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IZA DP No. 18083

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ABSTRACT

The Effects of Tenure-Track Systems on Selection and Productivity in Economics*

This paper examines how publication-based tenure-track systems affect the careers of Ph.D. graduates in Economics. We leverage a 2010 reform in Italy that replaced open-ended assistant professor (AP) positions with fixed-term contracts and introduced publication minimum requirements for career advancement. Using survey and administrative data, along with a Difference-in-Differences Event-Study approach comparing Economics to less academically-oriented fields, we find that the reform significantly reduced the likelihood of Economics Ph.D. graduates entering academia in Italy, while increasing transitions to academic careers abroad or to public and private sector jobs. Talented graduates were disproportionately affected, revealing negative selection into Italian academia following the removal of permanent AP positions. Despite these trends, tenure-track hires tend to publish more in high-ranking journals, suggesting that the reform's incentive effects may partly mitigate its negative selection effects.

JEL Classification: I23, J13, J24, J71
Keywords: academic careers, fertility, publications, tenure

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1 Introduction

The adoption of competitive tenure-track systems in academia has sparked significant debate regarding its effectiveness in fostering innovation and productivity in academic research. By providing job security to high-performing researchers, tenure aims to promote academic freedom and intellectual independence while incentivizing cutting-edge work (see for instance, McKenzie, 1996). However, critics contend that tenure may lead to complacency (Levin and Stephan, 1991; Bess, 1998; Chait, 2005; Brogaard et al., 2018), reduced accountability (Bennett and Chater, 1984), diminished teaching quality (Ehrenberg and Zhang, 2005; Figlio et al., 2015; Faria and McAdam, 2015), and gender disparities (McDowell et al., 1999; Ginther and Kahn, 2004; Blackaby et al., 2005), raising important questions about its broader impact on academic systems and individual career trajectories.[1]

While most of the existing literature focuses on the incentive effects of tenure—that is, the effort exerted before and after tenure is granted—among academics (e.g., Holley, 1977; Brogaard et al., 2018), little is known about how tenure-track systems affect the selection of prospective scholars into the academic profession.[2] By reducing job security at entry and making advancement more competitive, tenure-track systems may have significant selection effects. These effects could either amplify or offset the incentive effects, depending on the type of researchers they attract. This issue is particularly important for universities and countries that face challenges in attracting or retaining talented researchers. Furthermore, tenure policies may have long-term implications for gender equity and demographic challenges, as job security and career pressures intersect with personal life decisions, such as family formation (Goldin, 2014; Antecol et al., 2018).

This paper provides new insights into the implications of tenure-track systems

[1] See also Kaplan (2010) and McPherson and Schapiro (1999) for an in-depth discussion of the pros and cons of academic tenure

[2] Seminal theoretical work (e.g. Carmichael, 1988; Kahn and Huberman, 1988; Waldman, 1990) models tenure as a mechanism to elicit early-career effort through fixed probation and long-term protection. Empirically, some studies find a decline in productivity post-tenure (Holley, 1977; Brogaard et al., 2018) or, more broadly, with age (Levin and Stephan, 1991; Oster and Hamermesh, 1998).

by examining the effects of introducing publication-based tenure-track positions on three key outcomes: the selection of Ph.D. graduates into academia, their subsequent research productivity, and their family formation decisions. We leverage the 2010 Italian university reform, which introduced tenure-track positions for assistant professors alongside explicit publication thresholds for career advancement. While the rationale of the reform was to improve research productivity in Italian universities, it also reduced job security for young assistant professors—who were hired on permanent contracts until 2010—and made it more competitive to advance along the academic ladder. Thus, this reform represents a unique opportunity to investigate how reduced job security and heightened competition affect the selection of Ph.D. graduates into academia, their career choices, family decisions, and, for those who remain in academia, their research productivity.

Using comprehensive survey and administrative data on Italian Ph.D. graduates and faculty from 2003 to 2022, we apply a Difference-in-Differences Event-Study analysis to compare pre- and post-reform cohorts of Ph.D. graduates in fields more and less exposed to the reform. Exposure to the reform is measured based on a field's academic orientation at baseline, proxied by the proportion of graduates employed in academia prior to the reform. Hence, our main treatment group is constituted by graduates in Economics (and Statistics) and, in some specifications, also by graduates in other academically oriented fields such as Mathematics and Political and Social Sciences. Our findings indicate that the reform significantly reduced the likelihood of Italian Ph.D. graduates in academically-oriented fields starting an academic career in Italy. At the same time, it increased their propensity to pursue international academic careers or transition to public and private sector jobs. In line with these trends, we find evidence that treated graduates are more likely to start a family and have children, possibly due to fewer barriers to family formation after transitioning into non-academic professions, especially in the Italian public sector.

Importantly, the reform disproportionately affected more talented graduates, indicating a negative selection into Italian academia once the entry-level positions became

less attractive. Consistent with this, we find that more talented scholars are disproportionately more likely to start an academic career abroad after the reform. We also find that graduates from lower socio-economic backgrounds are more likely to exit academia, highlighting potential concerns about growing inequalities in the academic profession. Finally, despite the well-established finding in the literature that "the first significant leak in the academic pipeline occurs in the transition from graduate programs to assistant professorships" (Buckles, 2019), we find no significant gender-based differences in the effects of the reform.

Using publication records from SCOPUS, we also examine the impact of the reform on research productivity. We find no evidence that obtaining a tenured or untenured assistant professor position within the first two years of the reform—when both types of positions were available—affects the overall number of publications. However, when focusing on articles published in high-ranked journals, we observe that individuals entering academia through a tenure-track contract tend to have stronger publication records compared to those hired under the previous tenured contract system in the same years. This suggests that the reform's incentive effects may partially counterbalance its negative selection effects, motivating those who remain in academia to produce higher-quality research. Taken together, our results suggest that the overall effect of the tenure-track system on productivity is ambiguous, depending on whether the negative selection effect prevails over the positive incentive effects, conditional on pursuing an academic career or *vice versa*.

Our paper contributes to three lines of research. First, it contributes to the literature on the effects of tenure systems on research productivity and academic careers. While most of the existing studies focus on how tenure or evaluation criteria affect the behavior of those already in academia—mostly focusing on publication outcomes (Cater et al., 2008, 2017; Checchi et al., 2021; De Philippis, 2021; Huang et al., 2021; Nieddu and Pandolfi, 2022)—our analysis shifts attention to understanding how tenure reforms may shape talent allocation and interact with personal priorities such as career choices

and family formation, offering a broader perspective on how such systems influence both productivity and workforce composition.

Second, our findings speak to the literature on gender disparities in academia. Existing studies show that women have a lower probability than men of advancing in their academic careers (De Paola and Scoppa, 2015; Bagues et al., 2017; De Paola et al., 2017; Jappelli et al., 2017; Lundberg and Stearns, 2019). We also find that women are, on average, less inclined to pursue an academic career and less likely to be promoted to an associate professorship, but we do not find evidence that women are disproportionately affected in their choice of entering academia, nor in their career trajectories, by the introduction of more competitive and less secure tenure-track positions.

Third, our study also connects to the literature examining the effects of job insecurity on workers' labor market outcomes and fertility decisions. Previous studies estimate negative effects of job insecurity on productivity (Autor et al., 2007; Bassanini et al., 2014; Cingano et al., 2014, 2015; Cappellari et al., 2012; Bjuggren, 2018). In addition, a substantial body of empirical evidence shows that job insecurity has detrimental consequences on fertility (Prifti and Vuri, 2013; De Paola et al., 2021; Clark and Lepinteur, 2022), often prompting women to defer family formation until they achieve full integration into the labor market. Other studies document the positive effects of tenure and career advancements on fertility decisions (Wolfinger et al., 2008; De Paola et al., 2022). The present paper contributes to this literature by providing new evidence on how academic reforms that increase job insecurity exacerbate these trends. Our findings underscore the role of institutional policies in shaping not only labor market outcomes but also life-course decisions, highlighting the interconnectedness of job security and fertility behavior.

The findings of this paper have two key policy implications. First, the introduction of publication-based tenure-track systems may have unintended consequences on the selection, advancement, and retention of talent in academia, particularly in countries like Italy, where academic wages are relatively low and job security outside academia is

particularly high. Second, explicit promotion and tenure requirements can significantly affect the research productivity of individuals entering the Economics profession, shaping career trajectories and academic output.

The remainder of the paper is structured as follows. Section 2 describes the 2010 Italian university reform. Section 3 describes the data used in the empirical analysis. Section 4 presents the empirical strategy and the main findings of the analysis. Section 5 concludes.

2 The 2010 Reform of the Italian Academic System

The institutional framework governing careers in the Italian academia underwent significant changes during the period analyzed in this paper. Before 2010, there were three academic positions in the Italian system: Assistant Professor ("Ricercatore"), i.e., the entry-level position; Associate Professor, i.e., a mid-level position with substantially higher annual income (approximately 35% higher than Assistant Professors) and a larger teaching load; and Full Professor, i.e., the highest academic rank. All these positions were permanent, with tenure almost guaranteed following a formal probationary period of three years. Vacancies were filled through a national-level competition, overseen by a committee of five members. Candidates deemed qualified ("idonei") could be appointed to a position at the university initiating the competition, while other universities could appoint remaining candidates from the shortlist within three years.

In 2010, the Gelmini Reform introduced significant changes aimed at enhancing transparency and meritocracy in academic hiring and promotion processes.[3] One of the central features of the reform was the establishment of the National Scientific Qualification (NSQ), a centralized evaluation granting the qualification for Associate and

[3]The Gelmini Reform (Law No. 240/2010) was first introduced to the Italian Parliament as the 2009 Gelmini Bill (Disegno di Legge Gelmini), and was subsequently approved in December 2010, entering into force in January 2011. Some of its key features had already been discussed and partially announced as early as 2008.

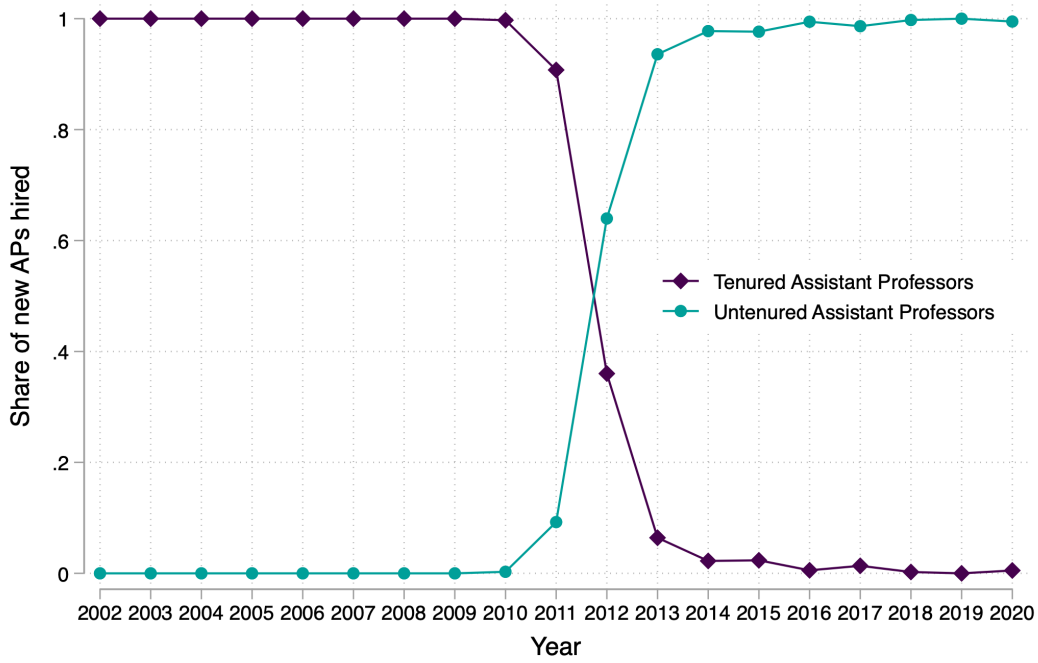
Full Professorships. Under this system, candidates' publications and CVs are evaluated against field-specific minimum standards. The evaluations are conducted by a committee of five full professors, randomly selected from a pool of volunteers who meet predefined scientific productivity thresholds. While obtaining the NSQ is a prerequisite for promotion, it does not guarantee a position. Promotions and new appointments are managed locally by university departments, which rely on central government funding to create vacancies.

Another significant change introduced by the reform was the restructuring of entry-level academic positions. Instead of a unique tenured assistant professor position, two new types of contracts for assistant professors were established and gradually adopted by Italian universities. The first, Type-A Assistant Professor ("Ricercatore di tipo A"), is a temporary position lasting up to three years with no direct career path. The second, Type-B Assistant Professor ("Ricercatore di tipo B"), is a tenure-track position lasting three years, which is converted into an Associate Professorship conditional on the achievement of the NSQ for associate professor. The rationale for the reform was to partly replicate through these two contracts a standard 6-year tenure-track assistant professorship as the one prevailing in many other countries. Figure 1 shows the shares of newly-hired assistant professors with tenured and untenured contracts from 2004 to 2022. While in 2012 almost 50% of new positions were covered by the new, temporary contracts, this figure increased to around 90% in 2013, reaching 100% in 2016.

The reform also reorganized academic disciplines into 14 standardized scientific sectors (i.e. *settori concorsuali*), which were intended to rationalize recruitment and promotion procedures by addressing the excessive fragmentation of *settori scientifico-disciplinari (SSD)* and ensuring candidate evaluation on a national scale within broader and more coherent fields. This reduced departmental discretion and increased inter-field competition, particularly in Economics, where publication metrics are relatively standardized.

Finally, the reform also abolished the automatic biannual salary increases for AP

Figure 1: Shares of newly-hired assistant professors by contract Type



NOTES. This figure shows the share of assistant professors hired with untenured and tenured contracts in Italy during the years 2004 to 2020.

positions and introduced stronger financial incentives for promotion to higher ranks. At the same time, salary progression within a given rank was extended to a three-year interval and made conditional on performance evaluations. As a result, meaningful economic advancement now occurs primarily through rank promotion rather than through seniority within a given rank, making the early stages of an academic career less financially attractive unless tenure can be achieved.

3 Data

In our empirical analysis, we rely on data from multiple sources. First, we use data from three waves of the survey on the professional careers of Italian Ph.D. graduates, conducted by the Italian National Institute of Statistics (ISTAT). This survey targeted all Ph.D. graduates from Italian universities, covering the 2004 and 2006 cohorts in the first wave, the 2008 and 2010 cohorts in the second wave, and the 2012 and 2014 cohorts

in the third wave. The first wave was conducted between December 2009 and February 2010, the second between February and July 2014, and the third between February and May 2018. Its purpose is to assess graduates' vocational integration and employment conditions approximately five and three years after graduation, respectively. Although the survey targeted the entire population of Ph.D. graduates in each cohort, the response rate was about 70%. The dataset includes detailed information on labor market outcomes, academic trajectories, including post-doc positions, satisfaction with the Ph.D., international mobility, and other factors. It also contains data on family background (e.g., parental education and occupation) and current family status (e.g., marital status and children).

Second, we construct a unique dataset covering the population of Ph.D. graduates from Italian universities between 2003 and 2020. This was achieved by combining information from the Italian library system, where all Ph.D. theses are deposited, with data from each university's publication repository system (IRIS). The resulting database comprises more than 200,000 Ph.D. graduates and contains detailed information, including thesis titles, abstracts, fields of study, defense years, Ph.D. programs, universities, and advisors. For a shorter time span (2008–2017), we also accessed a dataset compiled by the Italian Ministry of University and Research (MUR), which lists Ph.D. candidates. We used this administrative data to evaluate the coverage of our reconstructed panel of Ph.D. graduates, finding that it exceeds 90% for the years considered.[4]

Finally, we complement these data with information from two additional sources. The first is CINECA data, which covers the universe of assistant, associate, and full professors employed in Italian universities between 2003 and 2023 (thus not covering post-doctoral researchers). The second is SCOPUS records, which provide information on scientific publications. By linking these three data sources, we construct a comprehensive panel dataset that allows us to trace Ph.D. students' career trajectories within Italian academia and measure their research productivity in detail.

[4]We exclude online universities, as well as those for which the coverage in the thesis repository database is below 80%.

Table A1 in the Appendix reports summary statistics for our sample of Ph.D. graduates from both administrative and survey data. It is reassuring for the external validity of our results that the sample averages for baseline characteristics (such as gender) are comparable across the two data sources. However, we observe a larger discrepancy in the proportion of individuals employed in Italian academia, which is systematically higher in the ISTAT survey data. This difference is mostly explained by the fact that administrative records of university employees do not include postdoctoral contracts.

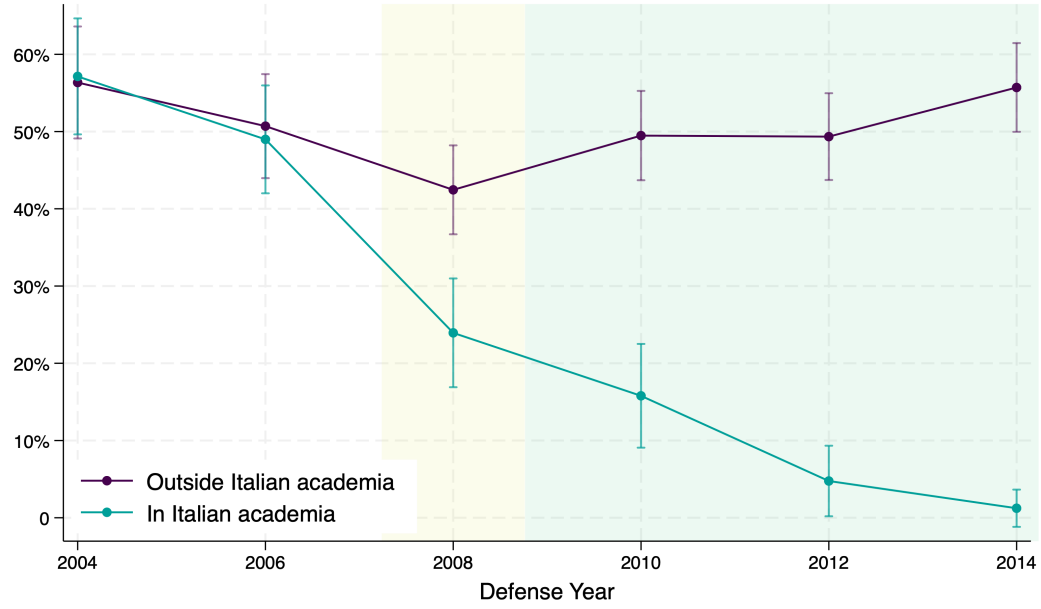
4 Empirical Analysis

4.1 Identification Strategy

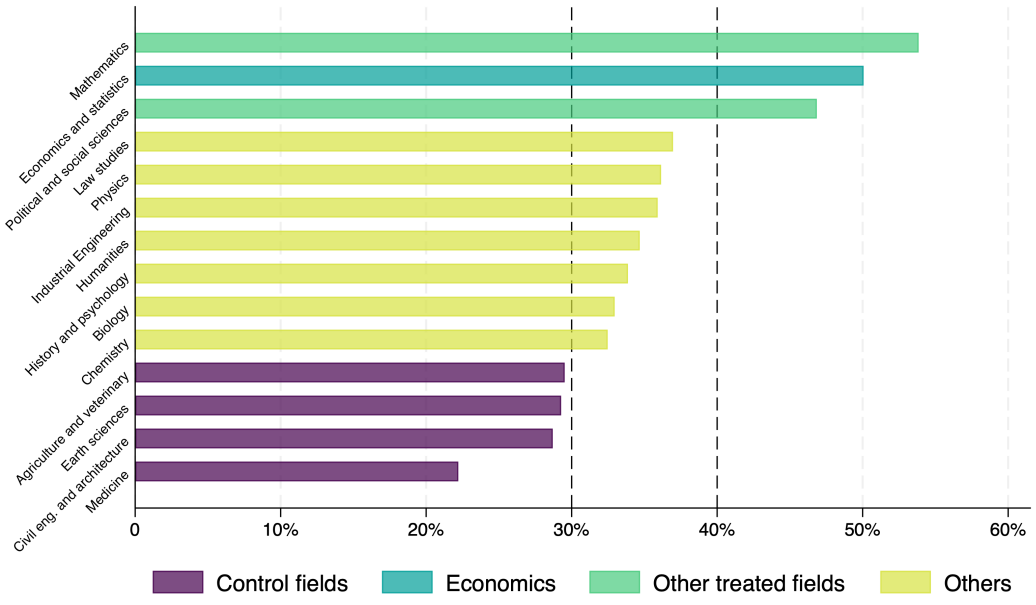
To assess the causal impact of the reform-induced reduction in job security for assistant professor positions, we adopt a Difference-in-Differences Event-Study (DiD-ES) approach that leverages the timing of the reform and heterogeneity in exposure across fields of study, driven by systematic differences in the relevance of academic careers as employment outcomes—i.e., the academic orientation of Ph.D. fields. In essence, our identification strategy compares the evolution of outcomes for Ph.D. graduates before and after the reform in fields where pursuing an academic career is more common, such as Economics, against fields where academia is a less prominent career path. Exploiting data from the ISTAT survey on the professional trajectories of Italian Ph.D. graduates, Figure 2 illustrates these two sources of variation.

Panel A of Figure 2 shows the impact of the reform on the probability of securing permanent contracts three years after the defense among Economics Ph.D. graduates pursuing an academic career in Italy. In particular, the figure traces how this probability evolved around the time of the reform for those pursuing a career inside or outside Italian academia. For graduates from the earliest cohorts covered by the ISTAT surveys (2004 and 2006), the share of those employed with permanent contracts three years after their

Figure 2: Sources of variation in the identification strategy



Panel A: Share of Ph.D. graduates with permanent contracts three years after graduation



Panel B: Share of Ph.D. graduates employed in academia

NOTES. Panel A of this figure depicts the proportion of Economics Ph.D. graduates who report being employed under permanent contracts three years after their Ph.D. defense year, separately for those employed in Italian academia and outside Italian academia. Dots indicate the sample mean, while vertical lines represent the associated 95% confidence interval. Panel B displays, for each academic field (as defined by the Italian Ministry of University and Research), the share of Ph.D. graduates who report being employed in academia in the first wave of the ISTAT survey on the professional trajectories of Italian Ph.D. graduates, covering those who obtained the Ph.D. in 2004 and 2006.

defense (in 2007 and 2010, respectively) is virtually identical inside and outside Italian academia, at approximately 50%. In contrast, only about 25% of 2008 graduates who remained in academia in Italy held a permanent contract within three years of their defense (by 2011), while the share of those from the same cohort with a permanent position outside Italian academia remained stable at around 50%.[5] Although this cohort graduated before the 2010 reform, they had only two years to secure a tenured assistant professorship before its abolition, making them the first to experience the effects of the institutional change, albeit partially.

For subsequent cohorts (2010, 2012, and 2014), the probability of obtaining a tenured position within three years continues to decline, and by the end of our sample period, it approaches zero. Conversely, the probability of working under an open-ended contract outside Italian academia remains stable throughout the entire sample period. For the latest cohort, graduating in 2014, the probability of securing a permanent contract outside Italian academia three years after graduation is comparable to that of the earliest cohort, remaining above 50%. Hence, we consider those who completed their Ph.D. in 2010 or later as fully exposed to the reform, those graduating in 2008 as partially exposed, and those graduating in 2006 or earlier as non-exposed.

Panel B of Figure 2 illustrates the variation in the academic orientation of Ph.D. programs across fields of study, which captures differences in exposure to the institutional changes introduced by the 2010 reform. Academic orientation in each field is measured by the share of Ph.D. graduates from pre-reform cohorts (2004 and 2006) who pursued academic careers either in Italy or abroad. The figure highlights that fields such as Mathematics, Political and Social Sciences, and Economics (and Statistics) are highly academically oriented, with approximately 50% of Ph.D. graduates working in academia at the time of the 2009 survey. In contrast, fields like Medicine, Earth Sciences, and Agriculture and Veterinary are considerably less academically oriented, with fewer than

[5]Section 4.2 provides a more detailed analysis of how job security evolved after the reform across different employment sectors, distinguishing between academic jobs abroad and non-academic jobs in Italy.

30% of graduates pursuing academic careers.

Hence, to examine the reform's impact, we compare changes in career outcomes for graduates in Economics (and in similarly academically oriented fields) with those of Ph.D. graduates in Medicine, Earth Sciences, Civil Engineering and Architecture, and Veterinary Sciences for cohorts exposed to the reform (i.e., graduating in 2008 or later) and non-exposed cohorts (i.e., graduating in 2004), using 2006 as the reference point. We then estimate the following specification:

$$Y_{ift} = \alpha + \sum_{t \neq 2006} \beta_t \mathbf{1}(t = \tau) \times \text{Economics}_f + \delta_f + \lambda_t + \epsilon_{ift}, \tag{1}$$

Alternatively, when we include in the treatment group also those with a Ph.D. in other academically oriented fields (Mathematics, and Political and Social Sciences), our specification becomes:

$$Y_{ift} = \alpha + \sum_{t \neq 2006} \beta_t \mathbf{1}(t = \tau) \times \text{AcademicallyOriented}_f + \delta_f + \lambda_t + \epsilon_{ift}, \tag{2}$$

In both specifications, Y_{ift} represents the outcome of interest (e.g., the probability of pursuing an academic career in Italy or abroad, or entering the public or private sector) for individual i, in field of study f, graduating in year t. $\mathbb{1}(t = \tau)$ is an indicator for graduation in year τ, allowing us to estimate year-specific effects relative to the base year 2006. Economics_f is a binary indicator equal to one for Economics Ph.D. graduates and zero for Ph.D. graduates in the least academically oriented fields (*i.e.*, Medicine, Civil Engineering and Architecture, Earth Sciences, and Agriculture and Veterinary Science). In the alternative specification, this indicator is replaced by $\text{AcademicallyOriented}_f$, which is a dummy variable equal to one for highly academically oriented fields (*i.e.*, Mathematics, Political and Social Sciences, and Economics and Statistics) and zero for the least academically oriented fields (defined as in the first specification). The coefficients β_t capture the differential change in career outcomes for graduates in highly academically oriented

fields versus less academically oriented fields, relative to the 2006 cohort. The inclusion of δ_f and λ_t ensures that the results account for unobserved heterogeneity across fields and common time shocks. ϵ_{ift} is the error term.

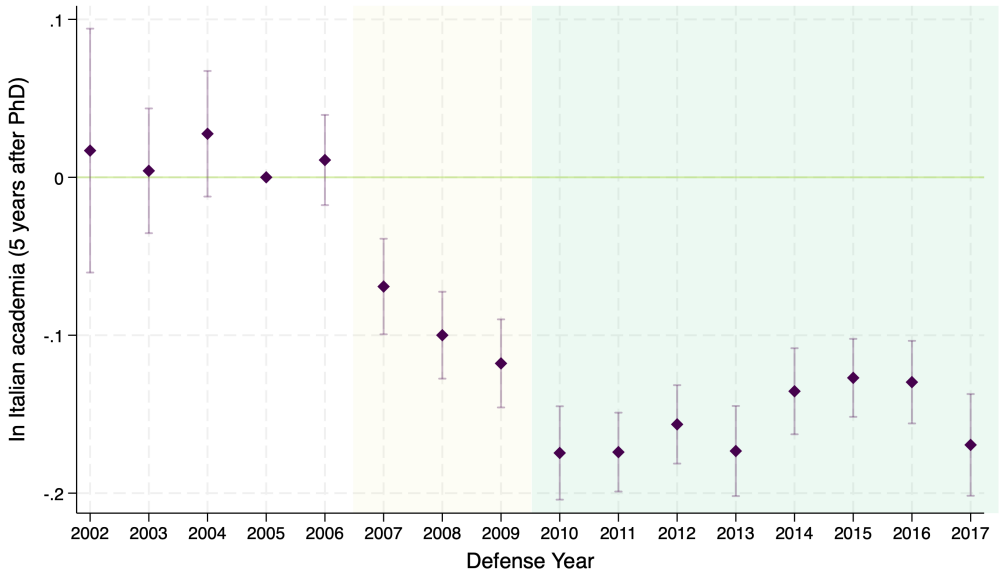
Depending on the dataset used for the analysis (ISTAT survey data versus administrative data), we also include additional sets of fixed effects. In our most conservative specification estimated in the ISTAT dataset, we include province-by-field fixed effects—since, for some cohorts, the dataset reports only the province of the Ph.D.-granting university—and defense year fixed effects. When using administrative data, we augment the specification by including university-by-department and university-by-year fixed effects. This approach accounts for potential university-specific shocks and variations in the thesis database's coverage across different cohorts of graduates. We cluster standard errors at the level of Ph.D. cohort $\times$ academic field.

4.2 Effects of the Reform on Career Choices

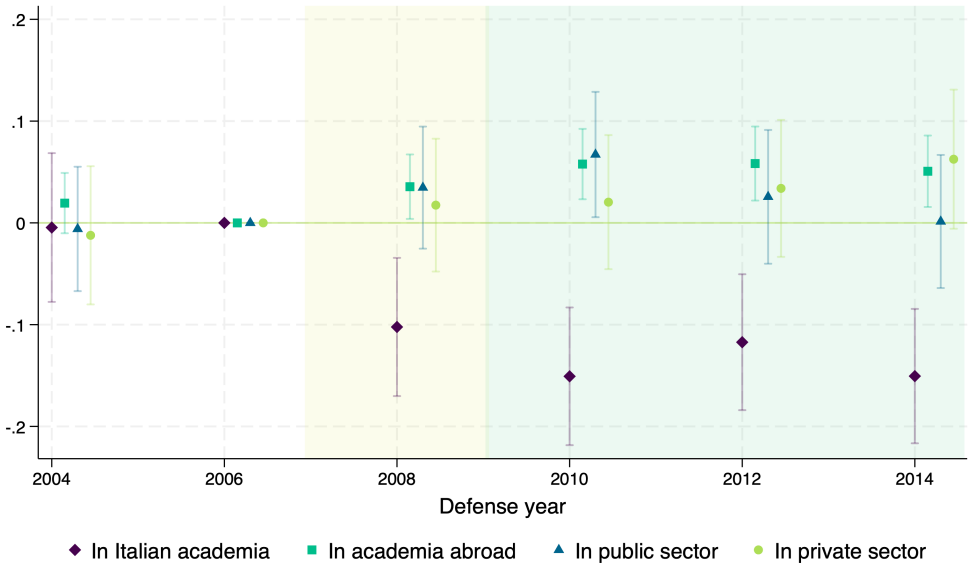
We begin our empirical analysis by examining how the abolition of tenure for assistant professorships affected the career choices of Italian Ph.D. graduates. The main results from this analysis are summarized in Figure 3.

Panel A of Figure 3 presents estimates based on Equation 1, using administrative data from all Italian Ph.D. graduates between 2002 and 2017. The outcome variable is a binary indicator equal to one if a graduate was employed in the Italian university system as assistant, associate, or full professor (the CINECA dataset does not cover post-doc positions) five years after obtaining the Ph.D. Each dot in the figure represents how the difference in the probability of being employed in Italian academia between Economics graduates and those from less academically oriented fields evolved relative to the 2006 baseline difference. The results show that prior to the reform, Economics Ph.D. graduates followed similar trends to their counterparts in less academically oriented fields. However, starting with the 2007 cohorts, Economics graduates became significantly more likely to

Figure 3: Reform effects on career choices



Panel A: Administrative data



Panel B: Survey data

NOTES. This figure depicts the point estimates and corresponding 95% confidence intervals from a set of regressions in the form of Equation 1. In Panel A, based on administrative data, the dependent variable is a binary indicator equal to one if a Ph.D. graduate is found in the census of professors employed in Italian universities within five years from their graduation year (as assistant, associate, or full professor). Panel B, based on ISTAT survey data, the dependent variables are binary indicators for Ph.D. graduates who report being employed, respectively, in Italian academia, in academia abroad, in the public sector, or in the private sector at the time of the survey, that is, three to five years after graduation. In Panel B, regressions include as controls: gender, an indicator variable for graduates who had achieved the highest grade in their Master's Degree (i.e., obtained the Laurea Magistralis with 110/110), an indicator variable for graduates with a university scholarship, distance in years between the M.Sc. and the Ph.D., a set of dummy variables for the educational level of the father (lower secondary, upper secondary, or tertiary), and province-by-field fixed effects.

leave Italian academia and pursue alternative career paths. For the latest cohorts of Economics Ph.D. graduates, the probability of being employed in Italian academia was reduced by almost 20 percentage points.[6] The main reason why the cohorts graduating between 2007 and 2010 were already partially affected by the reform is that by 2010, they typically reached the stage of applying for their first assistant professor (AP) position, which under the new system had become a fixed-term contract. This is consistent with the average time between Ph.D. completion and entry into academia as an assistant professor, which is 4.3 years in our administrative sample of Ph.D. graduates.

To complement this evidence, we leverage additional employment information from the ISTAT survey on the professional trajectories of Italian Ph.D. graduates. Specifically, we use detailed information on employment at the time of the interview (three to five years after the Ph.D., depending on the cohort) to examine the evolution of the probability of being employed in Italian academia—also as a post-doc, different from the analysis based on administrative data—foreign academia, the public sector, and the private sector.[7] Panel B of Figure 3 presents the key findings from this analysis. Consistent with the results based on our administrative data, the analysis based on the ISTAT survey data reveals that, while on parallel trends before 2008, Economics graduates became substantially less likely to pursue academic careers in Italy after the reform. This decline is not attributable to a rise in unemployment. Instead, it corresponds to a simultaneous increase in the likelihood of pursuing academic careers abroad or transitioning to public or private sector employment.

While the results in Figure 3 are obtained by comparing only Economics with other less academically oriented fields, Table 1 extends the analysis by including other academically oriented fields in the treatment group (Mathematics and Informatics, and Po-

[6] Appendix Figure A1 show the same results when estimating Equation 2 on the sample including other academically oriented fields. Results are qualitatively and quantitatively unchanged.

[7] The distinction between public and private sector jobs is based on the industry in which respondents work. We classify as public sector workers respondents working in public research institutions, in the non-tertiary education or health sectors (which in Italy are primarily public), public administrations and defense industry, and other extra-territorial organizations (such as embassies and consulates). Private sector workers are those not employed in academia or in the public sector.

Table 1: Reform effects on career choices

Panel A: Administrative Data

	Academic position:					
	(1)	(2)	(3)	(4)	(5)	(6)
	Any	Any	Any	Any	Assist.	Assoc.
Post X Economics PhD	-0.165***	-0.168***	-0.169***		-0.156***	-0.002
	(0.009)	(0.008)	(0.010)		(0.014)	(0.004)
Post X Academically oriented field				-0.142***		
				(0.011)		
Female	-0.035***	-0.034***	-0.034***	-0.035***	-0.029***	-0.009***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.002)
University-by-field FE	No	Yes	Yes	Yes	Yes	Yes
Defense year FE	Yes	Yes	No	No	No	No
University-by-year FE	No	No	Yes	Yes	Yes	Yes
Observations	26,678	26,428	26,406	31,117	26,406	26,406
Mean dep. var.	0.32	0.32	0.32	0.29	0.31	0.01
N. of University-by-fields		213	213	309	213	213
N. of clusters	65	65	65	91	65	65

Panel B: Survey Data

	Employed in:					
	For. Academia		Pub. Sect.		Priv. Sect.	
Post X Economics	0.041***		0.036*		0.038*	
	(0.011)		(0.020)		(0.022)	
Post X Academic. oriented field		0.036***		0.041***		0.062***
		(0.007)		(0.013)		(0.017)
Female	-0.015***	-0.015***	0.034***	0.037***	-0.042***	-0.040***
	(0.003)	(0.003)	(0.007)	(0.009)	(0.007)	(0.009)
Province-by-field FE	Yes	Yes	Yes	Yes	Yes	Yes
Defense year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15,848	18,650	15,848	18,650	15,848	18,650
Mean dep. var.	0.04	0.04	0.19	0.21	0.27	0.23
N. of Province-by-fields	185	257	185	257	185	257
N. of clusters	.	42	.	42	.	42

NOTES. This table reports estimates from a set of DiD regressions in the form of Equations 1 and 2 on the probability of being employed in Italian academia five years after the thesis defense (Panel A) and on the probability of being employed in Italian academia (including post-doc positions), foreign academia, non-academic public institutions, or the private sector three to five years after the thesis defense (Panel B). Panel A is based on administrative data, while Panel B is based on the ISTAT survey data. In Panel B additional controls include an indicator variable for graduates who had achieved the highest grade in their Master's Degree (i.e., obtained the Laurea Magistralis with 110/110), an indicator variable for graduates with a university scholarship, distance in years between the M.Sc. and the Ph.D., and a set of dummy variables for the educational level of the father (lower secondary, upper secondary, or tertiary). The averages of the dependent variables are computed within the treatment group in the pre-reform period. In Panel A, all columns report in parentheses standard errors clustered at the defense year by academic field level. In Panel B, standard errors are either robust (Columns 1, 3, and 5) or clustered at the defense year by academic field level (Columns 2, 4, and 6).

litical and Social Sciences). This analysis uses a standard Difference-in-Differences (DiD) regression, where the key coefficient is the interaction between the treatment dummy (either Economics or AcademicallyOriented) and a Post dummy, which equals one for cohorts graduating in 2007 or later. The results are consistent with those obtained when focusing solely on Economics. Ph.D. graduates more exposed to the reform are significantly more likely to either leave Italy for an academic career abroad or exit academia entirely.

Coefficients reported in Panel A of Table 1—based on administrative data—show that the reform reduced the probability of starting an academic career in Italy by nearly 17 percentage points, representing an increase of over 50% compared to the baseline average of 32%. This effect is entirely driven by a lower probability of obtaining an assistant professor position. Estimates in Panel B, based on ISTAT survey data, further reveal that the reform doubled the probability of Italian Ph.D. graduates in Economics or other academically oriented fields pursuing academic careers abroad (relative to a baseline probability in those fields of about 4%). The reform also increased the likelihood of these graduates being employed in non-academic public sector (by 3.6 to 4.1 percentage points) and private sector (by 3.8 to 6.2 percentage points) positions. While the relative effect for these latter outcomes is more modest, the change remains quantitatively meaningful (between 15% and 27% of the baseline pre-reform average in the treated group, reported at the bottom of the table). Lastly, an interesting additional finding from this analysis is that, regardless of the reform, women are generally less likely to start an academic career, either in Italy or abroad, and more likely to work in the public sector. This may be explained by a stronger preference for more secure jobs.

To help interpret these shifts in employment outcomes, it is important to consider how entry-level academic jobs in Italy compare to academic jobs abroad and to alternative non-academic careers in terms of pay and job security. To this end, we first exploit self-reported data from the ISTAT survey on academic wages in Italy versus other countries. Appendix Figure A2 depicts the average wage reported by Ph.D. graduates—

both in academically oriented fields and in Economics only—working in academia across countries. Graduates employed in academia abroad earn significantly more than those who remain in Italian academia: for instance, academics working in France, Germany, or the UK earn on average between €800 and €1,200 more per month, while those in the U.S. earn more than double the Italian average. While these pay gaps across countries may also reflect selection effects—if those with stronger profiles are more likely to move abroad—they are broadly consistent with administrative and survey data from other sources. Teichler and Höhle (2013) show that the median salary (adjusted for purchasing power) of a junior professor in Italy is considerably lower than in the vast majority of European countries.[8]

Also when compared to non-academic jobs in Italy, wages in academia are on average slightly lower than those in the public or private sector. Importantly, they did not increase much after the reform to compensate for the consistent drop in job security, which was the main attractive feature of Italian academic positions before the reform. Appendix Figure A3 shows the evolution of wages and job stability (proxied by the share of those working with a permanent contract three years after graduation) across different employment sectors before and after the reform.[9] While Italian academia was characterized by relatively high job stability before the reform, the reform sharply reduced this advantage. Among Ph.D. graduates working in academia in Italy, the share of those holding a permanent contract three years after graduation dropped by more than 30 percentage points after the reform, while job stability in other sectors remained broadly unchanged. As a result, the reform eliminated the main comparative advantage of Italian academia without offsetting this loss with higher pay. In contrast, graduates entering academia abroad or taking public or private sector jobs in Italy experienced either higher pay or more stable contracts, or both. This shift in the relative attractiveness of academic employment in Italy helps explain the sharp increase in exits from Italian academia

[8] Additionally, the 2024 Eurydice country reports on the "Conditions of service for academic staff working in higher education" confirm that Italy offers among the lowest gross salaries for junior academic positions in Europe (country reports are available at https://eurydice.eacea.ec.europa.eu/eurypedia).

[9] This analysis focuses on graduates in academically oriented fields, constituting our treatment group. Results are however similar when considering on the full sample of Ph.D. graduates.

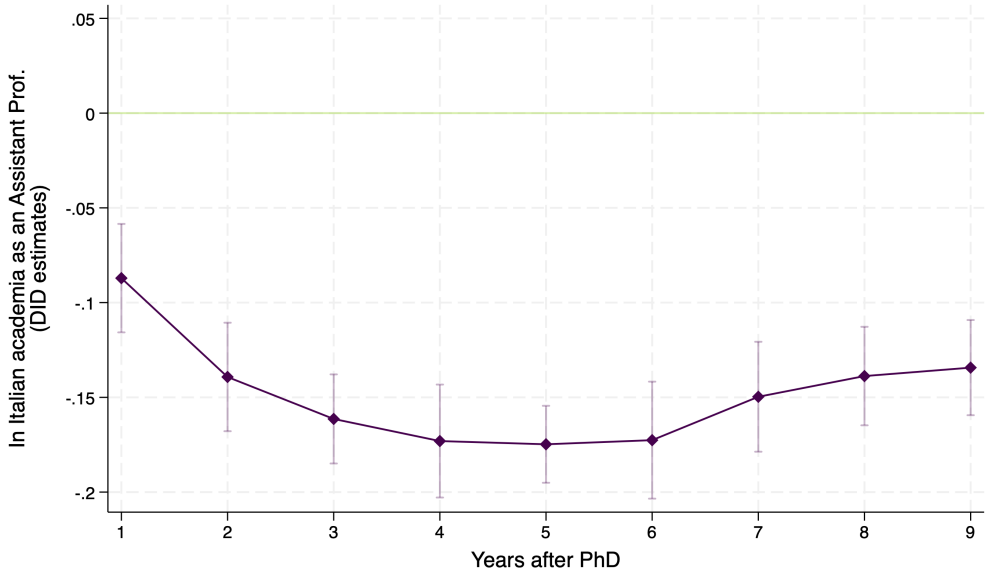
following the reform.[10]

Finally, we also exploit the longitudinal dimension of our administrative data to investigate the long-run effects of the reform on the career trajectories of Ph.D. graduates. Figure 4 shows the effect of the reform on the likelihood of being employed as an Assistant (Panel a) or Associate Professor (Panel b) in each year following the Ph.D. defense. The estimates indicate that the reform persistently reduced—and not merely delayed—Economics Ph.D. graduates' entry into Italian academia. While the short-run effects are less evident due to the low baseline probability of obtaining an associate professor position shortly after graduation, the impact of the reform on more senior academic positions becomes pronounced eight to nine years after graduation. In light of this evidence, the transition to foreign academia of Ph.D. graduates more exposed to the reform does not appear to be a temporary transition preceding a return to Italy in later years.

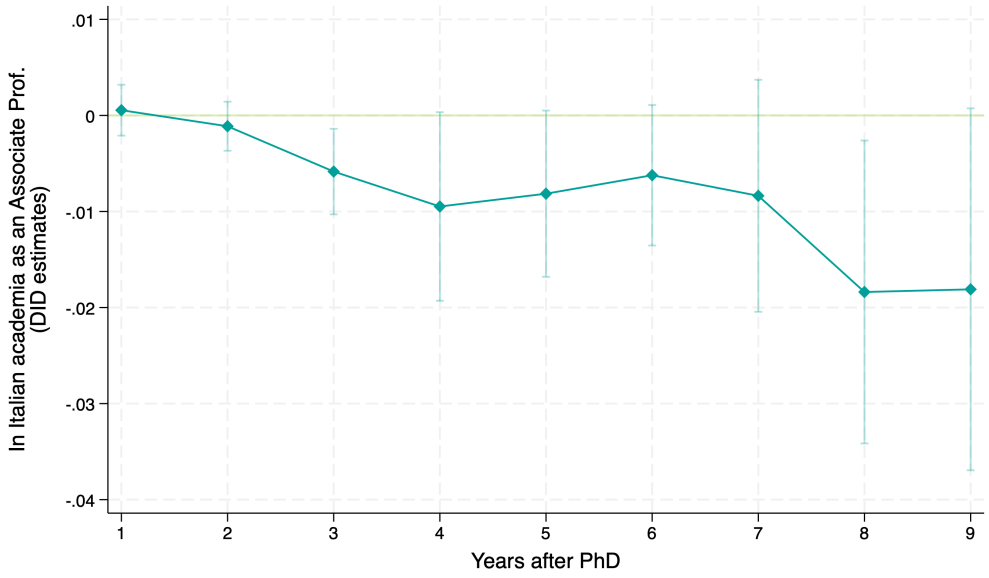
It should be noted that our main findings on entry and selection in Italian academia capture the overall effect of the reform. While our analysis does not allow us to disentangle the individual contribution of each component of the reform outlined in Section 2, we believe that the observed effects are primarily driven by the abolition of the tenured AP position. If anything, the other components of the reform—namely, the introduction of the NSQ, broader and more competitive academic fields for recruitment and promotion, clearer performance-based advancement paths, and steeper career trajectories between ranks—made the system more meritocratic and, therefore, likely more attractive to more talented researchers. This implies that the negative selection effects we document likely reflect a lower bound of the true impact of the abolition of the tenured AP position, as meritocratic improvements may have partially offset the discouragement effects associated with reduced job security for more promising potential scholars.

[10] Appendix Table A2 also presents a set of DiD regressions comparing how both wages and the probability of holding a permanent contract evolved across graduates employed in different sectors and countries, including our standard set of controls and fixed effects.

Figure 4: Short- and long-run effects of the reform on entering Italian academia



Panel A: Assistant Professor



Panel B: Associate Professor

NOTES. This figure depicts the point estimates and corresponding 95% confidence intervals from a set of DiD regressions on the probability of being employed in Italian academia as an Assistant Professor (Panel A) or Associate Professor (Panel B) in each year following the Ph.D. defense. Each dot indicates the estimated coefficient for the interaction term $Post \times Economics$ from a separate regression, where the dependent variable is a binary indicator equal to one if the Ph.D. graduate is found in the Italian university system either as an Assistant or Associate Professor j years after graduation (for $j \in [1, 9]$). Regressions also include a dummy for female candidates, university-by-year fixed effects, and university-by-field fixed effects.

4.2.1 Heterogeneous Effects of the Reform on Career Choices

To identify the characteristics of Ph.D. graduates driving the observed effects on career choices, we examine whether the decline in the likelihood of entering Italian academia and the corresponding increase in the probability of starting an academic career abroad vary by individual attributes such as gender, academic talent, and socio-economic status. Given the available data from the ISTAT surveys, which lack information on the academic record during the Ph.D., we proxy academic talent with a dummy variable that is equal to one for those whose Ph.D. was funded by a university scholarship or alternative funding sources, such as RA and TA contracts. Socio-economic status (SES) is proxied by the occupational status of the graduate's father at the start of his/her B.Sc. degree, specifically whether the father was employed at that time.

We then estimate a triple-DiD model where we interact the term $Econ \times Post$ with each of the aforementioned indicators, using employment in Italian and foreign academia as the outcome variables. Table 2 presents the results from this analysis.

The results show that the decline in the probability of remaining in academia after the 2010 reform is essentially the same for both female and male Economics Ph.D. graduates. Men and women also exhibit a statistically indistinguishable increase in the likelihood of starting an academic career abroad following the reform. However, the reform's effect appears to vary based on academic talent, as proxied by university funding during the Ph.D. Among those with a university scholarship, the decline in the probability of working in Italian academia is about 7 percentage points larger—twice as large as that of non-scholarship recipients—although this difference is not statistically significant. Nevertheless, scholarship recipients become significantly more likely to pursue an academic career abroad (the coefficient for non-scholarship recipients being close to zero). These findings suggest that higher-potential researchers are more likely to leave Italian academia and pursue opportunities abroad, particularly as the stability of the Italian assistant professor position diminishes and becomes less attractive. The stronger reduc-

Table 2: Heterogeneous effects of the reform on career choices

	Employed in:					
	Italian Acad.			Foreign Acad.		
Post X Economics	-0.127***	-0.076*	-0.233***	0.038**	0.015	0.060***
	(0.031)	(0.042)	(0.053)	(0.016)	(0.019)	(0.023)
Post X Econ X Female	-0.008			0.007		
	(0.044)			(0.021)		
Post X Econ X Univ. Scholarship		-0.065			0.037*	
		(0.049)			(0.023)	
Post X Econ X Father works			0.124**			-0.021
			(0.057)			(0.025)
Province-by-field FE	Yes	Yes	Yes	Yes	Yes	Yes
Defense year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15,971	15,971	15,971	15,971	15,971	15,971
Mean dep. var.	0.46	0.46	0.46	0.04	0.04	0.04
N. of Province-by-fields	186	186	186	186	186	186

NOTES. This table reports estimates from a set of DiD regressions on the probability of being employed in Italian academia (Columns 1-3) or in foreign academia (Columns 4-6) 3 to 5 years after graduation (depending on the cohort and the year of the ISTAT survey of Italian Ph.D. graduates). *Post* × *Economics* is the interaction term between the post-reform dummy and a binary indicator for Ph.D. graduates in Economics. In columns 1 and 4, *Post* × *Economics* is interacted with an indicator variable for female graduates. In columns 2 and 5, it is interacted with an indicator variable for graduates whose Ph.D. was funded by a university scholarship (including TA or RA contracts). In columns 3 and 6, it is interacted with an indicator variable for graduates whose father was working at the beginning of college studies. Controls include gender and age (proxied by the distance between the defense year and the year of the Master's degree). The averages of the dependent variables are computed within the treatment group in the pre-reform period. Robust standard errors in parentheses.

tion in the probability of entering Italian academia for talented Ph.D. graduates is also confirmed when we use an alternative proxy to identify higher-potential researchers in our administrative sample (rather than in the ISTAT dataset): whether they published at least one paper by the end of their Ph.D. (see Appendix Figure A4).

Additionally, we observe that the probability of leaving academia decreases less for individuals whose father was employed at the time they started their B.Sc. This implies that individuals from lower SES are more likely to leave not only Italian academia but academia in general after the reform, raising concerns about potential inequalities

associated with increased competition in the academic profession.

Overall, these heterogeneity results suggest that the elimination of the permanent assistant professor position particularly disincentivized high-potential scholars and those from lower SES backgrounds from continuing in academia in Italy. While higher-potential individuals are more likely to seek academic positions abroad, those from lower SES backgrounds are more likely to leave academia altogether, often transitioning into jobs in the private or public sectors, where they may find better job security or improved economic conditions.

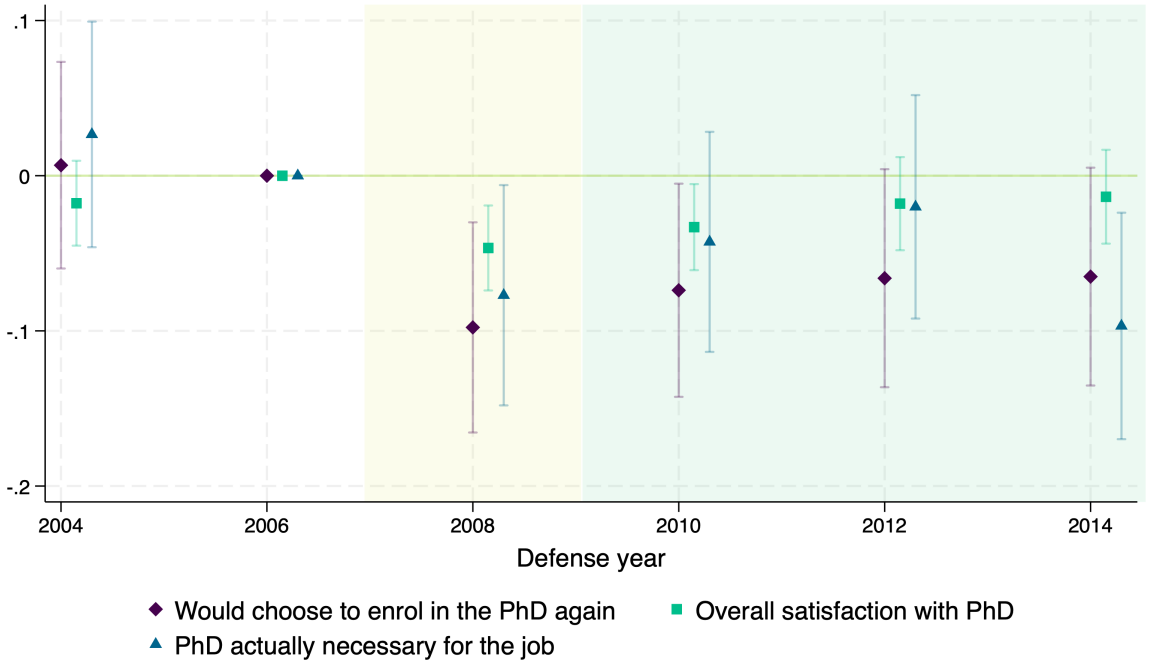
4.3 Effects of the Reform on Satisfaction and Family Formation

In this sub-section, we first replicate our main analysis to examine the effect of the reform on subjective measures of job satisfaction among Ph.D. graduates. Figure 5 illustrates the effect of the reform on the share of ph.D. graduates who (i) would pursue a Ph.D. again if given the choice, (ii) are overall satisfied with the Ph.D., and (iii) hold jobs where a Ph.D. was indeed necessary (i.e., primarily research-oriented roles).

In line with the observed increase in Ph.D. graduates leaving Italian academia after the reform, the share of those who would pursue a Ph.D again or report being overall satisfied with their Ph.D. declines more for treated cohorts, especially for 2008 and 2010 cohorts, which experience a reduction by approximately 10 percentage points. Similarly, the proportion of graduates employed in positions explicitly requiring a Ph.D. in Economics also declines by 10 percentage points, in particular for graduates from the 2008 and 2014 cohorts.

Next, we examine the effect of the reform on Ph.D. graduates' life decisions concerning family formation. The abolition of tenure for those pursuing academic careers in Italy could, in theory, have discouraged family formation by introducing greater career uncertainty. Conversely, by increasing the share of graduates pursuing careers in the public sector, where job security is typically higher, the reform may have positively

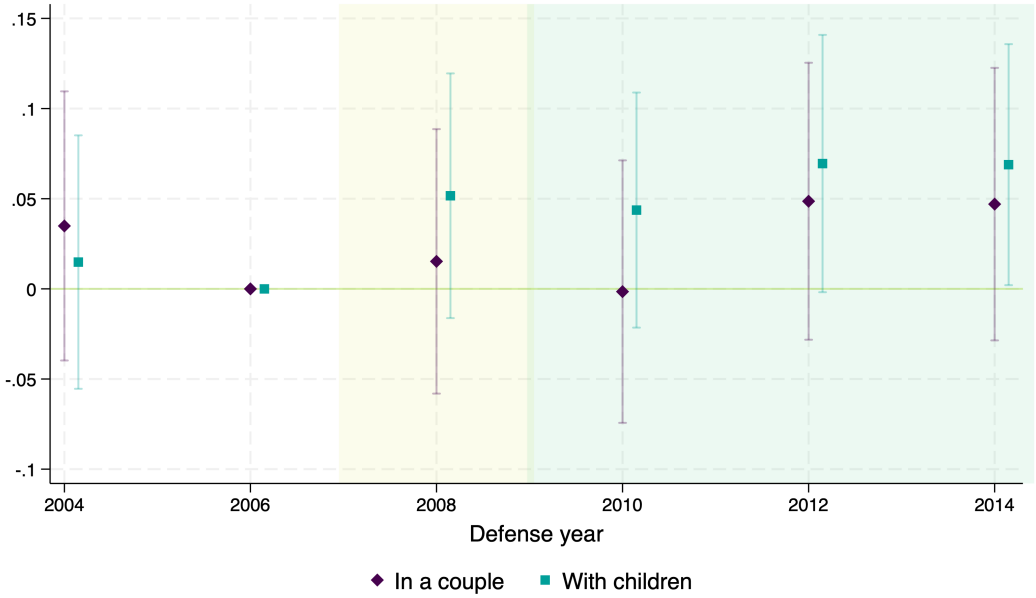
Figure 5: Reform effects on satisfaction with the Ph.D.



NOTES. This figure presents the point estimates and corresponding 95% confidence intervals from three regressions of the form of Equation 1. The dependent variable is a binary indicator that equals to one if the respondent states that: (a) would choose to enroll in the same Ph.D. program again; (b) the Ph.D. was necessary for the current job; and (c) is overall satisfied with the Ph.D. program, normalized to range from 0 to 1. All regressions include as controls: gender, an indicator variable for graduates who had achieved the highest grade in their Master's Degree (i.e., obtained the Laurea Magistralis with 110/110), an indicator variable for graduates with a university scholarship, distance in years between the M.Sc. and the Ph.D., a set of dummy variables for the educational level of the father (lower secondary, upper secondary, or tertiary), and province-by-field fixed effects.

influenced fertility. Figure 6 shows the reform's impact on the share of Ph.D. graduates who (i) live with a partner, and (ii) have children. Results suggest that the reform led to increases in family formation, particularly among graduates from more recent cohorts (2012 and 2014), with an observed increase of more than 5 percentage points. When decomposing these effects by employment sector (see Appendix Figure A5, Panels A and B), our results show that they are primarily driven by graduates employed in Italian non-academic public sector positions. As we show in Panel A of Figure A3, these positions are associated with greater employment stability among Ph.D. graduates in our sample, particularly relative to post-reform AP positions in Italian academia. Consistent with previous studies showing that job security and career prospects are important determinants of fertility and family formation (Del Bono et al., 2012; Prifti and Vuri,

Figure 6: Reform effects on family formation



NOTES. This figure presents the point estimates and corresponding 95% confidence intervals from two regressions of the form of Equation 1. The sample is restricted to graduates who obtained their Master's degree within the past 17 years (to focus on individuals likely under the age of 40). The dependent variable is binary indicator that equals to one if, at the time of the interview, the respondent: (a) lives with partner; and (b) has children. All regressions include as controls: gender, an indicator variable for graduates who had achieved the highest grade in their Master's Degree (i.e., obtained the Laurea Magistralis with 110/110), an indicator variable for graduates with a university scholarship, distance in years between the M.Sc. and the Ph.D., a set of dummy variables for the educational level of the father (lower secondary, upper secondary, or tertiary), and province-by-field fixed effects.

2013; Huttunen and Kellokumpu, 2016; De Paola et al., 2021, 2022; Clark and Lepinteur, 2022), our evidence suggests that career paths in Italian non-academic public sector jobs may provide a more supportive environment for starting a family.

4.4 Are the Effects Driven by Changes in Demand Factors?

One potential alternative explanation for our results is that the reduction in the probability of pursuing an academic career in Italy is not driven primarily by a choice made by Ph.D. graduates, but rather by a decrease in the demand for assistant professors in Italy in the years following the reform. This reduction in demand could have disproportionately affected Ph.D. graduates from more academically oriented fields. Starting in 2006, and particularly after 2008, the Italian university system experienced significant

cuts to the *Fondo di Finanziamento Ordinario* (FFO), the primary source of funding for universities, which severely restricted their ability to hire new researchers. The situation deteriorated further in 2011 with additional FFO reductions and a turnover freeze, which limited hiring to a fraction of retiring faculty. This austerity likely amplified the challenges introduced by the 2010 reform, intensifying its effects on career choices and academic productivity.

While we cannot entirely rule out this possibility, two key pieces of evidence suggest that a reduction in demand for academic positions is not the main driver of our findings. First, we have shown that funded Ph.D. graduates—typically the most talented—are the ones more likely to leave academia and pursue academic careers abroad after 2008. If the reduced likelihood of starting an academic career in Italy were primarily due to fewer available openings, we would expect increased competition for assistant professor positions, leading to positive selection rather than the negative selection we observe.

However, it is possible that more talented Ph.D. graduates were more likely to leave Italian academia because they had better outside options, such as pursuing an academic career abroad. To test this hypothesis, we exploit additional information from the ISTAT survey, which asks individuals living abroad or planning to do so (either permanently or temporarily) to rate on a scale from 1 to 4 the importance of the lack of qualified jobs in Italy as a factor in their decision to leave. Using our DiD specification, we estimate whether, in the years following the reform, the importance of the lack of qualified jobs in Italy as a reason for moving abroad increased in academically oriented fields. Results in Table 3 show that this is not the case. In both Economics and other more academically oriented fields, the lack of qualified jobs in Italy does not become a more significant factor for moving abroad, either for those already living abroad or for those planning to leave Italy in the near future, in the years following the reform.

Along the same lines, another possible explanation is that our results are driven by a change in hiring and promotion practices occurring at the department level. Tal-

Table 3: Potential demand factors

	Importance of lack of qualified jobs among:					
	Leavers		Potential leavers		Both	
Post X Economics	0.091		-0.066		0.086	
	(0.127)		(0.158)		(0.100)	
Post X Academic. oriented field		0.063		-0.096		0.089
		(0.072)		(0.102)		(0.059)
Province-by-field FE	Yes	Yes	Yes	Yes	Yes	Yes
Defense year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,073	1,418	1,124	1,405	2,241	2,882
Mean dep. var.	3.65	3.61	3.26	3.21	3.39	3.34
N. of Province-by-fields	112	155	132	180	151	208
N. of clusters	.	42	.	42	.	42

NOTES. This table reports estimates from a set of DiD regressions on a measure of the importance of the lack of qualified jobs in Italy reported by leavers and potential leavers as motivation for leaving Italy in the ISTAT survey of Italian Ph.D. graduates. The importance measure is on a 1-4 scale (where 1 corresponds to "Not important at all" and 4 to "Very important"). *Post* × *Economics* is the interaction term between the post-reform dummy and a binary indicator for Ph.D. graduates in Economics, while *Post* × *Academically oriented field* is the interaction between the indicator for academically oriented fields (Economics, Mathematics, Political and Social Sciences) and the *Post* dummy. All regressions include as controls: gender, an indicator variable for graduates who had achieved the highest grade in their Master's Degree (i.e., obtained the Laurea Magistralis with 110/110), an indicator variable for graduates with a university scholarship, distance in years between the M.Sc. and the Ph.D., and a set of dummy variables for the educational level of the father (lower secondary, upper secondary, or tertiary). The averages of the dependent variables are computed within the treatment group in the pre-reform period. Robust standard errors (in columns 1, 3, and 5) or standard errors clustered at the defense year by academic field level (in columns 2, 4, and 6) are reported in parentheses.

ented Ph.D. graduates could be discouraged from entering academia due to a shift in the (local) demand for academically productive scholars, especially if the reform triggered a shift toward a less meritocratic (or less productivity-rewarding) system. To test this hypothesis, we study promotion decisions in Italian departments over the period 2006–2020, examining whether any change occurred around the reform year. We focus on academic fields within each university where a promotion from assistant to associate professor took place, and estimate the role of candidate characteristics in explaining promotion outcomes. Results, presented in Appendix Table A3, show that local committees overall assign substantial weight to seniority and publication records. Having the highest seniority increases the probability of promotion by 18–24 percentage points, while

having the longest publication record increases it by 29–31 percentage points. Female candidates are about 3 percentage points less likely to be promoted. In the post-reform period (Column 4), we do not observe significant changes in promotion practices. The most senior and productive candidates are even more likely to be promoted, although evidence suggests that greater weight is placed on the quality rather than the quantity of publications. The gender gap in promotion rates declines slightly but remains negative. These findings suggest that, if anything, the reform led to more meritocratic and competitive hiring and promotion practices. This should in principle make the system more attractive to talented graduates, therefore going against our results on negative selection.

Although suggestive, these results indicate that our main findings are primarily driven by a change in Ph.D. graduates' labor supply induced by the reform, rather than by a shift in labor demand, such as a systematic reduction in the number of academic positions available to junior scholars. However, further investigation is needed to isolate the contribution of each mechanism.

4.5 Effects of the Reform on Research Productivity

Lastly, we examine how the reform influenced academic productivity. Due to differences in the likelihood of pursuing an academic career between exposed and unexposed cohorts of Ph.D. graduates, we are unable to apply the identification strategy outlined in Section 4.1. As a result, we focus on Ph.D. graduates in Economics who entered Italian academia as Assistant Professors, comparing the publication patterns of those hired under the pre-reform (tenured) system with those employed under the post-2010 tenure-track system.

Since the reform significantly influenced the selection of new entrants into Italian academia, as discussed in previous sections, researchers hired under the new regime are negatively selected relative to their pre-reform counterparts. Moreover, post-reform hires typically had about 2.5 additional years of research experience and entered with longer publication records, averaging three more publications. To account for these baseline

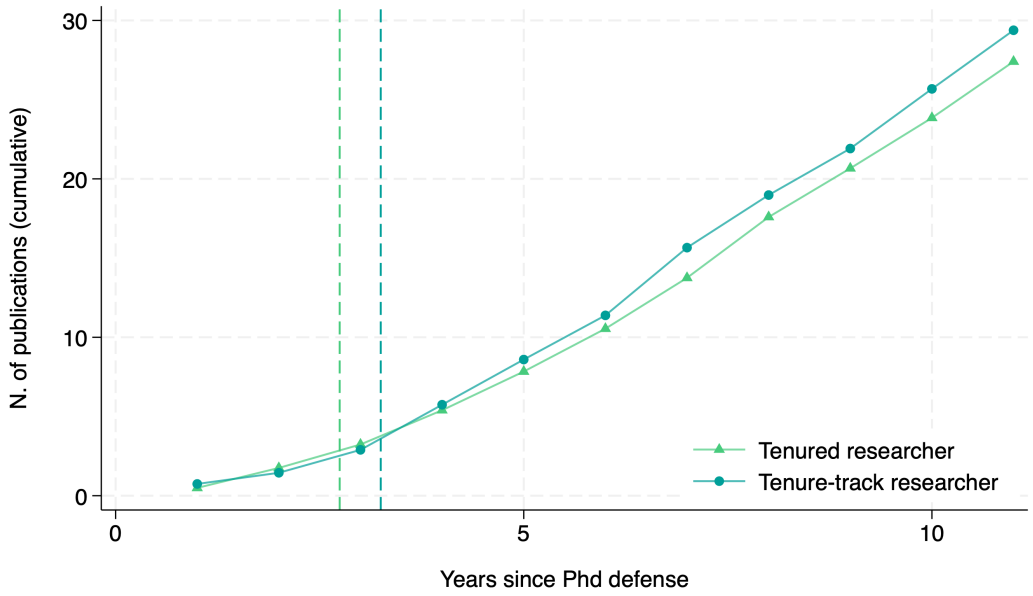
differences, we narrow our analysis to assistant professors hired during the transition period from 2010 to 2012, when both tenured and untenured positions were available (as shown in Figure 1).

We present the results of this exercise in Figure 7. Panel A displays the cumulative number of publications over the eleven years following the Ph.D. defense, distinguishing between associate professors hired under tenured and untenured contracts. Panel B focuses on articles published in high-ranked journals, providing a more refined perspective of research output quality.[11] Two key findings emerge from this analysis. First, the figure confirms that, in the transitional years, new hires were indeed more comparable in terms of research experience (2.74 years for the case of tenured assistant professors, and 3.14 for tenure-track assistant professors, as indicated by the dashed vertical lines) and pre-hiring publication records (2 and 1.8 publications, respectively). Second, it shows that the publication trajectories of assistant professors hired under the two regimes diverge, especially when considering articles in high-ranked journals. Specifically, tenure-track assistant professors exhibit a steeper trajectory in terms of higher-quality publications. These differences do not attenuate but actually widen over time, leading tenure-track assistant professors to have over one-third more articles in high-ranked journals by the end of our time window (11 years after the Ph.D.). This pattern is confirmed when we examine measures of researchers' publication impact. Appendix Figure A6 shows that assistant professors hired under tenure-track contracts accumulate, on average, 5.4 more citations per year than those hired under tenured contracts (p-value = 0.22). This translates into a career-normalized h-index (m-index) that is 18% higher for tenure-track researchers compared to their tenured counterparts (with averages of 0.75 and 0.63, respectively, and a p-value of 0.07).

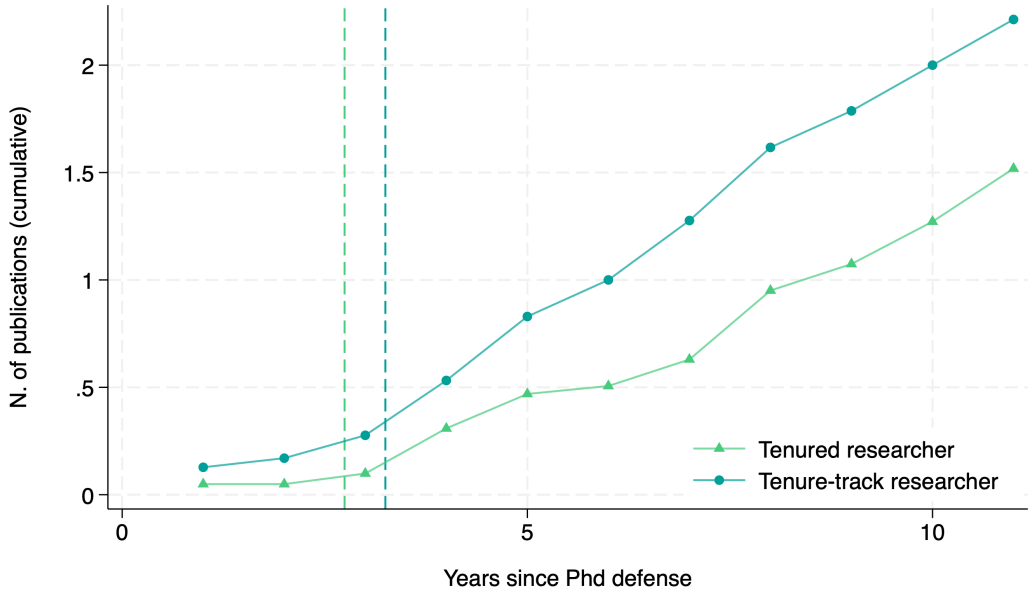
These findings align with previous literature documenting that tenure-track and multi-ladder promotion systems may foster research productivity (see for instance Nieddu and Pandolfi (2022); Checchi et al. (2021)). However, when interpreted alongside our ear-

[11] High-ranked journals are defined as those ranked among the top 100 according to the Scimago Journal Rankings.

Figure 7: Publication patterns of APs hired in transition years (2010-2012)



Panel A: all publications



Panel B: Articles in high-ranked journals

NOTES. This figure illustrates the publication patterns of assistant professors in Economics hired under tenured and untenured contracts during the transition years 2010–2012, when both contract types were available. Panel A shows the average cumulative number of publications by years since Ph.D. defense, separately for tenured and untenured assistant professors. Panel B focuses on publications in high-ranked journals, defined as those listed among the top 100 in the Scimago Journal Rankings. The dashed vertical line represents the average time between Ph.D. defense and the start of an assistant professorship for both groups.

lier findings on selection, the overall impact of the reform remains ambiguous. On one hand, the abolition of tenure for assistant professors seems to have reduced incentives for the most talented Economics Ph.D. graduates to pursue academic careers in Italy, as evidenced by the observed talent drain. On the other hand, the reform appears to have fostered higher-quality research output among those who did enter academia, likely driven by the increased pressure and performance incentives associated with tenure-track contracts. As a result, the overall effect of introducing tenure-track systems on productivity will depend on whether the negative selection effect outweighs the positive incentive effect, or *vice versa*.

5 Conclusions

In this paper, we investigate the effects of the introduction of a tenure-track system in the Italian university system on the selection of Economics Ph.D. graduates into academia. We document that the abolition of tenured positions for assistant professor significantly reduced the share of graduates pursuing academic careers in Italy. These trends are more pronounced for higher-achieving individuals, suggesting negative selection effects of the reform. However, the reform also led to an increase in the quality of publications among those entering the Economics profession, consistent with tenure-track systems inducing stronger incentives to publish in high-ranked journals. Additionally, we find that the reform contributed to increased family formation and higher fertility rates among affected Ph.D. graduates, particularly those transitioning into non-academic public sector positions, where employment stability might be higher.

Taken together, our findings highlight a balance between the negative selection effects and the positive incentive effects generated by the introduction of a tenure-track system. In countries like Italy, where university wages are relatively low compared to other countries and private sector jobs offer strong job security, policymakers seeking to reduce brain drain should carefully consider these dynamics. While tenure-track systems may

boost research productivity, they can also pose significant challenges in talent retention. To address these challenges, it might be necessary to offset the reduction in job security associated with tenure-track systems with additional supportive measures, such as higher salaries or faster career progressions. These adjustments could help ensure that academic careers remain attractive and accessible to a diverse range of scholars.

References

Antecol, H., Bedard, K., and Stearns, J. (2018). Equal but inequitable: Who benefits from gender-neutral tenure clock stopping policies? *American Economic Review*, 108(9):2420–41.

Autor, D. H., Kerr, W. R., and Kugler, A. D. (2007). Does employment protection reduce productivity? evidence from us states. *The Economic Journal*, 117(521):F189–F217.

Bagues, M., Sylos-Labini, M., and Zinovyeva, N. (2017). Does the gender composition of scientific committees matter? *American Economic Review*, 107(4):1207–1238.

Bassanini, A., Nunziata, L., and Venn, D. (2014). Job protection legislation and productivity growth in oecd countries. *Economic Policy*, 24(58):349–402.

Bennett, J. B. and Chater, S. S. (1984). Evaluating the performance of tenured faculty members. *Educational Record*, 65(2):38–41.

Bess, J. L. (1998). Contract systems, bureaucracies, and faculty motivation: The probable effects of a no-tenure policy. *The Journal of Higher Education*, 69(1):1–22.

Bjuggren, C. M. (2018). Employment protection and labor productivity. *Journal of Public Economics*, 157:138–157.

Blackaby, D., Booth, A., and Frank, J. (2005). Outside offers and the gender pay gap: Empirical evidence from the uk academic labour market. *The Economic Journal*, 115(501):F81–F107.

Brogaard, J., Engelberg, J., and Van Wesep, E. (2018). Do economists swing for the fences after tenure? *Journal of Economic Perspectives*, 32(1):179–194.

Buckles, K. (2019). Fixing the leaky pipeline: Strategies for making economics work for women at every stage. *Journal of Economic Perspectives*, 33(1):43–60.

Cappellari, L., Dell'Aringa, C., and Leonardi, M. (2012). Temporary employment, job flows and productivity: A tale of two reforms. *The Economic Journal*, 122(562):F188–F215.

Carmichael, H. L. (1988). Incentives in academics: Why is there tenure? *Journal of Political Economy*, 96(3):453–472.

Cater, B., Lew, B., and Pivato, M. (2017). The efficiency of tenure contracts in academic employment. *Journal of Public Economic Theory*, 19(2):331–361.

Cater, B., Lew, B., and Smith, B. (2008). A theory of tenure-track contracts. *Education Economics*, 16:203–218.

Chait, R. P. (2005). *The Questions of Tenure*. Harvard University Press.

Checchi, D., De Fraja, G., and Verzillo, S. (2021). Incentives and careers in academia: Theory and empirical analysis. *Review of Economics and Statistics*, 103(4):786–802.

Cingano, F., Leonardi, M., Messina, J., and Pica, G. (2014). The effects of employment protection legislation and financial market imperfections on investment: evidence from a firm-level panel of eu countries. *Economic Policy*, 25(61):117–163.

Cingano, F., Leonardi, M., Messina, J., and Pica, G. (2015). Employment protection legislation, capital investment and access to credit: Evidence from italy. *The Economic Journal*, 126(595):1798–1822.

Clark, A. E. and Lepinteur, A. (2022). A natural experiment on job insecurity and fertility in france. *The Review of Economics and Statistics*, 104(2):386–398.

De Paola, M., Nisticò, R., and Scoppa, V. (2021). Employment protection and fertility decisions: The unintended consequences of the italian jobs act. *Economic Policy*, 36(108):735–773.

De Paola, M., Nisticò, R., and Scoppa, V. (2022). Academic careers and fertility decisions. In Checchi, D., Jappelli, T., and Uricchio, A., editors, *Teaching, Research and Academic Careers*, pages 135–161. Springer, Cham.

De Paola, M., Ponzo, M., and Scoppa, V. (2017). Gender differences in the propensity to apply for promotion: Evidence from the italian scientific qualification. *Oxford Economic Papers*, 69(4):986–1009.

De Paola, M. and Scoppa, V. (2015). Gender discrimination and evaluators' gender: Evidence from italian academia. *Economica*, 82(325):162–188.

De Philippis, M. (2021). Multi-task agents and incentives: The case of teaching and research for university professors. *The Economic Journal*, 131(636):1643–1681.

Del Bono, E., Weber, A., and Winter-Ebmer, R. (2012). Clash of career and family: Fertility decisions after job displacement. *Journal of the European Economic Association*, 10(4):659–683.

Ehrenberg, R. G. and Zhang, L. (2005). Do tenured and tenure-track faculty matter? *Journal of Human Resources*, 40(3):647–659.

Faria, J. R. and McAdam, P. (2015). Academic productivity before and after tenure: The case of the 'specialist'. *Oxford Economic Papers*, 67(2):291–309.

Figlio, D. N., Schapiro, M. O., and Soter, K. B. (2015). Are tenure-track professors better teachers? *Review of Economics and Statistics*, 97(4):715–724.

Ginther, D. K. and Kahn, S. (2004). Women in economics: Moving up or falling off the academic career ladder? *Journal of Economic Perspectives*, 18(3):193–214.

Goldin, C. (2014). A grand gender convergence: Its last chapter. *American Economic Review*, 104(4):1091–1119.

Holley, J. W. (1977). Tenure and research productivity. *Research in higher education*, 6:181–192.

Huang, W., Liu, Q., Xing, J., and Zheng, S. (2021). The tenure-track system and academic research productivity: Evidence from reforms in chinese universities. *SSRN*.

Huttunen, K. and Kellokumpu, J. (2016). The effect of job displacement on couples' fertility decisions. *Journal of Labor Economics*, 34(2):403–442.

Jappelli, T., Nappi, C. A., and Torrini, R. (2017). Gender effects in research evaluation. *Research Policy*, 46:911–924.

Kahn, C. and Huberman, G. (1988). Two-sided uncertainty and "up-or-out" contracts. *Journal of Labor Economics*, 6:423–444.

Kaplan, K. (2010). Academia: The changing face of tenure. *Nature*, 468(7320):123–125.

Levin, S. G. and Stephan, P. E. (1991). Research productivity over the life cycle: Evidence for academic scientists. *American Economic Review*, pages 114–132.

Lundberg, S. and Stearns, J. (2019). Women in economics: Stalled progress. *Journal of Economic Perspectives*, 33(1):3–22.

McDowell, J. M., Singell, L. D., and Ziliak, J. P. (1999). Cracks in the glass ceiling: Gender and promotion in the economics profession. *American Economic Review*, 89(2):392–396.

McKenzie, R. (1996). In defense of academic tenure. *Journal of Institutional and Theoretical Economics*, 152:325–341.

McPherson, M. S. and Schapiro, M. O. (1999). Tenure issues in higher education. *Journal of Economic Perspectives*, 13:85–98.

Nieddu, M. and Pandolfi, L. (2022). The effectiveness of promotion incentives for public employees: Evidence from italian academia. *Economic Policy*, 37(112):697–748.

Oster, S. M. and Hamermesh, D. S. (1998). Aging and productivity among economists. *Review of Economics and Statistics*, 80(1):154–156.

Prifti, E. and Vuri, D. (2013). Employment protection and fertility: Evidence from the 1990 italian reform. *Labour Economics*, 23:77–88.

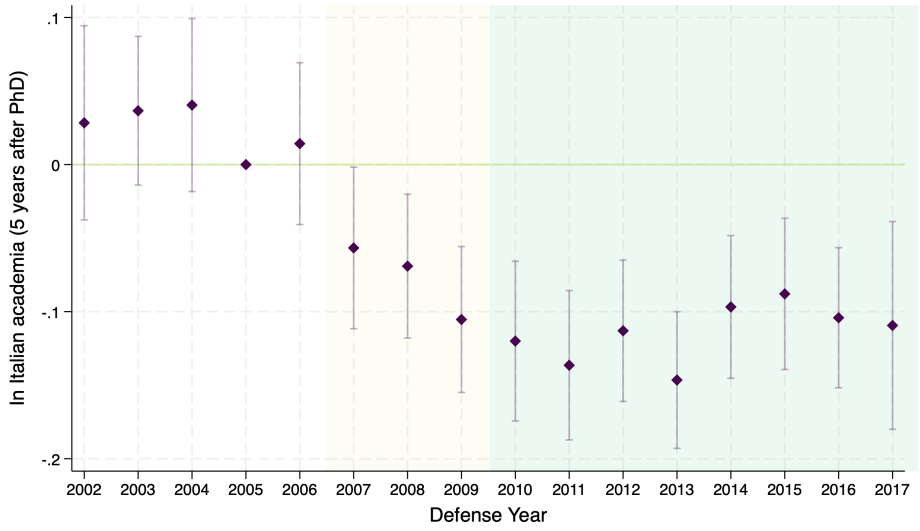
Teichler, U. and Höhle, E. A. (2013). *The work situation of the academic profession in Europe: Findings of a survey in twelve countries*. Springer Science & Business Media.

Waldman, M. (1990). Up-or-out contracts: A signaling perspective. *Journal of Labor Economics*, 8:230–250.

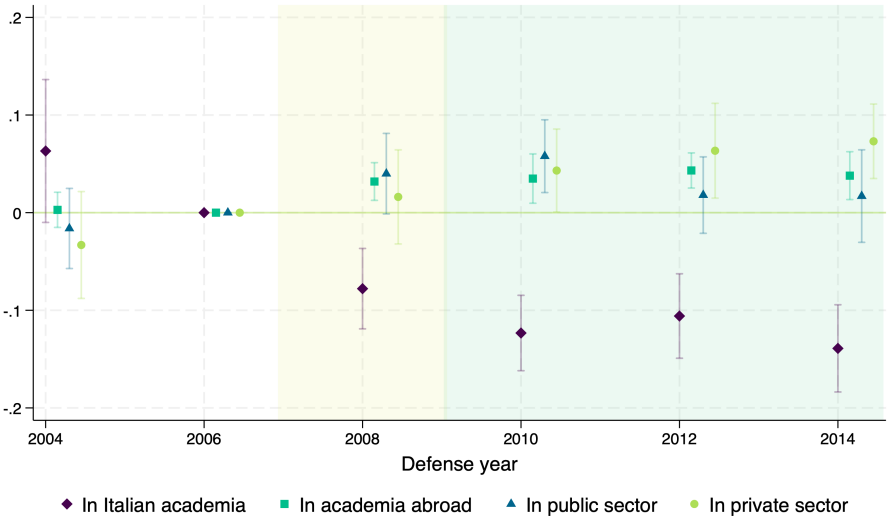
Wolfinger, N. H., Mason, M. A., and Goulden, M. (2008). Problems in the pipeline: Gender, marriage, and fertility in the ivory tower. *The Journal of Higher Education*, 79(4):388–405.

Appendix – Additional Figures and Tables

Figure A1: Reform effects on career choices (alternative specification)



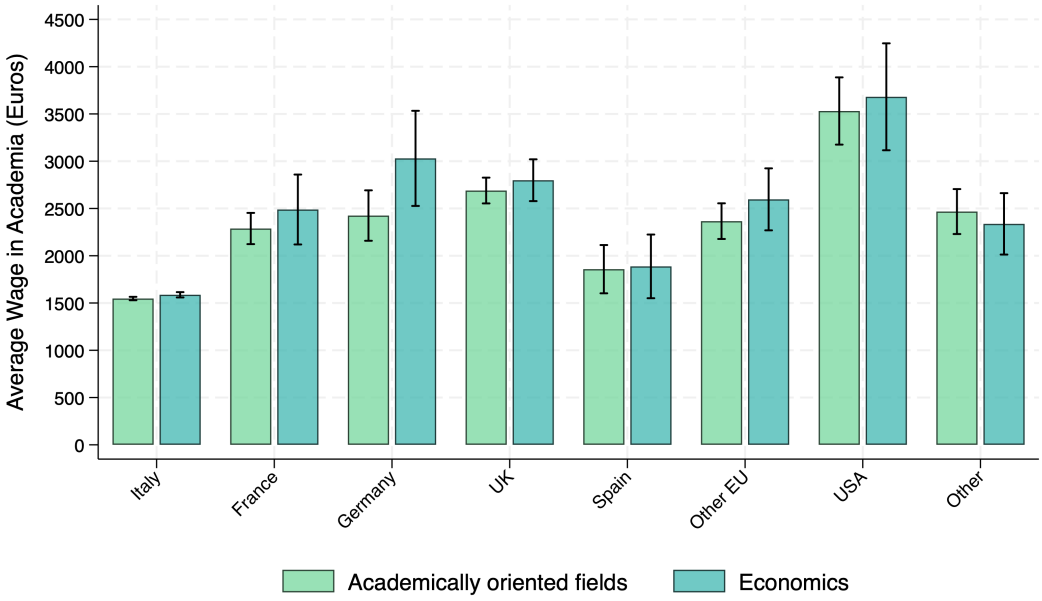
Panel A: Administrative data



Panel B: Survey data

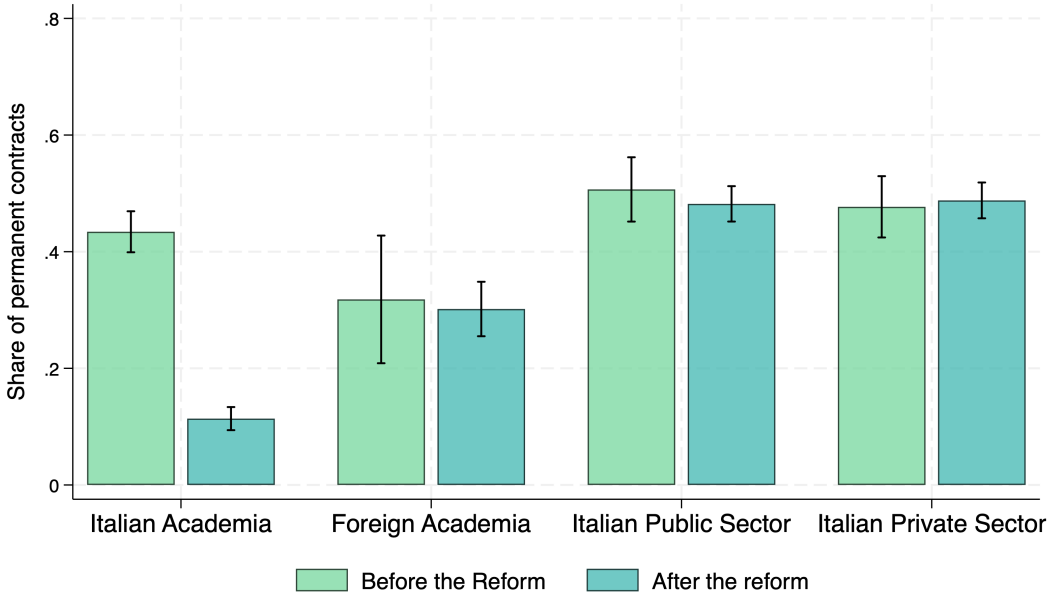
NOTES. This figure depicts the point estimates and corresponding 95% confidence intervals from a set of regressions in the form of Equation 2. In Panel A, based on administrative data, the dependent variable is a binary indicator equal to one if a Ph.D. graduate is found in the census of professors employed in Italian universities within five years from their graduation year (as assistant, associate, or full professor). Panel B, based on ISTAT survey data, the dependent variables are binary indicators for Ph.D. graduates who report being employed, respectively, in Italian academia, in academia abroad, in the public sector, or in the private sector at the time of the survey, that is, three to five years after graduation. In Panel B, regressions include as controls: gender, an indicator variable for graduates who had achieved the highest grade in their Master's Degree (i.e., obtained the Laurea Magistralis with 110/110), an indicator variable for graduates with a university scholarship, distance in years between the M.Sc. and the Ph.D., a set of dummy variables for the educational level of the father (lower secondary, upper secondary, or tertiary), and province-by-field fixed effects.

Figure A2: Average wages in academia, by country

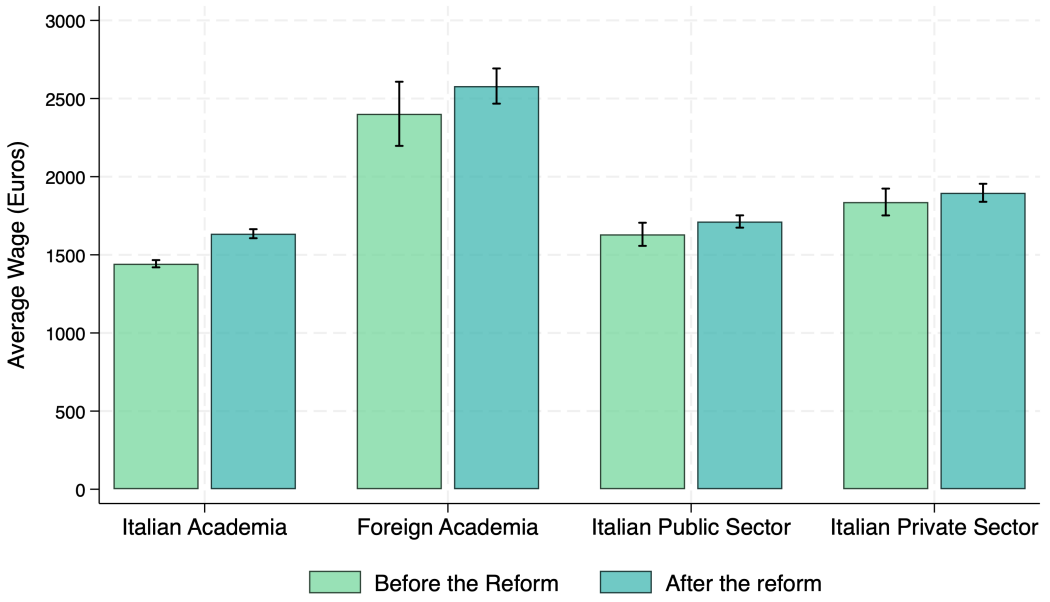


NOTES. This figure shows average self-reported monthly wages (in euros) among Ph.D. graduates—in academically oriented fields (Mathematics, Political and Social Sciences, and Economics) and in Economics only—employed in academia at the time of the ISTAT survey of Italian Ph.D. graduates (3–5 years after graduation, depending on the cohort) by country of employment. Wages are truncated at 1,000 and 5,000 euros per month. Vertical lines indicate 95% confidence intervals.

Figure A3: Employment outcomes by employment sector



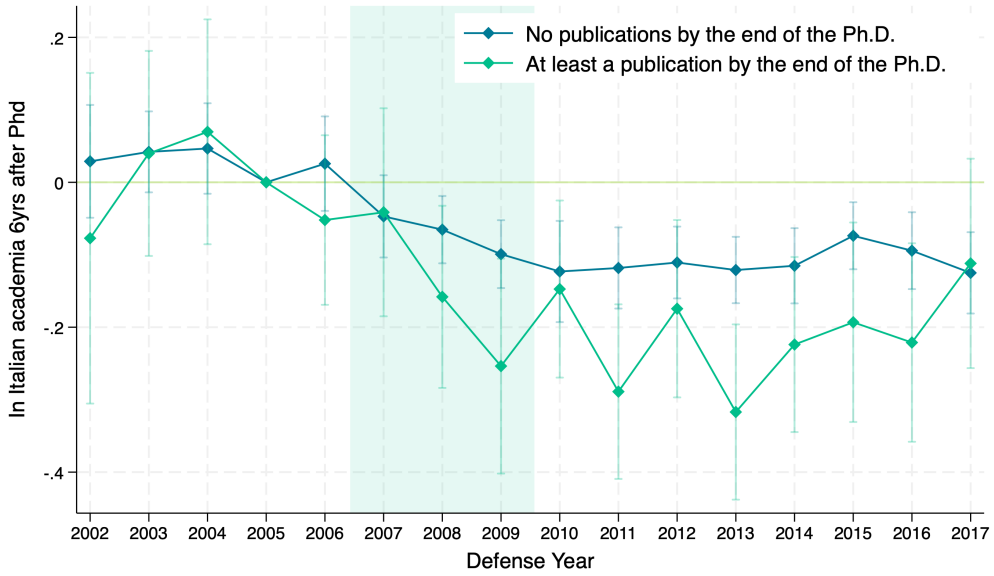
Panel A: Share of Ph.D. graduates with permanent contracts



Panel B.: Average monthly wages (euros)

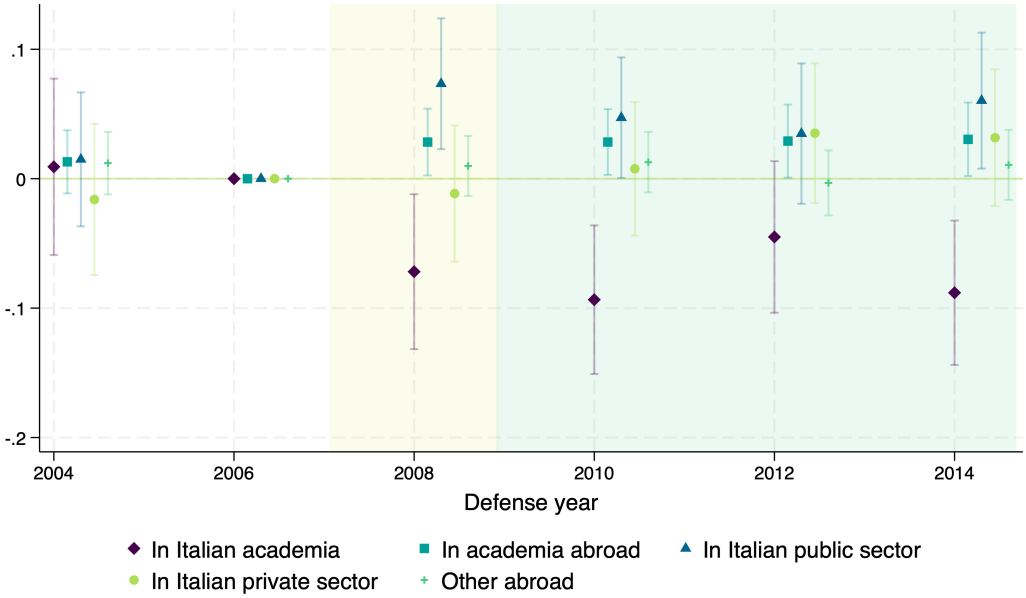
NOTES. This figure shows average employment outcomes for Ph.D. graduates in Economics and other academically oriented fields, based on ISTAT survey data. Panel A shows the share with a permanent contract 3 years after graduation; Panel B shows average self-reported monthly earnings in euros at the time of the interview (3–5 years after graduation, depending on the cohort). Results are shown separately by employment sector and country, and by pre- vs. post-reform cohorts. The classification into public and private sector is based on the employment industry of respondents. Wages are truncated at 1,000 and 5,000 euros. Vertical lines indicate 95% confidence intervals.

Figure A4: Heterogeneous effects of the reform by academic talent

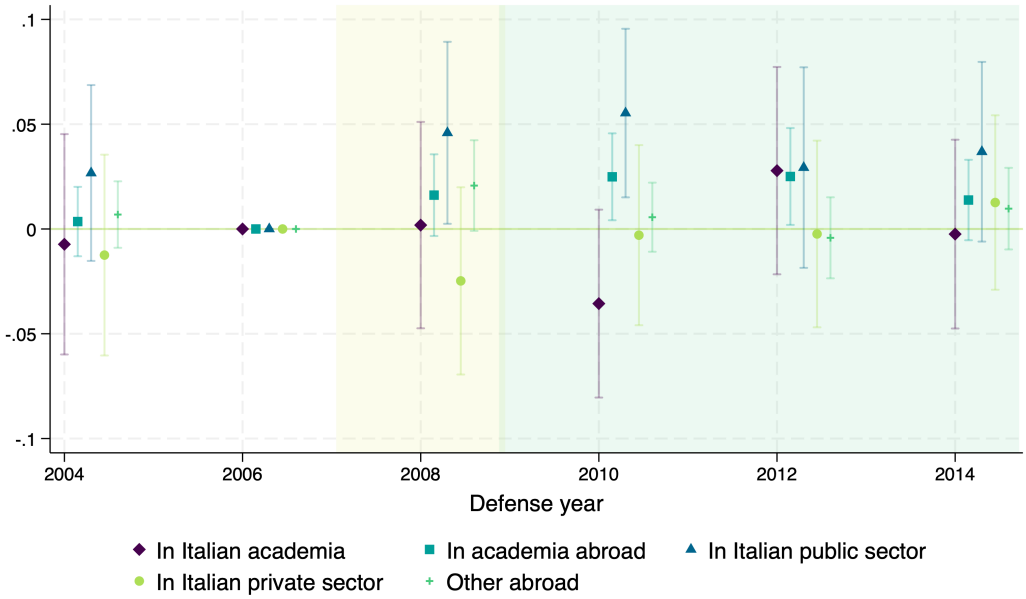


NOTES. This figure depicts the point estimates and corresponding 95% confidence intervals from a set of regressions based on Equation 2, estimated separately for Ph.D. graduates who do and do not have at least one publication by the defense year. The dependent variable is a binary indicator equal to one if a Ph.D. graduate is found in the census of professors employed in Italian universities within five years of graduation (as assistant, associate, or full professor).

Figure A5: Effects on family formation decomposed by employment sector



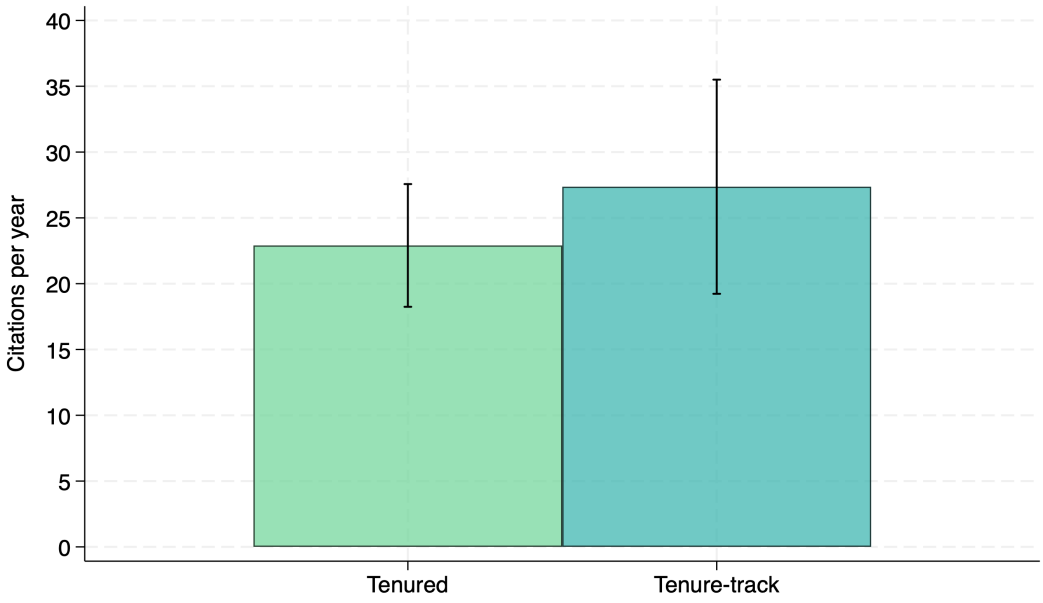
Panel A: Share of Ph.D. graduates in a couple



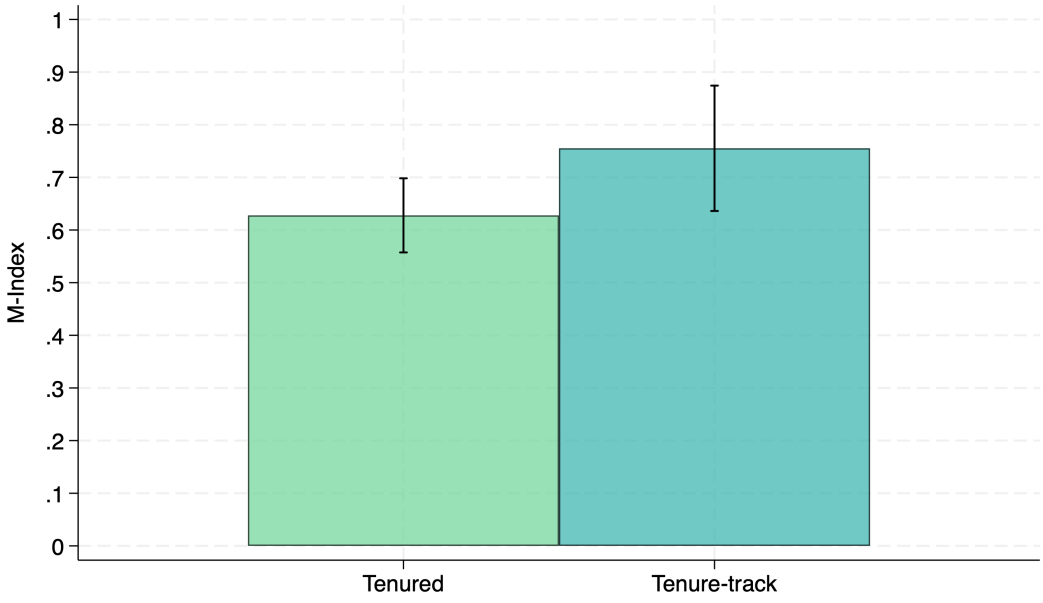
Panel B: Share of Ph.D. graduates with children

NOTES. This figure presents the point estimates and corresponding 95% confidence intervals from a series of regressions of the form of Equation 1. In Panel A(B), the outcome variable in each regression is an indicator variable that equals one if, at the time of the interview, the respondent has children (lives with partner) and is employed in: (i) Italian academia, (ii) in academia abroad, (iii) in the Italian public sector, (iv) in the Italian private sector, (v) in non-academic jobs abroad. The sample is restricted to graduates who obtained their Master's degree within the past 17 years (to focus on individuals likely under the age of 40). All regressions include as controls: gender, an indicator variable for graduates who had achieved the highest grade in their Master's Degree (i.e., obtained the Laurea Magistralis with 110/110), an indicator variable for graduates with a university scholarship, distance in years between the M.Sc. and the Ph.D., a set of dummy variables for the educational level of the father (lower secondary, upper secondary, or tertiary), and province-by-field fixed effects.

Figure A6: Publication impact of APs hired in transition years (2010-2012)



Panel A: Citations per year



Panel B: M-index

NOTES. This figure illustrates the publication impact of Ph.D. graduates hired as assistant professors in Economics under tenured and untenured contracts during the transition years 2010–2012, when both contract types were available. Panel A shows the average number of citations, calculated as the total number of citations received as of 2022 divided by the number of years since the first publication recorded in Scopus, separately for tenured and untenured assistant professors. Panel B reports, again separately for the two groups, the career-length-adjusted h-index (or m-index), computed as the h-index divided by the number of years since the first publication. Vertical lines indicate 95% confidence intervals.

Table A1: Summary statistics

Panel A: Administrative Data	(1) Economics	(2) Other Treated Areas	(3) Control Areas
Female	0.50	0.44	0.57
	(0.50)	(0.50)	(0.50)
In Italian academia	0.22	0.19	0.10
	(0.42)	(0.39)	(0.30)
If in Italian academia: years after defense	4.06	5.31	5.10
	(3.39)	(3.58)	(4.04)
If in Italian academia: same univ. as the PhD	0.43	0.47	0.71
	(0.50)	(0.50)	(0.45)
Observations	6387	6716	31473

Panel B: ISTAT Data	(1) Economics	(2) Other Treated Areas	(3) Control Areas
Female	0.50	0.45	0.57
	(0.50)	(0.50)	(0.49)
Years between master and PhD	5.97	5.62	6.48
	(2.42)	(2.28)	(2.77)
Public PhD scholarship	0.73	0.73	0.69
	(0.44)	(0.44)	(0.46)
Father education: lower secondary	0.30	0.31	0.31
	(0.46)	(0.46)	(0.46)
Father education: upper secondary	0.33	0.36	0.34
	(0.47)	(0.48)	(0.48)
Father education: tertiary	0.36	0.32	0.33
	(0.48)	(0.47)	(0.47)
In a stable relationship	0.50	0.44	0.54
	(0.50)	(0.50)	(0.50)
Has children	0.35	0.32	0.44
	(0.48)	(0.47)	(0.50)
Employed in Italian academia	0.32	0.30	0.20
	(0.47)	(0.46)	(0.40)
Employed in foreign academia	0.08	0.08	0.03
	(0.27)	(0.27)	(0.18)
Employed in public sector	0.26	0.29	0.43
	(0.44)	(0.45)	(0.49)
Employed in private sector	0.29	0.26	0.28
	(0.46)	(0.44)	(0.45)
Import. lack of qual. job for leavers (1-4 scale)	3.52	3.44	3.52
	(0.87)	(0.93)	(0.82)
Would do again the PhD	0.64	0.64	0.62
	(0.48)	(0.48)	(0.49)
Overall satisfaction with the PhD (0-1 scale)	0.70	0.72	0.69
	(0.21)	(0.21)	(0.21)
PhD necessary for the job	0.55	0.52	0.41
	(0.50)	(0.50)	(0.49)
Permanent contract 3 years after the PhD	0.42	0.32	0.29
	(0.49)	(0.47)	(0.45)
Observations	2483	2835	13504

Table A2: Reform effects on wages and job stability

	Within Academia		Within Italy	
	Earnings	Stability	Earnings	Stability
Employed in Italian academia	-878.800***	0.141**	-317.551***	-0.036
	(100.374)	(0.059)	(32.554)	(0.027)
Post X Employed in Italian academia	-10.071	-0.341***	199.504***	-0.299***
	(115.454)	(0.066)	(39.698)	(0.031)
Province-by-field FE	Yes	Yes	Yes	Yes
Defense year FE	Yes	Yes	Yes	Yes
Observations	1,884	2,033	3,771	4,143
Mean dep. var.	1,442.93	0.43	1,442.93	0.43
N. of Province-by-fields	104.00	107.00	113.00	114.00

NOTES. This table reports estimates from a set of DiD regressions comparing the evolution of (i) self-reported monthly earnings and (ii) the probability of holding a permanent contract, across different employment groups before and after the reform. Comparisons are drawn between Ph.D. graduates in Italian academia and those working in academia abroad (Columns 1–2), as well as between those employed in Italian academia and those with non-academic jobs in Italy (Columns 3–4). All regressions include as controls: gender, an indicator variable for graduates who had achieved the highest grade in their Master's Degree (i.e., obtained the Laurea Magistralis with 110/110), an indicator variable for graduates with a university scholarship, distance in years between the M.Sc. and the Ph.D., and a set of dummy variables for the educational level of the father (lower secondary, upper secondary, or tertiary). The averages of the dependent variables are computed among those employed in Italian academia in the pre-reform period. The sample is restricted to graduates in Economics and other academically oriented fields who are employed at the time of the ISTAT survey. Robust standard errors are reported in parentheses.

Table A3: Determinants of promotion decisions

	(1) Promoted	(2) Promoted	(3) Promoted	(4) Promoted
Female	-0.0276***	-0.0275***	-0.0286***	-0.0468*
	(0.00465)	(0.00643)	(0.00640)	(0.0211)
Seniority	0.180***	0.207***	0.238***	0.170***
	(0.00635)	(0.00795)	(0.00908)	(0.0503)
Publications	0.315***	0.294***	0.294***	0.334***
	(0.00766)	(0.00883)	(0.00854)	(0.0333)
Articles in top journals	0.107***	0.144***	0.158***	0.138***
	(0.00569)	(0.00879)	(0.00919)	(0.0369)
Female × Post-reform				0.0196
				(0.0221)
Seniority × Post-reform				0.0693
				(0.0511)
Publications × Post-reform				-0.0431
				(0.0344)
Articles in top journals × Post-reform				0.0204
				(0.0381)
University FE	Yes	No	No	No
University-by-field FE	No	Yes	No	No
University-by-field-by-year FE	No	No	Yes	Yes
Observations	30,189	30,189	30,189	30,189
Mean dep. var.	0.29	0.29	0.29	0.29
N. of rankings	7,260	7,260	7,260	7,260

NOTES. This table reports estimates from a series of regressions investigating the determinants of promotion to associate professor in academia. In all columns, the sample includes all assistant professors in a given year within university-field pairs where at least one promotion to associate professor occurs in the following year. The dependent variable is a binary indicator equal to one if an assistant professor is promoted to associate professor in the following year. The independent variables include a gender dummy and a set of binary indicators for whether the assistant professor ranks highest within their university-field cohort in terms of: (a) academic seniority; (b) total number of publications; and (c) number of articles published in journals ranked among the top 100 in the Scimago Journal Rankings. Column (4) additionally includes interactions between the baseline regressors and a post-reform dummy (year > 2010). All columns include year fixed effects, except Column (4), which includes university-by-field × year fixed effects. Standard errors, clustered at the university-field × year level, are reported in parentheses.