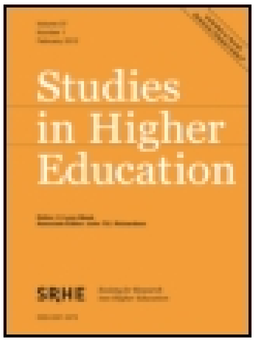

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Sex differences in the number of scientific publications and citations when attaining the rank of professor in Sweden

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ABSTRACT

The proportion of women tends to decrease the higher the academic rank, following a global pattern. Sweden has taken comprehensive measures to decrease this gap across 30 years, and many countries are following a similar path. Yet today only 27% of faculty with the rank of professor in Sweden are female. A common explanation is that academia is biased against women. According to this hypothesis, women have to reach higher levels of scholarly achievement than men to be appointed to the same academic rank. Publication metrics when attaining the rank of professor were compiled from the Web of Science for samples of the whole population of 1345 professors appointed at the six largest universities in Sweden during a six-year period. Men had significantly more publications and citations in both medicine and in the social sciences, rejecting the hypothesis that women are held to a higher scholarly standard in this context.

KEYWORDS

Academia; professor; sex bias; sex quotas; bibliometrics; patriarchy

Introduction

The majority of university students in Sweden are female, but the proportion of females amongst faculty members tends to decrease as academic rank increases. Across all disciplines the majority of professor-rank faculty in Sweden are male (Statistics Sweden 2015). This is also a consistent global pattern (Lariviere et al. 2013). Although Sweden has been implementing policies to increase female representation in academia for more than 30 years, its proportion of females amongst professor-rank faculty remains lower (27%) than amongst junior faculty (47%), doctoral students (48%), and freshmen (59%) (Universitetskanslersämbetet 2018). A common explanation is that females are disadvantaged in various ways, which may manifest as the proverbial 'glass ceiling' (e.g. Bukstein and Gandelman 2019; Yousaf and Schmiede 2016). Accordingly, academia is described as a patriarchal and male-dominated system by academics (e.g. Fahlgren 2013; Seierstad and Healy 2012; Sköld and Tillmar 2015, 16; Van den Brink and Stobbe 2014, 165) and politicians (Ericson et al. 2013; Justitiedepartementet 2016; Socialdemokraterna 2016). The former minister for higher education, Helene Hellmark Knutsson, stated that:

> Although Sweden is world-leading when it comes to the proportion of women in the labour market, and although 60% of the students have long been women, three out of four professors are still men. We must have higher ambitions than that. In Swedish universities, women and men should be able to act on equal terms and have the same career opportunities. All too often have notions about the male genius trumped competence, and too often have

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internal recruitment and networks played a greater role than hard work. This is, in the long run, damaging for the quality of Swedish research. (Hellmark Knutsson 2017)[1]

In other words, females are considered to be disadvantaged through sex-biased[2] evaluation and male in-group support, all of which are based on incorrect stereotypes, and decreases research quality. Any bias that selects less able academics over abler ones is a serious problem. Public trust and confidence in academia rests on its ability to efficiently produce accurate and reliable knowledge, some of which may ultimately inform public debate and national policies. The principle of meritocracy is the best method we know to achieve this, and it has served science very well. To not select and promote the most able individuals (regardless of sex, race, and political views) is, therefore, not only unfair to individual academics but potentially damaging to academia and even to society as a whole (Madison 2019; Utbildningsdepartementet 2013, 2).

However, evaluating sex bias in real-life situations is riddled with difficulties, mainly because of confounding variables that cannot be fully controlled. The male power-system is believed to permeate societies as a whole, which means that the sources of sex differences are partly to be found in the family, in school, and in any other milieu encountered (e.g. Anderson 2015; Nationalencyklopedin 2016). Thus, it cannot be determined how much specific factors might affect individuals' interest, motivation, or perceived obstacles for an academic career. From this perspective, it has been argued that universally applied, 'meritocratic values … militate against equal opportunity for women in a patriarchal society' (Knights and Richards 2003, 214). In essence, the idea is that certain socially constructed notions, values, and practices reinforce each other to propagate an unequal power balance across demographic categories, such as sex (e.g. Gamble 2001; Walby 1990). As such, this theory is near impossible to test, since in real life these factors cannot be experimentally manipulated, and so their causality cannot be disentangled. Non-experimental longitudinal studies might however indicate the likelihood and direction of possible causal patterns.

One aspect can nevertheless be assessed without challenging the direction of causality. A sex bias in granting access to a desired position will manifest itself in preferentially hiring or promoting members of one sex at a higher rate than equally or more qualified members of the other sex. The male power-system theory therefore predicts that females who reach the rank of professor will have objectively higher merits than males. Such a comparison can readily be made, because scientific publications are the central merit for this position, and publications can be quantified in terms of their number, their number of citations, and the status of the journals they are published in.

Here, we examine this hypothesis in the Swedish academic system. Sweden is ranked as one of the most sex-equal countries (World Economic Forum 2015) and has for a long time strived to increase equality in all domains of life. This makes Sweden particularly interesting as a forerunner for sex-equality policies and interventions, and an example of how these may play out in other countries. In Sweden, a university teaching position is termed 'lektor', while professor is reserved for the highest academic rank. Both lektor and professor are typically permanent positions, corresponding to tenured faculty in the US. The practical consequences of a higher rank are mainly higher salary and proportion of time available for research. Without external research funding, a lektor has commonly 0%–20% of full time available for research, while a professor typically has 30%–70%. The rank of professor is therefore attractive for academics devoted to research, and competition for such positions is high. The historical way to attain this rank is to apply for an open position as professor at an academic institution, and be evaluated in competition with other applicants by at least two senior academics. An increasingly common route is to promote a PhD who has a permanent position as lektor to professor, which was made possible by a law passed in 1997 (Regeringen 1997). Applications for promotion are also peer-evaluated, typically by at least two professors at other institutions, but not in competition with other applicants. The application must also be supported by the applicant's home institution, which has to provide the raise in salary and the time available for research.

One may argue that publication metrics are questionable as an index of scientific competence or quality. There may be legitimate causes for differences in productivity in terms of co-authorship, the type of data, how long it takes to complete a study and report it, and variation in publication standards across disciplines, for example. There are well-argued concerns about the validity of the journal impact factor metric with regards to evaluating individual scholars, according the Declaration on Research Assessment (sfdora.org). While these are serious problems for assessing individual scholars or comparing across disciplines and sub-disciplines (Knudson 2019; Ruscio 2016; West and Rich 2012; Wildgaard, Schneider, and Larsen 2014), they are inconsequential if comparisons are made within the same or similar disciplines or fields of study for the same time period. On the group level, bibliometric data have high criterion validity for the academic core goal to create and disseminate knowledge. Publishing more indicates you have created more knowledge and also made a greater effort to share it, and being cited and published in journals with higher impact factors indicate that experts in your area find this knowledge relevant and valuable (Braun et al. 2013; Lutter and Schröder 2016; Ruscio 2016; Ruscio et al. 2012). Publication metrics also have the advantage of being quantitative, reliable, and readily available in trustworthy, international databases. A remaining problem could be that the demographic category that characterises the group is not independent from all publication-related variables. We will consider this issue, as well as the particular metrics used, in the method section.

We also make the point that publication metrics are formally instituted and generally accepted as central criteria for evaluating academics that apply for a higher rank. Prospective applicants should therefore do their best to maximise their merits in these regards, even if they might have misgivings about their utility and validity. As such, the Hirsch-index (*h*-index in the following) can be argued to provide a healthy incentive, by accounting for both productivity and influence (Ruscio 2016). Other important metrics are scientific distinctions and research funding, although it may be argued that these are more subjective and prey to current and fleeting trends. Such data are scattered and difficult to obtain, and were for practical reasons not considered here.

By comparing the publication merits of each sex when being appointed to the rank of professor, we focus on the criteria for being hired as, or promoted to, the highest formal academic rank in Sweden. The magnitude of sex discrimination against female academics, based on the power-system theory, can thus be estimated by their greater scientific productivity. Specifically, we predict that females will have published more scientific papers that are more frequently cited and published in journals with higher impact factors, compared to males.

Method

Participant sample

Those appointed professors in the years 2009 through 2014 were identified through booklets issued in connection with the annual or bi-annual promotion ceremony, a tradition with medieval roots (Manning 2000). This source specifically lists those who are promoted to professor from a lower academic rank and includes all those individuals, regardless of their employment.[3] This tradition is upheld at the five largest universities in Sweden, located in Lund, Gothenburg, Uppsala, Umeå, and Stockholm, as well as by Karolinska Institutet, a medical university and research institute. These six institutions are also the more influential, prestigious, research intensive, and successful in attaining research grants. They were home to 58.3% and 56.9% of all academics with the rank of professor in Sweden in 2008 and 2014, as detailed in Table 1. Their age, name, portrait, faculty membership, discipline, and field of research, and when they received their PhD was extracted from the booklets. Their apparent sex was determined by their first name and a qualitative assessment of their portrait picture in the booklet. This population consisted of 1406 individuals (477 female and 929 male) across 129 self-reported fields of research (Table A1). These fields were categorised into 32 academic disciplines

Table 1. Overview of the total population of professors in Sweden, in terms of both numbers of individuals and full-time equivalents, separately for all institutions and for those selected for the present study.

	Full-time equivalents (FTE)									
	All institutions in Sweden					Selected institutionsxxxxLund, Gothenburg, Uppsala, Umeå, Stockholm, & Karolinska Institutet				
Year	Females	Males	Total	Source	Prop. females (%)	Females	Males	Total	Source	Prop. females (%)
2008	794	3407	4201	UKA2009, Table 8	*18.9*	505	1944	*2449*	UKA2009, Table 8	20.6
2014	1263	3812	5075	UKA2015, Table 25	*24.9*					
2014, age 65+	*100*	350	450	StatSwe2015, 24	*22.2*					
Year	Number of individuals									
	All institutions in Sweden					Selected institutionsxxxxLund, Gothenburg, Uppsala, Umeå, Stockholm, & Karolinska Institutet				
	Females	Males	Total	Source	Prop. females (%)	Females	Males	Total	Source	Prop. females (%)
2008	870	3783	4653	UKA2009, Table 9		*559*[d]	*2154*[d]	*2713*[c]		*20.6*
2014	1547	4807	6354	StatSwe2015, Table 1A	24.2	938	2676	3614	StatSwe2015, Table 3A	25.9
2008, age 55–59	222	855	1077	UKA2009, Table 9						
2008, age 60–64	238	994	1232	UKA2009, Table 9						
2008, age 65+	75	410	485	UKA2009, Table 9						
2014, age 65+	*225*[g]	*705*[g]	930	StatSwe2015, 24						
Retirement	*−282*[a]	*−1165*[b]				*−175*[f]	*−655*[f]			
Replacement	*959*[e]	*2189*[e]	*3148*		*30.4*	*554*[e]	*1177*[e]			32.9
2008	91.3%	90.0%	Proportion work-time (FTE/							
2014	83.0%	79.6%	number of individuals)							

Notes: [a]Estimated as 1 year of the 55–59 year-olds + all 60–64 year olds = 222/5 + 238. [b]Same as a, i.e. 855/5 + 994. [c]Based on number of individuals for all institutions and the selected institutions to all institutions ratio of FTEs in 2008 (58.3%). [d]Based on individuals total and proportion female for FTE 2008. [e]2014–2008 + retired. [f] Based on retired to all ratio across 2008 and 2014. [g]Based on F/M proportion for FTE and age 65+. UKA2009 = (Universitetskanslersämbetet 2009); UKA2015 = (Universitetskanslersämbetet 2015); StatSwe2015 = (Statistics Sweden 2015).

(Table A2), based on traditional academic structure (Wikipedia 2018) and the faculty membership given in the booklets.

This population of just appointed professors should be set in relation to the entire population of professors at the beginning and end of the study period, both at the selected institutions and in Sweden as a whole. Annual official figures are available from Statistics Sweden, a governmental authority, but differ somewhat across years in the specific variables and parameters given. For example, professors may be represented as numbers of individuals or as full-time equivalents (FTE), which corresponds to the number of work hours, and these figures may be reported across the sexes or separately for each sex. Table 1 compiles these data and their sources. Some data points missing from these statistics are estimated (denoted with italics). It can be noted from these figures that (1) the number of professors has increased by 36.5% and their FTE by 21.0% during these six years, (2) the FTE/number ratio has decreased from ∼0.9 to ∼0.8, which probably reflects a higher proportion of active but probably part-time senior professors (65+ years), and (3) the proportion of female professors has increased from ∼0.2 to ∼0.25 and reaches above 0.3 for the newly recruited in this period. There is an additional longer trend, by which the FTEs of both sexes have increased by almost equal numbers since 2004 (female 630 FTE and males 600 FTE), although there were initially more than 4 males for each female (Universitetskanslersämbetet 2015, 96). Importantly, the estimated replacement for the selected institutions across the study period, given the general increase and the retirement ratio, amounts to 554 females and 1177 males, and has an almost identical proportion of females (32.9%) as the study population (33.2%). The study population is slightly smaller than the estimated replacement (86% females and 79% males), which is likely due to an overestimation of the replacement because of an increase in retired but still active senior professors. We could not account for senior professors because the figures provide no indication of how large a proportion of professors remain active, or their mean age.

Comparing the age of the populations provides a check on the retirement estimates. The mean age in the whole population of current professors is 57.0 years (Statistics Sweden 2015, 26), while the mean age when being appointed in the present study was 52.3 years for females and 50.0 years for males, which given that they will retire at 65 corresponds to expected mean ages of 58.6 for females and 57.5 for males.

For assessing a group difference, it is essential that the groups be comparable. First, we therefore excluded 61 persons without an academic career proper, as indicated mainly by no or very few publications ($n = 29$), adjunct, honorary, visiting, or other forms of temporary professorships ($n = 13$), or not having a PhD ($n = 19$). About half of these excluded professors belong to the visual or performing arts ($n = 29$). Adjunct professor is a temporary, externally funded position, typically by a company or NGO. The remaining 1345 professors consisted of 446 females and 899 males. Table 2 shows that the sex proportion is essentially the same across the study years.

Second, disciplines tend to differ in their publication patterns and several other aspects, and the demographic category (sex) must therefore be proportional across disciplines so that these peculiarities do not skew the results if they are confounded with sex. Third, each group has to be large enough to allow statistical testing of possible group differences. Apart from the fact that a very small number or particularly low proportion of either sex makes group comparisons unreliable,

Table 2. Numbers of each sex and the proportion of female appointed to professor in the study period, after excluding those without an academic career proper.

Year	Total	Females	Males	Proportion females (%)
2009	216	72	142	33.6
2010	204	70	134	34.3
2011	280	95	181	34.4
2012	285	91	194	31.9
2013	211	70	141	33.2
2014	155	48	107	31.0
All years	1345	446	899	33.2

it has been argued that a discipline dominated by one sex might provide a less favourable environment for the other sex (Yousaf and Schmiede 2016). With these considerations in mind, we excluded disciplines with a sex ratio greater than 2/3, namely Earth sciences, Engineering and technology, Physics, Chemistry, and Economics, as well as 19 disciplines with fewer than 30 individuals (see Table A2). Biology had a relatively large sample size as well as an equal sex distribution, but was excluded because it is the only discipline within the Natural sciences to fulfil these criteria, and can therefore not form a cluster of similar disciplines. Most disciplines that have sufficient numbers of individuals as well as a fairly even sex distribution belong to the Social Sciences. Such a cluster was therefore formed in addition to Medicine, including Education, Law, Linguistics Political Science, and Psychology. Linguistics is traditionally part of the humanities, but was included because it fulfils the criteria and is in many respects similar to other Social Sciences disciplines.

Pilot work revealed that collecting publication metrics was prohibitively time-consuming, given the necessary error checking and quality control described below to analyse the full sample of professors. The average time per individual was in excess of two hours. Random samples of 130 participants of each sex was set as a goal, allowing for attrition and given the possibility of aggregating Medicine and the Social Sciences. We reasoned that a minimum 10% population sample should be representative, and calculated that 106 individuals per group is required to detect a meaningful effect on the order of 0.3 SD (one-sided) with a power of 0.7. Each participant was assigned a unique random integer, and were then sorted according to this integer, separately by sex and discipline cluster (Medicine and the Social Sciences). The first 50 of each sex were selected for Medicine, and the first 80 for the Social Sciences.

The publication searches revealed information that reclassified or excluded some participants, according to the same criteria as employed after the initial sampling (i.e. adjunct, honorary, and visiting professors). The final subsamples consisted of 148 participants from the Social Sciences (including Linguistics) and 83 from Medicine, corresponding to 34.9 and 18.4% of these populations. These are listed per discipline in Table 3, considering the first five a Social Sciences cluster.

Publication data

For the present purposes, it was desirable to have several measures that capture different and partly independent aspects of scientific achievement through publication metrics, such as scientific quality, mere productivity, and impact on the research community. Citation metrics at the author and article level are generally accepted as meaningful confirmatory evidence for use in qualitative promotion evaluations (Hicks et al. 2015; Knudson 2019). Hundreds of metrics exist, although they are all based on the number of publications and the number of citations, and in some cases properties of the publisher or journal (Ruscio et al. 2012; Wildgaard, Schneider, and Larsen 2014). Because comparisons could be made for groups within similar institutions, areas of research, and for the same period of time, we chose simple metrics that are easy to interpret (Hicks et al. 2015; Knudson

Table 3. Description of initially selected sample and the numbers found in Web of Science, compared with the total population belonging to these disciplines.

	Total			Sample			In Web of Science		
Discipline	Females	Males	Proportion females (%)	Females	Males	Proportion females (%)	Females	Males	Proportion females (%)
Education	25	27	48.1	18	18	50.0	14	17	45.2
Law	15	25	37.5	12	13	48.0	7	6	53.8
Linguistics	32	28	53.3	20	21	48.8	15	18	45.5
Political Science	13	17	43.3	12	14	46.2	11	14	44.0
Psychology	15	25	37.5	9	11	45.0	9	11	45.0
Medicine	162	286	36.2	47	36	56.6	46	36	56.1
Sum	262	408	39.1	118	113	51.1	102	102	49.3

2019; Ruscio et al. 2012; West and Rich 2012) and decided to not consider co-authoring. Counting co-authors and assigning main authorship according to established practices would require extensive additional work (Hagen and DeSalle 2008; Hagen 2014), but is unlikely to significantly affect the planned analyses. Controlling for co-authoring is empirically found to make little difference, and may also diminish the reliability of the metrics (Ruscio et al. 2012). More specifically, sex differences in co-authorship are small and their associations with publication metrics are even smaller or non-existent. The extent of publication co-authoring did not differ across the sexes amongst more than 11 thousand professors (Abramo, D'Angelo, and Di Costa 2019), with the exception of some disciplines not considered in the present study. In another sample of more than four thousand psychologists, females did co-author to a greater extent (86% vs. 80% of publications), but this was not associated with their productivity (Fell and König 2016). Similar patterns apply in Economics (Sarsons 2017) and Political Science (Teele and Thelen 2017), where females' level of co-authoring was not associated with their productivity.

Publication data were obtained from the Web of Science (Clarivate Analytics) by the second author in the spring of 2016, being at that time unaware that sex was of any significance (Fahlman 2016). Two-year journal impact factors (IF) for 2015 were obtained from Clarivate's Journal Citation Reports. The option for downloading complete information about each publication year was used for each individual publication, which made it possible to determine publication metrics until and including the year before the promotion of each professor, rather than at the time of the search. Each person's family name and given name initial was entered in the author's field, and it was confirmed that all publications found seemed to fit that individual's area of research. If no publications were found, alternative spellings or varieties were tried, such as the given name and each part of double family names separately. Multiple authors with the same or similar names were disambiguated by cross-checking with other databases and assessing the subject matter of the articles (Bornmann and Marx 2014). Twenty-seven participants were not found in Web of Science (WoS) (16 F and 11 M), mainly belonging to Education, Law, and Linguistics. This is reasonable because these disciplines have a tradition of publishing monographs and book chapters to a greater extent, as confirmed by relatively few publications in WoS also for the other participants belonging to these disciplines. The numbers not found were similar across the sexes, as detailed by comparing the numbers for the sample and those found in WoS in Table 3, that is, columns 5 and 8 for females and 6 and 9 for males. We confirmed that these participants had been searched for with their correct names, by finding their publications in Google Scholar (using Harzing's Publish or Perish software), and their publication metrics were then set to naught for the following analyses. Data for 5581 publications authored by the remaining 204 participants were downloaded. The distributions of all three publication metrics were strongly positively skewed. Table 4 lists the descriptive statistics across all publications for both raw values and square root and log10 transforms.

The publication data were aggregated for each participant as follows. Frequencies of publications and citations were summed for each individual across all years from PhD to the year before becoming a professor, which yielded five publication metrics: (1) total number of publications, (2) publications

Table 4. Descriptive summary statistics across all publications ($N = 5581$) for journal impact factor, total number of citations, and number of citations per year, up to the year each participant became professor.

	Mean	Minimum	Maximum	SD	Skewness	Kurtosis
Citations	8.96	0	1770.0	44.79	19.1	557.8
Square root of citations	1.39	0	42.1	2.65	4.0	29.1
Log10 citations	0.38	0	3.2	0.58	1.4	1.3
Citations per year	1.53	0	196.7	6.079	14.8	333.2
Square root of citations per year	0.61	0	14.0	1.07	3.1	17.4
Log10 citations per year	0.19	0	2.3	0.33	2.0	4.1
Journal impact factor	4.07	0	115.8	5.96	5.6	49.8
Square root of Journal impact factor	1.71	0	10.8	1.06	1.5	5.9
Log10 Journal impact factor	0.56	0	2.1	0.32	0.4	0.8

Note: Estimates are computed for all 5581 publications across all 231 participants.

Table 5. Descriptive statistics across all participants for total number of publications and citations, mean number of citations per year, and *h*-index, before and including the year each participant became professor.

	n	Median	Mean	Minimum	Maximum	SD	Skewness	Kurtosis
Publications (number of)	231	5.00	13.60	0	355.0	29.00	8.04	86.6
Sqrt Publications	231	2.23	2.70	0	18.8	2.40	1.94	8.5
Log10 Publications	231	**0.78**	**0.81**	**0**	**2.5**	**0.55**	**0.19**	**−0.7**
Publications per year	226	0.35	0.90	0	14.2	1.55	4.71	31.6
Sqrt Publications per year	226	0.59	0.73	0	3.8	0.61	1.36	3.3
Log10 Publications per year	226	**0.13**	**0.21**	**0**	**1.2**	**0.22**	**1.43**	**2.3**
Citations (*N*)	231	10.00	215.80	0	8277.0	687.70	8.02	84.5
Sqrt citations	231	3.16	8.30	0	90.9	12.16	2.70	10.8
Log10 citations	231	**1.04**	**1.20**	**0**	**4.0**	**1.09**	**0.38**	**−1.2**
Citations per year	231	2.02	36.8	0	1091.8	103.10	6.36	53.6
Sqrt citations per year	231	1.42	3.50	0	33.0	4.93	2.33	7.4
Log10 citations per year	231	**0.48**	**0.78**	**0**	**3.0**	**0.81**	**0.68**	**−0.8**
Journal impact factor (IF)	231	1.28	2.16	0	12.6	2.45	1.53	2.4
Sqrt Journal IF	231	**1.05**	**1.07**	**0**	**3.2**	**0.83**	**0.20**	**−0.9**
Log10 Journal IF	231	0.32	0.35	0	1.0	0.28	0.22	−1.1
h-index	231	2.00	4.03	0	30.0	5.32	1.93	4.2
Sqrt *h*-index	231	**1.41**	**1.51**	**0**	**5.5**	**1.32**	**0.55**	**−0.5**

Note: The transformation used in the following analyses are in bold.

per year, (3) total number of citations, (4) mean citations per year, (5) *h*-index, calculated as the largest *n* number of publications with at least *n* citations. The sixth metric was the (6) mean journal impact factor (IF), calculated as the mean of log-transformed journal IF across all publications for each participant, because that was closest to a normal distribution according to skewness and kurtosis estimates in Table 4. The descriptive statistics across all participants are listed in Table 5, again also with square root and log10 transforms, showing that the log transform is closest to a normal distribution for all variables except IF and *h*-index, for which the square root was preferred. The untransformed means and standard deviations in Table 5 are misleading because of the positive skew.

Table 6 demonstrates large differences between the disciplines for all metrics, with Education, Law, and Linguistics forming a cluster with the lowest metrics, followed by Political Science, Psychology, and Medicine. As a consequence, a comparison of the sexes across all disciplines is inappropriate due to large mean differences across disciplines, which result in large SDs on the order of several times the mean. WoS is less inclusive than Google Scholar, for example, which might lead to larger difference amongst social scientists, who tend to publish a larger proportion of their work in books and journals that are not featured in WoS (Knudson 2019, 102; West and Rich 2012, 362). Still, the present search included at least 35 book chapters and 67 conference proceedings, ~300 journals with naught IF, and ~315 publications from a mix of sources with no designated IF, including edited books and the Swedish physician's practitioner journal (Läkartidningen), for example.

The sex differences for the whole sample were substantial for all variables except for IF, but in the opposite direction from the predicted. The male point estimates were higher for 33 of the 36 combinations of the six variables and the six disciplines. Given these results, the most conservative way to test the sex differences is to (1) use the square root transformed data for IF and *h*-index and the log10 transformed data for publications and citations, and to (2) do this separately for Medicine and the Social Sciences, as initially devised in the sampling process. Table 7 lists these comparisons, including

Table 6. Mean publication data metrics for each discipline, across participants.

	Education	Law	Linguistics	Medicine	Political science	Psychology	All disciplines
Publications (*N*)	3.22	1.60	2.88	30.0	5.58	12.1	13.6
Publications per year	0.28	0.24	0.20	1.86	0.43	1.11	0.90
Citations (*N*)	6.14	8.80	9.68	547.3	44.6	121.7	215.8
Citations per year	1.37	1.06	1.41	93.08	8.75	21.0	36.8
Journal impact factor (IF)	0.65	0.63	0.44	4.34	1.63	1.92	2.16
h-index	0.90	0.52	0.59	8.66	2.23	4.25	4.03

Table 7. Sex differences for Medicine and the Social Sciences, separately, for each of the 6 publication metrics.

	Medians		Raw means*		Geometric-harmonic means			Transformed data				Sex difference		
Medicine														
$N_{Females} = 47$ $N_{Males} = 36$	Females	Males	Females	Males	Females	Males	Sex difference (%)	Transformation	Females	Males	Percentile	*d*	*t*	p_{corr}
Publications	20	28.5	26.6	34.5	15.20	24.96	**64.2**	log10	1.21	1.41	**0.69**	**−0.51**	**−2.34**	**.0312**
Publications/year	1.06	1.54	1.76	1.99	1.30	1.61	23.7	log10	0.36	0.42	0.59	−0.24	−1.06	.146
Citations	135	486	235.7	954.2	93.93	338.64	**260.5**	log10	1.98	2.53	**0.77**	**−0.74**	**−3.34**	**.00327**
Citations/year	31.0	79.9	46.63	153.7	21.90	65.09	**197.2**	log10	1.36	1.82	**0.77**	**−0.73**	**−3.28**	**.00320**
IF	3.75	4.7	3.96	4.83	3.16	3.57	29.4	sqrt	1.78	1.89	0.57	−0.19	−0.84	.202
h-index	6.0	11.0	6.42	11.58	5.67	10.36	**82.7**	sqrt	2.38	3.22	**0.80**	**−0.84**	**−3.69**	**.00138**
Social Sciences														
$N_{Females} = 71$ $N_{Males} = 77$														
Publications	1.0	4.0	3.30	5.54	1.77	3.20	**81.0**	log10	0.44	0.62	**0.67**	**−0.44**	**−2.70**	**.0226**
Publications/year	0.1	0.23	0.26	0.50	0.21	0.38	**77.3**	log10	0.08	0.14	**0.66**	**−0.41**	**−2.50**	.0335
Citations	1.0	1.0	20.50	38.70	2.73	3.89	42.5	log10	0.57	0.69	0.56	−0.15	−0.93	.177
Citations/year	0.23	0.25	3.55	6.87	0.99	1.49	50.9	log10	0.30	0.40	0.58	−0.20	−1.19	.117
IF	0.47	0.82	0.85	1.00	0.38	0.45	18.4	sqrt	0.62	0.67	0.53	−0.09	−0.52	.302
h-index	1.0	1.0	1.21	1.65	0.53	0.91	72.1	sqrt	0.73	0.96	0.63	−0.33	−2.03	.0851

Note: Measures are, from lefto to right, medians and arithmetic means, geometric-harmonic means and their proportional sex difference (%). transformed means (sqrt or log10) and their confidence intervals and effect size (d). Values in bold are statistically significant at $p < .05$ according to one-tailed *t*-tests after Holm-Sidak correction, corrected *p*-values are shown in the p_{corr} column. Aggregated transformed data statistics are based on individually transformed raw data. The proportional sex difference is the (male-female)/ female ratio of transformed data. Percentiles correspond to the effect size. * These means are non-representative because of the large skew, but included for transparency.

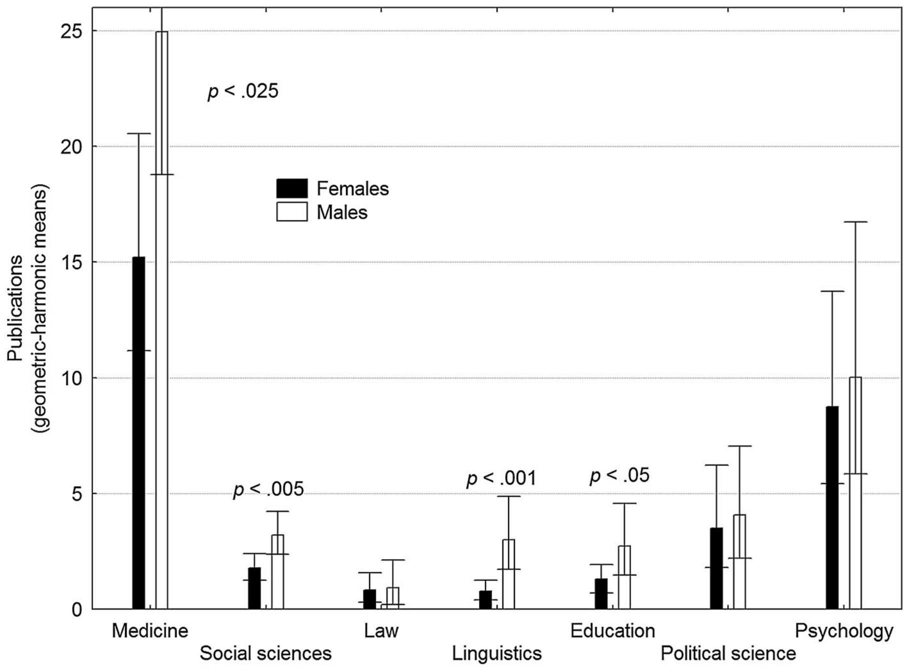

Figure 1. Number of publications as a function of discipline and sex. Error bars denote 95% confidence intervals and *p*-values are uncorrected for multiple comparisons.

medians, percentiles, proportional differences in percent, effect sizes (*d*), and *t*-values and *p*-values from one-tailed *t*-tests. Holm-Sidak correction (Abdi 2010) was applied to control for familywise Type I error amongst the dependent variables, the p_{corr} column in Table 7 showing the corrected *p*-values, resulting in one metric (*h*-index for the Social Sciences) moving above $p_{0.05}$ (from .0219 to .0847).

The results are visualised in more detail in Figures 1 through 4, which depict the interactions between disciplines and sex. Not visualised are IF, which exhibited no statistically significant sex differences, and citations, whose very large differences across disciplines made the graph difficult to read. The figures plot geometric-harmonic means, in other words the back-transformed (x^2 and 10^x) group means of the Sqrt and log10 transformed individual metrics. Confidence intervals are calculated as M ± 1.96(SD/(sqrt(N)) to the power of 2 for the square root transformed data and as 10 to the power of M ± 1.96(SD/(sqrt(N))) for the log10 transformed data, which makes them asymmetrical around the means. For comparability across both individual disciplines and the Social Sciences cluster, the figures show *p*-levels based on uncorrected *p*-values.

In summary, Table 7 and Figures 1–4 show that males had significantly more publications and publications per year in the Social Sciences cluster, and had more publications, citations, and citations per year in Medicine, as well as a higher *h*-index in both. There were no differences in journal IF. Figure 5 depicts the effect sizes for all combinations of the six metrics and six disciplines, exhibiting 8 medium and 11 small effects, and trends in the same direction for all but a few of the remaining 17 effects, as well as for the Social Sciences cluster.

Discussion

We tested the hypothesis that when appointed to the rank of professor, females have higher publication merits than males, reflecting a sex bias favouring males at Swedish universities. The data

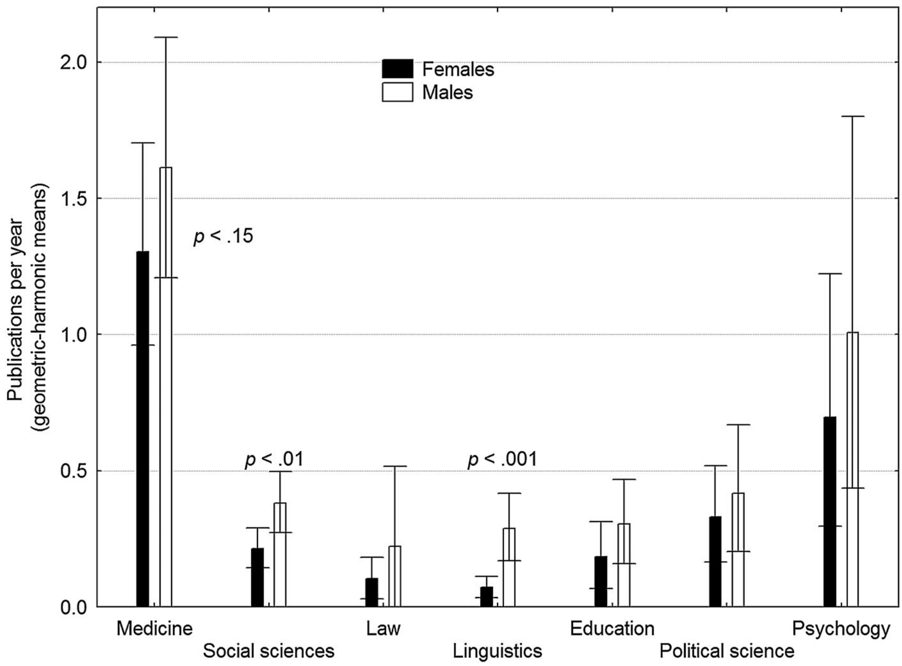

Figure 2. Number of publications per year as a function of discipline and sex. Error bars denote 95% confidence intervals and p-values are uncorrected for multiple comparisons.

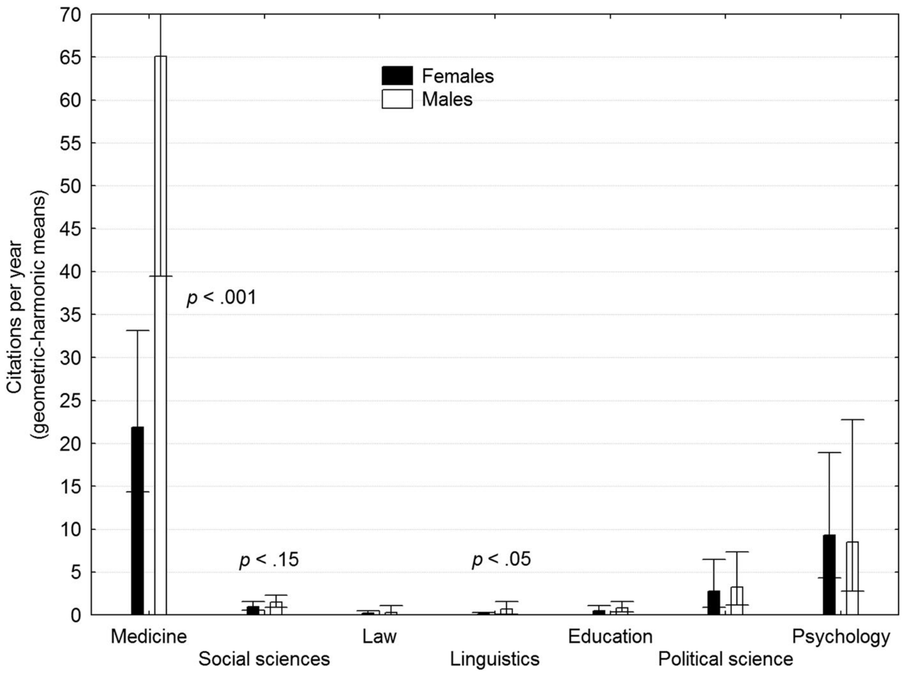

Figure 3. Number of citations per year as a function of discipline and sex. Error bars denote 95% confidence intervals and p-values are uncorrected for multiple comparisons.

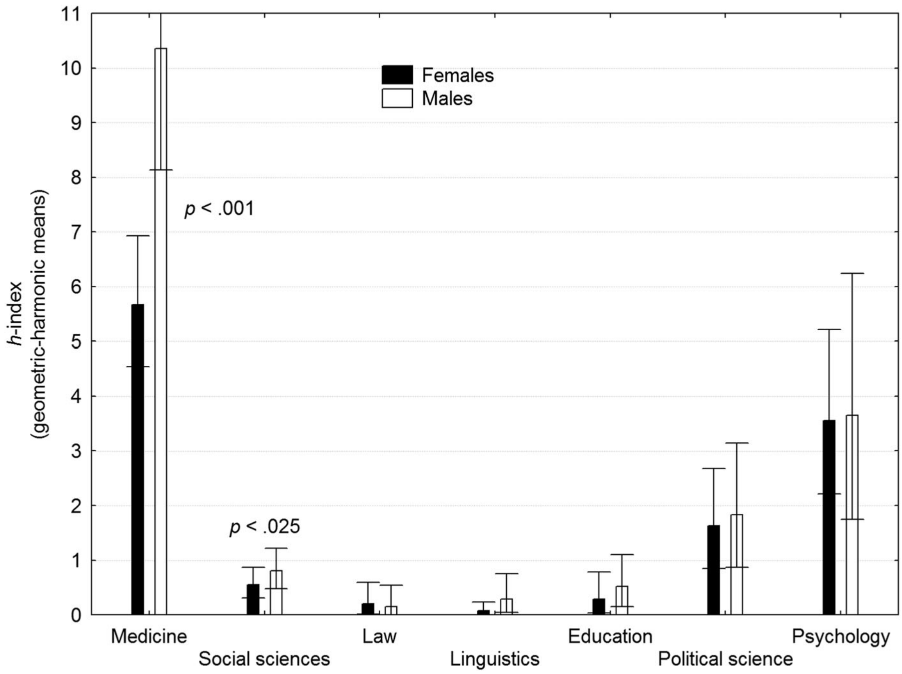

Figure 4. *h*-index as a function of discipline and sex. Error bars denote 95% confidence intervals. After correction for multiple comparisons, the sex difference *p*- for the Social Sciences increases to above .05.

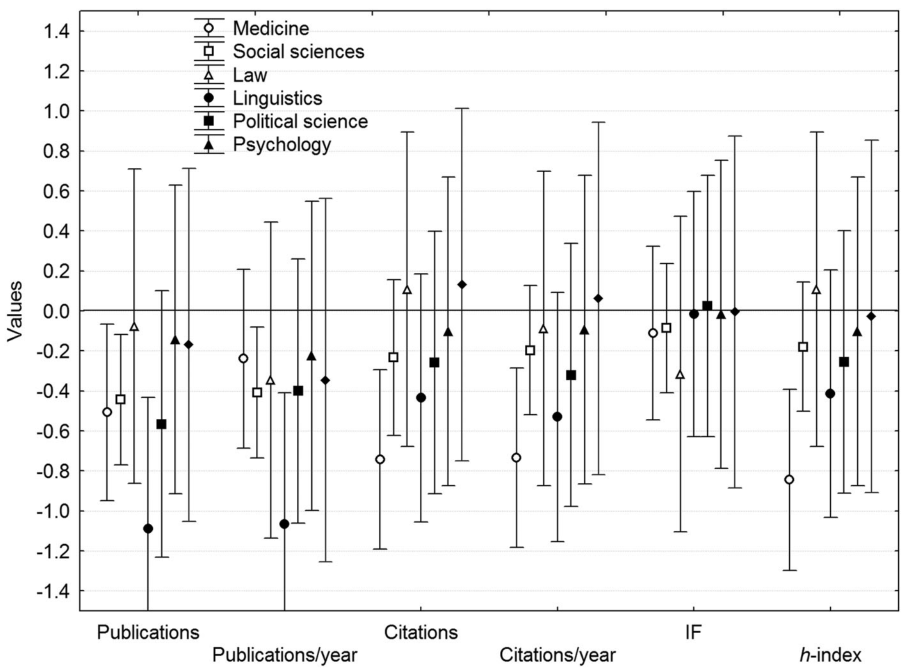

Figure 5. Effect sizes of the sex differences for each of the six publication metrics, separately for each of the six disciplines as well for the means across the five social sciences disciplines. Error bars denote 95% confidence intervals.

falsified this hypothesis, in that none of the 12 comparisons (2 discipline clusters × 6 metrics based on WoS data) exhibited any significant effect in this direction. In contrast, six of these metrics exhibited significantly ($p < .05$) higher values for males after Holm correction. In terms of magnitude, males had 64%–80% more scientific publications that had attained 42%–260% more citations, resulting in a 72%–83% larger *h*-index (Table 7). While these are quite large differences, their effect sizes were more moderate, due to the large variability stemming both from individual differences (Simonton 2014) and differences between disciplines, in the case of the Social Sciences.

The discussion is structured as follows. We first comment on an issue that has repeatedly been raised in previous reviews of this article. Limitations with the present study and alternative interpretations are then considered. Because our findings seem to contradict the common wisdom, as reviewed before, we conducted a systematic search in Scopus and WoS using the string academ* AND (sex OR gender) to compare them to the most recent literature. Finally, possible explanations are considered.

The present study measures productivity at the specific point in an academic's career when they are evaluated for the rank of professor. If that rank was attained exclusively on the basis of their academic performance, in accord with both the legislation and academic principles, women and men's merits should have been equal. The results show that at this point, and regardless of other potential differences in age, funding, number of children etc., female professors had, on average, lower levels of scholarly achievement than male professors. The result can be an effect of promoting females to professor at an earlier stage in their career. Other variables that might affect productivity, or whether some faculty faced greater challenges or had to work harder than others to obtain the same apparent academic merit, is irrelevant for the conclusion that the publication criteria for becoming a professor were effectively lower for females.

We will next consider limitations pertaining to the sampling and statistical analysis, data collection, representativeness of the population, and specific design choices. First, the sample size was limited to what was sufficient for detecting the suggested meaningful effect size (d) of 0.3, because obtaining publication data for each individual was quite demanding. As it turned out the observed effect sizes were larger than this for six of the twelve (2 discipline clusters × 6 publication metrics) sex differences, and more than double that for three of them. Moreover, the direction of the sex difference was consistent both for the two clusters of disciplines and the full matrix, namely for 33 of the 36 combinations (6 disciplines × 6 publication metrics). It should also be noted that citation rate is reasonably the least biased metric within discipline, whereas total citations and *h*-index are inflated by the time since first publication. The validity of the metrics used is therefore supported by the quite similar effects across citation rate and total number of citations.

Second, we noted in the introduction that the study population was somewhat smaller than the estimated replacement of professors who retire, and argued that this was unlikely to entail any bias if it were due to an overestimation of the replacement. Another possible explanation for this discrepancy is attrition, as some individuals decline to take part in the promotion ceremony. We believe that this is very rare, and that even those who will not participate are listed in the booklets, but have no means of testing this. Even so, there is no reason to assume that such attrition would be associated with both productivity and sex, which is the prerequisite for it biasing the results. Also, this attrition is most likely to occur for those who are already professors but are changing institution, as they might not find it worthwhile to experience the ceremony a second or third time. Since these individuals tend to be older, male, and have high merits, their exclusion would actually decrease the male merits, and would hence decrease the sex difference, as the results turned out.

Third, the results are limited to the population of professors that were appointed after 2008, which excludes the 870 female and 3783 male active professors who were appointed before this year (Statistics Sweden 2010). We are thus oblivious about possible differences in criteria for appointing them. However, those figures had changed to 1547 females and 4807 males six years later, increasing the proportion of females from 19% to 24% (Statistics Sweden 2016). This means that the number of male professors had increased by 28% and female ones by 78%.

Fourth, several disciplines were excluded because of their small *n* and skewed sex ratio for fear that they might be less representative. Most of these belong to the natural sciences and have, except for biology, a larger proportion of males. Having included such disciplines would likely have increased the effect found, because females seem to be particularly favoured in male-dominated contexts. Breda and Hillion (2016) found that females received higher scores when their sex was known than when it was not, indicating a positive bias, and that this difference increased up to 13 percentile points with the proportion of males in that subject. Similarly, Williams and Ceci (2015) found a 2:1 preference for females in hypothetical hiring experiments regarding tenure-track assistant professorships, when otherwise identical applications were randomly assigned to either sex.

Fifth, it is possible that using other databases than WoS would have affected the sex differences, as mentioned in the method section, although this would seem unlikely in light of the very high correlations between publication metrics across databases (Knudson 2019, 101). Still, the generally higher publication performance of males might be associated with publishing in more high-impact journals. As journals with lower impact are conceivably less likely to be indexed in WoS than in other databases, this may amplify the sex difference. The almost non-existent sex difference in journal IF speaks against this, however.

Sixth and finally, it could be argued that even if there were no difference in productivity, female authors might be less cited due to some unidentified bias. There seems to be no study that can substantiate this claim. Aksnes et al. (2011), for example, found that female professors in Sociology were cited approximately 10% less than the male ones, but that this difference was entirely explained by their significantly fewer publications.

Taken together, it seems inconceivable that any alternative data selection or transformation would either eliminate or reverse the direction of the group difference. Two systematic sample selection criteria were applied, excluding disciplines with small *n* and disciplines with a large sex skew. None of the disciplines with $n >= 30$ had any substantial sex skew (Table A2), and 36%–53% in the selected disciplines were female (Table 3). It is possible that the excluded data would exhibit a different pattern, but that would rather have increased the group difference according to the common idea that publication merits are hampered by belonging to a small discipline or to a small minority group (Yousaf and Schmiede 2016). Even so, it would be unlikely to change the overall pattern, because the excluded disciplines constitute a mere 28% of the whole population (929–670 = 259; see Table 3). Another possibility is that female academics were appointed on the basis of generally having higher merits apart from publications. There seems to be no indication of such a pattern. Females applying for promotion to professor at Uppsala University during the period 2001–2010 did not overall have higher pedagogical merits or more funding than their male counterparts in these years (Riis, Hartman, and Levander 2011, see 125 and Table 45).

Thus, how can these unexpected and yet robust results be understood? If we had merely compared merits across the sexes at any point in the academic career, higher male achievement could have been attributed to favourable conditions for males, such as more encouragement, more opportunities for co-authorship, and better access to resources, like funding and time for research. However, the present design evades these possible confounders and add-on explanations by considering only the evaluation of widely-used quantitative publication performance criteria, not how that performance was achieved. The results show that the criteria for becoming a professor, in terms of publication metrics, were effectively lower for females during the measured period.

This finding is inconsistent with the hypothesis that sex-biased evaluation and in-group support hold women to a higher standard in order to get ahead, as reviewed in the Introduction. Females have historically been hindered to engage in science by means of strict sex roles and the inflexibility of societal and family institutions, which have also often marginalised females' scientific achievements. The present study is concerned with the contemporary situation, however. It is frequently argued in the media and the public debate that academia of today is a hostile environment for females (Lawrence 2006), that academia discriminates against females (Johnson, Hekman, and

Chan 2016), and that academic quality would increase if academia fostered more of a gender perspective (Alnebratt 2011). The results from the search mentioned above include many scholarly papers that express one or more of these notions, but the vast majority of those do not present any empirical data or empirically based arguments. Amongst empirical studies there is one strand that relies on female academics' self-reported perceptions of discrimination and hardships. Most of them report negative experiences (e.g. Howe-Walsh and Turnbull 2016; Seierstad and Healy 2012), however other studies report that a substantial proportion of females feel they are treated equally as males (e.g. Seemann et al. 2016; Webster et al. 2016) or that their promotions were perceived as biased in their favour and against males (e.g. Van den Brink and Stobbe 2014, 169–170). Apart from being based on subjective experience, the main problem with such studies is that they rarely compare the sexes and control for confounding variables. It is conceivable that academics regardless of sex feel that they face unsurmountable demands, role conflict, hostility, and lack of support, simply because of the competitiveness and nature of academia. Recent empirical studies that employ more objective measures indicate that female academics are often favoured. In sociology, for example, females get a permanent position with 23%–44% fewer publications than males, and are overall 1.4 times more likely to get tenure (Lutter and Schröder 2016). Females were scored up to 13 percentile points higher on an exam when their sex was known than when it was not, indicating a positive bias, with the higher bias for the more male-dominated subjects (Breda and Hillion 2016). Likewise, empirical data suggest that females are advantaged in retention (Box-Steffensmeier et al. 2015), salary (O'Neill and O'Neill 2006), funding (Marsh, Jayasinghe, and Bond 2011; Raj et al. 2016), and publishing (Diamond et al. 2016). Also hypothetical hiring experiments indicate a preference for females in male-dominated disciplines (Williams and Ceci 2015), and a recent meta-analysis found very small preferences for the dominant sex in the respective occupation (Koch, D'Mello, and Sackett 2015). Across 111 studies covering four decades, males were preferred for male-dominated occupations with a meta-analytical effect size of 0.08 (Cohen's *d*), while a tendency to prefer females for female-dominated occupations was even smaller (0.02) and non-significant. There was no bias for sex-balanced occupations, nor when the raters were 'experienced professionals' (Koch, D'Mello, and Sackett 2015). That description seems befitting for the academics that evaluated the professors in the present study. Finally, the present results are also consistent with previous research in terms of generally higher scientific productivity for males (Aguinis, Hun Ji, and Joo 2018; Bendels et al. 2018; D'Amico, Vermigli, and Canetto 2011; Fridner et al. 2015; Holliday et al. 2014; Lerchenmueller and Sorenson 2018; Nielsen 2016; Raj et al. 2016; Riis, Hartman, and Levander 2011; van den Basselar and Sandström 2016). In conclusion, the recent literature paints a variegated picture, where more objective study designs tend to indicate a bias in favour of females, evidently more in line with the present results.

This discrepancy between empirical results and the more unequivocal claims in the media, academia, and the political level may be one explanation for the present results. If a majority of those involved in evaluating applications for the rank of professor believe that there is a bias against females, they might react so as to compensate for this, either deliberately or subconsciously and unwittingly. Combining the results from several different tests of their data, Breda and Hillion (2016, 477) concluded that 'evaluators may simply have a preference for gender diversity, either conscious (e.g. political reasons) or unconscious'.

Another explanation may be the application of so-called *affirmative action* and *equal opportunities promotion* measures that ostensibly compensate for inequality or unfairness without directly challenging meritocratic assessment (see Madison 2019, 2). This might take the form of always selecting from the favoured group if merits are identical, insignificantly different, or sufficient to perform the task (Utbildningsdepartementet 1994, 36, 2004, 46). Such measures will inevitably create a bias that origins from the ubiquitous margin of error and uncertainty in disclosing, communicating, and assessing merits.

A third explanation may be that university administrations somehow increase the proportion of female professors by non-meritocratic means, in accord with government goals to achieve sex equality 'in purely numerical terms, [concerning] the sex distribution amongst PhD students, teachers, and researchers' (Utbildningsdepartementet 1994, 26, 2004, 46).[4] Indeed, the Swedish government has decided that the less represented sex shall constitute at least 40% in all areas of education (Delegationen för jämställdhet i högskolan 2011, 166, 2009, 5; Utbildningsdepartementet 1994, 37), and that all official statistics should be broken down by sex in order to monitor this[5] (Utbildningsdepartementet 1994). It has also decided that a so-called *gender perspective* shall be applied to all higher education[6], that females be appointed when merits do not differ significantly between applicants of both sexes, and that universities be incentivised to increase the proportion of female professors.[7] As stated by the former minister for higher education:

> The Cabinet is now substantially increasing the level of ambition for the period 2017–2019. New recruitment goals for equal sex distribution amongst newly recruited professors are written into the universities' letters of regulation. They correspond to nine percentage points on average per institution for the upcoming period. In addition, the Cabinet has for the first time set a national goal: Equal numbers of women and men shall be recruited as professors 2030 at the latest. (Hellmark Knutsson 2017)[8]

Equality between the sexes is reasonably defined as equal performance based on equal ability, whereas preferential treatment that leads to different ability actually causes inequality. For example, some universities have offered female, but not male, assistant professors paid time for research in order to increase merits such that they can qualify for promotion to professor (Umeå universitet 2012). The present study can only conclude that no bias against females in attaining the rank of professor in relation to their publication metrics occurred for the years 2009–2014 in Sweden, and suggests that females have, on the contrary, been preferentially hired during this period.

Notes

1. Our translation. The original text reads

    > Trots att Sverige är världsledande när det gäller andelen kvinnor på arbetsmarknaden, och trots att 60 procent av studenterna länge varit kvinnor, är fortfarande tre av fyra professorer män. Vi måste ha högre ambitioner än så. I den svenska högskolan ska kvinnor och män kunna verka på lika villkor och med samma möjligheter till karriär. Alltför ofta har föreställningar om manliga genier fått gå före kompetens i högskolan och alltför ofta har internrekrytering och nätverk fått spela större roll än hårt arbete. Det är i längden skadligt för kvaliteten på svensk forskning.

2. 'The term "gender" is often reserved for societal manifestations of being male or female – the roles people play … I use "sex" as the more inclusive term … "gender" is most commonly used to refer to the psychological aspects of rearing … the way your parents and other socializing agents treated you based on your sex when you were growing up … ' (Halpern 2012, 160–161).
3. For examples, see https://lu.prodwebb.lu.se/sites/www.lu.se/files/prof_inst_19_okt_2012.pdf https://issuu.com/uppsalauniversitet/docs/profinst-2015.
4. Our translation of 'En aspekt på jämställdhetsfrågan låter sig beskrivas i rent numerära termer och gäller könsfördelningen bland forskarstuderande, lärare och forskare'.
5. In our translation, the original text reads 'According to the decree (1992:1668) concerning official statistics (adjusted 1994:1108), should official statistics based on individuals be divided per sex, unless particular arguments speak against it' 41.
6. In our translation, the original text reads 'The process is repeated prior to each three-year period until both sexes' proportion of the professors is at least 40%' 37.
7. In our translation, the original text reads

    > An amendment [to the legislation for higher education] should be made that clarifies that it is allowed to positively discriminate the underrepresented sex within the particular category of employees within the university or polytechnic, if the discrimination is a route to promote equality in work life, 40.

8. Nu höjer regeringen ambitionsnivån avsevärt för perioden 2017–2019. Nya rekryteringsmål för jämn könsfördelning bland nyrekryterade professorer skrivs in i de nya regleringsbreven for universitet och högskolor. I genomsnitt handlar det om en ökning om nio procentenheter per lärosäte för kommande målperiod. Dessutom har regeringen för första gången satt en nationell målbild: lika många kvinnor som män ska rekryteras som professorer senast år 2030.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendix

Table A1. Numbers of males and females for each field of study, according to the promotion pamphlets.

	N male	*N* female
Aesthetics	1	1
Anatomy	2	1
Anesthesiology	6	0
Anthropology	4	1
Applied linguistics	0	1

(*Continued*)

Table A1. Continued.

	N male	*N* female
Archeology	5	3
Architecture	4	0
Art history	3	1
Astronomy	4	0
Astrophysics	0	1
Biochemistry	15	5
Bioinformatics	7	1
Biology	30	21
Business	16	5
Business economics	21	6
Cardiology	12	3
Cellular biology	1	1
Chemistry	21	6
Child and youth studies	2	1
Civil engineering	32	10
Clinical laboratory sciences	18	7
Cognitive science	3	1
Computer linguistics	1	0
Computer science	22	1
Conservation science	1	1
Criminology	2	1
Culture geography	5	3
Demography	2	0
Dentistry	5	4
Dermatology and venerology	4	1
Design	1	3
Developmental biology	1	0
Didactics	7	3
Ecology	4	2
Economic history	5	4
Economy	20	3
Education	1	0
Endocinology	2	0
Environmental science	7	4
Epidemiology	15	10
Ethnology	3	7
Food science	0	4
Gender studies	1	4
General practice	6	2
Genetics	12	3
Geology	7	4
Geriatrics	5	4
Healthcare science	6	22
Histology	1	0
History	23	13
History of science and ideas	4	0
Human rights	1	1
Hydrology	1	0
Immunology	19	7
Informatics	6	5
Inorganic chemistry	5	1
Internal medicine	6	2
Islamology	2	0
Journalism	5	3
Languages	24	30
Law	26	15
Library and information science	1	2
Literature	6	9
Management	4	2
Marine biology	0	2
Mathematics	20	4
Media and communication	6	2
Medical chemistry	2	0

(*Continued*)

Table A1. Continued.

	N male	*N* female
Medicine	44	27
Meteorology	8	0
Meteorology	1	2
Molecular biology	1	1
Molecular biology	11	2
Museology	0	1
Nanophysics	2	0
Nature geography	9	2
Neurochemistry	1	1
Neurology	10	3
Neuroscience	11	5
Obstetrics and gynaecology	6	7
Oncology	9	9
Ophthalmology	0	2
Organic chemistry	4	1
Orthopaedics	6	1
Otorhinolaryngology	3	2
Pathology	4	6
Peace and conflict studies	1	0
Pedagogy	20	23
Paediatrics	7	0
Performing arts	15	6
Pharmacology	4	1
Philosophy	8	3
Philosophy of science	4	1
Phonetics	1	0
Physical chemistry	7	1
Physics	40	3
Physiology	6	6
Physiotherapy	3	6
Plant sciences	3	3
Political economics	24	5
Political science	16	11
Psychiatry	10	4
Psycholinguistics	0	1
Psychology	24	14
Public administration	3	0
Radiology	11	2
Research methodology	1	0
Rhetoric	1	0
Rheumatology	2	4
Social anthropology	0	1
Social work	10	6
Sociology	21	9
Sociology of immigration and ethnic relations	2	0
Speech and language pathology	0	3
Statistics	5	1
Surgery	13	5
Technology	1	1
Theology	8	5
Tourism	1	0
Toxicology	1	2
Transportation	3	1
Visual arts	7	9
Zoology	2	2
Sum	929	477

Note: Gross total, before any cases were excluded.

Table A2. Numbers of males and females for each discipline.

	N male	*N* female
Agriculture	0	5
Anthropology	9	9
Archaeology	5	3
Architecture and design	6	4
Biology	56	34
Business	22	7
Chemistry	49	14
Computer sciences	24	3
Culture geography	5	3
Earth sciences	27	9
Economics	72	18
Education	30	27
Engineering and technology	35	12
Environmental studies and forestry	7	3
Gender and sexuality studies	1	4
Human history	30	15
Journalism, media, and communication	11	6
Law	25	15
Library and museum studies	1	3
Linguistics	28	32
Mathematics	20	4
Medicine	287	163
Philosophy	13	5
Physics	42	4
Political science	18	12
Psychology	25	15
Religion	11	5
Social work	10	6
Sociology	25	10
Space sciences	4	0
Statistics	5	1
The arts	28	24
Sum	929	477

Note: Gross total, before any cases were excluded.