

# The gender gap in the early progression of academic careers: evidence from Italy

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## Abstract

**Purpose** – This paper contributes to the existing literature on the gender gap in academic career advancement by focusing on the very early stage of the academic career, i.e. the transition from Ph.D. completion to a tenured position.

**Design/methodology/approach** – Using Italian individual-level data, our econometric analyses estimate the likelihood of holding a tenured position conditional on a set of individual-level covariates.

**Findings** – Our findings support the idea that women have a lower probability of obtaining a tenured position. Results hold even when research productivity and experience are controlled for.

**Originality/value** – Our conclusions suggest that there is a significant gender gap in progression through an academic career.

**Keywords** Gender gap, Academic career, PhD holders

**Paper type** Research paper

## 1. Introduction

In recent years, European countries have taken strides towards achieving gender parity in university education. Despite persisting disparities in certain fields, particularly STEM, the incidence of tertiary graduates among women has surpassed that among men (OECD, 2020), and gender parity has nearly been achieved among doctoral degree holders (European Commission, 2021).

Although significant progress in gender equality, women remain underrepresented among university staff. In 2018, women comprised just over 40% of all academic staff (European Commission, 2021). However, similarly to private sector trends (McKinsey & Companies, 2023), their representation diminishes at higher hierarchical levels, constituting approximately 46.6% of grade C staff, 40.0% of grade B, and a mere 26.2% of grade A (Full professor) staff (European Commission, 2021). These statistics underscore the substantial underrepresentation of women in top academic positions, revealing a persistent gender gap (Bagilhole and White, 2011; Currie *et al.*, 2002; Alfano *et al.*, 2021a).

Though an examination of biased selection in the early stages of academic researchers' careers – the so-called “broken rung” (McKinsey & Companies, 2023) – may help to explain

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later disparities, the relevant literature is scarce. [Gaughan and Robin \(2004\)](#) find no specific advantages for men in obtaining permanent positions for post-doctorates in Life Sciences in the US and France. [Picardi \(2019\)](#) finds a gender-based glass door in Italian academia.

We contribute to this discourse with an econometric analysis of Italian cross-sectional microdata, investigating whether a gender gap in career advancement exists among recent PhD graduates early in their academic careers. Italy is a valuable case study for examining gender disparities in academia. While women constitute nearly half of PhDs, their representation drastically declines in higher academic ranks, dwindling to 22.2% among Grade A personnel. Studies attribute this partially to underinvestment in Italian higher education ([Gaiaschi and Musumeci, 2020](#)). Analyses by [Filandri and Pasqua \(2021\)](#), [De Paola and Scoppa \(2015\)](#) and [De Paola et al. \(2017\)](#) reveal substantial gender gaps in career progression, especially when evaluation committees comprise solely male members. However, these studies focus on existing university staff rather than PhD holders seeking academic roles. Our investigation fills this gap by providing evidence about gender disparities in Italian Universities. Part of the existing research on gender differences in academia suggests that it stems from disparities in performance and work experience, arguing that male academics outperform female colleagues in terms of the quantity (and impact) of research and working experience. See for instance [Abramo et al. \(2021\)](#), [Van Arensbergen et al. \(2012\)](#), [Symonds et al. \(2006\)](#). Of course, this productivity and experience gap is itself a puzzle ([Cole and Zuckerman, 1984](#)): on the one side it may be linked to multiple factors, such as voluntary self-selection into parenthood and forced social selection into domestic labour and childcare (see [Squazzoni et al., 2021](#)); on the other, it may be affected by gender bias in editorial boards of scientific journals ([Pautasso, 2015](#)) and may be more pronounced in some scientific fields ([Ginther and Kahn, 2004](#)).

The literature does not unanimously identify differences in research productivity and work experience as the main drivers of the career advancement gap. [Van den Besselaar and Sandstrom \(2016\)](#) note gender differences in academic careers even when accounting for productivity differentials. Discovering that women advance less in their academic careers than men, despite having the same level of scientific productivity and work experience, suggests the presence of a gender gap beyond that explained by productivity and experience alone.

In line with this view, we test whether a gender gap in academic career progression exists among Italian PhD holders in their early careers, even after controlling for research productivity and working experience. By doing so, we contribute to the understanding of gender disparities in academia, even though we cannot provide a conclusive explanation for the underlying reasons behind the observed gap. More specifically, our study checks whether the “productivity” and “experience” hypotheses explain the gap. We achieve this by utilizing Italian microdata on PhD holders who completed their doctoral studies a few years prior to the interview. Our analysis employs two-step Heckman regressions that account for respondents’ self-selection into academia and identify correlates of career progression towards tenured positions. Our findings indicate that experience and research productivity significantly contribute to securing a tenured position, which is encouraging as it signals meritocracy. Contrary to the productivity and experience hypotheses described above, when we control for these factors, women still face a substantially lower probability of obtaining a tenured academic position. This suggests that gender disparities in research productivity and years of experience do not fully explain the gaps in career advancement.

Beyond this main finding, we also demonstrate that the positive correlation between experience and research productivity with the probability of obtaining tenure is more pronounced for men than for women, indicating that experience and productivity are more highly valued for men.

The rest of this study is structured thus: section two delineates the Italian academic recruitment process; section three introduces the data and methodology employed in the econometric analyses; section four presents our analytical findings, while section five concludes.

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## 2. PhD holders' careers in the university system: the Italian case

Italy adopted doctoral education in 1980, awarding its first PhDs in 1985, considerably later than in Anglo-Saxon contexts. Initially, the Italian PhD experience was primarily the initial step toward an academic career, structured as an apprenticeship guided by professors (tutors). Consequently, enrollment comprised mostly of individuals aspiring for an academic trajectory, and available PhD positions remained limited. [Argentin et al. \(2014\)](#) noted that in the mid-1980s, around 2,000 new PhD holders emerged annually, increasing to approximately 4,000 by 2000. [Alfano et al. \(2021b\)](#) provide an in-depth analysis of Italy's doctoral education evolution, elucidating its connection to academic careers.

In the late 1990s, policy interventions reformed this landscape. Local universities were granted greater autonomy in structuring and defining PhD programs, though regulations also advocated for the inclusion of knowledge and skills with potential applicability beyond academia. Subsequently, Italy witnessed a remarkable surge in both PhD enrollees and graduates. According to [Argentin et al. \(2014\)](#), by 2008, there were approximately 12,000 new PhD graduates annually. The PhD then became the tertiary level of university education, with many graduates transitioning to non-academic sectors post-graduation. Notably, those employed in non-academic sectors (two third of the total) frequently experienced job-education mismatch, impacting their private returns adversely ([Gaeta et al., 2017, 2021](#)).

For individuals continuing in academia, the Italian system offered various non-tenured temporary positions, including research scholarships, fellowships, and roles as adjunct professors (contracted for specific courses, often compensated with a minimal hourly wage comprising just teaching hours). Until 2010, universities could offer only three permanent positions: assistant professor, associate professor, and full professor, obtained through public exams organized locally by interested universities. A significant reform in 2010 (law no. 240, 30 December 2010) introduced two primary changes. Firstly, the permanent assistant professor position was replaced by two non-tenured roles: type "A" assistant professor, with a renewable three-year contract, and type "B" assistant professor, ensuring promotion to associate professor status after a positive evaluation by a committee of full professors. Secondly, access to associate and full professor positions necessitated obtaining a "national habilitation", a positive evaluation of one's credentials and research by a national committee comprising full professors based on predefined scientific productivity standards. Our analysis uses data collected in 2009/2010, predating these latter reforms. Basing the analysis on an outdated sample and outdated system is certainly a limitation, as the results cannot be generalized to the current system. However, this (forced) choice also has some advantages: since the old system did not provide for a national habilitation, enrollment in tenured positions was more directly related to departmental choices, which appointed tenured positions with discretion. Furthermore, the academic *cursus honorum* had fewer steps compared to the current system, simplifying the evaluation of tenured positions.

[Filandri and Pasqua \(2021\)](#) examine the impact of gender on national habilitation and career advancements in academia, particularly focusing on the barriers women face despite having similar qualifications and performance as men. Their study reveals that gender discrimination significantly affects women's opportunities for promotion in academic settings. They conclude that the lower promotion rates for women in Italian universities cannot be attributed to lower scientific productivity or a lack of effort in applying for promotions, but rather to systemic gender biases in the academic career advancement process.

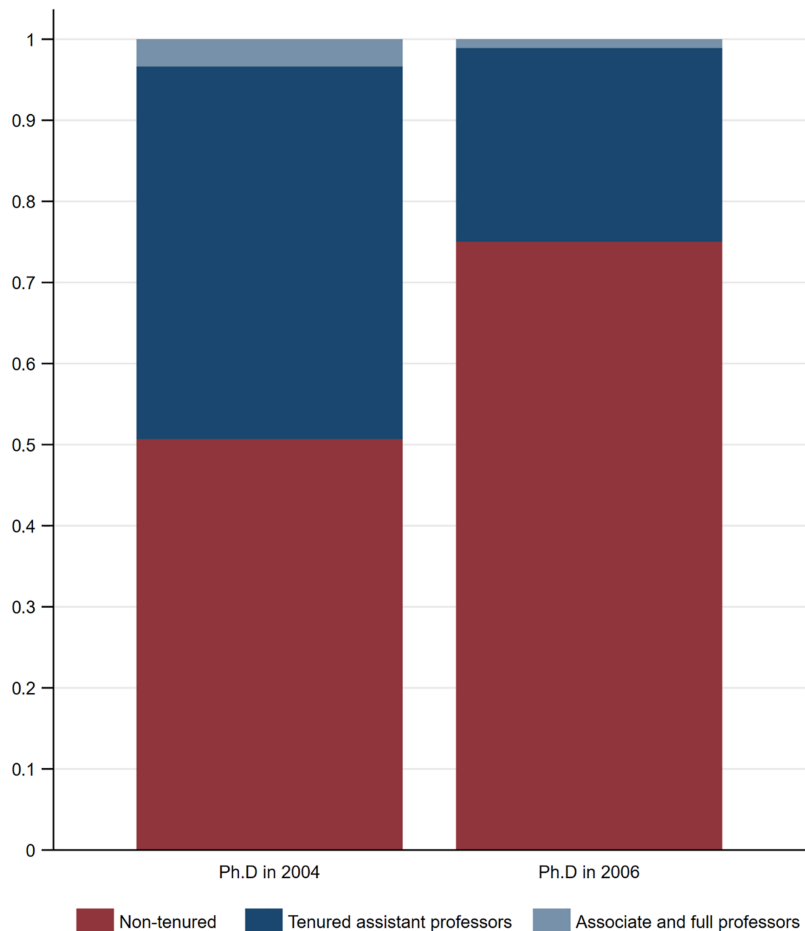
## 3. Data and methodology

The Italian Institute of Statistics (ISTAT) undertook multiple waves of the "Survey on the employability of PhD holders" to monitor the initial careers of doctoral graduates. The inaugural wave occurred between 2009 and 2010 and is the sole source available for our study. Subsequent waves (2014 and 2018) do not delineate the distinction between tenured and non-tenured positions, making the data unsuitable for our purposes. Consequently, we rely

on the initial wave while acknowledging that our findings might diverge from the current scenario. Furthermore, the years when the wave used in this study was carried out saw a substantial economic crisis that possibly affected gender equality.

The 2009–2010 wave involved two cohorts of PhD holders: those graduated in in 2004 and those d in 2006. Of the 8,814 cross-sectional observations in the dataset, our research design focuses on the 3,208 PhD graduates that work in academia (45.6% of whom earned their PhD in 2004), of whom 1,621 (50.5%) identify as women. Because there may be gender differences in the decision to pursue academic careers, the research design initially considered the whole cross-sectional sample, while subsequently taking into account the selection bias arising from respondents' self-selection into academia.

As for PhD recipients who work in academia, we built a dichotomous variable taking the value of one for those who declare they hold a tenured position: associate professors, full professors, and tenured assistant professors. Figure 1 plots the share of tenured and non-tenured positions according to PhD cohorts. About half (49.3%) of those who earned their PhD



Source(s): Figure created by authors

Figure 1. Tenured and non-tenured PhD holders by cohort

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in 2004 have a tenured position, whereas the share drops to 25% for the 2006 cohort. Most of the tenured positions are represented by tenured assistant professorships, and just 2% of the sample reached associate or full professorship status (3.4% for the 2004 cohort and 1.1% for the 2006 cohort). The share of women holding a tenured position is considerably lower than men (30% vs. 42%).

Such descriptive evidence provides an overview of disparities; however, a more detailed regression analysis is needed to isolate the effect of gender on career outcomes controlling for factors like family background, educational choices, place of residence and working experience and research productivity. Our research design accordingly relies on a probit model to estimate the likelihood of holding a tenured position conditional on a set of individual-level covariates extracted from the ISTAT dataset. Our dependent variable takes the value of one for respondents who declare they hold a tenured position and zero otherwise. Our set of covariates includes information on respondents that might be grouped into four clusters. Due to space constraints, we report the variable descriptions and descriptive statistics in the [Appendix](#), while the descriptive statistics for the sub-samples are available upon request.

Group (1) includes variables observing family background. We consider parents' level of education and occupational status, which are arguably relevant because respondents from wealthier families may be able to afford job insecurity (i.e. non-permanent employment) more easily. We also observe respondents' pre-academic secondary studies, which in Italy are organized into self-selectable heterogeneous tracks with different specializations, the choice of which is guided by family background ([Ballarino and Panichella, 2016](#)).

Group (2) includes the covariates that observe demographic characteristics. Besides age and current macro-area of residence, it includes one variable observing whether respondents work in a different region from that where they achieved their PhD, to proxy attitude towards moving to find better working opportunities. Finally, two variables observe marital status and whether the respondent is a parent, which are relevant because the existing literature highlights that uneven distribution of housework and childcare activities negatively impacts women's career opportunities ([Heijstra et al., 2017](#)).

Group (3) observes the relevant characteristics of respondents' studies. First, it includes one categorical variable identifying the respondents' scientific area, which may affect career advancement because of any cross-field heterogeneity in the available tenured positions and/or in gender incidence and attitudes towards gender equality. We are aware that a multilevel approach could be better suited to control for the fact that individuals are nested into scientific areas. Unfortunately, the number of scientific areas is low (14), which undermines the robustness of a multilevel approach ([Rabe-Hesketh and Skrondal, 2008](#)) [1]. This group also includes covariates that proxy respondents' ability. One measures their grades at the end of MA studies. The other is a dummy, taking the value of one for those who won a scholarship to complete their PhD. Finally, two variables observe elements concerning the respondents' PhD experience: finishing doctoral studies within three years (i.e. on time, in the Italian system), and undertaking a visit abroad while studying.

Group (4) controls for respondents' research productivity and experience. As reported in the introduction, scholars highlight that gender differences in academic careers may mirror gender heterogeneity in research productivity and experience, which, in turn, may be connected with the unequal involvement of women in housework and childcare activities. We aim to provide evidence about the existence of gender discrimination in PhD holders' academic career even after these gender differences in productivity are taken into account. In other words, it checks whether discrimination exists that is additional to that already reflected by the research productivity and experience gap. To this end, we first exploit the individual-level information included in the ISTAT dataset that allows us to observe the number of publications (articles in scientific journals and/or monographs) achieved by the respondents. In the ISTAT dataset, this information is only provided in the manner reported in [Table DS1](#) (no article/less than three articles/more than three articles; and no monograph/less than three monographs/more than three monographs). Unfortunately, these data are not complemented

by any information concerning the quality of these publications in terms of journals'/editor's impact and citations. The privacy guaranteed to respondents by ISTAT policy does not allow this information to be collected. The variable also lacks data about the number and ordering of the co-authors. We are aware that this is a limitation of the analysis, since there may be some trade-off between quantity and quality.

Consistently with previous literature, the descriptive statistics show that the proportion of women who have published more than three scientific articles is lower than that of men (80% vs. 86%). Similarly, among those who have published three or more monographs, the proportion of women is lower than that of men (8% vs. 10%). This evidence supports the notion that the gender gap manifests in gender differences in research productivity. Therefore, research productivity should be considered when examining whether other forms of gender discrimination impact career advancement.

Second, we built a variable that measures the number of years of work experience reported by the respondents when replying to the following question: "Which year did you begin working?" – bearing in mind that this was answered in 2010. Data in [Table DS1](#) do not show remarkable gender differences for average working experience. Values reported by women are slightly higher than those observed among men but also slightly more dispersed.

Finally, our set of covariates includes a variable for respondents' gender, coded as 1 for women and 0 for men. The inclusion of this covariate allows us to test whether, after accounting for all the control variables described above — especially work experience and research productivity — gender still shows a statistically significant correlation with the probability of holding a tenured position. If we find that the gender variable is statistically significant, this result would indicate that gender disparities exist in academic career advancement, suggesting potential underlying gender residual disparities or biases unaccounted for by the aforementioned covariates. Note that due to the nature of the data and the impossibility of a different identification strategy, the results of the following analyses must be interpreted as robust correlations, and do not imply causal relations.

## 4. Results

### 4.1 Base results

[Table 1](#) gives the probit analyses results, with coefficients and corresponding standard errors. The five columns present alternative specifications. To save space, the Table reports only the findings that concern the main variables this study is interested in. Results concerning the other covariates are available upon request.

Column (1) excludes years of experience from the controls as this variable shows the highest number of missing replies. The first finding is that having a good production of scientific papers and monographs is associated with a higher likelihood of accessing a tenured position. This result shows that despite the coarseness of our productivity measure, it still achieves the goal of explaining the likelihood of obtaining a tenured position. In other words, whatever its imprecision, this measure does not seem to be wrong. The second relevant finding is that even after controlling for productivity, being a woman remains associated with a lower probability of obtaining a tenured position. *Ceteris paribus*, we estimate a predicted probability of accessing a tenured position at 0.40 for males and 0.32 for women, with a difference of 0.08, statistically significant at 1%.

The specification in column (2) includes years of experience and this reduces N by 635 units because of missing values on this variable. As expected, years of experience turn out to be positively correlated with the probability of holding a tenured position. This finding is highly statistically significant. Still, the signs, the statistical significance, and – to a certain extent – the magnitude of the coefficients calculated for the woman dummy remain unvaried. In this specification, the predicted probability of a tenured position is 0.40 for men and 0.31 for women, and the difference of 0.09 is statistically significant at 1%.

**Table 1.** Results – probit estimation on academic workers

	(1) Tenured position	(2) Tenured position	(3) Tenured position	(4) Tenured position	(5) Tenured position
Woman	−0.246*** (0.0525)	−0.302*** (0.0597)	−0.194** (0.0966)	−0.560 (0.381)	−0.268*** (0.0834)
<i>Scientific papers:</i>					
<i>Three or less</i>	0.391** (0.169)	0.547*** (0.204)	0.543*** (0.205)	0.474 (0.296)	0.546*** (0.204)
<i>More than three</i>	0.583*** (0.156)	0.699*** (0.191)	0.698*** (0.191)	0.554** (0.273)	0.697*** (0.191)
<i>Monographies:</i>					
<i>Three or less</i>	0.298*** (0.0565)	0.291*** (0.0638)	0.288*** (0.0638)	0.295*** (0.0639)	0.323*** (0.0846)
<i>More than three</i>	0.337*** (0.0886)	0.323*** (0.102)	0.324*** (0.102)	0.323*** (0.102)	0.347*** (0.136)
Years of experience		0.115*** (0.0206)	0.142*** (0.0281)	0.115*** (0.0206)	0.115*** (0.0206)
Women*years of experience			−0.056*** (0.0392)		
Women*three papers or less				0.151 (0.414)	
Women*more than three papers				0.279 (0.385)	
Women*three monographies or less					−0.0692 (0.118)
Women*more than three monographies					−0.0531 (0.198)
<i>N</i>	3,208	2,573	2,573	2,573	2,573

**Note(s):** Standard errors in parentheses \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . All regressions include background, demographic and education control variables. Background controls are: parents education, parents job status, high school diploma. Demographic controls are: married, living alone, offspring, macro-region, age, migration. Education controls are: 2006 cohort, degree vote, area of PhD, scholarship during PhD, visits during PhD, teaching during PhD, PhD on time

**Source(s):** Table created by authors

This finding clearly supports the hypothesis that a gender gap in career progression exists even once we have controlled for productivity and experience. Our analysis thus strongly suggests that more research be devoted to the identification of factors that go beyond these channels.

#### 4.2 Gendered valuation of work experience and research productivity in academic career advancement

Beyond our main finding, our probit regression research design lets us examine whether the effects of work experience and research productivity on career advancement differ by gender. To test for any gendered valuation of work experience, we augmented specification (2) by including an interaction term between gender and experience in the estimated specifications. Column (3) reports the coefficients calculated through a specification which includes these interactions. The resulting predicted probabilities are reported in Table 2 and plotted in Figure 2. The results indicate that even if the likelihood of accessing a tenured position increases with years of experience, for women this variable has a much lower effect than for men. Not only do women face a reduced probability of getting a tenured position at the beginning of their career, but for them the probability of success does not increase at the same rate that it does for men. All else being equal, a man with five years of experience will access a



**Table 2.** Predicted probabilities of tenured position for men and women by years of experience

	(1) Men	(2) Women	(3) Difference
0 years of experience	0.314*** (0.0199)	0.258*** (0.0197)	-0.0560** (0.0278)
1 year of experience	0.358*** (0.0148)	0.282*** (0.0147)	-0.0758*** (0.0212)
2 years of experience	0.403*** (0.0131)	0.307*** (0.0125)	-0.0965*** (0.0188)
3 years of experience	0.451*** (0.0173)	0.333*** (0.0156)	-0.118*** (0.0236)
4 years of experience	0.499*** (0.0247)	0.360*** (0.0226)	-0.139*** (0.0332)
5 years of experience	0.547*** (0.0330)	0.388*** (0.0313)	-0.159*** (0.0445)

**Note(s):** Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Calculated from model (3) of [Table 1](#). Columns (1) and (2) report the adjusted predictions of gender at representative values of tenure, Column (3) reports the marginal effects of gender at representative values of tenure

**Source(s):** Table created by authors

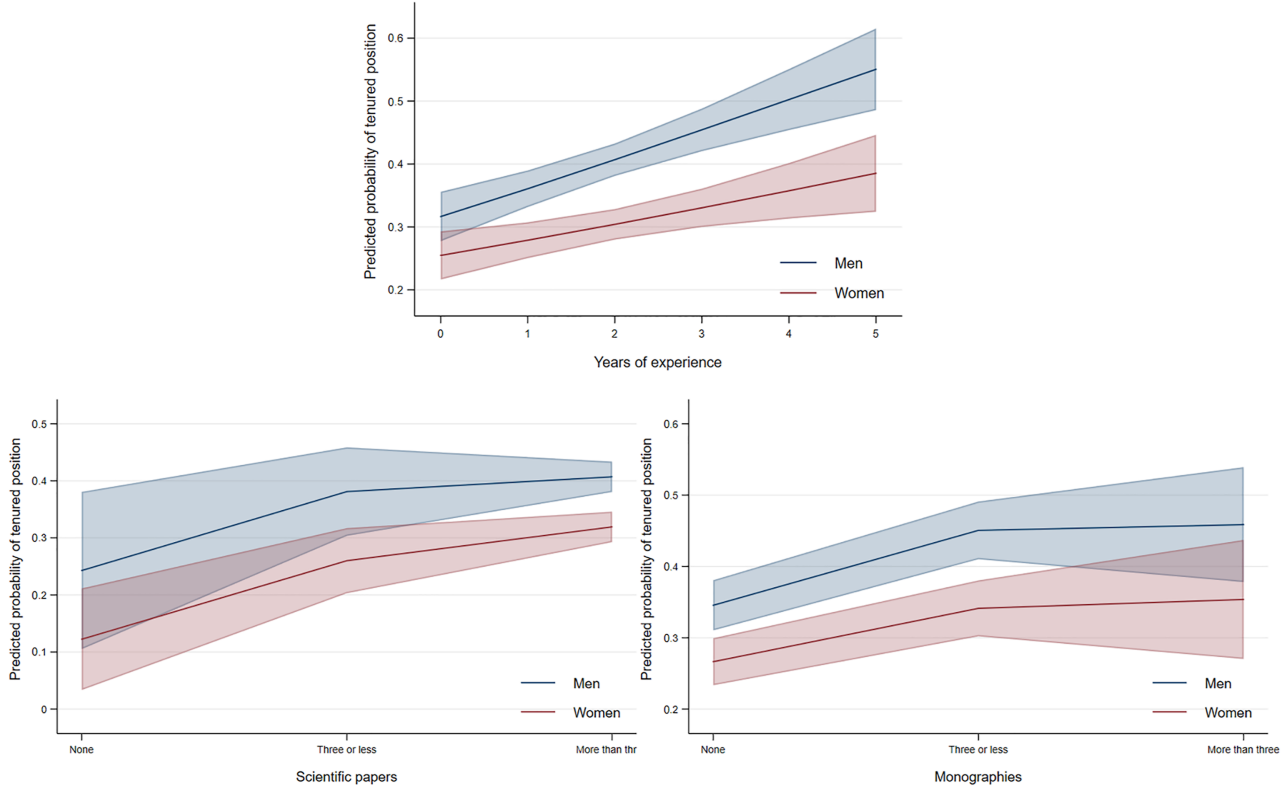
tenured position with a probability of about 0.55, while a woman with the same experience will have a probability of about 0.39. In other words, while work experience positively correlates with the probability of holding a tenured position for both men and women, the magnitude of this effect is evidently larger for men, i.e. women's work experience does not receive the same level of recognition or reward as men's.

In Columns (4) and (5) we test whether research productivity is also gendered. In Column (4) the regression includes interactions between gender and the number of published scientific articles, which results in the predicted probabilities given in [Table 3](#) (Columns (1) to (3)) and plotted in [Figure 2](#). With a low production of scientific papers, the difference between the predicted probabilities of men and women is not statistically different from zero. Instead, it becomes statistically significant at 5% for PhD graduates who have published three or fewer articles (about 12%), and lower but tightly estimated for those who have published more than three scientific articles (almost 9%). Column (5) replicates the analysis with an interaction between gender and monographs, whose predicted probabilities are reported in [Table 3](#) (Columns (4) to (6)) and plotted in [Figure 2](#). Again, we find evidence of a difference in probabilities of obtaining a tenured position between men and women that increases with productivity. With zero monographs the difference is almost 8% in favor of men. It becomes about 11% with three or less monographs and remains steady with more than three monographs, although the statistical significance decreases to 10%. These findings are qualitatively in line with [Weisshaar \(2017\)](#) and [Filandri and Pasqua \(2021\)](#).

**4.2.1 Robustness check: accounting for selection into academia.** The analysis described in [section 4.1](#) focuses on PhD holders pursuing an academic career. However, if women are held back from accessing tenured positions, they may be more likely to seek work outside academia. In the full sample, women are slightly overrepresented outside academia. The existing literature suggests that the process of selection is not random, and therefore must be accounted for. In this section we replicate the analysis performing a series of Heckman's two-step selection models, following the same steps of the main analysis. To correctly specify the model, we include in the selection equation all the control variables (except years of experience, to preserve sample size), while in the equation estimating the probability of a tenured position we include gender, years of experience, scientific papers and monographs. [Table 4](#) shows the results.

The coefficient associated to gender shows a negative sign in all the models considered, and a statistical significance of at least 5% in all the specifications, except that considered in





Source(s): Figure created by authors

Figure 2. Predicted probabilities of tenured position for men and women with 95% confidence intervals

**Table 3.** Predicted probabilities of tenured positions for men and women by scientific papers and monographs

	Scientific papers			Monographs		
	(1) Men	(2) Women	(3) Difference	(4) Men	(5) Women	(6) Difference
None	0.243*** (0.0704)	0.122*** (0.0455)	-0.120 (0.0837)	0.346*** (0.0180)	0.266*** (0.0169)	-0.0791*** (0.0246)
Three or less	0.381*** (0.0396)	0.260*** (0.0292)	-0.121** (0.0488)	0.451*** (0.0207)	0.341*** (0.0200)	-0.109*** (0.0286)
More than three	0.407*** (0.0136)	0.319*** (0.0137)	-0.0878*** (0.0199)	0.459*** (0.0411)	0.354*** (0.0426)	-0.105* (0.0588)

**Note(s):** Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Calculated from model (4) of Table 1. Columns (1) and (2) report the adjusted predictions of gender at representative values of scientific papers, Column (3) reports the marginal effects of gender at representative values of scientific papers. Columns (4) and (5) report the adjusted predictions of gender at representative values of monographs, Column (6) reports the marginal effects of gender at representative values of monographs

**Source(s):** Table created by authors

**Table 4.** Results – two-steps Heckman model

	(1) Tenured position	(2) Tenured position	(3) Tenured position	(4) Tenured position	(5) Tenured position
Woman	-0.103*** (0.0173)	-0.116*** (0.0186)	-0.0688** (0.0297)	-0.124 (0.0992)	-0.0970*** (0.0252)
<i>Scientific papers:</i>					
<i>Three or less</i>	-0.0483 (0.0516)	0.0175 (0.0576)	0.0160 (0.0575)	0.0204 (0.0900)	0.0175 (0.0575)
<i>More than three</i>	-0.109** (0.0541)	-0.0454 (0.0598)	-0.0447 (0.0597)	-0.0522 (0.0865)	-0.0457 (0.0597)
<i>Monographies:</i>					
<i>Three or less</i>	0.100*** (0.0191)	0.102*** (0.0204)	0.101*** (0.0204)	0.102*** (0.0205)	0.121*** (0.0278)
<i>More than three</i>	0.128*** (0.0315)	0.123*** (0.0346)	0.122*** (0.0346)	0.123*** (0.0346)	0.144*** (0.0460)
Years of experience		0.0606*** (0.00633)	0.0735*** (0.00897)	0.0606*** (0.00633)	0.0604*** (0.00633)
Women*years of experience			-0.025** (0.0125)		
Women*three papers or less				-0.00524 (0.110)	
Women*more than three papers				0.0114 (0.101)	
Women*three monographies or less					-0.0378 (0.0378)
Women*more than three monographies					-0.0448 (0.0657)
N	8,201	7,566	7,566	7,566	7,566

**Note(s):** Standard errors in parentheses \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . All regressions are estimated using Heckman's two-step estimator. The selection equation includes gender, scientific articles, monographies, background, demographic and education variables. Background variables are: parents education, parents job status, high school diploma. Demographic controls are: married, living alone, offspring, macro-region, age, migration. Education controls are: 2006 cohort, degree vote, area of PhD, scholarship during PhD, visits during PhD, teaching during PhD, PhD on time

**Source(s):** Table created by authors

Column (4). Overall, these results confirm the basic findings reported in section 4.1 and provide a more reliable estimate of the effect of the gender gap: the predicted probability of a tenured position is about 0.15 for men and 0.12 for women, with the difference statistically significant at the 1% conventional level.

Models (3)–(5) provide the results obtained when using the Heckman-corrected estimation method to check the robustness of the additional analyses run in section 4.2, i.e. those that focus on the gendered nature of work experience and research production.

On the basis of model (3), Table 5 reports the expected probability of a tenured position for men and women and the respective difference for the estimation that includes the interaction between gender and years of experience. Expected probabilities are estimated assuming that non-selection into academia implies non-participation in a tenured position (i.e. the expected value of a tenured position is taken to be 0 when it is expected to be unobserved). The gender difference is always negative and statistically significant. While the expected probabilities increase with years of experience both for men and women, they increase at a higher rate for men. As a result, at 5 years of experience women are 6.8% less likely to access a tenured position than men, as illustrated in Figure 3.

Table 6 reports the expected probabilities calculated for the estimations including the interaction between gender and scientific productivity (specifications (4) and (5) in Table (4)). As for scientific articles, the difference between men and women increases with quantity. With three or more articles, the probability of accessing a tenured position is 19.6% for men and 14.7% for women, with a statistically significant difference of about 5% in favor of men. Figure 3 provides a graphic representation of the difference. Finally, the estimation for monographs follows a similar pattern: at the highest level observed in our dataset, men's probability of accessing tenure is 22.5%, while women's is 16.7%, with a statistically significant difference of about 5.7% in favor of men.

These results indicate that when accounting for self-selection into academia, the estimated gender difference in the probability of accessing a tenured position decreases but does not disappear. Notably, the gender difference increases with years of experience and with scientific papers, suggesting that gender differences are reinforced throughout one's academic career.

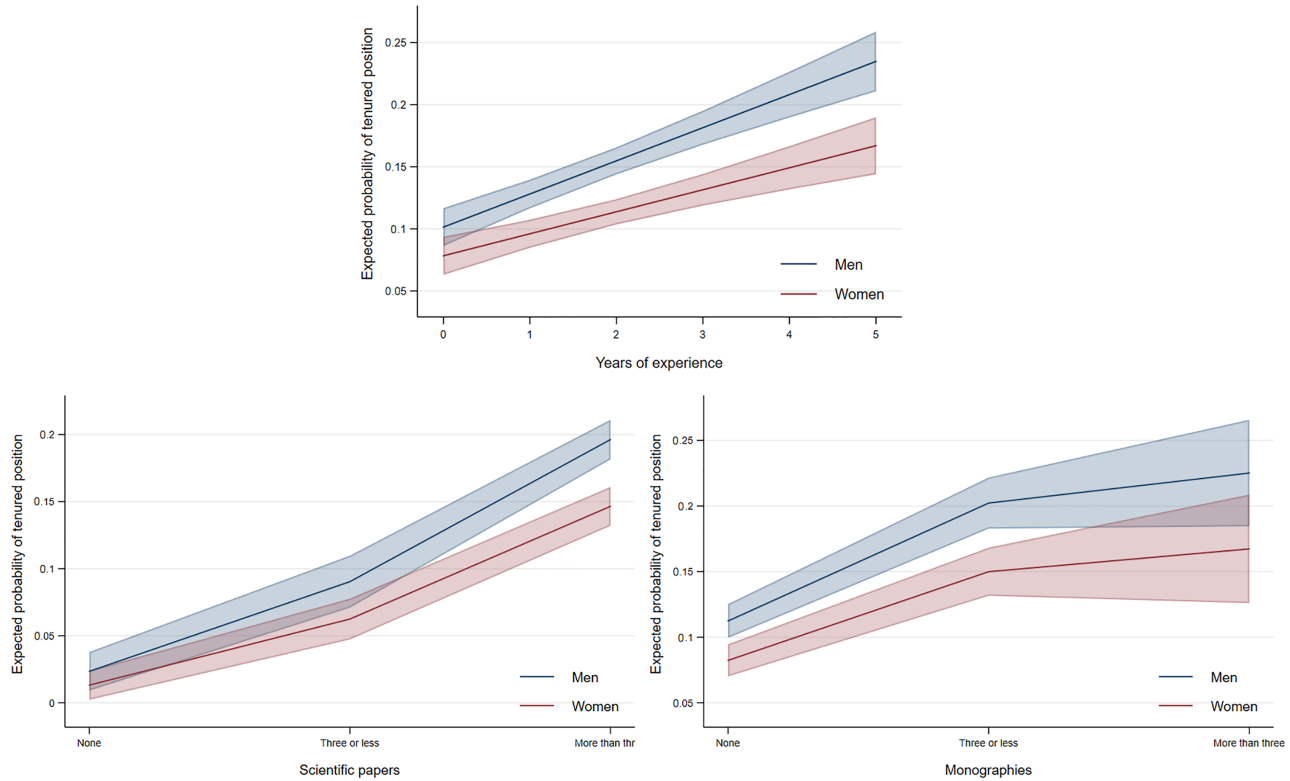
*4.2.2 Further results - investigating work-family balance and geographical mobility.* Previous analyses included variables proxying the work-family balance as controls. One could

**Table 5.** Expected probabilities of tenured position for men and women by years of experience

	(1) Men	(2) Women	(3) Difference
0 years of experience	0.101*** (0.00779)	0.0784*** (0.00783)	-0.0231** (0.0110)
1 year of experience	0.128*** (0.00591)	0.0961*** (0.00579)	-0.0320*** (0.00829)
2 years of experience	0.155*** (0.00557)	0.114*** (0.00522)	-0.0410*** (0.00768)
3 years of experience	0.181*** (0.00700)	0.132*** (0.00651)	-0.0500*** (0.00961)
4 years of experience	0.208*** (0.00942)	0.149*** (0.00889)	-0.0589*** (0.0130)
5 years of experience	0.235*** (0.0123)	0.167*** (0.0117)	-0.0679*** (0.0170)

**Note(s):** Standard errors in parentheses. \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ . Calculated from model (3) of Table 4. Columns (1) and (2) report the expected probabilities of tenured position by gender at representative values of years of experience, assuming that non-selection implies non-participation. Column (3) reports the marginal effects of gender

**Source(s):** Table created by authors



Source(s): Figure created by authors

Figure 3. Expected probabilities of tenured position for men and women with 95% confidence intervals

**Table 6.** Expected probabilities of tenured positions for men and women by scientific papers and monographs

	Scientific papers			Monographs		
	(1) Men	(2) Women	(3) Difference	(4) Men	(5) Women	(6) Difference
None	0.0235 <sup>***</sup> (0.00735)	0.0132 <sup>**</sup> (0.00556)	-0.0103 (0.00893)	0.112 <sup>***</sup> (0.00658)	0.0824 <sup>***</sup> (0.00625)	-0.0300 <sup>***</sup> (0.00886)
Three or less	0.0904 <sup>***</sup> (0.00990)	0.0625 <sup>***</sup> (0.00777)	-0.0279 <sup>**</sup> (0.0119)	0.202 <sup>***</sup> (0.00993)	0.150 <sup>***</sup> (0.00936)	-0.0523 <sup>***</sup> (0.0129)
More than three	0.196 <sup>***</sup> (0.00754)	0.147 <sup>***</sup> (0.00739)	-0.0498 <sup>***</sup> (0.0105)	0.225 <sup>***</sup> (0.0207)	0.167 <sup>***</sup> (0.0211)	-0.0578 <sup>**</sup> (0.0270)

**Note(s):** Standard errors in parentheses. \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ . Calculated from model (4) of Table 4. Columns (1) and (2) report the expected probabilities of tenured position by gender at representative values of scientific papers, assuming that non-selection implies non-participation, Column (3) reports the marginal effects. Columns (4) and (5) the expected probabilities of tenured position by gender at representative values of monographs, assuming that non-selection implies non-participation, Column (6) reports the marginal effects  
**Source(s):** Table created by authors

argue that such variables should also be included to ascertain whether they have different effects on men and women. Though a detailed investigation is beyond our scope, we tested whether being married and living with children have an influence on the probability of achieving tenure, and whether this difference is driven by gender. Accordingly, we replicated the analysis reported in Table 1, Column (2), and augmented it with an interaction between gender and a dummy indicating whether the respondent is married or co-living, and then with another interaction between gender and having children.

The results of the interactions, given in Figures A1 and A2 in the appendix, indicate that married men have a higher probability of having a tenured position than married women. However, this result should be treated warily. While for men getting married increases the likelihood of achieving tenure, for women getting married does not have a statistically significant effect on the probability of achieving tenure. As for having children, the results are comparable: men with children are more likely than women with children to have tenure, but the coefficient associated with having children is not statistically significant for women (i.e. having children is not correlated with a lower probability of a tenured position for women).

These results highlight that the direction of the causal relation between building a family and holding a tenured position is not straightforward. The positive relation between being married/having children and having a permanent position may well imply that researchers who escape academic job insecurity have an incentive to start a family. Moreover, this relation holds for men but not for women, indicating that the gender disparity in tenured positions in our sample of Ph.D. holders at the beginning of their research career is not driven by the work-family balance.

Finally, we also estimated the effect of an interaction between years of experience and being a woman for two sub-samples: one consisting of individuals working in a different region from where they obtained their PhD (e.g. “migrants”), and the other comprising those who remained in the same location after graduation. Figure A3 in the appendix shows that gender disparities increase with years of experience only among scholars who remain at the same university where they obtained their PhD. While this evidence could offer an interesting line of inquiry and inform policy actions by highlighting a potential “mobility premium,” it should be interpreted with caution, as the decision to remain in the same location is likely also correlated with other factors affecting career advancement (e.g. expectations, work-life balance, etc.).

## 5. Discussion and conclusions

This paper adds to the literature on the academic career advancement gender gap through an analysis of the transition from achieving a PhD to achieving a tenured academic position. Our findings demonstrate that gender inequality in career advancement exists even when

accounting for work experience and research productivity. Additionally, we show that work experience and research productivity are themselves gendered so that they favor men. These findings suggest that a “broken rung” (McKinsey & Companies, 2023) exists near the bottom of the academic career ladder.

These results echo the notion, based on analysis of the private sector, that the gender gap in accessing top positions originates much earlier in career trajectories (note that women represent only 22.2% of Grade A personnel, as reported by the EU Commission in 2019). While our study does not find a conclusive explanation of the causes explaining this barrier, it supports the idea that greater effort should be directed, both in research and policy actions, below where discrimination appears (i.e. the outcome level).

A notable recent effort in this regard has been made by the OECD, which has pointed out the importance of discriminatory social institutions, namely the “established set of formal and informal laws, norms and practices that [ . . . ] are at the heart of the inequalities that women face worldwide” (OECD, 2023, p. 13). In the case of academic jobs, the literature has highlighted that informal norms creating invisible barriers for women academics are rooted at both the societal and organizational/institutional level (Bain and Cummings, 2000). Gendered norms institutionalized in relationships and families can negatively impact women’s careers with regard to mobility (Pixley and Moen, 2003). This might be specifically relevant in the case studied here, since at the initial stages of an academic career, women are more likely than male colleagues to have a spouse with a full-time job (Winslow and Davis, 2016). Moreover, note that in Europe women spend 1.9 times more hours than men on unpaid care and domestic work (OECD, 2023): the disproportionate distribution of domestic work may be particularly significant in academic jobs, which are characterized by atypical work-leisure time allocation. Meanwhile, the gendered norms institutionalized in universities can impact on women’s time allocation in various functions (research, teaching, administrative).

Overall, our findings stimulate two avenues for further research. First, new studies should extend our findings using more recent and refined data. This appears to be a priority for gaining a deeper understanding of the determinants of gender disparities, as our research has shown that aggregate data have significant limitations when analyzing such complex social phenomena.

In particular, research would greatly benefit from more fine-grained data that: (1) allow us to refine measures of research productivity by looking at research quality; and (2) allow us to map the quality of the universities where PhD holders completed their studies and of the professors who supervised their work, since these elements may play a role in determining career advancement (Van Arensbergen *et al.*, 2012; Abramo *et al.*, 2021; Symonds *et al.*, 2006). Second, further research is needed to identify the reasons that might drive the inequality resulting from our elaborations. Numerous factors might be considered in this perspective. For example, an inspection of gender heterogeneity in the propensity for mobility seems useful. Migration enables access to a wider spectrum of job opportunities, and therefore results in occupation, career advancement and job-education matching (van Ham *et al.*, 2001), including among PhD holders (Alfano *et al.*, 2019; Ghosh and Grassi, 2020). This is particularly pronounced in the Italian context, where job conditions and opportunities vary by region (Parenti *et al.*, 2022). Nevertheless, women’s mobility is viewed as a problematic issue since it interacts with societal gendered norms that tend to prioritize men’s career development, and is particularly strong in the case of academic couples (the so-called two body problem). Note that while our elaborations include one variable observing mobility, this may be insufficient to measure respondents’ attitudes towards the idea of migrating at subsequent stages of their careers.

Further research may also explore the difficulties women face in balancing work and family, especially in the case of motherhood (Ahmad, 2017; Gonzales Ramos *et al.*, 2015). In gendered societies, unequal involvement in household chores is common (Cheung and Halpern, 2010; Goulden *et al.*, 2011; Williams and Ceci, 2012). Consequently, some women consider an academic career to be incompatible with family life (Mason *et al.*, 2013); others might be forced to abandon academic activities valuable for getting access to tenured positions. Further studies should also consider the impact that living in a gendered society exerts on women’s self-

confidence. Previous research has revealed that women scientists report greater uncertainty about reaching their career aims than men (Höge *et al.*, 2012) and this might induce some to opt out from academia. Though our analysis does not highlight a significant relationship between motherhood and achieving a tenured position, such a complex theme calls for further research.

Research on gender discrimination in recruitment should also be advanced. As reported in the introduction, De Paola and Scoppa (2015), and De Paola *et al.* (2017) provide alarming evidence that in Italian universities women have a lower probability of promotion when they are evaluated by committees consisting entirely of males. Shedding light on such practices would be invaluable.

Turning to policy implications, in recent years the European Commission has adopted a gender equality plan (GEP) as a basic requirement for universities that aim to participate in the Horizon Europe research programme. GEPs are strategic tools that establish priorities and objectives in working towards gender equality in academia; while they include various actions, they maintain a focus on promoting gender equality in career progression among academic staff. One immediate lesson that universities involved in designing their GEPs can gain from our research is that gender inequalities also emerge during the pre-tenure years. GEPs should devote considerable attention to monitoring gender equality in non-tenured researchers' career progression.

The road to achieving tenure in Italy is generally precarious and slow (Murgia and Poggio, 2018; Passaretta *et al.*, 2019; Gaiaschi and Musumeci, 2020). In such a context, gender inequality may make women perceive tenure as being more difficult and costly to reach than it is for men. The likelihood that women leave academia thus becomes higher than that observed for men, and this significantly undermines the likelihood that gender equality will be achieved among tenured academic staff. For this reason, policy interventions aimed at fast-tracking the tenure process and removing any inequality in the selection process are particularly important.

## Notes

1. We prefer a standard probit approach, but every estimation has been replicated with a multilevel probit strategy. The results are available upon request, and do not change meaningfully from those presented in the following sections.

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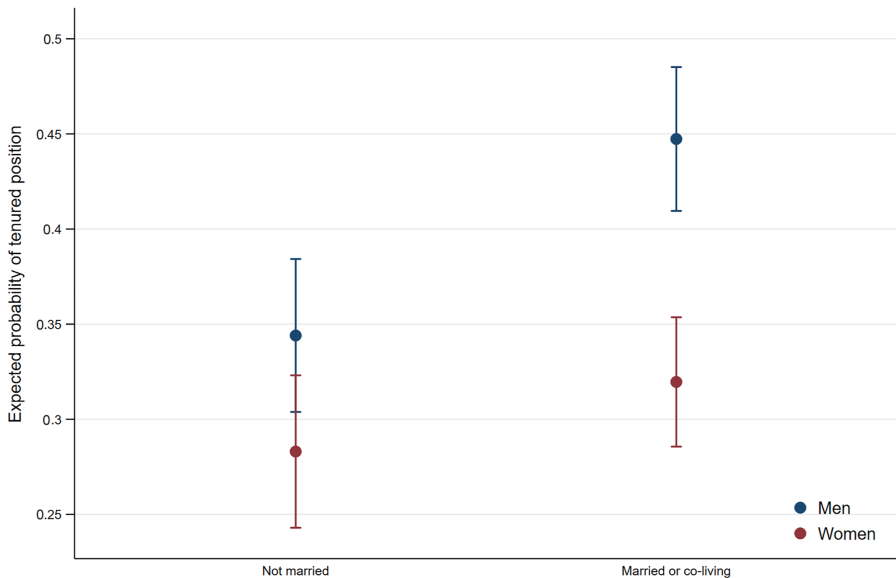
(The Appendix follows overleaf)

**Table A1.** Descriptive statistics by gender of background control variables (full sample)

Variable	Men N	Mean	Std.Dev	Women N	Mean	Std.Dev	Total N	Mean	Std.Dev
Parents without degree (b.c.)	4,075	0.592	0.492	4,739	0.605	0.489	8,814	0.599	0.49
One parent with degree	4,075	0.201	0.401	4,739	0.2	0.4	8,814	0.201	0.401
Both parents with degree	4,075	0.207	0.405	4,739	0.195	0.396	8,814	0.2	0.4
Parents not working (b.c.)	4,075	0.095	0.294	4,739	0.104	0.306	8,814	0.1	0.3
One parent working	4,075	0.45	0.498	4,739	0.445	0.497	8,814	0.447	0.497
Both parents working	4,075	0.455	0.498	4,739	0.45	0.498	8,814	0.452	0.498
Liceo Classico	4,075	0.24	0.427	4,739	0.325	0.469	8,814	0.286	0.452
Liceo Scientifico	4,075	0.516	0.5	4,739	0.471	0.499	8,814	0.492	0.5
Liceo Linguistico	4,075	0.007	0.081	4,739	0.038	0.191	8,814	0.023	0.151
Istituto Magistrale	4,075	0.008	0.09	4,739	0.051	0.22	8,814	0.031	0.174
Istituto Tecnico	4,075	0.204	0.403	4,739	0.087	0.282	8,814	0.141	0.349
Istituto Professionale	4,075	0.017	0.129	4,739	0.014	0.118	8,814	0.015	0.123
Istituto d'arte	4,075	0.002	0.044	4,739	0.003	0.054	8,814	0.002	0.05
Liceo Artistico (b.c.)	4,075	0.005	0.07	4,739	0.01	0.098	8,814	0.007	0.086

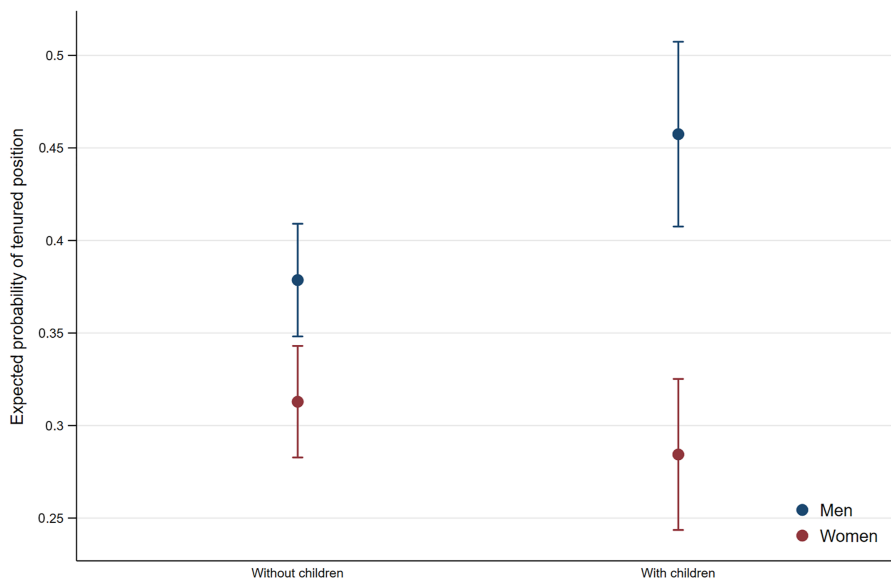
**Note(s):** (b.c.) = base category

**Source(s):** Table created by authors



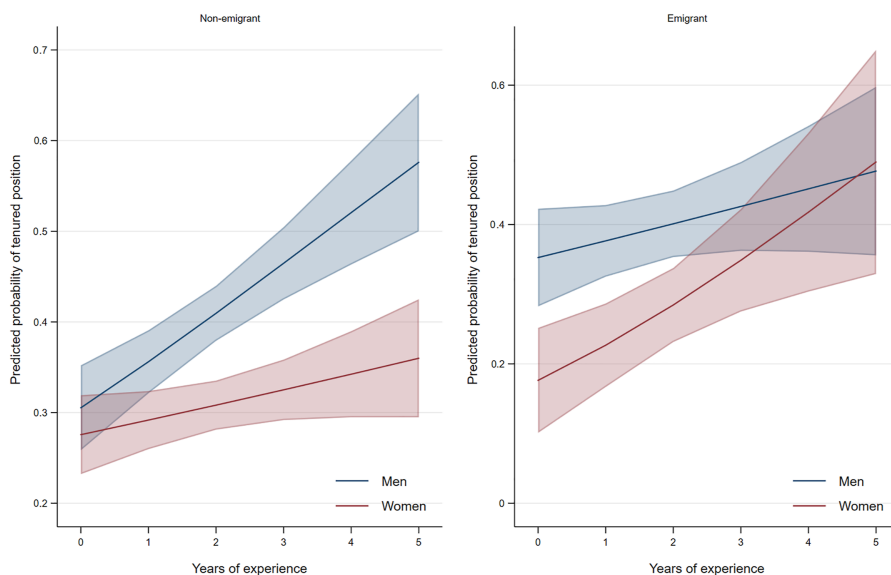
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**Figure A1.** The differential effect of being married on the predicted probability of a tenured position



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Figure A2. The differential effect of having children on the predicted probability of a tenured position



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Figure A3. The effect of years of experience on the predicted probability of a tenured position for non-emigrant and emigrant sub-samples

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