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Career prospects for female university researchers have not improved

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Abstract There are fewer female than male professors in the world (21–79 distribution in the country of examination). The unequal distribution of male and female professors has usually been taken to indicate that men and women have not had equal opportunities to achieve professorship. At the same time, the increase in the proportion of female professors has been taken as evidence that academia is becoming more gender equal. It is possible that both of these assumptions are flawed, and that the gender distribution among professors is the result of demographic inertia, i.e., affected by the previous distribution of men and women within the system, and how fast the distribution has changed.This study examines whether the chances, for men and women, of becoming a full professor changes over time, and whether gender differences may possibly depend on early career events. It concludes that women are significantly less likely than men to become professors and that this situation is not improving over time. In spite of policies that have tried to increase the proportion of female professors, the chances of a woman becoming a professor do not change over time. We also show that these gender differences in promotion rate can be attributed to early career events.

Keywords Academic career · Female researchers · Universities · Sweden · Promotion rate

Introduction

When the world of university research is described as a formal organizational hierarchy, it seems dominated by males. The male domination is particularly striking in the top positions of the academic hierarchy, but the situation is changing as women's share of the top positions is increasing. In Sweden the share of female professors has risen from 8 % in

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1995 to 21 % in 2010 (Statistics Sweden, 2010), and Sweden is not an exception since the trend is similar in most industrialized countries (e.g., Catalyst, 2011; European Commission 2006).

It is sometimes assumed, in the Swedish debate on female career opportunities within academia, that women's relative distribution over employment positions indicate that academic hierarchies are structured according to the researchers gender (Statistics Sweden 2010). The low proportion of female professors is often taken as evidence that women are disadvantaged in university organizations (Sandvik Wiklund et al. 2011; SCB, 2010). Following the same line of reasoning, changes in the proportion of female professors is assumed to indicate that career opportunities have improved in recent years. Both conclusions are questionable. To make a fair analysis of men and women's careers in universities, we must take into account the "demographic inertia" in the observed systems (Hargens and Long 2002).The proportion of women among PhD University employees increases so rapidly that an analysis based on women's distribution across the various organizational positions can be directly misleading. The faster the proportion of women increases in the university sector, the more "over-represented" men will appear to be in higher positions. For the same reason, the increasing proportion of female professor does not prove that career opportunities for women have improved.

American studies have shown that career opportunities at American universities are worse for women than for men (Ginther, Hayes 2003; Ginther and Kahn 2009; Long 2001). Women are not promoted to full professors to the same extent as men, and leave their university career to a higher extent. If these gender differences depends on the inner working of the university organization it constitute a serious problem that can affect the trust in the institution, as well as having a negative effect on the quality of knowledge production, since potential talents are not allowed to develop. It is a wasteful management of human resources.

Previous studies focusing on gender career within the university system are limited on a number of accounts. First, they focus almost exclusively on academic careers in the USA. This means that we know very little about gendered career trajectories outside the USA. As career trajectories depend on factors related to the work organization as well as societal factors outside the university system there are reasons to suspect that there may be differences across countries. Even though we have very little reason to suspect the promotion rates would be gender equal in countries outside the USA we have to acknowledge that there may be country differences. For example we know that women in Sweden do not leave the university system to any higher extent than men (Silander 2010)[1] whereas in the USA women do exit to a higher extent. Our data shows that the probability for men and women to leave the university system after finalizing the PhD is almost equal for men and women (10 years after the completion of PhD about 30 % female PhD's are still employed at the university and 29 % of male PhD's). Second, previous studies are based upon survey data from the Survey of Doctorate Recipients (SDR). Even though the SDR does have low levels of panel mortality it is still a problem as some of the results coming from analyses on this panel are not clear-cut and could theoretically be caused by biased panel. Third, few studies focus on possible changes in chances for men and women to be promoted to professors. This study sets out to remedy these limitations by analyzing register data

[1] Silander does have problems defining university belonging which opens up for some ambiguity in the results (Danell 2004). However, we have tested differences in exit with our data and finds that there are no significant differences between men and women in the risk of leaving the university system after finalizing the PhD (results available from the authors)

including all people within the university sector in Sweden. Thus, we have the opportunity to assess potential gender inequality in career trajectories outside the USA context without the risk that the respondents are biased in any sense. Our main aim is to examine changes in career trajectories for men and women and our secondary aim is to shown that there are reasons to assume that the causes for differences in career trajectories between men and women can be found within the university system.

There are two overarching reasons why we expect that the differences in promotion rate between men and women are decreasing. First, the university system has become increasingly accessible for women. The latter can be exemplified by Fig. 1 that shows the change in the proportion of female faculty within the Swedish university system. The reason for this growth relates to factors, like changing attitudes, changing legal frameworks, general improvements in gender equality and so on. Second, also internal factors are changing within the university system. One important such change is the Professor reform that took place in 1999 where the meaning of Professor changed from a position to a title. The latter means that the rules around promotion changed from a vacancy system to a meritocratic system, which is very important as previous research indicates that meritocratic systems are more beneficial for women (Spilerman, Petersen 1999), i.e., there are reasons to believe that the differences in promotion rates between men and women change over time. More precisely, there are strong reasons to believe that the gender gap has been decreasing.

We do not set out to explain the casual mechanisms behind actual or changing promotion rates, but it is important to be able to at least indicate that the explanation to those promotion rates may not only be attributed to university external causes. Ceci and Williams (2011) conclude in their meta study that women are not discriminated against, at least not within the math discipline, as the reasons for female underrepresentation is found in lifestyle choices, childbearing, career preferences, gendered expectations as well as performance differences. If they are correct it means that all causes for actual or changing differences in promotion rates between men and women can be attributed to non university system causes, which could render our study somewhat meaningless. Therefore we also set

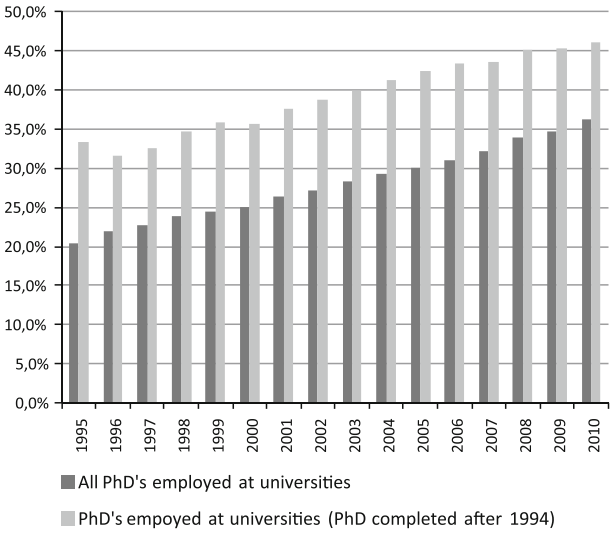

Fig. 1 Percent female PhD's employed at Swedish universities and university colleges. Note. Only those employed as lectures or researchers are included

Table 1 Descriptive statistics for event history data containing Swedish PhD's employed at Swedish universities (all subjects have completed their PhD 1990 or later)

Category	Total	Mean	Min	Median	Max
No. of subjects	15,124				
No. male subject	9,272				
No. female subjects	5,852				
No. of records	81,405	5.382505	1	4	16
(First) entry time		0.1264877	0	0	12
(Final) exit time		7.226197	1	6	20
Subjects with gap	1,982				
Time on gap if gap	3,645	1.559025	1	1	9
Time at risk	10,3731	6.858701	1	6	20
Failures	1,353	0.0894605	0	0	1

out to show that there are reasons to suspect that there are causes to be found within the university organization.

An analysis of gender differences in career prospects needs to track individuals over time. Results presented in this study are based on an analysis of individual careers. More specifically, we measure the promotion rates for individuals from the time they complete a PhD until they attain full professorship. We follow all PhDs employed in the Swedish university system between 1995 and 2010. This gives us the opportunity to examine gender bias in career prospects as well as to determine whether a potential gender bias is changing.

Data and method

We use Statistic Sweden's register for all employees at Swedish universities between 1995 and 2010, matched with the register of all individuals with a PhD in Sweden since 1971. For every year we know each employee's position in the system, her/his departmental affiliation, and the university and the area of science the employee works in. We also know the year in which each employee completed her/his PhD as well as the university that awarded the degree. In practice, we can study individual career trajectories between 1990 and 2010, as very few people become full professors in less than 5 years after achieving a PhD degree.

Sweden is a very good case study in terms of gender equality as it is one of the most gender equal countries in the world. For example Sweden was ranked as number three on the UN gender equality index in 2008 (UNDP 2012)[2] So, even though the analyses of Swedish data does not give us any opportunity to extrapolate our findings to other countries we can at least acknowledge that it is reasonable that the situation is not likely to be tremendously much better in other countries.

To be able to estimate individual gender differences in career prospects we calculate the promotion rates (in years) from the time of completing a PhD to the event of becoming a

[2] The gender development index measures three dimensions; reproductive health (maternal mortality and adolescent fertility rate), empowerment (seat in parliament and secondary and higher education attainment), and the labor market (participation in the labor force).

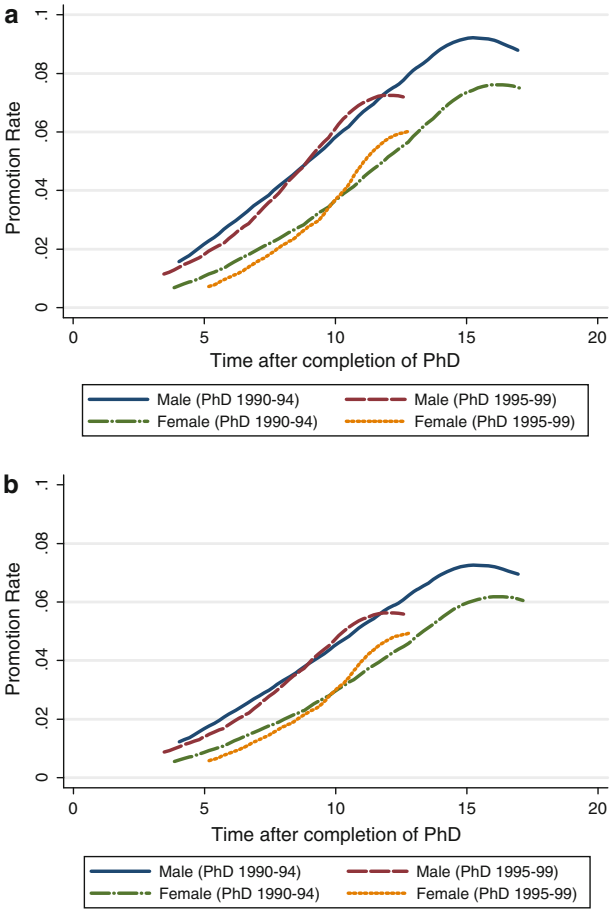

Fig. 2 **a** Comparison of promotion rate for university employees by gender and cohort. **b** Comparison of promotion rate for university employees by gender and cohort (controlled for discipline). Note. Smoothed estimates of promotion rates. Numbers within *parenthesis* denote the year in which PhD was completed

full professor. Promotion rate is calculated as an instantaneous propensity to be promoted, as expressed by the following equation:

$$r(t) = \lim_{t' \to t} \left(\frac{P(t \leq T < t' | T \geq t)}{t' - t} \right) \quad (1)$$

T is a random variable that represents the duration from the completion of a PhD until promotion to full professor. The numerator expresses the probability of the event occurring in the time interval t'-t given that the event has not occurred before.

Table 1 describes the data used in the study. The number of subjects is the number of individuals included in the material. The total number of individuals included in the data is 15,124, of whom 9,272 are males and 5,852 are females. Information about individuals is recorded annually. Registration of information is done as long as individuals are employed at a Swedish university. In the analysis each recorded occasion is treated as an event and Table 1 provides statistics on the total number of events under the title number of records.

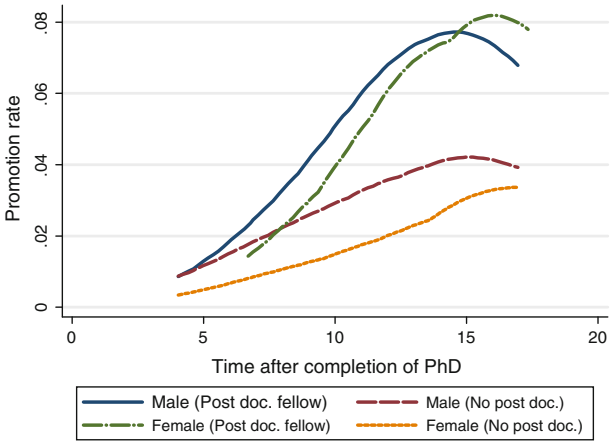

Fig. 3 Comparison of promotion rates of Swedish university employees by gender and early employment type (controlled for discipline)

Our data consists of 81,405 events (5.84 events per individual). Under the heading 'first entry time', we find information about the time from the dissertation year until the first recorded event. 'Final exit time' means the time until the last observation. Under the heading 'subjects with gap', we find information about how many individuals who for some reason have a gap in the observation series. The reason that there are individuals with gaps can be that they have been employed abroad, or that they have been unemployed, that is, for some reason, they were not employed at a Swedish university for some years. 'Time at risk' is the time that individuals are included in the analysis and the calculation of the promotional rates. 'Failures' is the number of individuals who, during the observation period, has been promoted to professors.

Analysis

Figure 2a shows the promotion rates for male and female researchers of different cohorts, not controlling for discipline whereas Fig. 2b shows the promotion rates where we control for discipline. Even though there are substantial differences across disciplines in promotion rates between men and women it does not change the overall conclusion about promotion rates over time between sexes. Two things can be observed in these figures. First, career prospects for female university researchers are clearly worse than for their male counterparts. Translated into hazard ratios, it means that women have a 37 % lower chance of becoming full Professors compared to men across cohorts. Second, and most important, gender differences in promotion rate have not decreased. This means that the increasing share of female professors is not a function of a changing probability of females being promoted, but a result of changes in the gender composition within universities.

From a policy perspective it is essential to clarify whether these results can be attributed to factors within the university organization. One way of doing this is to examine important career paths leading to full professorship. The most important early career position in the

Swedish system is a kind of postdoctoral fellowship.[3] These positions are highly sought-after, as they are perceived as necessary for a successful career. It is important to note that there are no differences in the likelihood of men and women in receiving these positions. However, the consequences are far from equal. Figure 3 shows that the promotion rates of men and women who have held postdoctoral fellowship positions are about equal, whereas men who have not held postdoctoral fellowship positions have a higher chance of becoming professors compared to women who have not held postdoctoral fellowship positions. A possible interpretation is that as long as competition over resources and positions is transparent, competitive women fare as well as men, but when men and women are allowed to compete over resources and networks in a more informal way, women are clearly worse off than men.

Conclusion

Fair play and respect for the scientific ethos within academia is not only a question of justice and gender equality, it touches the core of scientific endeavor. If women's career prospects at universities are affected by the mere fact that they are women, it is a clear breach of the principle of universalism (Merton 1973). Such practices will also damage the long-term development of science. It is obviously damaging to the collective quest for knowledge due to the wasteful management of scientific talent. It is also damaging to the public trust in science, since the foundation for this trust is the ethical standards of researchers and university organizations. So, unless universities, faculty, and departments fundamentally change how they organize networks and resources, women's transition from PhDs to professors will continue to look bleak in comparison to men's. As a large share of men who have not held tenure track positions are successful while women are not, it is evident that important human resources are not being used to their full potential.

Measured as chances of advancing to the position of full professors, the career prospects for female university researchers are as bleak today as they were 20 years ago, despite increasing gender equality within society as a whole and in spite of policy programs aimed at promoting female professors. From a research policy perspective, the crucial point is whether the differences in promotion rate is caused by factor external to the university organization, or factors internal to the organization. Ceci and Williams (2011) point in the direction that gender differences cannot be attributed to the university system, but fail to account for important organizational factors, such as access to informal networks and resources; they do not consider factors important early in the career in their meta analysis. In contrast to Ceci and Williams (2011), the observations presented in this study illustrate the importance of early career events for explaining gender differences. Women and men fair equally, in the Swedish system, when their careers are started off in a meritocratic way via the access of the Swedish postdoctoral fellowship whereas they do not in the group that do not achieve this important position. The latter is by no means any proof that women are discriminated against, only that we have reasons to assume that there may be factors within the university system that affects men's and women's' career trajectories differently. It also shows that we need more research around informal processes in order to fully solve the mechanism behind the difference in career trajectories between men and women.

[3] This position implies a 4 year fully financed full-time research position. It is important to note that these positions are limited to 4 years and that they do not result in a permanent position regardless of performance, as permanent positions are not related to these research positions.

For now we only note that the difference in probability between men and women in achieving a Professorship does not decrease over time in spite the fact that the gender equality in society is generally improving. E.g. the Gender inequality index dropped from 0.075 to 0.049 between 1995 and 2012 (UNDP 2012) or the wage gap decreased from 23.9 to 16.4 % between 1968 and 2000 (SOU 2001) in the country of examination. The latter means that society is getting better in terms of gender equality, but the university system is not necessary following the rest of the society.

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