Academic Careers and Fertility Decisions

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Abstract We investigate how academic promotions affect the propensity of women to have a child. We use administrative data on the universe of female assistant professors employed in Italian universities from 2001 to 2018. We estimate a model with individual fixed effects and find that promotion to associate professor increases the probability of having a child by 0.6 percentage points, which translates into an increase by 12.5% of the mean. This result is robust to employing a Regression Discontinuity Design in which we exploit the eligibility requirements in terms of research productivity introduced since 2012 by the Italian National Scientific Qualification (NSQ) as an instrument for qualification (and therefore promotion) to associate professor. Our finding provides important policy implications in that reducing uncertainty on career prospects may lead to an increase in fertility.

Keywords Fertility · Promotion · Academic Career · Career uncertainty

JEL Classification: J13, J65, J41, M51, C31

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Used Acronyms

ANVUR	National Agency for the Evaluation of the University and Research Systems ("AGENZIA NAZIONALE DI VALUTAZIONE DEL SISTEMA UNIVERSITARIO E DELLA RICERCA")
LPM	Linear Probability Model
MIUR	Italian Ministry of Education, Universities and Research ("Ministero dell'Istruzione, Università e Ricerca")
NSQ	National Scientific Qualification
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
RDD	Regression Discontinuity Design
RTD-A	Assistant Professor (Type A) ("Ricercatore a Tempo Determinato Tipo A")
RTD-B	Assistant Professor (Type B) ("Ricercatore a Tempo Determinato Tipo B")
RU	Assistant professor (permanent position) under the old regime ("Ricercatore Universitario")

1 Introduction

Do career prospects affect fertility choices? Researchers have long been concerned with the economic factors driving the decision to have a child, typically looking at such decision as the result of a utility maximization process that takes into account costs and benefits of children, subject to income constraints and individual's preferences (Becker, 1981). Women's fertility decisions interact with those regarding employment as they are the solution of a common constrained maximization problem (Del Boca & Sauer, 2009; Francesconi, 2002; Cigno, 1991). On the one hand, better employment prospects, by increasing opportunity costs, reduce fertility. On the other hand, higher income may lead to an increase in fertility. The ambiguity of this relationship (depending on whether the income effect prevails over the substitution effect) is confirmed by the changing correlation between fertility and female labour market participation observed in recent years.

An important aspect that has been attracting greater attention, especially in explaining the persistently low fertility rates of many advanced countries, is the increased labour market insecurity (Sobotka et al., 2011). As individuals are typically risk averse, higher economic insecurity and more uncertain career prospects might push them to decrease the number of children in order to reduce risk. There is growing empirical evidence on how economic uncertainty affects fertility decisions. Prior studies have shown a negative impact of aggregate unemployment on fertility (Currie & Schwandt, 2014). Other studies have investigated the impact of unemployment at the individual level, providing evidence of a strong negative effect that is mostly caused by the career shock rather than the income shock induced by unemployment (Del Bono et al., 2015). Some other works have looked at the fertility consequences of job instability focusing on temporary contracts (De La Rica & Iza, 2005) or on employment protection (De Paola et al. 2021; Prifti & Vuri, 2013; Bratti et al., 2005).

An alternative reason why the increased economic insecurity may affect fertility is that women might decide to postpone childbearing due to their desire to pursue a career: a higher economic instability might induce people, in particular the young, to defer family formation until they achieve full integration into the labour market. Unsurprisingly, the mean age of women at birth of first child has increased remarkably in most OECD countries, rising from an average of 24 in 1970 to 30 in 2017.[1] A number of recent papers find very relevant child penalties and women might consider these costs in their fertility decisions (see Bertrand, 2018 for a survey). While previous research has documented negative effects of fertility on a woman's career, little is known on the extent to which promotion affects fertility. The present research aims at filling this gap by addressing how career advancements within academic positions of women employed in the Italian University system affect fertility decisions. As explained above, the effect might be driven by different channels including income effects, reduced insecurity and desire for recognition on the workplace.

Academic career in Italy remains markedly characterized by strong vertical segregation: only 21% of full professors are women, while the proportion of women among associate and assistant professors is 36% and 47%, respectively. The low representation of women at the top of the hierarchical ladder can be due to many factors, such as differences in productivity, but they may also be related to the fact that promotion procedures favour men rather than women. For example, some previous works examining gender differences in the academic labour market show that women suffer a disadvantage in promotions and a within-rank pay gap (Blackaby et al., 2005; Ginther & Kahn, 2004; McDowell et al., 1999). Moreover, a number of papers looking at gender differences in career prospects in Italian academia provide evidence of a lower success probability of women compared to men in career advancement (Bagues et al., 2017; De Paola et al., 2017; Jappelli et al., 2017; De Paola & Scoppa, 2015). There is also evidence that the average number of years required for the transition from researcher to associate professor is greater for women (SIE gender commission, 2016).

Due to domestic responsibilities, which include among others child-rearing and household keeping, women might have less time to perform the research and teaching necessary for advancement. Many studies show, in fact, that women do much more household labour than men and that this extends to academics (Ward & Wolf-Wendel, 2004). These delays and difficulties might induce women who want to consolidate their professional position to postpone motherhood with negative consequences on their total fertility rate. This can also lead to involuntary

[1] In Italy, this figure has reached 32 years in 2018.

childlessness, also because of the health-related risks associated with delaying entry into motherhood (te Velde et al., 2012). The proportion of childlessness among women at the end of their reproductive period has increased dramatically in many OECD countries, especially in Italy where, the fraction of childlessness for those born in 1978 has doubled up (22.5%) with respect to that for women born in 1950 (11.1%).[2]

This chapter contributes to the existing research on economic uncertainty and fertility decisions by focusing on the impact of improvements in career prospects, which has been so far overlooked. More specifically, we analyse how the transition from the entering position in the Italian academia ("Researcher") to the position of Associate professor changes the propensity to have children. We use administrative data gathered by the Italian Ministry of Education and from the National Agency for the Evaluation of the University and Research Systems (ANVUR) providing information on both fertility decisions and career advancement. Our investigation relies on two different estimation strategies. The first one considers the whole sample of women hired by an Italian University as researchers starting from 2001 to 2018. For these women we have yearly information both on Compulsory Maternity Leave (which we use as a proxy of fertility decision) and on their career advancements: exploiting the panel structure of our dataset we estimate an individual fixed-effect model that allows us to control for time-invariant individual characteristics to investigate the impact of promotion to the position of associate professor on the probability of having a child. The second estimation strategy exploits the eligibility requirements in terms of research productivity imposed by Italian National Scientific Qualification (NSQ) to advance in the academic ladder from assistant to associate professor. This institutional feature allows us to adopt a Fuzzy Regression Discontinuity Design and estimate the causal effect of career advancement on fertility by comparing the propensity to have a child for women who just got the Qualification with that of women who just missed it.

Our empirical analysis shows that women who experience career advancements have a higher probability of having a child. More specifically, we document that promotion to associate professor positions increases the likelihood of child birth of about 0.6 percentage points, which translates into an increase by 12.5% of the mean. This finding is robust to a battery of checks, including a specification that allows either age or years of experience to enter non-linearly in order to flexibly control for the fact that both promotion and maternity could be related to age or seniority, respectively. More importantly, the size of the impact is fairly stable across the two alternative estimation strategies used in the empirical analysis. Moreover, as promotions from not tenured to tenured positions are those expected to have the

[2] The number of women working in the Italian academia who do not have children is particularly high. According to the report produced by the Gender Commission of the Italian Economic Society (2016), based on a survey proposed in 2014 and 2016 to the members of the Italian Economic Society, about 33.9% of female economists aged above 50 have no children, while this percentage is only 13% for their male counterparts. A similar gap is found also for individuals aged 40–50, with this figure being 32% and 23.4% for women and men, respectively.

highest impact on fertility, the effect we estimate focusing on promotions between tenured positions can be considered a sort of lower bound of the impact deriving from increased job security.

The estimated positive effect of promotion can be explained either by the higher income associated to promotion or by the fact that women who have obtained a career recognition feel more comfortable devoting time and energy to childbearing without fear of negative career repercussions.

We also find that the estimated effect is highly heterogeneous by age and geographic area of the individual's university. In addition, we document that the effect is more salient immediately after promotion and gradually vanishes with the number of years from promotion. Furthermore, we find heterogeneous effects depending on whether promotion occurs before or after 2012, i.e. when the recruiting system changed due to the Gelmini Reform, with the effect being larger in the latter case (i.e. an increase by 20% of the mean). This differentiated effect can be due to the fact that the reform, by increasing the minimum standard required to obtain promotion, has made it more difficult for women who want to pursue a career to have children before career advancement.

Importantly, we find similar results when we apply a Fuzzy Regression Discontinuity Design and estimate the impact of obtaining the National Scientific Qualification on the probability of having a child. The size of the impact is consistent in magnitude with that obtained using the individual fixed-effects model, though the estimates become relatively imprecise.

The chapter is organized as follows. In Sect. 2, we discuss the institutional background. In Sect. 3, we describe the data we use in the analysis and show some descriptive statistics. In Sect. 4, we present the results of the effects of promotion on fertility using the individual fixed-effects model. In Sect. 5, we illustrate the estimates obtained from our alternative estimation strategy based on a Fuzzy Regression Discontinuity Design. Section 6 offers some concluding remarks.

2 Institutional Background

In this section, we provide some information on the institutional setting of the Italian Academia. The rules governing careers in Italian universities have changed over time. The sample of individuals we consider was interested by two different systems. According to the first system, before 2012, there were three academic positions: Assistant Professor or Researcher ("Ricercatore"), i.e., the entry level; Associate Professor ("Professore Associato"); Full Professor ("Professore Ordinario"). All three were permanent positions: formally there was a probationary period of 3 years, but tenure was very rarely denied.

Since all were permanent positions, the key differences between associate professors and researchers were the annual income (about 35% higher for associate professor position) and teaching duties, that were more intense for associate professors.

In the first system, a university willing to fill a vacancy initiated a competition, and a committee of five members was selected to choose a shortlist of candidates (the so-called idonei).[3]

Once the process was concluded, the university that initiated the competition could decide to appoint one of the winning candidates as professor, while the other could be appointed by another university within three years. This mechanism remained in place until 2011.

In 2012, a new system was introduced, following a major reform of the university system in 2010 (the so-called Gelmini Law). The reform was aimed at increasing transparency and meritocracy through a two-stage procedure: a first stage, in which candidates aiming for promotion to associate or full professor positions are required to qualify in a centralized national competition held at the field level, the so-called National Scientific Qualification (NSQ), in which candidates' publications and CVs are evaluated in relation to a field-specific minimum standard; and a second stage, in which effective promotions (or new hiring) are managed at the local level by each university.

Obtaining the NSQ is only the first step to get a promotion. In fact, university departments can autonomously choose full and associate professors to hire among individuals who have obtained the NSQ, through an open competition for both internal and external candidates or, alternatively, through a competition limited to internal candidates. Then, the probability of being effectively promoted for individuals who gained the NSQ depends on the number of vacancies opened by university departments, which in turn depends on resources obtained from the central government.

As a consequence of the "Gelmini Reform", since 2012, the entering positions have become temporary with two main types of contracts, "Ricercatore di tipo A" and "Ricercatore di tipo B" with different contractual length but similar teaching duties. The position of "Ricercatore di tipo A" (type-A Researcher) may last for up to 3 years and is temporary, with no career path. The position of "Ricercatore di tipo B" (type-B Researcher) lasts for three years and is a tenure-track position towards Associate Professorship, conditional on the researcher obtaining the National Scientific Qualification as Associate Professor.[4] Therefore, while the position of Researcher in the pre-reform system was permanent, the new positions of type-A and type-B Researcher are temporary positions.

In our analysis we do not consider individuals in these temporary positions because we do not have data on their fertility decisions, so we focus on individuals

[3] One member was appointed by the university Department opening the vacancy while four members out of five were before 2008 elected by all the professors in the field (but de facto nominated by the same Department) and—after 2008—randomly selected (among all the full professors in each field). The number of winning candidates ("idonei") changed along time (3 in some periods, 2 in some others, 1 for a period of 2 years).

[4] Even if the contractual length of "Ricercatore di tipo A" and "Ricercatore di tipo B" is not different (three years for both), the length of the former can be—in some cases—prolonged for two additional years.

who were hired by an Italian University with a permanent contract in the position of assistant professors starting since 2001. Since we observe these individuals for a period of about 20 years (from 2001 to 2018), we are able to detect any change in their position in the hierarchical ladder.

In this study, we consider the procedure for obtaining the NSQ launched in 2012. We focus on individuals who have already a permanent position as Assistant Professor who apply in the NSQ for the Qualification of Associate Professor. In case of failure to obtain the promotion, they remain at the same level of the academic ladder. Promotion is quite relevant in terms of salary: the yearly gross salary for assistant professors is about €41,000, while it rises to €54,000 for associate professors and about €72,000 for full professors. As regards other aspects, Italian academics have similar obligations and constraints at all the hierarchical levels and carry out similar tasks. However, prestigious positions such as rector, dean, head of department are open only to full professors.

Italian academia is organized into 14 different scientific areas (e.g. physics, medicine, economics and statistics); each area is in turn divided into different scientific fields (e.g. applied physics, econometrics, private law), for a total of 184 fields. The NSQ is awarded by a committee (specific to each field) of five members, randomly selected from the full professors in each field who have reached some scientific productivity standards and volunteered for the task. Committee members evaluate candidates for both associate and full professor positions and award the NSQ. There are no limits to the number of qualifications awarded in each field. Committees have full autonomy on the criteria to be used in the evaluation, but some criteria were suggested by the Italian Ministry of Education, Universities and Research (MIUR) in relation to the research productivity of candidates in the previous 10 years, as measured by some bibliometric indicators (see Sect. 4 for details).

3 Data

We use administrative data from the universe of women working in Italian universities since 2001 until 2018. The dataset is collected by ANVUR, the Italian National Agency for Evaluation of University and Research, and provides detailed information on the academic position covered by each woman in each year, her *Age*, the years since hiring (*Experience*), Compulsory Maternity Leave, the geographical area of the University in which the individual is employed. Data are structured as an individual-year panel data set.[5] Due to the features of the dataset that only provides information on maternity leaves, we will focus exclusively on women aged up to 46.

[5] The dataset was provided to us in anonymized form for our empirical analysis at the Laboratory of ANVUR headquarters.

We build the dependent variable *ChildBirth*$_{it}$ a dummy equal to one for woman i who have a birth at year t (and zero otherwise). The data at hand also provide information on: age, years of experience (years since hiring in the University), academic position, academic fields (84 "macro-settori") and university's geographic areas (North-West, North-East, Centre, South, Islands).

The main explanatory variable is *Promotion to Associate Professor*, a dummy equal to one if an individual obtains a promotion in year t (or has obtained a promotion in the past k years).[6] In the second part of our analysis we will use as alternative explanatory variable *Qualification*, a dummy variable taking value one if the individual has been awarded the NSQ in the previous year or earlier (and zero otherwise). The NSQ introduces explicit thresholds in three productivity indicators (e.g. # of publications, # of citations, h-index, etc.) which vary across academic sectors, and scholars have to meet at least two out of three indicators in order to gain the eligibility for career advancements. We will exploit data for the NSQ in 2012 that provide for each candidate the score in each of the three productivity indicators and the outcome of the qualification procedure.

In Table 10 in the Appendix, we report some descriptive statistics for the universe of women who were hired by an Italian University as assistant professor in the period from 2001 to 2018 (excluding women who were already Associate and Full Professors in 2001)—whom our individual fixed-effects estimates are based on (descriptive statistics for the sample used in the RDD analysis are provided in Sect. 5). Women included in our sample are on average 40.17 years old (with a minimum of 24 years and a maximum of 46). The vast majority of them have an age ranging from 36 to 46. The probability of having a child is of 4%. About 15% of women who started their career as assistant professor have been promoted to associate professor in the period covered by our data.

4 The Effect of Promotion on Fertility: An Individual Fixed-Effects Approach

In this section, we investigate the impact of being promoted to the position of associate professor on the fertility decision of women working as researchers (i.e. assistant professors) in Italian Universities. In order to try to handle confounding factors deriving from unobserved heterogeneity, we exploit the panel structure of our dataset (with about 12,000 individuals observed on average for nearly 9 years) and estimate the following model including individual fixed effects:

$$\text{ChildBirth}_{\text{it}} = \beta_0 + \beta_1 \text{Promotion}_{\text{it}-k} + \beta_2 X_{\text{it}} + \mu_i + \lambda_t + \varepsilon_{\text{it}} \quad (1)$$

[6] We experiment with different values of k.

where the dependent variable is a binary variable $\text{ChildBirth}_{\text{it}}$ which takes the value of one if the researcher i in the year t had a child and zero otherwise. Among the independent variables, we consider the step variable $\text{Promotion}_{\text{it}-k}$ which takes the value of one starting from year t in which the researcher has been promoted to a higher position and zero otherwise (for k years). X_{it} is a vector of the candidate's characteristics including age and years of experience. μ_j and λ_t are individual and year fixed effects, respectively. In some specifications we also include scientific field- and geographic area-specific trends. In all the regressions, standard errors are robust to heteroskedasticity and allowed for clustering at the individual level. By estimating our model with individual fixed effects, we are able to take into account time-invariant heterogeneity in productivity across individuals, even if we are not able to control for variation of productivity occurring over time.

We estimate our model on the sample of women who were hired by an Italian University as assistant professor in the period from 2001 to 2018. We exclude women already in a position of Associate or Full Professor in 2001. We also restrict the sample to women under the age of 46, therefore ending up with 11,897 individuals and a total of 101,774 observations, one for each year since hiring.

Results from individual fixed-effects regressions are reported in Table 1. Reading across columns of Table 1, our estimates indicate that promotion to the position

Table 1 The effect of promotion on child birth. LPM with individual fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)
Promotion to Associate Prof.	0.006^{**}	0.006^{**}	0.006^{**}	0.006^{**}	0.006^{**}	0.005^{*}
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Age	−0.000	−0.002	−0.004	−0.004	−0.004	−0.001
	(0.000)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Age Sq.		0.000	0.000	0.000	0.000	0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Experience (yrs.)			0.002^{**}	0.002^{*}	0.002^{*}	0.002^{*}
			(0.001)	(0.001)	(0.001)	(0.001)
Individual FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	No	No	No	Yes	Yes	Yes
Geographic area-specific trends	No	No	No	No	Yes	Yes
Scientific field-specific trends	No	No	No	No	No	Yes
Observations	101,774	101,774	101,774	101,774	101,774	101,774
Clusters (individuals)	11,897	11,897	11,897	11,897	11,897	11,897

Notes: Estimates from OLS regressions are reported in each column. The dependent variable is *Child Birth*. We include individual fixed effects. Sample includes all female hired as assistant professors (RU) in Italian Universities after 2001 who are aged up to 46 followed until 2018. Standard errors clustered by individual are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Source: Administrative data provided by ANVUR of associate professor leads to an increase in the probability of having a child of about 0.6 percentage points, which is statistically significant at the 5% level. Results are quite stable across specifications. In column 1, we only control for *Age*, while in column 2 we also include *Age Squared*. The effect remains the same both in terms of magnitude and statistical significance also when we include *Years of Experience* (column 3), year dummies (column 4), geographical area-specific trends (column 5) and scientific field-specific trends (column 6). The size of the effect is slightly reduced to 0.5 percentage points when we include both scientific field- and geographic area-specific trends.

In the interest of comparing our main results with the OLS estimates, in Table 12 in the Appendix of the chapter, we report results from a Linear Probability Model in which we do not control for individual fixed effects. Results obtained when estimating a simple pooled OLS model might be biased due to the fact that women who are more likely to be promoted have peculiar features (for instance, they are characterized by a higher scientific productivity) which might also affect their probability of having a child. If these unobserved features positively affect the probability of both being promoted and having a child, we would expect an upward bias. In contrast, if these unobserved features are negatively correlated to fertility decisions, we will end up with a downward bias. A downward bias would emerge, for instance, if more productive women tend to postpone fertility or decide to have no children at all. This could well be the case if their higher productivity depends on the fact that, being free from duties related to childbearing, they devote more time to research. Estimates reported in Table 12 show that failing to account for individual unobserved heterogeneity leads to an insignificant effect of promotion on fertility when we control for years of experiences (column 3), year dummies (column 4), geographic area dummies (column 5) and scientific field dummies (column 6).

Next, we test the robustness of our main results, reported in Table 1, to several checks. To begin, column 1 in Table 2 shows the results obtained from a specification in which instead of controlling for age we include a saturated set of age dummies to flexibly control for the fact that both promotion and maternity could be related to age in a complex non-linear form. Notwithstanding the inclusion of age dummies, the impact of promotion on fertility is unchanged.

Second, we redo the same exercise and test whether results hold when replacing the variable *Experience* with the full set of dummies for the number of years of experience. This allows accounting for the fact that both promotion and maternity could be related to seniority in a complex way. Reassuringly, the estimates reported in column 2 of Table 2 are in line with our baseline results both in terms of magnitude and statistical significance.

Next, we carry out a robustness check excluding from our sample women too young or too old (respectively, bottom 1% in *Age* and top 1% in *Experience*). The estimates in columns 3 to 4 of Table 2 do not change qualitatively with respect to those shown in Table 1. Finally, in column 5 we exclude both at the same time and the results are unchanged.

In Table 3, we investigate whether the effect of promotion on fertility takes place immediately after promotion or in the subsequent years. In column 1, we restrict the

Table 2 The effect of promotion on child birth. Robustness checks

	(1)	(2)	(3)	(4)	(5)
	Using age dummies	Using experience dummies	Excluding bottom 1% in age	Excluding top 1% in seniority	Excluding both at the same time
Promotion to Associate Prof.	0.005*	0.005*	0.005*	0.005*	0.005*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Age		−0.000	−0.000	−0.001	−0.000
		(0.004)	(0.004)	(0.004)	(0.004)
Age Sq.		0.000	0.000	0.000	0.000
		(0.000)	(0.000)	(0.000)	(0.000)
Experience (yrs.)	0.002*		0.002*	0.002*	0.002*
	(0.001)		(0.001)	(0.001)	(0.001)
Individual FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
Geographic area- specific trends	Yes	Yes	Yes	Yes	Yes
Scientific field-specific trends	Yes	Yes	Yes	Yes	Yes
Observations	101,774	101,774	101,499	100,733	100,458

Notes: Estimates from OLS regressions are reported in each column. The dependent variable is *Child Birth*. We include individual fixed effects. Sample includes all female hired as assistant professors (RU) in Italian Universities after 2001 who are aged up to 46 followed until 2018. Standard errors clustered by individual are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Source: Administrative data provided by ANVUR

Table 3 The effect of promotion on child birth. Short versus long run effects

	(1)	(2)	(3)	(4)	(5)
	Up to 1 year from promotion	Up to 3 years from promotion	Up to 7 years from promotion	2 to 3 years after promotion	4 to 7 years after promotion
Promotion to Associate Prof.	0.010**	0.006**	0.005*	0.003	0.003
	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)
Age	−0.001	−0.000	−0.001	−0.001	−0.002
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Age Sq.	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Experience (yrs.)	0.002*	0.002*	0.002*	0.002*	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Individual FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
Geographic area-specific trends	Yes	Yes	Yes	Yes	Yes
Scientific field-specific trends	Yes	Yes	Yes	Yes	Yes
Observations	89,995	95,193	100,100	91,931	91,640

Notes: Estimates from OLS regressions are reported in each column. The dependent variable is *Child Birth*. We include individual fixed effects. Sample includes all female hired as assistant professors (RU) in Italian Universities after 2001 who are aged up to 46 followed until 2018. Standard errors clustered by individual are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: Administrative data provided by ANVUR

Table 4 The effect of promotion on child birth. Heterogeneous effects by age (above/below median)

	(1)	(2)
	Age < =40	Age > 40
Promotion to Associate Prof.	0.010*	0.001
	(0.006)	(0.004)
Experience (yrs.)	0.005**	0.001
	(0.002)	(0.001)
Individual FEs	Yes	Yes
Year FEs	Yes	Yes
Geographic area-specific trends	Yes	Yes
Scientific field-specific trends	Yes	Yes
Observations	49,184	52,590
Clusters (individuals)	8472	11,260
Mean of dependent variable	0.052	0.029

Notes: Estimates from OLS regressions are reported in each column. The dependent variable is *Child Birth*. We include individual fixed effects. Sample includes all female hired as assistant professors (RU) in Italian Universities after 2001 who are aged up to 46 followed until 2018. Standard errors clustered by individual are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Source: Administrative data provided by ANVUR

sample in order to include only observations within a year after promotion. We find that the probability of having a child increases by 1 percentage point immediately after promotion. In column 2, we consider a period up to three years after promotion and the impact reduces to an increase of 0.6 percentage points, while it reaches a lower bound of 0.5 percentage points when considering a period up to seven years after promotion (column 3).

Finally, in columns 4 and 5, we test whether the impact of promotion on the probability of having a child extends to the two-three years following promotion (column 4) or to the period between four to seven years after promotion (column 5), respectively. As expected, the estimates in columns 4–5 are lower in magnitude than the ones in column 1, though they are not statistically significant at conventional levels. The result showing that the impact of promotion reduces over time might depend on the fact that, since women in our sample are on average 37 years old, the time left for childbearing is limited.

In Table 4, we estimate our model (the specification with the full set of controls) separately for women aged below and above 40 (i.e. the median age). This permits to compare women who are more similar in terms of age and then as regards the probability of having a child. We find that the effect of promotion on fertility is mainly driven by younger women. This is consistent with the hypothesis that younger women, by facing lower time pressure to have a child, have greater incentives to postpone childbearing in the interest of pursuing a professional career.

Table 5 The effect of promotion on child birth. Heterogeneous effects by geographic area

	(1)	(2)	(3)
	North	Centre	South
Promotion to Associate Prof.	0.010**	−0.002	0.001
	(0.004)	(0.005)	(0.004)
Age	0.000	−0.003	−0.014**
	(0.006)	(0.006)	(0.005)
Age Sq.	−0.000	0.000	0.000*
	(0.000)	(0.000)	(0.000)
Experience (yrs.)	0.002	0.001	0.006**
	(0.002)	(0.001)	(0.003)
Individual FEs	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
Observations	46,892	22,149	32,734
Clusters (individuals)	5335	2767	3795
Mean of dependent variable	0.055	0.025	0.029

Notes: Estimates from OLS regressions are reported in each column. The dependent variable is *Child Birth*. We include individual fixed effects. Sample includes all female hired as assistant professors (RU) in Italian Universities after 2001 who are aged up to 46 followed until 2018. Standard errors clustered by individual are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Source: Administrative data provided by ANVUR

Thus, according to this prediction, the fertility response to promotion for younger women should be larger than that for older women.[7]

In Table 5, we investigate whether the effects are heterogeneous according to geographic areas in which university are located. We find that women affected by promotion in their fertility decisions are mainly those working in the North of the country. This might be due to the fact that the income constraint is more binding in a more developed area, where the support coming from grandparents is weaker (due to better employment conditions).

However, the higher supply of nurseries and kindergartens is likely to work in the opposite direction. It is well known that Southern regions are characterized by low availability of child care services: the percentage of places available in nurseries with respect to resident children (up to the age of 2) is approximately 30% in the North, 33% in the Centre and 13% in the South. Therefore, in Southern regions, even when a promotion (and a higher income) is obtained, couples can be discouraged by the lack of child care services, whereas the latter problem is less binding in Northern regions.

Furthermore, the North-South difference could also be explained by the fact that, due to different social norms, the pursuit of professional advancement is more relevant for women living in the northern part of the country (as documented

[7] Note that in our sample the average age at promotion is 43.

Table 6 The effect of promotion on child birth. Heterogeneous effects by university regulation

	(1)	(2)
	Promotion under old regime (pre-2012)	Promotion under new regime (post-2012)
Promotion to Associate Professor	0.003	0.009^{**}
	(0.003)	(0.005)
Age	−0.003	−0.001
	(0.005)	(0.004)
Age Sq.	0.000	0.000
	(0.000)	(0.000)
Experience (yrs.)	0.002	0.000
	(0.001)	(0.001)
Individual FEs	Yes	Yes
Year FEs	Yes	Yes
Geographic area-specific trends	Yes	Yes
Scientific field-specific trends	Yes	Yes
Observations	63,740	81,000
Clusters (individuals)	10,629	9631
Mean of dependent variable	0.032	0.044

Notes: Estimates from OLS regressions are reported in each column. The dependent variable is *Child Birth*. We include individual fixed effects. Sample includes all female hired as assistant professors (RU) in Italian Universities after 2001 who are aged up to 46 followed until 2018. Standard errors clustered by individual are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Source: Administrative data provided by ANVUR

by Istat, 2018, southern Italian regions are still characterized by strong gender stereotypes).

Table 6 reports the estimated effect of promotion on child birth depending on whether promotion took place in the period before 2012, i.e., during the old recruiting system, or in the period starting from 2012 when promotion is regulated by the Gelmini Reform. According to our data, the percentage of women who got promoted during the old regime (i.e. before 2012) is 11%, while this figure increases to 21% during the new regime (i.e. since 2012).

Results in Table 6 highlight that the effect of promotion is larger in the more recent period, i.e., under the new regime regulating career advancements in the Italian academia (i.e. an increase by 20% of the mean). This finding likely stems from the fact that the reform, through the National Qualification System, has increased the relevance of scientific productivity for promotion and therefore has made it more difficult for women who want to pursue a career to have children, as they would typically have less time to reach the minimum standards in terms of scientific productivity required for career advancement. On the other hand, once promoted, women increase their propensity to have children.

Finally, we verify if the impact of promotion on fertility is heterogeneous across macro-fields (Natural Sciences, Medicine, Engineering, Social Sciences and

Humanities) and we find a quite similar impact (results, not reported, are available upon request).

5 The Effect of Qualification on Fertility: A Fuzzy Regression Discontinuity Approach

In this section, we investigate the impact of improved career prospects on women fertility decisions using an alternative identification strategy which exploits the eligibility requirements in terms of research productivity imposed by the Italian National Scientific Qualification (NSQ) to advance in the academic ladder to positions for associate and full professor. As explained in Sect. 2, currently in order to get promoted to associate and full professors, candidates need first to obtain a National Scientific Qualification (NSQ), awarded by a national committee who consider candidates' publications and CVs in relation to a field-specific minimum standard.

Obtaining the NSQ is only the first step to get promotion. In fact, university departments can autonomously choose full and associate professors to hire among individuals who have obtained the NSQ, through an open competition for both internal and external candidates or, alternatively, through a competition limited to internal candidates. Then, the probability of being effectively promoted for individuals who gained the NSQ depends on the number of vacancies opened by university departments, which in turn depends on resources obtained from the central government.

To award the qualification, the committee members in each scientific field first consider three measures of candidates' scientific productivity (in the 10 years preceding the evaluation) in relation to some field-specific cutoffs (defined on the basis of the median values of these measures in the target position). In bibliometric (mainly scientific) fields,[8] the productivity indicators used are: (1) the number of articles published in scientific journals, (2) the total number of citations and (3) the h-index. In non-bibliometric fields (social sciences and humanities), the indicators are: (1) the number of articles published in scientific journals, (2) the number of articles published in high-quality journals and (3) the number of books.

The fact that Italian researchers have to meet at least two out of three productivity thresholds to qualify for associate and full professor allows us to employ a Fuzzy Regression Discontinuity Design and exploit the discontinuity in the likelihood of being awarded the qualification when two out of three indicators are equal or above the relative thresholds.

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[8] Bibliometric fields include mathematics, physics, chemistry, earth sciences, biology, medicine, agricultural and veterinary sciences, civil engineering and architecture, industrial and information engineering, and psychology.

The Regression Discontinuity Design (RDD), compared to the individual fixed-effect model adopted before, has the advantage of exploiting variation that is arguably exogenous around a given threshold. In fact, in a RDD framework individuals are characterized by some variable X over which they do not have full control, and that has to reach a given threshold for them to receive a certain treatment. In this way, focusing on individuals near the threshold (above and below) allows to compare individuals that are very similar in terms of observable and unobservable characteristics, but some of them are "treated" and some others are not. This enhances the credibility of the estimation results, since there are less concerns that treated and control individuals differ for factors other than the treatment.

Then, we estimate the causal effect of *Qualification* (and so the prospect of career advancement) on fertility by comparing the likelihood to have a child for women who just achieve and just miss the qualification. In this way, any jump in fertility in proximity of the cutoff point of productivity indicators can be interpreted as evidence of a treatment effect.[9]

Following most of the papers in the literature, we use a parametric approach. Formally, we estimate the following first-stage equation:

$$\begin{aligned}\text{Qualification}_{\text{it}} = \alpha_0 + \alpha_1 \text{Above}_{\text{it}} + \textstyle\sum_{m=1}^{3} \delta_m f\,(\text{distance}_{\text{itm}}) + \alpha_2 X_{\text{it}} \\ + \mu_j + \gamma_g + \lambda_t + \varepsilon_{\text{it}}\end{aligned} \tag{2}$$

where Above_{it} is a dummy variable equal to one when at least 2 of the 3 indicators are above (or equal) the relative thresholds, $f(\text{distance}_{\text{itm}})$ are three flexible functions of the distance of each m running variable (individual productivity indicator) from its respective cutoff, X_{it} is a vector of individual characteristics (e.g. age, seniority) and μ_j, γ_g, λ_t are dummies for scientific fields, university's geographic areas and year, respectively. ε_{it} is an error term. We will allow standard errors for clustering at the individual level.

Then, we use the discontinuity in the probability of achieving the qualification as an instrumental variable in the following second-stage equation:

$$\begin{aligned}\text{ChildBirth}_{\text{it}} = \beta_0 + \beta_1 \widehat{\text{Qualification}}_{\text{it}-k} + \textstyle\sum_{m=1}^{3} \delta_m f\,(\text{distance}_{\text{itm}}) \\ + \beta_2 X_{\text{it}} + \mu_j + \gamma_g + \lambda_t + \varepsilon_{\text{it}}\end{aligned} \tag{3}$$

where β_1 is the local average treatment effect (LATE) of being awarded the NSQ on the subsequent propensity to have a child.

We estimate our model on the universe of female assistant professors who have applied for the Associate Professor Qualification at the NSQ in 2012. We apply the same restrictions discussed in Sect. 3 and focus exclusively on women aged up to 46, thus ending up with a sample of 3986 individuals and 19,407

[9] For a similar strategy exploiting the discontinuity in productivity indicators from NSQ to analyse a different outcome (productivity after promotion), see Nieddu and Pandolfi (2018).

observations. As shown in Table 11 in the Appendix, women included in this sample are on average 41.74 years old with the majority of them being older than 41 (67.2%). The probability of having a child is of 5.2% (higher compared to the probability of 4% observed on the full sample). About 87% of them have a scientific productivity above the cutoff point for being considered for the National Scientific Qualification, about 69% of them have obtained the Qualification as Associate Professor (this percentage rises to 79.6% among those whose productivity is above the threshold). On the other hand, only 22.6% of women applying for the NSQ have been effectively promoted to the position of Associate Professor.

In Table 7, we report first-stage estimation results in which the dummy *Qualification* is used as a dependent variable in relation to the dummy *Above 2/3 cutoffs* for passing 2 out of 3 productivity thresholds. Controlling for the distance from the three different cutoffs, having met at least two of them strongly determines the probability of obtaining the NSQ. More precisely, individuals who met at least two of the three productivity thresholds have a higher probability of obtaining the

Table 7 First-stage results. The probability to obtain the qualification and the above 2/3 cutoffs

	(1)	(2)	(3)	(4)	(5)	(6)
Above 2/3 cutoffs	0.485***	0.484***	0.483***	0.483***	0.479***	0.476***
	(0.022)	(0.023)	(0.023)	(0.023)	(0.022)	(0.023)
Distance from cutoff (indicator 1)	0.000	0.000	0.000	0.000	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Distance from cutoff (indicator 2)	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Distance from cutoff (indicator 3)	−0.002*	−0.002*	−0.002*	−0.002*	−0.002***	−0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age		−0.002	0.079**	0.082**	0.085**	0.076**
		(0.002)	(0.033)	(0.034)	(0.034)	(0.034)
Age Sq.			−0.001**	−0.001**	−0.001***	−0.001**
			(0.000)	(0.000)	(0.000)	(0.000)
Experience (yrs.)				−0.004*	−0.002	−0.004*
				(0.002)	(0.002)	(0.002)
Field dummies	Yes	Yes	Yes	Yes	Yes	Yes
Geographic area dummies	No	No	No	No	Yes	Yes
Year dummies	No	No	No	No	No	Yes
First-stage F-statistics	462.831	458.907	456.205	457.065	453.138	443.343
Observations	19,407	19,407	19,407	19,407	19,407	19,407
Clusters (individuals)	3986	3986	3986	3986	3986	3986

Notes: Estimates from first-stage regressions are reported in each column. The dependent variable is a dummy indicating whether the individual qualified as associate professor in the NSQ 2012. Sample includes all female assistant professors (RU) in Italian Universities as for 2012 who are aged up to 46. Standard errors clustered by individual are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Source: Administrative data provided by ANVUR

NSQ of about 48 percentage points (the first-stage F-statistics is 443.343 in our most demanding specification in column 6).[10] The distance from indicator 1 is not statistically significant, while the distance from the second indicator is positive and statistically significant. The negative sign of the coefficient attracted by the third indicator might be driven by individuals in non-bibliometric fields as in these fields this indicator is represented by the number of books published in the last 10 years and often it happens that individuals with low research productivity publish their work as books.

In Table 8, we report results from the Two-Stage Least Squares estimation approach. In column 1, we do not control for individual covariates and find that having obtained the NSQ leads to an increase in the probability of having a child of about 1.6 percentage points. The effect, however, is not statistically significant at conventional levels.

Adding age and field dummies (column 2), age squared (column 3) and experience (column 4) reduces the effect to 1.2 percentage points. When adding geographic areas fixed effects (column 5) and years fixed effects (column 6) the magnitude of the estimated coefficient further reduces to 0.8 and to 0.6 percentage points, respectively. Importantly, this effect is in line with that in Table 6 for women who got promoted under the new regime that considers the NSQ as a pre-requisite, though it is not statistically significant at conventional levels, likely because of the reduced sample size (19,407 versus 80,100 observations). The estimated effect was of 0.9 percentage points when employing the individual fixed-effects model, while it becomes smaller (0.6 percentage points) when using the fuzzy RDD approach, which is reasonable considered that having acquired the NSQ is only the first step for promotion.

Finally, with the aim of investigating the impact of promotion on fertility using the Fuzzy Regression Discontinuity Approach described above, we have also experimented by instrumenting $Promotion_{it}$, instead of $Qualification_{it}$, with the dummy variable $Above_{it}$ (see Table 9). As expected, first-stage estimation results confirm that individuals with a scientific productivity above the cutoffs are more likely to be promoted. More precisely, individuals who met at least two of the three productivity thresholds have a higher probability of being promoted of about 14 to 17 percentage points (the first-stage F-statistics is 133.13 in our most demanding specification in column 6). As regards the second-stage results, we again find a

[10] In Table 13 in the Appendix, we report reduced-form estimates. Also in this case results are in line with those discussed above. As expected the magnitude of the effects is smaller.

Table 8 The effect of scientific qualification on child birth. Two-stages-least-squares results

	(1)	(2)	(3)	(4)	(5)	(6)
Qualified as Associate Professor	0.016	0.013	0.012	0.012	0.008	0.006
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Distance from cutoff (indicator 1)	−0.000	−0.000	−0.000	−0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Distance from cutoff (indicator 2)	0.000**	0.000**	0.000**	0.000**	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Distance from cutoff (indicator 3)	0.000	0.000	0.000	0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age		−0.003***	0.015	0.013	0.013	0.011
		(0.001)	(0.012)	(0.012)	(0.012)	(0.012)
Age Sq.			−0.000	−0.000	−0.000	−0.000
			(0.000)	(0.000)	(0.000)	(0.000)
Experience (yrs.)				0.002***	0.002***	0.002***
				(0.001)	(0.001)	(0.001)
Field dummies	Yes	Yes	Yes	Yes	Yes	Yes
Geographic area dummies	No	No	No	No	Yes	Yes
Year dummies	No	No	No	No	No	Yes
Observations	19,407	19,407	19,407	19,407	19,407	19,407
Clusters (individuals)	3986	3986	3986	3986	3986	3986

Notes: Estimates from two-stages-least-squares regressions are reported in each column. Dependent variable is *Child Birth*. The endogenous variable Qualified as Associate Professor is instrumented with the Above 2/3 Cutoffs. Sample includes all female assistant professors (RU) in Italian Universities as for 2012 who are aged up to 46. Standard errors clustered by individual are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Source: Administrative data provided by ANVUR

positive effect of promotion on the probability of having a child. The effect, even if imprecisely estimated, is larger in magnitude compared to the one obtained in Table 8, consistent with the fact that we are now looking at the effective promotion to associate professor, while before we were considering the effect of the qualification for an assistant professor position.

Table 9 The effect of promotion on child birth. Two-stages-least-squares results

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Second-stage estimation results						
Promotion to Associate Professor	0.049	0.035	0.034	0.034	0.022	0.021
	(0.037)	(0.034)	(0.034)	(0.034)	(0.034)	(0.040)
Distance from cutoff (indicator 1)	−0.000	−0.000	−0.000	−0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Distance from cutoff (indicator 2)	0.000**	0.000**	0.000**	0.000**	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Distance from cutoff (indicator 3)	0.000	0.000	0.000	0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age		−0.004***	0.012	0.011	0.011	0.011
		(0.001)	(0.012)	(0.012)	(0.012)	(0.012)
Age Sq.			−0.000	−0.000	−0.000	−0.000
			(0.000)	(0.000)	(0.000)	(0.000)
Experience (yrs.)				0.001	0.001	0.001
				(0.001)	(0.001)	(0.001)
Panel B: First-stage estimation results						
Above 2/3 cutoffs	0.161***	0.173***	0.172***	0.172***	0.168***	0.142***
	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)	(0.012)
First-stage F-statistics	175.707	174.973	172.713	171.856	165.398	133.126
Field dummies	Yes	Yes	Yes	Yes	Yes	Yes
Geographic area dummies	No	No	No	No	Yes	Yes
Year dummies	No	No	No	No	No	Yes
Observations	19,407	19,407	19,407	19,407	19,407	19,407
Clusters (individuals)	3986	3986	3986	3986	3986	3986

Notes: Estimates from two-stages-least-squares regressions are reported in each column. In the second stage the dependent variable is *Child Birth*. In the first stage the dependent variable is *Promotion*. Sample includes all female assistant professors (RU) in Italian Universities as for 2012 who are aged up to 46. Standard errors clustered by individual are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Source: Administrative data provided by ANVUR

6 Concluding Remarks

It is well documented that the shortfall of women in top academic positions is at least partially due to a family–work conflict since these jobs entail high effort and time which are incompatible with family related necessities. This conflict seems to induce many women to either sacrifice family or career.

While many papers have documented negative effects of fertility on a woman's career, we took a different approach by looking at the impact of improved career prospects on the decision to have a child. To this purpose, we use administrative data on the universe of female Assistant Professors employed in Italian universities from 2001 to 2018 and estimate an individual fixed-effects model to capture the effect of promotion to Associate Professor on fertility. Our results document that promotion to associate professor increases the probability of having a child by 0.6 percentage points, which translates into an increase by 12.5% of the mean.

The effect of promotion on fertility could be determined by a higher income available (the promotion determines an increase of about 35% of the disposable income): this is in line with the findings of Modena et al. (2013) that show that 40–50% of Italian couples were discouraged to have (more) children because of an insufficient income.

An alternative explanation for the positive effect of promotion we find in the present analysis could be the following: during the phase of assistant professorship, women postpone fertility—since having children is very time consuming—and devote their time and energy to scientific research in order to increase their scientific productivity and raise their probability of promotion. Once they are promoted, they have the possibility to have (more) children minimizing negative effects on their careers.

The effect of promotion on fertility we estimate is robust to various sensitivity tests, including a specification that allows either age or years of experience to enter non-linearly in order to flexibly control for the fact that both promotion and maternity could be related to age or seniority, respectively. In addition, we document that the effect mainly occurs immediately after promotion and gradually vanishes with the number of years from promotion. Also, we find that the impact of promotion is higher for women aged below 40, and for those who work in a university which is located in the North of Italy. Furthermore, we find that the impact is stronger under the new university regulation that, starting from 2012, considers the NSQ as a pre-requisite for career advancements. In particular, we show that promotion to associate professor under the new regime increases the likelihood of having a child by almost 1 percentage point, that implies an increase by 20% of the mean.

Our empirical analysis shows positive effects of promotion also when using a Fuzzy Regression Discontinuity Design in which we exploit the eligibility requirements in terms of research productivity introduced since 2012 in the system regulating career advancement in Italian academia. In this econometric framework the credibility of our identification strategy is increased since we are able to compare the fertility behaviour of very similar women: those who just pass the NSQ productivity thresholds and those who just miss them. We find that women who obtain the NSQ—and therefore increase substantially the probability of being promoted to Associate Professor in the near future—have a 0.6 percentage point higher probability of having a child, though the effect is imprecisely estimated due to the reduced sample size. This effect is similar in magnitude to the one obtained when looking at promotion since 2012 using individual fixed-effects regression analysis, suggesting that our main results are unlikely driven by omitted variable bias.

Our findings suggest that policies aimed at improving women career prospects are important not only to increase productivity and enhance equal opportunities but also to help increasing fertility. This could be very important for all OECD countries currently plagued by very low fertility rates.

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Appendix

Table 10 Descriptive statistics—individual fixed-effects approach

	Mean	SD	Min	Max
Child birth	0.040	0.196	0	1
Promotion to Associate Professor	0.148	0.355	0	1
Age	40.175	4.145	24	46
Aged 24 to 30	0.015	0.120	0	1
Aged 31 to 35	0.138	0.345	0	1
Aged 36 to 40	0.331	0.470	0	1
Aged 41+	0.517	0.500	0	1
Experience (yrs.)	6.051	4.165	0	25
Years from promotion	0.561	1.703	0	16
North	0.461	0.498	0	1
Centre	0.218	0.413	0	1
South	0.322	0.467	0	1

Source: Administrative data provided by ANVUR

Sample: only women; aged<=46; Assistant Professor in 2001 or later (we exclude women who were already Associate and Full Professors in 2001). Total Observations (individual*year): 101,774; Individuals: 11,897

Table 11 Descriptive statistics—Fuzzy regression discontinuity approach

	Mean	SD	Min	Max
Child birth	0.053	0.224	0	1
Promotion to Associate Professor	0.226	0.175	0	1
Qualified as Associate Professor	0.693	0.461	0	1
Above 2/3 cutoffs	0.870	0.336	0	1
Distance from cutoff (indicator 1)	8.760	249.103	−51	503.080
Distance from cutoff (indicator 2)	17.340	129.021	−69.708	959.164
Distance from cutoff (indicator 3)	3.621	124.342	−12	39
Age	41.744	3.217	24	46
Aged 24 to 30	0.0005	0.021	0	1
Aged 31 to 35	0.042	0.201	0	1
Aged 36 to 40	0.285	0.451	0	1
Aged 41+	0.673	0.469	0	1
Experience (yrs.)	7.943	3.539	0	24
North	0.491	0.500	0	1
Centre	0.202	0.402	0	1
South	0.306	0.461	0	1

Source: Administrative data provided by ANVUR
Sample: only women, aged<=46, Assistant Professor in 2012 followed in subsequent years (we exclude women who were already Associate and Full Professors in 2012). Total Observations (individual*year): 19,407; Individuals: 3, 986

Table 12 The effect of promotion on child birth. Linear probability model (LPM)

	(1)	(2)	(3)	(4)	(5)	(6)
Promotion to Associate Prof.	0.010^{***}	0.010^{***}	0.002	0.001	−0.001	−0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age	-0.004^{***}	−0.001	−0.001	−0.004	-0.005^{*}	-0.005^{*}
	(0.000)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Age Sq.		−0.000	−0.000	−0.000	−0.000	−0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Experience (yrs.)			0.002^{***}	0.001^{***}	0.001^{***}	0.000^{*}
			(0.000)	(0.000)	(0.000)	(0.000)
Year dummies	No	No	No	Yes	Yes	Yes
Geographic area dummies	No	No	No	No	Yes	Yes
Field dummies	No	No	No	No	No	Yes
Observations	101,774	101,774	101,774	101,774	101,774	101,774
Clusters (individuals)	11,897	11,897	11,897	11,897	11,897	11,897

Notes: Estimates from OLS regressions are reported in each column. The dependent variable is *Child Birth*. Sample includes all female hired as assistant professors (RU) in Italian Universities after 2001 who are aged up to 46 followed until 2018. Standard errors clustered by individual are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Source: Administrative data provided by ANVUR

Table 13 The effect of scientific qualification on child birth. Reduced-form results

	(1)	(2)	(3)	(4)	(5)	(6)
Above 2/3 cutoffs	0.008	0.006	0.006	0.006	0.004	0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Distance from cutoff (indicator 1)	−0.000	−0.000	−0.000	−0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Distance from cutoff (indicator 2)	0.000**	0.000**	0.000**	0.000**	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Distance from cutoff (indicator 3)	0.000	0.000	0.000	0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age		−0.003***	0.016	0.014	0.013	0.011
		(0.001)	(0.012)	(0.012)	(0.012)	(0.012)
Age Sq.			−0.000*	−0.000	−0.000	−0.000
			(0.000)	(0.000)	(0.000)	(0.000)
Experience (yrs.)				0.002***	0.002***	0.002***
				(0.001)	(0.001)	(0.001)
Field dummies	Yes	Yes	Yes	Yes	Yes	Yes
Geographic area dummies	No	No	No	No	Yes	Yes
Year dummies	No	No	No	No	No	Yes
Observations	19,407	19,407	19,407	19,407	19,407	19,407
Clusters (individuals)	3986	3986	3986	3986	3986	3986

Notes: Estimates from reduced-form regressions are reported in each column. Sample includes all female assistant professors (RU) in Italian Universities as for 2016 who are aged up to 46. Dependent variable is a dummy indicating whether the individual has a child birth. Standard errors clustered by individual are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Source: Administrative data provided by ANVUR

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