Candidates' Gender and the Glass Ceiling in Academia

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Abstract

There is vast evidence that the gender composition of selection committees influences the hiring and promotion of males and females differently. However, much less is known about the role of the gender composition of the candidates' pool. We investigate how the gender composition of the pool of internal candidates affects the decisions to promote male and female internal candidates and hire external male and female candidates for top positions. We focus on transitions of associate professors to full professors in Italian academia. For identification, we exploit that a centralized qualification process, exogenous to departmental gender preferences, partly determines the pool of internal candidates. We find that female professors' promotion probabilities and the hiring of external male candidates increase with the proportion of female internal candidates.

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1 Introduction

Women are underrepresented in top academic positions around the world. In Europe, women represent 47 percent of assistant professors, 40 percent of associate professors, and only 26 percent of full professors (European Commission [2021]). According to the American Association of University Professors, women accounted for 50 percent of assistant professors and 45 percent of associate professors but only 33 percent of full professors in the US in 2020. These figures indicate that women in academia face a "glass ceiling". Previous literature has shown that the gender composition of selection committees affects the probability that males and females achieve top-ranked positions differently (Bagues and Esteve-Volart [2010], Abramo, D'Angelo, and Rosati [2015], and Deschamps [2023]). However, much less is known regarding the role of the gender composition of the internal candidates' pool in the hiring and promotions of males and females. We study how the probability of promotion to full professorship of female and male associate professors is affected by the gender composition of the pool of internal candidates for full professorship in the department.

Theoretically, the gender composition of the pool of candidates can affect males' and females' promotion probabilities differently. As the quality of assistant professors is partly unobserved, promotions are discretionary, and selection committees may have gender preferences that influence their promotion decisions. However, the latter is illegal and socially penalized. Hence, if the proportion of women in top positions is too different from that of women in non-top positions (or too far from half), selection committees become suspicious of gender discrimination. As a result, decision committees may decide to promote more women (fewer men) when the proportion of female candidates is higher.

In this paper, we focus on the labor market of university professors. Beyond its direct interest to professors, this labor market is well suited to studying possible gender differences in promotion because the hierarchy is well defined and the professional path is unique (from assistant professor to associate professor and then to full professor). As

a result, the pool of internal candidates for full professorship equals the set of associate professors. Moreover, the pool of decision makers for promotions from associate to full professor is well defined as the set of full professors. Another advantage of the academic labor market is that we can measure on-the-job productivity using research output and departments can be ranked within the profession (McDowell, Singell Jr, and Ziliak [1999]).

The Italian academia relies on a centralized qualification system that causes exogenous variation in the pool of candidates. In particular, a centralized qualification system restricts the pool of eligible candidates to full professorship in a given department to those associate professors with the qualification for full professorship. Qualification committees are academic sector-specific and randomly selected from a pool of qualified volunteering full professors[1]. Therefore, the difficulty of obtaining the qualification changes over time for a given academic sector. We use this exogenous variation to identify the causal impact of the gender composition of the pool of associate professors on the probability of hiring a male or female external candidate and on the promotions of males and females to full professorship.

We study the probability of being promoted from associate to full professor for males and females separately. We model these probabilities as a function of the ratio of female associate professors, the total number of associate professors in logs, academic discipline dummies, year indicators, and department dummies. As the gender ratio of associate professors is endogenous to departments' gender preferences, we use an instrumental variable strategy: we predict the number of female and male associate professors using the average qualification rates of the national qualification system for each academic discipline and construct instruments for the female ratio of eligible-for-promotion associate professors and the total number of eligible-for-promotion associate professors.

We use panel data on the universe of Italian professors from the Italian Ministry of Ed-

[1] Bagues, Sylos-Labini, and Zinovyeva [2017] found that the gender of the selection committee does not affect the qualification probability of females and males differently.

ucation, including the professors' full name, position, gender, academic discipline, university, and department[2]. The data is available yearly since 2000. We use data from 2013, when the national qualification started to apply. We merge this information with data on the results from the national qualification[3]. For a subsample of professors, we also obtain data on research productivity from Google Scholar. For a subsample of departments, there is information on their quality according to the evaluations of the Italian Ministry of Education.

We find a positive but imprecise effect of the share of female associate professors on the likelihood of hiring external candidates. Moving to promotions, we show that a 10 percentage points increase in the share of female colleagues among associate professors increases the probability that a female associate professor becomes full by 0.02 points. As the average proportion of female colleagues among associate professors is 40%, we conclude that increasing this proportion from 40% to 50% would increase the probability that a female associate professor is promoted in a given year from its current average of 0.10 to 0.12. For the subsample of professors with information on research productivity from Google Scholar, the estimated effect stays invariant at 0.02 and remains unchanged when we include research output among the controls. The estimated effects are stronger for high-quality departments, according to the Italian Ministry of Education. Finally, we also find that the female ratio's positive effect on women's promotion probabilities is exacerbated when the proportion of females among full professors in the department is high.

We conclude that a model in which society and institutions are uncertain about the quality of candidates and penalize the influence of gender preferences in departments' promotion and hiring decisions can apply to promotions in Italian academia. We find that the share of female candidates for promotion to full professorship positively influences the probability that female candidates get promoted, while it does not influence male candidates. Moreover, this effect cannot be explained fully by differences in re-

[2]The data is publicly downloadable from https://cercauniversita.mur.gov.it/php5/docenti/cerca.php
[3]The data is publicly available at https://abilitazione.mur.gov.it/public/index.php

search productivity. We also find that the effect is exacerbated when the share of female full professors in the same academic discipline and university is high.

The remainder of this paper is organized as follows. In Section 3, we describe the Italian Academia. We provide details on our data in Section 4. In Section 5, we explain the empirical strategy. We discuss the results of our estimations and the possible mechanisms behind our findings in Section 6. Finally, section 7 concludes. The Appendices include the classification of academic disciplines and academic sectors.

2 Literature

The career trajectories within academia and the associated gender gap have garnered significant attention over time in economic literature. Gender inequalities are observed at various stages of the academic career, beginning with decisions to leave academia after obtaining a Ph.D., and persisting through to advancements to the highest ranks of the professorial career. The literature offers several potential explanations for this phenomenon. According to the pipeline theory, it's largely a matter of time before women progress through a metaphorical pipeline to attain high-level positions. Indeed, the increased enrollment in Ph.D. programs will eventually translate into a higher representation of women in the later stages of their academic careers. This pattern has been, for example, observed for math-intensive fields of study in U.S. academia (Ceci, Ginther, Kahn, and Williams [2014]). However, in many countries and disciplines, the share of women among faculty members remains low even after decades of improved recruitment of women at the undergraduate and doctoral levels (Ginther and Kahn [2004], Ginther and Kahn [2009], Ceci et al. [2014]; Lundberg and Stearns [2019]).

What are the factors potentially explaining such a leaking pipeline? Labor market factors may play a significant role. Kulis, Sicotte, and Collins [2002] investigated the potential influence of various factors in the U.S., including economic cycles affecting both academic and non-academic job opportunities, increased competition resulting from the influx of scholars from abroad, unionization within universities, career interruptions, and the pres-

tige associated with doctoral credentials. Their findings suggest that each of these factors contributes to some extent to the observed gender gaps, but none can fully account for them.

Differences in productivity also contribute to the gender glass ceiling in academia. The lower productivity observed among women can stem from several factors. One may be the presence of gendered roles at the household level, which can have a dual effect. On one hand, these roles may limit the time female researchers can allocate to work. On the other hand, they may also be mirrored within the department environment, with women potentially becoming more involved in tasks that are undervalued for promotions but essential for the smooth functioning of the department. These activities are often referred to as "academic housework" (Heijstra, Einarsdottir, Petursdottir, and Steinthorsdottir [2017], Babcock, Recalde, Vesterlund, and Weingart [2017]). A second factor contributing to lower productivity could be the absence of female mentors and role models in academia. As noted by Blau, Currie, Croson, and Ginther [2010], young female academics often have weaker informal relationships with senior female colleagues in their departments. A third factor influencing productivity may be the limited networks observed among women compared to men. For instance, female economists are less likely to co-author papers than their male counterparts, and they benefit less from spillover effects generated by the presence of other researchers. Bosquet, Combes, and García-Peñalosa [2019] found that men benefit significantly from peer effects provided by other male colleagues, which is not the case for women. Aligned with these findings, Blau et al. [2010] assessed the effectiveness of a program designed to assist female junior faculty in preparing for the tenure process, aiming to facilitate women's advancement in the economics profession. The program has been shown to increase publication rates and tenure applications among participants successfully.

The gender gap can also be attributed to biases in assessing work done by male and female researchers. Several studies indicate that higher standards are often applied to judge the quality of research produced by women compared to men (Card, DellaVigna, Funk, and Iriberri [2020], Dupas, Modestino, Niederle, Wolfers, et al. [2021], Hengel [2022]),

and women's work tends to receive fewer citations (Koffi [2021], Grossbard, Yilmazer, and Zhang [2021]). Similarly, unconscious biases are evident even among supervisors and mentors. Eberhardt, Facchini, and Rueda [2023] analyzed nearly 12,000 reference letters written in support of 3,700 candidates at a major UK university and found indications of unconscious biases influencing mentors' letter-writing behaviors. Consequently, women are systematically less likely to be described using terms emphasizing their consistent commitment over their ability. Similarly, Sarsons [2017] examined how credit is distributed among coauthors of academic publications and discovered gender disparities. While men tend to receive tenure at similar rates regardless of their coauthoring patterns, the evidence for women is the opposite: the more they coauthor, the less credit they receive.

Regarding the hiring process, differences in the probability of success of male and female candidates can depend on the gender composition of selection committees. The notion that a greater presence of women on these committees could enhance the chances of success for female candidates has been challenged by recent research. For instance, Deschamps [2023] studied the implementation of gender quotas in selection committees for entry into French academia. The findings indicate that the reform lowered women's likelihood of being hired and worsened female evaluations, with the negative impact particularly pronounced in committees chaired by men. Finally, the final outcome of promotion procedures in academia is likely influenced by other professors within the department and the scientific field of the competition. Johnson [2007] and Van den Brink and Benschop [2014] provided evidence from the UK and the Netherlands suggesting that men in senior positions within academic departments may serve as gatekeepers, employing various micro-processes to favor other men. All in all, previous research found evidence that the process of professorial recruitment in academia is still often characterized by limited transparency and accountability, leaving spaces for discrimination to occur (Van den Brink and Benschop [2012], Van den Brink and Benschop [2014]; Van den Brink [2010]).

In this paper, we contribute to the existing literature by analyzing the role played by

the gender composition of the candidate pool for full professor positions in hiring decisions. We take into account also the gender composition of the pool of full professors within the hiring department, and productivity, when data availability makes it possible. Italy serves as a compelling case study in this context. Nascia, Pianta, and Zacharewicz [2021] conducted a study using a sample of Italian researchers, including 374 individuals working in Italy and 207 working abroad, as part of the EU project MORE 3. Their research compared the career trajectories of researchers employed in Italy with those of Italian researchers working abroad. The findings revealed that researchers working abroad experience significantly faster career progression compared to their counterparts in Italy. Moreover, recruitment policies abroad were perceived as more transparent and meritocratic than those in Italy. Specifically, 57% of researchers in Italy considered recruitment in their institutions to be transparent and merit-based, whereas this figure rose to 80% among those working abroad. Several studies highlight the disparity in academic career engagement between men and women in Italy after completing a Ph.D. Zabetta and Geuna [2020] analyzed the career outcomes of 25,412 doctoral graduates from Italian universities between 1986 and 2006, observing data from 1990 to 2015. They found that approximately 40% of male Ph.D. holders pursued academic careers, whereas the percentage was less than 30% among women. This gender gap of at least 10 percentage points persisted across various scientific sectors. Carriero, Coda Zabetta, Geuna, and Tomatis [2023] examined the determinants of academic career engagement among six cohorts of Ph.D. students surveyed from 2004 to 2014, as well as 760 Ph.D. holders from the University of Turin graduating between 2007 and 2017. They found evidence of a persistent lower involvement of women in academia, even after controlling for personal motivations and the role of supervisors. Similarly, Checchi and Cicero [2022] studied the period from 1990 to 2019 and concluded that, at 7.5 years after completing a Ph.D., women have a 5.6 percentage points probability of obtaining an academic appointment, which is equivalent to what men achieve after 5 years post-Ph.D. completion. At 13 years after graduation or completion of a postdoc, women have the same likelihood of securing an academic position as men after 8 years.

Gender inequalities persist at subsequent stages of the academic career in Italy, including the probability of obtaining the National Scientific Qualification (NSQ), the post-doc and assistant professor hiring processes, and promotions from assistant professor positions to associate professors and full professors. The recruitment system in Italian academia underwent a reform with the enactment of Law 240/2010 (also called Gelmini reform under the name of the Minister who promoted it).[4] Since 2010, the initial stages of the academic career in Italy involve temporary positions as post-doc and assistant professor (called researcher type A and type B). Access to permanent positions (associate professorship) and the highest rank of the academic career (full professorship) is contingent upon receiving the NSQ. The selection procedure for obtaining the NSQ has been examined in recent studies. De Paola, Ponzo, and Scoppa [2018] investigated the probability of success in the NSQ of males and females, controlling for several measures of productivity and individual, field, and university characteristics. They found no gender differences in the probability of obtaining the NSQ but a lower probability of promotion for women. Bagues et al. [2017] investigated the quantity and quality of female candidates for the NSQ in Italy and Spain. They document the absence of gender discrimination on the NSQ. Still, they found that male evaluators on selection committees became less favorable toward female candidates, with each female evaluator joining the committee. However, the presence of more females on the committee did not affect the voting behavior of female committee members toward female candidates. In the hiring process for associate and full professor positions in Italy, De Paola and Scoppa [2015] provided evidence that female candidates were less likely to be promoted when the evaluation committee consisted exclusively of males. However, this gender gap disappeared when a mixed-gender committee assessed candidates. In contrast, Bagues et al. [2017] found a significantly wider gender gap in promotions when committees were gender-mixed compared to when they comprised only male evaluators. Bagues, Sylos-Labini, and Zinovyeva [2019] also identified that candidates' connections with committee members are likely to play a crucial role in receiving better evaluations in NSQ, not solely due to nepotism but also because applicants make more informed application decisions. Similarly, Abramo et al. [2015]

[4]See Section 3 for more details.

observed that a female committee president significantly increases the likelihood of candidate success when there is collaborative research with the president. Conversely, when a male president chairs the committee, success is primarily determined by the duration of shared tenure at the same university. Bello, Casarico, and Nozza [2023] further studied whether research similarity could drive promotions in Italian academia, relying on a unique dataset encompassing all job applications for tenure-track assistant professor positions in economics in Italy. Employing Natural Language Processing (NLP) techniques, they demonstrated that the level of similarity in research topics and approaches between applicants and members of the evaluation committee strongly correlates with the probability of success, particularly for men. The authors contend that female candidates are less likely to exhibit strong similarity to any committee member, mainly because committees are predominantly composed of men.

To the best of our knowledge, only two studies explicitly investigated gender disparities in the likelihood of being promoted to full professor positions in Italian academia. Marini and Meschitti [2018] focused on promotion patterns to full professor positions in Italy between 2013 and 2016, specifically addressing gender disparities. They utilized data from the NSQ and academic staff population from the Italian Ministry of Education. Their analysis controlled for scientific productivity (including metrics such as the number of articles, books, citations, H-index, and articles in top-tier journals), departmental budget for promotions and recruitment normalized by the number of associate professors, and departmental research performance in ministerial assessments. Their findings revealed that all else being equal, women had approximately 24% lower odds of being promoted. Filandri and Pasqua [2021] utilized administrative data on the entire academic staff population in Italian public universities obtained from the Italian Ministry of Education, along with NSQ data for the years 2012 and 2013, and productivity measures (such as h-index, citations, and publications).[5] They examined the career trajectories of 6,572 associate professors eligible for promotion to full professorship who underwent the NSQ process in 2012-2013. Using a multinomial logit model and controlling for gender, disci-

[5]This information has been acquired from the platform Scival.

plinary area, and university size, they assessed the likelihood of various career outcomes. The study revealed that women not only faced lower odds of advancing to full professorship but also experienced slower career progression than men. Even after accounting for seniority and productivity, the coefficient associated with the variable identifying women remained positive and significant in predicting the probability of experiencing a slow career progression. In the next Section, we provide an overview of Italian academia's institutional background before describing the data.

3 Institutional Background

Italian academia has a well-defined hierarchy: full professors are top-ranked, followed by associate professors, tenure-track assistant professors, and non-tenure-track assistant professors. Higher hierarchical levels imply more decision power and higher salaries. The teaching load increases from assistant to associate professor but stays constant when transitioning from associate to full professor.

Law 240/2010 regulates the recruiting process of associate and full professors in our sample. This law introduced the National Scientific Qualification (NSQ), a system designed to avoid local favoritism and to improve the quality of research and teaching in the Italian university system (Abramo and D'Angelo [2015], Nieddu and Pandolfi [2022], and Sala and Bosisio [2017]). Individuals must obtain the corresponding qualification granted by national committees to be eligible for an associate or full professor position. There is one committee for each scientific discipline. Each committee comprises five full professors associated with the corresponding scientific discipline. Components are randomly drafted from a list of research-active full professors who volunteer for the role. The committee establishes the qualification criteria for associate and full professorships and then evaluates the applicants' CVs for both roles.

The qualification is awarded to a candidate with the agreement of three out of five committee members. After being awarded the corresponding qualification, candidates can apply for associate professor and full professor positions. These positions are decided and opened at each university level. Associate and full professors decide on the

opening of associate professor positions in their department, while full professors decide on the opening of full professor positions. Positions may be open for internal candidates (there is a limit on the number of internal promotions that departments can do) or open for competition. In the latter case, each position is associated with a specific scientific discipline, but professors in other disciplines of the same sector can apply (with lower chances of winning). We show the list of academic disciplines and corresponding sectors in the Appendix.

4 Data and Descriptive Statistics

4.1 Datasets

In this section, we describe the four sources of data that we use in the analysis, and how we merged them to obtain the final dataset. As a main source, we rely on a panel dataset, including all professors employed in Italian universities from December 31, 2000, to December 31, 2022. Yearly information about professors is publicly available and accessible on the Italian Ministry of Education's website. For all professors, it reports name, surname, academic position (post-doc, assistant professor, associate professor, and full professor), disciplinary area, competition sector, and university affiliation (university, faculty, and department). We restrict our sample to associate and full professors. The Italian system comprises 14 scientific areas and 190 competition sectors. The database contains 1,397,015 observations on 108,410 professors uniquely identified by name, surname, and scientific area.[6].

We complement our main dataset with the NSQ database. containing information on the outcomes of qualification applications for the roles of associate professor or full professor across different areas and competition sectors since the inception of the NSQ system to December 31, 2022. There were qualification windows in 2012, 2013, 2016, 2018,

[6]The data is publicly downloadable from https://cercauniversita.mur.gov.it/php5/docenti/cerca.php

and 2021. For applicants in a given year, we have information on their name, surname, scientific area, and whether the applicant obtained or not the qualification as a full or associate professor. This data is publicly available and accessible on the website of the National Agency for the Evaluation of the University and Research System (also known by its Italian acronym ANVUR). The database contains 611,777 observations, referred to 45,969 applicants uniquely identified by name, surname, and scientific area.[7]

For a subsample of the population, we also obtain data on research productivity measured by yearly citations from Google Scholar. The Google Citations database documents the citations of works registered for each associate professor with a qualification for becoming a full professor on Google Scholar. This dataset was created using the R package "scholar" Version 0.2.4 (Keirstead [2016]). It includes the name and surname of the researcher and the number of citations of their registered papers each year since 1984. The database contains information on 11,195 associate professors uniquely identified by name and surname. For the purpose of our analysis, we use both cumulative and non-cumulative yearly citations.

Information on department quality has been retrieved from the ANVUR database. This database provides the overall scores assigned to university departments by scientific area in the three rounds of the ANVUR evaluation (2004-2010, 2011-2014, 2015-2019). It contains 2,234 observations measuring the quality of 91 Universities.

To create our final database, we first merged the professors' database with the NSQ database using the name, the surname, and the scientific sector.[8] We then worked with a unbalanced subsample of individuals who either were associate professors in 2013 (at the time when the qualification system to access competitions started to apply) or became associate professors at some point after 2013. In this latter case, they enter our

[7] The data is publicly available at https://abilitazione.mur.gov.it/public/index.php

[8] We homogenize the name and surname to avoid formatting problems and maximize the number of successful matches. In particular, we put the name and surname in small letters and canceled blanks, accents, apostrophes, and other non-alphabetical characters.

sample from the year they become associate professors. If they are eventually promoted to full professors, they exit the sample the year after the promotion. The sample consists of 79,478 observations corresponding to 20,823 associate professors with qualification as full professors. An alternative sample including all associate professors regardless of the NSQ outcome consists of 204,388 observations of 39,495 associate professors. Some authors have pointed out that women are less likely to apply for promotions (Bosquet et al. [2019]; De Paola, Ponzo, and Scoppa [2017]), perhaps due to the existence of gender differences in the preference for competitive environments (Niederle and Vesterlund [2010] and Buser, Niederle, and Oosterbeek [2014]) or in bargaining abilities in the labor market (Babcock, Gelfand, Small, and Stayn [2013] and Blackaby, Booth, and Frank [2005]). Our sample comprising all associate professors allows us to overcome this issue. Then, we also merged our sample with the Google citation and ANVUR databases.[9]

Table 1 shows descriptive statistics for the average associate professor in our sample. The probability that a given associate professor is promoted to full professor in a given year is 0.11. This probability goes down to 0.10 for female professors and rises to 0.12 for male professors. The average number of colleagues that compete for a promotion is 29.4. Female professors face slightly fewer competitors than males (28.8 versus 29.7), but differences are not statistically significant. This can be explained by the fact that women are in slightly smaller departments but differences in department size are insignificant. The average associate professor has slightly more than one-third female colleagues. As a result of gender segregation across disciplines, females have almost 40% female colleagues while males have one-third female colleagues, on average. Our predicted number of candidates is slightly higher but very close to the actual number. The same happens to the predicted share of female candidates. Females represent 35.5% of the total sample. The average associate professor has covered that role for over eight years. The average tenure is extremely similar for males and females. The same applies to the proportion of

[9]The merging operation with the Google database was not trivial because Google reports only the individual's name and surname but not the scientific area. Moreover, many researchers do not have a Google profile. We were able to obtain the yearly number of citations of about 54 percent of the associate professors with qualifications in our database.

professors for whom we do not observe tenure because they entered the role before the beginning of data collection in 2000. The latter share is 7.5% overall (7.9% for females and 7.2% for males).

Table 1: Descriptive Statistics

Panel A: Full Sample

Variable	Mean	Std. Dev.	Min.	Max.
Promotion	0.112	0.316	0	1
Number of candidates	29.4	28.817	1	189
Female/all ratio	0.355	0.187	0	1
Predicted number of candidates	29.57	30.045	0.187	198.945
Predicted female/all ratio	0.38	0.155	0	1
Female	0.355	0.479	0	1
Tenure in years	8.238	5.445	1	23
Censored tenure in years	0.075	1.163	0	23

Panel B: Female Professors Sample

Variable	Mean	Std. Dev.	Min.	Max.
Promotion	0.102	0.303	0	1
Number of candidates	28.828	27.265	1	189
Female/all ratio	0.395	0.182	0	1
Predicted number of candidates	28.949	28.315	0.218	198.945
Predicted female/all ratio	0.421	0.148	0	1
Female	1	0	1	1
Tenure in years	8.315	5.359	1	23
Censored tenure in years	0.079	1.188	0	23

Panel C: Male Professors Sample

Variable	Mean	Std. Dev.	Min.	Max.
Promotion	0.118	0.323	0	1
Number of candidates	29.715	29.633	1	164
Female/all ratio	0.333	0.186	0	1
Predicted number of candidates	29.913	30.952	0.187	186.263
Predicted female/all ratio	0.357	0.154	0	1
Female	0	0	0	0
Tenure in years	8.195	5.49	1	23
Censored tenure in years	0.072	1.149	0	23

Notes: Data is from the Italian Ministry of Education. The sample is composed of all Associate Professors in the years 2013-2023. The number of observations is 78,169, 27,771, and 50,398 in panels A, B, and C, respectively. "Promotion" is a dummy equal to one if the individual is promoted from Associate to Full Professor. Tenure in years expresses the years the individual has been an Associate Professor.

5 Econometric Strategy

We first study how the probability of hiring a candidate who works in another department or university changes with the proportion of females among qualified associate professors in the department. We perform regressions at the department and year level as follows:

$$E_{jt} = \beta_0 + \beta_1 P_{jt} + \beta_2 N_{jt} + \beta_3 X_{jt} + \epsilon_{jt} \tag{1}$$

where E_{jt} equals one if department j hires at least one external full professor in year t. We call P the proportion of females among eligible associate professors and N the logarithm of the total number of professors. We also control for department dummies and year indicators. We cluster standard errors at the department level.

In the previous equation, the coefficients associated with P and N may be biased due to omitted variables like changes in gender preferences of the pool of full professors in the department. We account for endogeneity using the predicted proportion and number of qualified associated professors. We predict these figures attributing to each individual the proportion of qualified associate professors in their discipline in the current year. We then add these proportions at the department level to compute the predicted number of qualified associate professors and their gender ratio. We now provide a simplified example of the construction of the instrument:

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
a	A	f	q	Fin	0.6	1	1	1	0.6
b	A	m	u	PoE	0.4	1	1	1	0.6
c	B	m	q	Fin	0.6	1	0	0.9	0
d	B	m	u	PuE	0.3	1	0	0.9	0
e	C	f	q	PoE	0.4	1	1	0.7	1
f	C	f	u	PuE	0.3	1	1	0.7	1

Notes:

(1) is the name of the associate professor

(2) is the name of the department

(3) is the gender where m is male, and f is female

(4) is an indicator equal to q if the individual is qualified according to the National Qualification System and u if unqualified

(5) is the name of the academic discipline (e.g.: Fin is Finance, PoE is Political Economy, and PuE is Public Economics)

(6) is the proportion of qualified professors among the associate professors in the discipline

(7) is the number of qualified professors in the department

(8) is the proportion of qualified female professors in the department

(9) is the number of predicted internal candidates for full professorship in the department

(10) is the proportion of predicted female internal candidates to full professorship in the department.

From the data in columns (1)-(6), we compute the figures in columns (7)-(10). The number of predicted internal candidates for full professorship in the department (column 9) serves as an instrument for the number of qualified professors in the department (column 7) and the proportion of predicted female internal candidates for full professorship in the department (column 10) serves as an instrument for the proportion of qualified female professors in the department.

We then move to our main specification to study the impact of colleagues' gender on female and male promotion opportunities. We estimate the following linear equation on the subsamples of males and females separately:

$$Y_{i,j,s,t} = \beta_0 + \beta_1 P_{-i,j,t} + \beta_2 N_{-i,j,t} + \beta_4 D_j + \beta_5 D_s + \beta_6 D_t + u_{i,j,s,t} \tag{2}$$

where Y is a binary variable indicating whether individual i, working in department j, and clasified in academic sector s is promoted to full professor in period t. P and N are the proportion of females among individual i's colleagues and the logarithm of the total number of colleagues, respectively. The vectors D include dummies for department

j, indicators for scientific sector s, and binary variables for year t, respectively. Finally, the error term u is clustered at the department level.

The correlation between the probability of being promoted for male and female associate professors and the gender of the other promotion candidates is affected by omitted variables like the department gender preferences and the relative quality of male vs. female candidates. We estimate the causal effect by exploiting the exogenous probability that the internal candidates are awarded the national qualification for their disciplines. We now provide a simplified example of the construction of the instruments:

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
a	A	f	q	Fin	0.6	0	0	0.4	0
b	A	m	u	PoE	0.4	1	1	0.6	1
c	B	m	q	Fin	0.6	0	0	0.3	0
d	B	m	u	PuE	0.3	1	0	0.6	0
e	C	f	q	PoE	0.4	0	0	0.3	1
f	C	f	u	PuE	0.3	1	1	0.4	1

Notes:

(1) is the name of the associate professor

(2) is the name of the department

(3) is the gender where m is male, and f is female

(4) is an indicator equal to q if the individual is qualified according to the National Qualification System and u if unqualified

(5) is the name of the academic discipline (e.g.: Fin is Finance, PoE is Political Economy, and PuE is Public Economics)

(6) is the proportion of qualified professors in the discipline of the associate professor

(7) is the number of qualified colleagues

(8) is the proportion of qualified female colleagues

(9) is the number of predicted colleagues qualified for full professorship

(10) is the proportion of predicted female colleagues qualified to full professorship.

From the data in columns (1)-(6), we compute the figures in columns (7)-(10). The number of predicted colleagues for full professorship (column 9) serves as an instrument for the number of qualified colleagues (column 7), and the proportion of predicted female colleagues qualified for full professorship (column 10) serves as an instrument for the proportion of qualified female colleagues.

6 Results

First, we study the impact of the gender composition of the pool of internal candidates for full professorship on the probability of hiring an external candidate. For this analysis, we use data at the department and year level. Then, we move to our main research question and estimate the impact of the gender composition of the candidates' pool on the differential probability of promotion to full professor for male and female associate professors. Finally, we study how our estimated effects change according to the gender composition of the pool of full professors, the group of individuals who decide on promotions, and on the external hiring of full professors.

6.1 Primary outcomes

Table 2 displays the results from OLS and IV regressions analyzing the relationship between the share of female associate professors and the logarithm of the total number of associate professors in a department and the probability of hiring an external candidate as in Equation 1. In columns (1) and (4), the outcome equals one if the department hires at least one full professor who was previously working in another university in that year. In columns (2) and (3) the outcome equals one if the department hires at least a female external professor. In columns (5) and (6) the outcome equals one if the department hires at least a male external professor. The OLS results in columns 1-3 show the association between the share of female associate professors and the probability of hiring an external candidate. These associations are all negative but not statistically significant. The IV estimates reported in columns 4-6 provide causal estimates of the impact of the gender mix of the pool of internal candidates on the probability of hiring any external candidate, a female, and a male external candidate. They reveal a positive but imprecise effect of the share of female associate professors on the likelihood of hiring external candidates and male external candidates, with coefficients equal to 0.016. The coefficient is four times smaller in the case of female external candidates. Overall, these results may indicate that a higher share of female associate professors within a department may be positively asso-

ciated with the likelihood of hiring external candidates, particularly men. Unfortunately, our data does not present enough variation to precisely identify any effect.

Table 2: Gender Mix and Probability of Hiring an External Candidate

	OLS			IV		
	All	Female	Male	All	Female	Male
	(1)	(2)	(3)	(4)	(5)	(6)
Share of Female Candidates	-.019	-.011	-.008	0.016	0.004	0.016
	(0.018)	(0.011)	(0.017)	(0.032)	(0.019)	(0.03)
Log-number of Candidates	0.007	-.0002	0.011	0.015	0.008	0.014
	(0.007)	(0.004)	(0.007)	(0.01)	(0.006)	(0.009)
Obs.	8275	8275	8275	8275	8275	8275
R^2	0.289	0.155	0.288	0.288	0.154	0.288
F statistic	3.101	1.403	3.092	3.1	1.402	3.091

Notes: Data is from the Italian Ministry of Education. The sample is composed of all Associate Professors in the years 2013-2023. The dependent variable is a dummy equal to one if department hires at least one external full professor in each year. Columns 1-2-3 report the results of the OLS; columns 4-5-6 report the results of the IV. *** p<0.01, ** p<0.05, * p<0.1.

We now assess the validity of the above IV estimates by ensuring the instrument is strong. Table 3 presents the first-stage results, i.e., the result of regressing the gender ratio of candidates and the log-number of candidates on their predicted values. Column 1 reports the relationship between the predicted share of female candidates and the actual share of female candidates. The coefficient on the predicted share of female candidates is 0.98, which is statistically significant at the 1% level, which confirms that the predicted share of female candidates is a robust predictor of the actual share. Column 2 displays the association between the predicted log-number of candidates and the actual log-number of candidates. The coefficient for the log predicted candidates is 0.85, also statistically significant at the 1% level, again confirming that the predicted number of candidates is a strong predictor of the actual number of candidates. The F statistics of the excluded instruments (104 and 21, respectively) are well above the commonly accepted threshold of 10, suggesting that the instruments used are sufficiently strong. These results reinforce the credibility of the IV estimates presented in Table 2, ensuring that the instruments are relevant and appropriately aligned with the theoretical expectations.

Table 4 presents estimates of the relationship between the share of female associate professors in a department (excluding the individual) and the probability of an associate professor being promoted to full professor, separated by the gender of the associate professor as in Equation 2. Columns (1) and (2) display OLS estimates, with the share of

Table 3: The Female-male Gender Ratio and the Log-number of Candidates Instrumented by the Log of the Predicted Number of Candidates and the Predicted Gender Ratio

	Share of Female Candidates	**Log-number of Candidates**
	(1)	(2)
Predicted Share of Female Candidates	0.978	-.105
	(0.016)***	(0.035)***
Log Predicted Candidates	-.001	0.849
	(0.005)	(0.01)***
Obs.	8275	8275
R^2	0.935	0.745
F statistic	104.11	21.229

Notes: Data is from the Italian Ministry of Education. The sample is composed of all Associate Professors in the years 2013-2023. The dependent variable is the ratio of female to male candidates in column 1, and the log of the number of candidates in column 2. *** p<0.01, ** p<0.05, * p<0.1.

female candidates in a department having a positive and statistically significant correlation with the probability of promotion for female associate professors (column 1) and a negative and significant correlation for male associate professors (column 2). Specifically, a ten percentage points increase in the share of female candidates is associated with a 0.007 increase in the probability of promotion for females and a 0.005 decrease for males. Both coefficients are statistically significant at the 1% level. Columns (3) and (4) report IV estimates, with the share of female candidates and the log-number of candidates instrumented by the predicted values which we constructed as explained in Section 5. The IV results suggest a strong positive causal effect for female associate professors (column 3), where a ten percentage points increase in the share of female candidates leads to a 0.02 increase in the probability of promotion, significant at the 1% level. For male associate professors (column 4), the causal impact is positive but less pronounced, at 0.047, and not statistically significant at conventional levels. The log-number of candidates is positively associated with promotion probability in both OLS and IV estimates for both genders, with higher coefficients in the IV estimates. In line with our theoretical model, the probability of promoting a man is more sensitive to the number of candidates. Indeed, with a smaller number of candidates, it is easier for the commission to be perceived as unfair if it promotes a man.

Table 5 presents the first-stage regression results for the IV estimates in Table 4. Columns (1) and (2) report the regressions of the share of female candidates on the predicted share of female candidates and the log of predicted candidates, separately for female and male associate professors. The coefficients on the predicted share of female candidates are 0.92

Table 4: Candidates' Gender and Probability of Promotion for Males and Females

	OLS		IV	
	Females	Males	Females	Males
	(1)	(2)	(3)	(4)
Share of Female Candidates	0.071	-.054	0.183	0.047
	(0.019)***	(0.014)***	(0.038)***	(0.035)
Log-number of Candidates	0.021	0.026	0.033	0.083
	(0.008)***	(0.006)***	(0.015)**	(0.014)***
Tenure in Years Dummies	Yes	Yes	Yes	Yes
Obs.	27771	50398	27771	50398
R^2	0.082	0.068	0.079	.
F statistic	2.994	4.164	3.01	2.939

Notes: Data is from the Italian Ministry of Education. The sample is composed of all Associate Professors in the years 2013-2023. The dependent variable is a dummy equal to one if the individual is promoted from Associate to Full Professor. Columns 1-2 report the results of the OLS; columns 3-4 report the IV results. All specifications include department, scientific discipline, sector, and individual fixed effects. Tenure in years dummies account for the years the individual has been an Associate Professor. *** p<0.01, ** p<0.05, * p<0.1.

and 0.98, both highly significant at the 1% level, indicating that the instrument effectively captures variations in the proportion of female candidates. Columns (3) and (4) display the regressions of the log-number of candidates on the predicted log-number of candidates and the predicted share of female candidates, separately for female and male associate professors. The coefficients on the log of predicted candidates are 0.85 and 0.87, significant at the 1% level. The F-statistics of the excluded instruments are well above the critical threshold of ten in all cases. These results validate the instrumental variables used in the IV approach by demonstrating their relevance and strength in predicting the instrumented variables.

Table 5: The Female-male Gender Ratio and the Log-number of Candidates Instrumented by the Log of the Predicted Number of Candidates and the Predicted Gender Ratio

	Share of Female Candidates		Log-number of Candidates	
	Females	Males	Females	Males
	(1)	(2)	(3)	(4)
Predicted Share of Female Candidates	0.918	0.977	-.292	-.221
	(0.01)***	(0.007)***	(0.023)***	(0.017)***
Log Predicted Candidates	-.007	-.009	0.848	0.868
	(0.003)**	(0.003)***	(0.008)***	(0.006)***
Tenure in Years Dummies	Yes	Yes	Yes	Yes
Obs.	27771	50398	27771	50398
R^2	0.797	0.796	0.963	0.964
F statistic	136.889	231.745	863.338	1541.99

Notes: Data is from the Italian Ministry of Education. The sample is composed of all Associate Professors in the years 2013-2023. The dependent variable is the ratio of female to male candidates in columns 1-2, and the log of the number of candidates in columns 3-4. All specifications include department, scientific discipline, sector, and individual fixed effects. Tenure in years dummies account for the years the individual has been an Associate Professor. *** p<0.01, ** p<0.05, * p<0.1.

Previous research for the UK and Netherlands shows that the gender ratio of the pool of professors in senior positions affects career patterns of professors in lower positions of

the ranking (Johnson [2007] and Van den Brink and Benschop [2014]). We next explore the role of the gender ratio of full professors in the department as an omitted variable and as a mediating factor in the effect of the gender ratio of candidates on promotion probabilities. Table 6 presents results from the regression analysis examining the impact of the gender ratio of associate professors on the probability of promotion to full professor, with additional controls including the gender ratio of full professors and its interaction with the gender ratio of candidates. The coefficient for the interaction of the gender ratios of full and associate professors (excluding the individual) is positive, sizeable, and highly significant (at 1% level) for the case of women and negative, sizeable, and significant at the 10% level for the case of men. Instead, the coefficients associated with the uninteracted gender ratio of associate professors are null. Hence, the gender composition of the pool of full professors is a crucial mediating factor for the effect of the gender ratio of colleagues on the probability of being promoted to full professor. In particular, more females over total full professors exacerbates the effect of the gender ratio of colleagues eligible for full professorship.

The coefficient for the log-number of candidates is positive and statistically significant for the female sample (0.022, $p < 0.01$), indicating that a higher number of candidates leads to a higher probability of promotion for female associate professors. For male associate professors, the coefficient is negative and not statistically significant (-0.006), suggesting no significant effect of candidate numbers on male promotion probabilities. The coefficient of the interaction of the log-number of candidates and the gender ratio of full professors is significant for the female sample (-0.016, $p < 0.1$) but not for the male sample (0.005). This suggests that the effect of the number of candidates on the probability of promotion for female associate professors is moderated by the proportion of female full professors, though the relationship is less clear for males.

Table 6: Candidates' Gender and Probability of Promotion for Males and Females - Interactions

	IV	
	Females	Males
	(1)	(2)
Share of Female Candidates x Share of Female Full Professors	0.169	-.105
	(0.059)***	(0.054)*
Share of Female Candidates	-.016	0.029
	(0.021)	(0.019)
Log-number of Candidates x Share of Female Full Professors	-.016	0.005
	(0.009)*	(0.008)
Log-number of Candidates	0.022	-.006
	(0.005)***	(0.006)
Obs.	75958	119697
R^2	0.035	0.033
F statistic	3.966	5.694

Notes: Data is from the Italian Ministry of Education. The sample is composed of all Associate Professors in the years 2013-2023. The dependent variable is a dummy equal to one if the individual is promoted from Associate to Full Professor. Columns 1-2 report the results of the OLS; columns 3-4 report the IV results. All specifications include department, scientific discipline, sector, and individual fixed effects. Tenure in years dummies account for the years the individual has been an Associate Professor. *** p<0.01, ** p<0.05, * p<0.1.

6.2 Mechanisms

According to McDowell et al. [1999], one of the main advantages of studying personnel economics using the job market of academics is that productivity can be measured using research output. We explore the role of a professor's research output as a mechanism for the effect of the share of female candidates on promotion opportunities. Table 7 presents the results of the IV estimation assessing the impact of the predicted share of female candidates and the log of the predicted number of candidates on the probability of being promoted from Associate to Full Professor for the subsample of professors for whom we have information on their productivity measured by citations of their work. Columns (1) and (2) replicate the IV estimates in Table 4 for the subsample of associate professors for whom productivity data is available. Columns (3) and (4) extend this analysis by including an additional control for productivity, proxied by yearly citations in logs. Comparing column (1) of Table 7 to column (3) of Table 4, we find that the impact of the share of female colleagues eligible for full professorship on promotion is slightly lower for the subsample of females with information on citations (0.15) but significant and statistically indistinguishable from the full female sample (0.18). Interestingly, the coefficient in column (1) remains arguably unchanged when we control for research productivity by adding the log of citations to Equation 2 (see column 3). These results show that differences in productivity are not a relevant factor behind our main result that female promo-

tion probabilities increase with the proportion of eligible colleagues. Comparing column (2) of Table 7 to column (4) of Table 4, we find that the effect of the share of eligible female colleagues has a negative, sizeable and significant effect on male promotion probability. This implies that the subsample of males for whom information on research productivity is available is not representative of the entire male sample. Interestingly, for this subsample of males, the effect of the share of female eligible colleagues more than doubles when controlling for citations. For both genders, the coefficients associated to the number of citations in logs have the expected positive signs and are highly significant. A 1% increase in citations implies a one-to-two points increase in the probability of being promoted to full professor.

Table 7: Candidates' Gender and Probability of Promotion for Males and Females Controlling for Productivity

	IV			
	Females	Males	Females	Males
	(1)	(2)	(3)	(4)
Share of Female Candidates	0.152	-.196	0.148	-.519
	(0.06)**	(0.042)***	(0.06)**	(0.075)***
Log-number of Candidates	0.018	0.174	0.019	-.196
	(0.023)	(0.027)***	(0.023)	(0.033)***
Log Citations			0.013	0.017
			(0.003)***	(0.003)***
Tenure in years dummies	Yes	Yes	Yes	Yes
Obs.	12272	28599	12272	28599
R^2	0.11	.	0.112	.
F statistic	1.927	2.754	1.88	1.226

Notes: Data is from the Italian Ministry of Education. Information on the number of citations is from Google Scholar. The sample is composed of all Associate Professors in the years 2013-2023. The dependent variable is a dummy equal to one if the individual is promoted from Associate to Full Professor. Columns 1-2 report the results of the IV specification on the subsample of the population for which we have data on productivity (Log of number of citations). Columns 3-4 report the results of the IV on this sample controlling for productivity, proxied by the logarithm of the number of citations. All specifications include department, scientific discipline, sector, and individual fixed effects. Tenure in years dummies account for the years the individual has been an Associate Professor. *** p<0.01, ** p<0.05, * p<0.1.

Another advantage of the academic job market as a case study, according to McDowell et al. [1999], is that department quality can be measured. We already control for department quality using department-fixed effects. However, department quality can be a mediating factor such that high or low-quality departments contribute to the effects of the gender ratio of colleagues eligible for a full professorship on promotions. Table 8 replicates the main IV specification, adding the interaction of the gender ratio of associate professors (excluding the individual) with department quality as measured by the Italian Ministry of Education. The results are based on a subsample of professors for whom de-

partment quality data is available (some departments do not apply for the assessment of their quality even if this could raise their funding). The estimated effect of the gender ratio of colleagues eligible for a full professorship on the promotion of females is lower for the subsample professors in low-quality departments than for professors in high-quality departments (0.13 vs. 0.22). The negative effect of the female share of competitors on males' promotions is also weaker for professors in low-quality departments than for those in high-quality departments (-0.10 vs. -0.13). Hence, we conclude that the positive effects found for females and the negative effects found for males are led by high-quality departments. These results should be taken with caution because, as evidenced by the regression sample sizes, high-quality departments are also bigger departments, and hence, we can not disentangle if our effects are stronger in some departments because they are big or because they are high-quality.

Table 8: Candidates' Gender and Probability of Promotion for Males and Females - Anvur

	Low Quality Departments		**High Quality Departments**	
	Females	Males	Females	Males
	(1)	(2)	(3)	(4)
Share of Female Candidates	0.129	-.102	0.224	-.126
	(0.074)*	(0.05)**	(0.049)***	(0.035)***
Log-number of Candidates	0.044	0.043	0.015	0.049
	(0.028)	(0.025)*	(0.018)	(0.013)***
Obs.	3110	5779	20861	38213
R^2	0.195	0.144	0.07	0.059
F statistic	1.982	2.374	3.279	5.048

Notes: Data is from the Italian Ministry of Education and the ANVUR assessment of department quality by the Italian Ministry of Education. The sample comprises all Associate Professors from 2013-2023, with the analysis limited to those for whom department quality data is available. The dependent variable is a dummy equal to one if the individual is promoted from Associate to Full Professor. Columns 1-2 report the results for the subsample of professors working in departments with quality below the median. Columns 3-4 show the results for the subsample of professors working in departments with quality above the median. All specifications include department, scientific discipline, sector, and individual fixed effects. Tenure in years dummies account for the years the individual has been an Associate Professor. *** p<0.01, ** p<0.05, * p<0.1.

7 Conclusion

Several explanations may account for the lack of women in high-level academic positions. According to the pipeline theory, once women have entered the lower rungs of their academic careers, it is mainly a matter of time before they move 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 doctoral levels (Ginther and Kahn [2004] and Ginther and Kahn [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 et al. [2010]). Some women may also devote excessive time to socially desirable tasks not considered in promotion decisions (Babcock et al. [2017]).

We contribute to the literature on gender differences in promotions by analyzing the role of the gender composition of the pool of candidates. We focus on Italian academia as this context provides a unique opportunity for identification because: (i) there is a unique career path that helps to identify the set of candidates and decision-makers, (ii) it is a highly regulated process that includes a national qualification system which exogenously modifies the set of candidates for promotion, and (iii) there is data on the universe of professors in the country and the results of the qualification system.

We use an instrumental variable strategy to identify the impact of candidates' gender ratio on promoting male and female professors. We use the predicted number of female and male professors according to the strictness of the qualification process in each discipline as an instrument for the candidates' gender ratio. Our instrument is exogenous to departmental gender preferences.

We found that a higher proportion of female colleagues increases the likelihood that female associate professors become full professors. Our findings indicate that forces from the bottom of hierarchical structures induce changes at the top and that the glass ceiling may be broken down due to pressures from female lower-ranked employees. We expect the glass ceiling to resist more in environments with fewer female candidates. Policy-makers should promote initiatives aiming at increasing the participation of women as candidates for top positions because this increases the chances of women achieving top positions.

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Appendices

A Academic sectors and disciplies

Area 01 - Mathematical and computer sciences

MAT/01 MATHEMATICAL LOGIC
MAT/02 ALGEBRA
MAT/03 GEOMETRY
MAT/04 COMPLEMENTARY MATHEMATICS
MAT/05 MATHEMATICAL ANALYSIS
MAT/06 PROBABILITY AND MATHEMATICAL STATISTICS
MAT/07 MATHEMATICAL PHYSICS
MAT/08 NUMERICAL ANALYSIS
MAT/09 OPERATIONAL RESEARCH
INF/01 COMPUTER SCIENCE

Area 02 - Physical sciences

FIS/01 EXPERIMENTAL PHYSICS
FIS/02 THEORETICAL PHYSICS, MATHEMATICAL MODELS AND METHODS
FIS/03 PHYSICS OF MATTER
FIS/04 NUCLEAR AND SUBNUCLEAR PHYSICS
FIS/05 ASTRONOMY AND ASTROPHYSICS
FIS/06 PHYSICS FOR THE EARTH SYSTEM AND THE CIRCUMTERRESTRIAL MEDIUM
FIS/07 APPLIED PHYSICS (CULTURAL, ENVIRONMENTAL HERITAGE, BIOLOGY AND MEDICINE)
FIS/08 TEACHING AND HISTORY OF PHYSICS

Area 03 - Chemical sciences

CHIM/01 ANALYTICAL CHEMISTRY

CHIM/02 PHYSICAL CHEMISTRY

CHIM/03 GENERAL AND INORGANIC CHEMISTRY

CHIM/04 INDUSTRIAL CHEMISTRY

CHIM/05 SCIENCE AND TECHNOLOGY OF POLYMER MATERIALS

CHIM/06 ORGANIC CHEMISTRY

CHIM/07 CHEMICAL FUNDAMENTALS OF TECHNOLOGIES

CHIM/08 PHARMACEUTICAL CHEMISTRY

CHIM/09 PHARMACEUTICAL TECHNOLOGICAL APPLICATION

CHIM/10 FOOD CHEMISTRY

CHIM/11 CHEMISTRY AND BIOTECHNOLOGY OF FERMENTATIONS

CHIM/12 CHEMISTRY OF THE ENVIRONMENT AND CULTURAL HERITAGE

Area 04 - Earth sciences

GEO/01 PALEONTOLOGY AND PALEOECOLOGY

GEO/02 STRATIGRAPHIC AND SEDIMENTOLOGICAL GEOLOGY

GEO/03 STRUCTURAL GEOLOGY

GEO/04 PHYSICAL GEOGRAPHY AND GEOMORPHOLOGY

GEO/05 APPLIED GEOLOGY

GEO/06 MINERALOGY

GEO/07 PETROLOGY AND PETROGRAPHY

GEO/08 GEOCHEMISTRY AND VOLCANOLOGY

GEO/09 MINERAL RESOURCES AND MINERALOGICAL-PETROGRAPHIC APPLICATIONS FOR THE ENVIRONMENT AND CULTURAL HERITAGE

GEO/10 GEOPHYSICS OF THE SOLID EARTH

GEO/11 APPLIED GEOPHYSICS

GEO/12 OCEANOGRAPHY AND ATMOSPHERIC PHYSICS

Area 05 - Biological sciences

BIO/01 GENERAL BOTANY

BIO/02 SYSTEMATIC BOTANY

BIO/03 ENVIRONMENTAL AND APPLIED BOTANY

BIO/04 PLANT PHYSIOLOGY

BIO/05 ZOOLOGY

BIO/06 COMPARATIVE ANATOMY AND CYTOLOGY

BIO/07 ECOLOGY

BIO/08 ANTHROPOLOGY

BIO/09 PHYSIOLOGY

BIO/10 BIOCHEMISTRY

BIO/11 MOLECULAR BIOLOGY

BIO/12 CLINICAL BIOCHEMISTRY AND CLINICAL MOLECULAR BIOLOGY

BIO/13 APPLIED BIOLOGY

BIO/14 PHARMACOLOGY

BIO/15 PHARMACEUTICAL BIOLOGY

BIO/16 HUMAN ANATOMY

BIO/17 HISTOLOGY

BIO/18 GENETICS

BIO/19 GENERAL MICROBIOLOGY

Area 06 - Medical sciences

MED/01 MEDICAL STATISTICS

MED/02 HISTORY OF MEDICINE

MED/03 MEDICAL GENETICS

MED/04 GENERAL PATHOLOGY

MED/05 CLINICAL PATHOLOGY

MED/06 MEDICAL ONCOLOGY

MED/07 MICROBIOLOGY AND CLINICAL MICROBIOLOGY

MED/08 PATHOLOGICAL ANATOMY

MED/09 INTERNAL MEDICINE

MED/10 RESPIRATORY SYSTEM DISEASES

MED/11 DISEASES OF THE CARDIOVASCULAR SYSTEM

MED/12 GASTROENTEROLOGY

MED/13 ENDOCRINOLOGY

MED/14 NEPHROLOGY

MED/15 BLOOD DISEASES

MED/16 RHEUMATOLOGY

MED/17 INFECTIOUS DISEASES

MED/18 GENERAL SURGERY

MED/19 PLASTIC SURGERY

MED/20 PEDIATRIC AND CHILDHOOD SURGERY

MED/21 THORACIC SURGERY

MED/22 VASCULAR SURGERY

MED/23 CARDIAC SURGERY

MED/24 UROLOGY

MED/25 PSYCHIATRY

MED/26 NEUROLOGY

MED/27 NEUROSURGERY

MED/28 DENTAL DISEASES

MED/29 MAXILLOFACIAL SURGERY

MED/30 VISUAL SYSTEM DISEASES

MED/31 ENT

MED/32 AUDIOLOGY

MED/33 LOCOMOTOR SYSTEM DISEASES

MED/34 PHYSICAL AND REHABILITATION MEDICINE

MED/35 SKIN AND VENEREAL DISEASES

MED/36 DIAGNOSTIC IMAGING AND RADIOTHERAPY

MED/37 NEURORADIALOGY
MED/38 GENERAL AND SPECIALIST PEDIATRICS
MED/39 CHILD NEUROPSYCHIATRY
MED/40 GYNECOLOGY AND OBSTETRICS
MED/41 ANESTHESIOLOGY
MED/42 GENERAL AND APPLIED HYGIENE
MED/43 FORENSIC MEDICINE
MED/44 WORKPLACE MEDICINE
MED/45 GENERAL, CLINICAL AND PEDIATRIC NURSING SCIENCES
MED/46 TECHNICAL SCIENCES OF LABORATORY MEDICINE
MED/47 OBSTETRIC-GYNECOLOGICAL NURSING SCIENCES
MED/48 NURSING SCIENCES AND NEURO-PSYCHIATRIC AND REHABILITATION TECHNIQUES
MED/49 APPLIED TECHNICAL DIETETICAL SCIENCES
MED/50 APPLIED MEDICAL TECHNICAL SCIENCES

Area 07 - Agricultural and veterinary sciences

AGR/01 ECONOMY AND RURAL ESTIMATE
AGR/02 AGRONOMY AND HERBACEOUS CROPS
AGR/03 GENERAL ARBORICULTURE AND TREE CROPS
AGR/04 HORTICULTURE AND FLORICULTURE
AGR/05 FORESTRY AND FORESTRY MANAGEMENT
AGR/06 WOOD TECHNOLOGY AND FORESTRY USE
AGR/07 AGRICULTURAL GENETICS
AGR/08 AGRICULTURAL PLUMBING AND PLUMBING-FORESTRY SYSTEMS
AGR/09 AGRICULTURAL MECHANICS
AGR/10 RURAL BUILDINGS AND AGROFORESTRY LAND
AGR/11 GENERAL AND APPLIED ENTOMOLOGY
AGR/12 PLANT PATHOLOGY

AGR/13 AGRICULTURAL CHEMISTRY

AGR/14 PEDOLOGY

AGR/15 FOOD SCIENCE AND TECHNOLOGY

AGR/16 AGRICULTURAL MICROBIOLOGY

AGR/17 GENERAL ZOOTECHNICS AND GENETIC IMPROVEMENT

AGR/18 NUTRITION AND ANIMAL FOOD

AGR/19 SPECIAL ZOOTECHNICS

AGR/20 ZOOCULTURES

VET/01 ANATOMY OF DOMESTIC ANIMALS

VET/02 VETERINARY PHYSIOLOGY

VET/03 GENERAL PATHOLOGY AND VETERINARY PATHOLOGICAL ANATOMY

VET/04 INSPECTION OF FOOD OF ANIMAL ORIGIN

VET/05 INFECTIOUS DISEASES OF DOMESTIC ANIMALS

VET/06 PARASITOLOGY AND PARASITIC DISEASES OF ANIMALS

VET/07 VETERINARY PHARMACOLOGY AND TOXICOLOGY

VET/08 VETERINARY MEDICAL CLINIC

VET/09 VETERINARY SURGICAL CLINIC

VET/10 VETERINARY OBSTETRICS AND GYNECOLOGY CLINIC

Area 08 - Civil Engineering and Architecture

ICAR/01 HYDRAULIC

ICAR/02 HYDRAULIC AND MARINE CONSTRUCTIONS AND HYDROLOGY

ICAR/03 HEALTH-ENVIRONMENTAL ENGINEERING

ICAR/04 ROADS, RAILWAYS AND AIRPORTS

ICAR/05 TRANSPORT

ICAR/06 TOPOGRAPHY AND CARTOGRAPHY

ICAR/07 GEOTECHNICAL

ICAR/08 CONSTRUCTION SCIENCE

ICAR/09 CONSTRUCTION TECHNIQUE

ICAR/10 TECHNICAL ARCHITECTURE

ICAR/11 BUILDING PRODUCTION

ICAR/12 ARCHITECTURE TECHNOLOGY

ICAR/13 INDUSTRIAL DESIGN

ICAR/14 ARCHITECTURAL AND URBAN COMPOSITION

ICAR/15 LANDSCAPE ARCHITECTURE

ICAR/16 INTERIOR ARCHITECTURE AND EQUIPMENT

ICAR/17 DRAWING

ICAR/18 HISTORY OF ARCHITECTURE

ICAR/19 RESTORATION

ICAR/20 TECHNIQUE AND URBAN PLANNING

ICAR/21 URBAN PLANNING

ICAR/22 ESTIMATE

Area 09 - Industrial and information engineering

ING-IND/01 NAVAL ARCHITECTURE

ING-IND/02 NAVAL AND MARINE CONSTRUCTION AND SYSTEMS

ING-IND/03 FLIGHT MECHANICS

ING-IND/04 AEROSPACE CONSTRUCTION AND STRUCTURES

ING-IND/05 AEROSPACE PLANTS AND SYSTEMS

ING-IND/06 FLUID DYNAMICS

ING-IND/07 AEROSPACE PROPULSION

ING-IND/08 FLUID MACHINES

ING-IND/09 SYSTEMS FOR ENERGY AND THE ENVIRONMENT

ING-IND/10 INDUSTRIAL TECHNICAL PHYSICS

ING-IND/11 ENVIRONMENTAL TECHNICAL PHYSICS

ING-IND/12 MECHANICAL AND THERMAL MEASUREMENTS

ING-IND/13 MECHANICS APPLIED TO MACHINES

ING-IND/14 MECHANICAL DESIGN AND CONSTRUCTION OF MACHINES

ING-IND/15 DESIGN AND METHODS OF INDUSTRIAL ENGINEERING

ING-IND/16 TECHNOLOGIES AND PROCESSING SYSTEMS

ING-IND/17 MECHANICAL INDUSTRIAL SYSTEMS

ING-IND/18 PHYSICS OF NUCLEAR REACTORS

ING-IND/19 NUCLEAR PLANTS

ING-IND/20 NUCLEAR MEASUREMENTS AND INSTRUMENTATION

ING-IND/21 METALLURGY

ING-IND/22 MATERIALS SCIENCE AND TECHNOLOGY

ING-IND/23 APPLIED PHYSICAL CHEMISTRY

ING-IND/24 PRINCIPLES OF CHEMICAL ENGINEERING

ING-IND/25 CHEMICAL PLANTS

ING-IND/26 THEORY OF THE DEVELOPMENT OF CHEMICAL PROCESSES

ING-IND/27 INDUSTRIAL AND TECHNOLOGICAL CHEMISTRY

ING-IND/28 ENGINEERING AND SAFETY OF EXCAVATIONS

ING-IND/29 RAW MATERIALS ENGINEERING

ING-IND/30 HYDROCARBONS AND SUBSOIL FLUIDS

ING-IND/31 ELECTROTECHNICS

ING-IND/32 CONVERTERS, ELECTRICAL MACHINES AND DRIVES

ING-IND/33 ELECTRICAL SYSTEMS FOR ENERGY

ING-IND/34 INDUSTRIAL BIOENGINEERING

ING-IND/35 ECONOMIC-MANAGEMENT ENGINEERING

ING-INF/01 ELECTRONICS

ING-INF/02 ELECTROMAGNETIC FIELDS

ING-INF/03 TELECOMMUNICATIONS

ING-INF/04 AUTOMATIC

ING-INF/05 INFORMATION PROCESSING SYSTEMS

ING-INF/06 ELECTRONIC AND COMPUTER BIOENGINEERING

ING-INF/07 ELECTRICAL AND ELECTRONIC MEASUREMENTS

Area 10 - Ancient, philological-literary and historical-artistic sciences

L-ANT/01 PREHISTORY AND PROTOHISTORY

L-ANT/02 GREEK HISTORY

L-ANT/03 ROMAN HISTORY

L-ANT/04 NUMISMATICS

L-ANT/05 PAPIROLOGY

L-ANT/06 ETRUSCOLOGY AND ITALIC ANTIQUITIES

L-ANT/07 CLASSICAL ARCHEOLOGY

L-ANT/08 CHRISTIAN AND MEDIEVAL ARCHEOLOGY

L-ANT/09 ANCIENT TOPOGRAPHY

L-ANT/10 METHODOLOGIES OF ARCHAEOLOGICAL RESEARCH

L-ART/01 HISTORY OF MEDIEVAL ART

L-ART/02 HISTORY OF MODERN ART

L-ART/03 HISTORY OF CONTEMPORARY ART

L-ART/04 MUSEOLOGY AND ARTISTIC AND RESTORATION CRITICISM

L-ART/05 ENTERTAINMENT DISCIPLINES

L-ART/06 CINEMA, PHOTOGRAPHY AND TELEVISION

L-ART/07 MUSICOLOGY AND HISTORY OF MUSIC

L-ART/08 ETHNOMUSICOLOGY

L-FIL-LET/01 EGEE CIVILIZATION

L-FIL-LET/02 GREEK LANGUAGE AND LITERATURE

L-FIL-LET/03 ITALIC, ILLYRIAN, CELTIC PHILOLOGY

L-FIL-LET/04 LATIN LANGUAGE AND LITERATURE

L-FIL-LET/05 CLASSICAL PHILOLOGY

L-FIL-LET/06 ANCIENT CHRISTIAN LITERATURE

L-FIL-LET/07 BYZANTINE CIVILIZATION

L-FIL-LET/08 MEDIEVAL AND HUMANISTIC LATIN LITERATURE

L-FIL-LET/09 NOVEL PHILOLOGY AND LINGUISTICS

L-FIL-LET/10 ITALIAN LITERATURE

L-FIL-LET/11 CONTEMPORARY ITALIAN LITERATURE

L-FIL-LET/12 ITALIAN LINGUISTICS

L-FIL-LET/13 PHILOLOGY OF ITALIAN LITERATURE

L-FIL-LET/14 LITERARY CRITICISM AND COMPARATIVE LITERATURE

L-FIL-LET/15 GERMAN PHILOLOGY

L-LIN/01 GLOTTOLOGY AND LINGUISTICS

L-LIN/02 TEACHING OF MODERN LANGUAGES

L-LIN/03 FRENCH LITERATURE

L-LIN/04 LANGUAGE AND TRANSLATION - FRENCH LANGUAGE

L-LIN/05 SPANISH LITERATURE

L-LIN/06 HISPANIC AMERICAN LANGUAGE AND LITERATURE

L-LIN/07 LANGUAGE AND TRANSLATION - SPANISH LANGUAGE

L-LIN/08 PORTUGUESE AND BRAZILIAN LITERATURE

L-LIN/09 LANGUAGE AND TRANSLATION - PORTUGUESE AND BRAZILIAN LANGUAGES

L-LIN/10 ENGLISH LITERATURE

L-LIN/11 ANGLO-AMERICAN LANGUAGES AND LITERATURES

L-LIN/12 LANGUAGE AND TRANSLATION - ENGLISH LANGUAGE

L-LIN/13 GERMAN LITERATURE

L-LIN/14 LANGUAGE AND TRANSLATION - GERMAN LANGUAGE

L-LIN/15 NORDIC LANGUAGES AND LITERATURES

L-LIN/16 NETHERLANDS LANGUAGE AND LITERATURE

L-LIN/17 ROMANIAN LANGUAGE AND LITERATURE

L-LIN/18 ALBANIAN LANGUAGE AND LITERATURE

L-LIN/19 FINNISH-UGR PHILOLOGY

L-LIN/20 NEW GREEK LANGUAGE AND LITERATURE

L-LIN/21 SLAVISTICS

L-OR/01 HISTORY OF THE ANCIENT NEAR EAST

L-OR/02 EGYPTOLOGY AND COPTIC CIVILIZATION

L-OR/03 ASYRIOLOGY

L-OR/04 ANATOLISTIC

L-OR/05 ARCHEOLOGY AND HISTORY OF ART OF THE ANCIENT NEAR EAST

L-OR/06 PHENICIAN-PUNIC ARCHEOLOGY

L-OR/07 SEMITICS - LANGUAGES AND LITERATURES OF ETHIOPIA

L-OR/08 HEBREW

L-OR/09 LANGUAGES AND LITERATURES OF AFRICA

L-OR/10 HISTORY OF ISLAMIC COUNTRIES

L-OR/11 ARCHEOLOGY AND HISTORY OF MUSLIM ART

L-OR/12 ARABIC LANGUAGE AND LITERATURE

L-OR/13 ARMENISTICS, CAUCASOLOGY, MONGOLISTICS AND TURCOLOGY

L-OR/14 PHILOLOGY, RELIGIONS AND HISTORY OF IRAN

L-OR/15 PERSIAN LANGUAGE AND LITERATURE

L-OR/16 ARCHEOLOGY AND HISTORY OF ART OF INDIA AND CENTRAL ASIA

L-OR/17 PHILOSOPHIES, RELIGIONS AND HISTORY OF INDIA AND CENTRAL ASIA

L-OR/18 INDOLOGY AND TIBETHOLOGY

L-OR/19 MODERN LANGUAGES AND LITERATURES OF THE INDIAN SUBCONTINENT

L-OR/20 ARCHEOLOGY, HISTORY OF ART AND PHILOSOPHIES OF EAST ASIA

L-OR/21 LANGUAGES AND LITERATURES OF CHINA AND SOUTH-EASTERN ASIA

L-OR/22 LANGUAGES AND LITERATURES OF JAPAN AND KOREA

L-OR/23 HISTORY OF EAST AND SOUTH-EASTERN ASIA

Area 11 - Historical, philosophical, pedagogical and psychological sciences

M-STO/01 MEDIEVAL HISTORY

M-STO/02 MODERN HISTORY

M-STO/03 HISTORY OF EASTERN EUROPE

M-STO/04 CONTEMPORARY HISTORY

M-STO/05 HISTORY OF SCIENCE AND TECHNIQUES

M-STO/06 HISTORY OF RELIGIONS

M-STO/07 HISTORY OF CHRISTIANITY AND THE CHURCHES

M-STO/08 ARCHIVING, BIBLIOGRAPHY AND LIBRARY ECONOMY

M-STO/09 PALEOGRAPHY

M-DEA/01 DEMOETHNOANTHROPOLOGICAL DISCIPLINES

M-GGR/01 GEOGRAPHY

M-GGR/02 ECONOMIC-POLITICAL GEOGRAPHY

M-FIL/01 THEORETICAL PHILOSOPHY

M-FIL/02 LOGIC AND PHILOSOPHY OF SCIENCE

M-FIL/03 MORAL PHILOSOPHY

M-FIL/04 AESTHETICS

M-FIL/05 PHILOSOPHY AND THEORY OF LANGUAGES

M-FIL/06 HISTORY OF PHILOSOPHY

M-FIL/07 HISTORY OF ANCIENT PHILOSOPHY

M-FIL/08 HISTORY OF MEDIEVAL PHILOSOPHY

M-PED/01 GENERAL AND SOCIAL PEDAGOGY

M-PED/02 HISTORY OF PEDAGOGY

M-PED/03 TEACHING AND SPECIAL PEDAGOGY

M-PED/04 EXPERIMENTAL PEDAGOGY

M-PSI/01 GENERAL PSYCHOLOGY

M-PSI/02 PSYCHOBIOLOGY AND PHYSIOLOGICAL PSYCHOLOGY

M-PSI/03 PSYCHOMETRY

M-PSI/04 DEVELOPMENTAL PSYCHOLOGY AND EDUCATIONAL PSYCHOLOGY

M-PSI/05 SOCIAL PSYCHOLOGY

M-PSI/06 PSYCHOLOGY OF WORK AND ORGANIZATIONS

M-PSI/07 DYNAMIC PSYCHOLOGY

M-PSI/08 CLINICAL PSYCHOLOGY

M-EDF/01 METHODS AND TEACHINGS OF MOTOR ACTIVITIES

M-EDF/02 METHODS AND TEACHINGS OF SPORTS ACTIVITIES

Area 12 - Legal sciences

IUS/01 PRIVATE LAW

IUS/02 COMPARATIVE PRIVATE LAW

IUS/03 AGRICULTURAL LAW

IUS/04 COMMERCIAL LAW

IUS/05 ECONOMIC LAW

IUS/06 NAVIGATION LAW

IUS/07 LABOR LAW

IUS/08 CONSTITUTIONAL LAW

IUS/09 INSTITUTIONS OF PUBLIC LAW

IUS/10 ADMINISTRATIVE LAW

IUS/11 CANON LAW AND ECCLESIASTICAL LAW

IUS/12 TAX LAW

IUS/13 INTERNATIONAL LAW

IUS/14 EUROPEAN UNION LAW

IUS/15 CIVIL PROCEDURAL LAW

IUS/16 CRIMINAL PROCEDURE LAW

IUS/17 CRIMINAL LAW

IUS/18 ROMAN LAW AND ANCIENT LAW

IUS/19 HISTORY OF MEDIEVAL AND MODERN LAW

IUS/20 PHILOSOPHY OF LAW

IUS/21 COMPARATIVE PUBLIC LAW

Area 13 - Economic sciences and statistics

SECS-P/01 POLITICAL ECONOMY

SECS P/02 ECONOMIC POLICY

SECS-P/03 FINANCIAL SCIENCE

SECS-P/04 HISTORY OF ECONOMIC THOUGHT

SECS-P/05 ECONOMETRY

SECS-P/06 APPLIED ECONOMICS

SECS-P/07 BUSINESS ECONOMICS
SECS-P/08 ECONOMICS AND BUSINESS MANAGEMENT
SECS-P/09 CORPORATE FINANCE
SECS-P/10 CORPORATE ORGANIZATION
SECS-P/11 ECONOMICS OF FINANCIAL INTERMEDIARIES
SECS-P/12 ECONOMIC HISTORY
SECS-P/13 PRODUCT SCIENCES
SECS-S/01 STATISTICS
SECS-S/02 STATISTICS FOR EXPERIMENTAL AND TECHNOLOGICAL RESEARCH
SECS-S/03 ECONOMIC STATISTICS
SECS-S/04 DEMOGRAPHY
SECS-S/05 SOCIAL STATISTICS
SECS-S/06 MATHEMATICAL METHODS OF ECONOMICS AND ACTUARIAL AND FINANCIAL SCIENCES

Area 14 - Political and social sciences

SPS/01 POLITICAL PHILOSOPHY
SPS/02 HISTORY OF POLITICAL DOCTRINES
SPS/03 HISTORY OF POLITICAL INSTITUTIONS
SPS/04 POLITICAL SCIENCE
SPS/05 HISTORY AND INSTITUTIONS OF THE AMERICAS
SPS/06 HISTORY OF INTERNATIONAL RELATIONS
SPS/07 GENERAL SOCIOLOGY
SPS/08 SOCIOLOGY OF CULTURAL AND COMMUNICATIVE PROCESSES
SPS/09 SOCIOLOGY OF ECONOMIC PROCESSES AND WORK
SPS/10 SOCIOLOGY OF THE ENVIRONMENT AND TERRITORY
SPS/11 SOCIOLOGY OF POLITICAL PHENOMENA
SPS/12 LEGAL SOCIOLOGY, DEVIANCE AND SOCIAL CHANGE
SPS/13 HISTORY AND INSTITUTIONS OF AFRICA

SPS/14 HISTORY AND INSTITUTIONS OF ASIA