

Does the Gender Composition of Scientific Committees Matter?*

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Abstract

We analyze how a larger presence of female evaluators affects committee decision-making using information on 100,000 applications to associate and full professorships in Italy and Spain. These applications were assessed by 8,000 randomly selected evaluators. A larger number of women in evaluation committees does not increase either the quantity or the quality of female candidates who qualify. Information from individual voting reports suggests that female evaluators are not significantly more favorable towards female candidates. At the same time, male evaluators become less favorable towards female candidates as soon as a female evaluator joins the committee.

Keywords: scientific committees, gender discrimination, randomized natural experiment.

JEL Classification: J71, J16.

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1 Introduction

The underrepresentation of women in academia remains a cause for concern among universities and policy makers around the world. In Europe, women account for 47% of PhD graduates, 37% of associate professors and only a mere 21% of full professors (European Commission 2016). Similar patterns may be observed in the US and the gender imbalance is even larger in Japan (National Research Council 2009, Abe 2012).

Several explanations may account for the lack of women in high-level positions. According to the pipeline theory, once women have entered the lower rungs of the academic career it is mainly a matter of time that they would move their way through a metaphorical pipeline to reach high-level jobs. However, in most disciplines, the share of women among faculty members remains low even after decades of improved recruitment of women at the undergraduate and the doctoral level (Ginther and Kahn 2004, 2009). Gender differences in promotion rates might also reflect differences in productivity, perhaps due to the existence of gendered roles at the household level or the lack of female mentors and role models (Blau, Currie, Croson and Ginther 2010). Some women may also devote excessive time to tasks that are socially desirable but which are not taken into account in promotion decisions (Vesterlund, Babcock and Weingart 2014). Furthermore, some authors have pointed out that women are less likely to apply for promotions (Bosquet, Combes and Garcia-Peñalosa 2013; De Paola, Ponzio and Scoppa 2015), perhaps due to the existence of gender differences in the preference for competitive environments (Niederle and Vesterlund 2007; Buser, Niederle and Oosterbeek 2014) or in bargaining abilities in the labour market (Babcock, Gelfand, Small and Stayn 2006; Blackaby, Booth and Frank 2005).

Beyond these supply-side explanations, the slow progress made by women has been sometimes attributed to the lack of female evaluators in the committees which decide on hiring and promotions. In this paper we examine whether the presence of women in scientific committees might help to increase the chances of success of female candidates and to improve the quality of the evaluations. There are several reasons for considering this hypothesis. First, there is evidence of gender segregation across different scientific subfields (Dolado, Felgueroso and Almunia 2012, Hale and Regev 2014). If men and women tend to do research in different subfields and evaluators overrate the importance of their own types of research, the lack of female evaluators might be detrimental for female candidates (Bagues and Perez-Villadoniga 2012, 2013). Second, research networks tend to be gendered (Boschini and Sjögren 2007, Hilmer and Hilmer 2007).¹ If evaluators are mostly male,

¹Boschini and Sjögren (2007) show that coauthoring is not gender neutral in Economics. Hilmer

male candidates might have a better chance to be acquainted with committee members and could perhaps benefit from these connections (Zinovyeva and Bagues 2015; Bagues, Sylos-Labini, Zinovyeva 2015). Third, men might hold more negative stereotypes of women than other women do or they may be biased against women reaching high-level positions. For instance, according to the World Value Survey, around 25% of US males believe that men make better political leaders and 16% think that men make better business executives. Women are half as likely to hold such views. A similar pattern is observed in Europe.² According to some authors, similar biases are also present in the academic world.³ Fourth, the presence of women in evaluation committees might also improve the quality of the evaluation. It has been argued that group performance is positively correlated with the proportion of women in a group (Woolley, Chabris, Pentland, Hashmi and Malone 2010). The presence of women in scientific boards might not only help to achieve gender balance in the academic profession, but it can also make science more meritocratic and invigorate its progress.

These arguments seem to have reached policy makers. A number of countries have introduced quotas requiring that scientific committees be at least 40% female (and male) and many universities and scientific institutions have their own internal guidelines ensuring the presence of both genders in committees.⁴ However, despite the increasing popularity of gender quotas in scientific committees, there are concerns about their effectiveness. Quotas are costly for senior female researchers, as

and Hilmer (2007) observe that in the US 55% of the Economics PhD students being advised by women are female, while only 18% of Economics PhD students advised by men are female.

²World Value Survey Wave 6: 2010-2014. Official aggregate v.20140429. World Values Survey Association (www.worldvaluessurvey.org).

³Gender discrimination in academia remains a controversial issue. According to meta-analyses by Ceci and Williams (2011) and Ceci, Ginther, Kahn, and Williams (2014), the more recent empirical evidence fails to provide any clear support to the assertions of discrimination in manuscript reviewing, interviewing, and hiring. However, other studies find that female researchers might still receive lower evaluations than male researchers with identical characteristics (Steinpreis, Anders and Ritzke 1999, Moss-Racusin, Dovidio, Brescoll, Graham and Handelsman 2012). Some experts in gender studies have also argued that male evaluators discriminate against female candidates. For instance, in a report commissioned by the European Commission, the expert group *Women In Research Decision Making* concludes that “(a)t the very least, having male only committees risks replicating stereotypes and bias, both regarding applicants and issues in research” (European Commission 2008, page 27). Another expert report on the situation of women researchers in Spain asserts that “there are prejudices about women among those who co-opt, promote or have the key to promotion. The bodies which control this are mostly male and, even if they are not totally conscious of it, they see an academic woman first as a woman and secondly as a colleague.” (Fundación Española para la Ciencia y la Tecnología 2005, page 48). Other researchers have voiced similar views (Bagilhole 2005, Barres 2006, Smith et al. 2015).

⁴Gender quotas in scientific committees were introduced in 1995 in Finland (amendment of the *Act on Equality between Women and Men*, Act No. 624/1992 and No. 206/1995.), in 2007 in Spain (*Constitutional Act 3/2007 of 22 March for Effective Equality between Women and Men*) and in 2014 in France (decree No. 2014-997, September 2 2014). The European Commission has also committed to reaching a target of 40% female participation in its advisory structures for Horizon 2020, the European Union’s research and innovation programme for 2014-20.

they increase disproportionately the amount of time that they have to devote to evaluation committees (Vernos 2013). Furthermore, a larger presence of women in committees may not necessarily benefit female candidates. Both men and women have developed their careers in an academic environment dominated by men, and both genders may tend to associate important academic positions, and the features they require, with men, not with women (Méndez and Busenbark 2012). And even if women are relatively more sympathetic towards female candidates, they may not have equal levels of voice and authority in deliberation processes (Karpowitz, Mendelberg and Shaker 2012, Brescoll 2011). The presence of women in the committee can also induce male evaluators to be less favorable towards female candidates. Past research on group dynamics suggests that men might not respond favorably to the presence of gender diversity, particularly in domains that men have historically dominated (Crocker and McGraw 1984). Female evaluators can also contribute to strengthen male identity (Akerlof and Kranton 2000) or they can trigger a licensing effect (Monin and Miller 2001, Khan and Dhar 2006).

A better understanding of the impact of scientific committees' gender composition on recruitment and promotion decisions is crucial in order to determine whether quotas are desirable. The empirical evidence has been so far inconclusive and typically based on small samples. Sometimes researchers seem to benefit from the presence of evaluators who share the same gender (Casadevall and Handelsman 2013, De Paola and Scoppa 2015), sometimes they seem to obtain relatively better evaluations from opposite-sex evaluators (Broder 1993; Ellemers, Heuvel, de Gilder, Maass and Bonvini 2004), and in some other cases gender does not seem to play any (statistically) significant role (Abrevaya and Hamermesh 2012; Jayasinghe, Marsh and Bond 2003; Milkman, Akinola and Chugh 2015; Moss-Racusin, Dovidio, Brescoll, Graham and Handelsman 2012; Steinpreis, Anders and Ritzke 1999; Williams and Ceci 2015). A brief summary of these studies is available in Appendix A.⁵ It is unclear whether these mixed findings reflect the idiosyncrasies of the different situations and samples analyzed in each study, or simple random sampling variation. The literature also does not shed light on the mechanisms through which a higher presence of female evaluators in committees may benefit female candidates. From a policy perspective, the lack of more extensive and clear evidence is disappointing.⁶

In this paper we analyze the role of evaluators' gender in academic evaluations

⁵All appendix material can be found in the Online Appendix.

⁶A related literature also analyses the role of evaluators' gender in non-academic occupations (Bagues and Esteve-Volart 2010, Bertrand, Black, Jensen and Lleras-Muney 2014, Booth and Leigh 2010, Kunze and Miller 2014), in sport activities (Sandberg 2014) or in the lab (Bohnet, van Geen and Bazerman 2015). In general, in these studies evaluators' gender is not relevant, with the exception of Bagues and Esteve-Volart (2010) who document that female applicants to the Spanish judiciary have lower chances of being hired when they are randomly assigned to an evaluation committee including women.

using the exceptional evidence provided by two large-scale randomized natural experiments in two different countries, Italy and Spain. The representation of women in Italian and Spanish universities is similar to their representation in other European countries and the US. Despite having achieved parity at the lower rungs of the academic ladder, women are still underrepresented in top academic positions. They account for approximately half of new PhD graduates, one third of associate professors but only one fifth of full professors in both countries.⁷ The Spanish and Italian institutional arrangements offer several unique features. In order to be either promoted or hired by a university at the level of associate or full professor, researchers are required to first obtain a qualification granted by a centralized committee at the national level. In these nation-wide examinations, which are performed periodically in all disciplines in both countries, evaluators are selected from a pool of eligible professors using a random draw. This allows us to consistently estimate the causal effect of committees' gender composition on evaluations. We also observe extensive and detailed information on evaluators' and candidates' research production, academic connections and their subfield of specialization. We exploit this information to explore the different mechanisms suggested by the theory about the role of committees' gender composition. Each country also offers some comparative advantage in terms of data availability. We use individual voting reports, available in Italy, to study the voting behavior of male and female evaluators within each committee. In Spain, we can observe the future productivity of promoted candidates. We use this information to examine the quality of the assessments granted by committees with different gender compositions. As we explain in more detail in section 2, there exist also a number of interesting institutional differences between the evaluation processes in the two countries. Having data for the two different institutional arrangements allows us to cross-validate the findings and to explore their robustness.

Our database includes information on all qualification exams that were conducted in Italy in years 2012-2014 and in Spain in years 2002-2006. Overall, these evaluations involved approximately 100,000 applications and 8,000 evaluators in all disciplines. Evaluation committees, which include five members in Italy and seven members in Spain, are composed mostly by men. Approximately one third of evaluation committees do not include any women, in one third there is just one female evaluator, and in one third of committees there are two or more women, but very rarely we observe a female majority.

⁷In Italy, women account for 54% of new PhD graduates, 35% of associate professors, and 21% of full professors (Ministry of Education, University and Research, year 2014). In Spain, women account for 49% of new PhD graduates, 40% of associate professors, and 21% of full professors (Ministry of Education, Culture and Sports, year 2014). According to information from individuals who obtained a PhD in the 90s in Spain, female graduates are half as likely to attain full professorship than male graduates (Sánchez de Madariaga, de la Rica and Dolado 2011).

In both countries male applicants tend to be more successful than female applicants. In Italy, approximately 38% of men receive a positive evaluation, compared to 35% of women. In Spain, 12% of male applicants qualify, while the success rate among female applicants is equal to 11%. When we take into account candidates' observable productivity, the remaining gender gap is equal to 1.5 percentage points (p.p.) in Italy and 1.4 p.p. in Spain, and it is statistically significant in both countries. We find no empirical support, neither from the average in the two countries nor from the majority of subsamples analyzed, to suggest that the presence of women in evaluation committees decreases the gender gap in a statistically or economically significant way. On the contrary, in Italy gender-mixed committees exhibit a significantly larger gender gap than committees composed only of male evaluators. An extra woman in a committee of five members increases the gender gap by somewhere between 0.4 and 3.3 p.p., considering a 95% confidence interval. In the Spanish case, we can reject any sizable impact. An additional woman in a committee of seven members may decrease the gender gap by at most 0.5 p.p. or it might also increase it by up to 1 p.p.

We also examine whether committees with a relatively larger proportion of women promote better candidates, using as a proxy of candidates' quality their research output before the evaluation and, in the case of Spain, also their research output during the following five years. We do not observe any significant difference in the past or future observable quality of candidates who have qualified in committees with different gender compositions.

Evidence from 300,000 individual voting reports, available in the case of Italy, suggests that there are two main factors that explain why female candidates do not benefit from a larger presence of women in committees. In mixed gender committees, female evaluators rate female applicants higher than their male colleagues, but the difference is small and statistically non significant. At the same time, the presence of female evaluators in committees makes male evaluators tougher upon female candidates, perhaps reflecting a licensing effect or male identity priming.

To gain a better understanding of why female evaluators do not exhibit a stronger same-sex preference and also to determine the validity of our findings in other contexts, we explore why none of the standard theories predicting that a larger presence of women in committees helps female candidates plays a major role in this context. First, we consider the gendered networks hypothesis. As expected, we find that research networks tend to be gendered in both countries. Female professors are significantly more likely to have an advisor, a colleague or a coauthor of the same gender. We also observe that committees tend to favor connected candidates. However, the likelihood of having a connection in a national committee is relatively low and, therefore, networks have only a limited effect on the evaluation outcomes. Sec-

ond, we examine the role of gender segregation across research subfields. At the level at which evaluations were conducted, around 200 different fields, gender segregation turns out to be relatively small. As a result, while evaluators tend to prefer candidates with a similar research profile, the impact of gender segregation on evaluations is negligible. Third, we study gender stereotypes. Stereotypes are expected to be more relevant when evaluators cannot observe accurately the quality of candidates, for instance because evaluators and candidates are specialized in different subfields of research. The influence of stereotypes on evaluation outcomes seems to increase, not decrease, when there are women in the committee. Finally, we also examine separately evaluations for high-level positions. Male evaluators might have prejudices against women being promoted to full professorships, but not to positions at lower levels of the career ladder. Results are mixed: we find support for this hypothesis in the case of Spain, but not in the case of Italy.

Our study contributes to the literature in several ways. We provide the first large-scale assessment of the causal impact of the gender composition of scientific committees. There is no evidence suggesting that, in the two evaluation systems considered in this study, female candidates benefit from the presence of a larger share of women in evaluation committees. We also examine explicitly the relevance of the different theoretical arguments that have been proposed in the literature in favor of increasing the share of women in committees. This analysis helps to assess the external validity of our findings and, as we discuss in detail in the final section of the paper, it provides a better understanding of when gender quotas might be desirable. Finally, we open the black box of committee decision-making and we analyze the voting behavior of individual committee members. Our findings suggest that interactions within committees might exacerbate the impact of gender stereotypes.

2 Institutional background

Several European countries have national evaluation systems which are meant to guarantee the academic quality of professors in public universities. The evidence presented in this paper is based on an analysis of two variants of such systems: the Italian system known as *Abilitazione Scientifica Nazionale*, which was introduced in 2012, and the Spanish system known as *Habilitación*, which was in place between 2002 and 2006.

Both systems require candidates for associate and full professorships to qualify in national evaluations held by an academic board in the appropriate discipline. In each country, there are nearly two hundred legally defined academic disciplines, each corresponding to a certain area of knowledge. Successful candidates can then apply

for a position at a given university. The time line of evaluations has the following steps. First, a call for applicants is announced in which candidates can apply for multiple disciplines and positions. When the list of applicants is settled, committee members are randomly selected from the list of eligible evaluators in the corresponding discipline. Once the committees are formed, the evaluation process begins and once this is over, the evaluation results are made public. Rostered evaluators can potentially resign at any point of the process, something that happens in 2% of cases in Spain and in 8% of cases in Italy. Resigned evaluators are substituted by randomly selected evaluators.

The procedure has also distinctive features specific to each country. In Spain, evaluations involve oral presentations by the candidates, while in Italy evaluations are based only on candidates' CVs and publications. In Spain qualification leads almost automatically to promotion, while in Italy the chances to get promoted conditional on obtaining qualification are much lower. The Italian system is relatively more transparent and exposed to public scrutiny. Nonetheless, in both systems there seems to be room for subjectivity. For instance, Zinovyeva and Bagues (2015) and Bagues, Sylos-Labini and Zinovyeva (2015) document that the presence of a coauthor or a colleague in the evaluation committee has a significant positive impact on candidates' chances of success in both countries.

We describe in detail the main features of each system below. This information is also summarized in Appendix B.

2.1 Abilitazione Scientifica Nazionale

In Italy, four out of five committee members are selected through a random draw from the pool of 'Italian' eligible evaluators and the remaining evaluator is drawn out of the pool of 'foreign' eligible evaluators. The former pool consists of full professors affiliated to Italian universities who volunteered to be members. The latter pool consists of professors affiliated to universities from OECD countries, who also voluntarily participate in Italian evaluations. The randomization procedure is subject to one important constraint: no university can have more than one evaluator within a single committee.

The eligibility of evaluators is decided in the following way. In science, technology, engineering, mathematics, medicine and psychology (STEMM), evaluators are required to have a research output above the median for full professors in the discipline in at least two of the following three dimensions: (i) the number of articles published in scientific journals, (ii) the number of citations, (iii) and the H-index. In the social sciences and the humanities (SSH), the research performance of evaluators has to be above the median in at least one of the following three dimensions: (i)

the number of articles published in high quality scientific journals (in what follows, A-journals),⁸ (ii) the overall number of articles published in any scientific journals and book chapters, and (iii) the number of published books. ‘Foreign’ eligible evaluators have to satisfy the same requirements. While ‘Italian’ evaluators work *pro bono*, ‘OECD’ evaluators receive €16,000 for their participation.

Evaluations are based solely on the material provided in candidates’ application packages consisting of CVs and recent publications. Committees have full autonomy regarding the criteria to be used in the evaluation and the number of qualifications to be granted. Each evaluation committee is required to draft and publish online a document describing the general criteria to be used in providing a positive assessment. Candidates may withdraw their application up until two weeks after evaluation criteria are publicized. A positive assessment of the candidate requires a qualified majority of four out of five votes. Once granted, qualifications are only valid for four years, while a negative evaluation means that candidates are excluded from participating in further national evaluations during the following two years.

An important feature of the Italian system is its extreme transparency: all the relevant information – including candidates’ and evaluators’ CVs, as well as individual evaluation reports – is published online. An independent evaluation agency appointed by the ministry also collects and publicizes information on the research output of final candidates in the ten years preceding the evaluation, as measured by the three bibliometric indicators described above. The evaluation agency compared the research productivity of candidates in each of these three dimensions with the research productivity of professors in the category to which they applied, and committees were asked to take this information into consideration.

2.2 Habilitación

In Spain, committees are composed of seven members. In evaluations for full professorships, all evaluators are full professors based in Spanish universities or research institutes. In evaluations for associate professorships, three committee members are full professors and four evaluators are associate professors. No more than one non-university researcher is allowed to be selected as a member of the committee for a given exam. Similarly, no more than one emeritus professor may be selected as a member of a given committee.

In order to be eligible, evaluators are required to satisfy some minimum research level which is assessed by the Spanish education authority.⁹ This requirement is

⁸An evaluation agency determined with the help of several scientific committees the set of journals to be considered as high quality in each field.

⁹The Spanish education authority determines professors’ eligibility according to the number of *sexenios* completed. *Sexenios* are granted periodically by the ministry on the basis of applicants’

satisfied by approximately 81% of full professors and 70% of associate professors. Unlike the Italian system, where participation is voluntary, in Spain all eligible professors can be selected to serve in committees.

Candidates for evaluation are required to make several oral presentations in front of a committee. For candidates to full professorships, these exams have two qualifying stages. In the first stage, each candidate presents the CV and then, in the second stage, an example of his or her research work. Exams for the position of associate professor, in addition to these two stages, have an intermediate stage where candidates give a lecture on a topic randomly chosen from a syllabus proposed by the candidate. In each stage evaluations are made on a majority basis. Qualifications have unlimited validity once they have been granted. The number of qualifications conceded at the national level is very limited and being accredited is, in most cases, equivalent to being promoted.

3 Data

We use data on all evaluations from the first edition of the Italian *Abilitazione Scientifica Nazionale* (years 2012-2014) and on all evaluations from the Spanish *Habilitación* (years 2002-2006). In Italy, the data includes information on 184 committees, one per each academic discipline. Each committee assessed both applications to associate and to full professorships. In Spain, there are in total 967 committees in 174 disciplines, of which 502 are committees evaluating candidates for full professorships and 465 evaluating candidates for associate professorships.

The dataset includes information on eligible and actually selected evaluators, applicants, and the final outcome of the evaluation. In addition to demographic characteristics and a number of productivity measures, we have also gathered information on research networks and research specialization. In Appendix C we provide detailed information on how this information was collected, and how each variable was constructed. Below we briefly summarize the main features of the dataset.

3.1 Evaluators

In Italy, 39% of Italian female full professors and 41% of Italian male full professors volunteered and were considered eligible to sit in evaluation committees. The list of eligible evaluators includes 5,876 professors based in Italian universities and 1,365 evaluators based in OECD universities. In the average field, the pool of eligible

research output in any non-interrupted period of a maximum of six years. Eligible associate professors are required to have held at least one *sexenio* while eligible full professors are required to have held at least two *sexenios*.

evaluators includes 32 ‘Italian’ professors and eight ‘foreign’ professors. While approximately 20% of ‘Italian’ evaluators are women, the ‘foreign’ pool is less feminized and only 12% of ‘foreign’ evaluators are women. Taking into account the composition of both pools, the expected share of women in the committee is around 18%, which is similar to the initial share of women in actual committees.¹⁰ Approximately one out of every thirteen evaluators resigned and was replaced by another eligible evaluator. These replacements slightly increased the share of women in committees to 19%, but the difference is not statistically significant. 41% of committees include no women at all, in 35% there is one woman, in 16% there are two women, and only 8% of committees have a majority of female evaluators.

Table C1 provides descriptive information on eligible evaluators based in Italy.¹¹ On average, they have been in a full professor position for 13 years. They list 131 publications in their CVs, of which just over half are articles in scientific journals, and the rest are books, book chapters, publications in conference proceedings, patents, etc. Around half of these publications were published during the previous ten years. To assess the quality of research output, in STEMM disciplines we compute their total Article Influence Score, summing up the Article Influence Score of all publications; in SSH disciplines we use the number of articles in A-journals.¹² About 28% of eligible professors are based in the South of Italy.

In columns 2-4, we compare characteristics of male and female evaluators. For this comparison, we normalize all variables at the discipline level. Female evaluators have significantly shorter tenure than their male counterparts and they also have lower research output in almost all dimensions. They are less likely to be based in the South, but this difference is not significant.

In Spain, the lists of eligible evaluators include 49,199 full professors and 61,052 associate professors.¹³ Women constitute 35% of eligible associate professors, but only 14% of full professors are women. Taking into account the composition of both pools, the expected share of women in the committee is around 19%. This figure is similar to the share of women in the initial set of committees selected by random draw and is unaffected by the resignation of 2% of evaluators. Overall, 32%

¹⁰We have calculated the expected gender composition of committees using a simulation with 1,000,000 draws, taking into account that the lottery that decided committee composition was subject to the constraint that committees cannot include more than one member from the same university.

¹¹Unfortunately, we were unable to gather systematic information on ‘foreign’ evaluators. In their case, the official CVs are not in a standardized format and they are often incomplete.

¹²Article Influence Score is available for all journals in the Thomson Reuters Web of Knowledge. It is related to *Impact Factor*, but it takes into account the quality of the citing journals, the propensity to cite across journals and it excludes self-citations.

¹³The Spanish data covers information from several evaluation waves, so many professors appear in the lists several times. In total, there are 7,963 individual full professors and 21,979 individual associate professors in these lists.

of committees are composed by only male evaluators, 29% of committees have one woman on board, 22% include two women, 11% three women, while only 6% have more women than men.

We collect information on the research outcomes of Spanish researchers from several sources. We observe their publications in international journals covered by Web of Knowledge and their articles and books in the Spanish language included in the database Dialnet, as well as patents in the European Patent Office in which these researchers are listed as inventors. We also have information on their activity as Ph.D. advisors and as members of dissertation committees. We compare female and male eligible evaluators, normalizing their characteristics at the level of exam and category. Results are very similar to the ones observed for the Italian academia (see columns 6-8 and 10-12 of Table C1). Female eligible evaluators are younger, have shorter tenure, and on average they published less than male researchers in the same discipline and rank. They have also lower accumulated quality-adjusted scientific production, they tend to participate less in advising and evaluating doctoral students, and they are relatively less likely to come from universities located in the southern regions of the country.¹⁴

3.2 Candidates

There were 69,020 applications in Italy. On average, there were 375 applications per field, with 117 of them participating in evaluations for full professor positions and 258 participating in evaluations for associate professor positions. Some candidates applied to more than one position: the average candidate participated in 1.5 evaluations.

As shown in the upper panel of Table C2, 31% of applications for the position of full professor and 41% of applications for the position of associate professor were submitted by women. Candidates for a full professorship are about 49 years old and candidates for an associate professorship are six years younger. About half of the applicants for associate professorships hold a permanent contract and about three fourths of applicants for full professorships do. Candidates mainly apply for an evaluation in the field in which they currently hold a permanent contract.

Female applicants tend to be younger among applicants for associate professorships, and they are of a similar age as their male counterparts in evaluations for full professorships (columns 3-5 and 8-10). In both cases the publication record of female candidates is significantly weaker. The only dimension in which women seem to be achieving better results than men is in publishing conference proceedings. In addition to information on productivity coming from candidates' CVs, we observe

¹⁴In Spain, we define A-journals following the journal rank developed by Dialnet, which categorizes journals in four groups according to their prestige.

the order in which candidates submitted their applications. In principle, the timing of the application might reflect both candidates' self-confidence and quality. We normalize this variable uniformly between 0 and 1. We observe that female candidates for the post of full professor apply a bit later than their male counterparts, but no similar gender difference can be observed among candidates for associate professor positions. In Italy, approximately 14% of applications were withdrawn once the identity and the criteria of evaluators were made public. Withdrawals were more common among female applicants. Overall, approximately 38% of applications by male candidates and 35% of applications by female candidates were successful.

As explained above, the evaluation agency of the Ministry of Education published detailed information regarding the research production of the final set of applicants in the 10 previous years. Around 38% of candidates were above the median in each of the three corresponding bibliometric dimensions. Performance according to these indicators is strongly correlated with success. Among those candidates whose quality was below the median in every dimension there was a success rate of only 4%, while among those who excelled in every dimension there was a success rate of 63%.

In addition to the final decision of the committee, we also collected information on the individual evaluation reports, available in the case of Italy. Overall we observe around 300,000 individual reports. 45% of these reports were favorable to the candidate and most of the time decisions were taken unanimously (in 86% of the cases). Unanimity is relatively more frequent when applicants are below the median in each of the three corresponding bibliometric dimensions (93%) and when applicants are above the median in all three dimensions (86%), and it is lower when applicants are above the median only in one (84%) or two dimensions (82%).

In Spain, overall there were 13,444 applications for full professorships and 17,799 applications for associate professorships (lower panel of Table C2). The gender ratios among applicants are very similar to the ones in Italy: around 27% of applicants to full professor are women and there are around 40% of women among applicants to associate professor. Once again, male applicants seem to have stronger research records than their female counterparts. They also tend to be slightly more successful in evaluations.

Finally, for the candidates who qualified in Spain, we collected information on their individual research productivity in a five-year period following the national evaluations and on their performance in future evaluations for promotion to full professor. This information allows us to assess the quality of selection not only in terms of candidate characteristics easily observable at the moment of the exam, but also in terms of dimensions that are difficult to observe but that are nevertheless important determinants of future productivity.

3.3 Connections

We identify professional links between candidates and eligible evaluators. We consider all the possible interactions within each discipline, around 2.5 million possible pairs in Italy and 5.5 millions in Spain. As shown in Table C3, the probability that a candidate and an eligible evaluator are affiliated to the same institution is around 3% in Italy and 5% in Spain. The probability that they have coauthored a paper is smaller: 1.4% in Italy and 0.4% in Spain.

In the case of Spain, we also observe if there was a student-advisor relationship or if the candidate and the eligible evaluator have participated in the same thesis committee.¹⁵ These links are relatively rare: in 0.2% of the cases the eligible evaluator is the PhD thesis director of the candidate and in 1.3% they have participated in the same thesis committee.

Male candidates tend to have more coauthors among eligible evaluators and they are more likely to have interacted with an eligible evaluator previously in a thesis committee (Table C3, columns 3-5).

3.4 Research similarity

We also collect information on the overlap of research interests between candidates and eligible evaluators. Due to data availability, there are some differences in how we define research similarity in the two countries. In the case of Italy, we have information on the field and the subfield where researchers with a permanent contract in an Italian university are officially registered. There are 184 fields (*settore concorsuale*) and approximately 370 subfields (*settore scientifico-disciplinare*).¹⁶ In about 60% of the cases the candidate and the eligible evaluator belong to the same subfield (Table C3).

In the case of Spanish researchers, we infer their research interests using information on their participation in doctoral dissertations, either as authors, advisors, or committee members. In Spain, all doctoral theses are classified in more than two thousand categories.¹⁷ Economics, for example, is divided into one hundred different research fields (e.g.: Labor Economics). We construct a measure of the overlap of the research interests of candidates and evaluators based on the subfield

¹⁵We consider three possible interactions: (i) the evaluator was a member of candidate's thesis committee, (ii) one of them had invited the other to sit in her students' thesis committee, or (iii) both of them sat in the same student thesis committee.

¹⁶Historically, each Italian researcher was assigned to certain *settore scientifico-disciplinare*. More recently, upon the introduction of the new system of competitive exams, researchers were assigned also to a *settore concorsuale*. The correspondence between the two classifications is not always unique, in some cases researchers belonging to the same *settore scientifico-disciplinare* may be assigned to different *settore concorsuale*.

¹⁷The author of the dissertation selects the subfield using the *International Standard Nomenclature for Fields of Science and Technology*, a system developed by Unesco.

of every dissertation where they have been involved. In the spirit of Jaffe (1986) and Bloom, Schankerman and Van Reenen (2013), we measure research proximity between individuals i and j as the angular separation of the vectors $S_i = (S_{1i} \dots S_{Ci})$ and $S_j = (S_{1j} \dots S_{Cj})$, where S_{Ci} is the share of dissertations in category C in which individual i has been involved:

$$Overlap_{ij} = \frac{S_i S'_j}{(S_i S'_i)^{1/2} (S_j S'_j)^{1/2}}. \quad (1)$$

This index takes value one if two individuals have participated in dissertations in the same subfields in the same proportion and value zero if there is no overlap. On average, in our sample the degree of overlap between candidates and evaluators is equal to 0.20. As shown in Table C3, female candidates are slightly more likely than male candidates to share their research interests with eligible evaluators.

4 Empirical analysis

We start our analysis by providing descriptive information on the average success rate of male and female applicants, unconditional and conditional on their observable research productivity. Then we investigate how the gender composition of committees affects the success rate of male and female candidates, candidates' decision to withdraw their application and the quality of male and female applicants who qualify. To achieve a better understanding of the observed patterns, we use the information provided by individual voting reports to examine how male and female evaluators vote within the same committee. We examine whether male and female evaluators vote differently depending on the gender of applicants, and we also investigate whether the presence of women in a committee affects the voting behavior of male evaluators. Finally, we explore the relevance of the main theories according to which evaluators' gender may be relevant.

4.1 Gender gap

We estimate the gender gap separately for the applicants in the two countries using the ordinary least squares (OLS) method:

$$Y_{ie} = \beta_0 + \beta_1 Female_i + \mathbf{X}_i \beta_2 + \mu_e + \epsilon_{ie} \quad (2)$$

where Y_{ie} is a dummy variable that takes value one if candidate i qualifies in evaluation e and takes value zero if the candidate receives a negative evaluation or withdraws the application before receiving the evaluation. Each evaluation e refers to the examination that was conducted in a given field and position (e.g. qualifi-

cation for an associate professorship in *Applied Economics* in Spain in year 2005). $Female_i$ is a dummy variable indicating the gender of the candidate and \mathbf{X}_i includes all (normalized) productivity indicators and individual characteristics listed in Table C2. We allow the effect of productivity indicators to vary across disciplinary groups, and the effect of age and contract type to vary across disciplinary groups and levels of promotion. Evaluation fixed effects (μ_e) control for any differences across evaluations that might affect the success rate of male and female candidates in a similar way. Throughout the analysis, we cluster standard errors at the committee level.

In Italy, the success rate of female candidates is 2.8 p.p. lower than male candidates in the same exam, unconditional on any measure of quality (Table 1, column 1, upper panel). In Spain, the unconditional gender gap is equal to 2.2 p.p. (column 1, lower panel). In both countries, approximately half of the gender gap can be explained by the differences in observable characteristics (column 2). The remaining conditional gender gap is equal to 1.5 p.p. in Italy (4% relative to the success rate of men) and 1.4 p.p. in Spain (12%) and it is statistically significant in both countries.

It is unclear whether the remaining gap should be attributed to evaluators biases or to differences in unobservable characteristics. There may be substantial differences in the quality of male and female candidates which are not fully captured by our controls. Furthermore, the individual proxies of quality that we use in our analysis, such as position, affiliation or publications might also be the outcome of discriminatory processes, which would further hinder the interpretation of β_1 .

4.2 The impact of committees' gender composition on the chances of success of male and female candidates

We examine whether the gender composition of committees affects the success rate of male and female applicants. In order to obtain causal estimates, our analysis exploits the random assignment of evaluators to committees. We compare the performance of applicants who initially were expected to face an evaluation committee with the same gender composition but, due to the random draw, were assigned to committees with a different number of female evaluators. Given that a few of the evaluators who were initially selected eventually declined to participate and were substituted by other (randomly selected) evaluators, first we report results from an intention-to-treat analysis where our independent variable is the gender composition of the initial set of evaluators. Later on, we instrument the gender composition of the committee which actually evaluated applicants using the gender composition of the committee initially drawn.

4.2.1 Intention-to-treat analysis

We estimate the following equation on the pool of applicants using OLS:¹⁸

$$Y_{ie} = \beta_0 + \beta_1 Female_i + \beta_2 Female_e^{initial} + \beta_3 Female_i * Female_e^{initial} + \beta_4 Female_e^{expected} + \beta_5 Female_i * Female_e^{expected} + \mathbf{X}_i \beta_6 + \epsilon_{ie} \quad (3)$$

where $Female_e^{initial}$ represents the share of female evaluators in the committee that was initially randomly drawn, before any evaluator resigned, and $Female_e^{expected}$ is the expected share of women in this committee, calculated based on the composition of the pool of eligible evaluators and the rules that determine the draw.¹⁹ In order to increase the accuracy of the estimation, we also include applicants' predetermined characteristics (\mathbf{X}_i) and, in some specifications, evaluation fixed effects (μ_e).

Coefficient β_2 captures the causal effect of committees' initial gender composition upon the success rate of male candidates, and coefficient β_3 shows how the gender gap varies depending on the share of women in the committee. Since $Female_e^{initial}$ is computed using the initial assignment of evaluators, coefficients β_2 and β_3 provide intention-to-treat estimates. The causal interpretation of β_2 and β_3 relies on the assumption that the assignment was indeed random. The way in which the randomization was conducted in each country suggests that there was little room for manipulation.²⁰ Nonetheless, before moving into the discussion of the impact of committees' gender composition on candidates' chances of success, we verify empirically that, conditional on the expected composition of the committee, its actual composition is uncorrelated with any observable predetermined factor. We estimate equation (3) using predetermined characteristics included in \mathbf{X}_i as outcome variables instead of controls. As expected, the evidence is consistent with the assignment being indeed random. Table 2 shows estimation results for the eleven predetermined variables that are common for Italian and Spanish databases. Out of forty four coefficients, only two are significantly different from zero at 5% level. A joint F-test cannot reject that quality of female and male candidates is similar across committees with different gender compositions.

We examine the causal impact of committees' gender composition in column 3 of Table 1. In Italy, the proportion of women in committees has no significant impact on the success rate of male candidates and it has a significant negative impact on

¹⁸Results from probit estimations are very similar and are available upon request. We report the results for the linear probability model because interpreting the interaction effects is simpler.

¹⁹To ease the interpretation of coefficient β_1 , we center $Female_e^{expected}$ at zero by subtracting its sample mean.

²⁰In Italy, a random sequence of numbers was drawn and was then applied to several disciplines. In Spain, the random draw was carried out publicly on the same day for all disciplines and was certified by the notary.

the relative chances of success of female candidates (upper panel). An additional female evaluator decreases the relative chances of success of female candidates by approximately 1.8 p.p. ($\beta_2 = -0.092$, $\Delta Female_e=1/5$). In Spain, the share of female evaluators has a positive effect on the success rate of male candidates and a negative effect on the success rate of female candidates, though these effects are not significantly different from zero (lower panel).

To make estimates from Spain and Italy more comparable, it is useful to consider explicitly the upper and the lower bounds of a 95% confidence interval. In Italy, an additional woman in the committee decreases the success rate of female candidates relative to men by somewhere between 0.4 and 3.3 p.p. In Spain, an extra woman on the committee can lower it by at maximum 1.0 p.p. but she can also increase it by up to 0.5 p.p. In sum, the impact that women in committees have upon the relative success rate of female candidates is negative and statistically significant only in the Italian case, but we cannot reject that the effect is statistically similar in the two countries.

4.2.2 Instrumental variables estimates

To account for the resignation of some evaluators before the actual evaluation took place, we instrument the final gender composition of the committee using as an instrument the initial composition determined by the random draw. Specifically, we estimate the following equation using the instrumental variables (IV) method:

$$Y_{ie} = \beta_0 + \beta_1 Female_i + \beta_2 Female_e^{final} + \beta_3 Female_i * Female_e^{final} + \beta_4 Female_e^{expected} + \beta_5 Female_i * Female_e^{expected} + \mathbf{X}_i \beta_6 + \epsilon_{ie} \quad (4)$$

where $Female_e^{final}$ represents the share of female evaluators in the committee that evaluated candidates, and $Female_e^{final}$ and $Female_i * Female_e^{final}$ are instrumented using $Female_e^{initial}$ and $Female_i * Female_e^{initial}$.

The first stage results of the IV estimation show that there is a strong relationship between the initial and the final gender composition of committees (see Table D1). The IV estimates are slightly larger but very similar to the intention-to-treat estimates (column 4 of Table 1). To further increase the precision of these estimates, we also reestimate equation (4) including evaluation fixed effects. The estimates are slightly more accurate but they are (statistically) unchanged (column 5 of Table 1).

Female and male evaluators differ in a number of dimensions. As shown in Table C1, male evaluators tend to be relatively older, have longer tenure, and a longer publication record. They are also more likely to be based in the south of Italy and Spain. In order to check whether our results can be explained by these differences, we estimate equation (4) including the interaction between evaluators'

characteristics and candidates' gender. The inclusion of these controls does not affect our previous estimates (Table 1, column 6).

The range of variation in gender composition that we exploit in our analysis is typically between committees with no women and committees with a minority of women. In Appendix E we also show that within this range there are no significant non-linearities.

4.3 Does the presence of women in the committee affect candidates' decision to withdraw?

So far we have considered the initial sample of candidates. Some of these candidates dropped from the evaluation process after committees were formed, perhaps because they anticipated that they had only a small chance to qualify and they preferred to avoid the costs associated to failure. These candidates did not receive an evaluation from the committee.

Therefore, the above estimates may in principle capture the effect that the gender composition of a committee has upon candidates' decision to self-select into the process. To examine this issue, we use data from Italy and estimate equation (4) using as the dependent variable the indicator for those candidates who did not withdraw their application. While relatively fewer women decided to go ahead with the application (-2.6 p.p.), these differences are not related to the share of female evaluators (Table 1, column 7). The evidence thus suggests that committees' gender composition does not affect application decisions and its impact on the chances of success of candidates can be attributed to evaluations.

4.4 Does the presence of women in the committee affect the quality of promoted candidates?

An additional justification for increasing female representation in committees might be that female researchers help to reduce evaluation biases and select better candidates, even though not necessarily more female candidates. To learn about the quality of the assessments, we compare the observable productivity of candidates who qualified in committees with different gender compositions:

$$q_{ie} = \beta_0 + \beta_1 Female_e^{final} + \beta_2 Female_e^{expected} + \epsilon_{ie} \quad (5)$$

where q_{ie} is a proxy of candidate i 's quality, measured at the time of the evaluation or during the following five years. We estimate equation (5) for all qualified candidates, and then separately for females and males. We instrument the final gender composition of the committee ($Female_e^{final}$) using the original one ($Female_e^{initial}$).

We consider several proxies of quality. First, we consider the research output of successful candidates at the time of the evaluation. As shown in Table 3, candidates that were promoted by committees with a different gender composition are at the time of the evaluation statistically similar in terms of the number of papers that they have published, the quality of the journals, the number of students advised or their participation in theses committees.

Using the Spanish data, we also examine the research productivity of successful candidates during the five-year period following the evaluation. Additionally, for the candidates who qualified to positions of associate professor, we check whether they succeeded in obtaining a qualification for full professorship. Once again, we see no evidence that the quality of candidates who qualify is related to the number of women who sat on these candidates' evaluation committees. Overall, we do not observe any indication that committees with more female evaluators select better or worse candidates.

4.5 Individual voting

We have documented that mixed-gender committees are not more favorable towards female candidates than all-male committees. This finding is consistent with several possibilities. It might be that female evaluators are not more favorable towards female candidates than their male counterparts. Alternatively, maybe female evaluators are more sympathetic towards female candidates (or less unbiased) but their presence in the committee induces male evaluators to become less favorable towards female candidates. To shed light on this issue, we analyze the information provided by individual voting reports, available in Italy.

First, we compare the assessments of male and female evaluators sitting in the same committee. We estimate the following equation:

$$V_{ije} = \beta_0 + \beta_1 Female_j + \beta_2 Female_i * Female_j + \mu_{ie} + \epsilon_{ije}, \quad (6)$$

where V_{ije} takes value one if evaluator j casted a positive vote for candidate i in evaluation e , and $Female_i$ and $Female_j$ are indicators that capture the gender of the candidate and the evaluator respectively. A vector of application fixed effects μ_{ie} captures any differences in application characteristics that are observable to all evaluators.

The empirical results suggest that, if anything, female evaluators are more favorable towards female candidates than male evaluators. Female candidates are 0.7 p.p. (1.6%) more likely to receive a positive vote from a female evaluator than from a male evaluator, although this difference is not statistically different from zero (Table 4, column 1). This estimate is likely to be a lower bound of the overall effect. Com-

mittee members share information and discuss their decision before casting their vote. A high fraction of committees reach unanimous decisions, suggesting that there may be less disagreement reflected in these final individual evaluations than there would have been at interim stages.

Another question that we would like to answer is whether the voting behavior of male evaluators changes when there are women on the committee. We estimate the following equation on the sample of assessments granted by male evaluators:

$$V_{ije} = \beta_0 + \beta_1 Female_i + \beta_2 Female_{je}^{final} + \beta_3 Female_i * Female_{je}^{final} + \beta_4 Female_{je}^{expected} + \beta_5 Female_i * Female_{je}^{expected} + \mathbf{X}_i \beta_4 + \epsilon_{ij}, \quad (7)$$

where $Female_{je}^{final}$ and $Female_{je}^{expected}$ stand respectively for the actual and the expected share of women in a committee including evaluator j .²¹ Coefficient β_2 captures how the probability that a male candidate receives a positive vote from a male evaluator varies depending on the gender composition of the committee. Similarly, coefficient β_3 captures how the presence of women in the committee affects the probability that a female candidate receives a positive vote from a male evaluator, relative to a male candidate.

There are three possible threats to the consistency of our estimates. First, similarly to the analysis conducted in previous sections, the initial assignment of evaluators to committees should be random. As shown above, this assumption is satisfied. Second, we do not observe the assessments that would have been casted by evaluators who resigned (8% of initial evaluators). This might introduce a selection bias if resignations are related to the gender composition of the committee or to evaluators' gender biases. We examine this possibility in Appendix F. We do not find evidence suggesting that resignations are related to gender issues. Third, given that we only observe the evaluations received by candidates who did not withdraw their application (86% of applicants), a bias might arise if candidates' withdrawal decision somehow depends on committees' gender composition or gender biases. Our previous analysis shows that the gender composition of committees does not affect application decisions (see section 4.3). As a robustness check, we also consider an additional specification where we impute a negative assessment to every withdrawn application.

According to our estimates, each additional female evaluator in the committee increases the probability that a male candidate receives a positive vote from a male evaluator by 0.3 p.p. ($\beta_2 = 0.017$, $\Delta Female_e^{final} = 1/5$) and it decreases the probability that a female candidate receives a positive vote, relative to a male candidate,

²¹We compute these expectations separately for each evaluator using the outcomes of 1,000,000 simulated random draws that take into account the rules of the randomization.

by 0.8 p.p. ($\beta_3 = -0.042$, $\Delta Female_e^{final} = 1/5$), although these estimates are not significantly different from zero (Table 4, column 2). To increase the accuracy of the estimation, we also include evaluation fixed effects. According to this specification, each additional woman in the committee reduces the probability that a female candidate receives a positive vote from a male evaluator by 1.2 p.p. ($\beta_3 = -0.061$, $\Delta Female_e^{final} = 1/5$), relative to the probability that a male candidate receives a positive vote (column 3). This effect is significant at the 5% level. The estimate is slightly larger, around 1.6 p.p., if we consider in our analysis also candidates who withdrew their application (column 4).

4.6 Mechanisms

The two large-scale randomized natural experiments provide a clear result: increasing the proportion of women in scientific committees does not increase the success rate of female candidates. The analysis of individual votes within the committee suggests that this is due to two factors. On the one hand, female evaluators are slightly more likely to vote in favor of female candidates than male evaluators, but this effect is not economically or statistically significant. On the other hand, the presence of women in the committee decreases the probability that female candidates receive a positive vote from male evaluators. Next, we analyze these two issues in more detail.

4.6.1 Why are women not more supportive of other women?

The literature has emphasized several theoretical arguments according to which evaluators are expected to favor same-sex candidates. The most prominent ones are the existence of gender segregation across research networks, gender segregation across subfields of research, gender stereotypes and discrimination against women attaining top positions. Next, we provide an in-depth examination of these theories and we try to understand why they do not play a more important role in our data.

Gender segregation across research networks One of the arguments behind gender quotas is the existence of ‘old boy networks’. If professional connections with committee members help to achieve success and, at the same time, these connections are gendered, female candidates might be at a disadvantage when evaluation committees do not include women. The relevance of ‘old boy networks’ depends on three factors: (i) the extent to which networks are gendered, (ii) the likelihood that applicants are evaluated by a member of their network, and (iii) the magnitude of the connection premium.

First, we examine whether research networks in Spain and Italy are gendered.

We consider all possible pairs between candidates and potential evaluators within a given field and we analyze whether the probability of being linked varies with their gender:

$$L_{ij} = \beta_0 + \beta_1 Female_i + \beta_2 Female_j + \beta_3 Female_i * Female_j + \mu_e + \epsilon_{ij} \quad (8)$$

where L_{ij} stands for any of the observable links between candidate i and eligible evaluator j . $Female_i$ and $Female_j$ are indicators for female candidates and eligible evaluators, and μ_e are evaluation fixed effects.

As expected, links tend to be gendered. The β_3 estimate is positive and significant in all specifications, indicating that, when a male eligible evaluator is substituted by a woman, female candidates' likelihood of being connected increases relatively more than male candidates' in every dimension (Table 5). In Italy, the likelihood of observing a female professor with the same affiliation as a female candidate is 0.6 p.p. (20%) larger than the likelihood of observing a similar link between a female professor and a male candidate.²² In Spain, female professors are 0.4 p.p. (8%) more likely to be in the same institution as a female candidate, relative to the probability of being affiliated to the same institution as a male candidate. Coauthorships are also relatively more likely when individuals share the same sex. In Italy female professors are 0.3 p.p. (23%) more likely to coauthor with a female candidate than with a male one; in Spain the premium is equal to 0.1 p.p. (23%). Similarly, PhD supervisions and participation in PhD committees are also gendered. Female professors are 0.04 p.p. (33%) more likely to have a female advisee and 0.03 p.p. (3%) more likely to have participated in the same dissertation committee as a female candidate.

Another relevant factor is whether candidates benefit from the presence of a member of their network in an evaluation committee. Previous work by Zinovyeva and Bagues (2015) and Bagues, Sylos-Labini and Zinovyeva (2015) documents the existence of a substantial connection premium in qualification exams in Spain and Italy. However, while connections in evaluation committees might be useful, they are relatively rare in a context where evaluations are conducted at the national level. For instance, as pointed out in section 3.3, the probability that a candidate and an eligible evaluator are colleagues is around 3% in Italy and 5% in Spain. The probability that they are coauthors is even lower, around 1.4% in Italy and 0.4% in Spain. In sum, we observe a relative large degree of gender segregation across networks and also a substantial connection premium, but the impact of these two

²²We have calculated this figure using the information reported in Table 5, column 1. The probability that a female professor and a female candidate in the Italian sample are affiliated to the same university is equal to 3.34% (0.0026+0.0017+0.0029+0.0262), and the probability that a female professor and a male candidate are colleagues is equal to 2.79% (0.0017+0.0262).

factors is likely to be attenuated by the scarcity of connections in committees.²³

Next, we study whether taking into account connections between candidates and evaluators affects our estimates of the impact of committees' gender composition. We estimate the following equation:

$$Y_{ie} = \beta_0 + \beta_1 Female_i + \beta_2 Female_i * Female_e^{final} + \mathbf{L}_{ie}^{final} \beta_3 + \beta_4 Female_i * Female_e^{expected} + \mathbf{L}_{ie}^{expected} \beta_5 + \mathbf{X}_i \beta_6 + \mu_e + \epsilon_{ie} \quad (9)$$

where \mathbf{L}_{ie}^{final} is a vector including the different types of links between committee members and candidates. We also include as controls the expected proportion of links in the committee $\mathbf{L}_{ie}^{expected}$ and we instrument the final composition of the committee ($Female_e^{final}$, \mathbf{L}_{ie}^{final}) using the outcome of the initial lottery draw ($Female_e^{initial}$, $\mathbf{L}_{ie}^{initial}$). The vector of coefficients β_3 provides information about the causal impact of connections in the committee.

Table 6 reports the results of this analysis. In line with the findings of Zinovyeva and Bagues (2015) and Bagues, Sylos-Labini and Zinovyeva (2015), we find that connections with evaluators are helpful for promotion. The presence of a colleague in the committee increases the success rate of connected candidates by 3.6 p.p. (10%) in Italy and by 4.6 p.p. (41%) in Spain.²⁴ The impact of coauthors is larger: 4.7 p.p. (13%) in Italy and 12.8 p.p. (112%) in Spain. Candidates with an advisor in the evaluation committee also enjoy a premium of 9.0 p.p. (79%) and when an evaluator has interacted previously with the candidate in some thesis committee the premium is around 2.5 p.p. (22%). However, the inclusion of connections as controls in the analysis does not affect significantly our estimates of the effect of evaluators' gender on candidates' success rate (columns 1 and 5 vs. columns 2 and 6). As pointed out above, a plausible explanation for why connections, while being gendered, do not affect significantly our estimates may be related to their scarcity. For instance, in Italy the probability that a female candidate and a male evaluator are coauthors is around 1.4%. This probability increases by 0.1 p.p. when the evaluator is also female. Taking into account the premium associated to the presence of a coauthor in the committee (4.7 p.p.), replacing a male evaluator by a female one translates into an increase in the average success rate of female candidates by a mere 0.005 p.p. Moreover, as we show in Appendix G, evaluators' support of connected candidates

²³There are may be also weaker links between candidates and evaluators, such as the existence of a common coauthor. Zinovyeva and Bagues (2015) show that these indirect links tend also to be gendered but they do not have a significant impact on evaluation outcomes.

²⁴To calculate these figures we take into account the number of committee members in Italy and Spain (5 and 7 respectively) and the average success rate in each country (37% and 11%). For instance, in Italy the presence of a colleague in the committee has an impact of 3.6 p.p. ($(\beta_3 = 0.181, \Delta Female_e^{final} = 1/5)$). Relative to an average success rate of 37%, this implies a 10% premium.

does not depend on their gender.

Gender segregation across research subfields Another argument in favor of increasing the share of women in committees has been the potential existence of gender segregation across subfields. If committee members tend to prefer candidates with similar research interests and, at the same time, men and women are segregated across research subfields, the lack of women in committees might hinder the ability of female candidates to succeed.

The extent of gender segregation across subfields is likely to depend on the level of aggregation at which evaluations are held. Segregation is probably larger when applicants are grouped in a few broadly defined fields. In the nation-wide evaluations that we analyze in this paper, applicants were classified in approximately 200 different fields (e.g. *Applied Economics*). We check whether, at this level of aggregation, candidates are more likely to have the same research interests as eligible evaluators of the same gender. We estimate equation (8) using as the dependent variable the research similarity between candidates and eligible evaluators. We observe gender segregation across research subfields in both countries but its magnitude is relatively small. In Italy, a female eligible evaluator is 1.3 p.p. relatively more likely to be in the same subfield as a female candidate than in the subfield of a male candidate. In Spain, the overlap between a female eligible evaluator and a female candidate is 0.4 p.p. larger (Table 5, columns 3 and 8).

Research similarity with evaluators tends to increase candidates' chances of success, but the effect of female evaluators on female candidates' relative success rate is unchanged when we control in the estimation for research similarity (Table 6, columns 3-4 and 7-8). This is consistent with the relatively small level of gender segregation observed. In sum, gender segregation across research interests is too limited for female candidates to benefit significantly from more female evaluators in the committee.

Stereotypes An additional theoretical argument in favor of a higher female presence in evaluation committees is that senior male researchers might have stereotypes against female candidates. If senior female researchers do not share these stereotypes, having more women on the committee might reduce the impact of gender prejudices.

Stereotyping might be stronger when evaluators are less informed about candidates' quality. Given that it might be particularly difficult to assess the quality of candidates who do research in subfields that lie far away from evaluators' knowledge, we divide evaluations in two groups based on the distance between evaluators' and candidates' research interests. The evidence suggests that information asymmetries

matter, but the presence of women in the committee does not contribute to eliminate potential gender biases. When candidates and evaluators work in similar areas, evaluators' gender does not have a significant impact (Table 7, first row). However, when candidates do research in a different subfield, female candidates tend to perform significantly worse when there are relatively more women in the committee. This pattern is observed in both countries.

It is also sometimes argued that stereotyping against women is stronger in sciences and mathematics-related disciplines (Reuben, Sapienza, and Zingales 2014). We compare the effect of female evaluators in STEMM and SSH disciplines, but we do not observe any significant differences between these two groups neither in Spain nor in Italy (Table 7, second row).

One might also expect prejudices against women to be stronger in disciplines that are less feminized and, therefore, offer fewer chances to interact with female researchers. We examine separately disciplines with a relatively low and a relatively high proportion of women among full professors. We do not find any evidence suggesting that evaluators in these two groups differ in terms of their preference for candidates of the same sex (Table 7, third row).²⁵

High-level positions The impact of committees' gender composition might also depend on the importance of the position at stake. Some male evaluators might be reluctant to see a female colleague at the top of the academic career ladder. They might hold negative stereotypes of women, for instance, regarding their leadership or other abilities specific to full professor positions. There might also be a problem of taste-discrimination.

We examine separately the effect of female presence upon the evaluation committee for candidates to full and associate professor positions (Table 7, fourth row). We do not observe any significant differences between these groups of evaluations in Italy, but we do observe a significant difference between exams for full and associate professorships in Spain. Specifically, it appears that in Spain, in committees assessing candidates to full professor positions, a higher female presence has a positive impact on female candidates' relative chances of success. However, the opposite is true in evaluations for promotion to more junior positions.

So, in the case of promotions to full professorships in Spain, but not in Italy, the result is consistent with the existence of stereotypes, or even of taste discrimination, against women by committees with low or no representation of women.

²⁵In Table H1 in Appendix H we report results from an alternative specification of heterogeneity tests. Instead of splitting the sample in two groups based on the overlap of candidates' and evaluators' research interests and on the degree of feminization of the discipline, we estimate a model with triple interactions exploiting the full range of possible values of these variables. Results from these alternative specifications are in line with the findings discussed in this section.

Analysis by disciplinary groups Beyond these theories, it might be that the gender composition of committees matters in some specific fields. The previous empirical literature of evaluators' gender does not provide a clear pattern. Two articles that study the role evaluators' gender in Science and Economics find that evaluators tend to prefer candidates of the same sex (Casadevall and Handelsman 2013 and De Paola and Scoppa 2015), but in two other studies conducted in the same disciplines evaluators exhibit a preference for candidates of the other sex (Broder 1993, Ellemers et al. 2004). Six other articles in different fields do not find any significant relationship.²⁶

Following the official classification of disciplines adopted by the Italian Ministry, we consider 16 different groups of disciplines: Industrial Engineering, Civil Engineering, Physics, Mathematics, Chemistry, Geology, Biology, Veterinary, Medicine, Psychology, Architecture, Economics and Business, Social Sciences, History, Languages and Law. We estimate equation (4) separately for each group and each country, including evaluation fixed effects and instrumenting the final composition of the committee with the initial one. We report these estimates in Figure 1. Out of 32 coefficients, 28 are not significant, one is significantly positive and three are significantly negative. When we take into account in the calculation of standard errors that we are running multiple regressions using a Bonferroni correction none of the coefficients remains significant. Altogether, it is not possible to reject that the impact is similar to zero in any of the different samples. Similarly, we cannot reject the hypothesis that the effect is similar across different fields.

4.6.2 Why does the presence of women in the committee affect the voting behavior of male evaluators?

There are at least three potential explanations. The presence of women in the committee might unleash a backlash against female candidates, particularly in fields that have been historically dominated by men (Crocker and McGraw 1984). While we cannot directly test this hypothesis, we do not observe any significant difference in the impact of committees' gender composition depending on the degree of feminization of the field (see Table 7, third row).

The presence of female evaluators might also induce a licensing effect (Monin and Miller 2001). In all-male committees, evaluators may feel that they have a moral obligation to worry about sexism and seek to overcome it by expressing more positive (and perhaps less discriminatory) views about female candidates. When there are women on a committee, men may feel licensed to express more honest opinions about female candidates. Furthermore, female evaluators might strengthen male identities

²⁶See more details in Table A1.

within committees and hence weaken their support for female candidates (Akerlof and Kranton 2000). Unfortunately, we cannot disentangle empirically these two competing hypotheses, licensing effect and male identity priming.

5 Conclusions

A larger presence of women in scientific committees is frequently defended in policy discussions. This paper contributes to this debate by providing a comprehensive and systematic analysis of the impact of scientific committees' gender composition. We exploit the exceptional evidence provided by qualification evaluations for full and associate professorships in every discipline in two different countries, Italy and Spain. These evaluations involved around 100,000 applications and 8,000 evaluators in all academic fields. The random assignment of evaluators to committees creates a setting of large-scale natural randomized experiments. We also take advantage of the availability of very detailed information about candidates, evaluators and the content of evaluations, in order to analyze explicitly the theoretical arguments that are usually employed in support of a higher representation of women in scientific committees.

In general, the presence of female evaluators in the committee neither increases the success rate of female candidates, nor does it alter the quality of selected candidates. Strikingly, in all but one subsamples we observe the opposite pattern in success rates: committees with a higher women share tend to be relatively less favorable towards female candidates. The only exception refers to evaluations to full professorships in Spain, where female candidates have better chances of success when evaluated by a committee with more women.

Information from individual votes within committees suggests that there are two factors that explain why a larger presence of women does not increase the success rate of female candidates. First, while female committee members are slightly more favorable towards female candidates than their male colleagues, this effect is not economically or statistically significant. Second, male evaluators become less favorable towards female candidates when women are present in the committee, perhaps due to a licensing effect or to male identity priming.

Two common arguments that are usually employed in support of a higher representation of women in scientific committees - gendered networks and segregation across subfields - do not play an important role in our data. We document the existence of gender segregation across research networks in both countries. A female candidate is significantly more likely to be connected to a female evaluator, as measured by coauthorships, affiliation, doctoral thesis supervision and participation in these committees. We also observe that committees tend to favor connected can-

didates. However, in the nation-wide evaluations that we consider in this paper the likelihood of connections between candidates and evaluators is small and, therefore, the impact of gendered networks on evaluations is very modest. We also find that evaluators have a preference for candidates with similar research interests but the extent of gender segregation within each field is relatively small. As a result, the impact of gender segregation on evaluation outcomes is very limited. Another justification for increasing the presence of women in committees is that male evaluators may hold stereotypes that have a negative effect upon female candidates. In order to explore the potential impact of gender stereotypes, we focus on cases where information asymmetries are expected to be important. Our results indicate that the gender of evaluators only matters when evaluators are not familiar with candidates' research. However, in this case gender-mixed committees are less favorable towards women than all-male committees.

It remains an open question how the specific institutional characteristics of the Italian and the Spanish promotion systems affect the role of committees' gender composition. Overall, we cannot reject that the estimates for both countries are statistically similar, but we observe a significant difference in the behavior of committees evaluating applications to full professor positions. In Italy, a larger presence of men in the committee increases the chances of success of female applicants. On the contrary, in Spain female applicants to full professorships tend to be relatively less successful when evaluated by an all-male committee. It is unclear whether this difference reflects random sampling or whether it captures some institutional or country-specific characteristic.²⁷

Our analysis may be relevant for the design of policies aimed at increasing the representation of women in the academic career. Several countries, including Spain, have introduced quotas in scientific committees requiring the presence of a minimum share of male and female evaluators. According to our results, in general, a higher representation of women in scientific committees *per se* does not increase the number of promoted female candidates, nor does it help candidates who prove to be more productive in the future. Introducing gender quotas indiscriminately might also have unintended consequences. Quotas may be detrimental for senior female researchers, who would have to spend a disproportionate amount of time sitting on committees and, in some cases, for junior ones, whose chances of success may be hindered.

To be sure, gender quotas could be desirable in certain cases. The analysis suggests that the prevalence of gender segregation across subfields might be an important determinant of whether female committee representation is likely to help

²⁷Some authors have argued that the degree of transparency in an evaluation procedure can affect gender biases (van den Brink, Benschop and Jansen 2010). Hence, one possible explanation is that the higher level of transparency and public scrutiny of the Italian system deterred male evaluators from discriminating against female applicants to full professor positions.

female candidates. We expect gender segregation to play a more important role when evaluations are held at a more aggregate level than the one considered here.²⁸ Another important factor is the potential existence of connections between evaluators and candidates. These connections, which tend to be gendered, are likely to be more relevant in committees at the university- or department-level. More empirical work is needed to understand the impact of gender quotas in those contexts. Moreover, there are certain features of gender quotas that are not captured by our analysis. Evaluators who are explicitly chosen to represent a minority might behave differently, perhaps being more inclined to take a positive view of candidates belonging to their own group. The introduction of quotas may also affect the strategic incentives of evaluators. Nonetheless, keeping in mind these limitations, our results cast doubts on a generalized implementation of gender quotas in scientific committees.

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²⁸The level of disaggregation at which scientific evaluations are held varies largely across countries and institutions. For instance, the European Research Council groups applications in 25 broadly defined areas (<http://erc.europa.eu/evaluation-panels>, accessed on September 1 2015), while in the National Institutes of Health (NIH), which considers only life sciences, grant applications are evaluated by 174 different “study sections” (<http://public.csr.nih.gov/StudySections/Standing/Pages/default.aspx>, accessed on September 1 2015).

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Table 1: The causal impact of committees' gender composition

	1	2	3	4	5	6	7
<i>Dependent variable:</i>	Qualified						Applied
	OLS	OLS	ITT	IV	IV	IV	IV
Italy							
Female candidate	-0.028*** (0.006)	-0.015*** (0.005)	-0.004 (0.009)	0.001 (0.011)	0.008 (0.008)	0.009 (0.007)	-0.026*** (0.006)
Share of women in committee			0.000 (0.059)	-0.0004 (0.071)	-	-	-
Female candidate* Share of women in committee			-0.092** (0.036)	-0.116** (0.050)	-0.128*** (0.035)	-0.132*** (0.036)	-0.025 (0.026)
Adj. R-squared	0.001	0.240	0.245	0.245	0.236	0.236	0.075
Number of observations	69020	69020	69020	69020	69020	69020	69020
Mean dep. var. (for men)	0.38	0.38	0.38	0.38	0.38	0.38	0.87
Spain							
Female candidate	-0.022*** (0.004)	-0.014*** (0.004)	-0.009 (0.007)	-0.009 (0.007)	-0.011 (0.007)	-0.009 (0.007)	
Share of women in committee			0.011 (0.017)	0.012 (0.018)	-	-	
Female candidate* Share of women in committee			-0.018 (0.026)	-0.019 (0.027)	-0.016 (0.028)	-0.029 (0.028)	
Adj. R-squared	0.001	0.036	0.039	0.039	0.005	0.005	
Number of observations	31243	31243	31243	31243	31243	31243	
Mean dep. var. (for men)	0.12	0.12	0.12	0.12	0.12	0.12	
<i>Controls for both panels:</i>							
Candidate characteristics		Yes	Yes	Yes	Yes	Yes	Yes
Exam FE	Yes	Yes			Yes	Yes	Yes
Expected share of women			Yes	Yes	Yes	Yes	Yes
Female candidate* Expected share of women			Yes	Yes	Yes	Yes	Yes
Committee characteristics						Yes	

Notes: *Candidate characteristics* include all individual predetermined characteristics listed in Table C2. *Committee characteristics* include the interaction between candidates' gender and the average tenure of evaluators (Italy only), their age (Spain only), their quality-adjusted productivity during the previous 10 years, and the proportion of committee members based in the South. The first-stage results for the IV estimations reported in columns 4 and 5 are available in Table D1. Standard errors are clustered by committee.

* p < 0.10, ** p < 0.05, *** p < 0.01.

Table 2: Randomization check

	1	2	3	4	5	6	7	8	9	10	11
<i>Dependent variable:</i>	All Publ.	Articles	Books	Chapters	Patents	Total AIS	A-journal articles	Coauthors per article	Prop. first-author	Prop. last-author	Age
Italy											
Share of women in committee	0.014 (0.034)	0.005 (0.031)	-0.023 (0.031)	-0.020 (0.028)	0.019 (0.021)	-0.005 (0.030)	0.038 (0.027)	0.017 (0.031)	-0.040* (0.023)	-0.011 (0.041)	-0.065* (0.035)
Female candidate*Share of women in committee	-0.027 (0.079)	-0.001 (0.071)	0.059 (0.066)	0.048 (0.063)	-0.040 (0.049)	0.018 (0.064)	-0.087 (0.061)	-0.044 (0.067)	0.093* (0.053)	0.031 (0.088)	0.150* (0.080)
Spain											
Share of women in committee	-0.019 (0.030)	-0.029 (0.031)	0.004 (0.022)	0.002 (0.022)	0.024 (0.015)	-0.068** (0.027)	-0.023 (0.022)	-0.040 (0.030)	-0.020 (0.031)	-0.023 (0.032)	0.034 (0.034)
Female candidate*Share of women in committee	0.015 (0.077)	0.038 (0.078)	-0.017 (0.054)	-0.010 (0.055)	-0.062 (0.038)	0.152** (0.068)	0.043 (0.057)	0.103 (0.076)	0.045 (0.078)	0.042 (0.080)	-0.093 (0.086)

Notes: OLS estimates. All regressions include also the variables *Female candidate*, *Expected share of women in committee*, and the interaction between the two. Standard errors are clustered by committee.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Quality of qualified candidates

	1	2	3	4	5	6	7
<i>Dep. var.:</i>	Publications	Citations	Total AIS	A-journal articles	PhD students advised	PhD thesis committees	Success in future evaluations
A. Italy, before the evaluation							
All	0.017 (0.088)	0.130 (0.117)	-0.055 (0.157)	-0.135 (0.255)			
Women	-0.044 (0.112)	0.139 (0.119)	0.154 (0.170)	-0.102 (0.317)			
Men	0.029 (0.101)	0.098 (0.150)	-0.208 (0.211)	-0.213 (0.251)			
B. Spain, before the evaluation							
All	0.022 (0.145)	0.072 (0.223)	-0.088 (0.244)	-0.200 (0.237)	0.125 (0.136)	-0.147 (0.132)	
Women	0.210 (0.206)	0.469 (0.370)	-0.004 (0.399)	-0.142 (0.329)	0.580** (0.229)	0.053 (0.220)	
Men	-0.124 (0.193)	-0.242 (0.291)	-0.215 (0.301)	-0.219 (0.333)	-0.170 (0.176)	-0.303* (0.168)	
C. Spain, after the evaluation							
All	0.016 (0.132)	-0.060 (0.218)	-0.098 (0.227)	-0.173 (0.181)	0.175 (0.135)	-0.086 (0.136)	0.042 (0.052)
Women	0.345 (0.213)	-0.009 (0.356)	-0.102 (0.376)	0.170 (0.288)	0.119 (0.212)	-0.117 (0.231)	0.001 (0.054)
Men	-0.187 (0.182)	-0.140 (0.281)	-0.247 (0.284)	-0.266 (0.252)	0.080 (0.191)	-0.134 (0.186)	0.019 (0.077)

Notes: OLS estimates for the sample of qualified candidates. Each coefficient corresponds to an independent regression for a given sample and dependent variable. In panels A and B the dependent variables are measured at the time of the evaluation. In panel C the dependent variables refer to the output in the five-year period following the evaluation. Success in future evaluations takes value one if a candidate who obtained a qualification for an associate professorship in our sample, qualifies in the evaluation for full professorship by year 2013. The dependent variables in columns 1-6 are normalized to have zero mean and unit variance for candidates within each exam. *Citations* and *Article Influence Score* are only available for candidates in science, technology, engineering, mathematics, medicine and psychology. Information on publications in *A-journals* is only provided for candidates in social sciences and humanities. All regressions include non-parametric controls for *expected share of women in the committee*, *disciplinary area*rank*, and *age*. Standard errors are clustered by committee.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Individual voting

	1	2	3	4
	All evaluators	Male evaluators		
Female candidate	-	-0.0004 (0.009)	0.008 (0.006)	-0.003 (0.006)
Female evaluator	-0.001 (0.007)			
Female candidate * Female evaluator	0.007 (0.005)			
Share of women in committee		0.017 (0.079)	-	-
Female candidate*Share of women in committee		-0.042 (0.043)	-0.061** (0.030)	-0.078*** (0.030)
<i>Controls:</i>				
Application FE	Yes			
Expected share of women		Yes	Yes	Yes
Female candidate*Expected share of women		Yes	Yes	Yes
Candidate characteristics		Yes	Yes	Yes
Exam FE			Yes	Yes
Number of observations	294,656	240988	240988	281289

Notes: OLS estimates. The dependent variable is an indicator that takes value one if the evaluator casted a positive vote for a given candidate. Column 1 includes information from all individual evaluations, columns 2-4 include information only on evaluations by male evaluators. In column 4 we also include applications that were withdrawn after committee composition was announced, imputing a negative assessment to these applications. Candidate characteristics include all predetermined characteristics listed in Table C2. Standard errors are clustered by committee.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Gender segregation across research networks and subfields

	1	2	3	4	5	6	7	8
	Italy			Spain				
	Colleague	Coauthor	Same subfield	Colleague	Coauthor	PhD Advisor	PhD committee	Research overlap
Female candidate	0.0026*** (0.0004)	0.0007** (0.0003)	0.0209*** (0.0060)	-0.0012 (0.0014)	-0.0003* (0.0002)	-0.0001 (0.0001)	-0.0010*** (0.0003)	0.0065** (0.0028)
Female evaluator	0.0017* (0.0009)	-0.0015*** (0.0004)	-0.0067 (0.0075)	0.0006 (0.0014)	-0.0015*** (0.0002)	-0.0013*** (0.0002)	-0.0047*** (0.0006)	-0.0110*** (0.0017)
Female candidate*	0.0029*** (0.0007)	0.0022*** (0.0005)	0.0133*** (0.0045)	0.0043*** (0.0016)	0.0010*** (0.0002)	0.0005*** (0.0002)	0.0013*** (0.0005)	0.0042* (0.0022)
Female evaluator	0.0262*** (0.0002)	0.0140*** (0.0001)	0.5897*** (0.0029)	0.0453*** (0.0007)	0.0045*** (0.0000)	0.0025*** (0.0000)	0.0142*** (0.0002)	0.1959*** (0.0010)
Constant								
Observations	2,555,839	2,555,839	1,373,825	5,445,067	5,445,067	5,445,067	5,445,067	4,711,621

Notes: OLS estimates. The number of observations corresponds to the number of possible pairs between candidates and eligible evaluators with non-missing information in a given exam. In Italy, only evaluators who are based in an Italian university are considered. All regressions include evaluation fixed effects. Standard errors are clustered by field.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Connections and research similarity

	1	2	3	4	5	6	7	8
	Italy				Spain			
Female candidate	0.008 (0.008)	0.006 (0.007)	-0.008 (0.009)	-0.010 (0.009)	-0.011 (0.007)	-0.010 (0.007)	-0.011 (0.008)	-0.011 (0.008)
Female candidate * Share of female evaluators	-0.128*** (0.035)	-0.124*** (0.034)	-0.061 (0.046)	-0.060 (0.046)	-0.016 (0.028)	-0.020 (0.028)	-0.017 (0.035)	-0.021 (0.035)
<i>Connections in committee:</i>								
Colleagues		0.181*** (0.036)		0.180*** (0.044)		0.319*** (0.031)		0.319*** (0.031)
Coauthors		0.237*** (0.048)		0.201*** (0.053)		0.869*** (0.140)		0.840*** (0.142)
PhD advisors						0.633*** (0.107)		0.575*** (0.115)
PhD thesis committee						0.174*** (0.037)		0.166*** (0.038)
<i>Research similarity:</i>								
Same subfield				0.046 (0.032)				
Overlap in research interests								0.124*** (0.037)
<i>Controls:</i>								
Expected connections		Yes		Yes		Yes		Yes
Expected same subfield				Yes				
Expected overlap in research interests								Yes
Number of observations	69020	69020	35832	35832	31243	31243	27998	27998

Notes: IV estimates. All regressions include exam fixed-effects, an interaction between *Female candidate* and the *Expected share of women in committee*, and controls for all individual predetermined characteristics listed in Table C2. Connection variables are measured in shares. *PhD thesis committee* refers to candidates and evaluators who have been members of the same doctoral thesis committee. *Same subfield* is the share of evaluators who belong to the same subfield (*settore scientifico disciplinario*) as the candidate. *Overlap in research interests* is based on evaluators' and candidates' participation in doctoral thesis committees, which are classified in 2,000 different subfields (see more details in Data section). *Expected connections* is a vector including the expected share in the committee of *colleagues*, *coauthors*, *advisors* and *PhD thesis committee*. Standard errors are clustered by committee.

* p < 0.10, ** p < 0.05, *** p < 0.01.

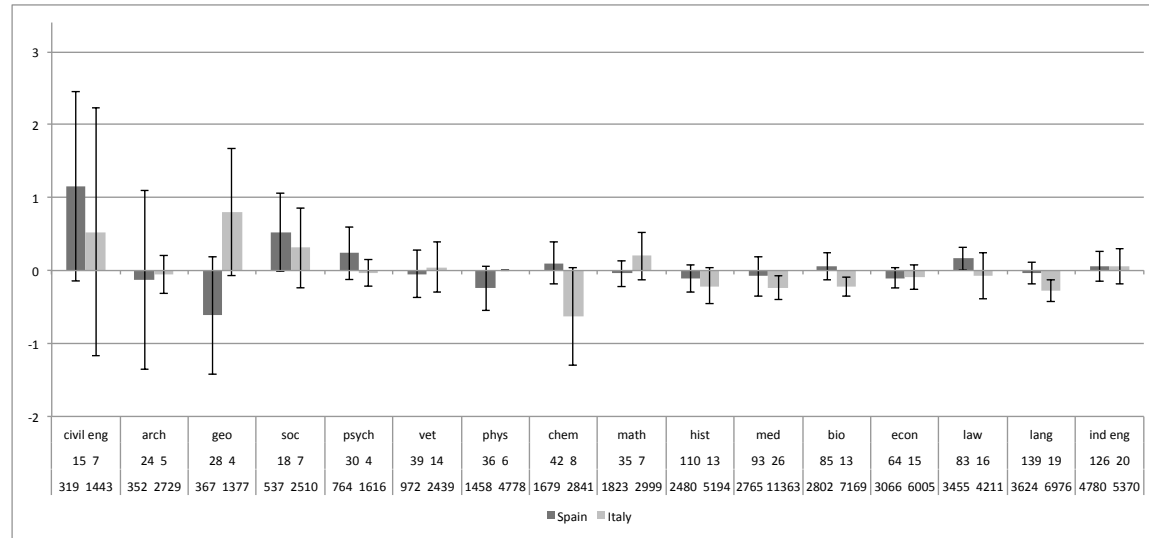
Table 7: Heterogeneity analysis

	1	2	3	4
	Italy		Spain	
	$\geq median$	$< median$	$\geq median$	$< median$
Research overlap	0.011 (0.046)	-0.179*** (0.069)	0.081* (0.047)	-0.125*** (0.044)
Discipline	SSH	STEMM	SSH	STEMM
	-0.116** (0.054)	-0.128*** (0.034)	-0.026 (0.038)	0.004 (0.041)
Feminization of field	$\geq median$	$< median$	$\geq median$	$< median$
	-0.149*** (0.042)	-0.072 (0.057)	-0.018 (0.040)	-0.016 (0.037)
Level of promotion	FP	AP	FP	AP
	-0.111* (0.059)	-0.138*** (0.038)	0.120** (0.054)	-0.072** (0.032)

Notes: IV estimates. The dependent variable is a dummy variable that takes value one if the candidate qualified. Each coefficient corresponds to an independent regression for the corresponding sample. *Research overlap* is a proportion of committee members with similar research interest as defined in section 3.4. SSH stands for social sciences and humanities, and STEMM for science, technology, engineering, mathematics, medicine, and psychology. *Feminization of the field* is measured by the proportion of women among full professors in the discipline. FP and AP stand, respectively, for full and associate professors. Standard errors are clustered by committee.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 1: The causal impact of committees' gender composition, by disciplinary group



Note: The figure reports the effect of a higher proportion of women among evaluators on the relative success rate of female candidates in the corresponding disciplinary group and country. The confidence intervals are not adjusted for multiple comparisons. At the bottom of the figure, the number of committees and the number of candidates in a corresponding group are shown. The disciplinary groups are sorted according to the number of applicants in each group in Spain.

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Appendix A. Summary of the literature

In this section we present a brief summary of the literature that analyzes how the gender composition of academic committees affects the relative success rate of female candidates. Table A1 summarizes the existent studies along a number of key dimensions: the type of analyzed evaluation, the field in which the analyzed evaluation took place, the empirical method used to identify the causal impact of the committee composition on the evaluation outcome, the size of the sample as measured by the number of applications evaluated by committees, and the main result of each study.

Table A1: Summary of the literature

Paper	Type of evaluation	Field	Empirical method	Applications	Results
Broder (1993)	Grant applications	Economics	Application fixed effects	1,479	Opposite-sex preference
Steinpreis, Anders and Ritzke (1999)	Job applicants and tenure candidates	Psychology	Randomized field experiment	238	No significant difference
Jayasinghe, Marsh and Bond (2003)	Grant applications	Several	Application fixed effects	2331	No significant difference
Ellemers et al. (2004)	Work commitment of students	Several	Identification based on observables	212	Opposite-sex preference
Milkman, Akinola and Chugh (2015)	Prospective students request a meeting	Several	Randomized field experiment	6,548	No significant difference
Moss-Racusin et al. (2012)	Laboratory manager position	Life Sciences	Randomized field experiment	127	No significant difference
Abrevaya and Hamermesh (2012)	Paper submitted for publication	Economics	Application fixed effects	2,940	No significant difference
Casadevall and Handelsman (2013)	Selection of conference speakers	Microbiology	Identification based on observables	1,845	Same-sex preference
De Paola and Scoppa (2015)	Job applicants	Economics and Chemistry	Identification based on observables	2,279	Same-sex preference
Williams and Ceci (2015)	Job applicants	Several	Randomized field experiment	873	No significant difference

Note: (*) We classify the empirical strategy followed by De Paola and Scoppa (2015) as identification based on observables and not as randomized natural experiment due to the nature of the empirical strategy implemented by the authors. This paper studies promotions in the Italian university system that was in place between 2008 and 2011. In this system, four out of five members of the evaluation committee were randomly selected from a pool of eligible evaluators. In their analysis, the authors study the relationship between the success rate of male and female candidates and the gender composition of committees, unconditional on the gender composition of the pool of eligible evaluators. The consistency of the estimation relies on the implicit assumption that the relative quality of male and female applicants is unrelated to the degree of feminization of the pool of eligible evaluators.

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Appendix B. Institutional background

There are several important differences between the Spanish and the Italian systems of centralized national evaluations. To facilitate the comparison, Table B1 summarizes the main features of the two systems.

Table B1: Main features of the evaluation systems in Italy and Spain

	Italy, <i>Abilitazione Scientifica Nazionale</i> , 2012-2014	Spain, <i>Habilitación</i> , 2002-2006
Eligibility requirement for candidates	None	None
Size of evaluation committees	5 evaluators	7 evaluators
Assignment to committees	Based on a random draw	Based on a random draw
Composition of committees	4 full professors based in Italian universities, 1 professor based abroad	In full professor exams, 7 full professors based in Spanish universities or public research centers. In associate professor exams, 3 full professors and 4 associate professors.
Constraints on randomization	No university can have more than one evaluator within a single committee.	Only one non-university researcher is allowed to be selected as a member of the committee for a given exam. Similarly, only one emeritus professor is allowed to be selected as a member of a given committee.
Minimum research quality requirement for evaluators	In STEMM disciplines, eligible professors should be above the median in their category and field in at least two of the following dimensions: (i) the number of articles published in scientific journals, (ii) the number of citations, (iii) and the H-index. In SSH disciplines, they should be above the median in at least one of the following dimensions: (i) the number of articles published in high impact scientific journals (so-called A-journals), (ii) the overall number of articles published in any scientific journals and book chapters, and (iii) the number of published books.	Eligible associate professors should have one <i>sexenio</i> and eligible full professors should have two <i>sexenios</i> . <i>Sexenios</i> are granted by the Spanish education authority on the basis of applicants' research output in any non-interrupted period of a maximum of six years.
Inclusion in the pool of eligible evaluators	Voluntary	Compulsory
Substitution of resigned evaluators	Based on a random draw	Based on a random draw
Voting rule	Qualified majority of 4	Simple majority
Number of qualifications granted by the committee	Unlimited	Limited by the number of available positions at the university level
Validity of a positive qualification	4 years (later extended to 6 years)	Unlimited
Penalization for a negative evaluation	2 years application ban	None
Application withdrawal	Up until two weeks after the evaluation criteria are publicized	Candidates can drop out from the process at any time
Evaluation	Evaluations are based solely on the material provided in candidates' application packages, consisting of CVs and selected publications.	Oral exams to full professor positions have two qualifying stages. In the first stage, candidates present their CVs. In the second stage, candidates present a piece of their research work. Exams to associate professor, in addition to these two stages, have an intermediate stage where candidates give a lecture on a topic randomly chosen from a syllabus proposed by the candidate.
Degree of transparency	The lists of potential and actual evaluators and candidates, as well as the lists of qualified candidates, are published online. Furthermore, the CVs of all participants and individual evaluation reports are published online. The evaluation agency also collects and publicizes information on the bibliometric indicators of candidates.	The lists of potential and actual evaluators and candidates, as well as the lists of qualified candidates, are published online.

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Appendix C. Data

The data on the participants in Italian evaluations, including the CV of all eligible evaluators and all candidates, was available at the website of the Italian Ministry of Higher Education and Research. We extracted all the individual characteristics that we use in the analysis from these CVs. Information on tenured researchers' affiliation and the length of tenure was obtained from the Consortium of Italian universities (CINECA). Affiliation of non-tenured researchers is from the most recent publication of the CV.

We also downloaded from the website of the Italian Ministry approximately 295,000 individual evaluation reports, five per each candidate. Due to the data collection problem, we are missing information on individual evaluations for 202 candidates. We are also missing 84 individual evaluation reports in three committees where evaluators abstained whenever there was a conflict of interest. We conducted a text analysis of the available individual evaluation reports and we identified approximately 9,000 different sentences that indicate the evaluator's decision to fail or to pass a given candidate.

The data on the participants in Spanish evaluations was collected from different sources, including the Spanish Ministry of Research and Science, Thomson Reuters (ISI) Web of Knowledge, the database of publications in Spanish language Dialnet, the European Patent Office and TESEO database on doctoral dissertations.²⁹

Publications indexed in above sources are matched to the list of professors in Spain based on individuals' names and field of research. This process suffers from an important problem with homonymity since there are lots of common surnames in Spain. In addition to this, bibliographic databases often incompletely record authors' names (this especially concerns the data on publications before 2010 in the Web of Knowledge). Facing the choice between minimizing the number of false positives or the number of false negatives, we generally preferred the former. This means that, on the one hand, the individuals are authors of the outcomes assigned. On the other hand, we are unable to assign research outputs that have an incomplete record of authors' names.

Below we describe in detail the process of data collection in the case of Spain.

²⁹We would like to thank Stéphane Maraut and Catalina Martinez for kindly sharing the data on academic inventors who have patented their inventions in the European Patent Office. For a description of how the patent data was collected and matched to professors, see Maraut and Martínez (2014), "Identifying Author-Inventors from Spain: Methods and a First Insight into Results," *Scientometrics*, Vol. 101, pp. 445-476.

Spanish Ministry of Research and Science The Spanish system of centralized examinations known as ‘*habilitación*’ was in place between 2002 and 2006. In total, 1,016 exams took place, around five per discipline. We restrict the sample in several ways. We exclude exams where the number of available positions was larger or equal than the number of candidates (two exams, both in Basque Philology) and disciplines where the number of potential evaluators was not large enough to form a committee (55 exams).³⁰ The final database includes 967 exams.

Information on candidates’ and evaluators’ first name, last name, tenure and ID number was retrieved from the website of the Ministry of Research and Science in July 2009 (<http://micinn.es>). Information on first names allows us to identify gender. In a few cases where it was not possible to assign gender based on first name, we searched online for a personal picture or document that would make it possible to assign gender.

The actual age of individuals is not observable. Instead, we exploit the fact that Spanish ID numbers contain information on their issue date to construct a proxy for the age of native individuals on the basis of his/her national ID number. In Spain, police stations are given a range of ID numbers which are assigned to individuals in a sequential manner. Since it is compulsory for all Spaniards to have an ID number by age 14, two Spaniards with similar ID numbers are likely to be of the same age (and geographical origin).³¹ In order to perform the assignment, we first use registry information on the date of birth and ID numbers of 1.8 million individuals in order to create a correspondence table which assigns year of birth to the first four digits of ID number (ranges of 10,000 numbers). To test the precision of this correspondence, we apply it to a publicly available list of 3,000 court clerks, which contains both the ID number and the date of birth. In 95% of the cases the assigned age is within a three-year interval of the actual age. In order to minimize potential errors, whenever our age proxy indicated that a candidate for an associate professorship is less than 27 years old and a candidate for full professorship is less than 35 years old, we assign age a missing value. This proxy is also not defined for non-Spaniards (less than 1% of the sample). We imputed the missing age with the average age of individuals at the same discipline and rank (around 5% of the sample).

In 2006 the system of *habilitación* was replaced by a system known as *acreditación*, which is still in place. Under the *acreditación* system applicants aspiring

³⁰In these cases, unfilled seats in the committee were filled with professors from related disciplines.

³¹There are a number of exceptions. For instance, this methodology will fail to identify the age of individuals who obtained their nationality when they were older than 14. Nevertheless, immigration was a rare phenomenon in Spain until the late 1990s. Additionally, some parents may have their children obtain an ID number before they are 14. This may be the case particularly after Spain entered in the mid 90s the Schengen zone and IDs became a valid documentation to travel to a number of European countries.

for promotion are also required to be approved by a national review committee. These committees evaluate candidacies on a monthly basis and their decisions are published in the Official State Bulletin. We collected information on the identity of all candidates that qualified for a FP position before September 2013.

The Ministry provides information on affiliation and on tenure in the position for eligible evaluators. Given that most candidates to full professor positions are eligible evaluators themselves in exams to associate professor positions, it is possible to obtain their affiliation by matching the list of eligible evaluators with the list of candidates. Using this procedure, we were able to obtain the information on affiliation for 93% of candidates to full professor positions. We obtained the information on affiliation for the remaining 7% of candidates from the State Official Bulletin or directly from professors' CVs that can be found online.

ISI Web of Knowledge We also collected information on the research output of eligible evaluators and candidates from the ISI Web of Knowledge.³²

Information on scientific publications comes from the Thomson Reuters ISI Web of Knowledge (WoK). We consider publications published since 1972 by authors based in Spain, as well as the number of citations received by these publications before July 2009. The WoK database includes over 10,000 high-impact journals in the categories of Science, Engineering, Medicine and Social Sciences, as well as international proceedings coverage for over 110,000 conferences. For the purpose of this analysis, we considered all articles, reviews, notes and proceedings.

The assignment of articles to professors is non-trivial. For each publication and author, WoS provides information on his/her surname and on his/her initial. In Spain, some surnames are very common (e.g., Garcia, Fernandez, Gonzalez), and this may create problems with homonymity. Moreover, unlike most other countries, individuals are assigned two surnames (paternal and maternal) and sometimes also several first names. When Spanish authors sign a paper they may do it with only their paternal or with their maternal surname, or they may hyphenate the two surnames. Authors may also sign using their first name, their middle name, or both.

We use the following matching procedure in order to deal with the above problems. First, we assign all publications and all professors in our sample to a broad disciplinary category. In order to attribute comparable disciplinary categories for publications and individuals, we aggregate disciplines defined by the Spanish Ministry and ISI disciplinary areas into the following categories: Agriculture; Chemistry; Biology; Geology; Physics; Mathematics and Computer Science; Engineering;

³²We are grateful to the *Fundación Española para la Ciencia y la Tecnología* for providing us with access to the data.

Medicine, Veterinary and Pharmacology; Economics and Management; Psychology, Sociology and Political Science.³³ Second, in each broad disciplinary category we match publications with individuals in our database using the information on their surnames and initials.

Specifically, the publication is assigned to a professor in the list of eligible evaluators if it is in the same disciplinary category as the professor, and the author's surname and initial, as reported by ISI, coincide (i) with the first surname and the first name's initial of the professor, (ii) with the last surname and the first initial, (iii) with the first surname hyphenated with the second surname and the first initial. We also repeat stages (i) through (iii) substituting the first initial with the middle-name initial. If a given publication can be assigned to more than one possible match, the value of this publication is divided by the number of such possible matches.

Given that the propensity to publish differs substantially across the disciplines, we normalize the number of individual's publications to have zero mean and unit standard deviation among applicants to the same exam and among eligible evaluators of a given category in a given exam. The number of citations of each publication depends on the time elapsed between the publication date and the date when the number of received citations is observed. Therefore, we first normalize the number of citations that each publication receives by subtracting the average number of citations received by Spanish-authored articles published in the corresponding ISI disciplinary area in the same year and then dividing by the corresponding standard deviation. Next, for each individual in our database we calculate the average number of citations per publication. For individuals who have no ISI publications, this variable takes the minimum value in the corresponding discipline. Finally, similarly to the number of publications, we normalize the number of individual's citations per publication to have zero mean and unit standard deviation among applicants to the same exam and among eligible evaluators of a given category in a given exam.

Dialnet Dialnet (<http://dialnet.unirioja.es>) is an open access bibliographic index created by the University of Rioja. It contains information on more than 8,000 journals and more than 3,5 million documents in Hispanic languages, including articles published in scientific journals, collective works and books. The database mainly covers publications in social sciences and humanities. Dialnet provides (in most cases) systematized information on individual authors' first name, paternal surname, maternal surname and affiliation, thus limiting potential concerns about homonymity.

³³In practice, apart from the case of journals *Science* and *Nature*, the ISI scientific categories are assigned to journals, not publications. In very rare cases a publication happened to be assigned to more than one broad disciplinary group.

We collected information on publications in Dialnet. Due to its lack of representativeness, we did not consider publications in Science and Engineering. We also excluded publications that appear in ISI Web of Science. We also restricted the set of journals considered to those which satisfy certain minimum research quality requirements (categories A, B or C) as established by the Integrated Scientific Journals Classification (CIRC) (Torres-Salinas et al. 2010).³⁴ Similarly, we considered only books and collective volumes that are published by publishers that satisfy a minimum quality requirement. In particular, we used the EPUC-CSIC publisher list, which summarizes the names of the main publishers in social sciences and humanities in Spain and abroad (Giménez-Toledo, Tejada-Artigas and Mañana-Rodríguez 2012).³⁵ Publications that have been excluded from our study are mainly publications in working paper series, non-refereed journals and volumes published by local universities (around 30%).

Teseo database on doctoral dissertations Since 1977, PhD candidates in Spanish universities have registered their dissertation in the database TESEO, which is run by the Ministry of Education. We retrieved all the information available in this database from the website <https://www.educacion.gob.es/teseo> in May 2011. While registration is compulsory, according to Fuentes and Arguimbau (2010) TESEO includes information on approximately 90% of all dissertations read in Spain during this period.³⁶ We observe information on 151,483 dissertations. TESEO provides the identity and affiliation of dissertations' authors, advisors and committee members. Approximately 40% of dissertations are female authored. Female supervisors are scarce and represent only 18% of the total. While 58% of the students they supervise are female, in the case of male advisors, 61% of their students are male.

We match TESEO data with the list of candidates and evaluators. In exams to full professor positions we are able to find the dissertation of 71% of candidates and 41% of evaluators. In exams to associate professor positions we observe the dissertation of 83% of candidates and 70% of evaluators. Missing information may be due to the fact that individuals (i) did their PhD abroad, (ii) defended their dissertation before 1977, (iii) there are spelling mistakes, (iv) the dissertation was not

³⁴Torres-Salinas, Daniel, Maria Bordons, Elea Giménez-Toledo, Emilio Delgado-López-Cózar, Evaristo Jiménez-Contreras y Elías Sanz-Casado (2010), "Clasificación integrada de revistas científicas (CIRC): propuesta de categorización de las revistas en ciencias sociales y humanas," *El profesional de la información*, v. 19, n. 6, pp. 675-683.

³⁵Giménez-Toledo, Elea, Carlos Tejada-Artigas and Jorge Mañana-Rodríguez (2012), "Scholarly Publishers Indicators (SPI)," 1st edition. Available at: <http://epuc.cchs.csic.es/SPI> [Accessed Nov. 18 2013.]

³⁶Fuentes, Eulàlia and Llorenç Arguimbau (2010), "Las Tesis Doctorales en España (1997-2008): Análisis, Estadísticas y Repositorios Cooperativos," *Revista Española de Documentación Científica*, Vol. 33(1), pp. 63-89.

included in TESEO for unknown reasons (approximately 10% of all dissertations), or (v) there was a problem with homonymity (in our dataset 0.1% of individuals share the same name, middle name, paternal surname and maternal surname).

Each thesis has been classified by its author using the Unesco International Standard Nomenclature for Fields of Science and Technology. This system developed by Unesco includes more than two thousand six-digits categories.³⁷ 80% of dissertations provide this information. Approximately half of the authors select one six-digit category, 35% select two categories, and 15% select three or more categories. There are on average around one hundred dissertations per category. We use this information to construct a measure of individuals' research interests. In particular, we take into account every dissertation where an individual appears as an advisor, committee member or author. We were able to obtain information on the research interests of 98% candidates to full professor positions, 94% of candidates to associate professor positions, 98% of eligible full professors and 96% of eligible associate professors.

³⁷Available at <http://unesdoc.unesco.org/images/0008/000829/082946eb.pdf>

Table C1: Descriptive statistics – Eligible evaluators

	1	2	3	4	5	6	7	8	9	10	11	12
	Italy				Spain							
	Full professors				Full professors				Associate professors			
	All	Male	Female	p-value	All	Male	Female	p-value	All	Male	Female	p-value
Female	0.20				0.14				0.35			
Tenure in position	13	0.07	-0.27	0.000	13	0.05	-0.33	0.000	10	0.01	-0.03	0.000
Age	-				52	0.00	-0.03	0.010	45	0.01	-0.02	0.001
All Publications:	131	0.04	-0.17	0.000	34	0.02	-0.14	0.000	14	0.05	-0.09	0.000
- Articles	73	0.05	-0.20	0.000	30	0.02	-0.14	0.000	12	0.05	-0.10	0.000
- Books	8	0.05	-0.19	0.000	1	0.01	-0.06	0.000	0.44	0.01	-0.02	0.000
- Book chapters	22	0.02	-0.07	0.005	3	0.01	-0.07	0.000	1	0.01	-0.01	0.003
- Conference proceedings	20	-0.00	0.02	0.552	-				-			
- Patents	0.42	0.00	-0.01	0.522	0.10	0.00	-0.02	0.001	0.04	0.01	-0.02	0.000
- Other	7	-0.00	0.00	0.909	-				-			
Total Article Influence Score	133	0.04	-0.24	0.000	33	0.01	-0.10	0.000	12	0.03	-0.07	0.000
A-journal articles	11	0.05	-0.14	0.000	4	0.03	-0.15	0.000	2	0.04	-0.06	0.000
All Publications, previous 10 years	74	0.03	-0.13	0.000	18	0.02	-0.10	0.000	9	0.04	-0.08	0.000
Total Article Influence Score, previous 10 years	72	0.03	-0.18	0.000	19	0.01	-0.07	0.000	8	0.04	-0.08	0.000
A-journal articles, previous 10 years	6	0.05	-0.13	0.000	2	0.02	-0.09	0.000	1	0.03	-0.04	0.000
PhD students advised	-				5	0.03	-0.20	0.000	1	0.08	-0.15	0.000
PhD committees	-				25	0.05	-0.33	0.000	5	0.07	-0.13	0.000
Based in the South	0.28	0.01	-0.03	0.169	0.34	0.02	-0.12	0.000	0.36	0.05	-0.09	0.000
Observations	5,876				49,199				61,052			

Notes: The table provides descriptive information for the pool of eligible evaluators in qualification exams in Italy and in Spain. In Italy it includes only evaluators who are based in an Italian university. Columns 1, 5 and 9 report mean values for each corresponding variable and sample. In columns 2, 3, 6, 7, 10 and 11 variables have been normalized to have zero mean and unit variance for individuals within each field and rank. Columns 4, 8 and 12 report the p-value of a t-test of the difference in means between male and female eligible evaluators in the corresponding variable. *Article Influence Score* (AIS) is only available for candidates in science, technology, engineering, mathematics, medicine. Information on publications in *A-journal articles* is only provided for candidates in social sciences and humanities. In Italy, southern regions refer to Abruzzo, Molise, Campania, Apulia, Basilicata, Calabria and islands. In Spain, southern regions include Extremadura, Castille-La Mancha, Andalusia, Murcia, Valencia and islands.

Table C2: Descriptive statistics – Applications

	1	2	3	4	5	6	7	8	9	10
	Applications to full professorships					Applications to associate professorships				
	Mean	St.Dev.	Male	Female	p-value	Mean	St.Dev.	Male	Female	p-value
Italy										
Female	0.31					0.41				
Age	49	8	-0.01	0.01	0.199	43	7	0.02	-0.03	0.000
Permanent position:	0.74	0.44	0.72	0.77	0.000	0.47	0.50	0.46	0.48	0.000
- same field	0.77	0.42	0.76	0.80	0.000	0.74	0.44	0.72	0.76	0.000
CV length (pages)	20	79	-0.01	0.03	0.006	14	60	-0.03	0.04	0.000
All Publications:	89	83	0.04	-0.09	0.000	53	54	0.04	-0.06	0.000
- Articles	53	65	0.06	-0.14	0.000	30	41	0.07	-0.10	0.000
- Books	3	6	0.04	-0.09	0.000	2	4	0.06	-0.08	0.000
- Book chapters	10	15	0.01	-0.03	0.004	6	10	0.01	-0.02	0.002
- Conference proceedings	14	26	-0.01	0.02	0.050	8	17	-0.01	0.01	0.028
- Patents	0.35	2.09	0.01	-0.03	0.000	0.19	1.39	0.03	-0.04	0.000
- Other	10	27	-0.00	0.00	0.938	8	20	-0.00	0.00	0.899
Number of coauthors per article	6	19	-0.01	0.02	0.024	6	18	-0.02	0.03	0.000
First-authored	0.22	0.19	-0.01	0.02	0.037	0.22	0.2	0.00	0.00	0.365
Last-authored	0.15	0.17	0.02	-0.04	0.000	0.11	0.15	0.02	-0.03	0.000
Average Article Influence Score	1.31	0.95	0.03	-0.09	0.000	1.30	0.99	0.03	-0.04	0.000
A-journal articles	6	9	0.04	-0.07	0.000	3	5	0.04	-0.05	0.000
Application order	0.50	0.29	0.50	0.51	0.012	0.50	0.29	0.50	0.50	0.717
Above the median in 3 indicators	0.42	0.49	0.45	0.37	0.000	0.36	0.48	0.37	0.33	0.000
Withdrawal	0.16	0.37	0.15	0.20	0.000	0.13	0.34	0.12	0.16	0.000
Qualified	0.36	0.48	0.37	0.34	0.000	0.37	0.48	0.38	0.35	0.000
Failure	0.48	0.50	0.48	0.46	0.012	0.50	0.50	0.5	0.5	0.975
Proportion of positive votes	0.46	0.47	0.46	0.44	0.051	0.44	0.47	0.45	0.43	0.000
Number of applications	21,594					47,426				
Spain										
Female	0.27					0.40				
Age	46	6	-0.01	0.03	0.015	37	6	0.03	-0.05	0.000
All Publications:	19	21	0.03	-0.09	0.000	8	14	0.07	-0.10	0.000
- Articles	17	21	0.04	-0.09	0.000	7	14	0.07	-0.11	0.000
- Books	0.64	1.47	0.01	-0.03	0.005	0.21	0.65	0.02	-0.02	0.000
- Book chapters	1.57	3.18	0.01	-0.02	0.086	0.54	1.41	0.01	-0.01	0.025
- Patents	0.04	0.33	0.00	0.00	0.919	0.02	0.22	0.01	-0.01	0.012
Average number of coauthors	3	10	0.00	0.01	0.691	5	23	0.00	0.00	0.863
First-authored	0.25	0.31	0.00	0.00	0.862	0.26	0.34	0.01	-0.01	0.200
Last-authored	0.24	0.30	0.01	-0.02	0.220	0.17	0.30	0.03	-0.05	0.000
Average Article Influence Score	0.75	0.43	-0.01	0.02	0.458	0.72	0.54	0.03	-0.06	0.000
A-journal articles	3	5	0.05	-0.10	0.000	1	2	0.06	-0.06	0.000
PhD students advised	2	3	0.03	-0.09	0.000	0.24	0.88	0.03	-0.05	0.000
PhD committees	7	9	0.03	-0.08	0.000	1	3	0.05	-0.08	0.000
Qualified	0.11	0.31	0.11	0.09	0.003	0.12	0.32	0.12	0.11	0.025
Number of applications	13,444					17,799				

Notes: Columns 1 and 6 report mean values for each corresponding variable and sample. In columns 3, 4, 8, and 9 all productivity variables have been normalized to have zero mean and unit variance for applications within each exam. Columns 5 and 10 report the p-value of a t-test of the difference in means between male and female candidates in the corresponding variable. *Article Influence Score* (AIS) is only available for candidates in science, technology, engineering, mathematics and medicine. Information on publications in *A-journal articles* is only provided for candidates in social sciences and humanities.

Table C3: Descriptive statistics – Links and Research Overlap

	1	2	3	4	5
	All		Male	Female	
<i>Italy</i>	N	Mean	Mean	Mean	p-value
Colleagues	2,555,839	0.028	0.027	0.030	0.000
Coauthors	2,555,839	0.014	0.015	0.013	0.000
Same subfield	1,373,790	0.598	0.597	0.599	0.020
<i>Spain</i>					
Colleagues	5,445,067	0.046	0.047	0.043	0.000
Coauthors	5,445,067	0.004	0.005	0.004	0.000
PhD advisor	5,445,067	0.002	0.002	0.002	0.322
PhD thesis committee	5,445,067	0.013	0.014	0.011	0.000
Overlap in research interests	4,711,621	0.196	0.183	0.218	0.000

Notes: The table provides information on links between candidates and eligible evaluators within each discipline. Information about research interests is only available for candidates with a permanent contract in an Italian university and for candidates who have defended their thesis in Spain or who have participated in a thesis committee in Spain. The variable *Same subfield* takes value one if a candidate and an eligible evaluator belong to the same subfield (*settore scientifico-disciplinare*). The variable *Overlap in research interests* measures the degree of overlap between the research interests of eligible evaluators and candidates, as measured by their participation in PhD thesis committees.

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Appendix D. First-stage estimates

Below we report the first-stage estimates from the IV estimations of the effect of committee gender composition on the relative success of female candidates reported in Table 1.

Table D1: First-stage estimates

<i>Dependent variable:</i>	$Female_e^{final}$	$Female_i * Female_e^{final}$	$Female_i * Female_e^{final}$
Second-stage estimates:	Column 4 of Table 1		Column 5 of Table 1
Italy			
$Female_e^{initial}$	0.822*** (0.048)	-0.006 (0.006)	
$Female_i * Female_e^{initial}$	-0.042 (0.032)	0.788*** (0.066)	0.810*** (0.055)
Controls:			
$Female_e^{expected}$	Yes	Yes	Yes
$Female_i * Female_e^{expected}$	Yes	Yes	Yes
Candidate characteristics	Yes	Yes	Yes
Exam FE			Yes
F statistics:	188	74	218
Sanderson-Windmeijer F statistics:	323	380	218
Spain			
$Female_e^{initial}$	0.954*** (0.021)	0.000 (0.002)	
$Female_i * Female_e^{initial}$	0.014 (0.012)	0.970*** (0.017)	0.966*** (0.020)
Controls:			
$Female_e^{expected}$	Yes	Yes	Yes
$Female_i * Female_e^{expected}$	Yes	Yes	Yes
Candidate characteristics	Yes	Yes	Yes
Exam FE			Yes
F statistics:	2396	3135	2310
Sanderson-Windmeijer F statistics:	2116	3503	2310

Notes: Standard errors are clustered by committee.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix E. Nonlinearities

The effect of the gender composition of committee on the relative success rate of females may be non-linear for a number of reasons. First, the presence of a woman in the committee may affect the voting behavior of male evaluators (see section 4.5). If this is the case, the transition from zero to one female evaluator in the committee may have a different effect than the transition from one to two female evaluators, or from two to three female evaluators. Second, decisions in the committee are taken on a (qualified) majority basis. Therefore, having a committee where the (qualifying) majority of members are female might have a particularly strong effect.

In order to correctly identify the potential existence of nonlinear effects, it is necessary to control for the probability that a given number of women is assigned to the committee. We consider the following model:

$$y_{ie} = \beta_0 + \beta_1 Female_i + \sum_k \gamma_k Female_i D_{ke} \\ + \sum_k \delta_k Female_i D_{ke}^{expected} + \mathbf{X}_i \beta_2 + \mathbf{Z}_i \beta_3 + \mu_e + \epsilon_{ie}$$

where D_{ke} is a dummy variable that takes value one if the number of female evaluators in committee e is equal to k and $D_{ke}^{expected}$ is the probability that exactly k female evaluators are assigned to a given committee. For Spanish evaluations, we directly compute these probabilities using information on the gender mix of the pool of eligible evaluators. For the Italian case, the direct computation is more complicated, since the assignment procedure required no more than one committee member from each university. Instead, we compute these probabilities using the outcomes of 1,000,000 simulated random draws, which account for the restrictions on the randomization.

Committees rarely included more than three women. Therefore, we only analyze the effect of having one, two, and three or more female evaluators. In both countries, four positive votes are required for qualification. The estimation results are presented in Table E1. Overall, the linearity of the effect of committees' gender composition cannot be rejected by the data.

Table E1: Nonlinearities

	1	2
	Italy	Spain
Female	0.000 (0.007)	-0.012 (0.007)
Female* 1 female evaluator	-0.017 (0.012)	-0.002 (0.010)
Female* 2 female evaluators	-0.036*** (0.012)	-0.005 (0.013)
Female* 3 or more female evaluators	-0.079*** (0.022)	-0.005 (0.014)
Number of observations	69020	31243

Notes: IV estimates. All regressions include as controls exams fixed-effects, the number of female evaluators in the committee, individual predetermined characteristics, and the expected probabilities to have 1, 2, and 3 or more female evaluators. Standard errors are clustered by committee.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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Appendix F. Committee composition and evaluators' resignations

In section 4.5 we estimate the effect of committee gender composition on the voting behavior of male evaluators. The consistency of these estimates relies on the assumption that evaluators' resignation was not affected by the gender composition of the committee. To examine this possibility, we estimate the following equation on the sample of initially drawn evaluators:

$$\begin{aligned} \text{Evaluator}_{je}^{\text{final}} = & \beta_0 + \beta_1 \text{Female}_j + \beta_2 \text{Female}_e^{\text{initial}} + \beta_3 \text{Female}_j * \text{Female}_e^{\text{initial}} \\ & + \beta_4 \text{Female}_{je}^{\text{expected}} + \beta_5 \text{Female}_j * \text{Female}_{je}^{\text{expected}} + \epsilon_{ij}, \end{aligned} \quad (10)$$

where $\text{Evaluator}_{je}^{\text{final}}$ is an indicator for those initially drawn evaluators who served in the final evaluation committee, $\text{Female}_e^{\text{initial}}$ is the share of women in the initially drawn committee and $\text{Female}_{je}^{\text{expected}}$ is the expected share of women in the committee conditional on the inclusion of evaluator j . Results from the estimation of equation (10) are reported in column 1 of Table F1. The presence of women in the committee does not affect the likelihood that a male or a female evaluator resigns. In column 2, we control for a number of evaluator characteristics including tenure, quality-adjusted productivity (total Article Influence Score in Sciences and the number of A-journal articles for Social Sciences and Humanities), and the location of their university. The estimates are unaffected by the inclusion of these controls.

Table F1: The effect of committee composition on evaluators' resignations

	Italy	
Female evaluator	0.117 (0.093)	0.106 (0.096)
Share of women in the committee	0.118* (0.071)	0.115 (0.071)
Female evaluator * Share of women in the committee	-0.085 (0.170)	-0.079 (0.174)
Expected share of women	-0.187 (0.192)	-0.173 (0.196)
Female evaluator * Expected share of women	-0.118 (0.289)	-0.127 (0.293)
Controls:		
Evaluator characteristics		Yes
Mean dependent variable	0.922	0.922
Number of observations	920	920

Notes: OLS estimates. The dependent variable is an indicator that takes value one if the initially drawn evaluator serves in the final evaluation committee.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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Appendix G. The effect of connections, by gender of evaluators and candidates

In Table G1 we explore whether the impact of connections depends on the gender of evaluators and candidates. We consider coauthors, colleagues and, in the case of Spain, also advisors. The gender of connections does not seem to play any role. Male and female candidates benefit equally from the presence of a female or a male connection in the committee.

Table G1: The effect of strong connections, by candidate and evaluator gender

	1	2
	Italy	Spain
Female candidate	0.006 (0.008)	-0.012* (0.007)
Female candidate * Share of female evaluators	-0.131*** (0.035)	-0.012 (0.028)
Share of connections in committee	0.204*** (0.040)	0.427*** (0.038)
Female candidate * Share of connections in committee	0.010 (0.065)	0.020 (0.060)
Share of female connections in committee	-0.008 (0.085)	-0.036 (0.101)
Female candidate * Share of female connections in committee	0.149 (0.125)	-0.084 (0.145)
Number of observations	69020	31243

Notes: IV estimates. All regressions include exam fixed-effects, individual predetermined characteristics, *Female candidate* Expected share of women in committee*, *Expected connections in committee*, *Female candidate* Expected connections in committee*, *Expected female connections in committee* and *Female candidate* Expected female connections in committee*. Standard errors are clustered by committee.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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Appendix H. Heterogeneity analysis, alternative specifications.

In section 4.6.1 we explore whether the effect of the committees' gender composition varies depending on whether evaluators and candidates share similar research interests and depending on the degree of feminization of the field. In Table 7 we report results from an analysis where we split the sample of candidates in each country in two groups based on the median value of each variable.

In this section we present an alternative specification. We estimate a model with triple interactions exploiting the full range of possible values of the running variables. First, we analyze the impact of research similarity. We estimate the following model:

$$\begin{aligned}
 Y_{ie} = & \beta_0 + \beta_1 Female_i + \beta_2 Female_i * Female_e^{final} + \beta_3 S_{ie}^{final} + \beta_4 Female_i * S_{ie}^{final} + \\
 & + \beta_5 Female_i * Female_e^{final} * S_{ie}^{final} + \\
 & + \beta_6 Female_i * Female_e^{expected} + \beta_7 S_{ie}^{expected} + \beta_8 Female_i * S_{ie}^{expected} + \\
 & + \beta_9 Female_i * Female_e^{final} * S_{ie}^{final} + \mathbf{X}_i \beta_{10} + \mu_e + \epsilon_{ie}
 \end{aligned} \tag{11}$$

where S_{ie}^{final} and $S_{ie}^{expected}$ stand for the actual and the expected research similarity between candidate i and committee e . We instrument the final composition of the committee ($Female_e^{final}, S_{ie}^{final}$) using the outcome of the initial lottery draw ($Female_e^{initial}, S_{ie}^{initial}$). In this model, coefficient β_2 shows the effect of committee gender composition when the committee members and candidates do not share research interests ($S_{ie}^{final} = 0$). Coefficient β_5 shows how this effect changes when candidates are evaluated by committees composed of evaluators who share research interests with the candidate.

As shown in Table H1, columns 1 and 2, in both countries the presence of women in the committee reduces the relative chances of success of female candidates when candidates and evaluators have different research interests. However, this effect disappears when candidates and evaluators share the same research interests.

Second, analyze the impact of the degree of feminization of the field. We estimate the following equation:

$$\begin{aligned}
 Y_{ie} = & \beta_0 + \beta_1 Female_i + \beta_2 Female_i * Female_e^{final} \\
 & + \beta_3 Female_i * Female_e^{final} * Female_d + \beta_4 Female_i * Female_e^{expected} \\
 & + \beta_5 Female_i * Female_e^{final} * Female_d + \mathbf{X}_i \beta_6 + \mu_e + \epsilon_{ie},
 \end{aligned} \tag{12}$$

where $Female_d$ is the proportion of women among full professors in the corresponding discipline. Equation (12) allows us to explore whether the effect of committee

gender composition varies depending on the feminization of the discipline. Results from this analysis are shown in columns 3 and 4 of Table H1. The effect of committees' gender composition on female candidates' success rate does not depend significantly on the degree of feminization of the field.

Table H1: The effect of committee composition, by research interest overlap and the degree of feminization of the field

	1	2	3	4
	Italy	Spain	Italy	Spain
Female	0.026 (0.031)	0.012 (0.020)	0.010 (0.009)	-0.011 (0.007)
Female * Share of women in the committee	-0.177** (0.077)	-0.096** (0.047)	-0.032 (0.109)	-0.008 (0.048)
Research similarity	0.107** (0.049)	0.231*** (0.046)		
Female * Research similarity	-0.072 (0.063)	-0.088 (0.069)		
Share of women in the committee *	-0.216 (0.138)	-0.055 (0.092)		
Research similarity				
Female * Share of women in the committee	0.242** (0.106)	0.282*** (0.105)		
* Research similarity				
Female * Share of women in the committee			-0.350 (0.421)	-0.046 (0.269)
* Feminization of the discipline				
Average research similarity	0.455	0.262		
Average feminization of the discipline			0.218	0.128
Candidate characteristics	Yes	Yes	Yes	Yes
Exam FE	Yes	Yes	Yes	Yes
Number of observations	35832	27998	69020	31243

Notes: Characteristics of final committees are instrumented by the characteristics of initial committees selected by random draw. Research similarity is measured in Italy as the proportion of committee members in the same subfield as the candidate and in Spain as the average overlap in research interests (see more details in Data section). Feminization of the discipline is measured by the proportion of women among all full professors in the discipline in 2012 in Italy and in 2002 in Spain. Columns 1 and 2 include also *Female candidate* Expected share of women in committee*, *Expected research similarity*, *Female candidate* Expected research similarity*, *Expected share of women in committee * Expected research similarity* and *Female candidate* Expected share of women in committee * Expected research similarity*. Columns 3 and 4 include *Female candidate* Expected share of women in committee* and *Female candidate* Expected share of women in committee * Feminization of the discipline*. Standard errors are clustered by committee.

* p < 0.10, ** p < 0.05, *** p < 0.01.