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Gender pay and productivity in UK universities: Evidence from research-intensive Business Schools

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ABSTRACT

Women academics earn less than men, even after controlling for a range of productivity-related covariates. However, the latter usually do not include direct measures of research productivity. This paper uses data from the Higher Education Statistical Authority (HESA) confirming the existence of unconditional and conditional gender wage gaps. Data separately collected for the recent 2021 Research Excellence Framework (REF) shows men are more research productive but that after controlling for academic grade there is no gender productivity gap. For both wage and productivity gaps, there are barriers for women to achieve the research productivity needed to be promoted, and reducing these would go a long way to eliminating such gaps.

1. Introduction

The extant literature shows males are paid more than women, including in academia (e.g., Ceci et al., 2014, for the U.S.; and with respect to economics Mumford and Sechel, 2020; Gamage et al., 2020, for the UK), even after controlling for observable productivity-related characteristics. This gender wage-gap likely results from both actual (unobservable) productivity differences, and such factors as (statistical) bias/discrimination that arises within a male-dominated culture that leads to stereotyping, even when productivity is the same for comparable sub-groups (Della Giusta and Bosworth, 2020).

Productivity differences potentially occur if family commitments lower the time females allocate to research activities (Probert, 2005; Mason et al., 2013; Winslow and Davis, 2016). As pointed out by Goldin (2014, p. 1094), "…winner-take-all positions, such as … tenured professor at a university …are … positions for which considerable work hours leads to a higher chance of obtaining the reward". Bias/discrimination factors, likely to mitigate against career advancement, include women being perceived as more conscientious and compliant (Eswaran, 2014), and less willing to compete (Buser et al., 2014), while (alpha) men are more 'pushy and ambitious', rate their work more highly, and when women internalise such prevailing cultural norms and stereotypes it often has negative outcomes (they are seen as 'aggressive' – Monroe, 2013). In general, prestige factors associated with academic advancement are more likely to be established and acquired by male academics (Coate and Howson, 2016).

Firstly, we measure (unconditional and conditional) gender wage-gaps for 24 research-intensive universities. The data used lacks a direct measure of research productivity. Secondly, using separate data for Durham University, we measure and rank research outputs to determine whether there was a gender gap in research productivity. From the first approach, we find women academics earn less than men, even after controlling for a range of productivity-related covariates, but when 'balanced' data by academic grade is used the wage gap largely disappears. The second analysis shows men are more research productive but that after controlling for academic grade there is no gender productivity gap.

2. Data and method

Two datasets are used. The first, comprising information on the population of individual staff supplied annually by UK universities to the Higher Education Statistical Authority (see HESA,

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2022), is used to show the extent to which there are gender wage gaps in the 24 research-intensive Russell Group (https://russellgroup.ac.uk/about/) Business Schools (defined here to include Economics).[1] The second dataset comprises information collected for Durham's submission to the 2021 Research Excellence Framework (see REF, 2021) audit that measures and ranks research outputs covering 2014–2020. The latter is used to determine whether there was a gender gap in research productivity.

HESA data limited to Russell Group Business Schools staff (excluding those on a teaching only contract) were used to estimate the following model:

$$\ln \hat{E}_{it} = \alpha + \beta_j(sex_{it} \times year_{it} \times X_{it}) \quad (1)$$

where E refers to full-time equivalent annual earnings for individual i in year t; *sex* is a dummy coded 1 for females[2]; *year* covers the academic years 2005/06 to 2019/20; and X is a vector of covariates comprising productivity-enhancing characteristics such as age (and age-squared), ethnicity, nationality, the proportion of a full-time equivalent (FTE) contract worked (and its squared term), whether promoted in year t, years since last promotion, and length of time working in the university system. A full list of variables is provided in Table A.1 in the Supplementary Appendix. Estimating Eq. (1) produces unconditional (i.e., estimating the model excluding X) and conditional estimates of the gender wage gap. OLS, matching estimators, and random effects were each applied, the latter having the additional benefit of capturing individual-specific differences that should help control for other (unobserved) productivity effects.

The Durham University Business School (DUBS) data for the population of those entered into REF 2021 was used to estimate the following model:

$$\ln \widehat{GPA}_i = \alpha + \beta_k(sex_i \times Z_i) \quad (2)$$

where *GPA* is the grade-point average score for individual i comprising the average scores of their best 5 journal articles over 2014–2020 (using a scale of 1 – denoting nationally recognised – to 4, which equates to 'world-leading'). The score for each paper was obtained from external and (blind) internal reviews of every paper published during the period (external reviews were obtained for all papers internally reviewed as 4, as well as around 25% of those graded 3 and on the margin of a 4, with external scores used in preference to internal scores). The vector Z included (logged) experience (proxied by years as an independent researcher, and experience-squared), ethnicity, nationality, (logged) FTE, and dummies for the department worked in (see Table A.2). An extended version of Eq. (2) was also estimated with dummies included in Z for academic grade (associate professor and full professor).

3. Results

The unconditional and conditional wage gaps obtained from estimating Eq. (1) are reported in Figure A.1 in the Appendix, along with a discussion of the size of these gaps. The underlying marginal effects are reported in full in the Appendix Table A.3; while Table 1 reproduces the marginal effects obtained from OLS estimation of Eq. (1).[3] Some of the major individual results include: female earnings increase at a slower rate with age; men experience larger increases in pay when promoted (the latter also covers institutional moves) and less of a negative effect the longer the period since their last promotion; black and mixed-race males have (relatively) lower wages vis-à-vis whites; and there is some evidence that male US- and EU-nationals do (relatively) better than UK males, while those originating in Muslim/Arabic countries and China/Japan do (relatively) less well.

Table 1
Elasticities[a] ($\partial ln\hat{y}/\partial lnx$) for *ln* earnings 2005/06 to 2019/20: Russell Group Business Schools (inc. Economics) from estimating Eq. (1) using OLS.
Source: Table A.3.

	Male	Female
Female	−0.111***	−0.088***
ln Age	0.895***	0.639***
>1 HEI in any year	0.011	0.002
>1 role in any year	−0.045***	−0.049***
ln FTE	−0.014***	0.018***
ln years in HEI (since 2004/05)	−0.007	0.042***
Promotion (coded 1 in year of promotion)	0.101***	0.069***
ln years since last promotion	0.006	−0.029***
Contract		
Fixed-term	−0.038***	−0.076***
Ethnicity		
Asian	−0.022***	−0.027***
Black	−0.125***	−0.071***
Mixed	−0.091***	−0.064***
Other	0.017**	0.025**
Unknown	−0.055***	−0.068***
Function		
Teaching & research	0.297***	0.229***
National grouping		
USA	0.099***	0.094***
Canada	0.009	0.067***
English medium in HEI	−0.027***	−0.022**
EU pre-2004	0.057***	0.022***
EU accession	0.011	−0.037***
Muslim, Arabic countries	−0.073***	−0.046***
Rest of Africa	−0.001	0.040*
Central & S. America	−0.051***	−0.019
China, HK, Taiwan, Macao	−0.079***	−0.020**
Japan, S Korea	−0.092***	0.045**
Rest Europe	0.011	−0.013
Russia, CIS	−0.057***	−0.071***
Rest Asia	0.028*	0.014
RoW, not known	−0.023**	−0.039***
Cost centre		
Business, Management & Accounting	−0.018***	−0.037***
Year dummies	Yes	Yes
N	35,199	16,706
$\bar{R}^2$	0.561	

[a]For discrete (dummy) variables the estimates need to be converted to $e^{\hat{\beta}} - 1$.
***/**/* significant at 1/5/10% levels (robust SE).

Fig. 1 reports the distribution of average GPA scores for the 134 academic staff submitted by Durham to the 2021 REF (unit of assessment 19). It shows that nearly 60% of males had an average GPA of 3 (internationally excellent) based on their best-5 papers, while for females that figure is nearer to 30%. The overall gap (of −0.153 in log terms) is statistically significant at the 5% level. Table 2 shows the marginal effects obtained from estimating Eq. (2); firstly, omitting academic grade the results show that women's GPA was 18% lower,[4] while controlling for academic grade results in a statistically insignificant gender effect. Other marginal effects reported in Table 2 are discussed in Appendix 1, noting here that research productivity is mainly associated with academic grade (e.g., male professors had, *cet. par.*, a GPA some 79% higher than male assistant professors; female professors were over 100%

[1] Separate results for Durham Business School are not reported here as it is a condition of using HESA data that results for individual institutions are not published. When limited to Durham, the results obtained are similar.

[2] The very small number of staff classified as 'other/non-binary' are omitted from the analysis.

[3] Marginal effects were estimated separately for males and females, and therefore use only the characteristics of each sub-group rather than averaging across all individuals.

[4] I.e., $e^{\hat{\beta}} - 1$.

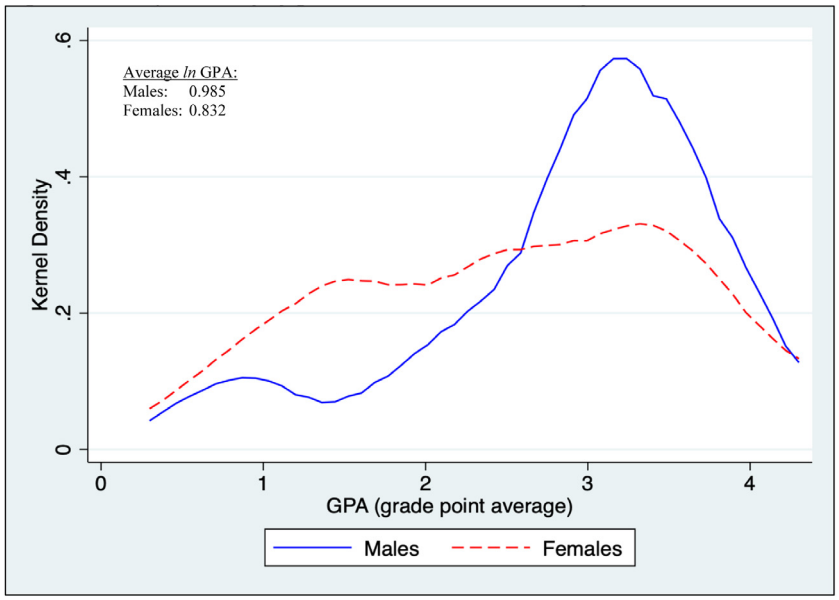

Fig. 1. Research productivity by gender, 2021, Durham University Business School.
Source: Data underlying 2021 REF return.

Table 2
Marginal effects ($\partial ln\hat{y}/\partial lnx$) from estimating Eq. (2) using OLS.[a]

	Males	Females	Males	Females
Female	−0.229**	−0.200**	−0.085	−0.078
Academic grade (benchmark: Assistant professor)				
Associate professor	–	–	0.308***	0.411**
Professor	–	–	0.581***	0.706***
ln Experience	−0.120	0.043	−0.262***	−0.076
ln FTE	−0.175*	−0.119	−0.056	0.102
Ethnicity (benchmark: White UK)				
Other white	−0.169	0.571	−0.097	0.354
Other	0.006	0.332	−0.044	0.130
National grouping (benchmark: UK)				
USA/Canada	−0.250	−0.149	−0.185	0.096
English medium in HEI	0.120	−0.057	0.150	0.127
EU	0.112	0.163	0.225	0.277
Muslim, Arabic countries	−0.188	−0.613*	0.026	−0.397
Rest of Asia	−0.004	0.837*	0.087	0.628*
China, HK, Taiwan, Macao	−0.070	0.505	0.014	0.472*
RoW	−0.472	0.413*	−0.375	0.578***
Department (benchmark: Accounting)				
Economics & finance	−0.172	−0.762**	−0.155	−0.468
Management & marketing	−0.075	−0.197	−0.137	−0.134
N	94	40	94	40
$\bar{R}^2$	0.192	0.192	0.371	0.371

[a]Matching was not feasible due to only 30 observations in each matched sub-group. For discrete (dummy) variables the estimates need to be converted to $e^{\hat{\beta}} - 1$.
***/**/* significant at 1/5/10% levels (robust SE).

more productive), recognising academic promotion is determined over time in large part by research productivity. Thus, as a robustness check, the 9 individuals promoted to full professor during 2014–2020 (14.6% of male, and 15% of female, full professors in 2021) were omitted when estimating Eq. (2) with no significant changes to the results reported in Table 2 (they were also retained with a promotion dummy added with again minimal change).

Lastly, Fig. 2 shows the relative density of females (with males as the reference group). If the two compared distributions are identical, the relative densities will be equal to 1. If the comparison distribution tends to have lower values than the reference distribution, the relative density will be larger than 1 at low values of r and smaller than 1 for large r, where $r = F_Y(y)$ and y is the variable of interest (see Jann, 2021, for more details). Fig. 2 presents both comparisons of (a) *ln* earnings and (b) GPA, showing in the first panel that females are overrepresented in terms of lower earnings and lower GPA and underrepresented at higher levels. The second panels for each variable compare the relative distributions when adjusted (balanced) by academic grade (using a logit matching function); in both diagrams the relative densities are not statistically different to 1 (except at the highest levels of earnings). This suggests that promoting relatively more females to higher grades will significantly reduce the wage and GPA gender gap. Table A.2 shows that 48.9% of DUBS

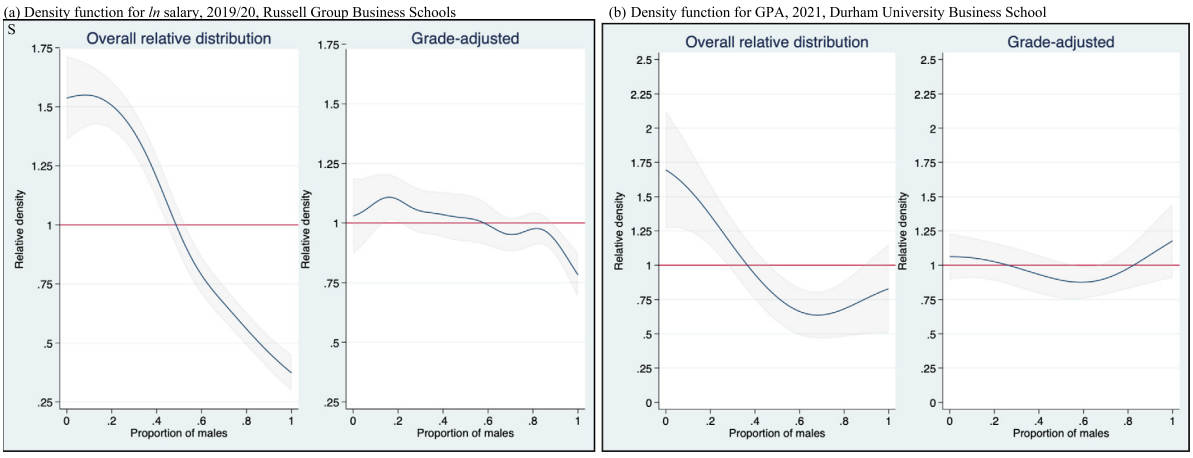

Fig. 2. Relative distribution of academic salaries and GPA. *Source:* Own calculations using (a) individual staff HESA data; and (b) data underlying 2021 REF return.

male staff in 2021 were professors, with only 25.6% of females at full professor grade. Figure A.2 shows the distribution of academic grades by gender for Russel Group Business Schools, with 21.5% of females being professors in 2019/20.

4. Conclusion

Those at higher academic grades on average earn considerably more and are more productive. Male academics in research-intensive Business Schools are over-represented at higher academic grades, and the results presented here generally confirm that earnings and research productivity gaps mostly disappear when grade-balanced gender sub-groups are compared (i.e., conditional wage differences are more likely due to bias/discrimination). The important research issue thus becomes determining which factors (family commitments, biases arising from culture and stereotyping, discrimination, etc.) impede productivity and career advancement for women and how to mitigate them.

Data availability

The data that has been used is confidential.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.econlet.2022.110738.

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