Selection into Research: Do gender and connections matter?

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Abstract

The article investigates whether the gender composition of selecting committees favours the presence of women in research activities. We exploit a novel data set on recruitment processes in a leading Italian research centre that mainly operates in hard science. Unlike previous studies that focus on selections into professorships (De Paola and Scoppa, 2011; Zinovyeva and Bagues, 2011; Bagues et al., 2014), this article examines entry level research positions, where gender imbalance usually starts taking place. We find some evidence of discrimination against women at entry research levels, which is attenuated (or even reversed) by the presence of women in selecting committees. On the contrary, gender discrimination does not seem to be a concern for hierarchically higher positions. The most important predictor for being selected seems to be previous connections with the research centre. While higher quality commissions tend to choose more productive candidates and their decisions are not influenced by pre-existing ties with the institution, in all remaining cases prior acquaintance of the candidate reveals to be the most important determinant of success. The analysis of the post-competition productivity of candidates shows that applicants with prior ties are significantly more productive, suggesting a positive signalling of prior ties about candidates' research quality.

Keywords. Gender quotas, Discrimination, Research Recruitment, Connections
JEL classification: J16; J71; J45

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1 Introduction

Over the past decades, researchers have sought to explain the great gender imbalance in research: women outnumber men by 18% when they complete university, but are under-represented compared to their male colleagues when we look at top positions. More specifically, in academia their share represents 37% of Associate Professors and just 20% of Full Professors.[1] This phenomenon is commonly known as the "leaky pipeline" or "glass ceiling" effect, with both metaphors evoking the difficulty for women to gain equal access at the top of several professions (Clark Blickenstaff, 2005; Cotter et al., 2001).

What makes the university environment peculiar is that research activities, differently from most jobs in the private sector, do not exhibit large disparities in work load across junior, intermediate and senior positions (Bosquet et al., 2014). Accordingly, child rearing - which traditionally concerns women more than men - should not be a major obstacle preventing women from reaching higher academic and research ranks.[2]

A recent report on the conditions in academia in Italy (Frattini and Rossi, 2013) shows a rather discouraging scenario for female academics. It is still significantly more difficult for women than for men to pursue a career in academia. The aim of this article is to contribute to the debate on gender discrimination in the Italian research community. This paper complements and extends the already existing investigation on the Italian research environment: we study the determinants of entrance to a non-academic research environment.

In 2005 the former president of Harvard University Larry Summers suggested that differences in innate aptitude are responsible for the failure of women to progress to top scientific positions (Barres, 2006). This statement provoked a heated debate in the academic community. Although it is hardly defendable, it stimulated the debate on this important topic.

For more than a decade, in many disciplines, affirmative action policies that "require pro-active steps"[3] have been designed in order to level the playing field for men and women and help to increase the number of female academics (Sugimoto, 2013). A direct affirmative action in this direction, currently hotly debated, consists of imposing gender quotas in selection boards when filling research positions. This has already been introduced in a few European countries such as Sweden, Norway, Finland and Spain, where the compulsory share of commission members of each gender is 40%. Also the European Commission has recently advocated this type of policies as a desirable tool to countervail the gender inequality which is still prevailing in the academic sector (Meulders and O'Dorchai, 2013, p. 7).

Nevertheless, imposing gender quotas in scientific selecting committees does not represent a zero-cost policy

[1] European Commission data, see Meulders and O'Dorchai (2013).
[2] See Ceci and Williams (2011) for a meta-analysis of the causes of women's under-representation in science.
[3] For an overview of affirmative action policies, see Holzer and Neumark (2000, p.484).

since it requires a disproportionate share of senior women's time for attending selecting committees (since they are fewer than required quotas), a "non-productive" activity from a researcher perspective. Thus gender quotas in selecting positions may reveal detrimental to female researcher, at least in the short run. Therefore, the effectiveness of such a policy should be carefully examined.

This paper aims to investigate the potential effectiveness of gender quotas in selecting committees. The focus of this study is a non academic research centre in Italy, a country characterised by substantial gender inequality in many spheres of public and private life (De Paola and Scoppa, 2011; Frattini and Rossi, 2013). More specifically, we analyze the selection procedures within the Foundation Bruno Kessler (FBK), an Italian research institution in hard science, located in the north-eastern part of the country. Our aim is to identify the main drivers for being selected in research positions, including whether a higher proportion of women in selecting committees raises the proportion of women selected for research jobs.[4]

The aim of this article is to contribute to the debate on gender discrimination in the Italian research community, studying the determinants of entry in a research job within a non-academic research environment. The contribution of this paper is threefold. First, in contrast to previous studies, we investigate gender discrimination in a non-academic research environment. The research institution we study is not related to any specific university, which allows us to shed light on research careers of women outside university. Second, we examine recruitment processes and not career advancements. The recruitment strategy to the institution studied here mainly operates at the lowest research levels, equivalent to post-doc or research fellowship positions at universities. To the best of our knowledge, no other study has so far investigated gender discrimination at the start of a research career. This is an extremely interesting level of the research ladder, because it may be the starting point of the scissors effect in women and men research careers. Third, in almost all cases only one candidate is selected. Therefore, the competition among candidates is more evident and explicit than in previous qualification data sets, and it allows us to use different econometric techniques that take into account the interdependent success probability of candidates applying for the same call.

Our results indicate that the introduction of gender quotas may be useful in promoting female researchers in their early careers, although we do not find evidence of discrimination for selections for higher hierarchical levels. Surprisingly, our analyses indicate that the most important factor in explaining the success of candidates are pre-existing ties with the institution or commission members, which however seem to be gender neutral. We also find differences in selection criteria according to the quality of the commission in terms of research output, as well as different productivities among selected candidates according to prior ties or not.

The paper is organized as follows. In Section 2 we discuss the related literature; Section 3 presents the in-

[4]We thank the Human Resource division of FBK for providing the data within the project "FESTA", supported by the EC under the 7th FP.

stitutional environment in which FBK operates and outlines the selection procedures adopted within this centre. In Section 4, we describe the sources of our data set and we report candidate and call level characteristics. We proceed in Section 5 with the estimation strategy and the results. Section 6 discusses and concludes.

2 Literature review

The economic literature has provided several explanations for the gender imbalance in academia and research activity. A number of studies attribute the poorer academic performance of women to their lower productivity. The lower productivity might be due to a lower number of international connections and coauthorships (Sugimoto, 2013), to the lack of role models in the upper echelons of the academic world (Blau et al., 2010), and to a higher burden of family responsibilities compared to men (Shen, 2013). A different line of argument is put forward by the supporters of the "pipeline" theory. According to this argument gender inequalities registered in academia are due to a shorter permanence of women in the academic pipeline. This theory suggests that women would reach gender parity in universities if they acquire the same tenure as their male colleagues (Gregory, 2003). However, lack of empirical support to this argument emerges and hence other interpretations have been proposed.

A recent body of literature based on behavioral and experimental studies posits the existence of a different preference system across genders with regard to risk aversion and competitiveness: women are found to be more risk averse, less competitive, less self-confident and to have lower performance in competitions than men.[5] Since competition for top positions in academia is fiercer, women could shy away from these jobs and prefer to remain at lower levels of the career ladder. If this were what women want and what they aim for, then, in economic terms there would be no inefficiency and no policy intervention would be required. But we cannot exclude the possibility that women were prevented from reaching the upper levels of the academic career because of gender discrimination.

Discrimination might operate through the larger (or the exclusive) presence of men in selecting committees. Male evaluators could be more likely to hire or promote a male researcher instead of a female if they are subject to gender stereotypes, if they have gendered connections to male candidates, or if they share the same research interests as male candidates. Therefore, examiners' gender-biased preferences could support the gender segregation of women in research.

A substantial number of studies have recently investigated the impact of the gender composition of selecting committees on the likelihood of female candidates to be selected for a research position. However, none of these

[5]For a detailed review of experimental studies see Gneezy and Rustichini (2004), Croson and Gneezy (2009), De Paola et al. (2013), Flory et al. (2012), Gneezy et al. (2009), Charness and Gneezy (2012), Niederle et al. (2013), Frick (2011), Kleinjans (2009), Datta Gupta et al. (2005), Datta Gupta et al. (2013), Villeval (2012) and Marianne (2011).

has examined entry level research positions, such as post-docs or research fellowships, which may be the starting levels of the gender imbalance in this type of profession.[6] These studies analyze centralized selection for Associate and Full Professor positions in Italy and Spain, where the promotion mechanisms are relatively similar and consist of a first phase of centralized selection, after which candidates apply for specific positions at the university level. The identification strategy hinges on the random assignment of evaluators to commissions (see De Paola and Scoppa (2011); Zinovyeva and Bagues (2011); Bagues et al. (2014)). This avoids endogeneity due to the possible existence of unobservables that may be correlated with commissions' and candidates' characteristics. The exogenous variation in the gender composition of the commission enables the estimation of the impact of an additional female commissioner on the likelihood of a female candidate to be selected.

Although these papers share the same methodology, the evidence is mixed. De Paola and Scoppa (2011) examine 1,000 candidates in Chemistry and Economics for the Italian qualifications to Associate and Full professorship held in 2008 and document same-sex preferences; on the contrary Bagues et al. (2014), analyzing 66,000 applications for qualifications to Associate and Full Professorship in all academic fields in Italy in 2013 (ASN - *Abilitazione Scientifica Nazionale*), report the opposite result: namely, each additional female commissioner decreases the success rate of female candidates by 2%. A mixed and different result is provided by Zinovyeva and Bagues (2011) on Spanish data from all academic fields: opposite-sex preferences are found in competitions for Associate professorship, whereas female evaluators tend to prefer female candidates in competitions for Full professorship. The authors explain their results with the internalization of the glass ceiling effect in academia by female evaluators, who may discriminate against potential future female competitors. However, little is known on the gender dynamics operating at the start of a research career.

3 Institutional background

3.1 The research institute

The Bruno Kessler Foundation (FBK) is a private non-profit research organization based in Trento (Italy), whose core activity is research in hard science, although some research is also performed in humanities and social sciences. It was established in March 2007 as a conversion of the pre-existing Trentino Institute of Culture (ITC), a

[6] Another strand of the gender discrimination literature has investigated non-academic competitions. Based on 150,000 applications to enter the Spanish Judiciary system, Bagues and Esteve-Volart (2010) find opposite sex preferences: commissions with relatively more females are more likely to hire a male candidate. Other studies examine the impact of evaluators' gender on decisions such as accepting articles in a leading journal in economics (Abrevaya and Hamermesh, 2012) or approving grant proposals for the economics Program of the National Science Foundation (Broder, 1993). In the former study no discrimination is documented against female authors, whereas in the latter there is a clear preference for opposite sex grant applicants.

research institute founded in 1962 and entirely funded by the local government (Provincia Autonoma di Trento).[7] It currently hosts around 350 researchers who work in five research units.[8] Each unit is composed of several independent sub-units that run various research projects and compete for national and international funds. The institute has an excellent reputation and attracts many young researchers not only from the local University of Trento, but also from other parts of Italy and from abroad.

3.2 The selection process

The selection procedure for hiring new researchers relies on a publicly advertised competition and follows the rules and stages outlined in the institutional guidelines. The guidelines cover two different selection processes: selection procedures for level I and II researchers, irrespective of whether contracts are fixed-term or permanent, and selection procedures for level III and IV researchers and employees with an equivalent salary. First and second level researchers are equivalent to the academic positions of Full and Associate Professor, whereas third and fourth level researchers are equivalent to the positions of Assistant Professor and Research Assistant, respectively.

For level I and II researchers, the selection committee analyses applicants' CVs, and short-listed candidates are required to give seminar presentations. A ranking of eligible applicants is eventually produced at the end of the process, and the first one is offered the position. If she accepts, she is hired; otherwise in case of refusal the offer is turned to the second eligible. And so on until either the offer is accepted or the eligible list is exhausted.

The selection of researchers for level III and IV researchers and employees with an equivalent salary consists of four stages. In the first stage, the selecting committee (or its president) carries out a first screening and provides a short-list with at most 20 candidates. These candidates are then interviewed by a committee composed by Human Resources officers and senior researchers working in the same research unit(s) that have required the hiring. This second phase determines the suitability of candidates. The list of suitable candidates is then ranked according to the quality of the candidates and adequacy for the position. Finally, the post is offered to the highest ranked candidate(s).

Each selecting committee in both cases consists of up to five members, with typically one from the Human Resource department. The remaining members are researchers from FBK (from the relevant unit or sub-unit that

[7] According to the provincial law 14/2005, art.28, regulating the transformation process from ITC to FBK, "Since the date indicated at subsection 2, the personnel working at ITC with open-ended contracts that does not establish a working contract with FBK, is transferred in the unique role of the provincial personnel, and is made available to FBK. The personnel transferred to the Province can ask to be hired at FBK within 120 days from the adoption of the governing body decision that identifies the collective contract indicated at subsection 13". Therefore, the data set investigated in this paper does not include calls dedicated to ITC personnel, since specific provincial laws regulated the transfer of personnel from ITC to FBK.

[8] The five centers are: Center for Information Technology-CIT, which focuses on computer science; Center for Materials and Microsystems - CMM, concerned with microsystems and microelectronics, as well as computational physics and materials; European Center for Theoretical Physics - ECT; Center for Italian-German Historical Studies - ISIG, which deals with the historical connections between Italy and Germanic countries, and Center for Religious Sciences - ISR.

posts the vacancy) or from other research institutions, in Italy or abroad.

Within the sluggish Italian academic labour market, a salient feature of FBK is the high turnover of researchers, leading to a large number of selection procedures each year (between 30 and 50 per year). This is mostly attributable to the fact that FBK has a limited number of tenure positions, while the majority of them are temporary ones, and are posted again after expiration. Given the smaller size of the two research units working in the field of humanities (history and religious studies) and the absence of largely accepted bibliometric criteria, we abstract from them and focus on science and engineering competitions in the other three units. The fraction of male researchers in these units clearly exceeds one half.

4 Data

The data used in this study were purposely collected from three main sources: candidates' CVs, FBK's administrative archives and the Scopus bibliometric database, which was considered to retrieve information about candidates' research output. Candidates applied online or via email, and their applications are kept within the institution for up to 5 years. Administrative archives hold official final reports, as well as the job advertisement contained in the public call. These three sources lead to a multilevel design of the analysis, since data relate to both the individual applicant and the call level.

The data analysed include information on 672 candidates from 112 calls posted between 2009 and 2011. The number of calls follows an irregular profile over the years: 37 calls were posted in 2009, 47 in 2010 and 28 in 2011. The number of applications follows a similar pattern: we examined 191 candidates in 2009, 290 candidates in 2010 and 191 candidates in 2011. Some of these competitions failed to fill the position, while a few resulted in recruitment of more than one candidate. For 27 competitions only one application was received. Our final sample excludes both competitions with only one applicant and competitions without any selected winner. As a result, the data set contains 616 applicants for 79 calls: 179 candidates for 26 calls posted in 2009, 266 candidates for 31 calls in 2010, and 171 candidates for 22 calls referred to 2011. Out of the 79 calls, 73 resulted in the recruitment of one candidate and they amount to 510 candidates, whereas five calls led to two recruitments and one to three, with 73 and 33 applicants, respectively.

The calls examined are all public calls, hence open to both external and internal candidates of FBK. The personnel already working at FBK, as employees and not as temporary collaborators, can proceed in the internal career ladder through the advancement procedures outlined in the institutional guidelines.[9] However, this does not hamper applications from the internal staff.

[9] Among the positions included in the analysis, internal advancements in the career ladder do not apply only for co.co.pro. workers, who are considered as fixed-term collaborators.

4.1 Candidate level variables

We analyse socio-demographic characteristics of the candidates such as gender, age, the country of birth (the region in the case of Italians), the highest educational level and the marks obtained, the year of graduation, the length of work experience and the field of study.[10] Candidates' age was missing in 47% of CVs, but the proportion was higher for candidates from abroad at 66%. When no age was reported, the age was estimated from the year of graduation.

Several categorical variables were constructed. Origin was coded distinguishing between Trentino-Alto Adige (local), the rest of Italy, the European Union (including Switzerland) and the rest of the world. The field of study was recoded in three main areas: 1) social sciences and humanities (within engineering fields); 2) engineering, computer sciences, architecture, environmental sciences; 3) hard sciences except engineering (mathematics, physics, chemistry, geography). Educational attainment consists of four categories: no degree, bachelor degree, masters and Ph.D.. We also added a variable to proxy the level of excellence of the candidate during her educational career, distinguishing four ranges of the final mark: 110 and 110 with honours[11]; between 100 and 109; between 90 and 99 and less than 90. Foreign marks were converted accordingly.

The data set also includes information on candidates' scientific output. Candidates self-reported their publications on their CVs. Nevertheless, in order to standardise the comparison within and between competitions, we have retrieved data regarding the number of publications and citations directly from Scopus, the Elsevier's bibliographic database founded in 2004.[12] In order to obtain applicants' publication records, the Scopus Author search page was queried with researchers' first and last names. If the author's name was not unique, the results were cross-checked with data appearing on candidate's CV, such as age, origin and field of study, in order to refine results and ensure the correct attribution of publications to candidates.[13] The Scopus database was accessed in August 2014. Both publications and h-index data were retrieved for the specific year of the FBK call for which the candidate applied, in order to get closer to the perception of the selection committee. We opted for collecting candidates' h-index besides the number of publications because we believe that this combined measure is a good proxy for the importance and significance of candidates' contributions (Hirsch, 2005).

Finally, candidates' pre-existing ties with FBK are captured by a dummy variable taking value 1 if the candidate

[10] Ph.D. activity alone is not considered as work experience, whereas lecturing and/or other types of employment, even if conducted during the Ph.D., are taken into account.

[11] This mark corresponds to distinction in the Italian university system.

[12] Although other bibliographic sources such as Google Scholar and Web of Science are available, many studies suggest that Scopus is superior both in terms of coverage and accuracy. According to Falagas et al. (2008, p. 338), "Scopus offers about 20% more coverage than Web of Science, whereas Google Scholar offers results of inconsistent accuracy.". Moreover, "Scopus helps distinguish between the researchers in a more nuanced fashion than Web of Science."(Meho and Rogers, 2008, p. 1711).

[13] Out of 616 candidates, 50 candidates, corresponding to 40 unique individuals were not uniquely identified. In order not to lose these observations, the average value for the h-index and the number of publications of namesakes in the same field as the individual applying to FBK were entered in the data set.

had prior ties with FBK or with one member of the selecting committee, either in the past or at the time of the application. Candidates were classified as having a pre-existing tie with FBK if they complied with at least one of the following criteria:

1) co-authorship with a member of the selecting committee;

2) supervision at the master or Ph.D. level by one of the commission members;

3) prior work experience (including internship) at FBK;

4) current work experience (including internship) at FBK.

We refer to 1) and 2) as commission ties and to 3) and 4) as institution ties, with the underlying hypothesis that ties with the institution may exert a stronger effect in the hiring procedures, since a candidate with prior or current work experience at FBK may have had more opportunities to show her skills and at the same time to create networks with the hiring institution.

4.2 Call level variables

For each call, the characteristics of the members of the selecting committee are included in the data set, jointly with information about the vacancy advertised. For committee members, gender, age and country of origin were obtained from administrative archives of FBK, and their bibliometric indices retrieved from Scopus for the year of the call. The latter data provide a measure of the intrinsic quality of the commission, which could be positively correlated with the meritocracy of the selection.[14] To distinguish between researchers and HR staff, a dummy variable HR (Human Resources department) identifies the non-researcher commission member(s).

Gendered commissions are described by two variables: a dummy variable taking value 1 if the commission included at least one female member, and another variable measuring the fraction of female members in the commission. At the call level, we also recorded information on the units posting the vacancies, like the duration of the contract (in months), the salary and the type of position advertised. The advertised positions are classified into the following categories: R1 are level I researchers, R3 level III researchers and R4 level IV researchers. Finally, our data set includes T4 positions, which are for level IV technicians, post-doc positions and fixed-term contracts (called "co.co.pro." in the Italian legislation).

[14] De Paola et al. (2014), working on the 2013 Italian qualifications to Associate and Full professorship, find that a commission whose members had an h-index above the median tends to weight a candidates' publications in the selection process more than other commissions; moreover, in the lower tail of the distribution of commissions' quality, candidates with a weaker publication record tend to be qualified, at the expense of stronger candidates.

4.3 Descriptive statistics

An average of 8 candidates applied per call.[15] The variation of the number of candidates across calls however is considerable: it ranged from two applicants to more than 30 applicants. Table 1 depicts the number of candidates and calls across the different positions included in the data set. We distinguish the different research positions into upper and lower positions. To the former type belong R1, R3 and R4 calls, which represent higher positions in the career ladder with respect to T4, post-doc and co.co.pro., which we refer to as lower positions. As can be noted in Table 1, the vast majority of the observations refer to lower positions. Descriptive statistics regarding monthly wage, applicant's age and contract length across the different research positions are reported in Table 20 in Appendix B.

Table 1: Number of candidates and calls across different positions

Position	N. applicants	N. calls	Average N. of candidates per call
R1	8	1	8
R3	65	13	5
R4	124	13	9.54
T4	22	2	11
post-doc	15	2	7.5
co.co.pro.	382	48	7.96
Total	616	79	7.8

Table 2 reports descriptive statistics for the candidate level variables. The average candidate was around 30 years old, with 4.6 years of work experience; he had around 6 publications and a corresponding h-index of 1.38. The proportion of women was about 20%. Almost 14% of the candidates were recruited (15.7% of the female candidates and 13.5% of the male candidates) and almost 11% had pre-existing ties with FBK members or with commissioners (similar for men and women, with 12.3% of the women and 10.5% of the men).

Table 2 also allows us to shed a preliminary light on some marked differences between male and female candidates: male applicants had on average one more year of work experience than female ones; they had on average three more publications, and their h-index was higher, although the disparity across genders was proportionally lower for the h-index.[16]

By decomposing the variable representing prior ties with FBK into the four categories indicated at the end of Section 4.1, we note that the majority of ties is represented by ties with the institution (Table 3). Forty candidates have been working in the past for FBK, whereas twenty-six are currently working for the institute. Only nine and eight observations have a co-author or a Ph.D./Master thesis supervisor among the commissioners, respectively.

[15] Applicants per call range from 6.88 in 2009, to 8.58 in 2010 and 7.77 in 2011, with an overall mean of 7.80.

[16] The differences in the standardized number of publications between male and female candidates are statistically significant - Wilcoxon rank-sum test, z= 4.093, p= 0.000 -, whereas they are not significant for the standardized h-index - Wilcoxon rank-sum test, z= 1.531, p = 0.126 -.

Table 2: Descriptive statistics - Candidates

Candidates					
	Mean	Std. Dev.	Min	Max	Observations
Female	0.196	0.397	0	1	616
Age	30.646	5.774	19	60	616
Females	29.942	4.736	20	53	121
Males	30.818	5.992	19	60	495
Success	0.139	0.346	0	1	616
Females	0.157	0.365	0	1	121
Males	0.135	0.342	0	1	495
Publications	5.982	21.659	0	424	616
Females	3.190	6.284	0	29	121
Males	6.664	23.917	0	424	495
H-index	1.388	3.188	0	39	616
Females	0.851	1.552	0	7	121
Males	1.519	3.461	0	39	495
Work experience	4.628	4.913	0	34	616
Females	3.609	3.723	0	25	121
Males	4.877	5.135	0	34	495
Ties with FBK	0.108	0.311	0	1	616
Females	0.123	0.330	0	1	121
Males	0.105	0.306	0	1	495

It can be the case that one candidate has more than one type of tie with FBK. In order to investigate the role of a different amount of ties, we constructed a "tie indicator" variable, which ranges between 0 and 4, where 0 indicates that the candidate does not have any tie with FBK, and 4 stands for having all the four types of ties with FBK. Of the 616 observations of the data set, 549 have no ties, 55 have one tie, 9 have two types of ties, 2 have three types of ties whereas one individual boasts of all types of ties.

Table 3: Decomposition of types of ties with FBK

	Co-author	Supervisor	Prior work	Current work	At least one tie	Institution	Commission
Frequency	9	8	40	26	67	56	16
Percentage	1.46	1.30	6.49	4.22	10.88	9.09	2.60

Notes: The percentage is computed with respect to the total amount of candidates (616).

Looking at the geographical origin of candidates, almost half are Italian natives, with one out of six candidates from the local region (Trentino-Alto Adige, see Table 4). It is interesting that a large number of applications came from foreign researchers, and that the share of these applications increased over the years, especially for those candidates applying from outside Europe. This confirms an increasing attractiveness of FBK to foreign researchers.

When we consider candidates' bibliometric measures, we notice large differences across fields of research, due to different publication propensities in different sectors of research. In order to compare candidates from different

Table 4: Geographical origin of candidates

Origin	2009	2010	2011	2009-2011
Trentino- Alto Adige	14.53	21.05	10.53	16.23
Rest of Italy	45.81	25.56	26.90	31.82
EU and Switzerland	13.97	17.29	14.62	15.58
Rest of the world	25.70	36.09	47.95	36.36
Total	100	100	100	100

Table 5: Candidates' h-indexes across macro fields of research

Field	Mean	Std. Dev.	Min.	Max.	Obs.
Field 1	.116	.448	0	2	43
Field 2	2.507	4.057	0	39	227
Field 3	.812	2.440	0	32	346

Notes: Field 1 includes social sciences within engineering fields; Field 2 math, physics and chemistry; Field 3 environmental sciences, engineering and computer sciences.

fields, we standardise the number of publications, as well as the value of candidates' h-index, according to 3 macro fields of research, more uniform in terms of bibliometric patterns: social sciences within engineering fields; math, physics and chemistry; environmental sciences, engineering and computer sciences.[17] Table 5 reports the average candidates' h-indexes across these macro fields of work, as well as the number of observations in each case.

Table 6 reports information about members of the selection committee; among them, 26% were female, but if female HR members are excluded, the percentage of female commissioners decreases to 8.6%. Women accounted for the 74% of the total HR personnel at FBK.

Commission members were mainly Italian: only 30% were not Italian, and among female commissioners only 5% were non-Italian. The average age of commissioners was 45 years, with an h-index of 15. Commissioners' h-index was standardized following the same procedure as for candidates' h-index.[18]

If we look more closely at the gender composition of commissions, only 16% of the commissions included a female researcher. Thus, all-male researchers commissions were dominant, they reached 92% in 2009 but the percentage was lower in the subsequent years, about 78-82%. Furthermore, the percentage of female researchers in commissions varies little, as generally only one member was female. The very high percentage of all-male commissions makes discrimination against female applicants a possibility if commissioners tend to have same-sex preferences regarding candidates. This will be further examined in the econometric analysis.

Table 7 depicts a series of descriptive statistics of successful and unsuccessful candidates, over the years under

[17] The field of research was indicated by each candidate on the CV sent to FBK at the time of the application.

[18] Unlike for candidates, who had to indicate their field of research in the CV, commissioners' field was retrieved from Scopus, as the principal sector of their publications appearing on the Elsevier database.

Table 6: Descriptive statistics - Commission members

Evaluators					
	Mean	Std. Dev.	Min	Max	Observations
Female commissioner	0.263	0.440	0	1	2058
Female commissioner (no HR)	0.086	0.280	0	1	1626
Origin	0.296	0.456	0	1	2058
Females	0.042	0.201	0	1	542
Males	0.387	0.487	0	1	1516
Age commissioner	45.267	11.385	25	71	1940
Females	40.094	9.606	27	58	542
Males	47.273	11.391	25	71	1398
Human Resources	0.210	0.407	0	1	2051
Females	0.741	0.438	0	1	542
Males	0.019	0.139	0	1	1509
H-index commissioner	15.071	11.698	0	47	1626
Females	4.821	4.445	0	19	140
Males	16.037	11.707	0	47	1486

analysis. The percentage of successful candidates among male and female applicants seems gender neutral in 2009, but then the observed fractions diverge in the other years. The fraction of successful female candidates over the whole set of candidates is quite constant over the years at about 20%.

Finally, Table 8 indicates that the disparity between men and women is greatest at high level research positions. No women applied for any level I position, while their share in applications and recruitment increases as the level of the position decreases. For instance, men and women are almost equally represented at the T4 level (which corresponds to the position of research assistants and technologists).

5 Empirical analysis

In this section we analyse whether women applying at FBK are discriminated in the selection process. We analyse the factors influencing the selection process, obviously including the gender of the applicant and the gender composition of the commission. The descriptive overview showed that women are in the minority both at the application and the recruitment stages. Is it possible that one of the reasons for this is the under-representation of women in the selecting committees?

We first conduct an analysis on the whole sample of candidates at FBK, and we proceed to examine hiring patterns on sub-samples of applicants, obtained by stratifying on relevant characteristics of the hiring process. We then investigate the relationship between gender, origin and pre-existing ties.

Table 7: Applicants by final outcome and year

Year		Unsuccessful	Successful	Total
2009	Female share	0.22	0.19	0.22
	Age	30.86	29.32	30.60
	Publications	9.84	6.55	9.27
	H-index	1.70	1.61	1.69
	Work experience	4.49	3.81	4.37
2010	Female share	0.18	0.33	0.20
	Age	29.85	30.24	29.89
	Publications	4.50	9.12	5.08
	H-index	1.28	1.91	1.36
	Work experience	4.14	5.12	4.26
2011	Female share	0.19	0.09	0.18
	Age	32.18	29.73	31.87
	Publications	3.78	5.09	3.95
	H-index	1.05	1.59	1.12
	Work experience	5.71	3.80	5.46

Table 8: Gender distribution of unsuccessful and successful applicants at different research levels

	Unsuccessful		**Successful**	
Position	Males	Females	Males	Females
R1	100.00	0.00	100.00	0.00
R3	80.39	19.61	64.29	35.71
R4	82.57	17.43	80.00	20.00
T4	52.63	47.37	66.67	33.33
post-doc	92.31	7.69	50.00	50.00
co.co.pro.	80.97	19.03	82.35	17.65
Total	80.75	19.25	77.91	22.09

5.1 Analysis on the full sample

To examine the effects of the gender composition of the commission on the probability of being hired we estimate Equation 1 by a conditional logit model:

$$Success_{ij} = \beta_0 + \beta_1 Female_{ij} + \beta_2 Female_{ij} * Female\ in\ commission_j + \beta_3 X_{ij} + \mu_j + \varepsilon_{ij} \quad (1)$$

where $Success_{ij}$ is a dummy variable taking value 1 if candidate i won the selection for call j and value 0 otherwise. We control for the gender of the candidate, $Female_{ij}$, and for the interaction between the gender of the candidate and a dummy variable indicating the existence of at least one woman in the commission, $Female_{ij} *$ Female in commission$_j$.[19] Thus, β_1 indicates the effect of being female on the probability of being selected by a all-male selecting committee, whereas β_1 + β_2 the effect of being female on the probability of being selected

[19]Given the low variability of the share of women among commissioners, we decided to opt for this specification in order to study the effect of the gender composition of the commission.

Table 9: Probability of success - Conditional logit

	1	2	3	4	5
Female	-0.033	-0.415	-0.371	-0.369	-0.404
	(0.309)	(0.379)	(0.383)	(0.406)	(0.432)
Female*Dummy fem. in Comm.		1.587**	1.545**	1.422*	1.101
		(0.760)	(0.763)	(0.798)	(0.817)
H-index standardized			0.221**	0.181	0.129
			(0.103)	(0.114)	(0.124)
Age squared				-0.002***	-0.002***
				(0.001)	(0.001)
Italian origins				1.052***	1.074***
				(0.339)	(0.352)
Ph.D.				0.790**	0.683*
				(0.384)	(0.413)
Work experience				0.090**	0.099**
				(0.045)	(0.047)
Ties with FBK					1.457***
					(0.351)
Pseudo R^2	0.000	0.016	0.030	0.104	0.164
Observations	614	614	614	614	614

Notes: The Table reports conditional logit coefficients, computed at the call level. The dependent variable is a dummy variable for being recruited. Standard errors are reported in parenthesis. Symbols *, ** and *** indicate that coefficients are statistically significant at 10%, 5% and 1% levels, respectively.

by a mixed-gender commission. X_{ij} is a vector of candidates' attributes, such as the Scopus h-index at the year of the competition, age and origin, a dummy for holding a Ph.D., years of work experience and the presence of pre-existing ties with FBK. Call fixed effects are captured by μ_j, which includes both the type of position and the area of specialization, as well as other factors that may influence candidates' probability of success.

Besides estimating Equation 1 by a conditional logit model, we also estimate a linear probability model as a robustness check. The conditional logit allows us to take into account candidates' inter-dependent probabilities of being recruited. The likelihood of the data in a conditional logit depends on the conditional probabilities, conditional on the number of positive outcomes (in our case the success) within group. For almost all calls in our data set only one candidate was selected per call and hence the group at the basis of the conditional logit is composed of those candidates applying for the same call. In other words, the conditional logit fits a logistic model that explains why one candidate had a positive outcome in a certain group, conditional on one of the candidates in the group having a positive outcome. Hence, the differences across candidates are considered at the call level. Estimates for the conditional logit are displayed in Table 9 and refer to coefficients.

In the first specification reported in Table 9, column 1, we are interested in knowing whether there is overall a lower probability of female candidates to be recruited. Our results reject this hypothesis. Examining the effect of the gender composition of the commission in column 2, it turns out that commissions with a female evaluator tend

to favour female candidates. This holds true also if we include a measure of candidates' scientific productivity, the standardized h-index, as in column 3. Being more productive in bibliometric terms has a positive impact on the probability of being appointed for the job. Other individual variables statistically significantly influence the chances of success, as reported in column 4 of Table 9: age has a negative impact, whereas Italian origin and holding a Ph.D. positively influence the probability of being recruited, as so does an additional year of work experience. Yet, by incorporating these variables the positive effect of the h-index becomes statistically insignificant.

If the estimation encompasses the dummy variable representing pre-existing ties, as in column 5, the interaction term between candidates' gender and the gender composition of the commission loses significance, while pre-existing ties bears a positive and highly significant coefficient. Therefore, it might be that the interaction term in the previous specifications of the model hides connections between female commissioners and female candidates. Moreover, all individual variables are significant, except for the productivity measure of candidates as captured by the h-index. This reveals the importance of prior ties, possibly at the expense of purely meritocratic patterns of selection, based on research output. Results of the final conditional logit model are confirmed both in significance and in signs when we change estimator, as we do with the estimates of Table 10. Linear probability models do not change substantially the results, thus providing a robustness check. It is important to note that in both final specifications the probability of selection is not statistically significantly different for female and male candidates and the presence of a female member in the selecting committee is also not statistically significant. This means that a female quota in selecting committees seems unlikely to have an impact, if we consider the whole data set.

5.2 Analysis on sub-samples of candidates

In this section we analyze if a gender gap in hiring patterns arises in sub-samples obtained by splitting the original data set according to relevant variables. All results displayed in Table 11 are from a conditional logit model. The model is the same as the full model specification of Table 9, column 5. First, we are interested in distinguishing commissions in terms of a bibliometric measure, as a proxy for the quality of the commission. To this end, we compute the average h-index of all selecting committees and divide the full sample of candidates in two sub-samples: those evaluated by commissions in the top fourth quartile of the h-index distribution and those in the three lower quartiles. Estimations performed on these two sub-samples are shown in columns 1 and 2 of Table 11.

The fourth quartile of commissioners in terms of research quality seems to be more responsive to candidates' research production, as highlighted by the positive and significant (at the 10% significance level) coefficient for the standardized h-index. Also Italian origin increases the probability of recruitment and so do more years of work experience, *ceteris paribus*. For candidates evaluated by the three lower quartiles in terms of h-index, the criteria that matter most for being recruited are being younger, having Italian origin and pre-existing ties with FBK. The

Table 10: Probability of success - Linear Probability Model

	1	2	3	4	5
Female	-0.004	-0.054	-0.046	-0.045	-0.036
	(0.043)	(0.048)	(0.048)	(0.047)	(0.046)
Female*(Dummy fem. in Com.)		0.205**	0.199**	0.173*	0.139
		(0.090)	(0.089)	(0.090)	(0.094)
H-index standardized			0.032	0.021	0.014
			(0.019)	(0.018)	(0.018)
Age squared				-0.002***	-0.001***
				(0.000)	(0.000)
Italian origins				0.115***	0.112**
				(0.042)	(0.043)
Ph.D.				0.114**	0.091**
				(0.044)	(0.044)
Work experience				0.009**	0.011**
				(0.005)	(0.005)
Ties with FBK					0.283***
					(0.082)
Call FE	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.005	0.013	0.019	0.051	0.109
Observations	616	616	616	616	616

Notes: The Table reports OLS estimates. The dependent variable is a dummy variable for being recruited. We control for call fixed effects. Standard errors, clustered at the call level, are reported in parenthesis. Symbols *, ** and *** indicate that coefficients are statistically significant at 10%, 5% and 1% levels respectively.

same estimation has been performed on two sub-samples divided in above or below the median of commission's h-index. No relevant differences between the two sub-samples are found in this case, meaning that a different hiring pattern emerges only for top quality selecting committees.

Next, we examine whether different characteristics are statistically significant if we consider separately lower and upper research positions at FBK.[20] As we pointed out in the introduction, what distinguishes our study from previous studies is the availability of data for entry research jobs: indeed, 417 out of 616 applications are for lower level research jobs, whereas only 197 are for upper research positions (columns 3 and 4 of Table 11). Females applying for lower level jobs have, *ceteris paribus*, a lower probability of being hired, although this is reverted if the commission includes a female researcher. Being younger, having more years of work experience and being Italian native positively influence the probability of selection, and so does having a higher h-index. Still, pre-existing ties with FBK play an important role in being recruited. If we look at the recruitment for upper levels of research positions, there is no evidence of observables affecting the probability of recruitment but nationality and having prior ties. This means that recruiting at higher levels follows different logics: being local seems to matter more than publishing good articles.

[20]Due to the scarce numerosity of candidates applying for level I and level II positions, we split the sample in two groups with respect to the hierarchy of research positions present in the sample. To this end, T4 candidates, although belonging to the same level as R4 positions, were included in the lower group, given the less research-oriented nature of their contracts.

Table 11: Probability of success according to various sample splits - Conditional logit

	1	2	3	4	5	6
	H-index commission:		**Position:**		**Discipline:**	
	4^{th} quartile	1^{st}- 3^{rd} quartiles	lower	upper	lower h	higher h
Female	-0.059	-0.359	-1.425**	0.637	-0.207	0.468
	(1.221)	(0.465)	(0.699)	(0.610)	(0.548)	(1.006)
Female*	15.444	0.814	2.000*	0.720	-0.504	15.592
*(fem. in Com.)	(1508.159)	(0.863)	(1.062)	(1.570)	(1.255)	(2216.181)
H-index stand.	0.321*	0.020	0.499***	-0.098	0.029	0.885***
	(0.183)	(0.257)	(0.186)	(0.239)	(0.153)	(0.332)
Age squared	-0.002	-0.002**	-0.002**	-0.001	-0.001	-0.009***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)
Italian origins	1.947**	0.890**	0.931**	1.578**	1.166***	1.555**
	(0.850)	(0.392)	(0.430)	(0.680)	(0.436)	(0.786)
Ph.D.	0.318	0.737	0.679	0.647	0.469	0.889
	(1.284)	(0.452)	(0.586)	(0.618)	(0.533)	(1.023)
Work experience	0.308**	0.081	0.141***	0.014	0.077	0.273*
	(0.153)	(0.052)	(0.055)	(0.102)	(0.056)	(0.148)
Ties with FBK	-0.447	1.590***	1.645***	1.790***	1.710***	2.806**
	(1.706)	(0.370)	(0.499)	(0.552)	(0.430)	(1.160)
Pseudo R^2	0.238	0.176	0.200	0.239	0.166	0.410
Observations	168	446	417	197	340	190

Notes: The Table reports conditional logit coefficients, computed at the competition level. The dependent variable is a dummy variable for being successful. Standard errors are reported in parenthesis. In models 1 and 2 observations are divided according to the average h-index of commissioners, whether belonging to the first three quartiles of the h-index of the commissions or to the fourth quartile; in models 3 and 4 the distinction is made according to the level of the post advertised in the competition: lower refers to co.co.pro., post-doc and T4 levels, whereas upper stands for R1, R3 and R4 types of positions; in models 5 and 6 observations are divided in two sub-samples according to the average h-index of the discipline involved by the competition: model 5 includes fields 1 and 3, whereas model 6 refers to field 2. Symbols *, ** and *** indicate that coefficients are statistically significant at 10%, 5% and 1% levels, respectively.

Finally, we divide candidates according to the h-index of the field of research. For this purpose we take the fields of research of Table 5. We group fields 1 and 3, which represent social sciences, engineering, computer sciences and environmental sciences, which are characterized by a lower h-index, separately from field 2, which corresponds to math, physics and chemistry. Looking at columns 5 and 6 of Table 11 we note that in both sub-samples being selected depends on being born in Italy and having pre-existing ties with the institution. For field 2, age and the h-index are statistically significant, which is not the case for the other fields. In both sub-samples, no indication of discrimination against female candidates and no effect of a female researcher in the commission can be found.

5.3 Gender, origin and prior ties

In the previous sections it emerged that in almost any model specification and sample split, the most important factors affecting the probability of recruitment are Italian origin and pre-existing ties with FBK. In half of the sub-samples, the probability of being recruited decreases with age and increases with work experience. Interestingly, in half of sub-samples of Table 11, scientific productivity is not statistically significant, while holding a Ph.D. does not statistically increase the chances of selection.

Table 12: Gender composition of successful and unsuccessful candidates, with and without connections with FBK

	Females	%	Males	%
Overall				
Ties	15	(12.4%)	52	(10.51%)
No ties	106	(87.6%)	443	(89.49%)
Successful				
Ties	6	(31.58%)	22	(32.84%)
No ties	13	(68.42%)	45	(67.16%)
Unsuccessful				
Ties	9	(8.82%)	30	(7.01%)
No ties	93	(91.18%)	398	(92.99%)

We find clear indications that pre-existing ties with FBK increase the probability of recruitment. This represents an alternative channel through which a gendered selection may take place, since prior ties precede the actual selection process. Therefore, we explore in more detail whether pre-existing ties are gender specific. The decomposition of prior ties with FBK across candidates' gender, however, shows that connections seem to be gender neutral. Table 12 reports the percentage of candidates with and without prior ties: overall, 12.4% of female applicants have previous ties with FBK, and the percentage for males stands at 10.51%.[21] If we look at successful and unsuccessful applicants separately, again, we do not find any statistically significant differences across genders.

We also examine the correlation between pre-existing ties with FBK and the region of origin of candidates. It does not come as a surprise that the proportion of candidates born in Trentino- Alto Adige or in the rest of Italy have a higher probability of prior ties with FBK, as portrayed in Table 13.

We now examine the impact of different types of ties with FBK on the probability of being recruited. We do this in two ways: first, we estimate the conditional logit model (5) of Table 9 by replacing the variable "Ties with FBK" with the four variables representing the different types of ties with FBK. Second, we estimate the same model by replacing two dummy variables indicating ties with commissioners or with the institution, in order to examine which dimension prevails. Results are reported in Tables 14 and 15, respectively. The analyses are performed on the full sample of candidates, since estimating the model on the sub-samples of candidates as in Table 11 entails

[21] Differences in proportions are not statistically significant; two-group test of proportions: z = -0. 599, p = 0.549.

Table 13: Pre-existing ties with FBK by country of origin

Origin	No ties	Ties	Total
Trentino- Alto Adige	76	24	100
Rest of Italy	90.8	9.2	100
EU and Switzerland	97.9	2.1	100
Rest of world	89.7	10.3	100
Total	89.1	10.1	100

huge standard errors. This is due to the low frequencies of the different types of ties in each sub-sample considered. Linear probability model estimations on the full data set in both cases did not provide significant differences.

The estimation including the four different types of ties sheds light on the significant positive effect of two types of ties on the chances of being recruited. More specifically, we find that having one's own supervisor among the commissioners and currently working at FBK are important drivers in the recruiting process, with the former type of tie having a stronger effect. However, when we consider ties distinguishing them into ties with the commission or with the institution, we can see that both dimensions are significant, with the coefficient of the dummy variable commission being slightly higher.

Finally, in the model of Table 16 we aimed at testing whether having incremental types of ties with FBK increases the chances of being recruited, treating equally the different ties. The coefficient of the tie indicator variable shows that having an additional tie with FBK significantly increases the chances of being hired, irrespective of the type of tie.

Having identified in pre-existing ties an important determinant of candidates' success at FBK, we conduct a post-competition analysis on those candidates who won a competition, splitting them into two groups: applicants with pre-existing ties and without pre-existing ties with the institution. The rationale for this is to investigate the role of ties in the ex-post candidates' research productivity, since hiring through networks can carry two opposite effects: the negative effect of an evaluation bias driven by acquaintances, and the positive effect of reducing information asymmetries regarding candidates' quality and research potential. It could hence be the case that the connections mechanism present at FBK competitions might contribute to hiring the most productive individuals and hence to making the selection more efficient.

We limit the analysis to the sub-sample of successful candidates, consisting of 86 observations, and we compare the number of publications in the two years following the competition between those individuals with prior ties and those without prior ties.[22] Table 17 shows that the h-index and number of publications of successful candidates with prior ties is on average higher than for successful candidates without prior ties. If we perform a Wilcoxon

[22] In this case we opted for a comparison of the number of publications rather than of h-indexes, since for a period of only two years gathering citations for the articles published in this very short time lapse is extremely rare and variability in the data would not be sufficient.

Table 14: Probability of success - Conditional logit with four types of ties

Female	-0.284
	(0.425)
Female*(Dummy fem. in Com.)	0.989
	(0.830)
H-index standardized	0.143
	(0.129)
Age squared	-0.002***
	(0.001)
Italian origins	0.913**
	(0.356)
Ph.D.	0.636
	(0.417)
Work experience	0.096**
	(0.047)
Co-author	0.672
	(1.024)
Supervisor	2.562**
	(1.002)
Prior work	0.738
	(0.480)
Current work	1.292**
	(0.566)
Pseudo R^2	0.180
Observations	614

Notes: Symbols *, ** and *** indicate that coefficients are statistically significant at 10%, 5% and 1% levels, respectively.

Table 15: Probability of success - Conditional logit with Commission and Institution ties

Female	-0.335
	(0.432)
Female*(Dummy fem. in Com.)	0.945
	(0.832)
H-index standardized	0.109
	(0.131)
Age squared	-0.002**
	(0.001)
Italian origins	1.015***
	(0.356)
Ph.D.	0.695*
	(0.414)
Work experience	0.096**
	(0.047)
Commission	1.815***
	(0.701)
Institution	1.225***
	(0.381)
Pseudo R^2	0.170
Observations	614

Notes: Symbols *, ** and *** indicate that coefficients are statistically significant at 10%, 5% and 1% levels, respectively.

Table 16: Probability of success - Conditional logit with tie indicator

Female	-0.341
	(0.424)
Female*(Dummy fem. in Com.)	0.990
	(0.824)
H-index standardized	0.128
	(0.124)
Age squared	-0.002***
	(0.001)
Italian origins	0.972***
	(0.353)
Ph.D.	0.669
	(0.416)
Work experience	0.100**
	(0.047)
Tie indicator	1.120***
	(0.287)
Pseudo R^2	0.170
Observations	614

Notes: Symbols *, ** and *** indicate that coefficients are statistically significant at 10%, 5% and 1% levels, respectively.

rank-sum test on the number of publications the difference is statistically significant at the 10% level (z= -1.667, p= 0.0954), although it is not for the standardized number of publications (z= -1.574, p= 0.1156).

Table 17: Post-competition productivity of successful candidates

	Ties	No Ties
Average N. of publications	4.78	3.29
Average N. of publications (std)	0.38	0.13

Notes: Data refer to the two years following the year of the competition and are retrieved from Scopus. The standardization occurs at the field level, as of Table 5.

There is hence some evidence of a positive informational effect of ties, suggesting that networks may help to select more productive candidates in terms of scientific publications.

When we decompose the post-competition productivity of successful candidates across the different types of ties, as in Table 18, we see that candidates with a co-author in the commission are on average more productive than candidates with other ties. Performing Wilcoxon rank-sum tests on all the average number of publications of the different tie variables, we find that only the co-author dummy is significant, both in levels and in standardized values (z = -2.131, p = 0.0331; z = -1.998, p = 0.0457). This means that the post-competition productivity of successful candidates who had a co-author in the commission is higher than the post-competition productivity of successful candidates who did not have a co-author among the commissioners.

This may suggest that commissioners who probably work at FBK and who are co-authors with successful candidates exert a positive effect on the propensity of publication of candidates. By replicating this analysis on the Commission and Institution dummy variables for ties, we find that only the post-competition productivity of candidates with a commission tie is significantly higher than the post-competition productivity of candidates without a tie in the commission, both in levels and in standardized values (Wilcoxon rank-sum test, z = -2.215, p = 0.0267; z = -2.002, p = 0.0453). Therefore, it emerges that having networks with commissioners is positively correlated with the post-competition propensity of publication, especially when the tie is represented by a co-authorship.

6 Discussion and conclusion

Gender disparities in some professional fields are a highly-debated issue. Several policy solutions have been proposed to reduce gender disparities, such as gender quotas for employees and, lately, gender quotas in selecting committees for research positions. The latter is motivated by possibly gender-biased preferences towards same-sex candidates in selecting committees, which are generally male-dominated.

In this paper we analyse whether female commissioners foster the hiring of female candidates. The analysis

Table 18: Post-competition productivity of successful candidates across ties

	Average N. of publications	Average N. of publications (std)
Co-author	9	0.997
Supervisor	7.3	0.765
Prior work	5.63	0.539
Current work	6.08	0.680
Commission		
Yes	6.8	0.629
No	3.38	0.156
Institution		
Yes	5	0.442
No	3.36	0.132

Notes: Data refer to the two years following the year of the competition and are retrieved from Scopus. The standardization occurs at the field level, as of Table 5.

uses data from recruitments at FBK, an Italian research centre mainly operating in hard science, a typically male-dominated field. Based on data on recruitment processes occurred between 2009 and 2011, we investigate the main determinants in the selection process, focussing on whether the gender composition of the selecting committees influences the selection of candidates in terms of gender. Our data set allows us to analyse factors influencing recruitment at the start of a research career, for our sample includes many entry level positions (post-docs, temporary jobs and research fellowships).

We also make use of bibliometric data retrieved from Scopus, a reliable source of information on publications and citations. We find that the most important determinants for successful applications are Italian origin of the candidate and prior ties with FBK. Ties play a major role if a commissioner member is the Ph.D./Master thesis supervisor of the candidate or if the candidate is currently working at FBK. The absence of evidence of discrimination on the whole data set is in contrast to previous research. Previous studies found either same-sex preferences (De Paola and Scoppa, 2011), opposite-sex preferences (Bagues et al., 2014) or mixed preferences depending on the level of the position (Zinovyeva and Bagues, 2011).

Candidates' h-index increases the probability of being recruited more when commission members themselves have a higher h-index. In such a case the effect of prior ties vanishes when candidates are evaluated by commissions in the fourth quartile of the distribution of commissions' h-index. On the contrary, we find that for commissions with lower h-index, prior ties with FBK are the most important factor for recruitment.

Interestingly, for entry level research positions we find that female candidates are discriminated against by all-male commissions, even after controlling for their research productivity and education, as well as for socio-demographic variables and prior ties with the institution. But this disadvantage is more than compensated by the presence of a female researcher in the selection committee, thus lending support to a potential benefit of gender quotas at lower research levels. The same does not hold true for top research positions, for which ties

with FBK and Italian origin are the main drivers for selection. Overall we do not find overwhelming evidence of gender discrimination in hiring, except possibly for lower research positions. However, looking at the internal organizational chart of FBK, women share declines with the hierarchy rank, as in most organizations. The real challenge is thus to understand how to promote female researchers at top positions.

From our analysis, it is evident that prior ties with the research centre play a major role in the recruitment decisions. For this reason we investigated more thoroughly the effect of pre-existing ties and we found that winners with prior ties with FBK obtain significantly more publications in the two years following the competition. This implies that there might be a possible positive role for prior ties in reducing the information gap between candidates and the selecting committees about candidates' research quality, confirming a result found by Bagues and Zinovyeva (2012).[23] They explain this result suggesting that with strong ties the selection bias driven by acquaintance would be too prevalent, while with no pre-existing ties there would be no informational advantage about applicants' potential.

Further research should be carried out on promotion mechanisms operating at FBK: it would probably be possible to isolate in a more explicit way contingent discrimination dynamics and the role of the gender composition of promoting commissions because prior ties should lose their importance.

[23] They posit the existence of an optimal distance in terms of pre-existing ties between evaluators and candidates in their analysis on academic promotions to Associate and Full Professorships in Spain. Being selected through weak ties with commissioners enhances ex-post research productivity, whereas being promoted with strong ties or without ties hinders candidates' research outcome.Strong connections are those with a Ph.D. thesis advisor or with a coauthor, while weak ties are identified in same university colleagues and to a lesser extent in Ph.D. thesis defense members.

A List of variables

Table 19: List of variables

Variable	Description
Female	Dummy variable assuming value 1 if the candidate is female and value 0 otherwise
Success	Dummy variable assuming value 1 if the candidate is recruited and value 0 otherwise
Dummy fem. in Comm.	Dummy female in commission: dummy variable assuming value 1 if the candidate is evaluated by a commission in which there is at least one female researcher (no HR) and value 0 otherwise
H-index standardized	Candidate's h-index at the year of the call, standardized by her macro field of research as indicated in Table 5
Age	Candidate's age in years
Age squared	Candidate's age squared
Italian origins	Dummy variable assuming value 1 if the candidate has an Italian nationality and value 0 otherwise
Ph.D.	Dummy variable assuming value 1 if the candidate has earned a Ph.D. and value 0 otherwise
Work experience	Candidate's work experience in years, excluding years exclusively devoted to Ph.D.
Ties with FBK	Dummy variable assuming value 1 if the candidate complies with at least one of the following criteria, and value 0 otherwise: 1) a co-author with a member of the selecting committee; 2) supervision at the master or Ph.D. level by one of the commission members; 3) prior work experience (including internship) at FBK; 4) current work experience (including internship) at FBK
Commission	Dummy variable assuming value 1 if the candidate has ties with FBK of type 1) or 2) and value 0 otherwise
Institution	Dummy variable assuming value 1 if the candidate has ties with FBK of type 3) or 4) and value 0 otherwise
Tie indicator	Variable assuming value 0 if the candidate has no ties with FBK, value 1 if she has one type of tie with FBK, value 2 if she has two types of ties with FBK, value 3 in case of three types of ties and value 4 in case of four different types of ties with FBK
Upper positions	R1, R3, R4 positions
Lower positions	T4, post-doc, co.co.pro. positions
Lower h	Competitions in social sciences within engineering fields, environmental sciences, engineering and computer sciences (fields characterized by lower h-indexes)
Higher h	Competitions in math, physics and chemistry (fields characterized by higher h-indexes)
Female commissioner	Dummy variable assuming value 1 if the commissioner is female and value 0 otherwise

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Table 19 – *Continued from previous page*

Variable	Description
Female commissioner (no HR)	Dummy variable assuming value 1 if the commissioner is a female researcher, not from the HR division, and value 0 otherwise
Origin commissioner	Dummy variable assuming value 1 if the commissioner comes from outside Italy and value 0 otherwise
Age commissioner	Commissioner's age in years
Human resources	Dummy variable assuming value 1 if the commissioner is from the HR division and value 0 otherwise
H-index commissioner	Commissioner's h-index at the year of the call
Monthly wage	Monthly wage of the posted positions expresses in Euros
Contract length	Contract length of the posted positions expressed in months

B Descriptive statistics of different research levels

Table 20 aims to shed light on some descriptive statistics of the various research levels at FBK.

Table 20: Descriptive statistics of different research levels

	Mean	Std. Dev.	Min	Max
Monthly wage	2687	905.228	750	7234
R1	7234	0	7234	7234
R3	3113	124.320	2667	3156
R4	2842	124.221	2750	3150
T4	2750	0	2750	2750
post-doc	3156	0	3156	3156
co.co.pro.	2394	815.445	750	4388
Applicant's age	30.65	5.774	19	60
R1	42.88	9.978	25	52
R3	32.94	5.431	26	55
R4	30.65	5.295	24	56
T4	26.59	5.378	20	37
post-doc	32.33	3.244	26	37
co.co.pro.	30.17	5.539	19	60
Contract length	21.46	11.010	3	44
R1	36	0	36	36
R3	29.63	9.117	12	42
R4	25.58	9.411	8	36
T4	8.36	1.177	8	12
post-doc	30.4	6.197	24	36
co.co.pro.	18.83	10.503	3	44

Notes: The monthly wage is specified in €, applicant's age in years and contract length in months of the posted job.

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