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Abstract

This paper investigates gender gaps in early-career outcomes, namely stabilization into or exit from academia, and relates them to measures of female representation in the working environment. To this end, survival analysis is applied to administrative data covering the universe of entry-position researchers employed under fixed-term contracts at Italian universities between 2011 and 2026. We find that female scholars have a systematically lower probability of stabilizing with a tenured position compared to male scholars, while no gender gap is found in the likelihood of leaving academia before stabilization. We also find that greater female presence and a less pronounced glass ceiling are associated with higher probability of stabilization, especially for women, and with lower probability of exit, whereby in this case no significant difference is observed across genders. These findings suggest that gender inequalities in early academic careers are reflected more clearly in access to stable employment than in differential probabilities of leaving academia, and that more gender-balanced academic environments may lead to more equitable and inclusive career trajectories.

Keywords: Gender Gap, Early Careers, Female representation, GCI, Survival Analysis, Italian Academia

JEL Codes: J16, J71, C41, I23

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1. Introduction

Academic institutions are often regarded as meritocratic environments in which career outcomes reflect individual qualifications, performance, and scientific contributions. However, recent research has documented how academic career trajectories are also shaped by class-based resources (Stansbury and Rodriguez, 2026; Mangset and Orupabo, 2025), racialized institutional norms (Essanhaji and Müftügil-Yalcin, 2026), ableism (Lindsay and Fuentes, 2022), heteronormative expectations, and the intersection of multiple social identities (Wright-Mair, 2023; Sim and Bierema, 2026). These studies challenge the assumption that academic institutions operate as neutral environments, highlighting how organizational norms and practices shape the recognition of merit, access to opportunities, and professional legitimacy. This broader perspective draws attention to the institutional conditions under which academic careers develop and to the importance of fostering more equitable and inclusive environments, whose benefits extend beyond any single underrepresented group. Within this broader landscape of academic inequalities, gender remains a particularly important dimension of analysis. Despite substantial progress in women's participation in higher education and academic careers, gender inequalities persist in academic labor markets internationally (Iaria et al., 2022; European Commission, 2025) and in Italy (De Paola and Scoppa, 2015; Filandri and Pasqua, 2021; Brunetti et al., 2023; Falco et al., 2023; Brunetti and Fabretti, 2026; Mezzetti and Negri, 2024, 2026; MUR, 2025). However, research focusing specifically on the early stages of academic careers remains more limited (see, e.g., Alfano et al., 2025; Gaiaschi, 2025). Despite women's substantial presence among graduates and doctoral candidates, their representation declines across successive career stages, leading to persistent underrepresentation among senior faculty and academic leaders. This pattern, known as the leaky pipeline, has been documented in the literature (Iaria et al., 2022; Falco et al., 2023), alongside efforts to identify the mechanisms underlying it. Recent contributions emphasize that the pipeline must be seen as a cumulative outcome of institutional practices, evaluation procedures, career incentives, family constraints, informal networks, and structural discrimination (see e.g., Bozzon et al., 2017; Lutter and Schröder, 2020; Brink and Benschop, 2012; Krefting, 2003; Nielsen, 2016). Gender disparities have indeed been found across multiple dimensions of academic life, including hiring, promotion, publication, citation patterns, grant evaluation, conference visibility, and access to leadership positions, reflecting the interplay of multiple mechanisms throughout academic careers (Bransch and Kvasnicka, 2022; Card et al., 2020; Gërxhani et

al., 2023; Hengel, 2022; Jappelli et al., 2017; Bagues et al., 2017). Their effects, however, are likely to be especially pronounced at the early stages of the academic path, when researchers face precarious and temporary positions. Within this literature, growing attention has been devoted to understanding whether and how the gender composition of academic organizations itself contributes to the generation or mitigation of these mechanisms, showing evidence suggesting that female representation within departments and decision-making bodies can improve the quality and fairness of academic institutions, thus reducing the very processes that generate the leaky pipeline (Bagues et al., 2026, Ooms et al., 2018; Stockemer et al, 2025).

This paper contributes to this literature in several ways. First, we assess the gender gap in early-careers outcomes within the academic environment, distinguishing between stabilization and exit. This distinction is informative because the two outcomes point to different mechanisms behind an observed gender gap: if women are less likely to stabilize but equally likely to exit, the disadvantage arises in the hiring and promotion processes of the university; if instead they stabilize at similar rates but exit more often, it reflects attrition from the academic system before promotion; and if both outcomes are unfavourable, the two channels add up and compound the disadvantage. Second, we examine the predictive power of women's representation on these outcomes. In other words, rather than focusing exclusively on documenting gender disparities in promotion, this study also evaluates whether more gender-balanced academic environments can be associated with better career outcomes, that is more likely and faster career stabilization or less likely transitions outside academia. Finally, examining the impact of different measures of women's representation on these outcomes, we aim at investigating whether what matters the most is women's presence or their position within the academic hierarchy and their access to decision-making roles. To the best of our knowledge, this is the first attempt in this direction.

To this end, we leverage a purposely generated dataset drawn from administrative data from the Italian Ministry of University and Research, mapping the universe of entry-level fixed-term researcher employed at Italian universities between 2011 and 2026. Their career trajectories are investigated, modelling the probability of stabilization and the probability of exit from academia in a survival analysis framework, featuring as covariates both the gender of the scholar to assess any potential gender gap, as well as different measures of women's representation within the working Department, to evaluate the potential role in this context of female representation.

Our results show that, all else being equal, women have a lower probability of stabilization than men. The probability of exit, by contrast, is similar for women and men, suggesting that the gender gap in stabilization is not accompanied by a corresponding gender gap in exit from academia. Our evidence is thus that the observed gender gap in career progression stems from lower promotion rates within universities, rather than from higher attrition out of academia. We also find that greater women's representation is associated with a higher probability of stabilization, with female scholars benefiting more, and with a lower probability of exit, albeit this latter effect does not vary with the gender of the scholar. Using two measures of gender balance, the female ratio and the glass ceiling index, we examine the distinction between descriptive and substantive representation. Our findings suggest that descriptive representation is more strongly associated with stabilization, potentially through a more supportive environment for early-career researchers, whereas substantive representation appears more relevant to the retention of academic staff. These findings, which are robust to a variety of checks, are consistent with the literature suggesting that women's presence can contribute to more inclusive academic environments, whose benefits can extend beyond women themselves to other groups facing discrimination or disadvantage.

The remainder of the paper is organized as follows. Section 2 reviews the related literature and presents the conceptual framework underpinning the empirical analysis. Section 3 describes the institutional background and Sections 4 presents the data and empirical strategy. Section 5 discusses the empirical findings and Section 6 concludes.

2. Literature and conceptual framework

This paper lies at the intersection of two streams of literature. The first one refers to the gendered leaky pipeline in academia. Most studies prove that inequalities emerge already at the point of recruitment, rather than only through slower promotion rates, albeit the available evidence is still mixed, depending on the scientific area, the country under analysis and its features in terms of academic career systems. For instance, Aksnes et al. (2025), show that in the US PhD women are less likely than men to enter tenure-track positions and subsequently obtain tenure. Similarly, Carriero and Naldini (2022), using data from approximately 32,000 PhD holders, find a significant gender gap in access to tenure-track positions in Italian academia, which is more pronounced in STEM areas than in the humanities and social sciences, and which is not explained by differences in scientific

productivity. More recently, Alfano et al. (2025) using individual-level data on Italian academia, find that women have a lower probability of obtaining a tenured academic position after completing their PhD, even after controlling for research productivity and professional experience. Similar evidence is reported in Gaiaschi (2025). Based on longitudinal data on Italian academics between 2010 and 2020, she investigates the transitions from post-doc positions to entry-level academic appointments as assistant professors. Controlling for several individual and organizational characteristics, an adjusted gender penalty of approximately 3–4% in recruitment emerges, with substantial variation across disciplines: the disadvantage reaches around 10% in physics but is statistically insignificant in several humanities and social science fields. On the other hand, Aksnes et al. (2025) do not report any of these gaps in Norway. Moratti (2021) also examines recruitment to permanent associate and full professorships in one Norwegian university, and reports that women are not underrepresented among successful applicants, albeit they face a disadvantage when moving from more distant institutions. Several other contributions examine precarious academic employment in Italy in a gendered perspective with a qualitative approach. For example, Bozzon et al. (2017) carried out 33 interviews between 2014 and 2015 in two north-Italy departments, one STEM and the other non-STEM, finding that precarious employment in the early stages of academic careers significantly limits personal lives. These difficulties are higher for women, as they face greater tensions between academic productivity expectations and caregiving responsibilities. Similarly, De Angelis and Grüning (2020) highlight how temporary and insecure contracts constrain women's career prospects and reproduce inequalities in access to stable academic positions. Bazzicalupo et al. (2023) find similar evidence, along with the negative impact on research quality, specifically for early-career geoscientists. These gaps tend to exacerbate during periods of crisis, such as the COVID-19 pandemic, as shown in Dordoni (2025). By conceptualizing gender as a structural dimension of economic and organizational life, the study underscores the need to examine precariousness not as a gender-neutral condition, but in terms of its differential effects across genders. All these contributions highlight how precarious employment and the organization of academic work may reinforce gender inequalities in careers. Based on these contributions, we expect that female scholars have worse early-career outcomes compared to men, i.e., that they have a lower probability of stabilization, i.e., of transition to tenured-track positions, and/or higher chances of leaving academia before the end of their fixed-term contract.

The studies closest to ours are Alfano et al. (2025) and Gaiaschi (2025). While Alfano et al. (2025) examine gender gaps controlling for scientific productivity and experience, they do not consider female representation. Gaiaschi (2025) relates recruitment gaps to scientific fields' feminization rather than to women's presence in decision-making bodies. Her analysis therefore emphasizes disciplinary composition rather than organizational power.

The second stream of literature we touch upon is the growing literature showing that gender representation is not merely a descriptive characteristic of organizations but may influence organizational behavior, decision-making processes, and ultimately career outcomes. Several studies suggest that departments characterized by a higher proportion of women tend to develop more collaborative and inclusive academic environments. Existing evidence indicates that female representation is associated with lower discrimination in hiring and evaluation, more impartial recruitment processes, narrower gender gaps in publication and citations, and more equitable bargaining outcomes (Stockemer et al, 2025; Baranski et al., 2023; Biasi and Sarsons, 2022).

For instance, Bagues et al. (2026) investigates whether higher female representation produces benefits that trickle down to women at earlier career stages, focusing on representation in the top academic positions. Exploiting quasi-random variation in promotions in Spain, they find that promoting a woman to Associate Professor increases the number of female Associate Professors in the department by about 1.5 after fifteen years and leads to approximately six additional female PhD graduates over the following decade, who are also more likely to remain in academia and obtain tenured positions. They also show that these effects are concentrated in departments where women are *"present but not yet in the majority"*, suggesting that trickle-down effects may depend on reaching a sufficient level of representation consistent with the idea of critical mass. A similar interpretation is proposed by Stockemer et al (2025), who argue that the presence of women in academic environments can reduce gender disparities in research outcomes by improving access to resources and collaborative opportunities. The underlying mechanisms can be multiple: female representation among senior faculty may improve departmental climate, making it more collaborative and inclusive, while also reducing sexual harassment (Folke and Rickne, 2022), may advocate for more family-friendly policies (Epifanio and Troeger, 2020), and serve as role models and mentors for junior scholars (Ginther et al., 2020; Carrella et al., 2010; Porter and Serra, 2020). The literature has also investigated how the presence of women in senior positions may contribute to reducing gender discrimination in hiring and

promotion processes (De Paola and Scoppa, 2015; Kunze and Miller, 2017) and in bargaining processes (Brunetti et al., 2024, Baranski et al. 2024; Biasi and Sarsons 2022; Small et al. 2007; Dufwenberg and Muren 2006). A higher presence of women in the department might also facilitate access to professional networks. This perspective is consistent with evidence showing that departments approaching gender parity exhibit smaller gaps in terms of publications and citations (Stockemer et al., 2025).

These findings do not imply that women systematically favor women. Rather, they suggest that greater gender diversity may improve institutional quality by reducing implicit biases, increasing transparency, expanding professional networks, facilitating access to mentoring and resources, and promoting merit-based evaluation. Under this interpretation, female representation benefits not only women but potentially all individuals exposed to discriminatory environments or structural disadvantages. Along this line, the recent report by UN Women (2026) reports that: "*when women lead and power is shared, all SDGs move forward*". Based on these contributions, we expect that higher degrees of female representations are associated with better early-career outcomes, i.e., higher stabilization rates and lower rates of leaving academia.

The analysis of representation requires distinguishing between descriptive and substantive representation (see Wängnerud, 2009 and references therein). Descriptive representation refers to women's numerical presence within an organization, whereas substantive representation concerns their presence in positions where strategic decisions are made and their potential influence on institutional practices and outcomes. In academia, particularly in Italy, full professors often occupy key institutional positions, including hiring committees, doctoral committees, departmental councils, and governance bodies that shape recruitment and career advancement. Departments with similar overall female representation may therefore differ substantially in women's representation among full professors and, consequently, in their presence in decision-making. The female ratio, measuring the number of female scholars relative to male scholars regardless of academic rank, provides a measure of descriptive representation. The glass-ceiling index, capturing gender imbalance among full professors, provides an alternative measure related to substantive representation and academic power. We therefore expect alternative measures of female representation to have different effects on early-career outcomes, either overall or specifically for women.

Finally, we acknowledge that academic fields differ considerably in gender composition, organizational culture, publication practices, and promotion norms. Consequently, the relationship between gender of the scholar, female representation and career progression may be different in traditionally male-dominated disciplines, such as STEM or Economics compared to fields where women already constitute a substantial share of the academic workforce (see, e.g., Lundberg and Stearns, 2019 and Gaiaschi, 2025). Based on this, we expect the effects of gender and of female representation to vary across scientific disciplines.

3. Institutional background

The Italian academic system has been experiencing several changes in the recruitment and promotion mechanisms. At the end of 2010 the so-called Gelmini reform (Law 240/2010) remarkably modified the entry-level position: the de-facto permanent assistant professor was replaced by two new entry-level researchers: the fixed-term junior assistant professors (Ricercatore a tempo determinato di tipo A, RtdA from now on) and the tenure-track associate professors (Ricercatore a tempo determinato di tipo B, RtdB, from now on).

RtdA are fixed-term appointments, typically lasting three years, with the possibility of an extension of two additional years. They represented an explicitly precarious stage of the academic career, in which researchers could acquire further research experience and qualifications but had no automatic entitlement to a subsequent academic position. By contrast, RtdB positions were introduced as three-year tenure-track appointments. Eligibility for an RtdB position could be established through different routes established by law, including previous experience as an RtdA or a specified and documented period of previous postdoctoral research experience. The same reform also introduced the National Scientific Qualification, NSQ (*Abilitazione Scientifica Nazionale)*, a requirement, along with a positive institutional evaluation from their Department, for RtdB to be appointed as associate professors at the end of the contract.[1]

Therefore, the typical trajectory established by this institutional design involves an initial RtdA appointment followed by an RtdB appointment and, conditional on the

[1] In 2022 the Law 79/2022 further reformed the entry-level fixed-term academic appointments, replacing RtdA and RtdB with a single fixed-term entry-level appointment, the *Ricercatore a tempo determinato in tenure track,* RTT. The mechanism however is the same: after a 6-year contract, and conditional on obtaining the NSQ and a positive evaluation, s/he gets the associate professorship. In our analysis RtdB and RTT are assimilated.

acquisition of the required NSQ and a positive evaluation, transition to associate professorship. This pathway is not automatic. Not all RtdA obtain a subsequent position: they could remain in other temporary academic positions, move to other institutions or sectors, or leave academia altogether.

This institutional configuration is particularly relevant for the analysis of academic precariousness and career stabilization. In this setting, the transition from RtdA to RtdB represents a particularly informative marker of career progression: it identifies the point at which a researcher moves from a temporary and explicitly non-tenure-track position to a position designed to provide a pathway towards academic stabilization, and is therefore central to our analysis.

Both early career researchers are recruited through public competitions, in which each department identifies the profile of the position to be filled, specifying the scientific discipline and its teaching or research needs.[2] Although recruitment is formally open and competitive, candidates may already belong to the scientific networks of department members, and positions may be designed with a potential candidate in mind, frequently an early-career researcher already holding a temporary position in the department. In this context, decision-making within the department may be relevant not only to determining whether a position is opened, but also to shaping the conditions under which recruitment and career progression occur.

Departments have limited resources to allocate to recruitment and internal career progression, and may freely decide how these resources are distributed across scientific disciplines and career stages. These decisions are made by the departmental council, in which full professors may play a particularly influential role even in the absence of formal voting differences within the council, and may involve competing interests and priorities, potentially reinforcing existing inequalities. This is where the gender composition of departmental decision-making bodies may become relevant. The presence of women, particularly among full professors, may affect which perspectives and interests are taken into account in the allocation of positions and in decisions shaping early-career trajectories. Examining women's representation thus allows us to investigate whether the

[2]Disciplinary fields are organized into 14 scientific areas (1 - Math, 2 - Physics, 3 - Chemistry, 4 - Earth Sciences, 5 – Biology, 6 – Medicine, 7 - Veterinary, 8 – Architecture, 9 – Engineering, 10 – Antiquities and Literary Studies, 11 - History, Philosophy, Pedagogy and Psychology, 12 – Law, 13 – Economics, 14 - Social Sciences).

gender composition of academic departments is associated with the likelihood that temporary researchers transition to a stable employment or leave academia.

4. Data and Empirical strategy

The dataset used for the empirical analysis has been suitably generated drawing from two different sources: the Italian Ministry of Universities and Research, and the National Agency for the Evaluation of Universities and Research.

The first data source refers to the universe of scholars who have worked in any Italian University between 2011 and 2026.[3] For each scholar, the data provide name and surname, gender, Department and University of affiliation, scientific area, and academic position as of December 31, each year t , which we categorize as follows: junior assistant professors (RtdA), tenured assistant professor, tenure-track associate professors (RtdB), associate professors, and full professors.[4]

Based on this data, we first compute, for each Department j and year t, the Female Ratio (FR) and the Glass Ceiling Index (GCI) defined, respectively, as follows:

$$FR_{jt} = \frac{NW_{jt}}{N_{jt} - NW_{jt}}$$

$$GCI_{jt} = \frac{NW_{jt}}{N_{jt}} \frac{NF_{jt}}{NFW_{jt}}$$

where N_{jt} is the number of professors working at the Department j in year t, NF_{jt} is the number of full professors, and NW_{jt} and NFW_{jt} are the number of female professors and the number of female full professors working at the Department j in year t, respectively. The FR measures the proportion of female scholars in the organization, with 0 denoting the complete absence of women, 1 denoting gender balance within the Department, and ∞ signalling that only women are present. Higher values of FR thus signal higher descriptive female representation. GCI also ranges between 0 and ∞ with value 1 signalling gender parity, but values greater than 1 denote that female representation decreases as the career

3 Data retrieved from the MUR website, https://cercauniversita.cineca.it/php5/docenti/cerca.php

4 The detailed list of possible positions includes: Ordinario, Straordinario, Straordinario a tempo determinato and Ordinario r.e. (which we gather in the category "full professor"), Associato, Associato non confermato, and Associato confermato (gathered in the category "associate professor"), Ricercatore, Ricercatore non confermato (collapsed in the category "assistant Professor"), Ricercatore a tempo determinato di tipo B and Ricercatore a tempo determianto in Tenure Track (gathered in the category "tenure-track associate professor) and Ricercatore a tempo determinato di tipo A (representing the category "junior assistant professor").

ladder increases, and ∞ a complete lack of women in the top career positions. Values higher than 1 thus signal a lower substantial female representation.

We then reconstruct the career paths of all scholars. Since this study investigates gender gaps in early-career trajectories, we first drop all scholars who entered the sample as associate or full professors, keeping only who has been RtdA during the sample period. Next, for each of them, we observe the employment status from the first year spent as RtdA until either the end of their permanence in the dataset or the last year in the sample period, 2026. For each scholar and each year, we thus have three potential outcomes: (i) s/he remains RtdA, (ii) s/he transitions to a tenure-track (RtdB) or permanent (Associate) position, (iii) s/he exits the database. Exits may result from non-renewal of the contract, relocating abroad or leaving for the private sector or other non-academic roles.

We also eliminate all namesakes, that is, professors with the same name and surname, as well as all scholars with missing information about the scientific sector. This is done to avoid any risk of misidentification in merging this first data source with the second one, as the merge is done based on the name, surname, and scientific sector.

The second source of data contains all the scholars accredited with the NSQ up to 2026, reporting for each name and surname, as well as the scientific sector.[5]

In merging these two datasets, three cases are possible: i) RtdA researchers in Italian academia who obtained the NSQ; ii) RtdA researchers in Italian academia who did not obtained it; and iii) scholars with NSQ but who never worked in Italian universities during our sample period. Since this study focuses on transitions from non-tenured to tenured academic positions, we restrict the sample to scholars in the first two cases and exclude those in the third.

This leaves us with an unbalanced panel of 18,074 unique scholars who have been RtdA at Italian universities between 2011 and 2026, for a total of 58,311 observations. Almost a third of these scholars are still in service as RtdA in 2026, and act thus as right-censored in our analysis, around a half ended up stabilized, while the rest left academia during our sample period. Figure 1 shows that the three potential outcomes are not equally distributed between male and female scholars, whereby male are more likely to be stabilized.

5 Data are taken from https://abilitazione.miur.it/public/index.php Note that for privacy reasons the names of those not qualified are removed 120 days after the publication of the accredited Qualification.

Figure 1. Distribution of potential outcomes, by gender.

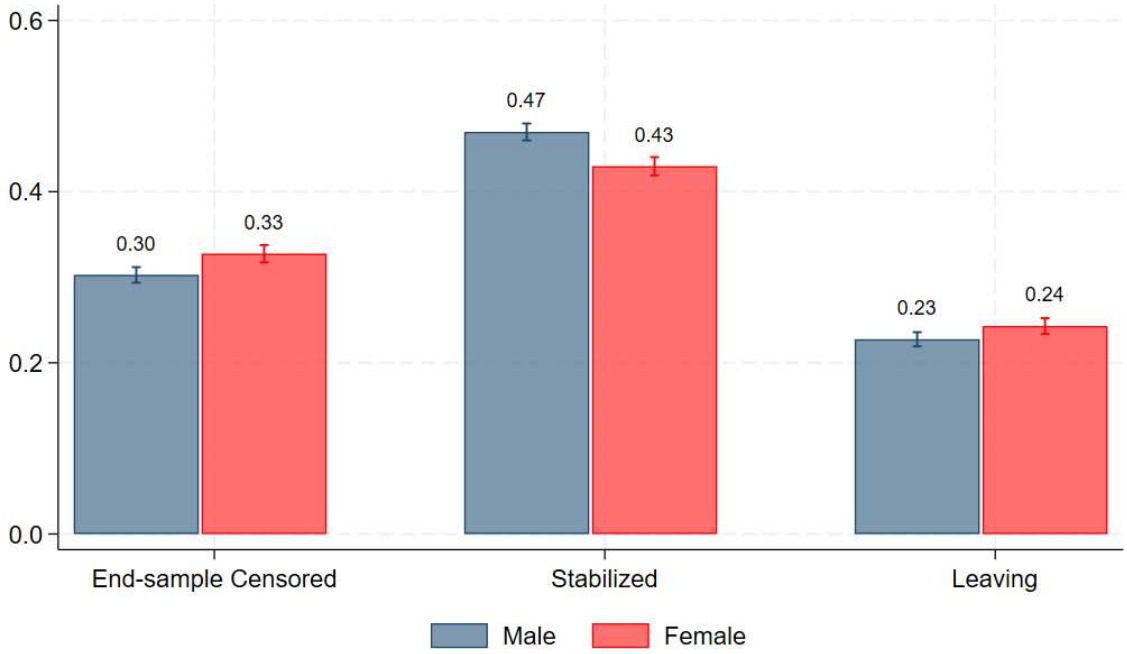
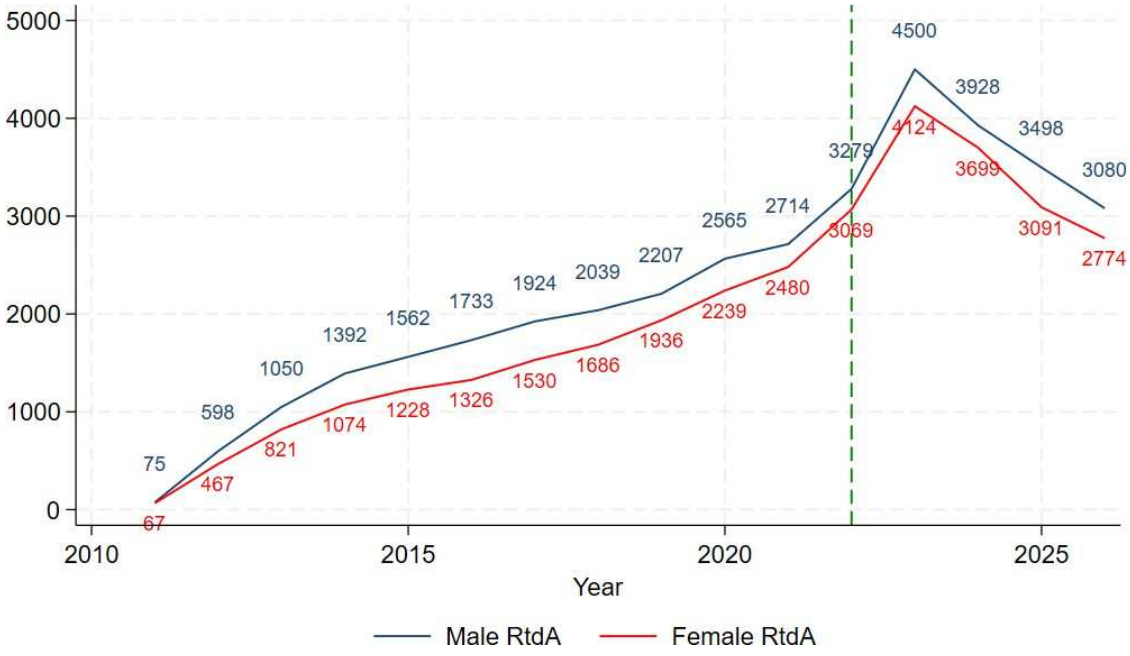


Figure 2 shows that the stock of RtdA increases as of 2011 after its introduction and reduces after the 2022, year in which a reform eliminated them, and that women remain consistently fewer than men during the overall observed period. Although the two groups start from almost identical numbers, the gap widens as these positions become more widespread, narrowing only after 2022 when availability of RtdA positions increased driven the PNRR funding.[6] This pattern is consistent with the interpretation that a substantial increase in recruitment opportunities enabled greater female participation, without, however, eliminating the numerical imbalance.

[6] The PNRR (Piano Nazionale di Ripresa e Resilienza, or National Recovery and Resilience Plan) is Italy's programme of reforms and investments funded through the European Union's NextGenerationEU initiative, established in response to the economic and social crisis caused by the COVID-19 pandemic.

Figure 2. Number of RtdA in the Italian Universities, by year and gender.



Note: The figure plots the stock of RtdA working in Italian universities, between 2011 and 2026, by gender. The green dashed line signals year 2022.

Finally, we associate with each scholar i present in the dataset in year t the Glass-Ceiling Index and the Female Ratio of their Department j in year t, denoted by GCI_{jt} and FR_{jt}.

Table 1 reports the descriptive statistics on the estimation sample, which includes 58,311 researcher-year observations. Women account for 47.1% of these observations, suggesting that the gender composition at this early career stage is broadly balanced. Most observations concern researchers in STEM fields (78.7%). Almost half are associated with universities located in Northern Italy (47.6%), while the South/Islands and the Center account for 30.5% and 21.9%, respectively. Observations are mainly concentrated in the first three years of the RtdA spell, which together account for 81.3% of the total. Looking at the departmental indicators of gender representation, the Female Ratio averages 0.651, indicating approximately 65 women for every 100 men on average in the departmental environment. The average GCI (1.748) reveals that women's representation among full professors is, on average, remarkably lower than among all academic ranks. Overall, these descriptive statistics highlight the difference between the broadly balanced gender composition at the entry stage of the academic career and women's lower representation within departments, particularly at the top of the academic hierarchy, motivating our analysis of how institutional gender composition relates to stabilization and exit.

Table 1: Descriptive Statistics on estimation sample

Variable	Obs	Mean	Std. dev.	Min	Max
Right-censored	58,311	0.355	0.478	0	1
Stabilized	58,311	0.425	0.494	0	1
Exit	58,311	0.220	0.414	0	1
Female	58,311	0.471	0.499	0	1
$T = 1$	58,311	0.310	0.462	0	1
$T = 2$	58,311	0.282	0.450	0	1
$T = 3$	58,311	0.221	0.415	0	1
$T = 4$	58,311	0.116	0.320	0	1
$T = 5+$	58,311	0.071	0.256	0	1
FR	58,306	0.651	0.230	0	8
GCI	53,281	1.748	0.969	0.205	9.84
STEM	57,073	0.787	0.409	0	1
Non-STEM	57,073	0.213	0.409	0	1
North	58,311	0.476	0.499	0	1
Center	58,311	0.219	0.413	0	1
South & Islands	58,311	0.305	0.460	0	1

Notes: The table reports the summary statistics of all the variables included in the empirical analysis. Right-censored, Stabilized, and Exit refer to the potential outcomes. T is the number of years the scholar has so far held an RtdA position, FR is the Female Ratio, and GCI the Glass-Ceiling Index. STEM areas include Math, Physics, Chemistry, Biology, Science, Engineering, and Architecture, Medicine, Agriculture & Veterinary, and Economics & Statistics. Non-STEM include Philosophy, History, Humanities, and Social Sciences.

In each year *t*, two mutually exclusive events can happen to each RtdA present in the sample. The first is *Stabilization*, defined as the transition to a tenure-track (RtdB) or to a permanent (Associate Professor) position.[7] We set the outcome to Stabilization if the scholar gets an RtdB position and a NSQ in the same scientific sector, since holding the NSQ is required for the transition from tenure-track to a permanent position.[8] The second possible event is *Exit*, occurring when the scholar disappears from the Italian academic registry. This event covers non-renewal of the contract, as well as moves abroad, to the private sector or to non-academic roles. Those who are still in RtdA positions in 2026, the last year of the panel, are classified as right-censored.

[7] We drop the 15 cases observed of RtdA transiting to a Full Professorship directly

[8] This definition makes the event Stabilization dependent on two distinct facts, namely winning a tournament as tenure-track RtdB and being granted the NSH. To assess which of the two drives our results, we replicate the analysis defining stabilization as entry into an RtdB position regardless of the NSH. Results remain qualitatively unchanged, showing that the gap is mainly driven by the access to tenure-track positions rather than to NHS qualification.

Because gender differences may emerge in either stabilization or in leaving academia, we model both outcomes separately (as, e.g., Putter et al, 2007; Austin et al, 2016). Moreover, opt for a discrete-time hazard framework since employment status is recorded annually. Letting $t = 1,2, \dots ,5$ denote the year spent in RtdA, T_i the discrete duration of the spell of individual i , and $J_i \in \{1,2\}$ the cause that ends it (1 = stabilization, 2 = exit), the cause-specific discrete hazard is defined as:

$$h_k(t \mid \mathbf{x}_{it}) \;=\; \Pr(T_i = t, J_i = k \mid T_i \geq t, \mathbf{x}_{it}) \qquad k = 1,2 \qquad (1)$$

that is, the probability that the spell of individual i ends in year t because of event k, conditional on still being in an RtdA position at the beginning of that year (or at the end of the previous year on our case).

Assuming that the cause-specific hazard rates are proportional and modelling them through a complementary log-log link and, they can be rewritten as:[9]

$$h_k(t \mid \mathbf{x}_{it}) \;\equiv\; \log\{-\log[1 - h_k(t \mid \mathbf{x}_{it})]\} \;=\; \alpha_{kt} + \mathbf{z}_{it}'\boldsymbol{\delta}_k \qquad k = 1,2 \qquad (2)$$

Our specification for the hazards of each of the two possible events k is:

$$\alpha_{kt} + \mathbf{z}_{it}'\boldsymbol{\delta}_k = \alpha_{kt} + \phi_k \,\text{Female}_i + \gamma_k \text{Rep}_{k,it} + \tau_k + \mathbf{x}_{it}'\boldsymbol{\beta}_k \qquad k = 1,2 \qquad (3)$$

where α_{kt} are the duration dummies (taking value 1 for each year spent in RtdA). They capture duration dependence and are expected to peak at years 3 and 5, corresponding to the end of the initial and renewed contract, respectively.

Female_i, a dummy equal to 1 if scholar i is female, is the main variable of interest in this analysis, and its associated coefficent(s) ϕ_k, capture the gender gap in the probability of stabilization, if $k = 1$, or of exit, if $k = 2$.

The variable $\text{Rep}_{k,it}$ represents the female representation in the Department of scholar i in year t. The subscript k reflects the fact that this measure differs across the two equations. In the Stabilization equation ($k = 1$) it refers to the Department in which the scholar is employed once stabilized, while in the Exit equation ($k = 2$) it refers to the Department s/he is leaving. This choice follows the logic of each event, since stabilization is decided and granted by the hiring Department, while exit is a response to the Department of origin. The

[9] This is the model of Prentice and Gloeckler (1978). It is the exact grouped-time counterpart of the Cox proportional hazards model (Cox 1972), and its coefficients have the same interpretation: $\exp(\beta_{kj})$ is the hazard ratio associated with a one-unit change in covariate j on the hazard of event k (Jenkins 1995).

measures used are the FR and of GCI, to proxy for descriptive and substantive female representation, respectively, entered with standardized values to allow a direct comparison of their coefficients.

Finally, all model specifications feature years fixed effects τ_k, and vector $\mathbf{X}_{it}$ of controls, including a dummy for the scientific area being STEM or not, and the geographical location of the University (Center or South & Islands, with North as reference category) and its size (via quartile dummies, with the smallest ones as reference category), the latter being used as proxy for financial resources (see, Filandri and Pasqua, 2021).

The two cause-specific models are estimated separately, treating being RtdA in the last panel year or the competing event as censoring. Estimation of the parameters occurs by maximizing the following Bernoulli log-likelihood:

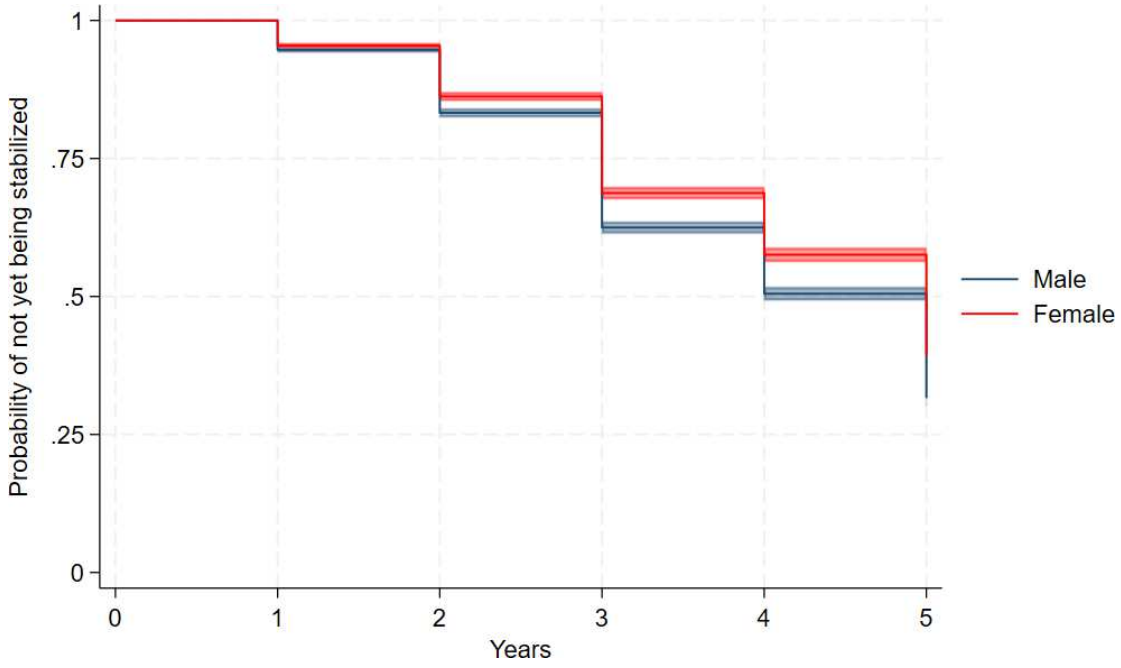
$$\ell_k(\boldsymbol{\alpha}_k, \boldsymbol{\beta}_k) = \sum_{i=1}^{N} \sum_{t=1}^{T_i} \{y_{k,it} \log(h_{k,it}) + (1 - y_{k,it}) \log(1 - h_{k,it})\} \qquad (4)$$

where $y_{k,it}$ takes value 1 if the spell of scholar i ends in year t because of event k, and 0 otherwise, $h_{k,it} \equiv h_k(t \mid \mathbf{x}_{it})$, and T_i is the last year in which i is observed at risk. Since each individual contributes several observations, standard errors are clustered at the individual level.

5. Main Findings

Figure 3 plots the Kaplan-Meier estimate of the probability that a scholar has not yet stabilized, by gender and years spent in RtdA. Consistently with expectations, the largest drops in both curves for male and female occur at the end of the third and of the fifth year, when the RtdA contract expires or its extension ends. Moreover, the survival function of women lies above that of men at every duration, which means that women are less likely to have obtained a stable position at any given point of the RtdA spell, proving that a gender gap is already visible in the unconditional data. The gap widens after the first year, remaining stable around 7 percentage points after the third years (when the share of female scholars still not stabilized is 68.75% against the 62.49% of male ones). The difference between the two functions is also confirmed by the log-rank test ($\chi^2(1) = 81.38$, $p \simeq 0.00000$).

Figure 3: Kaplan-Meier empirical survival function, by spell duration and gender, with 95% confidence intervals.



We now investigate whether the gap survives once we account for factors such as female representation in the Department, scientific area, and University characteristics, as well as whether it reflects differences in stabilization, in exit, or in both.

Table 2 reports the results for the transition from RtdA to a permanent or tenure-track position. The average marginal effect for *Female* is negative in all specifications: all else equal, women have between 3.1 to 4.9 percentage points lower probability of stabilization than men. Compared to a sample mean of about 14%, this corresponds to a reduction of approximately 22% to 35%, which is economically substantial.

The magnitude and significance of the gap are virtually unaffected by the inclusion of the controls discussed below, which suggests that the observed gap between women and men in terms of likelihood of stabilization is not driven by disciplinary field, geographic location or the size of the employing university.

The duration dummies show that the probability of stabilization rises with time spent in RtdA, with peaks in the third and fifth years, matching the points where the contract expires or can be extended.

Table 2: Determinants of the transition from RtdA to Stabilization.

	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.037***	-0.031***	-0.039***	-0.040***	-0.031***	-0.049***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$T = 2$	0.068***	0.071***	0.071***	0.068***	0.071***	0.070***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$T = 3$	0.223***	0.237***	0.229***	0.221***	0.237***	0.227***
	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)
$T = 4$	0.218***	0.226***	0.220***	0.219***	0.226***	0.219***
	(0.006)	(0.007)	(0.007)	(0.006)	(0.007)	(0.007)
$T = 5$	0.404***	0.423***	0.403***	0.405***	0.423***	0.397***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)
FR	0.031***		0.041***	0.009***		0.012***
	(0.003)		(0.002)	(0.003)		(0.003)
GCI		-0.005***	-0.002		-0.001	-0.001
		(0.002)	(0.002)		(0.002)	(0.002)
FR x Female				0.028***		0.050***
				(0.005)		(0.005)
GCI x Female					-0.009***	-0.000
					(0.003)	(0.003)
STEM	-0.010***	-0.024***	-0.004	-0.013***	-0.024***	-0.007*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Center	-0.009**	-0.005	-0.010**	-0.011***	-0.005	-0.011***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
South & Islands	-0.022***	-0.018***	-0.029***	-0.019***	-0.018***	-0.029***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Uni size, Q = 2	0.019***	0.025***	0.017***	0.025***	0.024***	0.024***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Uni size, Q = 3	0.035***	0.037***	0.030***	0.041***	0.037***	0.036***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Uni size, Q = 4	0.020***	0.025***	0.012***	0.027***	0.024***	0.020***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	52,040	47,491	47,491	52,040	47,491	47,491

Notes: The table reports the marginal effects of the variables included in the empirical counterpart of equation 3 for the outcome Stabilization (k = 1). Each model also features years fixed effects. T is the spell duration, while FR and GCI are the standardized Female Ratio, and the standardized Glass-Ceiling Index of the hiring Department, respectively. STEM is a dummy taking value 1 for the following scientific areas: Math, Physics, Chemistry, Biology, Science, Engineering, and Architecture, as well as Medicine, Agriculture & Veterinary, and Economics & Statistics.

Female representation in the destination university is strongly associated with the probability of stabilization. Specifically, a one-standard-deviation increase in our proxy for descriptive representation, FR, is associated with an increase in the probability of stabilization between 3.1 and 4.1 percentage points (pp), while a one-standard-deviation increase in substantive representation, as proxied by the GCI, lowers it by 0.5 percentage points. The association with FR (between 3.11 and 4.1 pp) is roughly six times larger than

that with the GCI (0.5 pp). Not surprisingly, once both are included in the model (Cols 4 and 6), only the former remains statistically significant. These findings suggest that stabilization is more strongly associated with women's overall presence in the department than with their relative representation at the top of the academic hierarchy, consistently with mechanisms such as access to mentoring, professional networks, and a more inclusive organizational climate, which greater female representation may facilitate.

These effects vary by gender. Results in column (4) for instance show that the marginal effect for FR is 0.9 pp for men and $0.9 + 2.8 = 3.7$ pp, i.e., about four times steeper, for women. As for the GCI, the effect is statistically significant only for women, who are penalized more where the glass ceiling is higher.

Among the controls, scholars in STEM fields have a lower probability of stabilization, consistently with the results reported by Gaiaschi (2025). Those employed in southern universities are less likely to stabilize than those in the North, while the difference between the Centre and the North is not statistically significant. University size shows a positive gradient: larger universities, typically having more resources, stabilize their RtdA researchers with higher probability.

Table 3 reports the results for leaving the academic system. In contrast with the stabilization models, the coefficient on *Female* is never statistically significant. In other words, we find no evidence that, all else equal, women are more likely than men to leave academia before stabilizing. The gender gap documented above therefore concerns only the transition to a stable position, not the decision or the necessity to leave the academia.

The duration dummies display the pattern expected from the structure of the contract, as the hazard of exit is highest in the third and fifth years, when the RtdA contract expires, or its extension ends.

Female representation in the working university is again a relevant predictor. Specifically, both FR and GCI are statistically significant and with the expected signs. The evidence suggests that scholars are less likely to leave universities with a higher share of women and a less pronounced glass ceiling. When both indicators are included, however, only the GCI remains statistically significant, pointing towards an higher relevance of substantive representation when it comes to human capital retention within the department.

Table 3: Determinants of the transition from RtdA to exit.

	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.000	-0.001	-0.000	-0.000	-0.001	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$T = 2$	0.002	0.002	0.002	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$T = 3$	0.126***	0.127***	0.127***	0.126***	0.127***	0.127***
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)
$T = 4$	0.015***	0.016***	0.016***	0.015***	0.016***	0.016***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$T = 5$	0.193***	0.195***	0.196***	0.193***	0.195***	0.196***
	(0.008)	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)
FR	-0.003**		-0.001	-0.003		-0.002
	(0.001)		(0.001)	(0.002)		(0.002)
GCI		0.004***	0.003***		0.002	0.002
		(0.001)	(0.001)		(0.002)	(0.002)
FR x Female				0.001		0.002
				(0.002)		(0.003)
GCI x Female					0.003	0.003
					(0.002)	(0.002)
STEM	0.010***	0.008***	0.008***	0.010***	0.008***	0.007***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Center	0.017***	0.016***	0.016***	0.017***	0.016***	0.016***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
South & Islands	-0.000	-0.004	-0.004	-0.000	-0.004	-0.004
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Uni Size, Q = 2	0.009***	0.010***	0.010***	0.009***	0.010***	0.010***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Uni Size, Q = 3	-0.003	0.000	0.000	-0.003	0.000	0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Uni Size, Q = 4	-0.007**	-0.008***	-0.008**	-0.007**	-0.008**	-0.008**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	51,943	47,305	47,305	51,943	47,305	47,305

Notes: The table reports the marginal effects of the variables included in the empirical counterpart of equation 3 for the outcome Exit (k = 2). Each model also features years fixed effects. T is the spell duration, while FR and GCI are the standardized Female Ratio, and the standardized Glass-Ceiling Index of the Department to which the scholar belongs, respectively. STEM is a dummy taking value 1 for the following scientific areas: Math, Physics, Chemistry, Biology, Science, Engineering, and Architecture, as well as Medicine, Agriculture & Veterinary, and Economics & Statistics.

Unlike in the stabilization models, however, the interactions of both measures with *Female* are never significant, meaning that the organizational environment of the home institution relates to the retention of men and women in a similar way.

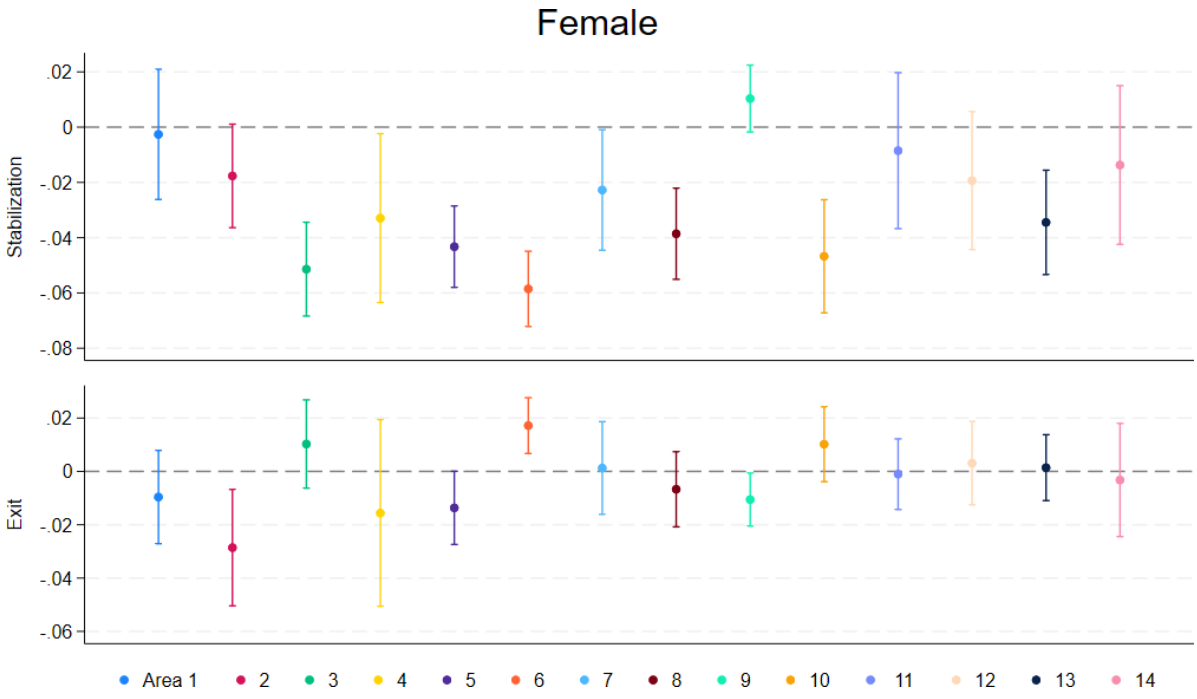
Among the controls, scholars in STEM fields are more likely to exit than those in the humanities and social sciences. This result is consistent with STEM researchers having better outside options in terms of both employment opportunities and salaries, (Schwabe,

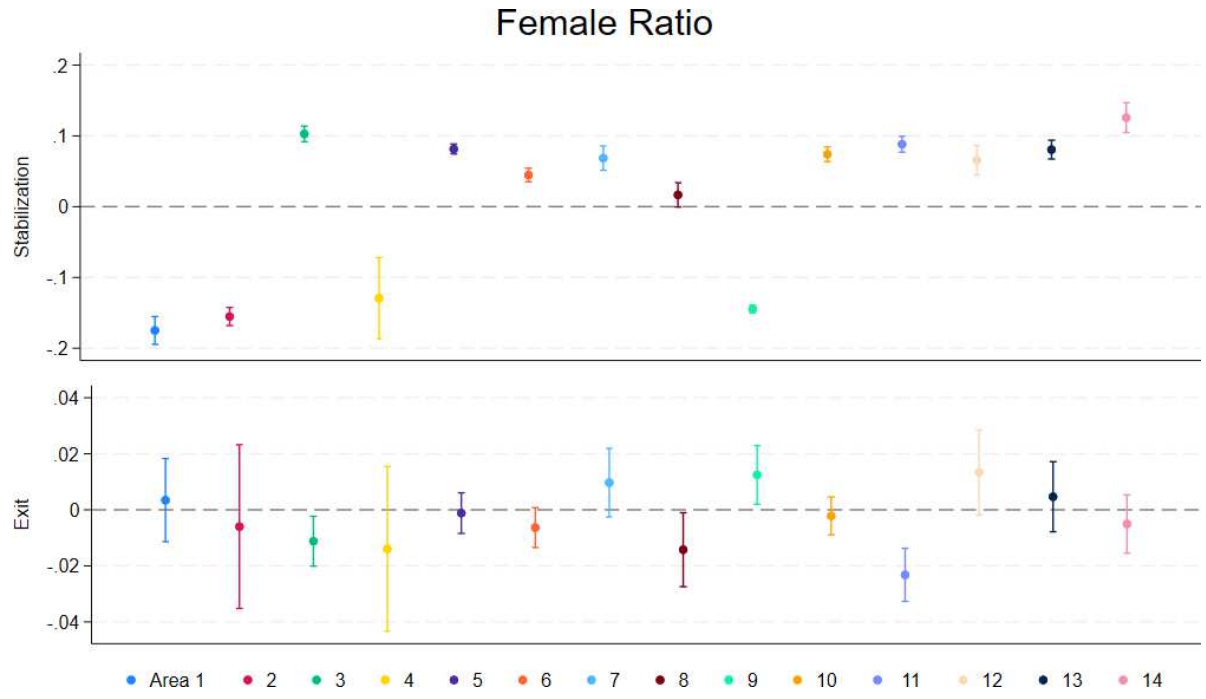
2011; ISTAT, 2026), albeit we cannot explicitly test this mechanism with our data. Universities located in the Center are more likely to exit than those in the North, while the difference with the South is not significant. University size also matters to the extent that it is a proxy for available resources; large Universities are associated with reduced hazards of exit, as expected.

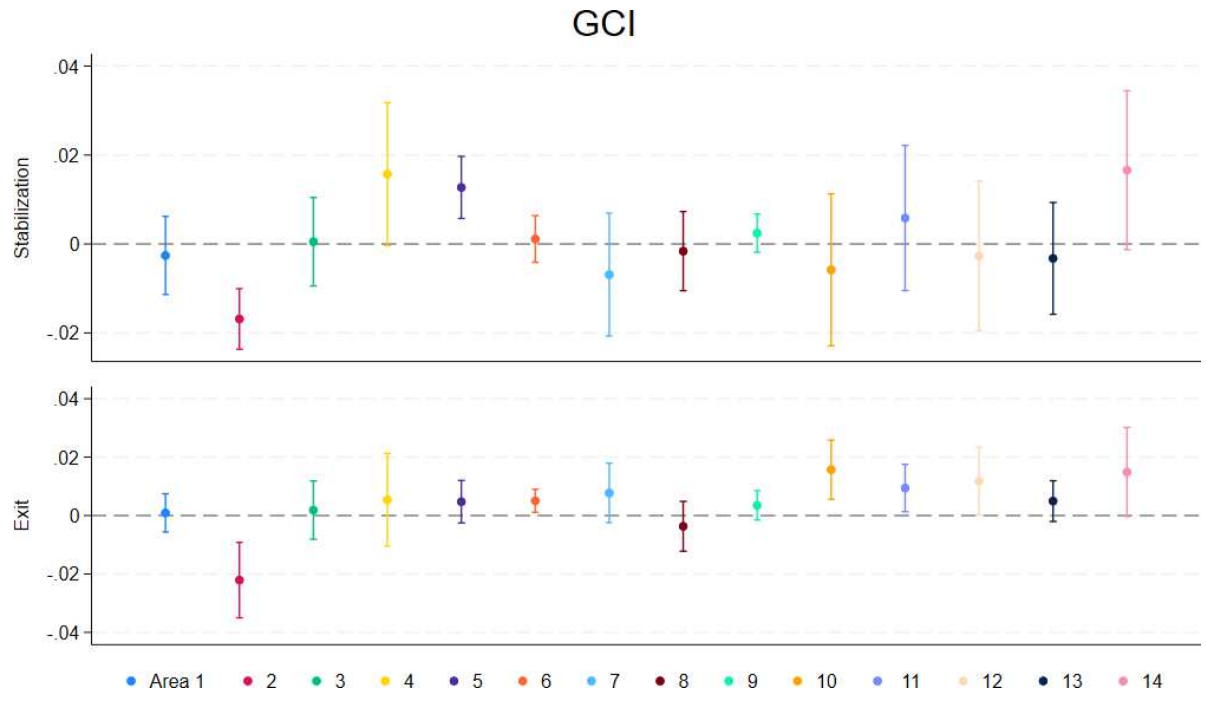
Taken together, these findings indicate that women do not leave academia with higher probabilities, rather they are less likely to reach a stable position, which is the pattern that motivates our focus on the transition out of precarity.

Figure 4 provides evidence of a huge degree of heterogeneity by scientific area, whereby the gender gap in stabilization is non-existent in humanities and social sciences, whilst it reaches 6pp in chemistry and medicine, the latter being also the only sector in which a women suffer higher probabilities of leaving. Similarly, despite the strong relevance of FR on stabilization and of GCI on exit are generalized, estimates remarkably vary with the scientific disciplines.

Figure 3. Average marginal effects on Stabilization and Exit, by disciplinary area.







Note: The figure plots the estimated marginal effects of Female, Female Ratio (FR) and Glass-Ceiling Index (GCI), by scientific areas.

All the results presented so far are robust to a variety of checks. First, we estimate Cox proportional hazards. Second, we opt for a multinomial logit which models all competing

events jointly. Third, we replicate the analysis using FR and GCI at the University rather than at the Department level. We also use the dummy for a female rector as a measure of strong female sensitivity in the University, finding qualitatively unchanged results. Finally, we replicate the analysis defining the event of stabilization as entering an RtdB position regardless of the NSQ. Also in this case, the main findings are confirmed, showing that conditioning on the NSQ does not cancel the estimated gap, and hence that the latter arises at selections to the tenure-track position.[10]

6. Conclusions

This paper investigates gender inequalities in academic early careers, by considering the potential role of female representation within the Department on the final outcomes.

We report a remarkable gender gap in the probability of stabilization whilst no difference in the probability of leaving academia before contract termination, leading to the conclusion that the gender gap in career progression stems from lower promotion rates within universities, rather than from higher attrition out of academia. We also find that higher female representation and a less pronounced glass ceiling increase the probabilities of stabilization and reduce the ones of exiting academia. Importantly, the effects on stabilization are stronger for women, suggesting that institutional environments characterized by greater female representation may be particularly relevant to female researchers' opportunities to achieve stable employment. No gender differences are observed instead on the effect of a less pronounced glass ceiling on exit probabilities. Taken together, these findings suggest that gender inequalities in early academic careers should not be interpreted primarily in terms of women's greater propensity to leave academia. Rather, they point to the importance of the institutional conditions under which researchers can move from precarious employment to stable positions.

These findings contribute to the literature on the leaky pipeline, gender representation, and organizational behavior by shifting attention from individual characteristics and choices to the institutional conditions under which academic careers unfold. The observed associations are consistent with the hypothesis that greater female representation and a less pronounced glass ceiling reflect organizational environments in which career opportunities

10 This result should not be read as evidence that the NSQ is neutral with respect to gender, as we do not model neither the probability nor the timing of obtaining the NSQ. Any potential gender differences at that stage, whose evidence can be found, e.g., in De Paola and Scoppa (2015), simply accumulate before or alongside the transition we study.

are more equally distributed and precarious employment is less likely to result in exit without stabilization. This interpretation does not require assuming that women in positions of influence preferentially support other women. The similar associations with exit for women and men suggest that the potential benefits of such environments may extend to researchers more generally.

Although this study focuses on gender inequalities, its institutional perspective raises broader questions about how academic organizations reproduce or mitigate social inequalities. Career opportunities may also be shaped by social class, ethnicity, disability, sexual orientation, and other dimensions of social position, which can intersect in structuring access to opportunities and career progression. The administrative data available for this study do not allow us to examine these intersections, nor to establish whether the mechanisms identified here operate similarly for other underrepresented groups. Future research should therefore investigate how institutional conditions interact with multiple dimensions of social position and whether environments associated with more equitable opportunities along one dimension also help address other forms of disadvantage.

From this perspective, female representation should not be understood merely as a measure of demographic balance, but also as a potential indicator of organizational conditions relevant to equity and inclusion. Reducing inequalities in academic careers requires attention not only to individual qualifications and performance, but also to the institutional arrangements through which these are evaluated and career opportunities are distributed. Examining these arrangements is essential to understanding how academic institutions may reproduce or mitigate inequalities and to identifying the conditions under which more equitable and inclusive career opportunities can be fostered.

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