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Gender differences in career advancements in Italian universities over the last 20 years

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Abstract

This article deals with gender differences in Italian universities in the last 20 years in terms of career advancements. Data are taken from the MUR (Ministry of University and Research) archive. In Italy, career advancements are still much easier for men, even if the gender gap has slowly narrowed in the last decades. The novelty of this paper is the analysis through event-history analysis models on the time elapsed to receive a promotion (from assistant to associate professor and from associate to full professor). The event-history analysis applied to career advancements has revealed that women take, on average, about one and a half more years than men to advance, with some differences among fields of study and macroregions. Furthermore, this gender gap is higher in the first years of the career. Two sociological metaphors used in the gender literature, the "leaky pipeline" and the "glass ceiling", seem to intervene powerfully in the gender gap of Italian universities careers.

Keywords: Gender differences, Italian universities, Career advancements, Glass ceiling, Leaky pipeline

Introduction

The recruitment and selective career advancement of faculty members are essential for the medium and long-term future of academic systems. Gender inequalities in academic careers can be usefully analyzed across four dimensions: participation; position; productivity; and recognition (Long and Fox, 1995).

Substantial differences characterize academic systems worldwide, especially in terms of the recruitment process of faculty members and the gender gap remains a crucial issue, as men are more likely and faster in their career than woman. Sexism in academia is experienced at both the systemic and individual levels, often culturally normalized and personally violent yet cloaked beneath veneers of professional activity and working relationships. The silence surrounding sexism in academia is deafening (Teixeira et al., 2018; Thun, 2020). Significant differences between the sexes can be seen in terms of inequalities in access to professional careers (Kirchmeyer, 2002), in reaching the highest positions and in terms of career speed in reaching those positions (European Commission 2021; World Economic Forum 2021). In general, there are also differences in terms of overall remuneration (Boden, 1999), in

salary in universities (Gibelman, 2003; Ginther and Hayes, 1999) and in the corporate and financial world (Bertrand and Hallock, 2001; Bertrand et al., 2010; Elkinawy and Stater, 2011). Significant disparities have also been highlighted by other studies with respect to credit access (Marlow and Patton, 2005) and public funding (Vossenberg, 2013). In short, even in 2021, in many countries with advanced economies, the gap remains significant despite equalizing gender policies.

Contemporary academic and policy research on academic employment has shown how academics continue to experience gender differences (David and Woodward, 1998). In Europe, only three countries—Iceland, Latvia, and Lithuania—have a higher proportion of female than male researchers in higher education (OECD, 2020). Then, there are fewer women as the standard academic career progresses. In the EU-28 in 2018, women made up 47% of assistant professors, 40% of associate professors and 26% of full professors. At the national level, the proportion of women among full professors ranged from 18% to 51%, exceeding 50% in only one country (European Commission, 2021). However, since 2013 the proportion of full women professors has increased in almost all European countries, and the increase continues to persist to 2018, albeit slowly. The only exceptions were Hungary and Spain. The largest increases were observed in Latvia, Slovenia, and Romania.

The Italian experience is in line with the European one. In fact, women are underrepresented in the academic staff (one-third of the population) and the proportion varies across fields and academic positions (Abramo et al., 2021). The road towards gender equality is extremely slow and non-linear (Gaiaschi and Musumeci, 2020). Their lower scientific productivity cannot explain the lower likelihood that women will be promoted to associate and full professorships in Italian universities. Additionally, it fails to explain the phenomenon of negative self-selection, whereby women are less inclined to apply for promotion (Filandri and Pasqua, 2019).

The goal of this paper is to study gender differences in career advancement intervals in Italy: to look at how they vary over time; to measure the length of time necessary to get a promotion in the transition from assistant professor to associate professor and from associate professor to full professor; to ask how those transitions are influenced by covariates like macroregion, year of recruitment, and field of study.

Background

In general, studies have revealed that women progress slower through the academic ranks, that they tend not to attain essential leadership roles, and that they earn less than men in comparable positions (Peterson, 2016; Van den Brink and Benschop, 2012a, 2012b).

The question that naturally arises is which factors, or which combination of factors, could cause this under-representation. Intersectionality is treated in several papers [for a comprehensive treatment of the intersectionality, the interested reader can refer to Collins and Bilge (2020)]. Beyond the intersectionality effects, it is common to refer to two sociological metaphors, well known in the literature to describe this gender gap: (1) the "glass ceiling effect" metaphor, and (2) the "leaky pipeline" metaphor. These metaphors have taken on particular significance in the analysis of academic careers.

- The "glass ceiling effect" was used for the first time by an American writer, Loden, in a 1978 speech, and, in the same year, by two executives, Schriber and Lawrence at Hewlett-Packard. It highlights an invisible barrier the prevent women from climbing the career ladder beyond a certain level (Cotter et al., 2001; Wirth, 2001). In 1986, two journalists, Hymowitz and Schellhardt, commented on the glass ceiling as something that could not be found in any corporate manual or discussed at a business meeting. It was an invisible and unspoken phenomenon that existed for executive-level leadership positions. These positions are reserved for men. Cotter et al. (2001) identify four criteria, in scientific literature, that might be used to define a glass ceiling effect: (a) in levels of authority; (b) in positions in the corporate hierarchy; (c) in earnings; and (d) in occupation. These criteria are generally framed in terms of "outcomes" rather than for one specific measure. So, they identify the four criteria as: (i) a gender (or racial) difference that is not explained by the other job-relevant characteristics of the employee; (ii) a gender (or racial) difference that is greater at higher levels than at lower levels of an outcome; (iii) gender (or racial) inequality in the chances of advancement into higher levels, not merely the proportions of each gender or race currently at those higher levels; (iv) gender (or racial) inequality that increases as a subject moves upwards through a career hierarchy. Baxter and Wright (2000) give a broad definition of the "glass ceiling", in which the difficulties of the ladder are present and increasing at each step. The latter definition looks closer than the first one to female career advancement in Italian universities.
- The "leaky pipeline" is a metaphor born in the studies of women in science, referring both to the loss of female students in secondary and tertiary education and—later on—across the different steps of the career ladder in scientific professions, including (but not exclusively to) academia (Alper, 1993a; Blickenstaff, 2005). A system, in this metaphor, is designed to channel something from one place to another. But the system malfunctions because it leaks losing some of what it carries before it reaches the destination. In academia, it would seem that the academic system clogs up rather than leaks: i.e., it lets some through more quickly than others. And often, it fails outright.

Several papers introduce concepts closer to the leaky pipeline (Alper, 1993b; Blickenstaff, 2005), as "sticky floors" and "mid-level bottlenecks" (Yap and Konrad, 2009). These concepts are related to the women's discouragement in approaching the university career because it will be too demanding, precarious, and difficult to be compatible with family work-load (Bataille et al., 2017). Interestingly, the concept of "gender blindness" (Thun, 2020) referred to the academic organization which does not take into account of the motherhood and female needs. In the Italian case, we do not have studies on the discouragement effect (which affects mostly the PhD's) but it seems that the system is "leaky" along with the entire ladder of the university career.

Other factors range from subtle gender stereotyping, patterns of socialization and upbringing, via issues of family and domestic responsibilities, to the structuring of academic work and career paths (Roth and Sonnert, 2010). There are also demographic cohort factors (current faculty members have been recruited from cohorts

where the proportion of women in the universities was much lower than today) (Stewart et al., 2009):

- gender differences in the recruitment, the advancement process, and the workplace (Regner et al., 2019);
- self-selection (personal choices) (Barrett and Barrett, 2011);
- etc.

Other studies indicate that women remain in stagnant career positions or leave their occupations to become full-time caregivers (Stone, 2007) or pursue other careers for many different reasons. Some scholars claim that balancing work and home commitments affect career progression in the corporate research and development sector. But other factors such as a lack of encouragement from management also prove relevant (Wyarczyc and Renner, 2006).

These variables are the industry, type of career, cultural context effect, and the individual condition. Above all, individual factors, organizational factors, and social factors are, generally, the essential intervening "situation variables". But these all oblige women to face a choice between "stay stuck or exit". Individual factors concern the capability of achieving leadership positions in organizations, mainly in academia (Roseberry et al., 2016). But fewer women than men are allowed to express this leadership capacity. It often only happens if they are encouraged to do so. In an "extreme evaluation", quoting the authors:

≪Striving towards the ideals of womanhood, professionalism, motherhood, wifehood, scholarship, community membership, and teaching, women find themselves attempting to negotiate often conflicting identities that leave them feeling like failure is their only option≫ (*Ibidem*)

This all creates tension between individual professional aspirations and being a "caring woman" (Acker and Feuerverger, 1996). Notably, in universities, many women faculty members also feel the distance between the public and private life and social roles (Parsons and Priola, 2013).

The gender gap in the universities is, then, truly emblematic. And the differences there are more relevant, often, than in other organizations (Goastellec and Pekari, 2013). Probably, the higher demand for hard skills from men and soft skills from women also leads to a "self-fulfilling prophecy" (Misra et al., 2011). In short, individual career and personal ambitions are more easily sacrificed than role expectations. Soft skills are the ones that best match the other roles women are subjected to in the private sphere, and, to some extent, in universities. These become, then, the skills considered most accessible, and therefore those expected of women. In the meantime, they are forced to adapt to the system of expectations. These postmodern theories inform our investigation of the business studies leaders' approach to faculty gender diversity. In fact, both the glass ceiling effect and the leaky or clogged pipeline are present. Thus, the research question is: does the gender gap affect the careers and the timing of promotions for Italian faculty members?

There will be two steps for statistical analysis. The first is a cross-sectional analysis of the MUR (Ministry of University and Research) archive (MUR 2020). This is done to describe the structure of Italian faculty positions in terms of gender ratio, from 2001 to

2020. The second step for pointing out the covariates related to the career advancements is a longitudinal event-history analysis (EHA).

Data and aims

This study considers Italian faculty population from 2001 to 2020, as provided by MUR. The dataset contains individual data for each year and the advancements occur at the beginning of each academic year. Each statistical unit has the following variables for each academic year:

- a unique identifier for each faculty member;
- first name and last name;
- gender;
- position: full professor (*Ful*), associate professor (*Ass*), and assistant professor (*Ast*). The *Ast* professor collects three categories: RTDa (3-year fixed-term professors, introduced in 2011), RTDb (2-year fixed-term professors, introduced in 2015), and RU (tenured assistant professors, discontinued in 2011);
- field of study: in Italy, the fields of study are classified into 14 categories. To simplify the analysis, we considered just six fields: (1) Humanities; (2) Economics; Social and Political Sciences, and Law; (3) STM (Science, Technology, and Mathematics); (4) Engineering and Architecture; (5) Agriculture and Veterinary; (6) Medicine. The adopted classification is close to the ISCED one, with some modifications necessary to take into account the Italian context;
- the university.

The final career record is obtained by merging the annual records with the first and last name as key and other variables in cases of homonym. The observation period is given by the interval between the recruitment (or the beginning of the study, 2001) and the retirement year (or the end of the study, 2020). The maximum observation period is twenty years.

The aims of the analysis are to determine:

- What has happened to men's and women's careers advancement in the last 20 years?
- Whether it is easier for men to advance in their career from the beginning and throughout? (assistant vs associate or associate vs full)?
- Whether it is faster for men to advance in their career from the beginning and throughout? (assistant vs associate or associate vs full)?
- Whether men's and women's career advancements are different among fields of study?

The limitations of our study are the lack of inclusion of data concerning maternal leave, motherhood, and productivity. On the other hand, to the best of our knowledge, the novelty and the strength of our study is the collection and the analysis of 20 years of data, which allows us to measure how gender penalizes women in the frequency of promotions and in the length of time necessary to receive a promotion and how gender penalization has changed over the last 20 years.

Marini and Meschitti (2018) provide a comprehensive summary of the literature on maternal leave, motherhood, and productivity, which are controversial. Among others, they present two different approaches for the first two issues. On the one hand, Fox (2005) shows how "family ties" has a negative effect on productivity, and on the other hand, Perna (2005), Sax et al. (2002) in US, and Heijstra et al. (2015) in Scandinavia show how "family ties" do not impact promotion. Wolfinger and Wilcox (2008) present different findings: motherhood and family formation "have strong and independent negative effects on the likelihood that women obtain ladder-rank positions", while "these findings do not extend to later career transitions. Irrespective of marriage and children, women remain less likely to get tenure and less likely to be promoted to full professors". When investigating productivity, Marini and Meschitti cite Weisshaar's study (Weisshaar, 2017) on the career advancement of Sociology, English, and Computer Science assistant professors in US in 1995. The study shows that "productivity measures account for a portion of the gender gap in tenure, but in each discipline a substantial share of the gender gap remains unexplained by these factors". In addition, in the same paper, Marini and Meschitti (2018) analyze the variables governing the process behind the promotion of women in Italian academia, including productivity, between 2013 and 2016. The study finds that men have 24% greater probability to be promoted to full professor, even when controlling for productivity, than women. Ginther and Hayes (1999) present a different perspective on gender differences in salary and promotion in the humanities in US. They state that "differences in promotion to tenure by gender persist after we control for productivity, demographic characteristics, and discipline".

Statistical analysis

As already mentioned, we, first, proceed with the cross-sectional analysis. Second, we proceed with the EHA.

Cross-sectional analysis

The original database is made up of individual observations. The total number of faculty members hovered around 60,000 and 65,000 over the observation period and the proportion of each position is around one-third. In Fig. 1, the lines describe the M/F ratio for the three levels. The full professors' indexes fall more steeply over the years.

To measure the variation over time, we compute the variation indexes:

$$V_{M/F}(2001, 2020) = \frac{M/F(2020) - M/F(2001)}{M/F(2001)}. \tag{1}$$

The gender ratio decrease between 2001 and 2020, measured by the variation indexes, shows that the "best improvement" is for the full professors (Table 1), which is equal to −0.51.

Table 2 shows the gender ratios computed for three positions and by different fields of study. As already seen, the gender ratio decreases from 2001 to 2020 for all fields and positions. "Engineering and Architecture" and "Humanities" show, respectively, maximum and minimum gender ratios in both years (and for three positions). These values mirror the well-known gender gap in these fields. Interestingly, only in Humanities the

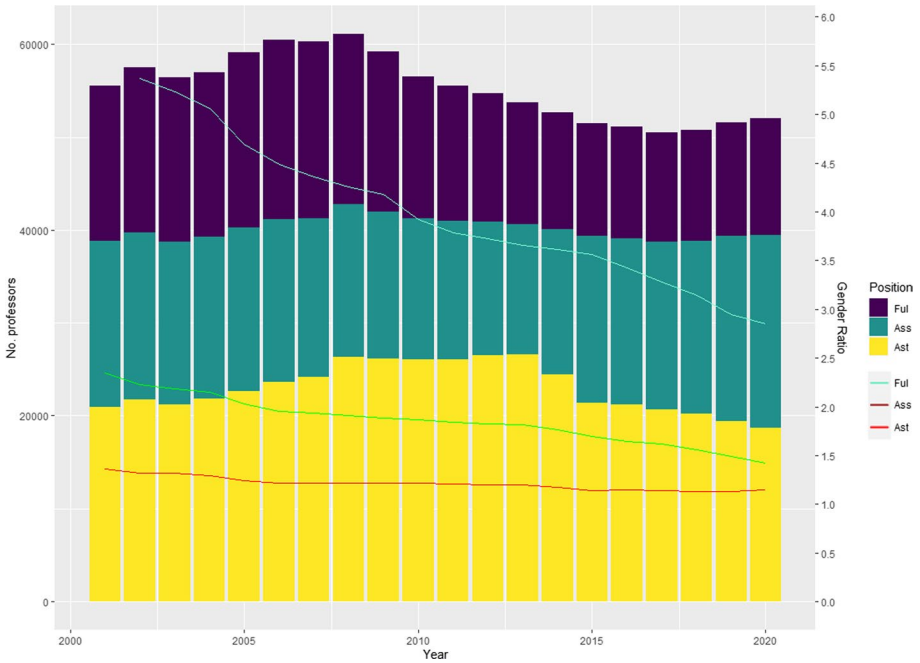

Fig. 1 Number of faculty members (bars) and M/F ratio (lines) by position in Italy from 2001 to 2020

Table 1 Gender ratios and variation indexes by position in Italy (2001 and 2020)

	Ast	Ass	Ful	Tot
$M/F(2001)$	1.36	2.35	5.82	2.33
$M/F(2020)$	1.15	1.42	2.85	1.53
$V(2001, 2020)$	−0.15	−0.40	−0.51	−0.34

Table 2 Gender ratios by position and fields of study in Italy (2001 and 2020)

Field of study	2001					2020				
	M/F				*N*	*M/F*				*N*
	Ast	Ass	Ful	Tot		Ast	Ass	Ful	Tot	
AgrVet[1]	1.37	2.73	9.41	2.71	2963	1.05	1.27	3.26	1.44	2974
EcSSLaw[2]	1.41	2.64	6.67	2.61	8367	1.10	1.28	2.85	1.53	9438
EngArc[3]	3.40	6.03	14.48	5.87	7851	2.25	2.74	5.51	3.00	8921
Humanities	0.66	1.04	2.38	1.11	9855	0.81	0.86	1.41	0.94	8399
Medicine	2.03	4.14	11.89	3.37	10578	1.14	1.90	3.84	1.68	7677
STM[4]	1.06	1.94	5.51	2.00	15976	1.02	1.31	2.60	1.37	14611
Overall	1.36	2.35	5.82	2.33	55590	1.15	1.42	2.85	1.53	52020

[1] AgrVet: Agriculture and Veterinary

[2] EcSSLaw: Economics, Social and Political Sciences, and Law

[3] EngArc: Engineering and Architecture

[4] STM: Science, Technology, and Mathematics

first two gender ratios are less than 1, while the gender ratio for full professors is still greater than 1.

In addition, Table 3 shows the gender ratios computed for three positions and by macroregion. The gender ratios are almost always in favor of women in the Center (2001) and the North (2020) for all positions.

Event-history analysis

Several papers have dealt with the issue of career advancements using logistic models (Durodoye et al., 2020; Marini and Meschitti, 2018; Perna, 2001; Smith et al., 2019; Thomas et al., 2004). The limitation of using these models is the fact that they fail at taking into account of the longitudinal nature of career advancements.

To better understand the career advancements of faculty, by controlling for different concomitant covariates, we apply a longitudinal EHA using the Cox discrete survival time model to study the duration and the timing of events. This model provides a framework to describe the timing of event occurrences and to model the relationship between event occurrences (career advancements) and covariates. To our knowledge, EHA has not been used in Italian academia, while there are several applications in other countries. Some papers apply continuous Cox models (Box-Steffensmeier et al., 2015; Ginther and Hayes, 1999; Groeneveld et al., 2012; Kaminski and Geisler, 2012; Long et al., 1993), while others consider discrete-time Cox models (Weisshaar, 2017; Wolfinger and Wilcox, 2008). We apply the discrete-time Cox model to take into account the discrete nature of the university career advancements, as promotions usually occur annually. One of the limitations of this model is a large number of parameters to model the time. To reduce the number of parameters, the best approximation is usually given by a polynomial.

The two events of interest are the transitions from *Assistant professor* to *Associate professor* and from *Associate professor* to *Full professor*. To carry out a longitudinal career advancement analysis with our data, we need to know the recruitment year (categorized into four 5-year classes) and the timing of advancements. For this reason, we consider the sub-population of all the faculty members hired between 2001 and 2020 as assistant professors and still working at the end of 2020. Assistant and associate professors still working in 2020 are censored observations. Retirements and drop-outs are right-censored cases. Most of the faculty members follow the usual promotion path *Assistant professor* $\longrightarrow$ *Associate professor* $\longrightarrow$ *Full professor* and we just consider this path.

Table 4 summarizes the transitions proportions, conditionally to field of study and gender, from *Assistant professor* to *Associate professor* and from *Associate professor*

Table 3 Gender ratios by position and macroregion in Italy (2001 and 2020)

Field of study	2001					2020				
	M/F				*N*	*M/F*				*N*
	Ast	Ass	Ful	Tot		Ast	Ass	Ful	Tot	
North	1.32	2.31	6.03	2.37	22004	1.19	1.43	2.71	1.56	21854
Center	1.32	2.24	5.59	2.24	16996	1.14	1.42	2.94	1.53	14219
South	1.46	2.51	5.80	2.38	16590	1.11	1.41	3.00	1.50	15947
Overall	1.36	2.35	5.82	2.33	55590	1.15	1.42	2.85	1.53	52020

Table 4 Career advancement proportions by gender and field of study: 2001–2020 (row percentages)

Field of study	Gender	Ast	Ass	Ful	*N*
AgrVet	F	82.7	16.8	0.5	7158
	M	80.8	17.8	1.4	8164
EcSSLaw	F	77.5	20.9	1.6	27889
	M	69.8	26.0	4.2	34100
EngArc	F	77.0	21.6	1.4	15104
	M	73.8	24.0	2.2	35998
Humanities	F	76.8	22.0	1.2	31740
	M	72.3	25.7	2.0	26121
Medicine	F	86.5	12.6	0.9	18579
	M	78.8	19.5	1.7	25344
STM	F	82.1	17.1	0.8	36341
	M	75.9	22.1	2.0	41154
Overall	F	80.0	18.9	1.1	136811
	M	74.4	23.3	2.3	170811

to *Full professor*, including all assistant professors hired between 2001 and 2020. The observation period in on average equal to 6.4 years. As expected few faculty members experiencing the two transitions are just 5434. The highest gender difference of the advancement proportions is in the Economics, Social and Political Sciences, and Law field, while the lowest gender difference is in the Agriculture and Veterinary field.

The Cox-discrete time model estimates the conditional probability that individual i will experience the target event in time period j ($T_i = j$) given that s/he did not experience it in any earlier time period ($T_i \geq j$):

$$h(t_{ij}) = Pr\{T_i = j \mid T_i \geq j\}. \tag{2}$$

To estimate $h(t_{ij})$, the general model is:

$$logit(h(t_{ij})) = [\tilde{\alpha} f(t)] + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_P X_P, \tag{3}$$

where f is a function of time, that is the time elapsed to the occurrences of the advancements ($t = 1, \ldots, 19$). X is the generic covariate considered in the estimation of the model. The usual discrete-time Cox model accommodates "time" with a number of parameters equal to the maximum length observed (in our case, the maximum number of years necessary to be promoted). To obtain a more parsimonious model, we include the term $\tilde{\alpha} f(t)$, whose better fit is a second-order polynomial in both models.

Since we consider two steps (*Assistant professor* to *Associate professor* and *Associate professor* to *Full professor*), two different models are estimated (Model 1 and Model 2). In Model 1, the probability of being associate at time t, assumed to be assistant at time $t-1$, is estimated. The Model 1 is fitted with a second-degree polynomial for *Time*; *Gender*, *Macroregions*, *Field of study, and Year of Recruitment* as main effects; interactions between *Time* and *Gender*, *Time* and *Field of study* and between *Gender* and *Field of study*. In Model 2, we estimate the probability of being full at time t, assumed to be associate at time $t-1$. The covariates are the same as Model 1 without the *Year of Recruitment* and the interaction between *Gender* and *Field of study*, plus an extra variable

Time Ast to Ass, which corresponds to the number of years necessary for the previous advancement. The baseline profile is given for a man, working in a northern university, in Agriculture and Veterinary field, hired between 2001 and 2005:

$$\begin{aligned} log\left(\frac{Ass_i(t)}{Ast_i(t-1)}\right) = \alpha_1\ t + \alpha_2\ t^2 + \beta_1\ Gender_i + \beta_2\ Macroregion_i + \\ + \beta_3\ FieldOfStudy_i + \beta_4\ YOfRecr_i + \beta_5\ Gender_i * t + \\ + \beta_6\ FieldOfStudy_i * t + \beta_7\ Gender_i * FieldOfStudy_i \end{aligned} \tag{4}$$

$$\begin{aligned} log\left(\frac{Ful_i(t)}{Ass_i(t-1)}\right) = \alpha'_1\ t + \alpha'_2\ t^2 + \beta'_1\ Gender_i + \beta'_2\ Macroregion_i + \\ + \beta'_3\ FieldOfStudy_i + \beta'_4\ TimeAstToAss_i + \\ + \beta'_5\ FieldOfStudy_i * t + \beta'_6\ Gender_i * t \end{aligned} \tag{5}$$

In Table 5, the estimated coefficients are reported. The estimates of the parameters in Models 1 and 2 have the same sign. So, the two-career advancements have the same pattern with some differences in magnitude. The probability of becoming an associate

Table 5 Parameter estimates of the Cox discrete-time models

Covariates		Model 1			Model 2		
		Estimate		Std. error	Estimate		Std. error
	Intercept	−7.436	***	0.141	−0.776	***	0.363
	Time	0.776	***	0.017	0.924	***	0.055
	$Time^2$	−0.027	***	0.001	−0.036	***	0.002
Gender(M)	F	−0.679	***	0.116	-0.844	***	0.128
FieldOfStudy(AgrVet)	EcSSLaw	1.079	***	0.133	0.927	**	0.341
	EngArc	0.181		0.136	0.365		0.352
	Humanities	0.622	***	0.134	0.032		0.355
	Medicine	0.544	***	0.141	0.858	*	0.362
	STM	0.442	***	0.132	0.487		0.348
Macroregion(North)	Center	−0.173	***	0.022	−0.080		0.059
	South	−0.380	***	0.020	−0.189	***	0.055
YOfRecr((2000;2005])	(2005;2010]	0.545	***	0.027	\	\	\
	(2010;2015]	1.801	***	0.038	\	\	\
	(2015;2020]	2.948	***	0.063	\	\	\
Time*Gender(M)	F	0.047	***	0.007	0.057	***	0.017
Time*FieldOfStudy(AgrVet)	EcSSLaw	−0.068	***	0.013	−0.089	*	0.044
	EngArc	0.024		0.013	−0.027		0.046
	Humanities	−0.016		0.013	-0.013		0.045
	Medicine	−0.054	***	0.013	−0.116	*	0.047
	STM	−0.012		0.012	−0.050		0.045
Gender(M)*FieldOfStudy(AgrVet)	F*EcSSLaw	−0.212	*	0.092	\	\	\
	F*EngArc	−0.036	0.096		\	\	\
	F*Humanities	−0.109		0.092	\	\	\
	F*Medicine	−0.371	***	0.099	\	\	\
	F*STM	−0.281	**	0.091	\	\	\

Baseline categories are in brackets. Time is computed in years

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

professor for the baseline profile at t=7 is 0.035, while for the corresponding female is 0.025. In Model 2, the time required to move from associate professor to full professor has, as expected, a positive linear effect, so for instance, the probability of becoming a full professor, conditioning on "Time Ast to Ass" = 7, for the baseline profile at t=7 is equal to 0.107, while for the corresponding female is 0.071. Based on the estimates from the second model, it can be observed that professors who spent less time in the transition from researcher to associate tend to spend less time in the second transition (coefficient "Time Ast to Ass"). Looking at the gender gap, it is "less difficult" for women to advance from assistant to associate than from associate to full. The probability of becoming an associate professor for an "average" assistant professor within seven years is 0.06 for women and 0.09 for men. The probability of becoming a full professor for an "average" associate professor within seven years is 0.182 for women and 0.302 for men. The gender effect is strong in both models, but it is attenuated by the interaction term "Time*Gender", which has a slight negative effect. This implies how, over time, the difference in career progress between males and females tends to decrease. Some dampening is given by the interaction of the field of study with time. The parameters of these interactions are almost all negative. The macroregional estimates reflect the usual divide by which career advancements are faster in the North. The interaction between gender and field of study was also reported in the first passage. What is observed is that STM disciplines and medicine are the fields of study where the gender difference is most remarkable.

Another interesting result regards the *Year of Recruitment*, occurring only in Model 1, in fact estimates show, for males and females, that it is easier to obtain an advancement especially in the last cohorts. On the other hand, in the transition from associate to full professor, the *Year of Recruitment* is not included because it is not significative.

The last output of the EHA is the estimated survival curves, that in our case, represent the probability of changing position in the observation period. This tool allows us to better describe career advancements quantitatively. The gender gap is apparent in all curves (Fig. 2). The comparison of survival curves, for both models, shows that the second advancement is faster than the first. The gender gap favors males, and it becomes slight higher over time (Fig. 2). For instance, after nine years and six months, 25% (1–75%) of the men *Assistant professor* have "moved" to *Associate professor*, while the time needed for women is ten years and three months. In the second case, the time needed to advance increases the gender gap (six years and ten months for the men, seven years and ten months for the women) (Table 6). The smaller difference between men and women, which seemed to reduce the stickiness in the gender ratio in enrollment and faculty recruitment, becomes again significant here. The same assessments apply in the second advancement.

Table 6 summarizes the years needed by 25%, 50% and 75% of faculty members to make one of the two advancements based on calculations made on the estimated model, considering the baseline profiles (reported in Fig. 2). It can be seen from the table that women, in all scenarios, take longer to advance their careers than men: the differences are higher from *Associate professor* to *Full professor*; 50% of the male assistants became associate professors in eight years and five months, while the same percentage of females became assistant professors one year and one month later. For the first step, however,

Table 6 Estimated percentiles in years and months to career advancements by gender and type of advancement for the baseline profile (northern university, Agriculture and Veterinary field, hired between 2001 and 2005)

	Ast ⟶ *Ass*		*Ass* ⟶ *Ful*	
	Men	**Women**	**Men**	**Women**
75%	9 yrs 6 mo	10 yrs 3 mo	6 yrs 10 mo	7 yrs 10 mo
50%	11 yrs 10 mo	12 yrs 7 mo	8 yrs 5 mo	9 yrs 6 mo
25%	13 yrs 8 mo	14 yrs 5 mo	9 yrs 8 mo	10 yrs 8 mo

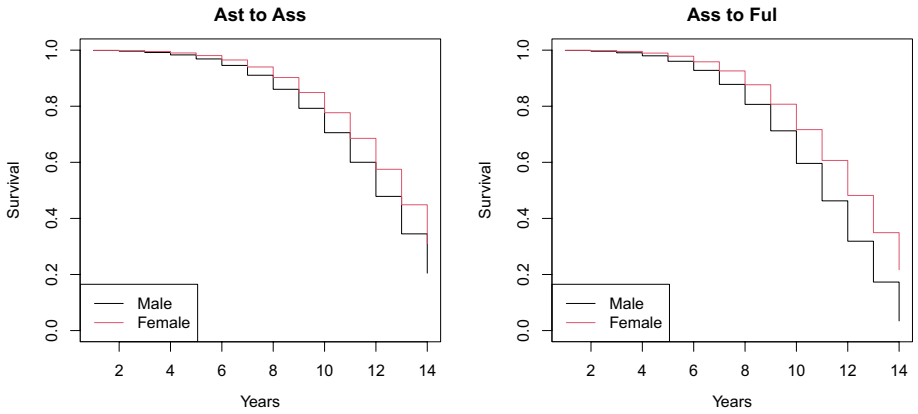

Fig. 2 Estimated discrete-time survival curve by gender and type of advancement for the baseline profile (northern university, Agriculture and Veterinary field, hired between 2001 and 2005)

the same percentage of women take nine months longer than men. However, it is notable that the baseline profile refers to the first cohorts, so Table 6 does not take into account the "gain" obtained by females recruited in the last years.

Discussion and conclusions

Despite the regulatory choices made and some undeniable progress, Italy remains a country with a high gender gap. This disparity is also to be found in universities. In many fields of study, there is an important difference between men and women, particularly for the top position. Not only do a greater proportion of men reach top positions, but they also do so faster. The Italian social structure is unquestionably the explanation for these differences. The disparity of access to higher positions is still culturally accepted and highlights a difference in the social role and the symbolic value assumed by those positions. In short, the distinction between "masculine" and "feminine" jobs still matters in the Italian imagination and much less than in other Nordic countries where occupational segregation is higher (Steinmetz, 2011). Though it has gradually decreased over time. It is evident that a broader base of women's participation in university courses in some scientific fields of study does not correspond to a greater presence of women employees in universities' said fields. For instance, in mathematics, Italian freshmen have been, for 40 years, equal to Italian "freshwomen". But the M/F ratio for full professors is more than four to one.

Our data show a sort of "friction effect", "wall resistance" in all the fields of study. It is as if women constituted a "social fluid" that flows less easily in the hydraulic system constituted by the structure of the Italian university. This fluid loses its natural thrust towards the summit, running into a narrow mesh filter at the end of the path. The parallel with the "glass ceiling" is obvious.

In the non-technical and non-scientific fields, as Bourdieu (2001) would note, the course of study is characterized by the fact that it is very close to the traditional definition of women activity in society. It is less frequented by men for just this reason. In the second case, a different effect can be hypothesized. In the choices regarding professional paths, for women who study business, choosing an academic career is preferable to other careers that their degree would allow. In fact, in 2020 the assistant professors M/F ratio was equal to 1.15 showing a "recent women preference" in the universities. This might be taken to suggest that a career as a company executive or entrepreneur is more demanding—in terms of time, willingness to travel, the ability to take risks, flexibility in changing jobs, coping with stress, etc. In the Italian imagination, all those conditions are considered much more manageable for men than for women. Women do not reach the professions that are better paid and more linked to power: power understood here as the power of disposition, leadership, etc. They do not do so because of the self-selection process to which Bourdieu (2001) refers. They are, therefore, more likely to choose a university career. Here they find greater opportunities for the same reasons because these are spaces that are not preferred by their male colleagues and they can manage family responsibilities, too. In short, a gendered form of distinction continues to be reproduced, in which, in the collective imagination, the best position is masculine. What is left is "feminine".

The stickiness comes back if we look at the gender gap in career advancement regarding access to the top of the career ladder and transition speed. There is surely a trend reducing the gender gap, but it looks slow. We do not actually know when the gender ratio for assistant professors will be the same for full professors.

Moreover, two ratios are computed within each gender: *Ass*/*Ast* and *Ful*/*Ass*, in 2001, 2010 and 2020 (Gaiaschi and Musumeci, 2020). These ratios give a different perspective of the career advancements within each gender. Table 7 shows the presence of the leaky pipeline (all the male ratios are always greater than the female ones) and the persistence of a glass ceiling effect measured by the female *Ful*/*Ass* ratios that are always between 0.35 and 0.60.

In conclusion, both the "leaky pipeline" and the "glass ceiling" effects seem to intervene powerfully in the gender gap of Italian universities in both careers' steps. In the first step, there is an evident glass ceiling effect, in fact the distance between the two curves is present till the end (Fig. 2, *Assistant professor* ⟶ *Associate professor*), with

Table 7 Ratios *Ass*/*Ast* and *Ful*/*Ass* by year and gender

	2001		2010		2020	
	Men	**Women**	**Men**	**Women**	**Men**	**Women**
Ass/Ast	1.035	0.599	0.693	0.450	1.218	0.982
Ful/Ass	1.148	0.463	1.227	0.585	0.764	0.381

a significative improvement for females in the last cohorts. On the other hand, in the second step, after 15 years, the distance between women and men is less evident (Fig. 2, *Associate professor* ⟶ *Full professor*). This is probably due to a "seniority effect", which is dramatically present in the Italian public administration labor market.

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