1886).

remain about the equality of opportunity between men and women in this section of the labour market (Reichenbach and Brown, 2004; British Medical Association, 2009). A recent report by the Medical Schools Council (2014) records that although 54% of entrants to UK medical schools are women, 42% of medical lecturers are women, 32% of senior lecturers are women and 17% of professors are women. A decline in female employment as careers progress has been referred to as the 'leaky pipeline' (Clark Blickenstaff, 2005) or the 'glass floor' (Guvenen et al., 2014).

The lack of representation in senior academic medical positions is consistent with the experience of women trying to climb the corporate ladder outside of the medical profession. For example, women hold only of 13.7% of the board positions in the EU (European Union, 2012). The near absence of women at the top has traditionally been attributed to 'supply-side' effects due to choices made by households associated with family formation (Mincer and Polachek, 1974). As nature has dictated that women are more likely to take time out of the labour force due to child rearing women are more likely to experience depreciation of their human capital stock during their careers[3]. This results in a limited pool of qualified female candidates in the 'pipeline' when senior positions are filled. Alongside this, is the 'glass ceiling' (Powell and Butterfield, 1994), that is, discriminatory barriers which inhibit the progression of women up the corporate ladder. These barriers manifest in different ways. Explicit favouritism towards male candidates has been ascribed to biased and stereotyped attitudes held by male supervisors. More subtle barriers include undervaluation of female achievements (Kulich et al., 2007), selection processes that favour male traits (Gneezy et al., 2003), the perception of women as high risk (Lee and James, 2007) or 'tokens' (Kanter, 1997), the biases of outside investors (Gregory et al., 2013), the appointment of women to already risky positions (Ryan and Haslam, 2005; Ryan et al., 2011) and discretion in performance evaluations favouring male candidates (Geddes and Heywood, 2003; Castilla and Benard, 2010).

The most recent 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, p.20).

This paper will examine the impact of the "Athena SWAN Charter", an initiative introduced in the UK in 2005 to advance the careers of women in medical schools[4]. Examples of progressive practices emerging from Athena SWAN include monitoring of the gender balance

[3]And, so the theory goes, women anticipate shorter careers, resulting in a smaller incentive for women to invest in the high level skills required for success at the top.

[4]The Athena Senior Women's Academic Network (SWAN) Charter is wider than the medical schools. It seeks to promote the careers of women in Science, Technology, Engineering, Maths, and Medicine (STEMM). See http://www.ecu.ac.uk/equality-charter-marks/athena-swan/.

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. However, whether these progressive policies translate into higher representation of females in academic positions is an open empirical question which this paper seeks to inform.

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 and Biomedical Research Units. A silver award is a demanding requirement. At the time of the announcement in July 2011, there were only 5 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, 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 lectures. Beyond the implications for policy setting in UK medical schools, these findings contribute to the literature in labour economics concerned with the equality of opportunity of female employment in high skilled professions and the debate over how best to address shortcomings in the labour market, be it through self-regulatory voluntary initiatives such as Athena SWAN or more formal legislative options such as mandatory quotas.

The paper proceeds as follows: an outline of the institutional context is provided below, before presenting descriptives of the data in section 2, the econometric methods relating to the two natural experiments in section 3, the results in section 4 and some concluding remarks in section 5.

1.1 Institutional background and Athena SWAN

There are 35 academic institutions with a medical school in the UK (see appendix), employing 3,133 full time equivalent clinical academics (3,453 individuals). These clinical academics, research, teach and practice medicine. There is a clear hierarchy in authority and pay grade. Professors represent the highest level of authority and command the highest pay, followed by readers, senior lectures and lecturers. There are also specialised research posts which are paid less than or similar to a lecturer but do not carry any teaching responsibilities.

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. To be eligible for an Athena SWAN award, a medical school's governing institution (i.e. the associated university) must be signed up to the Athena SWAN Charter. The charter is managed by the Equality Challenge Unit (ECU) and funded by the Royal Society, the Biochemical Society, the Department of Health, the Scottish Funding Council, the Department for Business, Innovation and Skills and the Higher Education Authority (Ireland). As such, Athena SWAN represents a non-legislative intervention, in contrast to mandatory quotas, which, for example, were introduced for Norwegian executive directors in 2005 (Bertrand et al., 2014).

The Charter was introduced in the UK in 2005 and institutions signed up at various points until 2011 when the last institutions (with a medical school) signed up. Participation in Athena SWAN is voluntary and schools (and sub-departments within the school) may be rewarded with 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 'solid foundation of policies and practices to eliminate gender bias and an inclusive culture that values female staff'. At the time of writing, no medical school holds a Gold award which would represent 'significant and sustained progress and achievement'.

The ECU commissioned a report into the impact of Athena SWAN in higher education in 2013 (Munir et al., 2013). The report surveyed 114 UK departments from Science, Technology, Engineering, Mathematics and Medicine 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 was 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, albeit the report also identified a number of outstanding shortcomings.

This paper adopts a substantially different approach to Munir et al. (2013). First, the focus here is exclusively on medical schools. 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 the descriptive comparisons in Munir et al. (2013) 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.

2 Data

The data on clinical academic employment used in this study 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[5] 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 (lecturer, senior lecturer or professor), 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 ethincity[6]. The data was then aggregated by the author at the level of the medical school, resulting in a panel dataset at the level of the school. Information relating to the medical school's 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.

The panel identifier is the academic institution (N=35) or 'school'. Here, the terms are interchangeable. However, some academic institutions have more than one medical *department* (see appendix). The MSC data count the population of employees from all medical departments within each academic institution. As such, one 'school' will contain the count of clinical academics from all its medical departments. Athena SWAN status is assigned separately at the level of the academic institution and at the level of each medical department.

Table 1 presents the employment rates of women in UK medical schools. Employment in UK medical schools marginally increases over this period by 137 FTEs with female employees occupying an increasingly greater proportion of the available positions. From 2004 to 2013, the number of clinical academic positions occupied by females increased by 6.33 percentage points, or 32.42% in relative terms. While the 'leaky pipeline' is evident by a 10% point decline in female participation across each level of seniority, 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.

[5] 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.

[6] Information on ethnicity is not available until 2005. See (Medical Schools Council, 2014) for full details of the data collection methods.

Table 1: Trends in Clincial Employment

		% 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%

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).

Table 2: Trends 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. The medical school's governing institution (i.e. the associated University) must sign up to Athena SWAN, before the medical school can apply for an award.
2. School awards are credited to medical departments. There can be more than one medical department per institution. In such cases, the date of award to the department who's 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.

Table 2 shows the adoption Athena SWAN by UK medical schools and their associated university. Clearly, 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. However, it is interesting that it is not until 2009 when the first medical department is awarded bronze status and there are only four departments with silver status in 2011. It is in this year, that the NIHR announced that future awards of research certain funds will be tied to Athena SWAN silver status. Since this announcement 27 medical schools have achieved a bronze award and 17 have achieved a silver award. Therefore, the possibility that the announcement of funding is a relative identifier for an institution's incentive to participate in Athena SWAN is not without foundation in these basic descriptives.

Table 3: 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.

Table 3 shows differences in female employment between treated and control medical schools. Treated schools (N=12) are those whose governing institution (i.e. the associated University) signed up to the Athena SWAN Charter in 2005. It is 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-difference tests, will seek to formally confirm or refute this hypothesis.

3 Methods

In this paper, two difference-in-difference (DiD) experiments will be 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. This section will outline the econometric methods for conducting these DiD experiments. 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 any have influence over the university's selection into Athena SWAN. 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 experiment will consider 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 will be 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. Although α_i is unobserved (and potentially correlated with D_{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-Difference). With more than two periods (as in this case) estimation of ϕ is achieved by interacting the treatment identifier with the year dummies.

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[7]. For example, if some medical schools and their associated university were already pursuing a progressive gender policy, and this led to the university to select into Athena SWAN and cause higher *change* in y_i over the DiD period, then estimation of ϕ would be biased upwards. To examine if this is the case, we can test for common trends over the two years of data prior to the Athena SWAN treatment[8]. Two years of data is the minimum required to test for common trends and ideally a longer series should be inspected. However, when estimated in section 4, ϕ is not positive, hence upward bias from uncommon trends is unlikely to be driving the result here. A stronger case for common trends can be made with respect to the second experiment, as a longer time series prior to treatment is available.

A second assumption requires the treatment which the treated group received did not spillover into the group that is considered to be untreated. For example, it is conceivable that schools that were treated with Athena SWAN 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 greater concern for the DiD than uncommon trends. However, to render the estimation of ϕ inconsistent, the spillover must take place during the period over which the DiD is estimated (which is relatively short). Moreover, there is a rich literature in economics that argues knowledge spillovers are 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. Moreover, by interacting this distance with female participation at the school's peers over time, we can directly control for the influence of each treated schools' best practice on each untreated school.

3.2 The funding announcement in 2011

The second experiment will assess 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. Specially, no medical school will be short-listed

[7]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.

[8]The Athena SWAN charter was introduced in June 2005. The 2004 and 2005 years in our dataset are considered pre-treatment as they are to the years ending 31st July. Given that employment contracts are likely to lag significantly, it is safe to consider the 2005 year as prior to the treatment.

for a NIHR research award unless the school itself has obtained an Athena SWAN silver award. An important feature of this treatment is that it applies to the population of UK medical schools. Anecdotal evidence, together with the timing of many of the medical school bronze and silver awards shown in table 2 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. Fortunately, (from a methodological perspective) 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. In addition, the announcement could be more critical for those in possession of an existing BRC (or BRU) than schools that have little history of funding from the NIHR. The schools that are further away from silver status and/or more reliant on funding, can be considered to be more constrained by the announcement. Consequently, if Athena SWAN matters for female employment, a larger reaction is expected among those schools that are more constrained by the announcement.

There are four variables available that could identify the force of the treatment on the schools. The first three proxy for a similar attribute, namely the distance of the school from silver status. These are 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. A simple way to incorporate these variables into a DiD regression is to consider each variable as a possible treatment and estimate equation 2 three times, remembering to expect a larger reaction from the non-treated schools.

While this may be sufficient for our purposes, a more sophisticated approach would be to instrument these variables with another variable that is correlated with these measures of distance from silver status. One concern with incorporating the variables directly into equation 2 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. Such a variable is said to be 'endogenous'. Instrumenting distance with another variable that is related to distance, but unrelated to the managerial choices on employment in 2011 is common econometric strategy to mitigate these types of problems. This is known as the instrumental variable (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. If this variable is sufficiently correlated with the proxies for distance from silver status and if one accepts the logic that this is unlikely to be related to management decisions on female employment in 2011 (other than through the specific mechanism of being part of Athena SWAN) then the instrument is said to be '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 for female participation 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 known as two-stage least squares. 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 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:

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

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

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

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).

The fourth proxy for the force of the treatment on the schools are the current holders of the NIHR's Biomedical Medical Centres and Units. These institutions and the value of the BRUs and BRCs are identified in table A2. To the extent that the announcement was unanticipated, the response in female employment can be identified with the DiD method shown in equation 2. The important identifying assumption in this case is common trends. In particular, a major concern might be that BRU and BRC holders manage their share of female employment more actively before the 2011 announcement, in anticipation of it. If this is the case, 2 will not identify the causal effect. However, the long time series prior to 2011 in the data allows the common trends assumption to be rigourously tested.

4 Results

Table 4 shows the results of the first difference in difference 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 satisfied. The 2006 year coefficient identifies the two period difference-in-difference. 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[9]. 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. This is consistent with the absence of any significant differences between treated and untreated schools in the descriptive section above.

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-difference experiment.

Table 5 shows the results of the second difference-in-difference 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. As described above, the estimation strategy is to use pre-announcement variation in Athena SWAN status to identify which

[9]Albeit, any unobserved fixed effect is already eliminated and unobserved time-varying drivers of female employment will only bias the estimate if they vary systematically between the treated and untreated controls.

Table 4: 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 difference. 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.

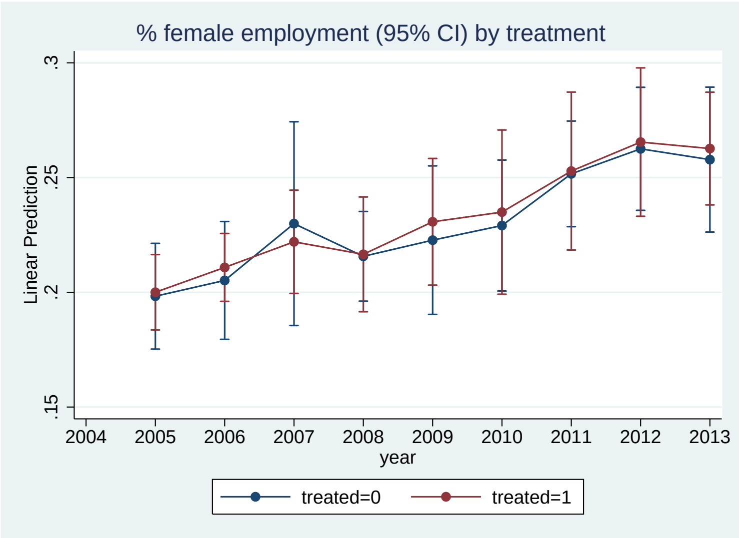
Table 5: The impact of 2011 NIHR funding announcement on Medical School Gender Diversity

	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 treatment with a variable that is correlated with the treatment identifier in 2011 but assumed to be unrelated to the managerial decisions on employment in 2011. This instrument is the treatment from the first experiment, namely whether the school's governing institution signed up to Athena SWAN in 2005.

Fig. 1: No impact of Athena SWAN on female employment

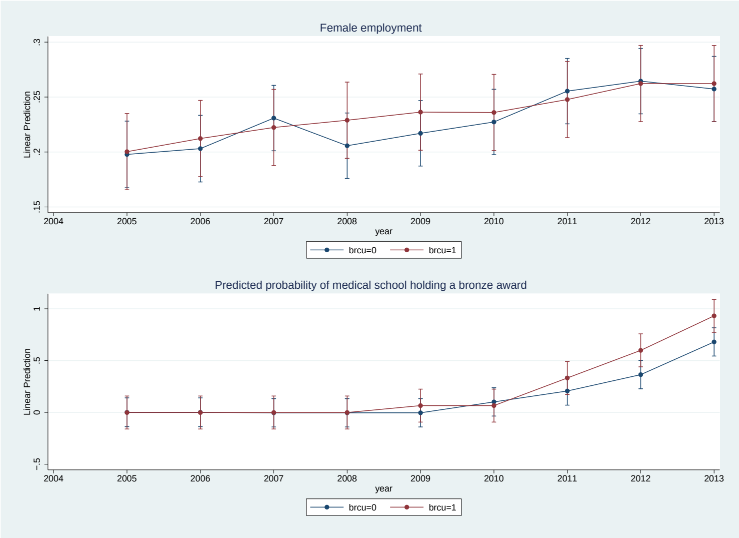


The graph shows that while the trend in female employment is positive over the period in which Athena SWAN has been introduced, there is no substantive difference between the school's whose governing institution signed up for Athena SWAN in 2005 and those that did not. The graph was produced using *marginsplot* 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.

schools were more constrained by the announcement. Reading across columns (1) to (6), 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 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). Recall that a school that does *not* have these attributes is considered to be more constrained by the announcement and is predicted to have a bigger reaction to the announcement.

As before the general trend in female employment over the sample period is identified by the year variables under *All Schools*. 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, none of the treated year interactions are statistically significant, indicating that treated schools did not react to the announcement in 2011 differently to the untreated schools. The negative coefficient on 2012 column (5) could suggest of a 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

Fig. 2: Current Biomedical Research Centre and Unit Holders



itself. Rather, it 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.

4.1 Further experiments and robustness checks

In this section, a number of further specifications are estimated to help establish the robustness of the findings above. The main findings have focused on the experience of all women at all levels employment, being the most comprehensive measure of employment available. However, by modifying the estimating equation, more nuanced aspects of this section of the labour market can be explored. Specifically, the following enhancements are considered:

1. Count models of female FTEs

2. The age compositions of female employment

3. Part-time female employment
4. Medical specialities
5. Proportion of posts that are NHS funded
6. London vs rest of the UK

In tables 4 and 5 the dependent variable was the percentage of females employed in each school-year. This is the most intuitive measure to consider when estimating the share of female employment. However, this variable increases both when a female academic clinician is appointed or when a male academic clinician leaves. Instead, the impact of Athena SWAN can be considered by focusing exclusively on female employment. Thus the dependent variable can be modified to a count of females employees, controlling for the size of the school with a count of male employees on the right hand side of the estimating equation. There are two standard models of count data which can easily be adapted to replicate the experiments above. These are the fixed effects panel versions of the poisson model and the negative binominal model. Neither of these models produced a result that is qualitatively different to those in tables 4 and 5. Consistent with the results of those experiments, none of the estimated treatment-year interactions were statistically significant under either the poisson or the negative binomial [10].

The 'leaky pipeline' is the tendency of female academics to drop out of the labour market at a faster rate than male academics. As a result, the average age of male academics is higher than female academics, even when controlling for the job grade (professor, senior lecturer etc) (Medical Schools Council, 2014). If Athena SWAN has been successful in arresting the leaky pipeline, the treated schools should have experienced a rise in the average female age to a greater extent than the untreated schools. However, this does not appear to be the case. The treated group of schools have an average age of female employees that is consistently below the average age of female employees in untreated schools. This can be seen in figure A1.

Athena SWAN recognises that female employees are more likely to work part-time than male employees and the over-representation of women in part-time roles is a significant obstacle to gender equality. Over the last ten years, part-time work has become more common amongst both male and female employees. In 2013, over 40% of female clinical academics in the data were part-time whereas 16% of male clinical academics were part-time. Several policies have emerged out of the adoption of Athena SWAN which are specifically targeted at ensuring a viable career path for female employees who opt for part-time employment at some stage of their career. These include flexible arrangements with respect to key meetings and maternity cover. In the MSC dataset, part-time employees are identified as working between 0.1 and 1 of a FTE. Therefore, the difference between treated and untreated schools can be analysed

[10] Output omitted for brevity but available upon request.

with respect to part-time employment. Figure A2 describes an increase in the trend towards part-time employment of female clinicians. However, whilst the point estimates of the treated schools lie above the untreated schools for most of the sample period, the differences are not statistically significant. This result should be cautioned because it is unclear precisely how Athena SWAN is expected to impact the level of female part-time employment. It could be that, in addition to any increase in part-time employment, changes resulting from Athena SWAN adoption allow female employees who would otherwise have chosen to work part-time to, in fact, work full time. However, while this remains a possibility, given the earlier findings with respect to the employment of all employees, it appears unlikely that there are many part-time female workers upgrading to full-time employment in Athena SWAN institutions.

The Royal College of Physicians (Elston, 2009) and the Medical Schools Council (2014) have suggested that female clinical academics tend to select into medical specialities that are 'people orientated' and 'plannable'. For example, approximately 57% of employees in medical education are women, whereas only 13% of surgeons are women. It is interesting to consider whether the impact of Athena SWAN varies by speciality. However, like part-time employment, it is unclear *ex-ante* whether female-friendly specialities would experience a bigger or smaller reaction to the introduction of Athena SWAN. On the one-hand, resistance to the introduction of progressive policies is expected to be smaller in specialities where women are already well represented, but on the other hand, the scope for redressing imbalances with respect to gender equality is greater in specialities where women are under-represented. Figure A3 shows that the increase to female employment occurred similarly in both female-friendly specialities and traditionally male dominated specialities. In terms of the reaction to Athena SWAN, treated schools saw a bigger increase with respect to traditionally male dominated specialities than female-friendly specialities. Although the differences are not large enough to be statistically significant for any one particular year, the overall trend suggests at some success for Athena SWAN in breaking into traditionally male dominated specialities.

An alternative measure of the extent of reliance on NIHR funding is to consider posts funded by the NHS. The data supplied by the Medical Schools Council breaks down the FTE employment in UK medical schools into three categories: those posts funded by the Higher Education Funding Councils (43%), posts funded by the NHS (44%) and other sources such as charities and endowments (13%). Many of NHS posts, (although in the data it is not possible to identify which ones) will have been funded by the NIHR. Schools with a BRU and BRC are very likely to have a high proportion of NHS post. In addition, the NIHR's Integrated Academic Training Pathways provides a small number of funded posts in England (Medical Schools Council, 2014). As such the NIHR's funding announcement could be considered to affect schools with a greater number NHS posts. The easiest way to exploit this information is to identify schools with a high proportion of NHS posts (e.g. above the 50th percentile) and incorporate this identifier directly into D_{it}. Alternatively, the IV approach could be used but in this case there is not an obvious available instrument. Instead, lagged values of NHS posts can be used. To the extent that these values are correlated with a reliance on NIHR funding in 2011 but uncorrelated with decisions on female employment in 2011 then they can also be considered to be valid instruments. A convenient feature of the panel data is that there are several lagged values of the proportion of NHS posts readily available. A weighted average of these lagged values can be incorporated in an estimation framework known as generalised methods of moments (GMM). One advantage of the GMM approach is that a because there are multiple instruments, a statistical test on the validity of the joint-set of instruments can be used (the over-identification test). A perceived weakness of this approach is that the identification is driven by the statistical relationships present in data, rather than clear economic intuition. Indeed, it is possible that high levels of NHS funding in the past might have direct effects on how female employment evolves in the school. Such an effect compromises the appropriateness of using lagged values as instruments. As such, it is best to interpret the GMM result with a degree of caution, albeit here the GMM result is consistent with the other results in this paper.

The results relating to NHS posts are shown in table 6. A more direct method of incorporating the information on NHS posts is to incorporate it as a continuous variable which proxies the degree of exposure to the 2011 announcement. To simplify the analysis, we can split the time period into two; a pre and post treatment period. This is shown in column (3) of table 6. An additional check is to interact the measures of distance from silver status used in table 5 with the proportion of NHS funded posts. The combination of these attributes could reasonably proxy a school's exposure to the 2011 announcement. The results are shown in column (4) of table 5. None of these additional experiments finds a statistically significant result on the post-treatment difference-in-difference coefficients.

The market for academic clinicians in London might operate differently to the rest of the UK. A high concentration of medical schools in a relatively small geographical area, together with a diverse demographic and high incomes has led some to conjecture that labour markets in London in general are more competitive. This is particular relevant given the earliest economic theory of discrimination argues that discrimination is more costly and therefore less likely to persist in competitive markets (Becker, 1957). The raw descriptives also suggest that London is different. The mean share of female employment in London in the sample period is 26.3% compared to 21.9% in the rest of the UK ($p<0.01$). However, when the fixed effect of being in London is controlled for in the regression figure A4 shows that there is no difference between the London institutions and the rest of the UK in terms of their reaction of Athena SWAN over the sample period.

Table 6: Using % of NHS funded posts as a proxy for reliance on NIHR funding

	NHS Posts Binary FE	GMM	Continuous FE	Exposure FE
	(1)	(2)	(3)	(4)
Pre-treatment, treated year interactions				
2005	-0.031	-0.028		-0.047
	(-1.66)	(-1.50)		(-0.97)
2006	-0.041**	-0.033		-0.038
	(-2.09)	(-1.28)		(-0.67)
2007	-0.039	-0.056*		0.052
	(-1.23)	(-1.67)		(1.03)
2008	0.0002	-0.041		0.06
	(0.01)	(-1.41)		(0.99)
2009	0.0038	-0.032		0.012
	(0.13)	(-1.29)		(0.16)
2010	-0.0032	-0.015		0.015
	(-0.11)	(-0.48)		(0.23)
2011	0.011	-0.0061		0.099
	(0.52)	(-0.15)		(1.56)
Post-treatment, treated year interactions				
2012	0.0029	-0.0075		0.092
	(0.14)	(-0.20)		(1.19)
2013	-0.0026	0.002		0.017
	(-0.12)	(0.052)		(0.16)
Post treatment			0.019	
			(0.43)	
School FE	Yes	Yes	Yes	Yes
N	337	337	337	337
No. Schools	35	35	35	35

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 of the treatment. The treated group in columns (1) and (2) comprise the top 50% of schools in terms of NHS funded posts. Column (3) uses the % NHS funded posts as a continous variable and interacts this with the post 2011 period. Column (4) proxies for the exposure of the schools by interacting the school's distance from silver status with the % NHS funded posts.
2. Each column also included year dummies for all schools in the regression (as in tables 4 and 5) but the output is omitted for brevity.

5 Conclusion

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 charter or the announcement of 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 it is clear that true equality for clinical academics in medicine is unlikely without continued oversight and action from the ECU.

An important caveat to the findings herein is that the long term impact of Athena SWAN on UK medical schools can not be identified until further time elapses. The first round of funding to be awarded by the NIHR, with the requirement of Athena SWAN silver status will take 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 the precision of the estimates are 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.

A third caveat is that the absence of a strong 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, there is qualitative evidence to suggest that the perception of the equality of opportunity has improved since the introduction of Athena SWAN (Munir et al., 2013). However, whether or not this perception eventually translates into a higher share of female employment in the top academic medical positions is unlikely to be identified until several years hence. Therefore, this is left for future work.

Appendix

Athena SWAN Charter principles

To be eligible for an Athena SWAN award, an institution must become a member of the Charter. The six Charter principles are as follows:

1. To address gender inequalities requires commitment and action from everyone, at all levels of the organisation
2. To tackle the unequal representation of women in science requires changing cultures and attitudes across the organisation
3. The absence of diversity at management and policy-making levels has broad implications which the organisation will examine
4. The high loss rate of women in science is an urgent concern which the organisation will address
5. The system of short-term contracts has particularly negative consequences for the retention and progression of women in science, which the organisation recognises
6. 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

Source: Equality Challenge Unit: *http://www.ecu.ac.uk/equality-charter-marks/athena-swan/about-athena-swan*

Table A1: UK Medical Schools

Institution	Department
Cardiff University	Medical School
Durham University	Department of Medicine, Pharmacy & Health
Imperial College London	Department of Medicine
King's College London	Faculty of Life Sciences & Medicine
Keele University	School of Medicine
Lancaster University	Faculty of Health and Medicine
Liverpool School of Tropical Medicine	Medical School
London School of Hygiene and Tropical Medicine	Multiple
Newcastle University	Multiple
Plymouth University	Peninsula School of Medicine
Queen Mary, University of London	School of Medicine
Queen's University Belfast	School of Medicine, Dentistry & Biomedical Sciences
St George's, University of London	Medical School
SWANsea University	College of Medicine
University College London	Medical School
University of Aberdeen	The School of Medicine & Dentistry
University of Birmingham	College of Medical and Dental Sciences
University of Bristol	School of Clinical Sciences
University of Brighton and the University of Sussex	Brighton & Sussex Medical School
University of Cambridge	School of Clinical Medicine
University of Dundee	School of Medicine
University of East Anglia	Norwich Medical School
University of Edinburgh	Multiple
University of Exeter	Exeter Medical School
University of Glasgow	School of Medicine
University of Leeds	School of Medicine
University of Leicester	Multiple
University of Liverpool	Multiple
University of Manchester	School of Medicine
University of Nottingham	Multiple
University of Oxford	Multiple
University of Sheffield	The Medical School
University of Southampton	Faculty of Medicine
University of St. Andrews	School of Medicine
University of Warwick	Warwick Medical School
University of York	Hull York Medical School

1. The medical schools' governing institution (i.e. the associated University) must sign up to the Athena SWAN Charter, before the medical school can apply for an award.

2. In the case where a university has more than one medical department and so potentially more than one Athena SWAN award relating to medicine, the award relating to the department who's description of activity most closely matched those of a medical school was taken. Where this was ambiguous, the earliest Athena SWAN award at each level was taken.

Table A2: Current NIHR Biomedical Research Centres and Units

	Academic Institution	Value (£)
BRC		
Cambridge Biomedical Research Centre	University of Cambridge	110,073,288
Great Ormond Street Biomedical Research Centre	University College London	35,660,795
Guy's and St Thomas' Biomedical Research Centre	King's College London	58,724,775
Imperial Biomedical Research Centre	Imperial College London	112,992,915
Moorfields Biomedical Research Centre	UCL Institute of Ophthalmology	26,548,596
Newcastle Biomedical Research Centre	Newcastle University	16,636,125
Oxford Biomedical Research Centre	University of Oxford	97,988,771
Royal Marsden Biomedical Research Centre	Institute of Cancer Research	61,543,735
Southampton Biomedical Research Centre	University of Southampton	9,677,372
Maudsley Biomedical Research Centre	King's College London	48,873,298
UCL Hospitals Biomedical Research Centre	University College London	98,204,505
BRU		
Barts Cardiovascular Biomedical Research Unit	Queen Mary (London)	6,557,380
Birmingham Liver Biomedical Research Unit	University of Birmingham	6,561,700
Bristol Cardiovascular Biomedical Research Unit	University of Bristol	6,970,180
Bristol Nutrition Biomedical Research Unit	University of Bristol	4,500,000
Cambridge Dementia Biomedical Research Unit	University of Cambridge	4,500,000
Leeds Musculoskeletal Biomedical Research Unit	University of Leeds	6,675,334
Leicester Cardiovascular Biomedical Research Unit	University of Leicester	6,559,020
Leicester-Loughborough Diet, Lifestyle & Physical Activity BRU	Loughborough University	4,500,000
Leicester Respiratory Biomedical Research Unit	University of Leicester	4,500,000
Liverpool Pancreatic Biomedical Research Unit	University of Liverpool	6,563,040
Manchester Musculoskeletal Biomedical Research Unit	University of Manchester	4,950,000
Maudsley Dementia Biomedical Research Unit	King's College London	4,500,000
Newcastle Dementia Biomedical Research Unit	Newcastle University	4,500,000
Nottingham Hearing Biomedical Research Unit	University of Nottingham	6,257,280
Nottingham Digestive Diseases Biomedical Research Unit	University of Nottingham	7,199,341
Oxford Musculoskeletal Biomedical Research Unit	University of Oxford	9,794,722
Royal Brompton Cardiovascular Biomedical Research Unit	Imperial College London	9,740,780
Royal BromptonRespiratory Biomedical Research Unit	Imperial College London	9,735,620
Southampton Respiratory Biomedical Research Unit	University of Southampton	7,314,600
Queen Square Dementia Biomedical Research Unit	University College London	4,500,000

1. Source: NIHR: *http://www.nihr.ac.uk/about/biomedical-research-centres.htm*
2. Current NIHR grant holders have funding for five years from 1st April 2012.

Fig. A1: Average age of female employment

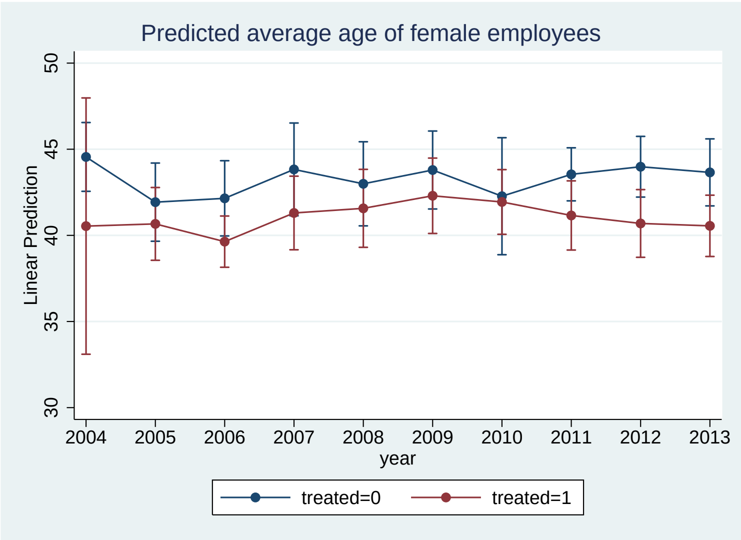


Fig. A2: Part-time employment of women

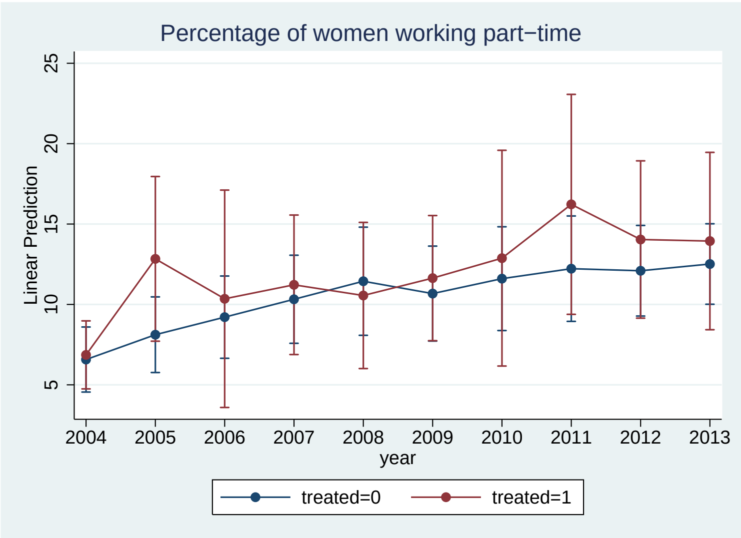


Fig. A3: Female Employment by Specialities

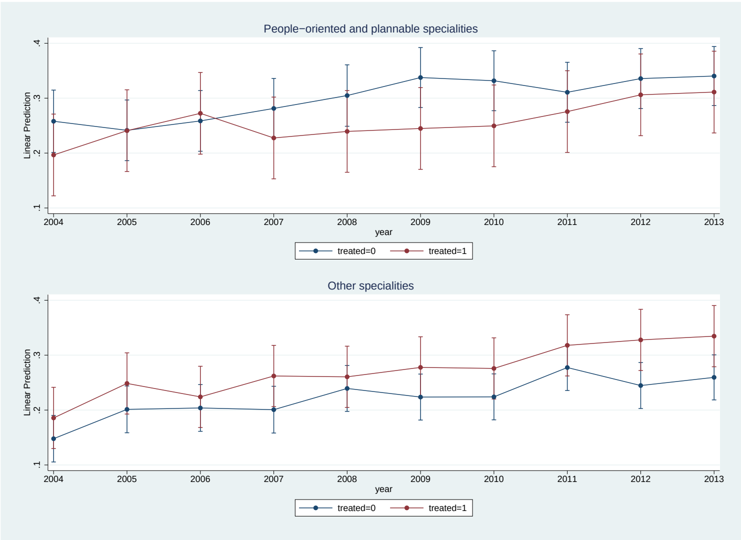
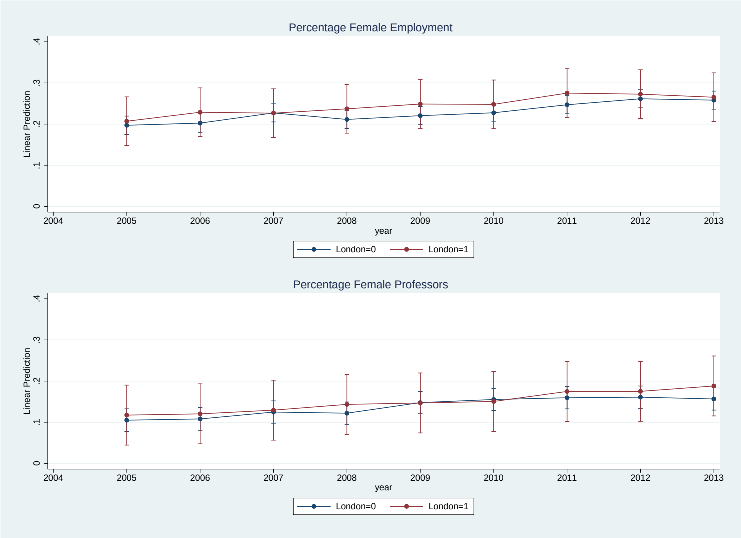


Fig. A4: London vs Rest of the UK



References

Ahern, K. R. and A. K. Dittmar (2012). The changing of the boards: The impact on firm valuation of mandated female board representation. *The Quarterly Journal of Economics 127*(1), 137–197.

Audretsch, D. B. and M. P. Feldman (1996). R&D spillovers and the geography of innovation and production. *The American Economic Review 86*(3), 630–640.

Becker, G. S. (1957). *The Economics of Discrimination*. University of Chicago Press.

Bertrand, M., S. Black, S. Jensen, and A. Lleras-Muney (2014). Breaking the glass ceiling? The effect of board quotas on female labor market outcomes in Norway. *National Bureau of Economic Research Working Paper Series*.

British Medical Association (2009). Equality and diversity in UK medical schools. Technical report, British Medical Association.

Cameron, A. C. and P. K. Trivedi (2005). *Microeconometrics: methods and applications*. Cambridge University Press.

Castilla, E. J. and S. Benard (2010). The paradox of meritocracy in organizations. *Administrative Science Quarterly 55*(4), 543–676.

Clark Blickenstaff, J. (2005). Women and science careers: leaky pipeline or gender filter? *Gender and Education 17*(4), 369–386.

Elston, M. A. (2009). Women and medicine: The future. Report, Royal College of Physicians.

European Union (2012). Women in economic decision-making in the EU: Progress report. a Europe 2020 initiative. Technical report, European Union, Commission Staff Working Document, Luxembourg: Publications Office of the European Union, 2012.

Geddes, L. A. and J. S. Heywood (2003). Gender and piece rates, commissions, and bonuses. *Industrial Relations: A Journal of Economy and Society 42*(3), 419–44.

Gneezy, U., M. Niederle, and A. Rustichini (2003). Performance in competitive environments: Gender differences. *The Quarterly Journal of Economics 118*(3), 1049–1074.

Gregory, A., E. Jeanes, R. Tharyan, and I. Tonks (2013). Does the stock market gender stereotype corporate boards? evidence from the market's reaction to directors' trades. *British Journal of Management 24*(2), 174–190.

Guvenen, F., G. Kaplan, and J. Song (2014). The glass ceiling and the paper floor: Gender differences among top earners, 1981-2012. *National Bureau of Economic Research Working Paper Series*.

House of Commons (2014). Women in scientific careers. Report, House of Commons Science and Technology Committee.

Kanter, R. M. (1997). *Men and Women of the Corporation*. New York: Basic Books.

Kulich, C., M. K. Ryan, and S. A. Haslam (2007). Where is the romance for women leaders? The effects of gender on leadership attributions and performance-based pay. *Applied Psychology 56*(4), 582–601.

Lee, P. M. and E. H. James (2007). She'-e-os: Gender effects and investor reactions to the announcements of top executive appointments. *Strategic Management Journal 28*(3), 227–241.

Medical Schools Council (2014). A survey of staffing levels of medical clinical academics in uk medical schools as at 31 july 2013. A report by the medical schools council. Technical report, Siobhan Fitzpatrik.

Mincer, J. and S. Polachek (1974). Family investment in human capital: Earnings of women. *Journal of Political Economy 82*(2), S76–S108.

Munir, F., C. Mason, H. McDermott, J. Morris, B. Bagihole, and M. Nevill (2013). Advancing women's careers in science, technology, engineering, mathematics and medicine: Evaluating the effectiveness and impact of the Athena SWAN charter. Report, Loughborough University.

Powell, G. N. and D. Butterfield (1994). Investigating the 'glass ceiling' phenomenon: An empirical study of actual promotions to top management. *Academy of Management Journal 37*, 68–86.

Reichenbach, L. and H. Brown (2004). Gender and academic medicine: Impacts on the health workforce. *British Medical Journal 329*(7469), 792–795.

Ryan, M. K. and S. A. Haslam (2005). The glass cliff: Evidence that women are over-represented in precarious leadership positions. *British Journal of Management 16*(2), 81–90.

Ryan, M. K., S. A. Haslam, M. D. Hersby, and R. Bongiorno (2011). Think crisis-think female: the glass cliff and contextual variation in the think manager-think male stereotype. *Journal of Applied Psychology 96*(3), 470–484.

Stevenson, B. (2010). Beyond the classroom: Using title ix to measure the return to high school sports. *The Review of Economics and Statistics 92*(2), 284–301.