

Gender disparities in career progression in Italian academia: a regional perspective

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Sintesi. Questo articolo presenta un'analisi dettagliata delle disparità di genere nella progressione di carriera all'interno delle università italiane, secondo una prospettiva regionale. Utilizzando un'analisi statistica completa di tutto il personale accademico presente nelle università italiane dal 2000 al 2023, valutiamo come e in che misura persistano differenze di genere nel raggiungimento della posizione di professore ordinario nei diversi ambiti scientifici e nelle varie regioni. I nostri risultati mettono in evidenza la persistenza delle disparità di genere e l'entità del "soffitto di cristallo" nel mondo accademico, offrendo una panoramica basata sui dati delle difficoltà che le donne incontrano nell'avanzare verso posizioni accademiche senior

Abstract. This paper presents a detailed analysis of gender disparities in career progression within Italian universities from a regional perspective. Using a comprehensive statistical analysis of all scholars enrolled in Italian universities from 2000 to 2023, we assess how and to what extent gender differences persist in achieving full professorship across scientific fields and regions. Our findings highlight the persistence of gender disparities and the extent of the glass ceiling effect in academia, providing a data-driven overview of the difficulties faced by women in advancing to senior academic positions.

Keywords: Inequality, Gender bias, Academic career, Glass ceiling.

JEL codes: I23, C35

Introduction

According to recent legislation¹ on gender equality, public administrations (PAs) must consistently report data disaggregated by gender, ensuring transparency in differentiating information for men and women. The Italian Department for Equal Opportunities recently issued a directive² that faces significant implementation challenges, particularly within universities. As both public institutions and workplaces, universities are expected to demonstrate a heightened commitment to gender equality. This expectation arises from the universities' role as exemplars within society. In this paper, we examine the careers of all scholars in Italian universities from 2000 to 2023, paying special attention to the gender dimension. Specifically, we analyze the career trajectories of scholars enrolled in Italian universities during the new century, considering their career progression over the entire period and investigating whether the probability to be promoted to the highest levels is influenced by gender or other factors such as research area or region. To account for all these factors, a logistic regression is applied to estimate the probability of promotion. The rest of the paper is organized as

¹ Decree-law 36/2022

² The guidelines "Linee guida sulla parità di genere nell'organizzazione e gestione del rapporto di lavoro con le pubbliche amministrazioni" have been elaborated in line with the contents of article 5 of decree-law 36/2022 and were enacted on 06/10/2022

follows. Section 2 is dedicated to the literature review. In Section 3, the Italian academic system is presented, focusing on role classification, the classification of scientific research areas, and the geographical distribution of academia across the country. Section 4 begins with a description of the dataset and the variables considered, followed by a presentation of the statistical models used. Section 5 provides a detailed overview of all the qualitative variables considered in our analysis, including their distributions where relevant. In Section 6, the empirical results are presented, and finally, in Section 7, we provide conclusions and final remarks.

Literature review

The economic, social, and cultural differences between Northern and Southern Italy are well-documented in various studies (see, for example, Aiello and Scoppa (2000), Andreotti et al (2013), Aiello and Pupo (2012), and references therein). Interestingly, our study reveals that these differences are almost entirely nullified when considering the status of women in top university positions. This finding aligns with several studies on gender disparities in academia, where various hypotheses have been proposed over the last decades. In Bailyn (2003), which analyzes the findings of the report *A Study on the Status of Women Faculty in Science at MIT*, it is already highlighted that certain aspects of academic careers are influenced by practices that are inherent at both the individual and institutional levels, disadvantaging women. Innate discrepancies between genders are considered by Sapienza et al (2009), while differences in career goals and interests are studied by van Anders (2004); Van den Besselaar and Sandström (2016). Explicit and implicit biases against female academics are documented in Budden et al (2008).

Additionally, several studies consider the reluctance of women to seek promotion (van Anders, 2004; Van den Besselaar and Sandström, 2016; Sapienza et al, 2009; Budden et al, 2008; Filandri and Pasqua, 2021; Eslen-Ziya and Yildirim, 2022), while networking practices influenced by gender contribute to the marginalization of women in academia (Benschop, 2009). The literature provides evidence that men scientists often dedicate more time to research whereas women are often assigned a greater workload of teaching and administrative tasks (Bailyn, 2003; Beaudry and Larivière, 2016; Misra et al, 2012; Guarino and Borden, 2017). Even in nations known for their gender equality, systemic gender bias persists in academia, often in subtle forms, greatly affecting a mother's capacity to succeed in a merit-based environment (Thun, 2020; Brommesson et al, 2022).

While some important experiences have been done in the direction to transform the gendered academic dynamics (Parsons and Priola, 2013; Van den Brink and Benschop, 2012), gender inequalities represent a structural phenomenon and changes in this area occur gradually and slowly. As pointed out in (Picardi, 2019), universities, which are often considered neutral places, actually generate gendered practices that lead to gender inequalities, especially during the initial phase of recruitment and in the attainment of high-level positions. The dynamics that create these inequalities often remain hidden.

Among all the positions in academia, women are particularly underrepresented in science, and gender inequalities are especially evident at the latest stages of the academic career when the 'leak' of female scientists out of the academic world is much larger than that of male (O'Brien and Hapgood, 2012), and the glass ceiling phenomenon is observed. For example, although the four Nordic countries (Denmark, Finland, Norway, Sweden) are considered as the most progressive in women's rights between European countries, in these nations for each female scientist there are two male colleagues (Euro-pean Commission, 2021). The slow pace of career advancement for women in Dutch universities is studied in Van den Brink and Benschop (2012), where a multilevel analysis seeks to understand why efforts to improve policies for the recruitment and selection of full professors do not have the desired effects in terms of equal opportunities for women. The

underrepresentation of women in worldwide academia and their very slow career advancement is also highlighted in the review work of Cama et al (2016).

Regarding the statistical model we chose to analyze career advancement, the use of logistic regression is not new in the context of data on academic promotion (Beasley et al, 2006; Filandri and Pasqua, 2021; De Paola and Scoppa, 2015). The novelty of our work lies in the comprehensive analysis of the entire Italian university system to gain a deeper understanding of the overall situation. In a recent study (Falco et al, 2023), the entire dataset was considered, but all scholars with the same name were excluded, significantly reducing the sample size.

The Italian system

In this subsection, we will clarify how university roles are classified in Italian universities, how the macro areas of research are categorized, how universities are classified, and how they are distributed throughout the Italian territory.

Academic role classification

Over the last 30 years, Italian academic roles have undergone numerous changes in denomination and classification. Here, we have developed a classification that aligns with the European standard and encompasses all the diverse roles still present in Italian universities. Grade A is the highest level in academia. In Italy, according to MIUR classifications, this corresponds to the role of “Ordinario”, also known as the Full Professor level, alternatively referred to as “Professore di prima fascia”. Grade B corresponds to the position of Associate Professor or “Professore di seconda fascia” in Italian academia. Grade C corresponds to the position of “Ricercatore RtdB”. This position has existed since 2010, and after three years, scholars become Associate Professors, i.e., Grade B, if they obtain the corresponding qualification³. Grade D is introduced to account for the “Ricercatore RtdA” position, which is a tenure track position. This position also existed from 2010, but it does not have an automatic promotion to the upper level, so after three or five years, if you don’t get another position such as RtdB, you no longer belong to academia. In Italian academia, there is also a position called “Ricercatori universitari a tempo indeterminato”, which can be translated as the tenured assistant professor position. This role seems to exist only in a few European countries and is equivalent to a permanent position at Grade C, where tenured positions are not typically found. Grade E is used to describe this group of tenured assistant professors. Moreover, in Italian academia, there still exist some different roles due to temporary laws, which very often in Italy become permanent laws, where very few people are enrolled at those levels. They are classified within one of the previous grades according to the tasks and duties of the different positions.

Academic research area classification

Italian academic research areas are divided into 14 macro areas. They are described in Table 1. Every area contains different scientific disciplinary sectors, referred to in Italian as “Settore Scientifico Disciplinare” (SSD). There is a total of 370 SSD whose number vary in different disciplinary area. Although STEM (Science, Technology, Engineering, and Mathematics) disciplines are related to the classification of degree courses, we can consider Areas 1 to 4 and Area 9 as STEM areas. In Table 1 we report also the total number of scholar in each macro areas at the end of 2023, and for the same period the percentage of women. We notice a large heterogeneity in the number of scholars across macro-areas. In only three sectors (05 Biology, and 10 Antiquities, philology, literary studies, and art history) is the percentage of women equal to or greater than 50%, while in Sector 11 (History, philosophy, pedagogy, and psychology), it almost reaches 50%. Four macro-areas of research have

³ From 2024, RtdB and RtdA no longer exist and are replaced by the *Research Tenure Track (RTT)* position.

a percentage of women less than 30%, with the lowest level reached by sector 09 (Industrial and information engineering), with 20.62% of women.

Table 1 Code, name, number of SSDs, and total number of scholars for the 14 research areas. The SSDs M-EDF/01 and M-EDF/02, present in both area 06 and area 11, are counted only once in the overall total. Year 2023.

Code	Name	SSD	Scholars	% women
01	Mathematics and informatics	10	3601	29.63
02	Physics	8	2792	23.39
03	Chemistry	12	3312	50.00
04	Earth sciences	12	1192	29.45
05	Biology	19	5402	56.03
06	Medicine	52	9682	38.19
07	Agricultural and veterinary sciences	30	3439	42.83
08	Civil engineering and architecture	25	4106	38.41
09	Industrial and information engineering	39	7231	20.62
10	Antiquities, philology, literary st., art history	77	5219	54.56
11	History, philosophy, pedagogy and psychology	34	4998	49.57
12	Law	21	4998	40.20
13	Economics and statistics	19	5769	39.76
14	Political and social sciences	14	1977	41.83
Tot		370	63703	39.94

Geographical distribution of Italian universities

In Italy in 2023, there were 98 universities. The names of these universities, listed in alphabetical order as recorded in the MUR database, along with their types (the majority being national, 17 private, and 11 online), and their respective geographical regions are reported in Appendix 1. In Table 2, we report the number of universities and the number of scholars for each of the 20 political regions in Italy, along with the percentage of women. For further details on this indicator, please refer to the bottom panels of Figure 1. The percentage of women ranges from 31% in Trentino AA (North) to 44% in Valle d'Aosta (also located in the North). Moreover, only the 12% of the universities have a female rector (or dean). This is the first indicator of how difficult it is to break the glass ceiling in Italian universities. Specifically, only 12 universities in Italy are led by a female leader. In terms of territorial distribution, the majority of universities, totaling 33, are located in the North of Italy, with 14 of them situated in Lombardy. In the central part of Italy, there are 31 universities, while in the South, there are 23 universities. If the number of universities can be considered as an indicator of regional educational development or institutional density (Guironnet and Peypoch, 2018), these figures underscore the substantial variation between the North and South of Italy.

Data and methods

We refer to data available on the web site of the Italian Ministry of University and Research (MUR) Ministry of University and Research (2000). We have assembled a dataset covering all scholars in Italian universities from 2000 to 2023. We merged the downloaded data for each year and each area. Unfortunately, we do not have a unique identification code for each scholar, and name is not unique. After removing scholars with exactly the same name, university, and area, we obtained a total of 109,239 observations. We further eliminated nearly 600 scholars because they either had the same

name but changed research area (among the 14 considered) or were demoted in their academic role (e.g., from full professor to associate professor). Moreover almost 1700 scholars in the Telematica Universities will not be included in the modelling the promotion. For each scholar, we recorded their position and the university where they served at the end of each year. This information allowed us to reconstruct their careers, including all promotions, and track their mobility. Additionally, we have data on each scholar's gender, macro sector, and disciplinary scientific sector. The number of scholars present in the dataset in 2000 and still present in 2023 is 14,692, so they were followed for the entire period. We are primarily interested in promotions from Grade B to Grade A, but we also consider promotions from Grade E to Grade B. In the first case, we analyze approximately 30,000 individuals (29,214 to be precise) after excluding individuals who held the position of Associate Professor in 2000, as we were unable to estimate their date of entry. For promotions from Grade E to Grade B, we encountered the same issue, along with an additional one. Since Grade E positions no longer exist, government incentives were introduced in the last two years to accelerate promotions. During this period, 40% of researchers were promoted. To properly assess gender effects on promotions, we excluded those promoted during these last two years. After also removing individuals who already held a Grade E position in 2000, the final sample for this analysis consisted of just over 21,000 individuals (21,983, to be precise).

Summary statistics (mean, standard deviation, median, minimum, and maximum) for waiting times for promotion from Grade E to Grade B are reported in Table 3, while those for promotion from Grade B to Grade A are presented in Table 4. A detailed overview of all the variables considered in our analysis, including their distributions where relevant, is postponed to Section 5.

Table 2 Name, number of universities and number of scholar in each of the 20 Italian political region. Year 2023.

Region	University	Scholars	Female %
PIEMONTE	4	4026	40.19
VALLE D'AOSTA	1	56	44.64
LOMBARDIA	14	10395	39.15
TRENTINO-ALTO ADIGE	2	1113	31.09
VENETO	4	4410	39.61
FRIULI-VENEZIA GIULIA	3	1492	33.24
LIGURIA	1	1408	39.56
EMILIA ROMAGNA	4	6059	40.88
TOSCANA	7	4786	39.01
UMBRIA	2	1040	40.86
MARCHE	4	1629	42.26
LAZIO	13	7282	39.54
ABRUZZO	4	1726	40.85
MOLISE	1	321	34.58
CAMPANIA	7	6059	42.65
PUGLIA	5	3083	41.32
BASILICATA	1	323	38.08
CALABRIA	4	1495	39.93
SICILIA	4	4396	41.40
SARDEGNA	2	1755	39.03
ONLINE	11	849	40.75
Total	98	63703	39.94

Table 3 Waiting time statistics for promotion from Grade E to Grade B, by Italian region and gender.

Region	Mean	Std. Dev.	Median	Min	Max
Piemonte	9.82	3.95	10.0	1	22
Valle d' Aosta	7.89	4.86	7.5	1	18
Lombardia	10.07	4.17	10.0	1	21
Trentino-Alto Adige	8.81	3.79	9.0	1	21
Veneto	9.48	3.99	9.0	1	22
Friuli-Venezia Giulia	10.24	4.37	10.0	1	21
Liguria	9.47	3.93	9.0	1	21
Emilia Romagna	10.05	4.17	10.0	1	21
Toscana	10.21	4.40	10.0	1	21
Umbria	10.44	4.14	10.0	1	21
Marche	10.55	4.31	10.0	1	21
Lazio	10.52	4.52	10.0	1	22
Abruzzo	10.29	4.27	10.0	1	21
Molise	9.34	5.78	8.0	1	21
Campania	10.69	4.34	11.0	1	21
Puglia	11.41	5.07	12.0	1	22
Basilicata	10.92	4.30	11.0	3	21
Calabria	11.21	4.59	11.0	1	22
Sicilia	10.44	4.39	10.0	1	22
Sardegna	10.51	4.37	11.0	1	21
Male	9.84	4.30	10.0	1	22
Female	10.91	4.35	11.0	1	22
Total	10.30	4.35	10.0	1	22

Statistical Model

In a first approach we want to understand if the probability to be promoted to the Grade A position is affected by gender bias. We initially consider all academics and do not account for scientific productivity due to two main reasons. The first is that there is a very huge amount of literature that consider the effect of productivity on promotion and it is well known the effect of the so called “productivity gap” in favour of men on promotion. Nevertheless in almost all published works only some subgroups of population corresponding to specific SSD are taken into consideration because reconstructing productivity is very difficult due to the great variety of scientific sectors and the impossibility of defining a homogeneous indicator for productivity. For example, in Mezzetti and Negri (2024) productivity is measured with a new measure and it is included in the model for two subgroups of population.

On the other hand, considering the systemic scarcity of women across various dimensions within the entire Italian university system, as depicted in the next Section 5, our aim is to check if every researcher have equal opportunities for promotion to higher levels given they have attained that academic level. The premise of this idea is that every researcher who has attained an academic level possesses the minimum qualifications required by the SSD and the university to apply for a higher position.

In order to understand how the probability of being promoted is affected by other factors, we consider a logistic regression model where the probability of promotion depends on gender, and we

incorporate fixed effects for the macro-area of research, the geographical region, and other quantities such as the time elapsed before promotion.

Table 4 Waiting time statistics for promotion from Grade B to Grade A, by Italian region and gender.

Region	Mean	Std. Dev.	Median	Min	Max
Piemonte	7.06	3.53	7.0	1	21
Valle d'Aosta	7.78	5.40	6.0	2	17
Lombardia	7.17	3.73	6.0	1	22
Trentino-Alto Adige	7.53	4.23	7.0	1	22
Veneto	7.58	3.90	7.0	1	22
Friuli-Venezia Giulia	8.29	4.49	8.0	1	18
Liguria	7.22	3.80	6.0	1	21
Emilia Romagna	7.82	4.03	7.0	1	21
Toscana	8.38	4.59	7.0	1	22
Umbria	8.18	4.05	8.0	1	18
Marche	7.26	4.17	6.0	1	20
Lazio	7.93	4.34	7.0	1	21
Abruzzo	7.30	4.26	6.0	1	21
Molise	10.63	4.87	10.0	2	21
Campania	7.93	4.25	7.0	1	22
Puglia	7.33	4.49	6.0	1	22
Basilicata	10.00	3.02	10.0	6	14
Calabria	7.64	3.95	7.0	1	18
Sicilia	7.37	4.10	6.0	1	22
Sardegna	7.66	4.22	7.0	1	22
Male	7.42	4.06	6.0	1	22
Female	8.03	4.21	7.0	1	22
Total	7.60	4.11	7.0	1	22

Logistic Regression Models

First, we consider a model for promotion to Grade A from Grade B. In this model, the response variable is the promotion from Associate Professor to Full Professor. We consider only academics who have held the title of "Associate Professor" at least once from 2000 to 2023, totaling nearly 60,000 professors. Let Y_{ijk} represent the response variable for individual i , that at year k , is a researcher in area j , belonging to a university in region h . $Y_{ijk} = 1$ if the researcher is promoted to Full Professor in year k , and $Y_{ijk} = 0$ if the researcher is still an Associate Professor at year k , which is the last time the researcher is observed. Each researcher is observed only once, either at the time of promotion (with $Y_{ijk} = 1$) or at their last observation.

The waiting time is calculated as the duration, in years, that a researcher remains in the position of Associate Professor (Grade B). The waiting time for promotion results in a left and right censored variable. This is because we may not observe the entry time in academia, and the last observation may either be followed by a promotion at a higher level or may never be followed by a promotion. Additionally, we do not know for how much longer the individual will be observed. To address the issue of left censoring, we excluded more than 30,000 individuals who held the position of Associate Professor in 2000, as we were unable to estimate their date of entry.

We model the promotion event with a logistic regression, where a function of the probability to be promoted, denoted as $E(Y_{ijk})$, is a linear function of gender, waiting time, and the squared waiting

time. We include scientific area, region, and year of promotion or year of entry as fixed effects. Online universities were excluded because the mechanisms for career advancement can differ significantly from those in traditional universities.

Descriptive results

Let us give some idea on gender dimension in Italian universities with a focus on the highest position (Grade A). The analysis is done along four different directions: role, research area, geographical region and promotion to highest role. The dynamics between these different aspects and the impact of the first three on the latest one will be analyzed through a statistical model in Section 4.1.

Table 5 Percentage of woman in Italian universities according to the academic role in 2000

Role	Female	Female %	Total
Grade A	1992	13.41%	14850
Grade B	4759	27.87%	17075
Grade E	8551	41.29%	20711
Total	15302	29.10%	52636

Role dimension

At the end of 2023 there were 63703 scholars and 25242 were women (39.94%). Table 6 describe the percentage of women in different role in 2023 in Italy. What is evident from Table 6 is the drastic jump in the percentage of women who hold Grade A. If for the lower grades the percentage is between 42% and 50%, in Grade A it becomes less than 28%. Note that women are nearly at parity only in Grade E, corresponding to the lowest level, with practically zero probability of advancing in the role after 2023.

Table 6 Percentage of woman in Italian universities according to the academic role in 2023

Role	Female	Female %	Total
Grade A	4671	27.91%	16736
Grade B	11255	42.85%	26264
Grade C	2857	41.87%	6824
Grade D	4267	46.97%	9085
Grade E	2392	49.89%	4794
Total	25442	39.94%	63703

If we refer to Table 5, we observe that the situation has only seen a slight improvement over the past 20 years. In 2000, only 29% of Italian scholars were women, but this percentage varies considerably across different roles. At Grade E, it stands at 41%, then decreases to 28% for Grade C, and further to 13% for Grade A. Therefore, from 2000 to 2023, the situation has seen a modest improvement, with the percentage of women in Grade A rising from 13.4% to 27.9%. As explained earlier in Section 3, Grade B and Grade C did not exist in Italian universities in 2000. Another interesting insight into the gender difference in roles is provided by Table 7 and Table 8 where the reported percentage in the first line can be read as penetration rate for Grade A position. In 2000, the distribution of roles among men is almost uniform, with each role having a similar representation. Conversely, among women, it is observed that over 50% occupy the lowest grade, while only 13% are able to attain the highest role, Grade A.

In 2023, the situation becomes slightly less clear with the introduction of five roles instead of three. However, Table 8 reveals a significant gender disparity, notably in the penetration rate for Grade A positions, which stands at only 18% for women compared to 31% for men.

Table 7 Percentage distribution of role with respect to gender in Italian universities in 2000.

Role	Female %	Male %	Total %
Grade A	13.2%	34.44%	28.321%
Grade B	31.1%	32.99%	32.44%
Grade E	55.88%	32.56%	39.35%
Total	100%	100%	100%

Table 8 Percentage of woman in Italian universities according to the academic role in 2023

Role	Female %	Male %	Total %
Grade A	18.35%	31.53%	26.27%
Grade B	44.24%	39.23%	41.23%
Grade C	11.23%	10.37%	10.71%
Grade D	16.77%	12.59%	14.26%
Grade E	9.4%	6.28%	7.53%
Total	100%	100%	100%

Research area dimension

The analysis of the distribution by gender in Grade A across the 14 macro-areas of research is shown in Table 9. In 2023, we observe that in the STEM macro-areas of research, the percentage of women in Grade A remains consistently low, with the lowest percentages being 16% and 14% in Areas 2 and 9 respectively, despite continuous growth since 2000. But what is truly astonishing is that in no area of top-level research do women comprise 50%, even in fields like (5 and 10) where women are the majority.

Another indicator of gender disparity is provided by the femininity ratio, which represents the ratio of women to men. This ratio is reported for the years 2000 and 2023 across the 14 different macro-areas in Table 9. Even today, at the highest level, there are only 37 women for every 100 men. Although the situation has steadily improved over the last 20 years, with a gradual increase from 2000 to 2023 (where there were 16 women in Grade A for every 100 men), it still falls short of achieving gender parity. Many differences persist across the various macro-areas. For example, in areas 2 (Physics) and 9 (Industrial and information engineering), the gender disparity is most pronounced, with only 18 and 15 women for every 100 men, respectively. In macro-area 10, women outnumber men, but they still fall short of achieving gender parity.

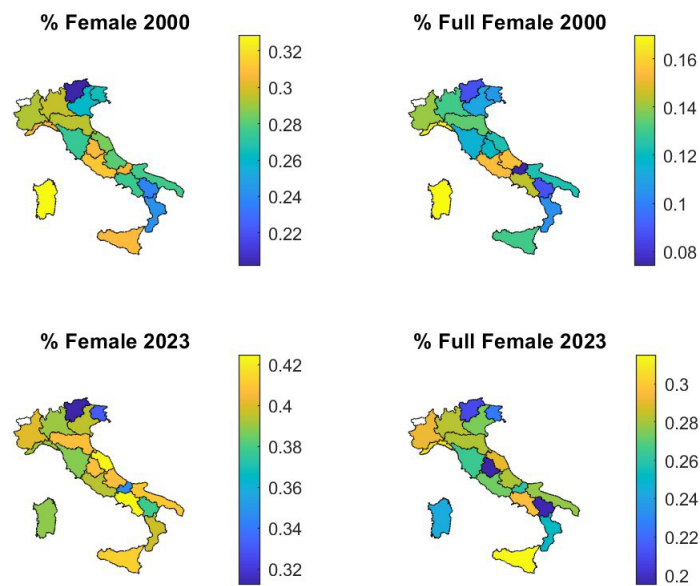
Table 9 Proportion of female and male and ratio women to men by Macro Area for Grade A position in 2000 and 2023.

Area	2000			2023		
	F	M	Ratio	F	M	Ratio
1	0.15	0.85	0.17	0.21	0.79	0.26
2	0.05	0.95	0.05	0.16	0.84	0.19
3	0.11	0.89	0.12	0.37	0.63	0.59
4	0.09	0.91	0.10	0.20	0.80	0.25
5	0.22	0.78	0.29	0.39	0.61	0.65
6	0.07	0.93	0.07	0.22	0.78	0.28
7	0.09	0.91	0.10	0.26	0.74	0.36
8	0.09	0.91	0.10	0.27	0.73	0.36
9	0.03	0.97	0.03	0.14	0.86	0.16
10	0.33	0.67	0.50	0.46	0.54	0.86
11	0.22	0.78	0.28	0.42	0.58	0.71
12	0.11	0.89	0.12	0.29	0.71	0.41
13	0.12	0.88	0.14	0.27	0.73	0.38
14	0.15	0.85	0.17	0.31	0.69	0.45
Total	0.13	0.87	0.16	0.28	0.72	0.37

Geographical dimension

We now examine the gender dimension across the 20 regions of Italy.

Indeed, as illustrated in Figure 1, the proportion of women in universities approaches 50%, yet drops below 30% across nearly all regions when considering those occupying Grade A positions. While there has been a slight improvement in all regions by 2023, the percentage of Grade A scholars still remains significantly below 50%. An analysis of the distribution of women per area and per political region is shown in Figures 2 and 3. In nearly all regions and across almost all areas, the majority of Grade A positions are held predominantly by men. The only sector where the presence of women exceeds 50% in some regions is Area 10 (Antiquities, philology, literary studies, art history). The situation has improved slightly in some areas (5, 10, and 11) over the past 20 years, as depicted in Figure 3, but in others, especially STEM fields such as 1, 2, and 9, the scarcity of women in the highest positions in academia remains very significant.

Figure 1 Percentage of women and woman in Grade A position in Italian universities, in 2000 and in 2023

Promotion dimension

To understand the underrepresentation of women in senior positions within academia, we investigate the promotion dimension to Grade A in Italian universities. We analyze data related to promotion to Grade A position from Grade B and promotion to Grade B from Grade E. Other type of promotions are not considered because are very peculiar and don't affect the final model. Although there are some cases of direct promotion from Grade D to Grade B or A, they are very few and not important for understanding the phenomenon. Moreover, promotion from Grade C to Grade B is practically automatic after three years and only a few cases do not obtain this promotion. In Section 6 we will use this data to estimate the probability of being promoted to Grade A and to Grade B, respectively. Table 10 reports the numbers of promotions from Grade B to Grade A, the percentage of women among the promoted individuals, and the percentage of women in Grade A, from 2000 to 2023. From the data reported in the table, it is observed that in years with fewer promotions due to the suspension of competitions caused by financial difficulties or government actions, the percentage of promoted women decreases. Although the number of positions each year varies greatly, going from a minimum of 29 in 2009 to a maximum of 2151 in 2001, the percentage of women promoted is around 30% with a minimum of 21% to a maximum of 37%.

Figure 2 Percentage of women in Grade A position in Italian university in each Macro Area, in 2000.

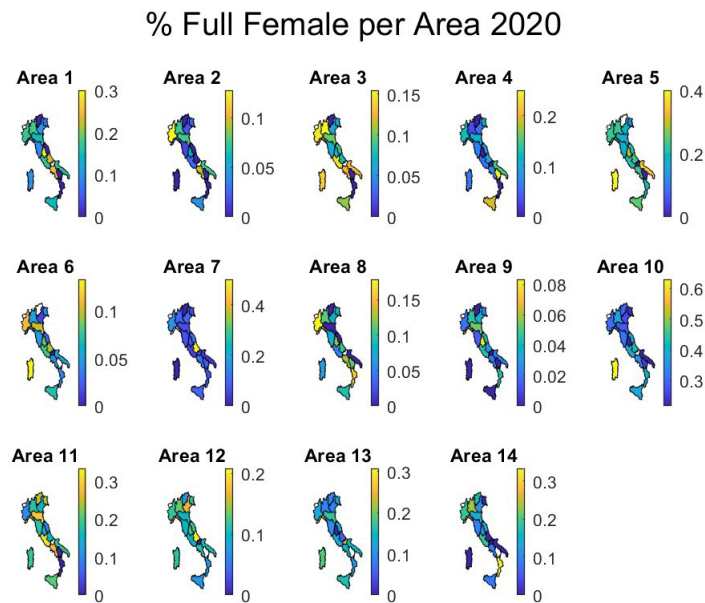
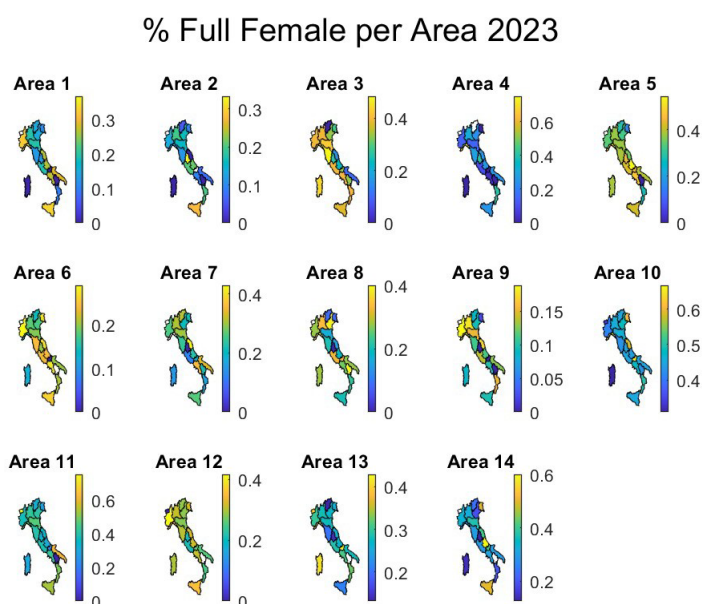


Table 10 Promoted to Grade A from Grade B. Years 2001 – 2023

Year	Promoted Grade A	F. Promoted	% F. Promoted	% F. in Grade A
2001	2151	484	22.50	14.70
2002	1583	411	25.96	15.69
2003	352	89	25.28	16.04
2004	571	153	26.79	16.49
2005	1601	442	27.61	17.55
2006	1079	303	28.08	18.19
2007	361	118	32.69	18.61
2008	146	42	28.77	18.93
2009	29	6	20.69	19.23
2010	289	81	28.03	20.17
2011	613	182	29.69	20.73
2012	232	64	27.59	20.92
2013	145	37	25.52	21.21
2014	264	65	24.62	21.40
2015	450	103	22.89	21.55
2016	989	290	29.32	22.12
2017	816	243	29.78	22.92
2018	1240	387	31.21	23.69
2019	1266	433	34.20	24.71
2020	1174	363	30.93	25.29
2021	1640	559	34.08	26.13
2022	1148	421	36.67	26.90
2023	1563	574	36.72	27.90
Total	19702	5850	29.69	

Figure 3 Percentage of women in Grade A position in Italian university in each Macro Area, in 2023.**Table 11** Promoted to Grade B from Grade E. Years 2001 – 2023

Year	Promoted Grade B	F Promoted	% F Promoted	% F in Grade E
2001	2825	1019	36.07	42.28
2002	2202	781	35.47	43.02
2003	399	165	41.35	43.10
2004	821	280	34.10	43.54
2005	2309	866	37.51	44.43
2006	1390	550	39.57	45.01
2007	425	166	39.07	45.04
2008	183	72	39.34	45.03
2009	28	13	46.43	45.19
2010	665	238	35.79	45.31
2011	955	365	38.22	45.35
2012	347	132	38.04	45.57
2013	170	57	33.53	45.69
2014	2273	869	38.23	46.52
2015	3101	1246	40.18	47.66
2016	1121	470	41.93	47.99
2017	1078	446	41.37	48.41
2018	1601	694	43.35	49.27
2019	1602	774	48.31	49.61
2020	1364	686	50.29	49.70
2021	1068	546	51.12	49.92
2022	1951	1041	53.36	49.18
2023	188	94	50.00	49.80
Total	28066	11570	41.22	

The waiting time for promotion varies across different areas; the minimum average value is observed for males in Area 1, with a mean value of 6.20 years, while the maximum is observed for women in Area 10, with a mean value of 8.97 years. Additionally, Area 1 exhibits the highest difference in average waiting time between males and females. Surprisingly, in Area 2, where women are underrepresented, the average waiting time for women is 4 months less than that for male colleagues. Therefore, women are promoted less frequently, but they experience shorter waiting times for promotion.

Empirical results

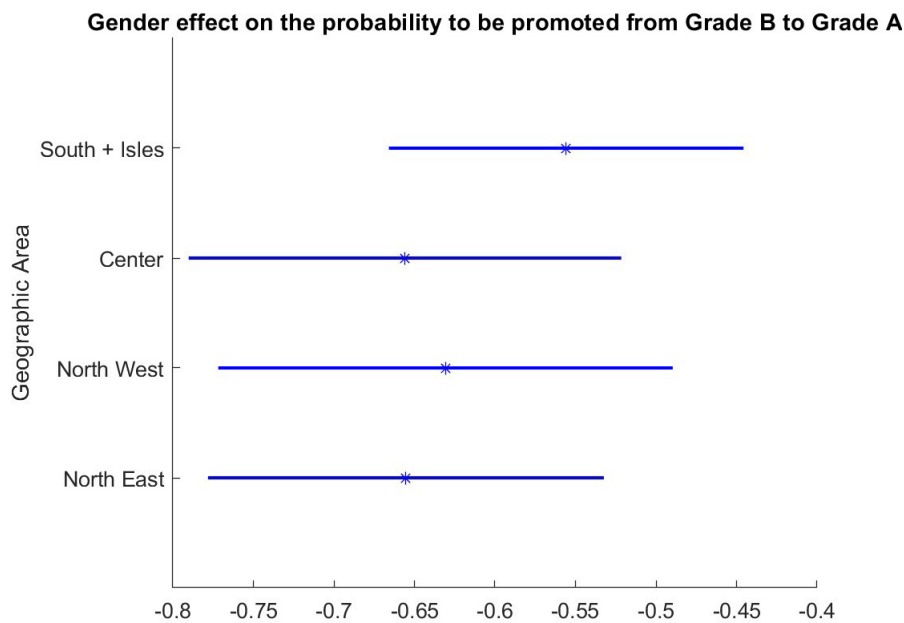
The results of the logistic regression for promotion from Grade B to Grade A are presented in Table 12. The analysis considers gender, waiting time, squared waiting time, research area, year of entry, and mobility. Regions are grouped into four macro-areas: (i) North-East, (ii) North-West, (iii) Central Italy, and

(iv) Southern Italy and Islands. Additionally, the entry year is categorized into five classes. Overall, the logistic regression results provide valuable insights into the factors influencing promotion from Grade B to Grade A. First of all, the coefficient for the gender effect (female versus male) is -0.619, with a 95% confidence interval of (-0.68, -0.56), indicates that, on average, females are less likely to be promoted compared to males, holding other variables constant. Regarding waiting time, both the linear (0.317) and quadratic (-0.016) terms show significant associations with promotion. This suggests a non-linear relationship. Initially, as waiting time increases, the likelihood of promotion also increases, as indicated by the positive linear term. However, as waiting time continues to increase, the effect starts to diminish, as indicated by the negative quadratic term. This implies that while waiting time positively influences promotion likelihood, the effect weakens as waiting time increases, resulting in a diminishing rate of increase for promotion.

To better understand the geographical heterogeneity in the promotion, we run stratified analysis by geographical area, including again as fixed effects the research area and the period of entry. In Figure 4, the odds ratios (OR) and their corresponding 95% confidence intervals are shown for the effect of gender (females versus males) when logistic regression is stratified for each geographical macro area. The relationship between the probability of promotion and waiting time is well captured by a second-order relation, as illustrated in Figure 5, which displays the results from the stratified analysis for the same geographical macro areas. Once again, it is evident that the probability of promotion for women is consistently lower, as the four red curves lie below their corresponding blue curves.

The same analysis has been conducted for promotions from Grade B to Grade E. Table 13 presents the results of the logistic regression, using the same fixed effects as in the model for promotion from Grade B to Grade A. Gender still has a negative effect on promotion, but it is no longer as significant, as in the model for promotion from grade B to Grade A. Besides, the transition from Grade B to Grade E is no longer as relevant in academic careers, as Grade E positions are no longer advertised and are therefore destined to disappear from Italian universities. Figure 6 illustrates the geographical heterogeneity in waiting times for promotion from Grade E to Grade B. When stratifying the logistic regression, the effect of gender is significantly different from zero only in the South and Islands, where the two curves appear at the lowest positions. In contrast, for the other macro-regions, the curves for males and females are nearly overlapping.

Figure 4 Coefficients for Probability to be promoted (from Grade B to Grade A) for females versus males, stratified by geographic area



Mobility

The body of literature analyzing academic mobility is already extensive, see for example, Angervall and Hammarfelt (2023), and Yan et al (2020). We were able to reconstruct mobility in this data set. The 7.11% of faculties experiments one in life a change of University, 75% of them change also the regions. Generally, one of the motivations for moving is the opportunity for career advancement, and our data confirm that mobility favors promotions. We introduced a dummy variable for regional mobility throughout the career in the logistic models presented in Table 12. Our results show a positive association between mobility and the probability of promotion. Specifically, the association with promotion from Associate to Full Professor is 0.49 (95% CI: 0.38–0.59), while the association with promotion from Grade E to Grade B is 0.86 (95% CI: 0.67–1.05). Although this association is strong and significant, introducing the mobility effect causes the gender variable to lose its significance, therefore we excluded from the model. This can be explained by the fact that changing universities and regions is more common among men than women, with 68.2% of mobility occurring among men. Moreover, the probability of changing regions is significantly and negatively associated with being female, with a coefficient of -0.18 (95% CI: -0.23 to -0.12).

Table 12 Promotion from Grade B to Grade A: Estimation Results for a Logistic Model. Total observations: 29,214.

Variable	Estimate	SE	t-Stat	p-Value
(Intercept)	-1.122	0.093	-12.110	< 0.001
gender	-0.612	0.032	-19.134	< 0.001
waiting time	0.318	0.012	25.580	< 0.001
waiting time2	-0.016	0.001	-25.675	< 0.001
NW vs NE	-0.199	0.044	-4.522	< 0.001
Center vs NE	-0.282	0.043	-6.558	< 0.001
South + Is vs NE	-0.069	0.039	-1.754	0.079
Area 2 vs 1	-0.226	0.102	-2.220	0.026
Area 3 vs 1	-0.379	0.102	-3.724	< 0.001
Area 4 vs 1	-0.637	0.145	-4.399	< 0.001
Area 5 vs 1	-0.203	0.088	-2.303	0.021
Area 6 vs 1	0.142	0.076	1.864	0.062
Area 7 vs 1	-0.390	0.100	-3.897	< 0.001
Area 8 vs 1	-0.253	0.089	-2.856	0.004
Area 9 vs 1	0.053	0.081	0.648	0.517
Area 10 vs 1	-0.152	0.083	-1.831	0.067
Area 11 vs 1	0.123	0.082	1.511	0.131
Area 12 vs 1	0.251	0.083	3.022	0.002
Area 13 vs 1	0.294	0.082	3.601	< 0.001
Area 14 vs 1	-0.023	0.101	-0.226	0.821
Year Entry 2005-10 vs < 2005	-0.625	0.035	-17.621	< 0.001
Year Entry 2010-15 vs < 2005	-1.255	0.047	-26.586	< 0.001
Year Entry 2015-20 vs < 2005	-1.973	0.060	-32.807	< 0.001
Year Entry > 2020 vs < 2005	-3.240	0.189	-17.120	< 0.001
Mobility	0.485	0.052	9.392	< 0.001

Conclusions

In this study, we have explored gender dynamics within Italian academia, focusing on the promotion process from Associate Professor to Full Professor. Our analysis highlights persistent gender disparities in academic career progression. Women experience longer waiting times for promotion, even after accounting for key factors such as research area and entry cohort. Despite advancements over the past two decades, the proportion of women promoted to Full Professor remains significantly lower than that of men, indicating the presence of structural barriers that still affect gender equity in career advancement.

Although regional differences exist, our findings reveal a consistent pattern of gender disparity across all areas of Italy. This suggests that the challenges faced by women in academic promotions are systemic rather than region-specific, emphasizing the need for comprehensive strategies to address gender inequality in academia that have to be implemented at a national level.

A key limitation of our study is the lack of individual-level data, such as age, which prevents us from directly assessing the age at promotion. Additionally, while we investigate gender disparities in promotion probabilities and waiting times, we are not able to have a measures of academic productivity or a measure of internal competition within departments, which could provide further

insights into the promotion process. Future research should incorporate additional data sources and advanced statistical techniques, such as Cox analysis, to better understand the mechanisms driving these disparities. Achieving gender parity in academic leadership is not only a matter of fairness but also a crucial step to promote diversity in academia. Ensuring equal opportunities for career advancement will not only benefit current female researchers but also serve as an important example for future generations of women in academia, inspiring young scholars to pursue and achieve leadership positions without facing systemic barriers.

Table 13 Estimation result for a logistic model, Promotion from Grade E to Grade B. 21983 Observations.

Variables	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	2.264	0.141	16.051	< 0.001
gender	-0.066	0.039	-1.679	0.09
waiting time	0.47	0.019	24.5	< 0.001
waiting time2	-0.034	0.001	-39.385	< 0.001
NW vs NE	0.266	0.062	4.317	< 0.001
Center vs NE	-0.197	0.055	-3.58	< 0.001
South + Is vs NE	-0.119	0.051	-2.34	0.02
Area 2 vs 1	0.04	0.145	0.279	0.78
Area 3 vs 1	-0.104	0.126	-0.827	0.41
Area 4 vs 1	-0.114	0.173	-0.661	0.51
Area 5 vs 1	-0.393	0.111	-3.558	< 0.001
Area 6 vs 1	-0.833	0.101	-8.236	< 0.001
Area 7 vs 1	-0.322	0.122	-2.645	0.008
Area 8 vs 1	-0.224	0.116	-1.941	0.052
Area 9 vs 1	-0.012	0.113	-0.11	0.91
Area 10 vs 1	-0.097	0.111	-0.873	0.382
Area 11 vs 1	-0.118	0.112	-1.051	0.293
Area 12 vs 1	-0.188	0.112	-1.681	0.093
Area 13 vs 1	-0.288	0.112	-2.564	0.01
Area 14 vs 1	-0.131	0.133	-0.98	0.327
Year Entry 2005-10 vs < 2005	-1.444	0.052	-27.763	< 0.001
Year Entry >= 2010	-2.313	0.068	-34.173	< 0.001

Figure 5 Probability to be promoted from Grade B to Grade A, as a function of waiting time for males and females, Stratified by geographic area

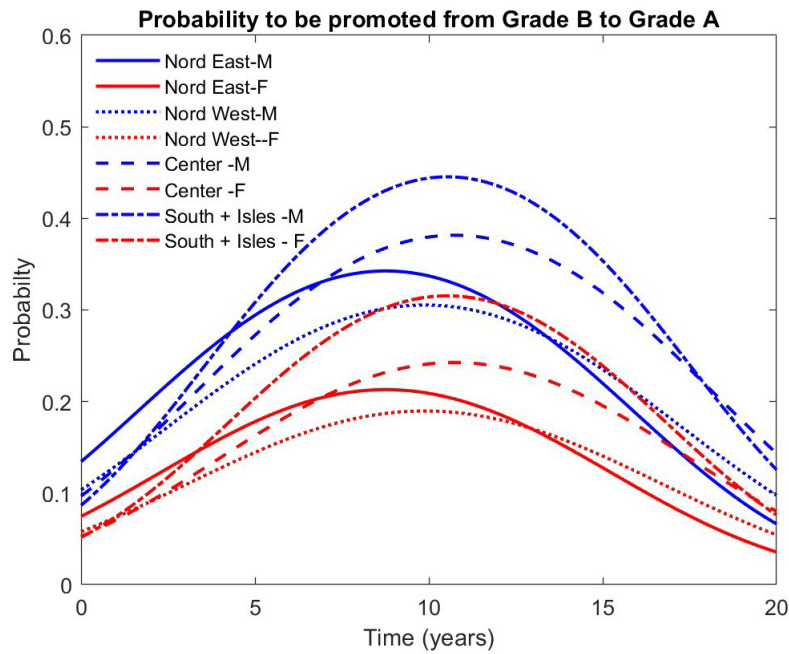
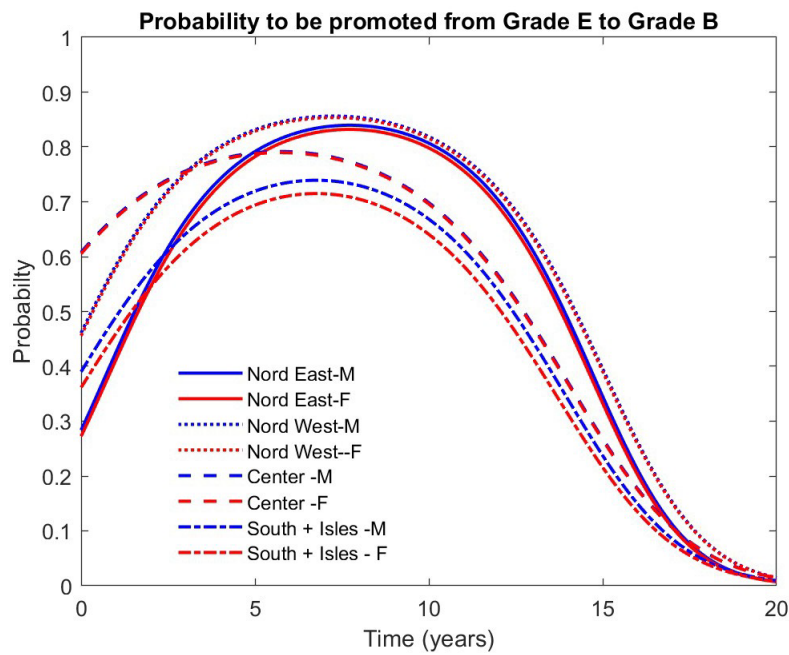


Figure 6 Probability to be promoted from Grade E to Grade B, as a function of waiting time for males and females, Stratified by geographic area



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Appendix 1 Name of the University, Kind (S=National, P=Private, T=Online), Geographical Region. For online universities, the geographical region is left blank.

N	Name	Kind	Region
1	BARI	S	PUGLIA
2	BASILICATA	S	BASILICATA
3	BERGAMO	S	LOMBARDIA
4	Bocconi MILANO	P	LOMBARDIA
5	BOLOGNA	S	EMILIA-ROMAGNA
6	BRESCIA	S	LOMBARDIA
7	Ca' Foscari VENEZIA	S	VENETO
8	CAGLIARI	S	SARDEGNA
9	CAMERINO	S	MARCHE
10	CAMPANIA - L. VANVITELLI	S	CAMPANIA
11	CASSINO e LAZIO MERIDIONALE	S	LAZIO
12	CATANIA	S	SICILIA
13	CATANZARO	S	CALABRIA
14	Cattolica del Sacro Cuore	P	LOMBARDIA
15	CHIETI-PESCARA	S	ABRUZZO
16	DELLA CALABRIA	S	CALABRIA
17	EUROPEA di ROMA	P	LAZIO
18	FERRARA	S	EMILIA-ROMAGNA
19	FIRENZE	S	TOSCANA
20	FOGGIA	S	PUGLIA
21	GENOVA	S	LIGURIA
22	Gran Sasso Science Institute	S	ABRUZZO
23	HUMANITAS University	P	LOMBARDIA
24	I.U.S.S. PAVIA	S	LOMBARDIA
25	INSUBRIA	S	LOMBARDIA
26	IULM MILANO	P	LOMBARDIA
27	L'AQUILA	S	ABRUZZO
28	L'Orientale di NAPOLI	S	CAMPANIA
29	LUMSA ROMA	P	LAZIO
30	Libera Università di BOLZANO	P	TRENTINO-ALTO ADIGE
31	LINK CAMPUS	T	LAZIO
32	LIUC CASTELLANZA	P	LOMBARDIA
33	Luiss Guido Carli	P	LAZIO
34	LUM Giuseppe Degennaro	P	PUGLIA
35	MACERATA	S	MARCHE
36	Mediterranea di REGGIO CALABRIA	S	CALABRIA
37	MESSINA	S	SICILIA

N	Name	Kind	Region
38	MILANO	S	LOMBARDIA
39	MILANO-BICOCCA	S	LOMBARDIA
40	MODENA e REGGIO EMILIA	S	EMILIA-ROMAGNA
41	MOLISE	S	MOLISE
42	Napoli Federico II	S	CAMPANIA
43	PADOVA	S	VENETO
44	PALERMO	S	SICILIA
45	PARMA	S	EMILIA-ROMAGNA
46	Parthenope di NAPOLI	S	CAMPANIA
47	PAVIA	S	LOMBARDIA
48	PERUGIA	S	UMBRIA
49	PIEMONTE ORIENTALE	S	PIEMONTE
50	PISA	S	TOSCANA
51	Politecnica delle MARCHE	S	MARCHE
52	Politecnico di BARI	S	PUGLIA
53	Politecnico di MILANO	S	LOMBARDIA
54	Politecnico di TORINO	S	PIEMONTE
55	ROMA Foro Italico	S	LAZIO
56	ROMA La Sapienza	S	LAZIO
57	ROMA Tor Vergata	S	LAZIO
58	ROMA TRE	S	LAZIO
59	S. Raffaele MILANO	P	LOMBARDIA
60	SALENTO	S	PUGLIA
61	SALERNO	S	CAMPANIA
62	SANNIO di BENEVENTO	S	CAMPANIA
63	SASSARI	S	SARDEGNA
64	SCIENZE GASTRONOMICHE	P	PIEMONTE
65	Scuola IMT Altì Studi LUCCA	S	TOSCANA
66	Scuola Normale Superiore di PISA	S	TOSCANA
67	Scuola Superiore Sant'Anna	S	TOSCANA
68	SIENA	S	TOSCANA
69	SISSA TRIESTE	S	FRIULI-VENEZIA GIULIA
70	Stranieri di PERUGIA	S	UMBRIA
71	Stranieri di SIENA	S	TOSCANA
72	Stranieri REGGIO CALABRIA	S	CALABRIA
73	Suor Orsola Benincasa NAPOLI	P	CAMPANIA
74	TERAMO	S	ABRUZZO
75	TORINO	S	PIEMONTE
76	TRENTO	S	TRENTINO-ALTO ADIGE
77	TRIESTE	S	FRIULI-VENEZIA GIULIA
78	TUSCIA	S	LAZIO

N	Name	Kind	Region
79	UDINE	S	FRIULI-VENEZIA GIULIA
80	UKE Università Kore di ENNA	P	SICILIA
81	UniCamillus	P	LAZIO
82	UNICUSANO	T	LAZIO
83	Univ. Campus Bio-Medico di ROMA	P	LAZIO
84	Univ. Studi Guglielmo Marconi	T	LAZIO
85	UNINT	P	LAZIO
86	E-CAMPUS	T	LOMBARDIA
87	Giustino Fortunato	T	CAMPANIA
88	UNINETTUNO	T	LAZIO
89	IUL	T	TOSCANA
90	Leonardo da Vinci	T	LAZIO
91	PEGASO	T	CAMPANIA
92	San Raffaele Roma	T	LAZIO
93	UNITELMA SAPIENZA	T	LAZIO
94	Universitas MERCATORUM	T	LAZIO
95	IUAV di VENEZIA	S	VENETO
96	Urbino Carlo Bo	S	MARCHE
97	VALLE D'AOSTA	S	VALLE D'AOSTA
98	VERONA	S	VENETO