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Marco Giovanni Nieddu^{*}, Roberto Nistico[†], and Lorenzo Pandolfi[‡]

Abstract

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 (Kahn and Huberman, 1988; Waldman, 1990; Checchi et al., 2021; De Philippis, 2021).¹ 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.²

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, little is known about how tenure-track systems affect the selection of prospective scholars into the academic profession. 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 (Antecol et al., 2018; Goldin, 2014).

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

¹See also Carmichael (1988); McKenzie (1996); McPherson and Schapiro (1999).

²See Kaplan (2010) for a deeper discussion on the critiques of academic tenure

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. Our findings indicate that the reform significantly reduced the likelihood of Italian Ph.D. graduates entering academia 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 public and private sector professions.

Importantly, the reform disproportionately affected more talented graduates, indicating a negative selection into Italian academia once the entry position becomes 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 profes-

sorships” (Buckles, 2019), we find no significant gender-based differences in the effects of the reform.

Using publication records from SCOPUS, we also study the reform effect 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 tenure-track system on productivity is ambiguous, depending on whether the negative selection effect prevails on the positive incentive effects conditional on pursuing an academic career or *vice versa*.

Our paper contributes to three lines of research. First, it mainly contributes to the literature on the effects of tenure on research productivity and career trajectories by providing first evidence on how the introduction of tenure-track system affect the selection of Ph.D. graduates into academia. Unlike previous studies, which mostly focused on publication records (Cater et al., 2008, 2017; Checchi et al., 2021; De Philippis, 2021; Huang et al., 2021; Nieddu and Pandolfi, 2022), our analysis highlights how tenure reforms indirectly influence talent allocation, offering a nuanced perspective on the interplay between academic policies, productivity, and personal priorities.

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, 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, there is a substantial body of empirical evidence showing that job insecurity has detrimental consequences on fertility ([Prifti and Vuri, 2013](#); [De Paola et al., 2021](#); [Clark and Lepinteur, 2022](#)), often pushing 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 Economics, 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.

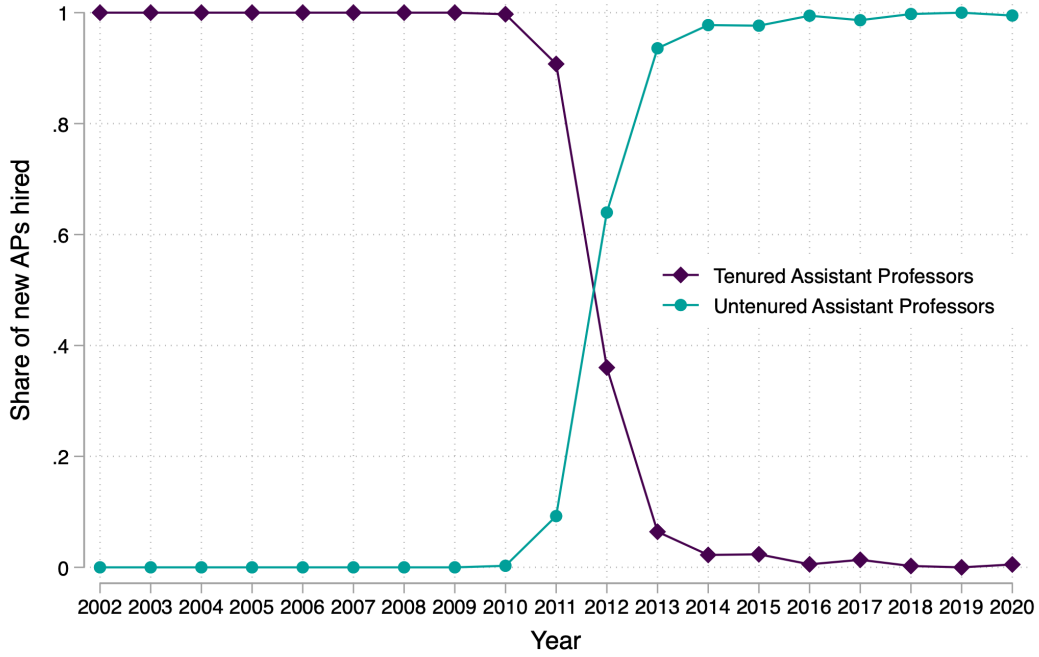
2 The 2010 Reform of the Italian Academic System

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. 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 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”),

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.

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 Italian academia into 14 scientific areas (e.g., mathematics, physics, medicine, economics). Each area was further divided into 184 scientific fields (e.g., applied physics, econometrics, private law). Promotions within the system became more significant in terms of salary progression. Assistant professors earn an annual gross salary of approximately €41,000, which increases to about €54,000 for associate professors and €72,000 for full professors. While academic tasks and responsibilities are

similar across ranks, certain prestigious roles, such as rector, dean, or department head, are reserved for full professors.

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 includes more than 200,000 Ph.D. graduates and contains detailed information such as 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.³

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.

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

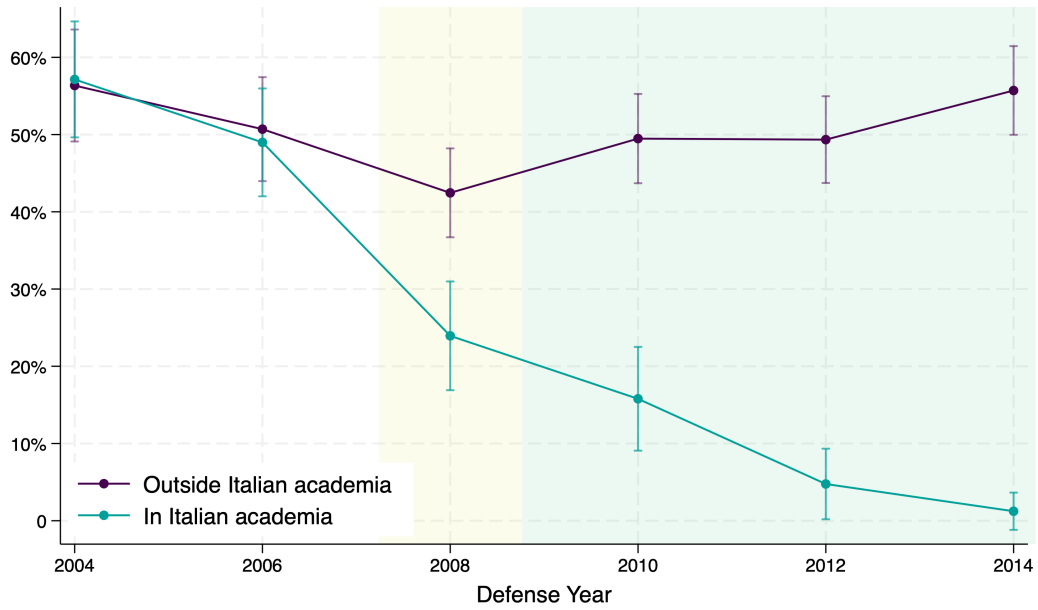
³We exclude online universities, as well as those for which the coverage in the thesis repository database is below 80%.

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.

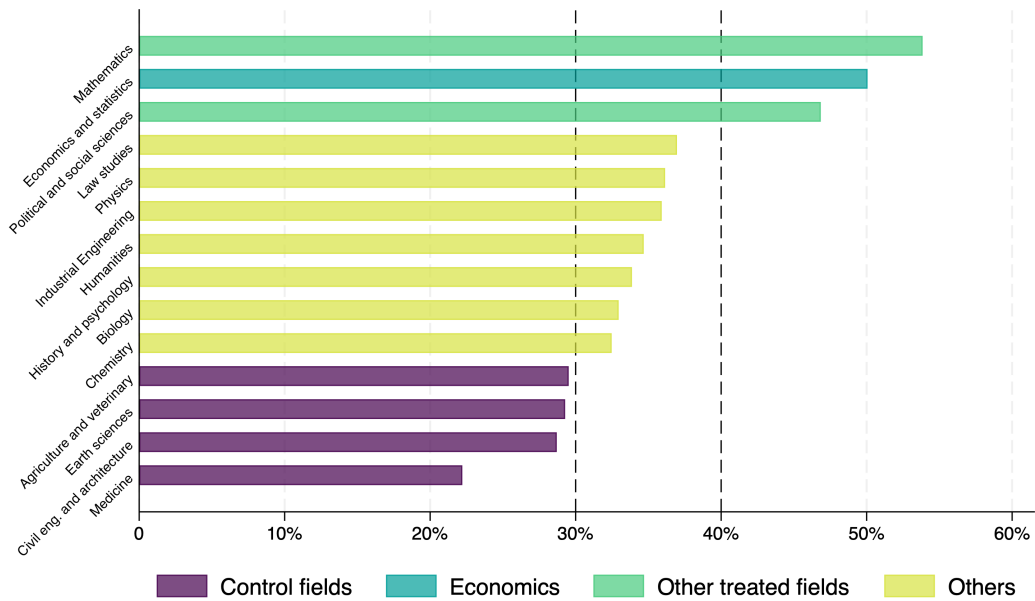
Panel A of Figure 2 shows the impact of the reform on the probability of securing permanent contracts three years after the defense among Economics Ph.D. graduates pursuing an academic career in Italy. In particular, the figure traces how this probability evolved around the time of the reform for those 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 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 secured a permanent contract within three years of their defense (by 2011), while the share of those from the same cohort employed with a permanent contract outside Italian academia remained stable at around 50%. 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.

Figure 2: Sources of Variation in the Identification Strategy



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



(b) 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.

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 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:

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

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:

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

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 . $\mathbf{1}(t = \tau)$ 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 1 for Economics Ph.D. graduates and 0 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 1 for highly academically oriented fields (*i.e.*, Mathematics, Political and Social Sciences, and Economics and Statistics) and 0 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.

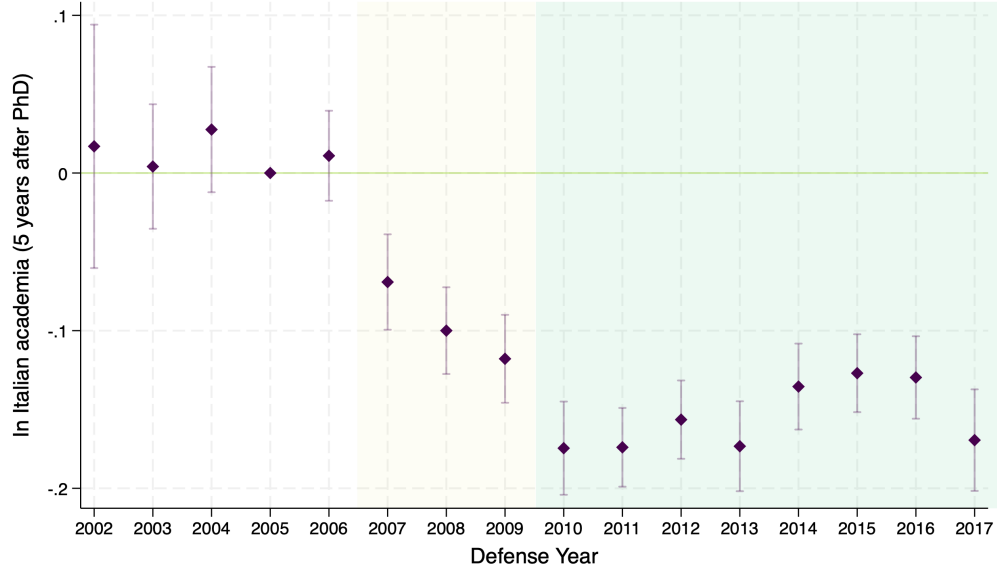
Depending on the dataset used for the analysis (ISTAT survey data versus administrative data), we also include additional sets of fixed effects. In our most conservative specification estimated in the ISTAT dataset, we include university-by-field fixed effects (where the university is proxied by the province where it is located) 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

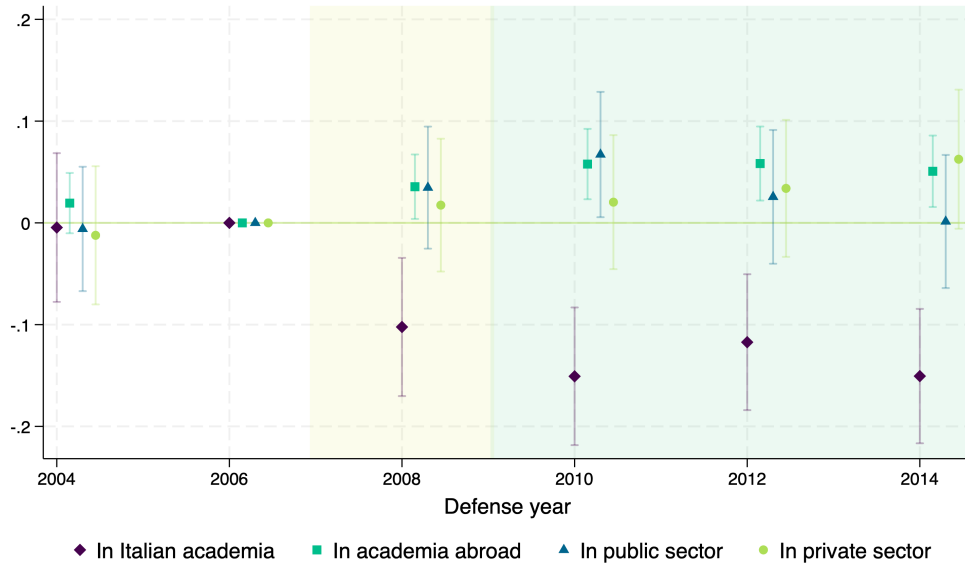
We begin our empirical analysis by examining how the abolition of tenure for assistant professorships affected the career choices of Italian Ph.D. graduates. The main results from this analysis are summarized in Figure 3.

Panel A of Figure 3 presents estimates based on Equation 1, using administrative

Figure 3: Reform Effects on Career Choices



(a) Panel a: Administrative data



(b) Panel b: Survey Data

NOTES. This figure depicts the point estimates and corresponding 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, reports point estimates and confidence intervals from four different regressions in which 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 three to five years after graduation.

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 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.⁴

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 about 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.⁵ 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.

⁴Appendix Figure A1 show the same results when estimating Equation 2 on the sample including other academically oriented fields. Results are qualitatively and also quantitatively unchanged.

⁵The 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*** (0.009)	-0.168*** (0.008)	-0.169*** (0.010)		-0.156*** (0.014)	-0.002 (0.004)
Post X Academic. oriented field				-0.142*** (0.011)		
Female	-0.035*** (0.003)	-0.034*** (0.003)	-0.034*** (0.003)	-0.035*** (0.003)	-0.029*** (0.004)	-0.009*** (0.002)
University-by-area FE	No	Yes	Yes	Yes	Yes	Yes
Defense year FE	Yes	Yes	No	No	No	No
University-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 Univ.-by-Area		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*** (0.011)		0.036* (0.020)		0.038* (0.022)	
Post X Academic. oriented field		0.036*** (0.007)		0.041*** (0.013)		0.062*** (0.017)
Female	-0.015*** (0.003)	-0.015*** (0.003)	0.034*** (0.007)	0.037*** (0.009)	-0.042*** (0.007)	-0.040*** (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 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. $Post \times Economics$ is the interaction term between the post-reform dummy and a binary indicator for Ph.D. graduates in Economics, while $Post \times Academically\ oriented\ field$ is the interaction between the indicator for academically oriented fields (Economics, Mathematics, Political and Social Sciences) and the $Post$ dummy. 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 (primary, secondary, or tertiary). Standard errors (in parentheses) are clustered at the defense year by academic field level.

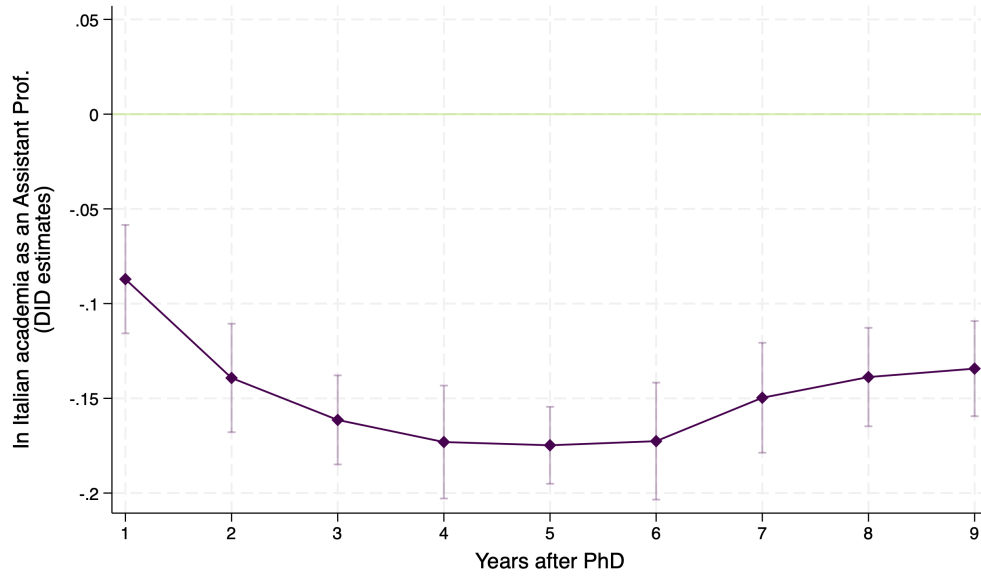
While the results in Figure 3 are obtained by comparing only Economics with other less academically oriented fields, Table 1 extends the analysis by including other academically oriented fields in the treatment group (Mathematics and Informatics, and Political and Social Sciences). This analysis uses 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 1 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 institutions (by 3.6 to 4.1 percentage points) and in the private sector (by 3.8 to 6.2 percentage points). 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 on 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.

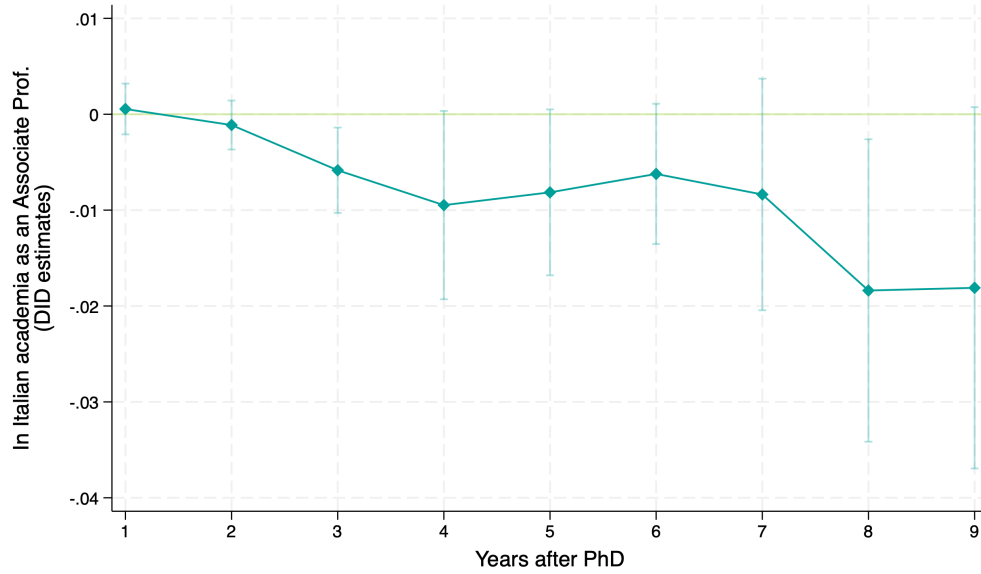
We also exploit the longitudinal dimension of our administrative data to investigate the long-run effects of the reform on the career trajectories of Ph.D. graduates. Figure 4 shows the effect of the reform on the likelihood of being employed as an Assis-

tant (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.

Figure 4: Short- and Long-Run Effects of the Reform on Entering Italian Academia



(a) Assistant Professor



(b) Associate Professor

NOTES. This figure depicts the point estimates and corresponding 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-area fixed effects. Standard errors are clustered at the defense year and academic field level in Panel A and robust in Panel B.

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. Additionally,

Table 2: Heterogeneous Effects of the Reform on Career Choices

	Employed in:					
	Italian Acad.			Foreign Acad.		
Post X Economics	-0.127*** (0.031)	-0.076* (0.042)	-0.233*** (0.053)	0.038** (0.016)	0.015 (0.019)	0.060*** (0.023)
Post X Econ X Female	-0.008 (0.044)			0.007 (0.021)		
Post X Econ X Univ. Scholarship		-0.065 (0.049)			0.037* (0.023)	
Post X Econ X Father works			0.124** (0.057)			-0.021 (0.025)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Province-by-area FE	Yes	Yes	Yes	Yes	Yes	Yes
Defence 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). $Post \times Economics$ is the interaction term between the post-reform dummy and a binary indicator for Ph.D. graduates in Economics. In columns 1 and 4, $Post \times Economics$ 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). Robust standard errors in parentheses.

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 exit not only Italian academia but academia in general after the reform, posing concerns for 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.

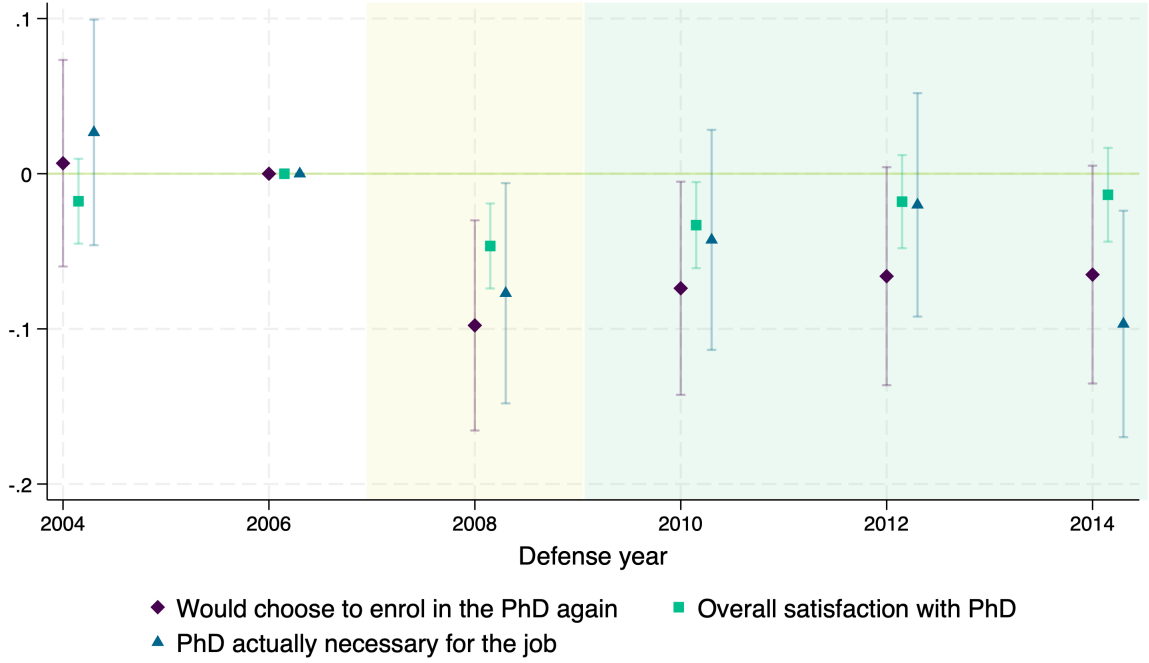
4.3 Effects of the Reform on Satisfaction and Family Formation

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

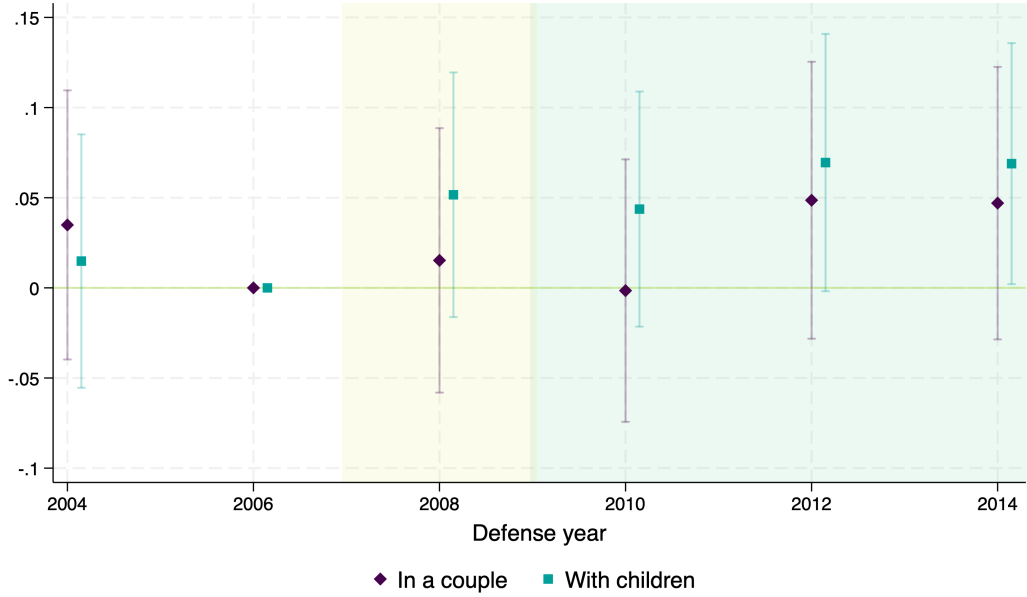
Figure 5: Reform Effects on Satisfaction with the Ph.D.



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.

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 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. We interpret this finding in light of the career choices discussed in the previous section. As academic jobs in Italy became relatively less attractive following the abolition of tenured entry positions, many potential scholars were discouraged from pursuing academic careers in the country. Instead, they opted for academic careers abroad or positions in the public and private sector, where working conditions may be more conducive to family formation.

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 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.

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 utilize additional information from the ISTAT survey, which asks individuals living abroad or planning to do so (either permanently or temporarily) to rate (in 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 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.

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

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)	
Father educ. dummies	Yes	Yes	Yes	Yes	Yes	Yes
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”). $Post \times Economics$ is the interaction term between the post-reform dummy and a binary indicator for Ph.D. graduates in Economics, while $Post \times Academically\ oriented\ field$ is the interaction between the indicator for academically oriented fields (Economics, Mathematics, Political and Social Sciences) and the *Post* dummy. 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.

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.

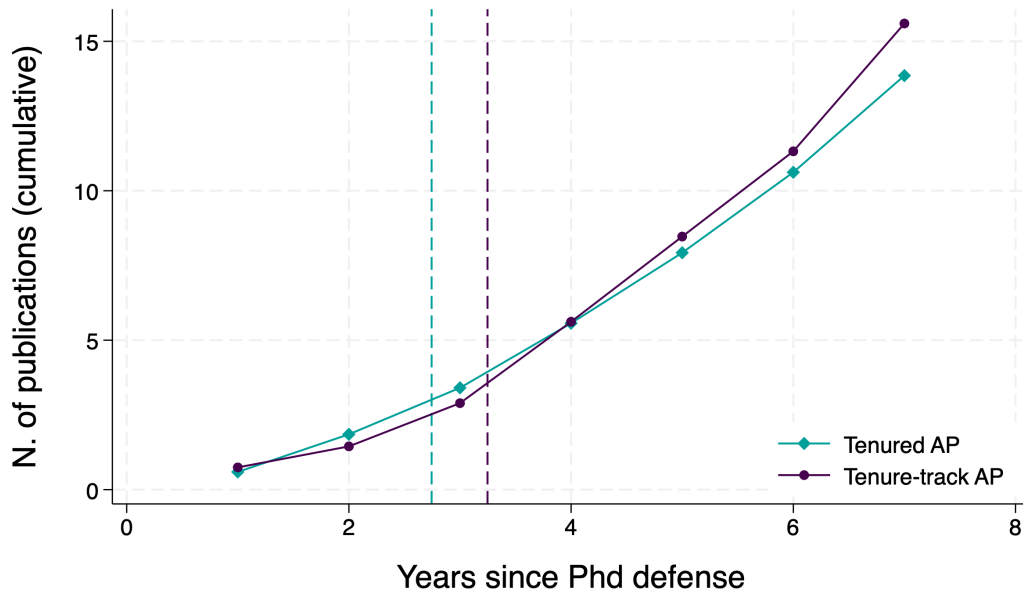
Since the reform significantly influenced the selection of new entrants into Italian academia, as discussed in previous sections, researchers hired under the new regime are negatively selected relative to their pre-reform counterparts. Moreover, post-reform hires typically had about 2.5 additional years 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 transitional 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 seven 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.⁶ 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 when considering articles in high-ranked journals. Specifically, tenure-track assistant professors exhibit a steeper trajectory in terms of higher-quality publications.

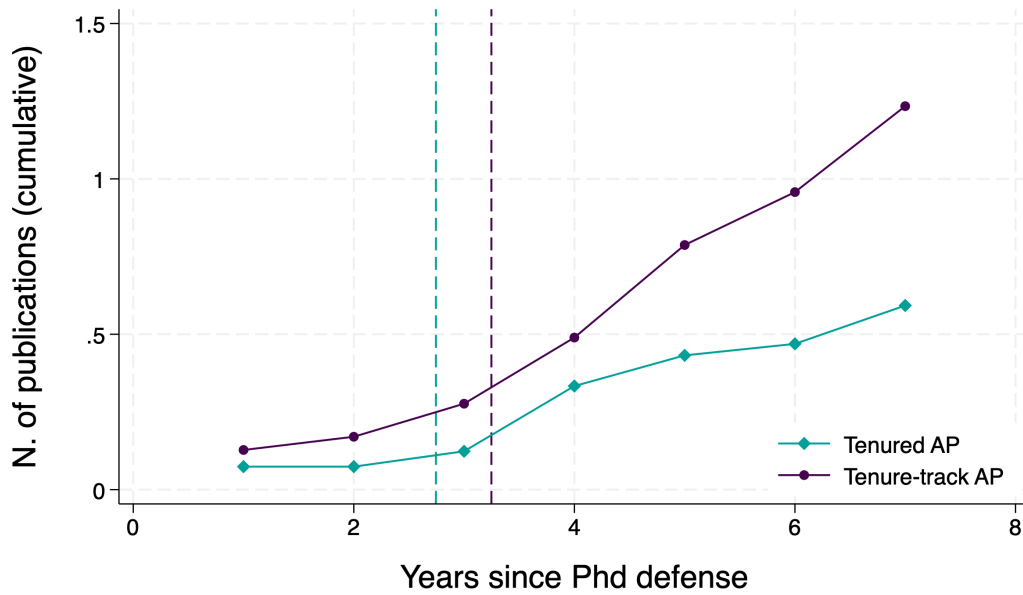
This finding aligns with previous literature documenting that tenure-track and multi-ladder promotion systems may foster research productivity (see for instance [Nieddu](#)

⁶High-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)



(a) Panel A: all publications



(b) 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.

and Pandolfi (2022); Checchi et al. (2021)). However, when interpreted alongside our earlier 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. This might be attributable to the greater likelihood of transitioning into academic careers abroad or securing jobs in the public and private sectors, where job security 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.

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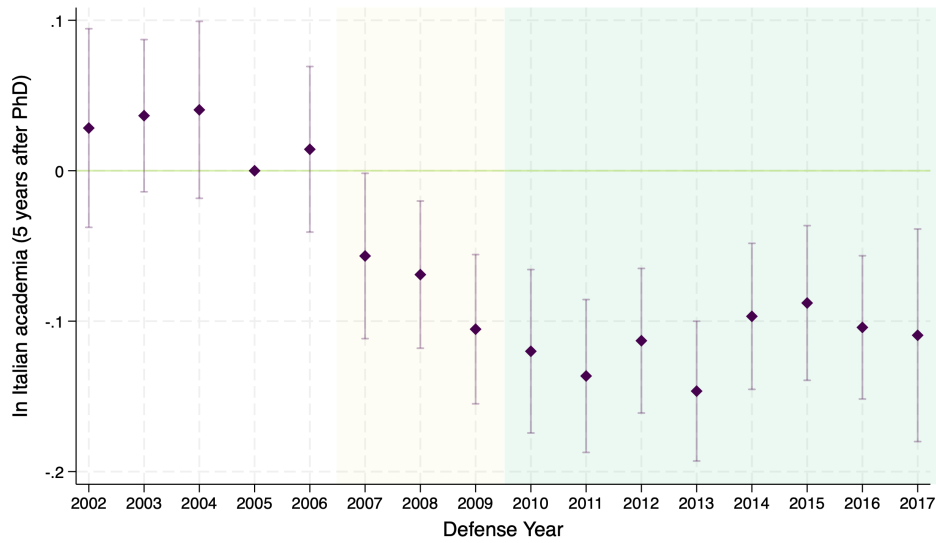
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Appendix

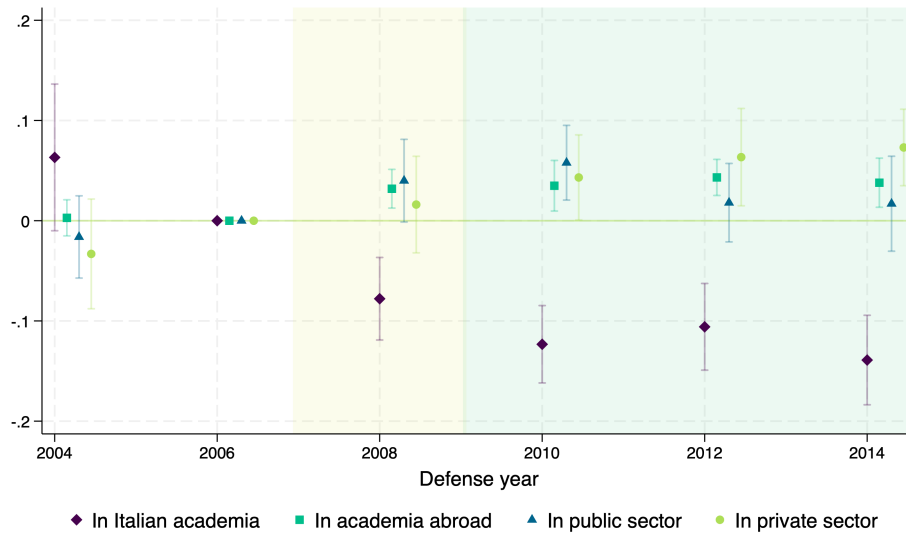
Table A1: Summary Statistics

Panel A: Administrative Data	(1)	(2)	(3)
	Economics	Other Treated Fields	Control Fields
Female	0.50 (0.50)	0.44 (0.50)	0.57 (0.50)
In Italian academia	0.22 (0.42)	0.19 (0.39)	0.10 (0.30)
If in Italian academia: years after defense	4.06 (3.39)	5.31 (3.58)	5.10 (4.04)
If in Italian academia: same univ. as the PhD	0.43 (0.50)	0.47 (0.50)	0.71 (0.45)
Observations	6387	6716	31473
Panel B: ISTAT Survey Data	(1)	(2)	(3)
	Economics	Other Treated Fields	Control Fields
Female	0.50 (0.50)	0.45 (0.50)	0.57 (0.49)
Years between master and PhD	5.97 (2.42)	5.62 (2.28)	6.48 (2.77)
Public PhD scholarship	0.73 (0.44)	0.73 (0.44)	0.69 (0.46)
Father education: primary	0.30 (0.46)	0.31 (0.46)	0.31 (0.46)
Father education: secondary	0.33 (0.47)	0.36 (0.48)	0.34 (0.48)
Father education: tertiary	0.36 (0.48)	0.32 (0.47)	0.33 (0.47)
In a stable relationship	0.50 (0.50)	0.44 (0.50)	0.54 (0.50)
Has children	0.35 (0.48)	0.32 (0.47)	0.44 (0.50)
Employed in Italian academia	0.32 (0.47)	0.30 (0.46)	0.20 (0.40)
Employed in foreign academia	0.08 (0.27)	0.08 (0.27)	0.03 (0.18)
Employed in public sector	0.26 (0.44)	0.29 (0.45)	0.43 (0.49)
Employed in private sector	0.29 (0.46)	0.26 (0.44)	0.28 (0.45)
Import. lack of qual. job for leavers (1-4 scale)	3.52 (0.87)	3.44 (0.93)	3.52 (0.82)
Would do again the PhD	0.64 (0.48)	0.64 (0.48)	0.62 (0.49)
Overall satisfaction with the PhD (0-1 scale)	0.70 (0.21)	0.72 (0.21)	0.69 (0.21)
PhD necessary for the job	0.55 (0.50)	0.52 (0.50)	0.41 (0.49)
Permanent contract 3 years after the PhD	0.42 (0.49)	0.32 (0.47)	0.29 (0.45)
Observations	2483	2835	13504

Figure A1: Reform Effects on Career Choices (alternative specification)



(a) Panel A: Administrative data



(b) Panel B: Survey Data

NOTES. This figure depicts the point estimates and corresponding 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, reports point estimates and confidence intervals from four different regressions in which 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 three to five years after graduation.