No Fair Sex in Academia: Is Hiring to Editorial Boards Gender Biased?

Abstract

The editorial boards of academic journals overrepresent men, even above their proportion in university faculties. We test whether this sex disparity is caused by anti-female bias, supposing that anti-female discrimination means women must have a higher research output than men to overcome bias against them. We collect a dataset of the research output and sex of 4,319 academics on the editorials boards of 120 journals within four social science disciplines: Anthropology, Psychology, Political Science and Economics. Using a transformation of the *h*-index as our indicator of research output, we find male research output to be 0.35 standard deviations ($p < 0.001$) above female research output. However, the gap falls to 0.13 standard deviations ($p < 0.001$) when years publishing is controlled for. Our results are replicated with alternative dependent variables and using robust regression. We followed up our research with a survey of 231 academics, asking for their attitudes towards discrimination in hiring to editorial boards. Although two-thirds of academics supported no bias, for every 1 academic who supported discrimination in favour of men, 11 supported discrimination in favour of women. Our results were consistent with the hypothesis that academics and journal editors are biased in favour of women, rather than against women.

Introduction

Academics have documented many sex disparities in their occupation that could be suggestive of pervasive anti-female bias. Despite women being more than 50% of undergraduates in many disciplines, they are less likely to go into a career in academia (Ceci et al., 2014), they achieve lower pay and lower rank within academia (Aiston, 2014; Dunkin, 1991; Ginther and Hayes, 1999, 2003; Ginther and Khan, 2004; Santos and Dang Van Phu, 2019), their papers are less likely to be cited (Abramo, et al., 2009; D'Amico et al., 2011; Dion et al., 2018; Huang et al., 2020; Maliniak et al., 2013; Schucan Bird, 2011, Strumia 2021) and they are less likely to win academic awards (Chan and Torgler, 2020; Lincoln et al., 2012). Only 2% of the individuals considered to be 'eminent' in science, prior to 1950, are women (Murray, 2003).

These disparities pose a key question: to what extent do sex biases or sex differences explain different outcomes? Feminist scholars have argued that anecdotal reports of sexism in the lived experience of female academics (Meyers, 2013) and the fact of sex disparities themselves, suggests that academia is systemically sexist. On the other hand, some academics have suggested psychological differences could explain sex disparities.

For example, female graduate students report being less interested in their careers than the male students (Ferriman et al., 2009), a sex difference that also increased with age. Part of this difference in careerism maybe because women have a greater interested in family and family commitments, being more likely to take time off for parental leave (Boston College

Center For Work and Family, 2019) and sick leave (Herr et al. 2020), which has adverse effects on academic career outcomes (Ahmad, 2017).

There is also the potential for intelligence differences to be driving outcomes. For example, Darwin (1871) thought that the great success of men to achieve eminence in academic research (Murray, 2003) could be reflective of differences in intelligence. In meta-analyses (Lynn, 2017, 1994; Lynn and Irwing, 2004), women tend to have lower IQs than men. Furthermore, men also outperform women in general knowledge tests (Tran et al., 2014) which may be particularly useful for academics who have to memorise and synthesise knowledge from prior academic literature. However, the sex differences in intelligence are not absolutely clear cut; in children, boys do not have an advantage in intelligence (Lynn, 2017) and in some cognitive abilities, such as reading ability (Lynn and Mikk, 2009), women outperform men. Nonetheless, men have a higher variance in their intelligence (Baye and Monseur, 2016) which may cause more men to outperform women in intellectually elite occupations such as academia (Nyborg, 2005; O'Dea et al., 2018). For example, Baye and Monseur (2016) find the male variance in the Programme for International Student Assessment tests is 1.17 times the female variance. If we assume aptitude to be normally distributed, this implies that for the 98th percentile score in women, there are twice as many men as women at or above this level of aptitude.

This paper seeks to examine whether hiring to editorial boards in academic journals is sex-biased. Many previous studies on editorial boards show that they overrepresent male academics relative to their proportion in university faculties (eg. Amrien et al., 2011; Cho et al., 2014; Mauleón et al., 2013; Metz and Harzing, 2009, 2012; Morton and Sonnad, 2007; Ioannidou and Effie, 2015; Mazov and Gureev, 2016), indicating hiring to editorial boards could be sex-biased. We contribute to this question by comparing the academic output of men and women who are hired to editorial boards and through a survey of academics on their attitudes towards women in academia.

The editors of journals hire academic experts, usually without pay, to sit on the editorial boards. Academics sitting on editorial boards can perform three main tasks - advising on strategy for the journal, helping in decisions on what to publish and improving the journal's reputation through association (Wiley, 2021). Some longitudinal studies of editorial board membership show that whilst the proportion of women on editorial boards is increasing, this is in parallel if not below the growth in the number of women in academia (Addis and Villa, 2003; Huang et al., 2020; Mauleón et al., 2013; Metz and Harzing, 2012). These studies are focused on certain niches such as journals from Spain or management journals. Nonetheless, if these studies are generalisable, sex representation in editorial boards are not changing over time.

A sex bias in hiring to editorial boards, or anywhere else in academia, may be detrimental to the careers of those being discriminated against and for the quality of scientific research as a whole. The Impact factor of journals has been found to correlate with the research productivity of the members of its editorial board, although not with its sex proportion (Hafeez et al., 2019). This means sex bias could undermine the quality of academic journals. Not being allowed on an editorial board prevents discriminated individuals from this experience as an academic, but it also might have knock-on effects on the careers of these discriminated individuals. Sitting on an editorial board places an academic within a network of high-quality researchers whom you can exchange ideas with or who can help each other in other ways.

A potential consequence of sex bias could be that it distorts scientific output. Addis and Villa (2003) suggest that because the sexes differ in their academic interests, the proportion of women on an editorial board could affect which articles are published. An example of sex differences in academic interest includes men preferring 'thing-oriented topics' over 'people-oriented topics' (Luoto, 2020).

Due to concerns that women are being discriminated against, multiple publishers have asked their journal editors to increase the proportion of women on their editorial boards. For example, *Nature* has been reviewing the sex balance in its journals and asking that editors improve this balance since 2012 (Nature, 2017). More recently both the *Lancet* and *Elsevier* have been urging their editors to improve the sex ratio in their boards (Laudine et al., 2018; Bayazit, 2020; Elsevier, 2021a). To improve transparency, *Elsevier* publishes the sex ratio for each of its journals, which may act as an incentive for editors to increase female representation in order to be seen as more progressive or avoid reputation-damaging accusations of sexism (Elsevier, 2021b).

Attempts to employ affirmative for women on journal boards may be helpful to create a meritocratic representations if they are being discriminated against. However, if women are not discriminated against, affirmative action policies may reduce meritocracy in academia, creating the very problems of discrimination affirmative action was meant to counteract. As such, stronger evidence on whether sex bias is at play is essential for judging whether affirmative action policies can be justified or are counterproductive.

Our first method for investigating the possibility of whether there is bias in hiring to editorial boards is to compare the academic output of men and women who have been hired. A critical trait for being admitted to an editorial board is academic expertise (Lindsey, 1976) which may be measured as research output. All other things being equal, if women are being discriminated against they would have to be more impressive academically to compete with men.

It must be noted that a sex difference in the academic output of editorial board members can only be an indicator, not proof of sex bias. As mentioned, men seem to have a higher variance and average intelligence. This would cause men, on editorial boards, to have a higher academic output even if there was no bias. Thus if women have a higher academic output, despite their lower variance in IQ, we can be confident that there is anti-female bias. We can also say that the larger the sex difference in favour of men, the lower the likelihood of anti-female bias and the higher the likelihood of anti-male bias. So if men have a higher academic output than women we can be confident that there is no extreme anti-female bias.

The reasoning for our test comes from Gary Becker's taste discrimination model of the labour market (Becker, 1971). If an employer has a distaste for one group of employees, but cannot provide them with a different wage rate, he will only hire members of this group that are sufficiently extra productive to outweigh the cost of going against the employer's discriminatory tastes.

This same reasoning has been applied at least once before to editorial boards. Hafeez et al. (2019) found that for Psychiatry journals, despite women publishing half as many papers as men, they served on journals with the same mean impact factor. This result suggests women are not being discriminated against when Psychiatry journal boards hire. The authors also found that when women were in leadership positions the journal was less likely to include women on its editorial and advisory boards. This should not be the case if male academics are more likely to discriminate against women. Hafeez et al. also found that ,despite women being underrepresented on journal boards relative to the proportion of women in Psychiatry, they were represented in equal proportion to their level of seniority in academia. We go beyond this prior paper by testing for sex differences in output, in editorial boards, in a wider range of disciplines.

A similar test for sex bias in hiring was used by Guy Madison and Pontus Fahlman (2020). The authors found women had fewer publications and citations upon becoming assistant professors in Sweden (the equivalent status to professor in the United States). Likewise, Strumia (2021) found male physicists have a greater research output than women before being hired by a university. These results suggest that women are unlikely to be discriminated against in hiring by universities, despite there being more male than female academics. Our paper thus applies the same logic to test whether there might be sex bias in hiring to editorial boards.

However, other research of gender bias and hiring in academia have typically run experiments by asking faculty members to judge the resumes are hypothetical hires. These studies have reported mixed results. Williams and Ceci (2015) asked academics to evaluate hypothetical hires, who were identical except for sex. They found on average university faculty preferred women to men at a 2:1 ratio. Carlsson et al. (2020), using similar methods also found a preference for women. A follow up study (Ceci and Williams, 2015) found no preference for women compared to better qualified men. Quadlin (2018) also asked faculty to evaluate hypothetical hires, and found that amongst highly competent candidates with high GPAs, men were preferred to women at a 2:1 ratio. Suggesting high academic achievement may be more valued in men than in women. Older studies (Foschi and Sigerson, 1994; Steinpreis et al., 1999) focused on hiring to non-faculty positions, such as laboratory manager (Moss-Racusin et al., 2012), and found results consistently in favour of male applicants. A caveat to these resume studies is that sex may be confounded with unobserved ability, making a preference for one sex over another possibly meritocratic.

In our test of whether editorial boards are sex-biased, we decide to use journals from the social science and humanities. Firstly, women make up a higher proportion of these scholars so getting a large sample with enough women may be easier when avoiding STEM disciplines. Secondly, it has been argued that women prefer these less quantitative disciplines (Kahn and Ginther, 2017), and may have less aptitude for STEM disciplines (Reilly and Neumann, 2013; Lord, 1987). If this were true, the effect of higher male performance would be more likely to obscure the effect of anti-female discrimination, making non-STEM disciplines more appropriate for our test. Whether or not women have less interest or aptitude for STEM disciplines, we chose to study social sciences just in case this would bias our results. Thus although we are concerned with gender bias in academia as a whole, our method only focuses on testing this hypothesis within social science disciplines.

We thought it was also important to choose disciplines within a large range of political persuasions in case politics influences bias in hiring to editorial boards. Some research has suggested that right-wingers exhibit an anti-female bias (Austin and Jackson, 2019; Christopher and Mull, 2006; Hodson et al., 2017). Other research finds that left-wingers may be prone to bias towards groups with low status including women (Winegard et al., 2020). Overall this body of research indicates that as one moves politically right one becomes less pro-female and more pro-male. Whilst a large range of disciplines with a very large sample size would be necessary to test whether politics did create biased hiring, having a range of disciplines allows us to be sure that our results are not due to the political confounds of any particular discipline.

We chose four social science disciplines to study: Anthropology, Psychology, Political Science and Economics. These disciplines vary widely in their political persuasions, with economics being the least left-wing and Anthropology being the most left-wing (Langbert, 2020). The ratio of Democrat to Republican faculty members in each discipline is presented in Table 1 below.

Table 1

Political Affiliation of University Faculty

Discipline	**Democrat - Republican Ratio in Faculty**
Economics	5.5:1
Political Science	8.2:1
Psychology	16.8:1
Anthropology	133:1
Source: Langbert (2020)	

There have been many studies on sex representation on editorial boards including in Anthropology (Bruna et al., 2017), Psychology (Evans et al., 2005; Hafeez et al., 2019; Over, 1981; Palser et al., 2021; Robinson et al., 1998), Political Science (Fraga et al., 2011; Palmer et al., 2020) and Economics (Addis and Villa, 2003; Gibbons and Fish, 1991; Mumford, 2016). Anthropology, Psychology and Economic editorial boards tend to slightly underrepresent women relative to the number of academic staff in these fields. This could suggest there is anti-female bias in these journals' boards.

However in Political Science (Fraga et al., 2011; Palmer et al., 2020), Economics (Mumford, 2016) and Psychiatry (Hafeez et al., 2019) editorial board sex proportions have been compared to the sex proportion amongst senior academics, not just the totality of junior and senior staff. When this is done editorial boards have a similar sex proportion to that of senior academics, suggesting editorial boards' apparent sex disparities could be close to the meritocratic ideal.

Data

To choose which journal's editorial boards to study, we employed the website Scimagojr (SCImago Journal & Country Rank, https://www.scimagojr.com/) which contains a dataset of 34,346 journals on their website based on Scopus, Elsevier's abstract and citations dataset. We ranked journals in each of the disciplines we studied according to the number of citations per document they had in a two years. From this ranking, we then took the top 30 journals from each discipline, our results reflect whether there is bias in the elite of each discipline studied.

We disagreed with the discipline label of some of the journals on Scimagojr. For example, some of the 'Economics' journals such as the 'Journal of management' were deemed closer to Business Studies than Economics. Likewise, 'Politics' journals such as the 'Journal of Political Economy' typically only had economists as authors. Nonetheless, the Journal of Political Economy was also classified as an Economics Journal by Scimagojr, a classification we agreed with. Journals not obviously in the correct disciplines were ignored. In table 9 of appendix A, we present a list of all 120 journals used in this study and their respective disciplines.

From the websites of the journals, we recorded members of their editorial boards. The term 'editorial board' had slightly different meanings for different journals. Some used the term to describe everyone working for the journal. Most however used it to label a subsection of the editorial team involved in more advisory work. When there was no subsection of a journal's staff labelled the 'editorial board' we took the relevant subsection that seemed closest in meaning such as 'advisory board'. As such our methodology did not include journal chief editors as part of the editorial board.

In line with the practice of previous research on sex representation on editorial boards, we coded the sex of academics according to whether their names were clearly male or female (eg. Iaonnidou & Rosiana, 2015). When this was not obvious we used Google Search to find their sex from pictures or left the sex variable missing when this was insufficient. Of the 5,625 editorial board members in our dataset, we were unable to determine the sex of 7 individuals.

To measure the productivity of academics on editorial boards we obtained relevant statistics from their Google Scholar page when it was available. These statistics included the publication count, *h*-Index, *i*10 Index, citation count, *h*-Index since 2016 and the citation count since 2016. Furthermore, to control for years publishing in academia we also recorded the year of the researcher's first publication. When the researcher did not have a page on Google Scholar we left these statistics missing.

For ease of interpretation, our measures of academic output were log10 transformed and then scaled into standard deviation units as 'Z scores', according to the mean and standard deviation values for that metric within each journal. This allows us to compare the relative performance of researchers in different editorial boards. For example, a transformed *h*-index of 1 means the researcher's *h*-index is one standard deviation above the mean of the respective editorial board's members. Nonetheless, we also used raw data in the appendix.

All our data was collected between March and June 2021[1]. Although 5,625 editorial board members were recorded, 7 individuals couldn't be identified by sex and a further 1,098 individuals did not have Google Scholar pages. Of the board members recorded 40% were women, but 42% of researchers without Google Scholar pages were women meaning women were slightly less likely to have a Google Scholar page.

Sometimes Google Scholar pages for individual academics contained errors in them. Some papers had the wrong date on them and others were attributed to the wrong author. When a Google Scholar Page included five or more articles with citations that the author had not written, we noted the page as overattributing research to the author. We excluded these 'over-attributed individuals'. When the earliest paper on a Google Scholar page appeared to be of the wrong date or by a different author we made use of the next earliest paper that appeared to be correct.

Despite our attempt to remove academics with exaggerated publication metrics, some unusual results remained. Some academics had higher *h* and *i*10 indexes for the period after 2016 compared to their all-time *h* and *i*10 Indexes. We removed 21 academics because they had higher indexes of academic output for the period since 2016 than they had over all-time. Furthermore, some academics had very large academic outputs. For example, one academic had 2,876 publications, possibly suggesting either errors with Google Scholar, plagiarism or that they mostly relied on co-authors to write the papers. To deal with these extreme values we applied Tukey's Fences to identify positive outliers and removed 44 observations from the dataset.

In deleting observations our data cleaning approach loses information and degrees of freedom in our results and thus may be critiqued. As such we re-ran our main results, in table 12 of Appendix B, without omitting any observations for over-attribution, being outliers, or having inconsistent metrics post-2016 and for all time.

After excluding observations we went from having 4,520 complete cases to 4,319 complete cases. This moved the sample from being 39.4% female to 40.2% female. As such, in removing the academics with the greatest publication metrics we were more likely to exclude men making our results slightly biased in finding a female advantage in academic output. The descriptive statistics for this complete dataset are in Table 2.

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[1] In this time period journal rankings by citations changed from the default year of 2019 to 2020. This can be verified with the Internet Archive (Internet Archive, https://web.archive.org/web/*/https://www.scimagojr.com/journalrank.php). During data gathering, this change was not noticed meaning journals were ranked by citations in different years depending upon when the data was gathered.

Table 2

Descriptive Statistics

Statistic	Mean	Standard Deviation	Minimum	25th Percentile	75th Percentile	Max	Skew	Kurtosis
Years Publishing	24.2	11.1	2.0	16.0	31.0	70.0	0.6	2.8
h-Index	30.5	21.4	1.0	15.0	40.0	136.0	1.8	7.8
Transformed *h*-Index	0.0	1.0	-4.1	-0.6	0.7	2.7	-0.2	3.1
h-Index since 2016	23.4	14.5	0.0	13.0	30.0	96.0	1.8	8.5
Transformed *h*-Index Since 2016	0.0	1.0	-5.6	-0.6	0.7	2.7	-0.3	3.5
*i*10 Index	56.6	59.9	0.0	18.0	71.0	504.0	3.8	26.7
Transformed *i* 10 Index	0.0	1.0	-4.1	-0.7	0.7	2.8	-0.2	3.4
Publication Count	128.8	132.4	1.0	45.0	163.0	1,151.0	6.0	57.1
Transformed Publication Count	0.0	1.0	-4,.2	-0.7	0.7	2.9	0.0	3.4
Citation Count	8,406.1	13,415.8	1.0	1,382.0	9,356.0	159,016.0	4.7	35.3
Transformed Citation Count	0.0	1.0	-5.0	-0.6	0.7	2.6	-0.4	3.7
Citation Count since 2016	3,895.1	5,427.3	0.0	861.0	4,626.5	58,699.0	5.9	64.0
Transformed Citation Count since 2016	0.0	1.0	-6.6	-0.6	0.7	2.7	-0.5	4.3

In Table 3 we present a correlation matrix of our recorded variables, with the dependent variables in their raw and transformed versions. Notably, our measures of research output strongly correlate with each other. This suggests any of the dependent variables will work similarly well as a measure of research output. For simplicity, we thus focus on the popularly used *h*-index. The *h*-index is the largest value of ‘*h*’ for which an author has published ‘*h*’ articles with ‘*h*’ citations each. The *h*-index has the advantage of being easy to understand (Rørstad and Aksnes, 2015) and having high external validity (Ruscio et al., 2012) in its association with academic rank eg. professor versus assistant professor. However, the differences between the indexes for a researcher’s entire career versus just what they have done since 2016 may be related to sex, especially since women have been increasingly joining academia.

Table 3

Correlation Matrix

	Years Publishing	*h*-Index	Transformed *h*-Index	*h*-Index since 2016.	Transformed *h*-Index Since 2016	*i*10 Index	Transformed *i*10 Index	Publication Count	Transformed Publication Count	Citation Count	Transformed Citation Count	Citation Count since 2016	Transformed Citation Count since 2016
Years Publishing	1												
h-Index	0.62	1											
Transformed *h*-Index	0.65	0.88	1										
h-Index since 2016	0.58	0.96	0.86	1									
Transformed *h*-Index Since 2016	0.65	0.85	0.97	0.89	1								
*i*10 Index	0.6	0.94	0.79	0.87	0.74	1							
Transformed *i*10 Index	0.68	0.86	0.98	0.84	0.94	0.82	1						
Publication Count	0.5	0.81	0.71	0.73	0.66	0.89	0.76	1					
Transformed Publication Count	0.63	0.78	0.86	0.74	0.81	0.76	0.89	0.84	1				
Citation Count	0.5	0.83	0.66	0.81	0.64	0.77	0.62	0.66	0.56	1			
Transformed Citation Count	0.63	0.82	0.93	0.81	0.92	0.71	0.9	0.63	0.77	0.69	1		
Citation Count since 2016	0.41	0.82	0.66	0.85	0.68	0.75	0.62	0.63	0.55	0.95	0.7	1	
Transformed Citation Count since 2016	0.51	0.78	0.9	0.82	0.93	0.68	0.87	0.59	0.72	0.67	0.97	0.72	1

Results

To begin with we follow previous literature in simply comparing the sex proportions on editorial boards to comparison samples. In Table 4 we show the sex proportion in journal boards in each discipline. To see whether these proportions are representative of the field they should be compared with the population of academic researchers, be it for example faculty members or published researchers. We use the terms overrepresent and underrepresent to denote whether the fraction of women on editorial boards in a discipline, is greater or less than female representation in the relevant population of academics who could be placed on editorial boards (ie. active authors and university faculty members).

For comparison, we found a range of datasets representing the sex proportion amongst academics in the disciplines we have studied. Our first source of comparison is the sex proportion of active authors with at least two publications during the years 2014-2018. The figures are provided for the USA and the EU28 (The European Union plus the United Kingdom). These figures are reported by Elsevier (De Kleijn et al., 2020) in their 2020 Gender Report and are derived from the Scopus dataset. Unfortunately this data does not have sex proportions specifically for Anthropology or Political Science so we use the proportions for the closest related discipline groups ‘Arts and Humanities’ and ‘Social Sciences’. From the UK we have the sex proportions amongst academic staff from the Higher Education Statistics Agency (2021). We use the proportions from 2016 because newer staff might be too early in their research career to get on a journal board. For economics we also record the proportion of published economists registered with the Research Papers in Economics Author Service as of 2021 (Research Papers in Economics Author Service, 2021).

Table 4

Proportion female of editorial board members, active authors and university faculty

Discipline	Sampled Editorial Boards	Active Authors (USA)	Active Authors (EU28)	Academics in UK Universities as of 2016	Registered authors with the Research Papers in Economics Author Service
Anthropology	49%	43% (Arts and Humanities)	43% (Arts and Humanities)	51%	N/A
Psychology	41%	56%	58%	61%	N/A
Political Science	39%	47% (Social Science)	44% (Social Science)	37%	N/A
Economics	28%	24%	34%	30%	26%
Sources: De Kleijn et al., (2020), Higher Education Statistics Agency (2021), Research Papers in Economics Author Service (2021)					

Editorial boards in Anthropology, Political Science and Economics seem to be broadly representative of their fields. Anthropology editorial boards are 49% female which is close to to the proportion of UK Anthropologists who are female - 51%. Although Anthropology has a greater percentage of women than active authors in the Arts and Humanities these may not be an accurate match for the disciplines. Political Science overrepresented women relative to their role in UK Universities but not compared to active authors in social science. Whether this is because other Social Sciences have more women, or because the UK has an unusual lack of women in their Political Science departments is unclear because the data reported by Elsevier (De Kleijn et al., 2020) does not give a sex breakdown for individual disciplines within the Social Science. Compared to every comparison, our sample of Psychology editorial boards underrepresents women.

In previous research Anthropology underrepresented women (Bruna et al., 2017) but we find women proportionally represented in editorial boards. Political Science (Fraga et al., 2011; Palmer et al., 2020) and Economics (Mumford, 2016) were only representative of senior academics, however in our sample here they appear broadly representative of all academic staff. Only our results from Psychology (Evans et al., 2005; Hafeez et al., 2019; Over, 1981; Palser et al., 2021; Robinson et al., 1998) were in line with prior research suggesting women are under-represented.

One possibility could be that publishers, at least in Anthropology, Politcis and Economics, have been successful in encouraging their journals to increase female representation in recent years. Nonetheless, whether these proportions are meritocratic will depend on the research output of women. Assuming no underlying differences in ability, if the sex disparities found here represent anti-female bias, women would need to substantially outperform men to get on Psychology editorial boards. Moreover, female research output should be approximately equal to men’s in Anthropology, Political Science and Economics.

Our first method for testing whether women need a higher level of research productivity than men to get on editorial boards is to simply compare research productivity between men and women on editorial boards. As stated in the data section, our measures of research productivity are standardised relative to the mean research productivity of academics in editorial boards of journals residing in the same discipline. This ensures that there is no bias from differential sex interest in disciplines that may be associated with higher or lower absolute levels of research productivity.

Before using regression to compare sex differences whilst using controls, we present the sex distributions of research productivity by discipline in figure 1. This is to create a clear visualisation of the results of our study. Test results for Welch’s t-tests and their p values for the difference between male and female research productivity are reported in table 5.

Figure 1:

Distributions of Log10 Transformed h-Index of female and male editorial board members

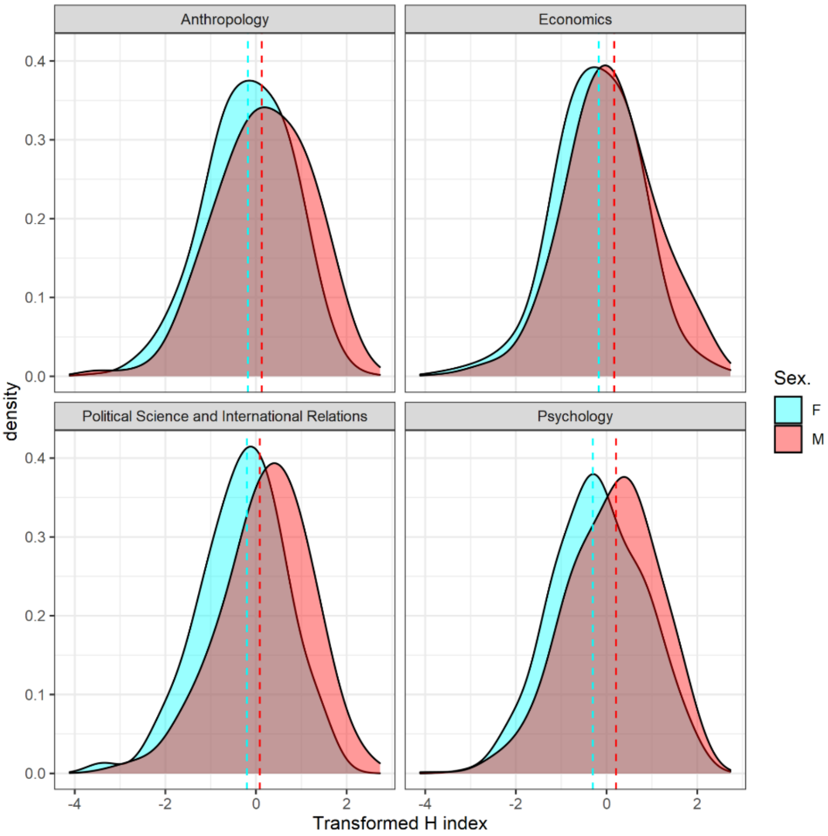

Table 5

Sex Differences in log 10 transformed h-Indexes of editorial board members

	Mean Difference	*t* value	*P* value	Degrees of Freedom
Anthropology	**0.34**	**5.23**	***p* < 0.001**	**928.17**
Psychology	**0.31**	**6.12**	***p* < 0.001**	**1439.83**
Political Science	**0.44**	**6.48**	***p* < 0.001**	**757.80**
Economics	**0.28**	**4.10**	***p* < 0.001**	**535.46**
Note: Positive mean difference indicates male advantage and negative denotes female advantage.				

In each discipline, men have a higher level of research productivity in terms of our transformed *h*-index. The female disadvantage in research output is between 0.28 standard deviations below men in economics to 0.44 standard deviations below men in political science. Moreover, this difference is statistically significant in each discipline ($p < 0.001$). Our results are the opposite of what would be expected if women were being discriminated against, strongly suggesting that women are not discriminated against in hiring to editorial boards. It should be noted that despite including just as many journal boards in Economics as we have included in Anthropology and Psychology, it has substantially fewer degrees of freedom because the economics journals had fewer editorial board members.

Psychology editorial boards under-represent women and yet still the women who do manage to get on the editorial boards dramatically underperform against men by 0.44 standard deviations. This could suggest that despite women being underrepresented on Psychology editorial boards relative to their presence in universities they are still overrepresented relative to their merit. Likewise, women may be overrepresented relative to their merit in Economics, Political Science and Anthropology. Despite women being proportionally represented in these disciplines, male research output is still higher.

Also of note is that there is no monotonic relationship between sex differences in research output and how right-wing a discipline's faculty is (disciplines are ordered in the table from the most left-wing to least left-wing). To properly test for any sex bias arising from political opinion between disciplines we would need to include more disciplines.

We again analyse the differences between male and female research productivity now using ordinary least squares regression. This has multiple advantages. Firstly, we can combine our samples from different disciplines, using dummies to control for any discipline effect, giving us a larger sample size. Nonetheless, we also run regressions for each discipline separately. Secondly, we can control for the number of years a researcher has been publishing. More years in publishing allows an academic to increase their publication count and receive additional citations for old articles, boosting metrics of research output. This means a brilliant academic may have a lower *h*-index than a mediocre academic who has been publishing for longer. Thus a meritocratic editorial board should take into account the length of an academic's career when judging their research output. Since men tend to have had longer careers in academia (Huang et al., 2020; Martinez et al., 2007) whilst women are joining academia at greater rates we should control for the length of academics' publishing years to see whether women are held to a higher standard. On the other hand, time in academia is itself an indicator of knowledge and experience which could help as a member of an editorial board. Time in academia is correlated at 0.62 with the *h*-index in our sample. Thus controlling for years publishing could be partially controlling for the variable we are trying to model - merit to be on a journal board. This possibility becomes more severe if younger and less experienced scholars are less intelligent. Akcigit et al. (2020) have shown that there are more academics today than before. The authors show that reduced selectiveness for joining academia has reduced the IQ of the average PhD student. This is corroborated by the fact that scientists are becoming less productive (Huang et al., 2020). Given arguments for and against this control variable we decide to run regressions with and without it.

Table 6

Regression model of Log10 Transformed h-Index, Standardised as Z scores

Disciplines Used in Models	Anthropology		Psychology		Political Science		Economics		All disciplines			
Model Number	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Sex Female = 1 Male = 0	-0.34*** (0.06)	-0.10* (0.05)	-0.30*** (0.05)	-0.14*** (0.04)	-0.51*** (0.07)	-0.21*** (0.06)	-0.28*** (0.07)	-0.12* (0.05)	-0.35*** (0.03)	-0.14*** (0.02)	-0.30*** (0.05)	-0.14*** (0.04)
Years Publishing		0.06*** (0.002)		0.06*** (0.002)		0.06*** (0.003)		0.07*** (0.002)		0.06*** (0.001)		0.06*** (0.001)
Anthropology									0.03 (0.04)	-0.10** (0.03)	0.03 (0.06)	-0.13** (0.04)
Economics									-0.04 (0.04)	0.15*** (0.03)	-0.04 (0.05)	0.15*** (0.04)
Political Science									-0.00 (0.04)	-0.16*** (0.03)	0.08 (0.05)	-0.14** (0.04)
Sex X Anthropology											-0.03 (0.08)	-0.06 (0.06)
Sex X Economics											0.02 (0.09)	-0.01 (0.07)
Sex X Political Science											-0.20* (0.08)	-0.05 (0.06)
Constant	0.17*** (0.05)	-1.41*** (0.07)	0.12*** (0.03)	-1.36*** (0.05)	0.21*** (0.04)	-1.39*** (0.08)	0.08* (0.04)	-1.47*** (0.06)	0.14*** (0.03)	-1.38*** (0.03)	0.12*** (0.03)	-1.38*** (0.04)
Observations	935	935	1,612	1,612	836	836	936	936	4,319	4,319	4,319	4,319
R^2	0.03	0.46	0.02	0.47	0.06	0.38	0.02	0.48	0.03	0.44	0.03	0.45
F Statistic	28***	400***	37***	672***	56***	257***	16***	439***	32***	692***	19***	432***

*p<0.05; **p<0.01; ***p<0.001

Our regression models of the transformed *h*-index are presented in table 6. Models using only sex as an independent variable find women perform worse in terms of research output in each disciplines (p < 0.001). When we control for the years publishing we find it has a consistent positive effect (p < 0.001) on research output regardless of what disciplines are studied. Every 10 years of experience in academic publishing is associated with a research output increase of between 0.6-0.7 standard deviations. This is in accordance with our expectation that academics with less experience tend to have a lower research output. Years publishing moderates the effect size of sex in every discipline, more than halving sex's effect size in every regression. Without the years publishing control, men perform better than women between 0.28 and 0.51 standard deviations, but with the control men only perform better by 0.1-0.21 standard deviations.

The moderating effect of years publishing is to be expected given sex and years in academia are confounded; female academics tend to have less experience because they are becoming more represented in academia over time (Miller and Wai, 2015) and they are more likely to quit their academic career (Huang et al., 2020). Thus a partial cause of low female representation in editorial boards may be their lower levels of experience, as evidenced by the fact that years publishing correlates with the *h*-index and it moderates the sex difference in academic output. This result corroborates the finding that academia is a 'leaky pipeline' with female scholars, and particularly the worst-performing female scholars (Rørstad and Aksnes, 2015), being more likely to drop out of academia and its editorial boards.

When we combine all the disciplines together in regression models 9-12 we find sex still has a statistically significant effect on research output. In regressions 11 and 12 we use the interaction terms between discipline and sex, indicating whether some disciplines significantly differ in their respective sex effects. In these regressions, we find no statistically significant interaction terms. Log-likelihood ratio tests were used to judge whether models 11 and 12 are superior to models 9 and 10. The chi-square values were insignificant so the discipline sex interaction terms do not improve the models. Thus we cannot reject the null hypothesis of sex's effect being homogenous across disciplines.

To test whether our results are robust we ran the same set of regressions for alternative dependent variables representing academic output. These variables were the non-transformed raw *h*-index, the *h*-index score since 2016, the publication count and citation count. We also reran our regressions without cleaning our data, to see whether our results were the artifact of our cleaning method. We also employed robust regression, using Huber weights, to test whether our results were robust to outliers. To test for whether a possible confound, between-sex differences in subdiscipline and subdiscipline citations, drives our results, we also tried dummy variables for each academic journal. The results of all these robustness checks were extremely similar to the results in table 6. As such, we present these results in appendix B. For the regressions in table 6, we also tried robust and clustered standard errors. The *p* values for all regression coefficients remained within the same thresholds for statistical significance. These results are not reported but are in the code within the supplementary files.

Survey

To see if the sex disparity in research output reflects anti-male bias we decided to run a survey of academics. If academics said they supported discrimination in favour of women that would support the theory that hiring to editorial boards is biased in favour of women. If this was not the case, the survey results would indicate that sex disparities on editorial boards are best explained by sex differences alone.

We designed our survey using Alchemer (https://www.alchemer.com/). We created four questions on attitudes towards gender bias[2] in hiring to journals and four questions on attitudes towards age bias in hiring to journals. We asked questions on age bias for two reasons. The first reason was to test if years publishing's effect on research output was partly due to age bias. The second reason was that given the younger age of female academics, an age bias may inadvertently cause a gender bias. We asked a further two questions on general attitudes to meritocracy in hiring. All questions were on a 0-10 scale. When questions offered a choice between two extremes (eg. pro-male bias to pro-female bias), the question stated that option 5 was a neutral answer. For questions on gender bias and age bias, higher numbers indicated a pro-female bias or a pro-young bias[3]. We achieved this by creating labels for each side of our 0-10 scale. Pictures of the questions asked can be found in the supplementary materials.

We gathered a sample of survey respondents using Prolific (https://www.prolific.co/). Individuals are paid to answer surveys through this website. Our inclusion criteria were for all individuals to have a PhD giving us 425 respondents. We employed a question asking respondents whether or not they worked in academia or were publishing academic papers. After excluding individuals not in academic publishing we had a sample size of 231. All respondents were from Western countries such as The United States, The United Kingdom and Israel.

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[2] In our survey of academics we use the term 'gender' rather than 'sex'. A reviewer asked us to use the term 'sex' instead of 'gender' in the paper to avoid confusion regarding whether we were discussing biology or the 'social construct' of gender. This paper makes no comment on the distinction between sex and gender.

[3] For questions 5 and 7, our survey responders were told higher numbers indicate a pro-old preference instead of a pro-young preference. For ease of interpretation across different questions, answers for questions 5 and 7 were mirrored around point 5. Thus a raw answer of 3 became an answer of 7 and vice versa.

Table 7

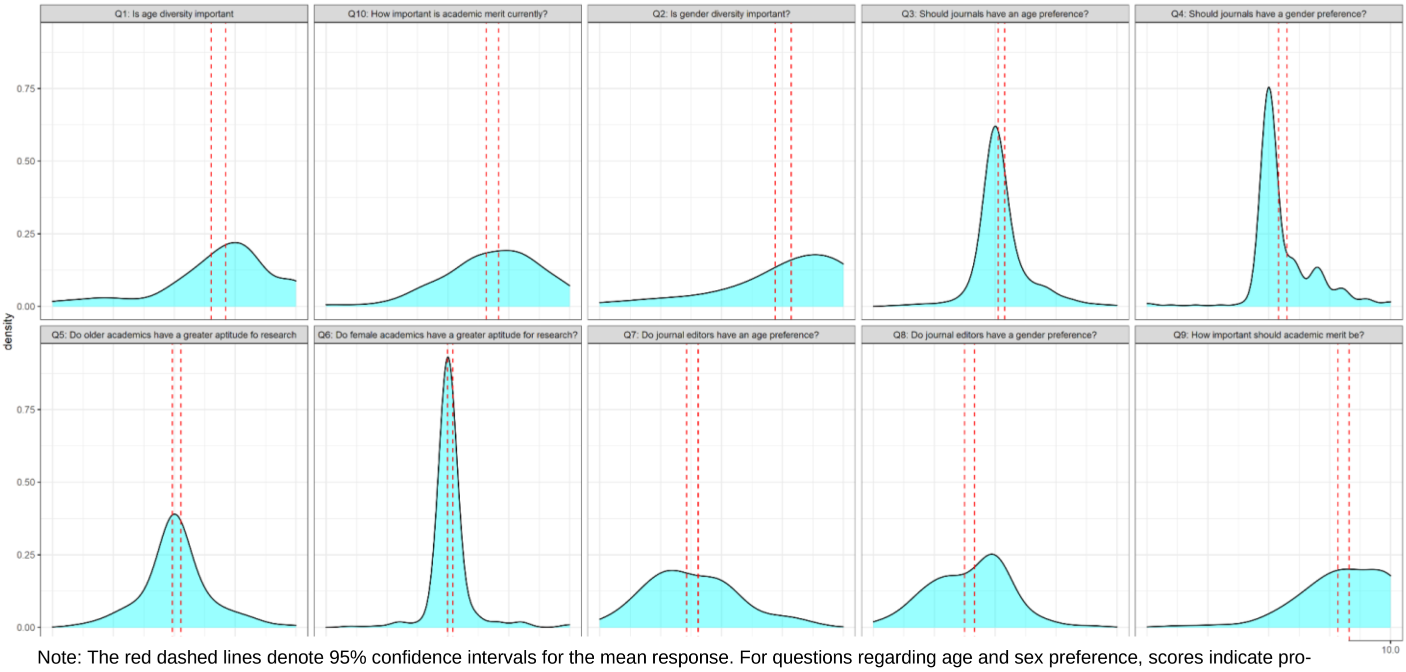
Survey Results

Question	Mean Response	t value (A mean response of 5 is the null hypothesis)	Percent of responses below 5	Percent of responses at 5	Percent of responses above 5	number of responses
Q1. Is age diversity in editorial boards important?	6.8***	11.9	13%	8%	79%	231
Q2. Is sex diversity in editorial boards important?	7.5***	15.3	13%	5%	82%	231
Q3. Should journal editors have an age preference in hiring to editorial boards? (Pick 5 for no age preference)	5.3***	3.8	8%	71%	21%	231
Q4. Should journal editors have a sex preference in hiring to editorial boards? (Pick 5 for no sex preference)	5.6***	6.6	3%	64%	33%	231
Q5. Do older academics have a greater aptitude for academic research than younger academics (Pick 5 for no age difference)	5.1	1.1	21%	55%	24%	231
Q6. Do female academics have a greater aptitude for academic research than men? (Pick 5 for no sex difference)	5.1	1.7	4%	87%	9%	231
Q7. Do you think journal editors have an age preference in hiring to editorial boards? (Pick 5 for no age preference)	3.8***	-9.9	62%	24%	13%	231
Q8. Do you think journal editors have a sex preference in hiring to editorial boards? (Pick 5 for no sex preference)	3.9***	-10.0	55%	35%	10%	231
Q9. How important do you think academic merit *should be* for hiring to editorial boards?	8.1***	26.2	3%	4%	93%	231
Q. 10 How important do you think academic merit currently is for hiring to editorial boards?	6.8***	14.2	13%	10%	77%	231

Critical values $p<0.05$, $|t| > 1.96$; $p < 0.01$, $|t| > 2.60$; $p < 0.001$, $|t| > 3.3$

Figure 2

Density plots of survey responses



Note: The red dashed lines denote 95% confidence intervals for the mean response. For questions regarding age and sex preference, scores indicate pro-young and pro-female preferences, whilst higher scores indicate pro-old and pro-male preferences.

Summary statistics from our survey are shown in Table 7 and density plots of question responses are presented in Figure 2. The red dashed lines in figure 2 indicate the 95% confidence intervals for the mean response. We used a t-test on the mean response to each question to see whether it differed significantly from 5. On question 4, academics were asked “Should journal editors have a sex preference in hiring to editorial boards?”. To ensure all respondents correctly interpreted the question as implying that a sex preference would be discriminatory and anti-meritocratic, we labelled the right end of responses “They should favor females above their academic accomplishments” and the left the same but for males.

The mean response to this question was 5.6 which is significantly different from 5 ($p <$ 0.001). Moreover, one-third of academics said journals should have a pro-female bias and nearly two thirds (64%) said journals should have no age preference. This meant for everyone 1 academic preferring men, there were 11 who preferred women. Although most academics were against a sex bias, they were overwhelmingly more likely to support journals preferring women than the reverse. This suggests there is a large minority of academics that would act to discriminate against men in hiring to editorial boards.

Only 3% of our respondents thought journal editors should be biased in favour of men. Such a low response for this option could indicate academics only chose this option by mistake in answering the question or were lying for the sake of humour. For comparison, an opinion poll found 4% of Americans indicated that they believed reptilians ran the world (Public Policy Polling, 2013). This 4% figure has been dubbed by blogger Scott Alexander (2013) as the ‘Lizardman’s Constant’ to be used as a rule of thumb indicating the maximum survey response that may be explained by mistakes or malice on the respondents' behalves. Since support for anti-female discrimination is lower than the Lizardman's Constant we should be sceptical whether any respondents actually support bias against women at all.

The results suggest that there is a large minority of academics that want to discriminate against men in hiring to editorial boards. The reverse case of academics willing to discriminate against women seems extremely rare.

In our model of research output on editorial boards, we found scholars with more years of publishing performed better. This might not just be due to older scholars having more experience but a result of biased lower requirements for younger scholars. In question 3 academics were asked, "Should journal editors have an age preference in hiring to editorial boards?”. The mean answer was 5.3 indicating an average pro-young bias. It was significantly different from the no bias response of 5 ($p < 0.001$). 21% supported a pro-young bias, 71% supported no bias and 8% supported a pro-old bias. These results, whilst not as extreme as the sex responses, indicate a moderate pro-young bias in academia; nearly 3 academics preferred young academics for every 1 that supported older academics.

These results indicate that academics are far more likely to be biased in favour of women and younger scholars. As such, female academics are likely advantaged over men not only because of their sex but also because of their relative youth.

In addition to asking academics whether they had an age or sex preference, we asked them whether they thought journal editors were biased. For the sex question, the mean answer was 3.9 and for age 3.8. These differed significantly from 5 ($p < 0.001$), suggesting academics thought journals were biased in favour of men and older scholars. So whilst academics are biased in favour of women and young people they believe other academics have the opposite bias. This result seems somewhat paradoxical. We speculate in the discussion that academics have such strong anti-male bias which deludes them into thinking academia has the opposite bias.

What motivates the academics to prefer young and female academics? We asked respondents whether they valued sex and age diversity in questions 2 and 1 respectively. A response of 0 meant diversity was “not important”, whilst a response of 10 indicated that diversity was “very important”. Mean responses were 7.5 for sex and 6.8 for age. 82% and 79% gave responses above 5 for sex and age diversity respectively. With responses overwhelmingly closer to 10 than 0, it seems academics place much value on diversity.

We also asked academics whether they believed men and older scholars have greater aptitude than female and young scholars. The mean response to both questions was 5.1 which was not significantly different from 5. This indicates academics thought neither sex had a greater aptitude for research, despite the fact men tend to receive more citations (Abramo, et al., 2009; D'Amico et al., 2011; Dion et al., 2018; Huang et al., 2020; Maliniak et al., 2013; Schucan Bird, 2011), academic awards (Chan and Torgler, 2020; Lincoln et al., 2012) and are more likely to be considered eminent in their field (Murray, 2003). It also suggests academics believe young scholars are just as good as older scholars.

In table 8 we present a correlation matrix of all our survey questions to better examine what makes scholars prefer women. Concern for sex diversity (Question 2) correlates at 0.34 ($p < 0.001$) with belief that journal editors should prefer women (Question 4). Curiously however, concern for age diversity (Question 1) does not appear to correlate with belief that journal editors should prefer younger scholars (Question 3). This could suggest that whilst academics prefer women for the sake of diversity, preference for younger scholars is not to do with a general concern for age diversity. This could be because some scholars that believe in age diversity think this requires more older scholars to be represented on journal boards.

In our survey, we found no statistically significant belief that younger or female scholars had a greater aptitude than older or male scholars. This could indicate that bias against men is so strong amongst academics that they refuse to believe in greater male academic ability. We find belief in higher female aptitude (Question 6) correlates at 0.22 ($p < 0.001$) with a preference for hiring women (Question 4). This would support the idea that bias in favour of women is motivating bias regarding their ability and also discrimination in favour of women. The belief that journals are biased against women (Question 8) had a small negative correlation (-0.12) with a preference to discriminate in women (Question 4). This could suggest that discrimination in favour of women is motivated by countering perceived injustices against women. However, this correlation was not statistically significant.

Table 8

Survey Correlation Matrix

	Q1.	Q2.	Q3.	Q4.	Q5.	Q6.	Q7.	Q8.	Q9	Q10.
Q1. Is age diversity in editorial boards important?	1									
Q2. Is gender diversity in editorial boards important?	0.54***	1								
Q3. Should journal editors have an age preference in hiring to editorial boards? (Pick 5 for no age preference)	0.05	0.005	1							
Q4. Should journal editors have a gender preference in hiring to editorial boards? (Pick 5 for no gender preference)	0.14*	0.23***	0.34***	1						
Q5. Do older academics have a greater aptitude for academic research than younger academics (Pick 5 for no age difference)	0.02	0.07	0.04	0.03	1					
Q6. Do female academics have a greater aptitude for academic research than men? (Pick 5 for no gender difference)	0.14*	0.17*	0.06	0.22***	-0.004	1				
Q7. Do you think journal editors have an age preference in hiring to editorial boards? (Pick 5 for no age preference)	-0.04	-0.03	-0.06	-0.11	0.03	-0.20**	1			
Q8. Do you think journal editors have a gender preference in hiring to editorial boards? (Pick 5 for no gender preference)	-0.11	-0.18**	0.04	-0.12	-0.15*	0.004	0.18**	1		
Q9. How important do you think academic merit *should be* for hiring to editorial boards?	-0.04	-0.05	-0.10	0.02	0.03	0.06	-0.13	0.07	1	
Q10. How important do you think academic merit currently is for hiring to editorial boards?	-0.15*	0.01	0.07	-0.04	-0.17**	-0.07	-0.11	0.17*	0.16*	1

*p<0.05; **p<0.01; ***p<0.001

Discussion and Limitations

Our results have shown that men substantially outperform women on editorial boards in Political Science, Psychology and Anthropology between 0.10-0.45 standard deviations in research output depending on model specification. These results are robust, remaining stable when different measures of research output are used, when journal effects are controlled for, when robust regression was used in addition to OLS and whether or not we cleaned our data to discard outliers (including clearly erroneous data). In regression results, we found controlling for years publishing reduces the male advantage in research output. We were uncertain of the best reason for this but suggested a few hypotheses: older scholars have had more time to publish papers, younger cohorts of scholars are worse than older ones or journals have an pro-old age bias.

Overall we can be confident that male research output is higher than women's on editorial boards. This is unlikely under the hypothesis of anti-female bias which predicts that women have a higher research output. The regression results update our prior beliefs away from anti-female discrimination and towards the possibilities of anti-male discrimination and men being better at academic research. To further explore the hypothesis of anti-male bias, we surveyed academics on their attitudes to gender bias. We found that whilst most academics were opposed to discrimination, they were 11 times more likely to support discrimination in favour of women than against with regards to hiring to editorial boards. Moreover, support for anti-male discrimination represented only a trivial 3% of our sample. This further supports the idea that there is anti-male bias in hiring to editorial boards. Academics also supported discrimination in favor of younger scholars. This means the moderating effect of years publishing on the sex disparity in research output may be because age bias indirectly creates a sex bias.

There are some limitations to our research methods. There may be potential errors in our data gathering because of human error or Google Scholar making errors. Nonetheless, we do not believe any such data errors could substantially alter our results. This is because our results were extremely similar when using different dependent variables, both when we included and excluded outliers and when we used robust regression. Furthermore, when citations on Google Scholar have been compared with citations on the Web of Science database no sex bias was found (Andersen and Nielsen, 2018). This suggests any errors from Google Scholar are unlikely to cause bias in our results.

A limitation of our survey work of academics is that the respondents may not be a representative sample. Respondents were people who supplemented their income by answering online surveys, suggesting our respondents were disproportionately poor and possibly poorly performing academics. It could be that academics near the bottom of the career ladder have different attitudes to discrimination than those higher up, such as journal editors. We sampled 'elite' journals, with the greatest citations per paper, creating further differences to the academics in our survey sample. It is not impossible that whilst our respondents wanted to discriminate against men, journal editors may discriminate against women. Nonetheless, this hypothesis seems very unlikely. The fact that top publishers and journals are supporting affirmative action in favour of women (Bayazit, 2020; Elsevier, 2021a, 2021b; Laudine et al., 2018; Nature, 2017) would suggest that high performing academics share the same attitudes to sex bias as our surveyed academics who are likely poor performing. Moreover, academics at elite institutions are overwhelmingly left-wing which is associated with having pro-female preferences (Winegard et al., 2020), suggesting editors of top journals are likely to share the same preferences. For example, 39% of elite American liberal arts colleges have no registered Republican professors (Langbert, 2020).

The fact that many academics and publishers are concerned that academia has an anti-female bias would seem to make the theory of anti-male bias unlikely if these academics were rational in their claims. However, this also poses a paradox, if so many academics are publicly against anti-female discrimination how can academia still be so biased against women? For example, in our survey results, whilst academics on net supported discrimination in favour of women and younger scholars they believed other academics who ran journals had the opposite biases.

Clark and Winegard (2020) explain this paradox by arguing that the pervasive narrative of misogyny could itself be caused by academia and society at large having an anti-male bias. This could be an example of preference falsification (Kuran, 1997), whereby individuals lie about their true preferences, or self-deception (Trivers, 2011) whereby individuals lie to themselves about what is true or desirable to avoid the reputational costs of breaking social taboos. After all, there are large incentives to believing in the value of diversity and affirmative action. Academics that do not support affirmative action for women or diversity might be shunned or even 'cancelled' by their colleagues who are overwhelmingly left-wing, if they are hired at all. For example, Cern physicist Alessandro Strumia lost his job for publicly arguing that higher male performance in academia was not a result of discrimination. This theory would also explain why, in our survey results, academics do not believe in sex differences in academic aptitude despite greater male average intelligence (Lynn, 1994, 2017, 2021; Lynn and Irwing, 2004; Nyborg, 2005), greater variance in male intelligence (Baye and Monseur, 2016) and the overwhelming representation of men as eminent figures in science (Darwin, 1871; Murray, 2003). Furthermore, we found that those who were more strongly biased against men, more strongly believed academia was biased against women. Although this could be a rational desire to balance the scale, it could also illustrate anti-male bias making scholars biased in their evaluation of academia.

If anti-male bias is so common and accepted that could explain why our results are consistent with anti-male bias despite anti-female bias being a more popular theory with academics. This speculative hypothesis raised by our results may deserve proper testing in future studies.

Since our data is not longitudinal we cannot say that editorial boards have not previously exhibited a bias against women, but we can be reasonably confident that there is no systematic bias now. As such, affirmative action policies for editorial board may be undermining meritocracy. In Gary Becker's taste discrimination model of the labour market (1971), profit seeking firms should employ discriminated groups because they are accepting of lower wages. Likewise, journals looking for top talent could do well in recruiting men other editorial boards have ignored.

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Appendix A

Table 9

List of Journal Editorial Boards

Anthropology Journals	Economics Journals	Political Science and International Relations Journals	Psychology Journals
Journal of Consumer Research	Quarterly Journal of Economics	American Journal of Political Science	The Annual Review of Psychology
Journal of Peasant Studies	Journal of Economic Perspectives	American Political Science Review	Psychological Bulletin
American Ethnologist	Brookings Papers on Economic Activity	International Organization	Psychological Science in the Public Interest
Journal of Human Evolution	Journal of Political Economy	British Journal of Political Science	International Review of Sport and Exercise Psychology
Annual Review of Anthropology	Journal of Economic Literature	Political Analysis	Annual Review of Clinical Psychology
Science, Technology & Human Values	Journal of Financial Economics	International Security	Annual Review of Organizational Psychology and Organizational Behavior
Journal of Marriage and Family	Review of Environmental Economics and Policy	International Affairs	Personality and Social Psychology Review
American Journal of Physical Anthropology	Energy Economics	Review of International Organizations	Social Issues and Policy Review
Journal of Cross-Cultural Psychology	American Economic Review	Geopolitics, History, and International Relations	Journal of Personality and Social Psychology
Evolutionary Anthropology	Economic Policy	Critical Social Policy	Journal of Occupational Health Psychology
Games and Culture	Journal of Finance	European Journal of International Relations	Clinical Psychology Review
Evolutionary Human Sciences	Cambridge Journal of Regions, Economy and Society	Journal of Peace Research	Educational Psychology Review
Archaeological and Anthropological Sciences	American Economic Journal: Applied Economics	Policy and Society	Educational Psychologist
Journal of Racial and Ethnic Health Disparities	Econometrica	Global Environmental Politics	Current Directions in Psychological Science
Race and Social Problems	Economic Geography	Chinese Journal of International Politics	Trends in Cognitive Sciences
Anthropological Theory	Review of Economics and Statistics	East European Politics	Developmental Review
Cross-Cultural Research	Small Business Economics	Research and Politics	Behavior Research Methods
Sexualities	Review of Economics Studies	Journal of Conflict Resolution	Behaviour Research and Therapy
Journal of Anthropological Sciences	The Review of Financial Studies	Security Dialogue	Neuropsychology Review
Human Ecology	Journal of Business & Economic Statistics	Cooperation and Conflict	Psychological Methods
Culture, Medicine, and Psychiatry	Annual Review of Economics	World Politics	Perspectives on Psychological Science
Medical Anthropology: Cross Cultural Studies in Health and Illness	Finance Research Letters	European Union Politics	European Journal of Psychology Applied to Legal Context
Discourse Studies	World Development	Political Science Research and Methods	Computers in Human Behavior
Chinese Sociological Review	Journal of Accounting and Economics	Perspectives on Politics	Psychological review
Anthrozoas	American Economic Journal: Economic Policy	Democratization	Journal of the Learning Science
Journal of Contemporary Ethnography	Ecological Economics	Political Studies Review	European Review of Social Psychology
American Journal of Human Biology	Annual Review of Resource Economics	Journal of Contemporary China	Trauma, Violence & Abuse
Journal of Eastern African Studies	Journal of Asian Finance, Economics and Business	Politics	Journal of Business and Psychology
Journal of Human Trafficking	American Economic Journal: Macroeconomics	International Studies Quarterly	Journal of Applied Psychology
Culture and Psychology	Oeconomia Copernicana	Geopolitics	Journal of Behavioral Addictions

Appendix B

In Table 10 we re-run the results of table 6 with dummy variables for journals. This is to check whether women have a lower academic output because they prefer subdisciplines that receive fewer citations. Some of the sex coefficients are lower and some higher after controlling for journal effects. In model 2, controlling for journal effects make the sex coefficient lower from -0.10 to -0.09. This makes the coefficient lose its statistical significance at the 5% level. Given the close consistency of the table 10 results and the low p values for coefficients in the other 11 models, it is very likely that model 2 is a false negative.

Table 10

Regression models of Log10 Transformed h-Index, Standardised as Z scores

	Anthropology		Psychology		Political Science		Economics		All disciplines			
Model Number	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Sex Female = 1 Male = 0	-0.23*** (0.06)	-0.09 (0.05)	-0.33*** (0.05)	-0.19*** (0.04)	-0.44*** (0.07)	-0.24*** (0.06)	-0.23*** (0.07)	-0.13* (0.05)	-0.31*** (0.03)	-0.17*** (0.02)	-0.33*** (0.05)	-0.19*** (0.04)
Years Publishing		0.06*** (0.002)		0.05*** (0.002)		0.05*** (0.003)		0.06*** (0.003)		0.06*** (0.001)		0.06*** (0.001)
Anthropology									-1.24*** (0.27)	-0.97** (0.21)	-1.29*** (0.27)	-1.02** (0.20)
Economics									-1.46*** (0.27)	-0.60*** (0.21)	-1.49*** (0.25)	-0.62*** (0.20)
Political Science									-1.25*** (0.28)	-0.83*** (0.22)	-1.21*** (0.26)	-0.82*** (0.21)
Sex X Anthropology											0.10 (0.08)	0.10 (0.06)
Sex X Economics											0.10 (0.08)	0.05 (0.06)
Sex X Political Science											-0.11 (0.08)	-0.05 (0.06)
Journal Dummy Variables	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Constant	-0.42** (0.04)	-1.92*** (0.12)	1.30* (0.50)	-1.07*** (0.05)	0.04 (0.04)	-1.39*** (0.07)	-0.14*** (0.04)	-1.63*** (0.06)	0.43*** (0.03)	-1.06*** (0.03)	0.43*** (0.03)	-1.05*** (0.03)

Observations	935	935	1,643	1,643	843	843	941	941	4,362	4,362	4,362	4,362
R^2	0.19	0.53	0.24	0.55	0.24	0.48	0.29	0.53	0.24	0.53	0.24	0.53
F Statistic	7***	33***	17***	63***	8***	24***	13***	33***	11***	39***	11***	38***

*p<0.05; **p<0.01; ***p<0.001

As a robustness test, we use the robust regression with Huber weights. This approach puts lower weights on observations with a high residual. This is useful for seeing whether lessening the effect of outlier values changes our results. For example, this helps us to be confident that human errors in data gathering or random errors by Google Scholar have not distorted the results. Our robust regressions are created using the *rlm()* function in the R package **MASS**. For details on the robust regression see Venables and Ripley (2010). The Robust regression results are shown in Table 11.

The use of robust regression does not seem to change our results substantially. The predicted sex disparity appears approximately the same and is still statistically significant in every model. Likewise, the coefficients for years publishing are the same, rounded to two decimal places. There are still no significant sex discipline interaction terms. Overall this suggests that outlier observations are not distorting our regression results.

Table 11

Robust Regression models of Log10 Transformed h-Index, Standardised as Z scores

	Anthropology		Psychology		Political Science		Economics		All disciplines			
Model Number	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Sex Female = 1 Male = 0	-0.34*** (0.07)	-0.11* (0.05)	-0.33*** (0.05)	-0.14*** (0.04)	-0.53*** (0.07)	-0.25*** (0.05)	-0.26*** (0.07)	-0.13* (0.05)	-0.36*** (0.03)	-0.15*** (0.02)	-0.33*** (0.05)	-0.14*** (0.04)
Years Publishing		0.06*** (0.002)		0.06*** (0.002)		0.06*** (0.003)		0.07*** (0.002)		0.06*** (0.001)		0.06*** (0.001)
Anthropology									0.04 (0.04)	-0.11** (0.03)	0.04 (0.06)	-0.13** (0.04)
Economics									-0.06 (0.04)	0.15*** (0.03)	-0.07 (0.05)	0.15*** (0.04)
Political Science									0.02 (0.04)	-0.14*** (0.03)	0.09 (0.05)	-0.01* (0.04)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Sex X Anthropology											-0.01 (0.08)	0.04 (0.06)
Sex X Economics											0.07 (0.09)	-0.01 (0.06)
Sex X Political Science											-0.19* (0.09)	-0.09 (0.06)
Constant	0.20*** (0.05)	-1.40*** (0.06)	0.16*** (0.03)	-1.37*** (0.05)	0.25*** (0.04)	-1.34*** (0.08)	0.08* (0.04)	-1.46*** (0.06)	0.17*** (0.03)	-1.38*** (0.03)	0.16*** (0.03)	-1.38*** (0.03)
Observations	935	935	1,612	1,612	836	836	936	936	4,318	4,319	4,319	4,319
Residual Standard Error	1.02	0.66	1.06	0.71	0.96	0.72	0.94	0.62	1.01	0.69	1.00	0.68

*p<0.05; **p<0.01; ***p<0.001

Table 12

Regression models of Log10 Transformed h-Index, Standardised as Z scores. Includes individuals with erroneous Google Scholar pages

	Anthropology		Psychology		Political Science		Economics		All disciplines			
Model Number	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Sex Female = 1 Male = 0	-0.36***	-0.10*	-0.34***	-0.15***	-0.49***	-0.20**	-0.30***	-0.11*	-0.37***	-0.14***	-0.34***	-0.15***
	(0.06)	(0.05)	(0.05)	(0.04)	(0.06)	(0.05)	(0.07)	(0.07)	(0.03)	(0.02)	(0.05)	(0.04)
Years Publishing		0.06***		0.06***		0.05***		0.07***		0.06***		0.06***
		(0.002)		(0.002)		(0.002)		(0.002)		(0.001)		(0.001)
Anthropology									-0.42***	-0.53***	-0.41***	-0.55***
									(0.04)	(0.03)	(0.05)	(0.04)
Economics									-0.55***	-0.33***	-0.55***	-0.34**

									(0.04)	(0.03)	(0.05)	(0.04)
Political Science									-0.42***	-0.56***	-0.36***	-0.56***
									(0.04)	(0.03)	(0.05)	(0.04)
Sex X Anthropology											-0.03	0.06
											(0.08)	(0.06)
Sex X Economics											0.04	0.06
											(0.08)	(0.06)
Sex X Political Science											-0.16	0.001
											(0.08)	(0.06)
Constant	0.01	-1.57***	0.42***	-1.07***	0.06	-1.39***	-0.13***	-1.64***	0.43***	-1.07***	0.42***	-1.07***
	(0.04)	(0.06)	(0.03)	(0.05)	(0.04)	(0.07)	(0.04)	(0.06)	(0.03)	(0.03)	(0.03)	(0.03)
Observations	961	961	1,707	1,707	884	884	970	970	4,522	4,522	4,522	4,522
R^2	0.03	0.47	0.03	0.47	0.07	0.40	0.02	0.50	0.08	0.49	0.08	0.49
F Statistic	33***	426***	48***	754.85***	68.5***	296***	19***	476***	100***	858***	58***	536***

*p<0.05; **p<0.01; ***p<0.001

In table 12 we rerun our regression analyses but with the inclusion of individuals that Google Scholar has misattributed 5 or more papers to and without removing outlier observations. We do this to see whether our exclusion of these individuals may have biased our results. The results are almost indistinguishable from the regression results in table 6. Some of the coefficients on sex are slightly different - within 0.03 of the coefficients in table 6. This means our exclusion of 'overattributed individuals' has only changed our estimates of the sex gap in research productivity by a maximum of 0.03 standard deviations. This suggests that our results are not an artifact of our data cleaning process.

In tables 13-15 we use alternative dependent variables for research output instead of our transformed *h*-index. The variables employed are the raw *h*-index and transformed citation and publication counts. There are no notable differences between these regressions and our main results in table 6. This suggests the sex difference in academic output is measurement invariant and not a coincidence or *p*-hacked result of relying on our transformed *h*-index.

Table 13

Regression models of Raw h-Index

	Anthropology		Psychology		Political Science		Economics		All disciplines			
Model Number	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Sex Female = 1 Male = 0	-7.53*** (1.23)	-3.23*** (0.96)	-7.21*** (1.23)	-3.30*** (0.93)	-8.53*** (1.09)	-3.92** (0.93)	-5.60*** (1.35)	-2.67** (1.02)	-7.24*** (0.64)	-3.03*** (0.50)	-7.21*** (1.04)	-3.94*** (0.80)
Years Publishing		1.03*** (0.04)		1.44*** (0.04)		0.87*** (0.04)		1.30*** (0.05)		1.21*** (0.02)		1.21*** (0.02)
Anthropology									-8.69*** (0.84)	-11.33*** (0.65)	-8.54** (1.15)	-11.7**** (0.89)
Economics									-11.75*** (0.85)	-7.79*** (0.66)	-12.21*** (1.04)	0.14** (0.04)
Political Science									-10.56*** (0.87)	-13.68*** (0.68)	-10.03*** (1.14)	-14.42*** (0.88)
Sex X Anthropology											-0.32 (1.70)	1.45 (1.31)
Sex X Economics											1.61 (1.81)	1.07 (1.40)
Sex X Political Science											-1.32 (1.78)	-1.81 (1.47)
Constant	31.3*** (0.86)	2.55 (1.31)	39.87*** (0.79)	3.68** (1.19)	29.85*** (0.70)	4.85*** (1.37)	27.67*** (0.73)	-0.52 (1.18)	29.89*** (0.58)	9.11*** (0.72)	30.87*** (0.67)	9.44*** (0.76)
Observations	935	935	1,612	1,612	836	836	936	936	4,319	4,319	4,319	4,319
R^2	0.04	0.43	0.02	0.45	0.07	0.37	0.02	0.45	0.08	0.45	0.08	0.45
F Statistic	38***	359***	34***	647***	61***	245***	17***	379***	95***	714***	55***	446***

*p<0.05; **p<0.01; ***p<0.001

Table 14

Regression models of Log10 Publication Count, Standardised as Z score

	Anthropology		Psychology		Political Science		Economics		All disciplines			
Model Number	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Sex Female = 1 Male = 0	-0.36*** (0.06)	-0.12*** (0.05)	-0.29*** (0.03)	-0.13*** (0.04)	-0.53*** (0.07)	-0.20** (0.05)	-0.23*** (0.07)	-0.06 (0.05)	-0.34*** (0.03)	-0.34*** (0.02)	-0.29*** (0.05)	-0.12*** (0.04)
Years Publishing		0.06*** (0.002)		0.06*** (0.002)		0.06*** (0.002)		0.07*** (0.002)		0.06*** (0.001)		0.06*** (0.001)
Anthropology									0.03 (0.04)	-0.11*** (0.03)	0.06 (0.06)	-0.12*** (0.04)
Economics									-0.04 (0.04)	0.16*** (0.03)	-0.05 (0.05)	0.15** (0.04)
Political Science									-0.002 (0.04)	-0.16*** (0.03)	0.10 (0.05)	-0.13** (0.04)
Sex X Anthropology											-0.07 (0.08)	0.02 (0.06)
Sex X Economics											0.07 (0.09)	0.04 (0.06)
Sex X Political Science											-0.34** (0.09)	-0.08 (0.06)
Constant	31.3*** (0.86)	2.55 (1.31)	39.87*** (0.79)	3.68** (1.19)	29.85*** (0.70)	4.85*** (1.37)	27.67*** (0.73)	-0.52 (1.18)	29.89*** (0.58)	9.11*** (0.72)	30.87*** (0.67)	9.44*** (0.76)
Observations	935	935	1,612	1,612	836	836	936	936	4,319	4,319	4,319	4,319
R^2	0.04	0.43	0.02	0.45	0.07	0.37	0.02	0.45	0.08	0.45	0.08	0.45
F Statistic	38***	359***	34***	647***	61***	245***	17***	379***	95***	714***	55***	446***

*p<0.05; **p<0.01; ***p<0.001

Table 15

Transformed Log10 Citation Count, Standardised as Z score

	Anthropology		Psychology		Political Science		Economics		All disciplines			
Model Number	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Sex Female = 1 Male = 0	-0.34*** (0.06)	-0.12* (0.05)	-0.25*** (0.03)	-0.09* (0.04)	-0.43*** (0.07)	-0.14** (0.05)	-0.25*** (0.07)	-0.10 (0.06)	-0.31*** (0.03)	-0.11*** (0.02)	-0.25*** (0.05)	-0.10* (0.04)
Years Publishing		0.05*** (0.002)		0.06*** (0.002)		0.05*** (0.003)		0.07*** (0.003)		0.06*** (0.001)		0.06*** (0.001)
Anthropology									0.03 (0.04)	-0.10*** (0.03)	0.06 (0.06)	-0.10** (0.04)
Economics									-0.04 (0.04)	0.15*** (0.03)	-0.03 (0.05)	0.16** (0.04)
Political Science									-0.002 (0.04)	-0.15*** (0.03)	0.07 (0.05)	-0.14** (0.04)
Sex X Anthropology											-0.09 (0.08)	-0.00 (0.06)
Sex X Economics											0.00 (0.09)	-0.03 (0.07)
Sex X Political Science											-0.17* (0.09)	-0.02 (0.07)
Constant	0.17*** (0.05)	-1.34*** (0.07)	0.10** (0.03)	-1.37*** (0.05)	0.17*** (0.04)	-1.39*** (0.09)	0.07 (0.04)	-1.37*** (0.06)	0.13*** (0.03)	-1.35*** (0.03)	0.10** (0.03)	-1.35*** (0.04)
Observations	935	935	1,612	1,612	836	836	936	936	4,319	4,319	4,319	4,319
R^2	0.03	0.43	0.02	0.44	0.04	0.35	0.01	0.42	0.02	0.41	0.02	0.41
F Statistic	28***	353***	25***	631***	38***	221***	12***	334***	25***	606***	15***	379***

*$p<0.05$; **$p<0.01$; ***$p<0.001$