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DISCUSSION PAPER SERIES

IZA DP No. 16206

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ABSTRACT

Gender and Career Progression in Academia: European Evidence

We study career trajectories of university researchers in Europe, with a particular emphasis on the speed of career progression by gender. Using the panel data collected by the MORE project (Mobility Survey of the Higher Education Sector) - a longitudinal database that gathers survey responses from over 10,000 university researchers across Europe - we find that women have a lower probability of promotion, but conditional on a career advance, their career development proceeds at a faster pace than that of comparable male researchers. Faster progression among women is positively influenced by the share of female researchers in the academic environment. Higher salaries in sectors outside academia appear to reinforce the positive selection of women preferring to stay in academia.

JEL Classification: J20, J24, J62

Keywords: career progression, academic careers, promotion

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Introduction

Career choices in academia and other research-intensive workplaces reflect intrinsic motivation and passion for research as well as a mix of expectations about financial returns and career advancement relative to available alternatives (e.g. Lent et al., 1994). As the labour market for researchers is gender-biased against women (e.g. Torren, 1993; Howe-Walsh et al., 2016), one would expect to find several studies of career progression by gender. However, longitudinal studies are rare, and tend to focus on a specific aspect of career advancement, such as the role of international mobility (Reed et al., 2011; Van Balen et al., 2012; Cañibano et al., 2020), with limited attention to gender differences typically using cross-sectional, historical, or small-sample qualitative data.[1] (Bailyn, 2003; Probert, 2005; Silander et al, 2022). As a result, little is known about what influences the duration of a career stage, and what leads to promotion, by gender.

This lack of information is problematic if the duration of a career stage can shed light on skills and experiences required for the next career step.[2] Moreover, career choices tend to be studied separately from gender-related issues - notwithstanding the gender imbalance prevailing in research jobs and STEM - providing only a partial view of the factors underpinning the prevailing conditions observed.

This paper aims to study career progressions in academia and, by doing so, contribute to bridge two distinct streams of research. The first stream focuses on academic and research careers of doctorate holders, their international mobility (Gläser, 2001; Auriol et al., 2013; Cañibano et al., 2019), and their relation to innovation activity in host institutions and countries. This body of work reveals that academics, researchers, and other knowledge workers, particularly in STEM, are the principal input to all technology transfers, which are a fundamental element for productivity improvements and economic growth. Career development is extracted from bibliometric surveys and qualitative data (Cañibano et al., 2019 offer useful summaries in Tables 1 and 2) and classified on a scale ranging from 'pure academia' to 'pure industry'. Research careers emerge as shaped by critical, timely decisions, such as the choice of a research topic (Gläser et al., 2014), whether or not to have an international experience (Fernández-Zubieta et al., 2015; Franzoni et al., 2012 and 2014), and actively seeking opportunities of career progress (Lawson & Shibayama, 2014). As noted by Cañibano et al., 2019, whether or not to pursue a career in academic research depends on "*productivity and preferences (Balsmeier & Pellens, 2014), gender and family (Fox and Stephan, 2001), perceptions of incentives (Fitzenberger and Schulze, 2013), the determinants of exit from academic research (Geuna and Shibayama, 2015), informational problems leading into a Ph.D. study (Mangematin, 2000), trade-offs between salary and publication freedom (Sauermann and Roach, 2014), issues regarding mentors capacities to provide information on a diversity of potential careers (Bozeman and Gaughan, 2011; Sauermann and Roach, 2012), the existence of suitable role models (Steele, Fisman, and Davidson 2013), the geographical location of suitable industry jobs (Sumell et al., 2009) and the market power of star scientists (Zucker and Darby, 2006; Zucker et al, 2002)*" (p.1975).

Though informative, this literature analyses what influences the probability of undertaking research in academia rather than the duration between the "critical junctures" identified (ibid. p. 1974). As such, this research overlooks the relationship between gender and academic careers.

[1] At times, despite the availability of panel data, the determinants of a particular status, such as work in academia or being promoted, are investigated using a cross-sectional approach (e.g. logistic regression) without fully exploiting the dynamic potential of the data at hand or complementary topics associated with career progression.

[2] For instance, a cross-sectional analysis may reveal that fertility decisions emerge as having a negative and statistically significant effect on whether one is promoted. Sign and statistical significance of the fertility coefficient would then lead one to conclude that there is a trade-off between that career and having children. However, this may not be the case if having children is accompanied by a temporary career break, which results in a lower cumulative labour supply vis-à-vis the amount regarded as a minimum for promotion. Such possibility would instead emerge in duration analysis and in approaches that explicitly model the effects of time.

The second stream of research focuses on changes that have been effective in reducing gender disparities in the workplace. This line of research relies on case studies and qualitative research, restricting the ability to generalise its findings. Women in academia emerge as more likely to be disadvantaged and prejudiced than their male equivalents, as the organisations in which they work have commonly been structured and defined by men (Bailyn, 2003; Probert, 2005). As a result, women's performance and career progression are viewed with (often implicit and unintended) gender-bias lenses regardless of whether equal opportunity policies and practices are in place (Reed et al., 2011; Silander et al., 2022). Gender bias is viewed as being structural in workplaces. As such, it can be acknowledged and mitigated but cannot disappear.

We aim to bridge these two literatures by quantitatively analysing gender differences in academic and research careers and by focusing on the duration of being in a career stage prior to (rather than the probability of) promotion. To do so, we develop a theoretical model to frame the empirical analysis, which uses the data collected by MORE (Mobility Survey of the Higher Education Sector) - a longitudinal database collecting survey answers from more than 10.000 university researchers across Europe.

Our contribution is therefore to analyse the determinants of career progression over a long period: three steps in the careers of European researchers - on average more than 15 years. In addition, we quantify the relative significance of factors besides family formation that influence women's career progression in research, such as those related to international mobility (work experience abroad) and institutional variables (e.g. proportion of women in the workplace).

Theoretical background

To frame the analysis and identify the factors influencing career progression, we develop a theoretical model building from Faria et al. (2013), which we apply to the case of a research institution. The model represents the dynamic problem of an employer (academia or research organisation) that maximises its reputation – the latter arising from the output of its permanent and probation employees, subject to their labour costs. The maximisation yields the optimal number of probation employees that can be promoted to permanent positions. This condition, in turn, is rearranged to derive the duration of the probation period, which is a function of individual characteristics (e.g. age, education, but also marriage and fertility decisions, experience abroad, and productivity) and locational and institutional settings.

Formally, the problem is framed by considering an employer (university or research institute) whose objective function is to maximise its 'net' reputation. This, in turn, arises from the output of its employees.

Employees have different levels, and for simplicity, we consider only two: 'higher' and 'lower', with the lower level employees, who have a lower salary and face a given probability of not being promoted, aiming to become higher-level employees. Given:

P = number of employees at higher level employed; p = number of employees at lower level employed; A = individual productivity – e.g. nr papers, grants, awards; Z = individual characteristics – especially gender, but also marital status, age, nr children, education, foreign experience; K = institutional characteristics, e.g. % women, employee size, location; r = employer's impatience; t = time; and f(.), c(.) = function and cost functions, respectively, then the dynamic (infinite horizon) problem of the research employer is to maximise, concerning P at time t, the following objective function:

$$\theta(P_t) = \int_0^{\infty} \left\{ f(P_t, A_t, Z_t, K_t) - c(P_t, p_t) \right\} e^{-rt} dt$$

The number of employees at higher level over time is captured by:

$$P_t = \int_{-\infty}^{t-T} p_u \sigma e^{-\sigma(t-u)}$$

where σ = rate at which lower-level employees fail to be promoted, and (t-T) is the last cohort that was promoted to a higher level at time t. Hence T = time from hiring to current promotion round at time t.

To solve the problem, we first obtain the growth rate of employees promoted at higher level:

$$\dot{P}_t = \sigma p_{t-T} e^{-\sigma T} - \sigma P_t$$

from which we derive the number of employees of lower level at time t:

$$p_t = \left[\frac{\dot{P}_{t+T}}{\sigma} + P_{t+T} \right] e^{\sigma T}$$

We substitute p_t in the employer's objective function to obtain:

$$\theta(P_t) = \int_0^{\infty} \left\{ f(P_t, A_t, Z_t, K_t) - c(P_t, \left[\frac{\dot{P}_{t+T}}{\sigma} + P_{t+T} \right] e^{\sigma T}) \right\} e^{-rt} dt$$

the two forward components are solved recursively as:

$$\int_0^{\infty} \dot{P}_{t+T} e^{-rt} dt = -P_T + r e^{rT} \int_T^{\infty} \dot{P}_u e^{-ru} du$$

$$\int_0^{\infty} P_{t+T} e^{-rt} dt = e^{rT} \int_T^{\infty} P_u e^{-ru} du$$

These are substituted back in the employer's objective function, resulting in:

$$\theta(P_t) = \int_T^{\infty} \left\{ f(.) - c(P_t, \sigma, r, T) \right\} e^{-rt} dt + \int_0^{T} \left\{ f(.) - c(P_t, \sigma, r, T) \right\} e^{-rt} dt - c(P_T) e^{\sigma T}$$

where the last two terms do not depend on P_t. Therefore, maximising the objective function for P_t yields the first-order condition:

$$\frac{\partial \theta(P_t)}{\partial P_t} = f'(P_t, A_t, Z_t, K_t) - c'(\sigma, r, T) = 0$$

that in turn produces P*, the optimal P - the number of employees at a higher level. From here, to get a closed-form solution, one needs to specify the functions f(.) and c(.). From here one derives the T, the duration of being employed at a lower level, consistent with the optimal number of employees P*. This can be represented as:

$$T = \left\{ f'(A_t, Z_t, K_t) \right\}^{\frac{1}{c'(\sigma, r)}}$$

whereby the duration to promotion time T is a function of individual productivity A_t, gender and other demographic individual characteristics Z_t, and institutional characteristics K_t, which include the employer's impatience (r) and the failure rate of being promoted (σ).

Our empirical analysis aims at estimating the linearised version of the solution for T - the duration of a career stage as a function of individual and institutional factors.

Econometric strategy

As the relationship between individual characteristics and the duration of the career phase can be measured only if there is actually a transition towards the subsequent state (i.e. a promotion), we face a problem of endogenous sample selection: we possibly analyse the speed of career progression only for those researchers that are observed at the beginning and at the end of each career stage.

To overcome this problem, we use an extended regression model (ERM), which applies a two-step regression: first, we model the sample selection problem using the stage transition and the characteristics common to all researchers, starting with gender[3]. The first regression follows:

$$Selection_{iat} = \tau \bullet gender_i + \omega \bullet age\_dis_{ia} + \varphi \bullet civil\_servant_{ia} + \theta \bullet academics_{ct-1} + \epsilon$$

where *age_dis* identifies researchers that at the moment of the change of stage, or at the time of observation for those that have not had any change of stage, are in the top 25% of age distribution among all the samples involved[4].

In the selection phase, we also control for the international experiences of the researchers, inserting a dummy that identifies researchers who never spent more than three months abroad during their careers.[5].

We also account for the commitment to teaching with two dummy variables equal to 1 if the time dedicated to teaching is between 25% and 50% of overall working time (medium commitment) or higher than 50% (Intensive commitment). The maintained hypothesis is that career progression for researchers is negatively influenced by an unbalanced distribution of work time in favour of teaching.

Once we obtain the estimate of the probability of transition between career stages (e.g. for women), we regress the duration of the stage for the previously listed characteristics using the "enhanced" sample (second step) using the specification.[6]:

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[3] This step is based on a Heckman correction model, so its results are mathematically similar to a Tobit model for the variable determining the selection.

[4] This approach follows Le Feuvre et al. (2019), which highlight how overcoming certain thresholds of age has a negative effect on researchers' cumulative probability of career progression. We use the last quartile of distribution because Le Feuvre et al. determine that the negative effect is more and more consistent for those heavily over the median value, so we isolate those subjects using a value between the median and the maximum.

[5] We use this variable to test if researchers following an "internal career" (i.e. a career without leaving their working country) have a higher probability of job progression than those who do not. This strategy tests the decision not to move and avoids possible collinearity with mobility variables in the main regression.

[6] Even if there are no explicit contraindications to using the same covariates in the two estimation phases for ERMs, we use different variables in the first regression, except for gender and the percentage of female researchers in the host location. This choice solves two problems: first, the data collected are mainly qualitative variables, and splitting them into the two stages limits the risks of collinearity; second, the non-superposition of variables avoids functional-form identification and yields statistically more robust results.

$$L_{aict} = \alpha \bullet gender_i + \beta_1 \bullet age_{it} + \beta_2 \bullet age_{it}^2 + \rho \bullet family_i + \gamma \bullet mobility_{ai} + \vartheta \bullet field_i$$
$$+ \delta \bullet academics_{ct-1} + \varepsilon$$

where *L* is the duration of stage *a* of researcher *i* in country *c* at time *t*, *gender* is a dummy that indicates if researcher *i* is a woman, *age* and *age²* are indications of age at the time of transition *t*, *family* includes dummies on the presence of partner and children, *mobility* includes variables on international mobility during the stage *a* (in particular categories of duration of the experience and distance between the mobility and the change of stage), *field* indicates what the research area of each person is, and *academics* measure quota of female researchers on the total in country *c* at time *t-1*.

We use the formal model described above for both transitions from Stage 2 to Stage 3 and from Stage 3 to Stage 4. For regression from Stage 3 to Stage 4, we add a dummy indicating if researchers define themselves as a civil servant instead of scholars or public employee[7], following the indication reported by Benz et al. (2021).

Data description

MORE provides a unique lens on mobility patterns and career paths arising from more than 10.000 university researchers across Europe. The survey has three waves. Data has been harmonised to provide consistent classifications of scientific sectors, educational qualifications, and career stages across countries. MORE also contains data on international mobility, the characteristics of these experiences (countries of destination, sectors, duration ...), and researchers' position concerning current and next career steps.

Career stages are defined according to the classification of the European Commission, DG for Research and Innovation, which consists of four levels: (i) up to PhD (first stage), (ii) PhD holders not yet fully independent (second stage), (iii) established researchers that have developed a level of independence (third stage), and (iv) researchers leading their research area (fourth stage).

From the MORE dataset, we selected all those who self-define as researchers and all those who declare to be at least at the second career stage, which we use as benchmark. We excluded respondents with time inconsistencies, such as being promoted to Stage 3 before being promoted to Stage 2 and all those that still need to have complete information about their career progression. The resulting sample contains about 7.170 individuals distributed across 31 European countries. Data includes careers starting between 1965 and 2016. Of these, 1,575 are in Stage 2, 3,398 in Stage 3, and 2,197 in Stage 4. Women represent 40% of the working sample, with quotas that decrease from 47% in Stage 2 to 30% in Stage 4. The classification elaborated by the European Commission offers the advantage of comparing the careers of countries with different and not entirely coincident roles. However, the expected levels are mainly based on the development of research skills accompanied by some more objective elements (for example, for the R4 level, it is possible that the researcher is at the head of a research facility such as a laboratory is indicated). The development of these skills is not strictly linked to formal career progression. Although they are desirable prerequisites, the expected levels do not precisely measure a transition from one career stage to the next. However, it is easy to imagine that researchers chose points of transition between levels coinciding with a formal transition between different roles.

The dependent variable is the duration (years of permanence) of each career stage. Our main explanatory variable is gender (a dummy), with women as reference. We include other personal characteristics such as age at the moment of stage progression (or the time when data was collected for those that do not have yet progressed to the next stage of career) and the presence of partners and/or children. A limitation of MORE

[7] This approach captures researchers that arrive in top positions through an internal university career and are hence in a management rather than a research role. The variable indicates whether those researchers began to see themselves as managers before formally reaching such position (Stage 4).

is the lack of information about when partners and/or children entered the researcher's life. Hence, we do not know whether they were present at, and influenced, by a particular stage of their career.

We include controls for the main area of research (six groups: Engineering and Technology, Humanities, Medical Sciences, Natural Sciences, Social Sciences, and Agricultural Sciences - the benchmark) and any international experience during each stage of the career.[8], and the distance in years between the international experience and the time of promotion[9]. Regarding the scientific profile of the researchers, MORE does not collect data relating to scientific productivity.

Control dummies for countries where the researcher currently works are used, though MORE does not have information on the country/ies in which the researcher spent each career stage.[10].

We also include the quota of female researchers in each country in the year preceding that of promotion under the maintained hypothesis that countries with a more significant percentage of women in academia are more likely to offer women a more favourable environment for their careers.[11].

After these trimmings and impositions, the resulting working sample contains 5,286 observations, of which 655 are for researchers in Stage 2, 3,082 for researchers in Stage 3 and 1,549 for researchers in Stage 4. Women account for 47.7% of researchers in Stage 2, 43.5% in Stage 3, and 34.5% in Stage 4.

Results

Tables 1A and 1B present the results, for stage duration and selection, respectively.

Promotion from Stage 2 to Stage 3

Column A focuses on the transition from Stage 2 to Stage 3. The estimates for gender reveal an apparent contradiction: women have an 8.4% less probability of being promoted from Stage 2 to Stage 3 (first step of the analysis, in Table 1B). However, the duration of the stage before the promotion shows that women reach Stage 3 in a shorter time than their male colleagues: on average, women take 6.7 months less than men (-0.5577 years).

Furthermore, the share of female researchers in each country in different years has no statistically significant effect on the probabilities of career progression. However, it has a negative and significant effect on the duration of the career stage. For each additional percentage point of female researchers in the country, women's duration in Stage 2 is faster than that of men by about a week (-0.01861 years).

Concerning age, the coefficient of its linear value is positive and equal to 1.0225, while the coefficient for the square of age is negative and equal to -0.0083. Both estimates are statistically significantly different from zero, suggesting that the permanence in Stage 2 is directly linked to age, but with age progress, so

[8] MORE questionnaires capture any experiences abroad in the academic field lasting more than three months, with different duration categories that have been reclassified into two groups (up to three years, three years or more).

[9] To test for the robustness of the results, we also included variables that approximate the researchers' satisfaction with their working conditions. In particular, we included dummies for a favourable judgment of the quality of life, job security and whether the respondent believes she/he could not have obtained a higher wage outside the academic sector. Although these questions were asked at the time of data collection, a favourable judgment of various aspects of the research activity can be interpreted as an approximation of motivations both on the past career (i.e. having "held on" to arrive at the current situation) and on its continuation.

[10] We impose the maintained assumption that researchers with a temporary experience abroad stay in the same country for the entire duration of their overseas stay.

[11] These data are not part of the MORE database but are sourced from the OECD - Science Technology and Innovation dataset. This covers the countries of interest since 1996.

does experience, which eases the promotion to a higher career level. Concerning the selection regression, the dummy for the last quartile of the age distribution shows that older researchers have a lower probability (exactly 12.9% less probabilities) of arriving at Stage 3: this confirms the hypothesis advanced by Le Feuvre et al. (2019) that being older than the reference cohort is an obstacle to career progression.

Concerning international mobility, the coefficients of the duration categories and experience abroad are negative, but the coefficient of the event's distance from the time of the next promotion is positive. The benefits of spending time in a different country seem to vanish quickly: a temporary experience abroad helps the progression to the next career stage, both for short (-0.9042, equal to 11 months less) and longer spells (-1.0211 years). However, the positive effect exists only if moving abroad is near the promotion time (0.4854). Two or more years after the upward transition, such effect has dissipated. This result also emerges in the selection regression, where the probability of being promoted from Stage 2 to Stage 3 is 30% lower for researchers that have not considered gaining international experience.

The coefficients for partners and children are not statistically significant. This result is novel and noteworthy because these elements are considered among the main constraints affecting women's academic careers. However, we caution against over-interpreting this result, as MORE data do not capture when partners and children enter the surveyed researchers' lives. Therefore, their nil statistical influence in the regression cannot be viewed as a lack of influence.

Among the "satisfaction variables", the only statistically significant is the outside option – i.e. the wage in the non-academic sector. For respondents believing that their salary is greater than or equal to what they could earn outside of academia, career progression to level 3 is, on average, about 3.5 months (-0.29432 years) faster. This result may underpin higher motivation for those who self-select to be in academia, focusing on advancing their career.

Controls for the research fields show how career transitions are, on average, faster in all the sectors considered concerning the benchmark (Agricultural Sciences), with more substantial effects for Medical Sciences and Social Sciences, where the relative gain is about one year and a half.

Finally, the selection results reveal that subjects with a medium or intensive commitment to teaching have higher chances of advancing from Stage 2 to Stage 3 (coefficients are respectively 0.7127 and 0.6645). This result shows how universities value teaching as a central element of departmental activities.

Promotion from Stage 3 to Stage 4

Column B presents the results of the transition from Stage 3 to Stage 4. The sign and significance of the gender coefficient are similar to the one observed in the promotion from Stage 2 to Stage 3: women have a 20% lower chance to reach an apical position, but they still have an advantage with respect to men in terms of shorter permanence in Stage 3 (-0.6415 equal to 8 months). For women, career progression is more limited, but those who make it can advance their status faster than comparable men.

In contrast to the previous stage of promotion, the share of women among researchers is not significant in the selection regression but is negative and statistically significant in the duration regression: for each percentage point of women in research, the permanence in Stage 3 is reduced by just over a fortnight (-0.0438 equal to 0.53 months). A possible interpretation is that an environment in which women are more represented in leadership positions is less affected by gender bias when it comes to filling a managerial role, which eases and accelerates women's career progression.

Age does not seem to have a direct effect on the timing of the transition between one stage and another, but the age distribution dummies inserted in the selection regression show that subjects in the last quartile have a lower probability (more than 10%) to access Stage 4. "Elderly" researchers are less valued when applying for leading roles for the first time. It should be highlighted that MORE data do not include

information on researchers' productivity, which may be partly proxied by age. In other words, the effect of older age may mask lower (academic) productivity.

International experiences do not appear to influence the duration in Stage 3, but the choice of not considering a spell abroad reduces the probability of accessing Stage 4 (the coefficient is -0.2864), that an essential element of leadership in academia is an extensive international network, built through time spent working abroad.

Controls for research areas confirm that in Medical Science and Social Science, career progression is considerably faster and that such advantage is as high as 18 months. The other variables are not statistically significant - therefore, we do not observe effects related to family conditions and international mobility in passing to Stage 4.

Discussion

The results on the full sample highlight that gender influences academic career progressions. To better understand the structure of career progression, we apply the model to sub-samples by gender, removing the gender dummy from the explanatory variables. Table 2 presents the results for the transition from Stage 2 to Stage 3, while Table 3 shows the corresponding results from Stage 3 to Stage 4. In both tables, column A presents the results for women while column B presents those for men, easing the direct comparison between the two groups. The results for the duration regression are discussed first.

In the transition from Stage 2 to Stage 3, no significant differences by gender emerge in the age structure: the increase in duration is positively linked to age and negatively to age squared. The coefficients have similar values, suggesting that age does not affect the speed of career progression of men and women differently. A significant difference emerges in the selection regression: the coefficient for the last age quartile is negative and significant only for men (equal to -0.2113), confirming that being relatively old hinders progression to leadership positions, especially for men.

The presence of partners and/or children seems to have no significant effect on the speed of promotion, in contrast with the literature observing that women slow their career progression to carry out their family planning objectives. This is noteworthy, notwithstanding the limits associated with MORE's limited information on the dynamics of family status.

A significant difference between genders arises instead in the case of international mobility, which seems less important for women (the statistical significance of the duration of the experience abroad is lower and marginally significant for mobility up to 3 years). For stays abroad longer than three years, they advantage only men to move faster to Stage 3 (-1.0356). In the selection regression, the coefficients for not undertaking an international experience are negative, significant, and slightly higher for men (in absolute terms, -0.2710 vs -0.3318), implying that mobility fastens career progression.

In the selection regression, teaching is associated with large and statistically significant coefficients. The higher coefficients for women relative to men, however, suggest a higher expectation for them to undertake teaching rather than research.

Increasing the share of women out of total researchers by one percentage point accelerates the transition by just under half a month for women alone (-0.0335 years, equal to 0.4 months), a result that confirms the hypothesis when women gain more comprehensive access to the labour market, the integration of female researchers follows suits.

Related to this is the fact that the outside option for women has a negative and statistically significant effect: female researchers who believe in having a higher salary than what they (believe) could earn elsewhere access Stage 3 on average 4.3 months earlier (-0.3592 years) than both other women and their male colleagues. On average, women have greater difficulty in obtaining a wage equal to that of men,

especially in the private sector. Therefore the variable measuring the relative salaries in academics and elsewhere can be viewed as an indicator of greater motivation to build a career in a working environment where their abilities are less affected by gender bias.

Finally, concerning research areas, Engineering and Technology stand out, as it is statistically significant and high only in the case of women (-2.0545 vs -0.6882). Engineering and Technology is a male-dominated field, and hence women who try to work in this area are highly selected, displaying more vital determination and motivation than comparable males.

The results for the transition from Stage 3 to Stage 4 present a significantly different scenario than those of earlier career progression (Table 3).

In general, fewer variables are statistically significant in regressions about Stage 3, and these are almost all related to the subsample of females. A key indicator with stronger statistical significance is the share of female researchers, which has a negative effect. With respect to the transition from Stage 2 to Stage 3, the female presence in research reduces the duration of the career stage, but intensities vary by gender: for women, the gain associated with one extra percentage point of female share is almost one month (-0.0579 years); for men, the same effect is about a fortnight (-0.0375 years). Having women in research favours the promotion of female researchers within academia.

Among the explanatory variables of selection regression, only a few achieve statistical significance. The decision not to work abroad caps the probability of progression also for access to Stage 4. The penalty is slightly higher for women than men (respectively -0.3011 and -0.2684). For Stage 4, the age distribution dummy works against men: older male researchers have a 21% lower probability of accessing a leadership position, while for female researchers, the age distribution has no statistically significant effect.

Lastly, the coefficient associated with researchers who define themselves as civil servants is noteworthy, as it is positive and significant for women (+16%) but not significant for men. Women who lead research groups tend to carry out managerial activities more intensely than in research. The marked difference in the structure of promotion to the highest level of career relative to promotion at lower levels of seniority likely reflects different incentives by gender. As a consequence, they invite us to analyse academic careers in well-defined and separate career stages.

Conclusions

In this work, we identify the determinants of the speed of career progression of European researchers, with a particular focus on the career of female researchers. The results depict a scenario where women's career progression proceeds with greater difficulty relative to that of men, but conditional on being promoted women move to the highest career levels faster than comparable male colleagues. This dichotomy applies both to the transition from the second to the third stage (consolidation of the researcher's career) and to access to the fourth career stage (leadership positions).

To further explore the mechanisms leading to the observed outcomes, we applied our statistical model to separate samples by gender. In doing so, we found two key determinants of progression: the share of female researchers in the total number of researchers and the wage offered in the non-academic sector (i.e. the outside option). Both factors are negatively related to the outcome. Faster career progression for women (relative to comparable men) occurs in academic and research environments characterised by a higher share of women in leadership position, and where gender bias is likely to be lower. We also find that higher wages in the non-academic/non-research sector operate a positive selection whereby the women who remain in research are highly motivated and driven to perform. This is particularly so in the transition between career Stage 2 and career Stage 3.

Table 1 – Complete model		
Table 1A – Regression results: Stage duration		
	A	B
Dependent Variable	**Duration Stage 2**	**Duration Stage 3**
Gender	-0.5577***	-0.6415**
	(0.141)	(0.311)
Age	1.0225***	0.1866
	(0.089)	(0.177)
Square age	-0.0083***	0.0020
	(0.001)	(0.002)
Presence of partner	-0.1294	-0.0175
	(0.193)	(0.404)
Presence of children	0.0161	0.1729
	(0.174)	(0.356)
International mobility duration		
Up to 3 years	-0.9042***	0.5019
	(0.310)	(0.629)
More than three years	-1.0212**	1.220
	(0.464)	(0.629)
Distance between international experience and change of	0.4854***	0.4137**
	(0.076)	(0.161)
Research area		
Engineering and Technology	-1.2332***	-0.7179
	(0.376)	(0.639)
Humanities	-1.6886***	-1.3733**
	(0.392)	(0.682)
Medical Sciences	-2.0599***	-1.4934**
	(0.394)	(0.676)
Natural Sciences	-0.3236	-0.0582
	(0.375)	(0.632)
Social Sciences	-2.1133***	-1.4938**
	(0.372)	(0.640)

Female quota of researchers	-0.0186**	-0.0439**
	(0.009)	(0.018)
Wage comparison with non-academic sector	-0.2943**	-0.2863
	(0.139)	(0.269)
Job security	0.0579	0.2094
	(0.171)	(0.394)
Quality of life	-0.2451	0.6056*
	(0.176)	(0.362)
Constant	-18.7674***	-2.8056
	(1.913)	(4.424)
Number of observations	4,603	4,631

Table 1B – Regression results: selection		
	A	B
Dependent Variable	**Access to Stage 3**	**Access to Stage 4**
Gender	-0.0837**	-0.1945***
	(0.040)	(0.042)
Age distribution	-0.1289***	-0.1028**
	(0.044)	(0.044)
Civil servant		0.0611
		(0.051)
Female quota of researchers	-0.00111	0.0010
	(0.003)	(0.003)
Any international mobility considered	-0.3043***	-0.2864***
	(0.042)	(0.045)
Commitment to teach		
Medium	0.7127***	0.0468
	(0.044)	(0.050)
Intensive	0.6646***	0.0867
	(0.068)	(0.072)
Cons	0.1313	-0.5278***
	(0.100)	(0.108)
Number of observations	4,603	4,631

Table 2 - Robustness check: comparison between women and men in transition between Stage 2 and Stage 3		
Table 2A – Regression results: Stage duration		
	Women	Men
Dependent Variable	**Duration Stage 2**	**Duration Stage 2**
Age	0.99043***	0.99455***
	(0.141)	(0.114)
Square age	-0.00875***	-0.00733***
	(0.002)	(0.001)
Presence of partner	-0.12717	-0.32459
	(0.272)	(0.277)
Presence of children	-0.05671	0.16973
	(0.254)	(0.240)
International mobility duration		
Up to 3 years	-0.97724*	-0.78922**
	(0.509)	(0.383)
More than three years	-0.88850	-1.03562*
	(0.852)	(0.540)
Distance between international experience and change of	0.52641***	0.44307***
	(0.123)	(0.095)
Research area		
Engineering and Technology	-2.05459***	-0.68829
	(0.614)	(0.471)
Humanities	-1.94237***	-1.44241***
	(0.602)	(0.511)
Medical Sciences	-2.23459***	-1.94898***
	(0.598)	(0.524)
Natural Sciences	-0.63627	0.02379
	(0.593)	(0.477)
Social Sciences	-2.47831***	-1.74870***
	(0.577)	(0.482)
Female quota of researchers	-0.03335**	-0.00551
	(0.014)	(0.012)
Wage comparison with non-academic sector	-0.35921*	-0.23156
	(0.218)	(0.180)

Job security	0.06219	0.01927
	(0.256)	(0.231)
Quality of life	-0.30823	-0.03912
	(0.261)	(0.251)
Constant	-16.09868***	-20.32109***
	(3.043)	(2.439)
Number of observations	2,071	2,532

Table 2B – Regression results: selection		
	Women	**Men**
Dependent Variable	**Access to Stage 3**	**Access to Stage 3**
Age distribution	-0.03707	-0.21136***
	(0.067)	(0.059)
Female quota of researchers	0.00010	-0.00268
	(0.004)	(0.004)
Any international mobility considered	-0.27103***	-0.33183***
	(0.062)	(0.058)
Commitment to teach		
Medium	0.81976***	0.63482***
	(0.066)	(0.059)
Intensive	0.73887***	0.62137***
	(0.096)	(0.096)
Cons	-0.10206	0.26947**
	(0.150)	(0.137)
Number of observations	2,071	2,532

Table 3 - Robustness check: comparison between women and men in transition between Stage 3 and Stage 4		
Table 3A – Regression results: Stage duration		
	Women	Men
Dependent Variable	**Duration Stage 3**	**Duration Stage 3**
Age	0.10801	0.22789
	(0.292)	(0.221)
Square age	0.00224	0.00191
	(0.003)	(0.002)
Presence of partner	-0.37331	0.15144
	(0.568)	(0.574)
Presence of children	-0.15375	0.45999
	(0.528)	(0.481)
International mobility duration		
Up to 3 years	-0.54802	0.08422
	(1.007)	(0.804)
More than three years	-0.58486	0.67094
	(2.741)	(1.362)
Distance between international experience and change of	0.57950**	0.32328
	(0.254)	(0.209)
Research area		
Engineering and Technology	-2.21147**	0.28381
	(1.117)	(0.786)
Humanities	-3.84110***	0.20052
	(1.073)	(0.878)
Medical Sciences	-3.21516***	-0.46564
	(1.069)	(0.866)
Natural Sciences	-2.02005*	1.10750
	(1.037)	(0.794)
Social Sciences	-3.49275***	-0.26801
	(1.028)	(0.814)
Female quota of researchers	-0.05789*	-0.03750*
	(0.030)	(0.022)
Wage comparison with non-academic sector	-0.18082	-0.28218

	(0.456)	(0.333)
Job security	0.30650	0.09749
	(0.650)	(0.494)
Quality of life	0.14531	0.89148*
	(0.578)	(0.463)
Constant	4.03975	-6.35017
	(7.258)	(5.525)
Number of observations	1,865	2,766

Table 3B – Regression results: selection		
	Women	Men
Dependent Variable	**Access to Stage 4**	**Access to Stage 4**
Age distribution	0.05978	-0.19550***
	(0.073)	(0.056)
Civil servant	0.16053*	0.01070
	(0.085)	(0.064)
Female quota of researchers	0.00552	-0.00198
	(0.004)	(0.004)
Any international mobility considered	-0.30114***	-0.26842***
	(0.071)	(0.058)
Commitment to teach		
Medium	0.09584	0.02525
	(0.087)	(0.062)
Intensive	0.03114	0.14171
	(0.115)	(0.093)
Cons	-0.97920***	-0.37931***
	(0.181)	(0.139)
Number of observations	1,865	2,766

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