Can Affirmative Action Remedy Gender Inequality in Science? Evidence from Early Career Funding

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March 2025

Abstract

We evaluate the impact of a large national affirmative action policy designed to reduce gender inequality in science. The policy extended the maximum age of eligibility for an important early-career grant in China by five years for women while leaving it unchanged for men. This policy significantly increases the share of this grant awarded to women, successfully achieving its immediate goal. This benefit, however, did not lead to improved future career outcomes. Affected women were less likely to secure larger and more prestigious grants, did not publish more papers, and produced fewer last-authored papers and top journal publications. While they were more likely to be promoted to associate professor, their chances of reaching full professorship declined. Furthermore, these effects were concentrated among high-performing female scientists and those at top-tier institutions. Our findings highlight the need for coordinated, multi-faceted policies to remedy persistent gender inequality in science.

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1 Introduction

Women remain significantly underrepresented in many STEM fields, with the gender gap widening at senior levels (Ceci et al., 2014; Huang et al., 2020). This persistent gender disparity stems from many factors, including explicit bias in promotion and evaluation (Sheltzer and Smith, 2014; Van der Lee and Ellemers, 2015; Witteman et al., 2019), unequal recognition for work (Sarsons, 2017; Wiedman, 2020), and the disproportionate burden of caregiving and family responsibilities (Urry, 2015; Kim and Moser, 2025). While some barriers to gender equality have declined over time (Ceci and Williams, 2011; Blau and Kahn, 2017; Card et al., 2023), caregiving responsibilities continue to significantly constrain women's career advancement, particularly for early-career female scientists (Goldin, 2014; Ma et al., 2018).

One approach to addressing this inequality is to compensate women for their greater time spent on household labor by providing more professional opportunities or advantages. For example, policies could explicitly counterbalance gender disparities in family responsibilities by granting women larger funding allocations or preferential consideration in the competition for important career opportunities (European Commission, 2009; Antecol, Bedard and Stearns, 2018; Fernandes et al., 2023). Such policies align with the broader framework of affirmative action, which seeks to expand opportunities for historically disadvantaged or marginalized groups (Fryer Jr and Loury, 2005; Arcidiacono and Lovenheim, 2016; Bleemer, 2022).

In this paper, we study the career impacts of a large national affirmative action policy targeting early-career female scientists in China. To our knowledge, it is the world's largest policy of its kind aimed at reducing gender inequality in STEM fields. Since its inception in 2011, it has affected approximately 0.7 million female scientists.[1] The policy changed the age eligibility for female applicants to the National Natural Science Foundation of China (NSFC) young scientist grant (in Mandarin, *zhongguo ziran kexue jijin weiyuanhui qingnian xiangmu*), the country's most important early-career funding program. In 2011, it extended the maximum age limit for female applicants

[1]This estimate is based on the number of female young scientist grant applicants reported in NSFC annual reports.

from 35 to 40 years while maintaining the limit for men. Its explicit goal was to increase the proportion of grant recipients awarded to female scientists. By expanding early-career funding opportunities for women, the policy directly addresses structural barriers contributing to persistent gender inequality in academic science, where early funding gaps can lead to long-term career divergence (Ceci and Williams, 2011; Goldin, 2021; Krauss, Danús and Sales-Pardo, 2023).

We use a triple-differences research design to estimate the policy effect on key career outcomes for female scientists, including the early-career funding, receipt of larger and more prestigious grants, scientific productivity, and academic promotion. To track these effects, we construct a new dataset linking multiple administrative datasets, covering 52,000 Chinese scientists who were aged 36 to 45 at the time of the policy announcement (i.e., born between 1966 and 1975). Our analysis consists of two comparisons: first, we compare outcomes between eligible (1971-1975 cohorts) and ineligible (1966-1970 cohorts) women, before and after the policy. Second, to account for potential pre-existing trends, we apply the same difference-in-differences method to men, assuming they may exhibit trends similar to those of their female counterparts. Our final estimate is the difference between these two difference-in-difference estimates.

We find that the NSFC affirmative action policy substantially increased the share of young scientist grants awarded to women, successfully achieving its immediate goal. The policy quadrupled the likelihood of women receiving the young scientist grant, marking a major shift in award distribution and even reversing the previously large gender imbalance. Our heterogeneity analysis reveals that high-performing scientists benefit the most, while we find no significant differences in the policy effect across fields with varying female representation or between scientists at high- and lower-tier institutions.

However, this benefit did not translate into long-term career outcomes. First, we estimate a statistically significant negative effect of the policy on treated women's likelihood of winning larger and more prestigious grants from the same agency, ultimately reducing their total research funding. The negative effect is concentrated among high-performing female scientists and those at high-tier institutions. Because the NSFC prohibits people from applying for more than one

grant simultaneously, we attribute this penalty to a displacement effect. While the young scientist grant can be awarded only once, other larger grants have no age limit and can be awarded multiple times. As a result, this displacement effect may have substantial long-term consequences for female scientists' career trajectories.

Second, regarding scientific output in academic journals, we find a small negative effect of the policy on the total number of publications for female scientists. However, while the policy increased their first-authored publications, it reduced their last-authored publications and top publications. These patterns suggest that female scientists took on more junior roles after the policy, potentially hindering their career progression.

Finally, we find that the policy did not reduce gender inequality in senior academic roles. While it increased the likelihood of promotion to associate professor, it reduced the likelihood of promotion to full professor for female scientists in the ten years following its introduction. Consistent with our findings on grants, the effects on academic promotion are concentrated on higher-performing female scientists and those at high-tier institutions. Overall, our results suggest that the policy had unintended negative consequences on women's long-term career progression.

Our study makes three key contributions. First, we contribute to the debate on the effectiveness of policies designed to increase women's underrepresentation in science, particularly in senior roles. Previous studies have evaluated gender quotas for scientific committees (European Commission, 2009; Bagues, Sylos-Labini and Zinovyeva, 2017), preferential funding or promotion for female scientists (European Commission, 2009; Fernandes et al., 2023), mentoring programs (Blau et al., 2010; Delgado and Murray, 2023), and extended parental leave (Antecol, Bedard and Stearns, 2018). However, these studies often rely on small-scale evaluations and yield mixed evidence on their effectiveness. In this paper, we evaluate a national affirmative action policy that provides additional funding opportunities exclusively to early-career women, affecting 0.7 million female scientists in China—the world's producer of scientific research (Wagner, Zhang and Leydesdorff, 2022). We find that while this policy successfully expanded early-career funding access to women, it did not translate into improved future career outcomes, including scientific

publications and academic promotion.

Second, we show how policy design can produce unintended consequences in efforts to address gender inequality in the labor market. Our findings suggest that the policy of directly targeting women's demands may not be insufficient to remedy the persistent gender inequality at the senior levels in STEM fields. Such policies may interact with competitive forces in unintended ways—potentially limiting access to other competitive resources (larger and more prestigious grants in our setting) or altering the productivity of male peers (Antecol, Bedard and Stearns, 2018)—ultimately resulting in negative career consequences for women. These results highlight the need for coordinated, multi-faceted policies to support women's career advancement.

Finally, we provide causal evidence on how early-career funding opportunities shape long-term career advancement. While previous studies (Ley and Hamilton, 2008; Sege, Nykiel-Bub and Selk, 2015; Beaudry and Larivière, 2016) have documented correlations between research funding and career development, causal evidence remains limited. Leveraging a unique natural experiment, we show a large-scale funding initiative influenced long-term outcomes for female scientists, offering new insights into the role of early-career financial support in shaping academic careers.

The rest of our paper proceeds as follows. Section 2 provides an overview of gender inequality in science, the context in China, and the affirmative action policy we study. Section 3 introduces the main datasets used in our analyses. Section 4 presents our research design, followed by Section 5, which presents our empirical results. Section 6 discusses the implications of our findings, and the final section concludes.

2 Background

In this section, we discuss gender inequality in science, both globally and in China, the context of our study. We then describe China's national research funding system ("NSFC") and the affirmative action policy under study.

2.1 Gender inequality in science

Despite many initiatives and policies aimed at promoting gender equality, disparities persist in science. While women now comprise a substantial share of undergraduate and graduate students in many STEM fields, they remain underrepresented in faculty positions throughout the world, particularly at senior ranks (Ceci and Williams, 2011; Larivière et al., 2013; Antecol, Bedard and Stearns, 2018; Kim and Moser, 2025). Beyond representation, women also lag behind in securing scientific funding, publishing in academic journals, and receiving citations, further reinforcing their marginalization in the scientific community (Lerchenmueller and Sorenson, 2018; Huang et al., 2020).

Several factors contribute to the persistence of gender inequality in science. Goldin (2021) and Kim and Moser (2025) document that female scientists face disproportionate childcare and family responsibilities, which can limit their time and flexibility for research activities and ultimately harm their career advancement. Additionally, gender bias in hiring and funding decisions, particularly in the early stages of a female scientist's career, create barriers that contribute to the leaky pipeline in science (Sheltzer and Smith, 2014; Van der Lee and Ellemers, 2015). These disadvantages tend to compound over time due to cumulative disadvantage mechanisms such as the Matthew effect, where early-career setbacks reduce future success and advancement (Merton, 1968; Bol, de Vaan and van de Rijt, 2018).

In the People's Republic of China, the focus of our study, the government has promoted gender equality in the labor market since its founding in 1949. These efforts aimed to counter deeply rooted cultural norms that historically favored men (Zheng, 2016; Edwards, 2020). Despite government efforts, gender disparities in Chinese science persist, particularly at senior levels (Ma et al., 2018). As in many other countries (Ceci et al., 2014; Bagues, Sylos-Labini and Zinovyeva, 2017; Lundberg and Stearns, 2019), Chinese women are more likely than men to earn undergraduate degrees and comprise nearly 40 percent of PhD students (Ma et al., 2018). However, their representation declines sharply in academia, with women comprising only about one-third of STEM faculty. This gender gap widens at higher academic ranks, with women holding a disproportion-

ately small share of the most prestigious positions. In 2019, female scientists accounted for only six percent of members of the Chinese Academy of Science and five percent of members of the Chinese Academy of Engineering.

2.2 Scientific funding from the NSFC

Our empirical analysis focuses on research funding from the National Natural Science Foundation of China (NSFC). Established in 1986, the NSFC supports basic research and fosters the development of talented scientists through a rigorous merit-review system. It is China's largest sponsor of basic science research and serves a role similar to that of the U.S. National Science Foundation (NSF).[2] In recent years, the NSFC has become the world's largest research funding agency in terms of applications received: in 2019, the NSFC received about 230,000 applications—more than three times the combined total of the NSF and the National Institutes of Health (NIH).[3]

Both the supply of and demand for NSFC grants have grown substantially over time. The foundation's budget expanded from about 10 million US dollars in 1986 to around $5.4 billion in 2022, reflecting a significant increase in research investment. However, competition for funding has become more intense. Despite the substantial rise in available funds, the success rate for grant applications has decreased from over 20 percent to 17 percent in the past two decades, underscoring the persistent selectivity of the funding process.[4]

The NSFC has two flagship funding mechanisms—the young scientist grant and the general grant. The two programs account for more than 80% of the NSFC's total funding, but differ in several key aspects. First, the young scientist grant is designed to support early-career scientists and imposes an age limit on applicants, whereas the general grant is open to scientists of all ages. Second, while a scientist can, at most, receive one young scientist grant in their career, there is no limit on the number of general grants awarded to a scientist. Third, the average funding amount of a general grant is more than twice that of a young scientist grant. These distinctions highlight the

[2]

[3]Sources: http://www.scio.gov.cn/xwfbh/xwbfbh/wqfbh/35861/37047/, https://nexus.od.nih.gov/all/2019/03/13/nih-annual-snapshot-fy-2018-by-the-numbers/, https://www.nsf.gov/about/how. Accessed December 30, 2021.

[4]Source: https://www.nsfc.gov.cn/publish/portal0/ndbg/2022ndbg/02/.

differing objectives of the two programs—the young scientist grant serves as a stepping stone for young scientists, while the general grant provides sustained support for scientists throughout their careers.

2.3 The affirmative action policy

In 2010, the Central Committee of the Communist Party of China and the State Council jointly issued a directive advocating for policies to reduce gender inequality in professional workplaces (Ma et al., 2018). In response, the National Natural Science Foundation of China (NSFC) implemented a policy in 2011 that extended the maximum age of eligibility for female applicants to the young scientist grant from 35 to 40 years old, while maintaining the age limit for male applicants at 35.

The policy explicitly states that its goal is to help compensate for the gender imbalance in the time women typically devote to childcare and family responsibilities responsibilities. By targeting women early in their careers, it has the potential to generate a virtuous cycle, echoing the "Matthew effect." Furthermore, by providing additional flexibility in the timing of when women can apply for this important grant—given that previous age eligibility requirements coincide with periods of heightened caregiving demands—it was seen as a promising solution to address a key driver to gender inequality in science and other white-collar professions (Bertrand, Goldin and Katz, 2010; Blau and Kahn, 2017; Lindsey, 2020). As such, this policy stands out as one of the few designed to address this root cause of gender inequality in these fields (Ceci and Williams, 2011; Antecol, Bedard and Stearns, 2018). To the best of our knowledge, it is the only policy of its kind implemented at the national level, covering all young female scientists in China.

In Figure 1 we plot the proportion of NSFC young scientist grants and general grants awarded to females over time. Before 2000, females received less than 20 percent of young scientist grants. Since then, this proportion has risen gradually, reaching 32.7 percent by 2010.[5] In 2011, the first year of the affirmative action policy, the proportion of young scientist grants awarded to females

[5]Note that there was a slight dip in female share of general grant awardees in 2011, as many female scientists aged 36 to 40 became newly eligible for the NSFC young scientist grant following the announcement of the affirmative action policy and scientists cannot apply for the two grants in the same year.

Figure 1. Proportion of female awardees in the two main NSFC grants

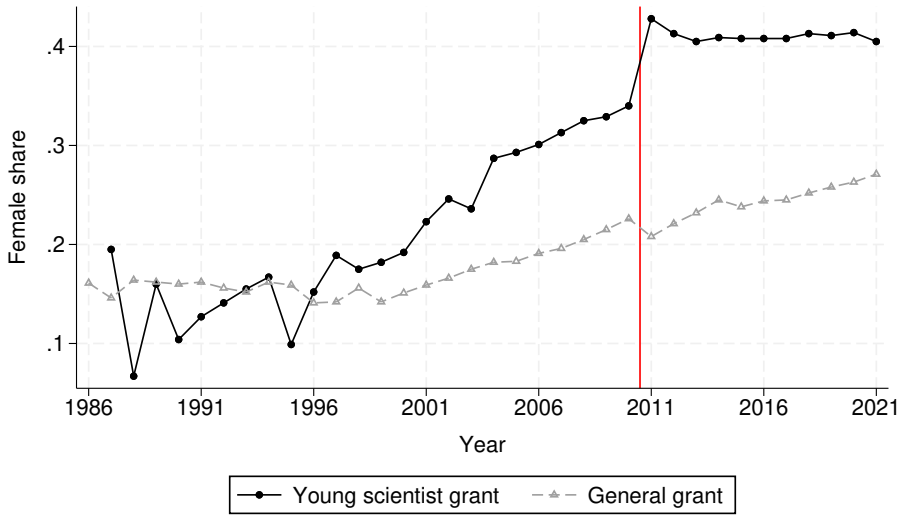


Figure 1 notes: this figure shows the proportion of the youth scientist and general grants awarded to women each year. These data come from the Annual Reports of the National Natural Science Foundation of China. The running variable is time, and the vertical line indicates the beginning of the affirmative policy we study.

rose to 42.8 percent, and has since remained stable. In contrast, the proportion of NSFC general grants awarded to females was also relatively low before 2000 (less than 15 percent), and it rose more gradually between 2000 and 2010 to roughly 22 percent, where it has remained stable over the past decade.

3 Data

We construct three primary datasets for this study: one containing demographic information and promotion histories of Chinese scientists, another recording NSFC grants and their recipients, and a third on scientific publications. These datasets are linked using individual names and affiliations to study the impact of the NSFC affirmative action policy on scientists' funding, publications, and career advancement.

3.1 Scientists

Our primary dataset on scientists comes from the CNKI (*China National Knowledge Infrastructure*) scholar database, which is supplemented by administrative data on NSFC grant awardees and

participants.

CNKI scholar dataset: The *China National Knowledge Infrastructure* (CNKI, `https://navi.cnki.net/knavi/journals/index`) is a comprehensive full-text database that covers more than 90% of all Chinese-language academic journals. A distinct feature of the CNKI is its practice of requiring journals to provide detailed author information on the first page of each article. This includes the author's name, gender, birth year, home institution, and academic rank as of the publication year. For this study, we focus on journals indexed by the *Chinese Science Citation Database* (CSCD), which includes all high-quality science journals in China.[6] As a whole, we extracted information on 461,803 scientists from 2,285 Chinese universities and research institutions.[7]

NSFC grant awardees and participants: Our second scientist data source comes from administrative NSFC records, which include all NSFC grant awardees and participants. We scraped the data from the NSFC's official website (`https://kd.nsfc.cn/`) between May and September 2021. The dataset includes information on 644,180 scientists affiliated with 2,415 Chinese universities and research institutions. It provides information on each scientist' name, home institution, and academic rank at the time of their application. We supplement the CNKI scholar dataset with the academic rank information of this dataset, matching records between the two datasets based on scientists' names and institutions.[8]

For each scientist in our data, we collected demographic and career information, including name, gender, year of birth, academic field, academic rank, career history, and institution. We restrict our main analysis sample to scientists born between 1966 and 1975, creating a ten-year birth cohort window centered around the policy announcement. This ensures that we are comparing scientists of roughly similar ages, who are facing comparable incentives for promotion and career

[6]We focus on the 375 journals with detailed author information, accounting for 43% of all indexed journals. These selected journals have longer histories and higher impact factors, suggesting they are among the highest-quality science journals in China.

[7]We scraped the information in March and April 2022.

[8]To facilitate subsequent data integration, we exclude observations with the same names and from the same institution. The excluded observations account for only 2.56% of the total.

advancement.[9] With this birth-year restriction, our analysis sample comprises 52,562 scientists, of which 31.8 percent are female.[10]

3.2 NSFC grants

Our second main data source is administrative data from the NSFC on grants awarded between 1986 and 2021. This dataset contains information on grant types, funding amounts, scientific fields, and awardees' names and institutions. We match the grants data to our scientist sample based on scientists' names and institutions. The matched dataset accounts for 20 percent of all NSFC young scientist grants and 29 percent of all NSFC general grants.[11]

Figure 2 presents the average number of the two main NSFC grants awarded to scientists, broken down by gender and cohort. Panel A indicates that female cohorts affected by the affirmative action policy (i.e., those born in 1971 or later) have a much higher chance of receiving a young scientist grant compared to older cohorts.[12] In contrast, Panel B suggests that the policy-affected female cohorts do not appear to benefit in terms of receiving general grants.

3.3 Scientific publications

We collect records on scientists' publications from the abstract and citation database *Scopus*. Scopus is the world's largest abstract and citation database of peer-reviewed literature and has the following two unique features: First, it provides much greater scope and access to Chinese-language journals than other such services, such as *Web of Science*. Second, it uses an algorithm based on authors' names, affiliations, and email addresses to create a unique author identification number for each scientist.

We use the Scopus Application Programming Interface (API) to extract information about the

[9] The 1971 cohort is the first cohort affected by the policy.

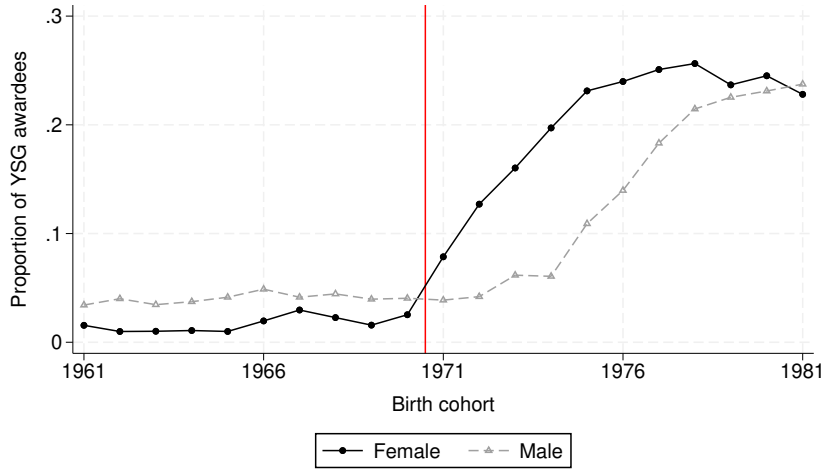
[10] As shown in the first two columns of Table A1, the field and institution distributions in our main analysis sample are comparable to those in the overall CNKI scholar dataset.

[11] As shown in the third and fourth columns of Table A1, the field and institution distributions for young scientist grant awardees are comparable across all awardees and those in the CNKI scholar dataset, except that grant awardees in the CNKI scholar sample are more likely to have an engineering background and less likely to come from the medical science field.

[12] Female scientists in our main analysis sample received 26.6% of all NSFC young scientist grants in the first year of policy implementation.

Figure 2. Receipt of NSFC grants by gender and cohorts

(A) Young scientist grant



(B) General grant

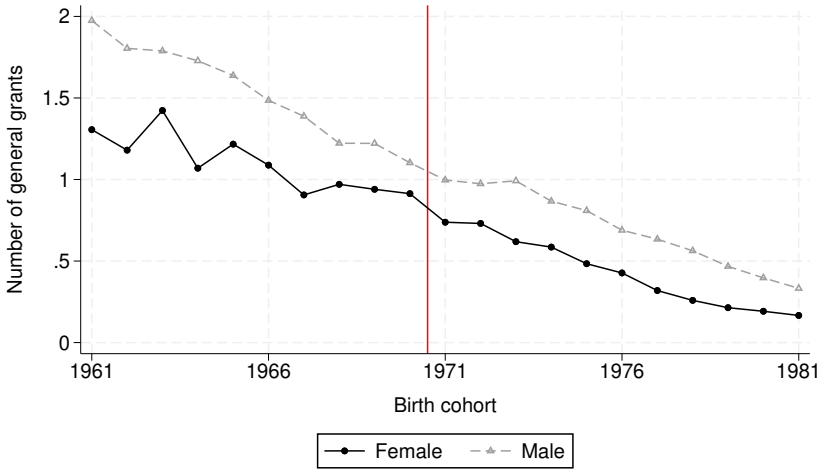


Figure 2 notes: this figure shows the average number of young scientist grants and general grants that scientists in our sample have been awarded at the end of our study period, by gender and birth cohort.

scholarly publications of the scientists in our data. These include the names and affiliations of all authors of a given paper, the order of appearance of these authors' names, the year of publication, and the name and impact factor of the journal in which the article was published.[13] We successfully linked 72% of the scientists in our data to publication records in Scopus.[14]

We construct five key variables to measure the quantity and quality of a scientist's output: (1) the total number of peer-reviewed journal articles published in a given year, (2) the number of first-authored journal articles in a given year, (3) the number of last-authored journal articles in a given year, (4) the number of "top journal articles" in a given year, defined as articles published in top 25% of journals indexed by Scopus, ranked by impact factor within the field, and (5) the number of citations to the scientist's work in a given year.

3.4 Summary statistics

We provide summary statistics by cohort and gender in Table 1. As shown in the first three columns, the distributions of academic fields and types of home institutions are similar for both younger and older female cohorts. However, younger female cohorts are less likely to hold associate or full professorship, are more likely to receive early-career grants but fewer later-stage general grants, and are less likely to publish in the Scopus-indexed journals. These patterns are also observed among male scientists (as indicated in the last three columns), though the differences are marginally significant in fields and types of home institutions. Overall, the summary statistics suggest that older cohorts hold more senior positions and publish more than younger cohorts, with similar patterns for both women and men.

4 Research Design

The main goal of our empirical analysis is to assess the impact of the affirmative action policy on cohorts of female scientists who, due to their age, were affected by the policy. In this section, we describe how we implement a triple-differences approach to estimate this effect using a quasi-

[13] We access the Scopus API using the "pybliometrics" package developed by Rose and Kitchin (2019).

[14] Among the scientists who could not be matched to a Scopus profile, many work primarily in the fields of economics, management, or medicine, or are affiliated with government-based research institutions.

Table 1. Summary statistics

	Female			Male		
	Younger (1)	Older (2)	Diff. (1)-(2)	Younger (3)	Older (4)	Diff. (3)-(4)
Field						
Math&Physics	0.061	0.059	0.002	0.082	0.086	-0.004
Chemistry	0.074	0.087	-0.013***	0.063	0.071	-0.008***
Life Science	0.156	0.161	-0.005	0.104	0.122	-0.018***
Earth	0.096	0.098	-0.001	0.100	0.112	-0.012***
Engineering	0.242	0.231	0.010	0.343	0.323	0.020***
Computer Science	0.099	0.099	0.000	0.158	0.141	0.017***
Economics&Management	0.053	0.054	-0.000	0.056	0.051	0.005**
Medicine	0.219	0.211	0.008	0.095	0.094	0.001
Home institution						
Elite univ.	0.221	0.229	-0.008	0.285	0.272	0.014***
Key univ.	0.180	0.177	0.003	0.179	0.187	-0.008**
Other univ.	0.440	0.428	0.012	0.374	0.369	0.005
CAS	0.028	0.025	0.003	0.050	0.050	0.000
Other institutions	0.131	0.140	-0.009	0.112	0.123	-0.010***
Pre-policy characteristics						
Associate professor	0.185	0.288	-0.103***	0.203	0.260	-0.057***
Full professor	0.017	0.100	-0.083***	0.036	0.178	-0.142***
Early-career grant	0.042	0.012	0.029***	0.061	0.022	0.039***
Number of general grants	0.044	0.100	-0.055***	0.073	0.175	-0.102***
Having top pubs	0.148	0.156	-0.009	0.174	0.201	-0.026***
Having pubs	0.375	0.401	-0.026***	0.413	0.453	-0.040***
N	9979	6050		20191	14217	

Table 1 notes: this table compares distributions across fields and types of home institutions, academic ranks, awarded grants, and publications by cohort and gender. The younger cohorts consist of individuals born between 1971 and 1975, while the older cohorts are those born between 1966 and 1970. The first three columns focus on female scientists, while the last three columns focus on male scientists. "Elite univ." are China's top-tier 985-project universities which include 39 prestigious schools like Peking University and Tsinghua University. "Key univ.'' are a group of 211-project key Chinese universities, including 77 institutions that are second only to 985-project universities in prestige. The Chinese Academy of Sciences (CAS) is China's premier national research institution with more than 100 affiliated institutes and laboratories.

experimental design.

4.1 Treatment status

We determine treatment status—whether an individual benefited from the extra eligibility for the young scientist grant under the affirmative action policy—based on their birth year, their gender, and the policy's implementation date. The policy was announced in December 2010 and came into effect in 2011. Starting that year, it extended the maximum age for women to apply for the young scientist grant from 35 to 40. As a result, women aged between 36 and 40 in 2011 — those born between 1971 and 1975 -– suddenly became newly eligible for the grant, as long as they had not turned 41 by January 1st of the following year. Women younger than this benefited from the full five additional years of eligibility. We classify all women in our sample born in 1971 or later as treated by the policy.

4.2 Implementation

To estimate the effect of the affirmative action policy, we use a triple-differences strategy (Gruber, 1994). The first difference is by cohort: women born in 1971 or later gained at least one year of additional eligibility under the policy, which allowed women aged 40 or younger to apply for the young scientist grant starting in 2011. The second difference is by year, with only years from 2011 onward being affected by the policy. The third difference is based on gender, as the policy applied exclusively to women.

This empirical strategy involves two sets of comparisons. First, we compare outcomes between eligible ("younger") and ineligible ("older") women, as defined by their birth date, both before and after the policy implementation. This difference-in-differences approach, however, may be biased if the younger and older cohorts display differential pre-policy trends in outcomes such as grant receipt. To mitigate this potential bias, we apply the same difference-in-differences method to men, assuming they may exhibit trends similar to those of their female counterparts. Our final estimate is the difference between the two sets of difference-in-difference estimates, which likely provides an unbiased measure of the policy effect.

To implement this approach, we specify the following estimating equation:

$$y_{itg} = \beta_0 + \beta_1 T_i P_t F_g + \beta_2 T_i P_t + \beta_3 P_t F_g + \gamma_i + \theta_t + \varepsilon_{itg} \tag{1}$$

In this equation, the variable y_{itg} represents the outcome for individual i of gender g, observed in year t. Our outcome variables include annual measures of grant receipt (by type), various measures of scholarly output, and measures of academic promotion.[15] The indicator variable T_i takes the value of 1 if the individual was born in or after 1971, and 0 otherwise. The indicator variable P_t is 1 if the observation pertains to a year 2011 or later, and 0 otherwise. The indicator variable F_g is 1 if the observation is for a female scientist, and 0 for a male scientist. The fixed effects γ_i and θ_t capture individual- and year-specific fixed effects. This equation estimates β_1, the overall triple-differences estimand of the impact of the policy.

We also estimate a related set of parameters using an event-study version of the triple-differences approach. The corresponding estimating equation is

$$y_{itg} = \delta_0 + \sum_{\tau=-10}^{10} \alpha^{\tau}(T_i F_g \tau_{it}) + \sum_{\tau=-10}^{10} (\delta_1^{\tau} T_i \tau_{it} + \delta_2^{\tau} F_g \tau_{it}) + \gamma_i + \theta_t + \varepsilon_{itg} \tag{2}$$

4.3 Assessing the identification assumption

As discussed by Olden and Møen (2022), the triple-differences estimator does not rely on the parallel trends assumption for two separate difference-in-differences specifications. Instead, it requires that the two difference-in-differences specifications have the same bias. In our setting, this means that the relative outcomes of younger female cohorts (born in 1971 or later) versus older female cohorts (born before 1971) follow the same trend as the relative outcomes of younger male cohorts versus older male cohorts in the absence of the NSFC affirmative action policy. To assess this assumption, we use event-study results from Section 5 as a visual check of the parallel trends assumption, which is critical for our identification strategy.

To provide further transparency, we also provide difference-in-differences event-study results

[15] Because scholarly output measures are positive and have many zero values, we use a Poisson regression instead (Chen and Roth, 2024).

separately for women and men. As Figure A2 shows, the pre-policy trends in grant receipt for younger and older cohorts are parallel for both women (the target group of the affirmative action policy) and men (who are not subject to the policy). This suggests an absence of pre-trends that could bias our triple-differences estimates. After the policy, we observe a sharp increase in the likelihood of receiving a young scientist grant for women, but no such change for men. In contrast, the likelihood of receiving a general grant decreases sharply for women post-policy, while it steadily increasesfor men.

Contemporaneous policy shocks to grant receipt: The NSFC introduced three other policies around the same time as the 2011 affirmative action policy, which could potentially confound our main estimates. First, in 2010, the NSFC recommended giving priority to female grant applicants, though this recommendation was not mandatory (Zhao, Ma and Miao, 2016; Yu and Gao, 2023). However, since this gender-specific policy likely affects both younger and older female cohorts similarly, its impact cancels out in our triple-differences estimation. Second, beginning in 2011, the NSFC gradually increased the proportion of female panel experts deciding on final grant applications. But this change was slow, with female share rising from 9% in 2010 to just 13% in 2021 (Yu and Gao, 2023). Moreover, because this gender-specific policy applies equally to younger and older female cohorts, it is unlikely to affect our estimates. Third, during the 2010-2012 period, the NSFC substantially expanded its funding (Hu, 2020), as shown in Figure A1. If older cohorts benefited more from the funding expansion due to their greater research skills or experience, the comparison between younger and older cohorts could be biased. This potential bias, however, is mitigated by including a parallel difference-in-differences estimate for men, who were also exposed to the funding expansion.

5 Results

In this section, we present our main empirical results. We begin by estimating the NSFC affirmative action policy's impact on its primary target—receipt of the young scientist grant. We then examine its effects on other career outcomes, including receipt of the NSFC's general grant, the quantity

Figure 3. Impact of the policy on receipt of the young scientist grant - event study

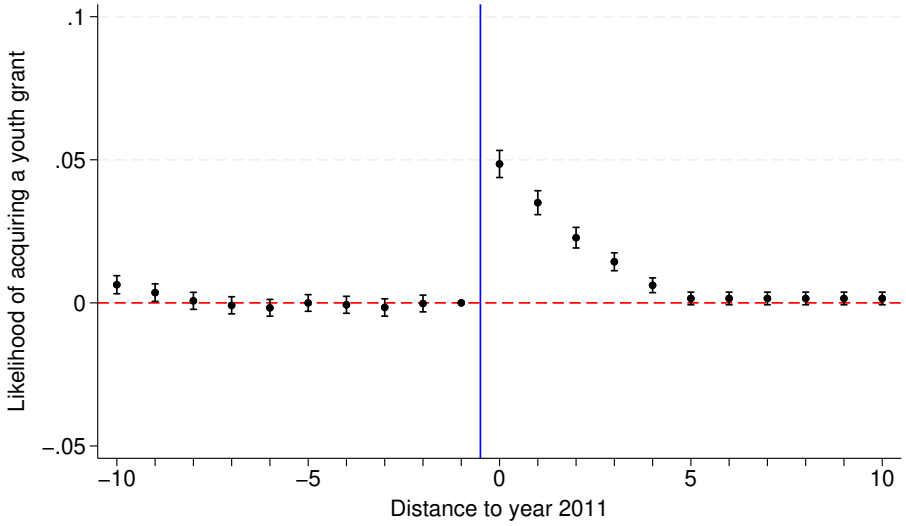


Figure 3 notes: this figure presents our estimates of α^{τ} from equation 2 along with 95% confidence intervals. The outcome variable is a binary indicator at the scientist-year level, equal to one if the scientist received the young scientist grant in that year. The running variable represents the number of years relative to 2011, the first year the policy was in effect.

and quality of peer-reviewed publications, and academic promotions.

5.1 Impacts on receipt of young scientist grants

We present our estimates of the policy's effect on female scientists' likelihood of receiving the young scientist grant. We first present our main results in both event study and tabular form. We then discuss robustness checks, followed by an analysis of heterogeneity across fields, institutions, and scientists' pre-policy productivity.

Figure 3 presents the event study results for the full sample (cohorts born between 1966 and 1975), revealing two key patterns. First, there is no evidence of differential trends between groups in the pre-policy period. Second, we observe an immediate increase in the outcome variable following the policy's implementation, with the largest increase in the year after the policy's announcement. This effect decays over time as more cohorts of female scientists age out of eligibility for the young scientist grant.

These results remain robust to the following sample restrictions: (1) scientists who appear in both the CNKI scholar dataset and the administrative NSFC grant awardee/participant dataset, and (2) a narrower group of birth cohorts for better comparability. As shown in both Figure A3 and Figure A4, we observe similar patterns: no differences in trends between groups before the policy, a sharp increase when younger women become eligible, and then a return to no detectable differences once they are no longer eligible for applying for the young scientist grant.

Next, we explore heterogeneity in these patterns by field, institution, and individual productivity. First, we examine field heterogeneity in terms of women's representation. As shown in panel (a), we find no significant differences in the policy effect between fields with higher female representation and those with lower female representation.[16]

Second, we examine heterogeneity by prior individual productivity. Specifically, we generate separate estimates for individuals with and without Scopus publications prior to 2011.[17] As shown in panel (b), high-performing scientists (i.e. those with top publications) are more likely to benefit from the policy than their lower-performing counterparts.

Finally, we examine heterogeneity by institution rank in panel (c). We adopt a similar approach here, generating separate estimates for scientists at high-tier institutions, which we define as those recognized by the Chinese government's "Project 985" or "Project 211", as compared to scientists at lower-tier institutions. Overall, we observe little difference in the outcomes across these groups.

Table 2 presents the triple-differences results corresponding to the above event study findings. Column (1) reports the overall effect, analogous to the results in Figure 3, showing a large positive impact of the policy on receipt of the young scientist grant. Compared to the baseline likelihood, the policy increased the likelihood of receiving the grant fourfold. Columns (2) and (3) examine heterogeneity by the field's female representation, mirroring the findings in panel (a) of

[16]Female scientists are more representative in chemistry, life science, and medicine compared to math-intensive fields such as math, physics, geoscience, engineering, and computer science (Ceci and Williams, 2011; Stockard, Rohlfing and Richmond, 2021).

[17]As defined in Section 3, "top publications" are journal articles published in the top 25% of journals covered by Scopus, ranked by impact factor within the field.

Figure 4. Heterogeneity in the policy effect on receipt of the young scientist grant

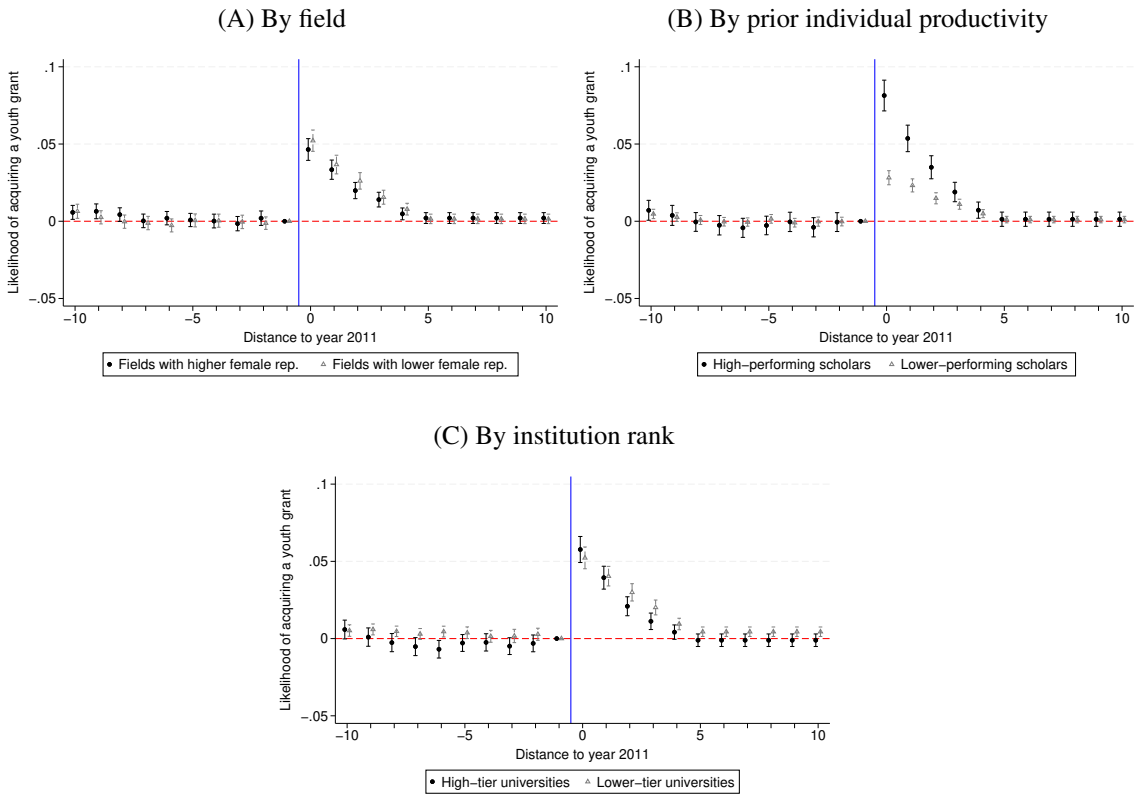


Figure 4 notes: this figure presents estimates of α^{τ} from equation 2, along with 95% confidence intervals. The outcome variable is a binary indicator at the scientist-year level, equal to one if the scientist received the young scientist grant in that year. The running variable represents the number of years relative to 2011, the first year the policy was in effect. Panel (a) presents estimates separately for scientists in fields with higher female representation (i.e., chemistry, life science, and medicine) and those in fields with lower female representation (i.e., math, physics, geoscience, engineering, and computer science). Panel (b) presents estimates separately for scientists with and without Scopus publications prior to 2011, the year when the NSFC affirmative action policy was introduced. Panel (c) presents estimates separately for scientists at high-tier universities (i.e. those recognized by the Chinese government's "Project 985" or "Project 211") and those at lower-tier universities.

Table 2. Impact of the policy on receipt of the young scientist grant

	Full sample	Fields with female rep.		Scientists' productivity		Universities	
		Higher	Lower	Higher	Lower	High-tier	Lower-tier
β_1: policy effect	0.012***	0.010***	0.013***	0.019***	0.007***	0.014***	0.013***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Outcome mean	0.0030	0.0027	0.0032	0.0047	0.0018	0.0042	0.0024
N	1,059,177	344,841	645,393	440,181	618,996	469,119	415,338

Table 2 notes: this table presents estimates of β_1 from equation 1. The outcome variable is a binary indicator at the scientist-year level, equal to one if the scientist received the young scientist grant in that year. Column (1) presents estimates from the full sample. Columns (2) and (3) provide separate estimates for scientists in fields with higher versus lower female representation. Columns (4) and (5) present separate estimates for high-performing and lower-performing scientists, classified based on their pre-policy publication records. Columns (6) and (7) present separate estimates for scientists at high-tier vs. lower-tier universities. *** < 0.01, ** < 0.05, * < 0.1.

Figure 4. Consistent with the event study results, we find no significant differences in the policy effect across fields with higher versus lower female representation. Columns (4) and (5) present heterogeneity results in terms of scientists' prior productivity, as shown in panel (b) of Figure 4. The policy's benefit for high-performing scholars is nearly three times that for lower-performing scholars. Finally, columns (6) and (7) report heterogeneity results by institution rank, analogous to panel (c) of Figure 4. While the estimates are similar in magnitude across institution types, scientists at lower-tier universities had a much lower pre-policy likelihood of wining the grant. As a result, the NSFC affirmative action policy has a relatively larger impact on female scientists at these universities compared to those at high-tier universities.

Our interpretation of these results is that the policy effectively achieved its goals in the short run. We find large and significant policy effects on the likelihood of newly eligible women receiving the young scientist grant. While we find no significant differences in the policy effect across fields with higher versus lower female representation, we find the policy strongly benefits high-performing female scientists. Across institutions, the policy effect is similar in magnitude for scientists at high-tier and lower-tier universities. However, given the lower baseline likelihood of receving the grant at lower-tier institutions, the policy led to a substantially larger proportional increase for scholars at these institutions.

5.2 Impacts on receipt of subsequent grants from the NSFC

In this subsection, we examine whether this policy affects scientists' likelihood of securing subsequent funding from the NSFC. Our analysis focuses on the general grant, the NSFC's largest grant category and the primary source of support for basic research in China.[18] The general grant differs from the young scientist grant in at least two key ways. First, its average funding amount is more than twice that of the young scientist grant.[19] Second, while a scientist can receive the young scientist grant only once and must apply before reaching an age limit, the general grant imposes no such restrictions on age or the number of times a scientist can receive it.

Figure 5 presents the event study results for the full sample. As in previous analyses, we find no evidence of differential pre-trends in the pre-treatment period. However, following the policy announcement, the likelihood of women receiving a general grant declines significantly by more than two percentage points. This negative effect fades over time, and by year four, women's likelihood of securing a general grant approaches that of men, aligning with the three-year duration of the young scientist grant. The observed "displacement" effect is primarily driven by the NSFC's rule prohibiting scientists from applying for both the young scientist grant and the general grant in the same year.[20]

As in Subsection 5.1, we obtain similar results when restricting the analysis to two alternative samples: scientists recorded in the NSFC system (Figure A5) and the 1970/1971 birth cohorts for better comparability (Figure A6). To further address potential gender-specific pre-trends, we conduct a placebo test, treating the 1966–1970 cohorts as "treated" under the NSFC affirmative action policy and using the 1961-1965 cohorts as the control group. As Figure A7 shows, we find no "policy" effect on receipt of the general grant, suggesting that gender-specific pre-trends are unlikely to bias our main estimates.

[18] Together, the general grant and the young scientist grant constitute more than 80% of the NSFC's total funding.

[19] In 2011, the average funding amount was approximately 600,000 RMB for a general grant, compared to 250,000 for a young scientist grant.

[20] As a result, female scientists who gain additional years of eligibility for the young scientist grant due to the policy also experience a policy-induced period of ineligibility for the general grant. Panel (B) of Figure 2 illustrates a downward level shift for women after 2011.

Figure 5. Impact of the policy on receipt of the general grant

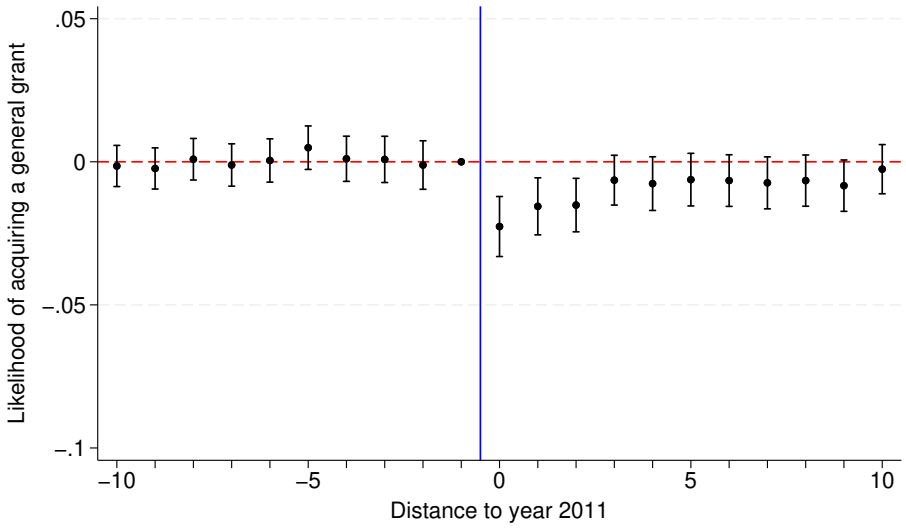


Figure 5 notes: this figure presents estimates of α^{τ} from equation 2, along with 95% confidence intervals. The outcome variable is a binary indicator at the scientist-year level, equal to one if the scientist received the general grant in that year. The running variable represents the number of years relative to 2011, the first year the policy was in effect.

We next explore heterogeneity in the policy effect on general grant receipt by field, individual productivity, and institution, as shown in Figure 4. Consistent with the young scientist grant results, we find no significant differences in the policy effect between fields with higher and lower female representation. While high-performing female scientists and those at high-tier institutions benefit more from the NSFC affirmative action policy in terms of the young scientist grant, they receive fewer general grants accordingly, as shown in panels (b) and (c) of Figure 4.

Table 3 presents the triple-differences results, which align with the corresponding event study findings. To explore whether the policy has a sustained "displacement" effect on general grant receipt, we divide the post-policy period into two phases: the first five years (2011-2015) after the policy announcement and the following five years (2016-2021). As Table A2 shows, the policy continues to have a negative, albeit smaller, effect on general grant receipt even five years after its introduction. This suggests that the NSFC affirmative action policy may have a longer-term negative effect on female scientists' likelihood of securing general grants, potentially hindering

Figure 6. Heterogeneity in the policy effect on receipt of the general grant

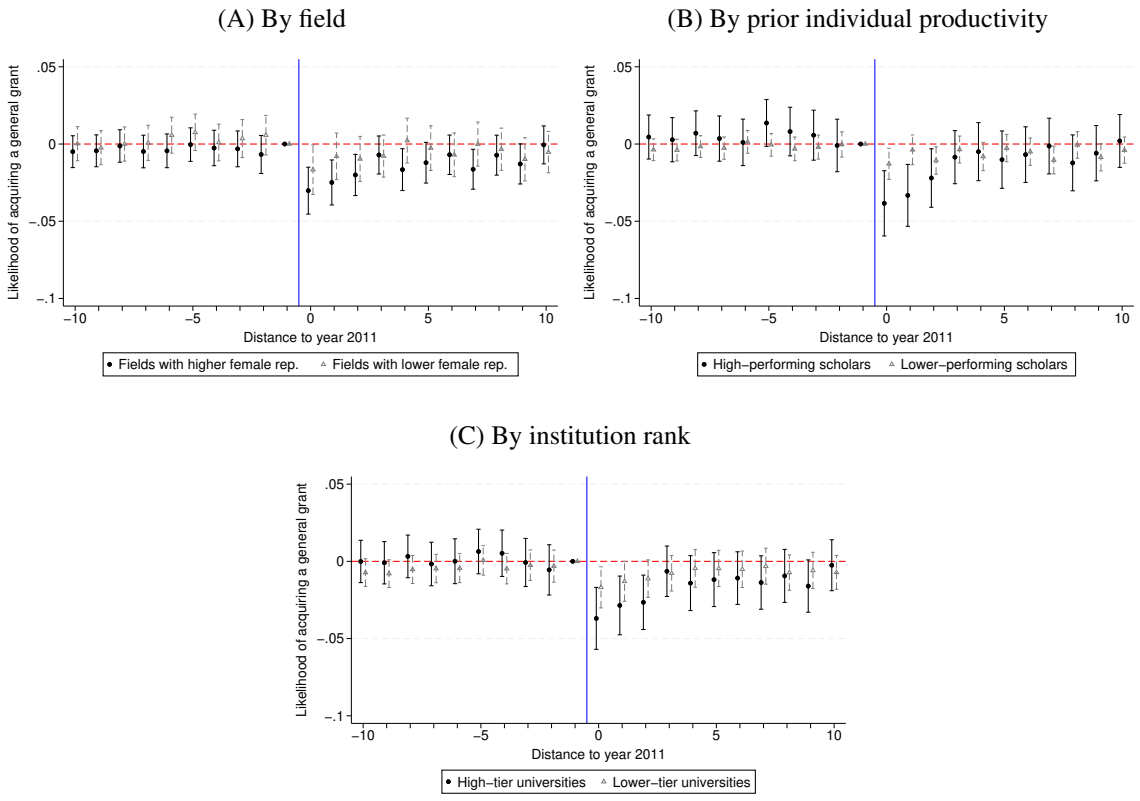


Figure 6 notes: this figure presents estimates of α^{τ} from equation 2, along with 95% confidence intervals. The outcome variable is a binary indicator at the scientist-year level, equal to one if the scientist received the general grant in that year. The running variable represents the number of years relative to 2011, the first year the policy was in effect. Panel (a) presents estimates separately for scientists in fields with higher female representation (i.e., chemistry, life science, and medicine) and those in fields with lower female representation (i.e., math, physics, geoscience, engineering, and computer science). Panel (b) presents estimates separately for scientists with and without Scopus publications prior to 2011, the year when the NSFC affirmative action policy was introduced. Panel (c) presents estimates separately for scientists at high-tier universities (i.e. those recognized by the Chinese government's "Project 985" or "Project 211") and those at lower-tier universities.

Table 3. Impact of the policy on receipt of the general grant

	Full sample	Fields with female rep.		Scientists' productivity		Universities	
		Higher	Lower	Higher	Lower	High-tier	Lower-tier
β_1: policy effect	-0.010***	-0.008***	-0.011***	-0.017***	-0.005***	-0.017***	-0.004***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Outcome mean	0.023	0.020	0.024	0.036	0.013	0.034	0.015
N	1,059,177	344,841	645,393	440,181	618,996	469,119	415,338

Table 3 notes: this table presents estimates of β_1 from equation 1. The outcome variable is a binary indicator at the scientist-year level, equal to one if the scientist received the general grant in that year. Column (1) presents estimates from the full sample. Columns (2) and (3) provide separate estimates for scientists in fields with higher versus lower female representation. Columns (4) and (5) present separate estimates for high-performing and lower-performing scientists, classified based on their pre-policy publication records. Columns (6) and (7) present separate estimates for scientists at high-tier vs. lower-tier universities. *** < 0.01, ** < 0.05, * < 0.1.

their career progression.

Total amount of NSFC funding: To assess the overall policy effect on NSFC funding, we study its effect on the total amount of NSFC funding that scientists receive. As shown in column (1) of Table 4, the policy led to a significant reduction in overall funding, with a decrease of about 17,000 yuan, or 15 percent of the average annual funding.[21] The decline is more pronounced among female scientists in fields with lower female representation (column (3)), higher-performing scientists (column (4)), and those at high-tier institutions (column (6)). In contrast, lower-performing female scientists (column (5)) and those at lower-tier institutions (column (7)) do not experience an overall decrease in funding. These findings suggest that the policy may have unintentionally constrained funding opportunities for highly capable female scientists, potentially hindering their career progression and long-term research productivity.

As a whole, our findings suggest that the policy increased the proportion of female scientists receiving the young scientist grant but at the expense of reducing their chances of securing the more lucrative general grant, ultimately lowering their total funding. These effects are particularly concentrated among higher-performing female scientists and those at high-tier institutions. *

[21] In contrast, as shown in Table A3, the policy does not affect the overall number of grants that scientists receive.

Table 4. Impact of the policy on total amount of funding received annually

	Full sample	Fields with female rep.		Scientists' productivity		Universities	
		Higher	Lower	Higher	Lower	High-tier	Lower-tier
β_1: policy effect	-1.669***	-1.177	-2.219***	-4.479***	-0.048	-4.730***	1.297
	(0.651)	(1.067)	(0.928)	(1.259)	(0.637)	(1.226)	(0.820)
Outcome mean	10.861	9.624	11.777	17.630	6.055	16.076	7.344
N	1,059,177	344,841	645,393	440,181	618,996	469,119	415,338

Table 4 notes: this table presents estimates of β_1 from equation 1. The outcome variable is the total funding a scientist received in a given year, measured in tens of thousands of Chinese yuan (with an average exchange rate over the study period, 10,000 yuan is approximately $1,400). Column (1) presents estimates from the full sample. Columns (2) and (3) provide separate estimates for scientists in fields with higher versus lower female representation. Columns (4) and (5) present separate estimates for high-performing and lower-performing scientists, classified based on their pre-policy publication records. Columns (6) and (7) present separate estimates for scientists at high-tier vs. lower-tier universities. *** < 0.01, ** < 0.05, * < 0.1.

5.3 Impacts on scientific productivity

In this subsection, we examine the impact of the policy on the academic productivity of female scientists. The productivity measures include both the quantity and quality of a scientist's output: (1) the total number of peer-reviewed journal articles published in a given year, (2) the number of first-authored journal articles in a given year, (3) the number of last-authored journal articles in a given year, (4) the number of "top journal articles" in a given year, defined as publications in top 25% of Scopus-indexed journals, ranked by impact factor within the field, and (5) the number of citations received in a given year. The first three measures reflect research quantity, while the last two capture research quality.

Figure 7 presents the estimated policy effects on the quantity of publications. As panel (a) shows, we find no significant policy effect on the total number of journal publications. However, the policy increases female scientists' first-authored publications while reducing their last-authored publications. These findings are consistent with our previous grant results: the NSFC affirmative action policy led to more young scientist grants but fewer general grants for female scientists, suggesting that female scientists are less senior than males after the policy. Except for positive effects on the total number of publications six years before the policy, we find no clear evidence of

Figure 7. Effects of the policy on scientific productivity: Quantity of publications

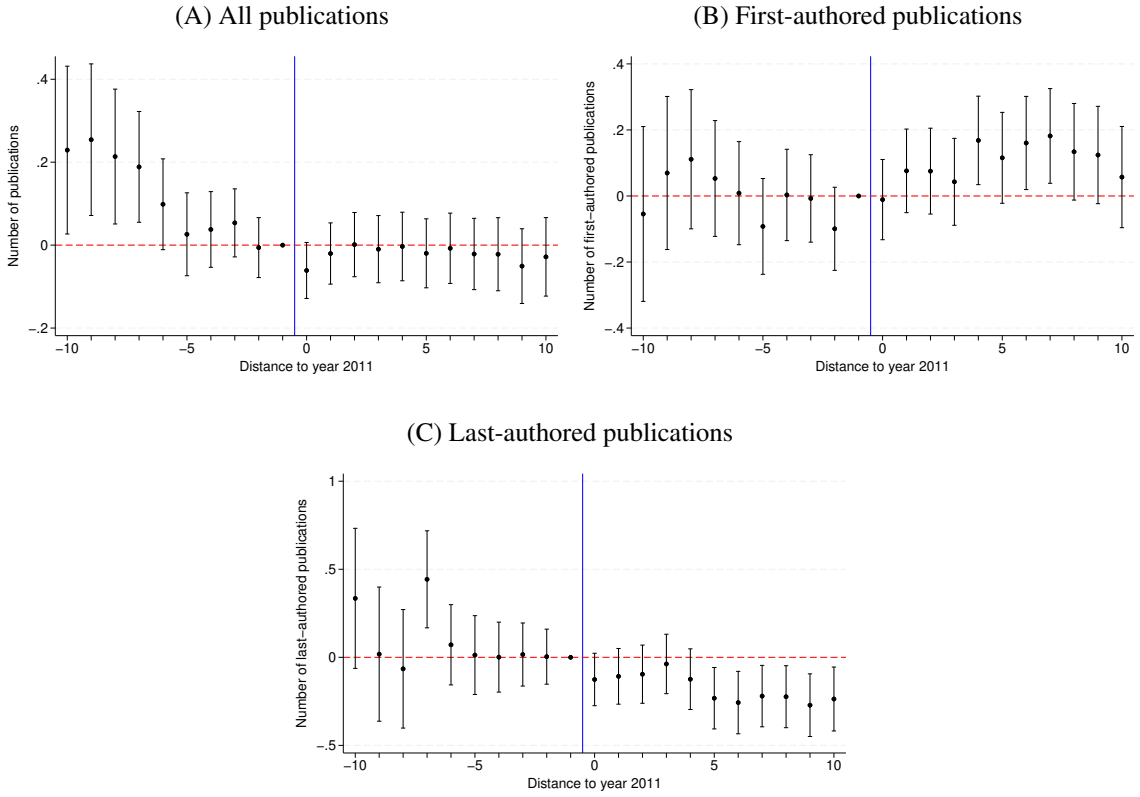


Figure 7 notes: this figure presents estimates of α^{τ} from equation 2, along with 95% confidence intervals. The outcome variables, measured at the scientist-year level, include the total number of peer-reviewed journal articles published in that year(panel (a)), the number of first-authored journal articles (panel (b)), and the number of lasted-authored journal articles (panel (c)). The running variable represents the number of years relative to 2011, the first year the policy was in effect.

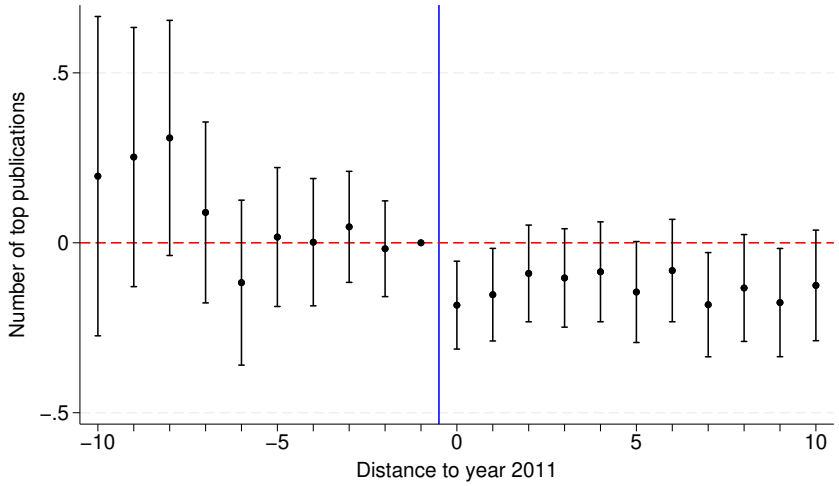
pre-trends in our analyses.

Figure 8 presents the estimated policy effects on the quality of publications. Panel (a) shows that the policy has a negative effect on female scientists' likelihood of publishing in top journals. In contrast, panel (b) shows no significant policy effect on the number of citations received by female scientists. As with previous analyses, we find no clear evidence of pre-trends.

Table 5 presents the triple-differences estimates for scientific productivity, which align with the corresponding event study findings. We find a small negative effect of the NSFC affirmative action policy on the total number of publications for female scientists. However, the policy increased

Figure 8. Effects of the policy on scientific productivity: Quality of publications

(A) Number of top publications



(B) Number of citations

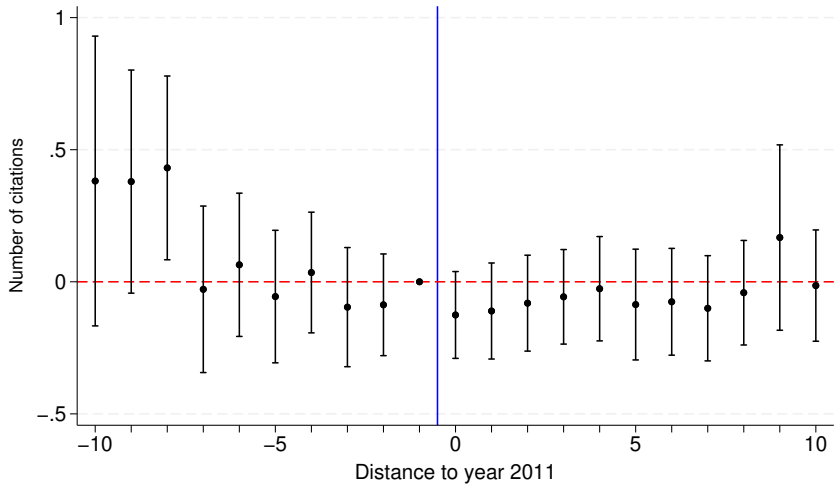


Figure 8 notes: this figure presents estimates of α^{τ} from equation 2, along with 95% confidence intervals. The outcome variables, measured at the scientist-year level, include the number of citations received in that year and the number of journal articles published in "top" journals (panel (b)).

Table 5. Impact of the policy on academic productivity

	No. of publications				No. of citations
	All	First-authored	Last-authored	Top	
β_1: policy effect	-0.087***	0.111***	-0.238***	-0.165***	-0.071
	(0.034)	(0.041)	(0.073)	(0.064)	(0.071)
Outcome mean	1.116	0.219	0.283	0.428	18.757
N	711,396	570,192	536,277	530,229	689,556

Table 5 notes: this table presents estimates of β_1 from equation 1. The outcome variables are the total number of peer-reviewed journal articles published in a given year (column (1)), the number of first-authored journal articles (column (2)), the number of last-authored journal articles (column (3)), the number of top journal articles (column (4)), and the number of received citations (column (5)). *** < 0.01, ** < 0.05, * < 0.1.

female scientists' first-authored publications while reducing their last-authored publications and top publications.[22] These findings suggest that the policy may inadvertently hinder female scientists' career progression.

5.4 Impacts on academic promotion

In this subsection, we estimate the policy effect on the academic promotion of female scientists. Since almost no female scientists from the 1971-1975 cohorts (the policy-targeted group) were promoted to full professor during the 2001-2005 period (six years before the policy) likely due to their young age, we restrict our analysis to promotions occurring from five years before to ten years after the policy.[23] We present the results in Figure A8.[24] We find a positive policy effect on promotion to associate professor but a negative effect on promotion to full professor.[25] This aligns with the policy's immediate impact on young scientist grants—considered as an important

[22]To account for potential estimation bias from pre-trends observed six years before the policy, we limit the analysis to a 15-year period spanning from five years before to ten years after the policy. As Table A4 shows, the patterns remain similar, except that the negative effect on the total number of journal publications is no longer statistically significant.

[23]During the 2001-2005 period, only 0.11% of female scientists from the 1971-1975 cohorts were full professors, and only 3.74% were associate professors.

[24]Results for the full 2001-2021 period are also provided in Figure.

[25]To provide further transparency, we also provide difference-in-differences event-study results separately for women and men. As Figure A9 shows, the pre-policy trends in academic promotion for younger and older cohorts are parallel for both women (the target group of the affirmative action policy) and men (who are not subject to the policy).

Figure 9. Effects of the policy on academic promotion

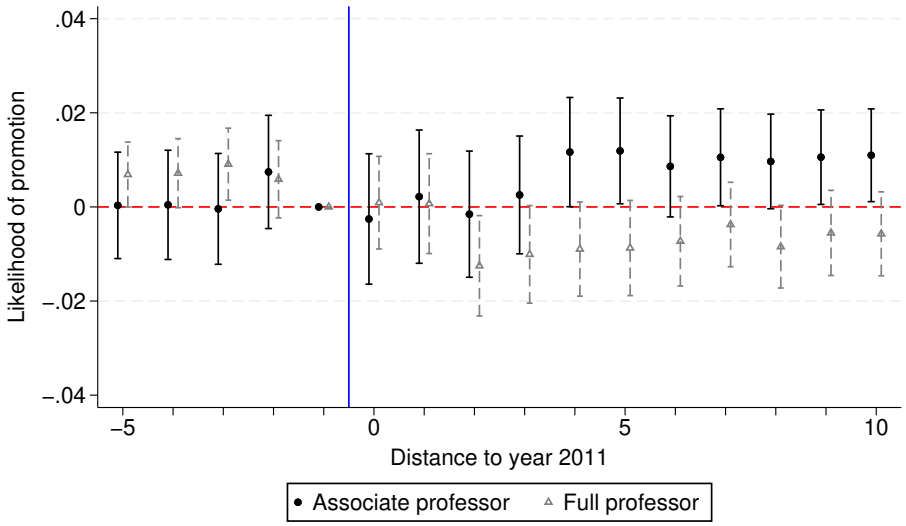


Figure A8 notes: this figure presents estimates of α^{τ} from equation 2, along with 95% confidence intervals. The outcome variables are binary indicators at the scientist-year level, equal to one if the scientist was promoted to associate or full professor in that year. The analysis sample is restricted to the 2006-2021 period.

stepping stone to tenure—as well as its negative effect on general grants, which are more critical for advancing research later in a scientist's career.

We obtain similar results when restricting the analysis to scientists recorded in the NSFC system, as shown in Figure A10. Additionally, we conduct a placebo test, treating the 1966–1970 cohorts as "treated" under the NSFC affirmative action policy and using the 1961-1965 cohorts as the control group. As Figure A11 shows, we find no "policy" effect on promotion to associate professor or full professor, suggesting that gender-specific pre-trends are unlikely to bias our main estimates.

Next, we investigate heterogeneity in the policy effect on academic promotion across fields, levels of individual productivity, and institution tiers, as shown in Figure 4. Consistent with our findings on grant outcomes in Subsections 5.1 and 5.2, we find no significant differences in the policy effect between fields with higher and lower female representation. Panels (c) and (d) show that high-performing female scientists are less likely to be promoted to full professor after the pol-

icy, while we find no significant differences in the policy effect on promotion to associate professor between high-performing and lower-performing scientists. Panels (e) and (f) show that female scientists at high-tier institutions are more likely to be promoted to associate professor, but are less likely to be promoted to full professor after the policy.[26]

We present the tabular analog to these results in Table 6. These estimates align with the visual patterns observed in Figures A8 and 10. Column (1) shows that the policy led to a 13 percent overall increase in the likelihood of promotion to associate professor but a 43 percent overall decrease in the likelihood of promotion to full professor for female scientists. In columns (4) and (6), we find that the policy positively affected promotion to associate professor for high-performing female scientists and those at high-tier universities, while reducing their likelihood of promotion to full professor.

To sum up, our results suggest that the NSFC affirmative action policy increased the likelihood of promotion to associate professor but reduced the likelihood of promotion to full professor for female scientists. The results are consistent with our grant findings, which show that the policy led to an increase in young scientist grant receipt but a decrease in receipt of general scientist grants—funding that is more critical for later career progression. The policy effects on academic promotion are concentrated on higher-performing female scientists and those at high-tier institutions.

6 Discussion

In this section, we explore potential explanations for why the NSFC affirmative action policy did not appear to meet its intended goal of reducing gender inequality in science.

In previous sections, we show that the policy increased the likelihood of female scientists receiving the young scientist grant, aligning with the NSFC's immediate goal of raising the share of female young scientist grant awardees (Ma et al., 2018; Yu and Gao, 2023). However, this policy inadvertently displaced their receipt of general grants, which are more critical for long-

[26] A more granular analysis suggests that the policy effect on academic promotion is concentrated among female scientists at elite universities (i.e., 985-project universities) rather than key universities (211-project universities). This pattern may reflect the more stringent NSFC funding requirements for promotion at elite universities compared to key universities.

Figure 10. Heterogeneity in the policy effect on on academic promotion

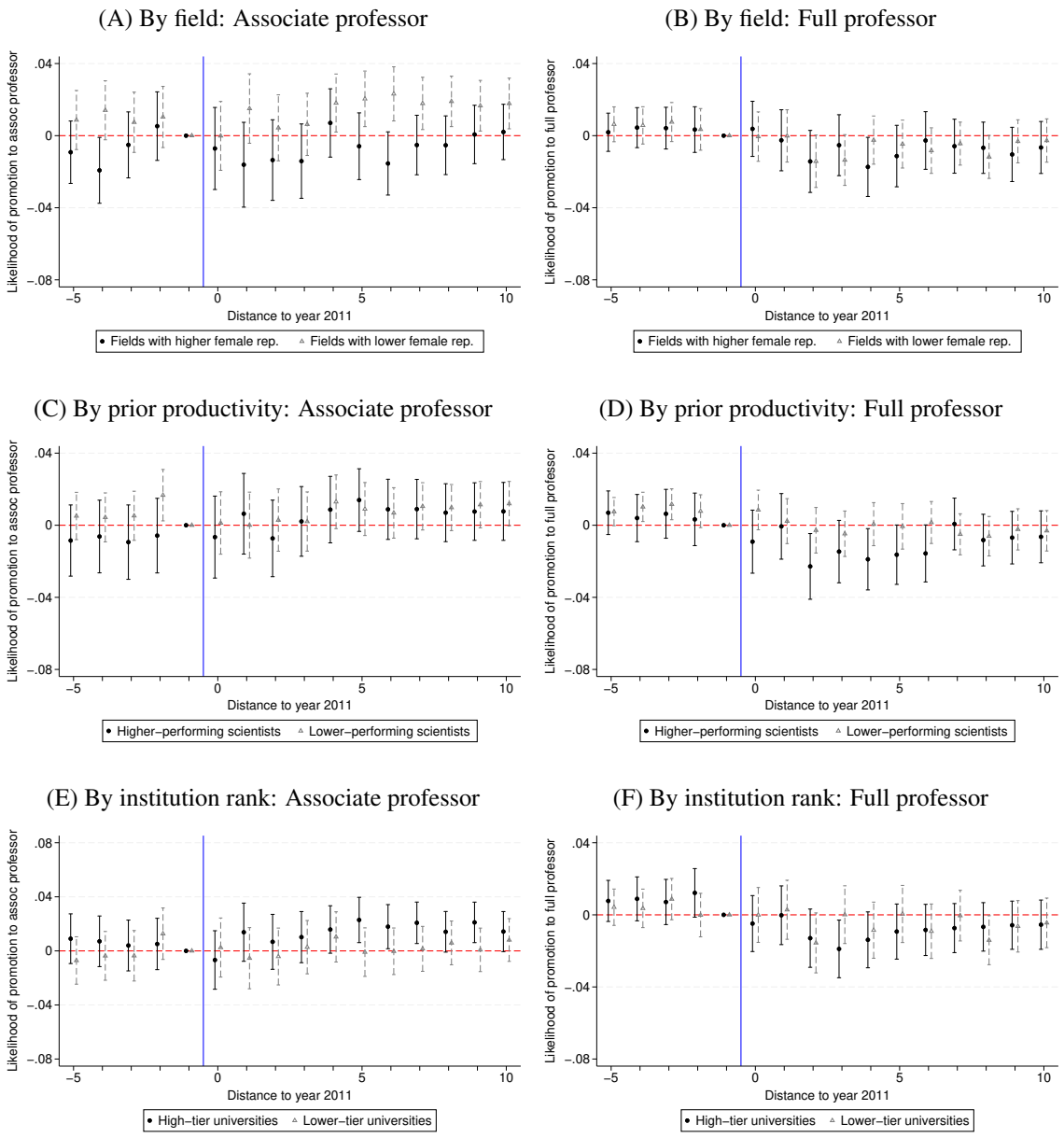


Figure A8 notes: this figure presents estimates of α^{τ} from equation 2, along with 95% confidence intervals. The outcome variable is whether or not the scientist received a promotion to the rank indicated in the panel label during a given year. Panels (a) and (b) present estimates separately for scientists in fields with higher female representation (i.e., chemistry, life science, and medicine) and those in fields with lower female representation (i.e., math, physics, geoscience, engineering, and computer science). Panels (c) and (d) present estimates separately for scientists with and without Scopus publications prior to 2011, the year when the NSFC affirmative action policy was introduced. Panels (e) and (d) present estimates separately for scientists at high-tier universities (i.e. those recognized by the Chinese government's "Project 985" or "Project 211") and those at lower-tier universities.

Table 6. Impact of the policy on academic promotion

	Full sample	Fields with female rep.		Scientists' productivity		Universities	
		Higher	Lower	Higher	Lower	High-tier	Lower-tier
Panel A: Promotion to associate professor							
β_1: policy effect	0.005***	-0.001	0.006**	0.011***	0.001	0.009***	0.002
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Outcome mean	0.037	0.038	0.036	0.037	0.037	0.036	0.039
N	725,168	230,032	449,120	321,248	403,920	314,448	293,344
Panel B: Promotion to full professor							
β_1: policy effect	-0.012***	-0.010***	-0.011***	-0.015***	-0.008***	-0.016***	-0.008***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Outcome mean	0.028	0.026	0.029	0.033	0.024	0.028	0.028
N	725,168	230,032	449,120	321,248	403,920	314,448	293,344

Table 6 notes: this table presents estimates of β_1 from equation 1. The outcome variable is whether or not the scientist received a promotion to the rank indicated by the relevant symbol during a given year. Column (1) presents estimates from the full sample. Columns (2) and (3) present estimates separately for scientists in fields with higher female representation (i.e., chemistry, life science, and medicine) and those in fields with lower female representation (i.e., math, physics, geoscience, engineering, and computer science). Columns (4) and (5) present estimates separately for scientists with and without Scopus publications prior to 2011, the year when the NSFC affirmative action policy was introduced. Columns (6) and (7) present estimates separately for scientists at high-tier universities (i.e. those recognized by the Chinese government's "Project 985" or "Project 211") and those at lower-tier universities. *** < 0.01, ** < 0.05, * < 0.1.

term career progression, due to the NSFC's restriction preventing applicants from applying for both grants in the same year. As a result, while the policy increased female scientists' chances of promotion to associate professor, it reduced their chances of advancing to full professor. This raises an important question: why would female scientists choose to use their additional eligibility for the young scientist grant if it ultimately hinders their career advancement?

General grant applications are more competitive: We argue that the higher competition for general grants is the primary reason for female scientists choosing to apply for young scientist grants first. As shown by Figure A12, the success rate of general grant applications is significantly lower than that of young scientist grant applications in the early years of policy implementation, suggesting the greater competitiveness of general grants. Moreover, the applicant pool of general grants consists of more senior researchers, making the competition even more intense.

Differences in NSFC evaluation criteria reinforce this pattern. For young scientist grants, reviewers are instructed not to focus on applicants' prior research achievements, but instead on their creative potential.[27] In contrast, general grant reviewers must consider applicants' accumulated research contributions.[28] These differences in evaluation further incentivize female scientists to apply for young scientist grants first.

Another related explanation is female scientists' preference for lower-risk or less competitive opportunities (Niederle and Vesterlund, 2011; Buser, Niederle and Oosterbeek, 2014). Even before the policy, female scientists rarely applied for general grants when they were still eligible for young scientist grant applications.[29] If preferences for competition shape grant application choices, this could help explain why female scientists are more likely to pursue young scientist grants first.

Imperfect information: Imperfect information may also play an important role in explain-

[27] See "Key Points When Evaluating the NSFC Young Scientist Grant," `https://www.bit.edu.cn/publish/bit/docs/2014-01/20140122103410566802.pdf`.

[28] See "Key Points When Evaluating the NSFC General Grant," `https://www.bit.edu.cn/publish/bit/docs/2014-01/20140122103351835789.pdf`.

[29] Although we lack direct data on grant applications, we examined the older cohorts (1966–1970) who received general grants before age 35 but never received young scientist grants. The very low share of women among these general grant awardees (1.0%) suggests a tendency to avoid this more competitive path.

ing this behavior. Female scientists may have faced imperfect information about the future–specifically, uncertainty over whether receiving a young scientist grant would fully offset the funding lost from foregone general grants. At the time of the policy announcement, no clear cost-benefit statistics on young scientist grant applications were available. Instead, prevailing information suggested that receiving a young scientist grant first was an important avenue for advancement. In some high-tier institutions, it was even considered an essential qualification for promotion to associate professor. For junior scientists, young scientist grants likely signaled career success, as three-quarters of general grant recipients had previously received one. Reflecting this widespread belief, the policy was largely welcomed by affected female scientists: in a national survey of scientists, 78.1% of female scientists viewed the policy favorably (Zhao, Ma and Miao, 2016). Through the lens of the availability heuristic, applying for young scientist grants first may have seemed like the optimal strategy for any eligible scientist, regardless of gender.

7 Conclusion

In this paper, we evaluate the impact of a national affirmative action policy designed to address gender inequality in academic science. The policy extended the maximum age of eligibility for female scientists applying to a major early-career grant in China from 35 to 40 years old, while maintaining the existing age limit for men. By providing women with additional opportunities to secure early-career funding, this policy intervention likely helps reduce gender inequality in science.

We find that the policy substantially increased the share of young scientist grants awarded to women, successfully achieving its immediate goal. This benefit, however, did not translate into improved future career outcomes. Affected women did not publish more papers and in fact, produced fewer last-authored papers and top journal publications. They were less likely to be promoted to full professor, though they had higher chances of promotion to associate professor. We argue that this is largely because the NSFC prohibits people from applying for more than one grant simultaneously. By increasing women's likelihood of receiving the young scientist grant,

the policy inadvertently displaced the application of larger, more prestigious grants, ultimately reducing the total research funding for affected women. Furthermore, the policy effects were concentrated among high-performing female scientists and those at top-tier institutions—the very individuals most likely to break into elite, male-dominated roles in science.

Our findings offer important lessons for policies aimed at addressing gender inequality in science. Prior efforts, such as extended parental leave for scientists or gender quotas for scientific committees, have had limited impacts on the targeted outcome, with some even leading to unintended negative consequences.[30] Our study complements this evidence by showing that increasing early-career funding opportunities exclusively for women may not necessarily enhance their future career progression, as the policy can result in the loss of other, more substantial funding opportunities. These findings suggest that to effectively address the persistent gender inequality in academic science, a more comprehensive approach is needed—one that combines multiple, potentially complementary strategies.

[30] Bagues, Sylos-Labini and Zinovyeva (2017) and European Commission (2009) show small effects from increasing female representation on key funding committees and from providing research funding exclusively to a small number of female scientists. Antecol, Bedard and Stearns (2018) show that gender-neutral tenure clock-stopping policies in U.S. universities do not improve women's chances of earning tenure.

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Appendices

A Appendix Figures

Figure A1. The NSFC's annual funding amounts from 1986 to 2021

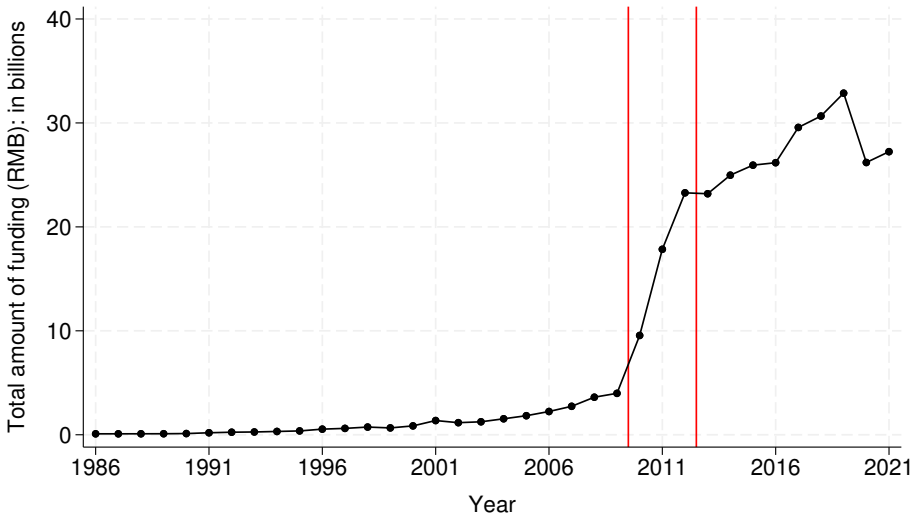
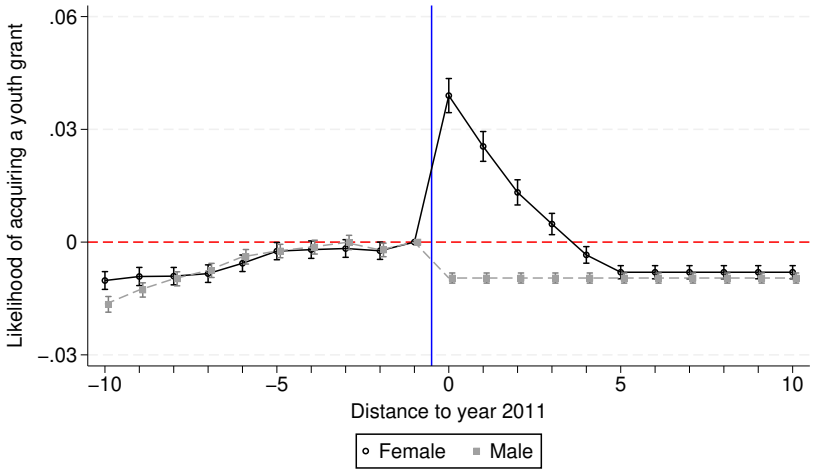


Figure A1 notes: this figure shows the NSFC's annual funding amount from 1986 to 2021. The values are in billions of RMB (1 RMB = 0.157 US dollar in 2021).

Figure A2. Event-study estimates of the policy effect on grant receipt: Female vs. male scientists

(A) Young scientist grant



(B) General grant

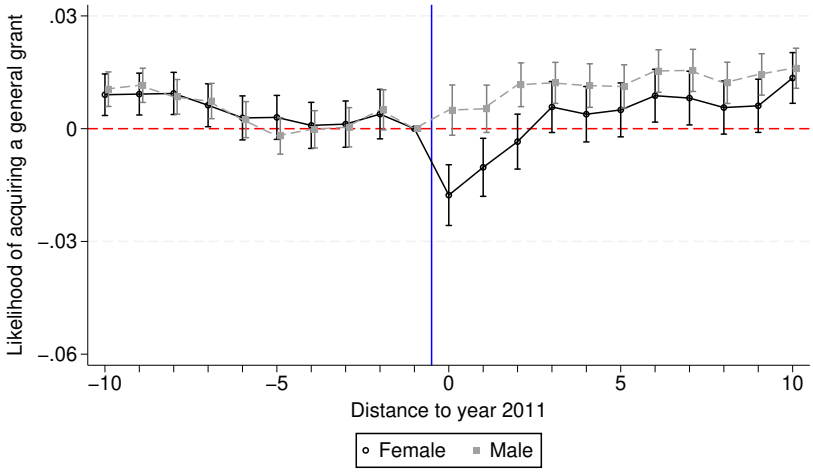


Figure A2 notes: this figure presents event-study estimates of α^{τ} from equation 2, along with 95% confidence intervals, for women and men separately. The outcome variables are a dummy variable for receiving a young scientist grant in a given year in Panel (a) and a dummy variable for receiving a general grant in a given year in Panel (b). The running variable represents the number of years relative to 2011, the first year the policy was in effect.

Figure A3. Policy effects on receipt of the young scientist grant: Scientists recorded in the NSFC system

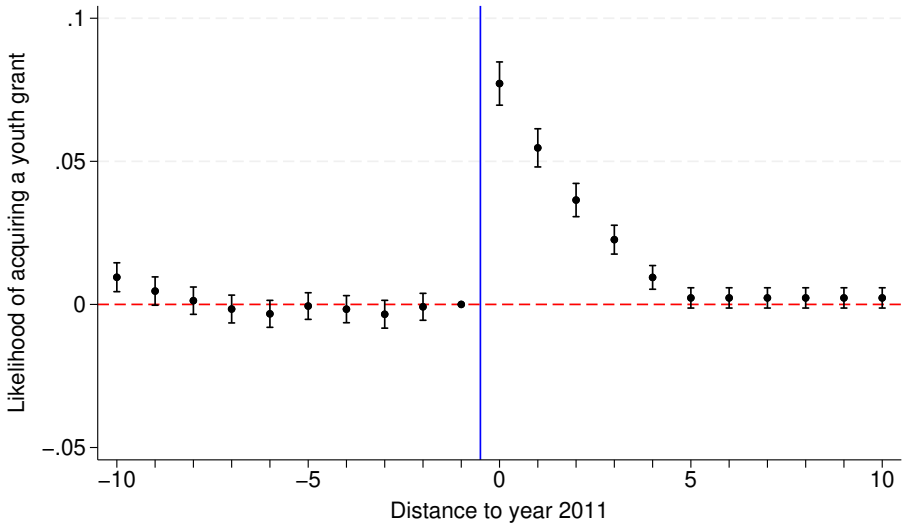


Figure A3 notes: this figure presents estimates of α^{τ} from equation 2, along with 95% confidence intervals. The outcome variable is a binary indicator at the scientist-year level, equal to one if the scientist received the young scientist grant in that year. The running variable represents the number of years relative to 2011, the first year the policy was in effect. The sample includes only scientists recorded in the NSFC system.

Figure A4. Policy effects on receipt of the young scientist grant: Female scientists in the 1970/1971 cohorts

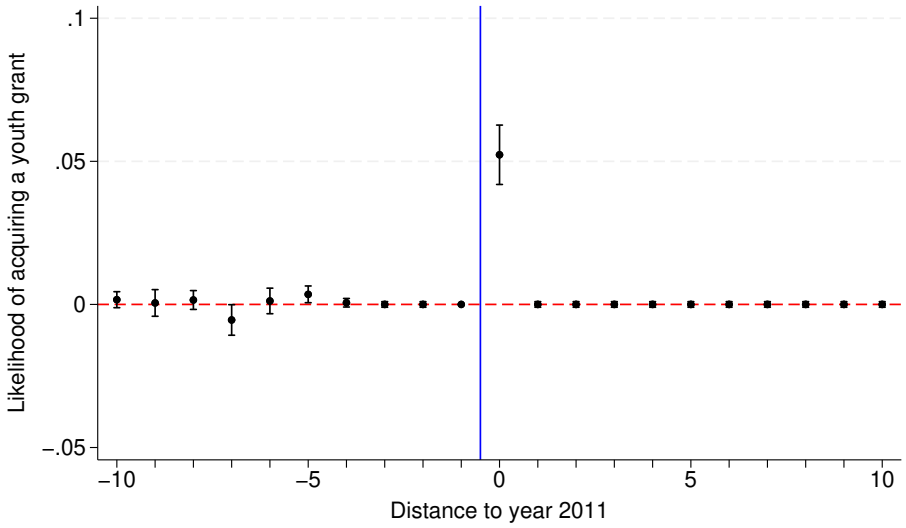


Figure A4 notes: this figure presents estimates of α^{τ} from equation 2, along with 95% confidence intervals. The outcome variable is a binary indicator at the scientist-year level, equal to one if the scientist received a young scientist grant in that year. The running variable represents the number of years relative to 2011, the first year the policy was in effect. The sample includes only female scientists in the 1970 and 1971 birth cohorts, who are highly comparable.

Figure A5. Policy effects on receipt of the general grant: Scientists recorded in the NSFC system

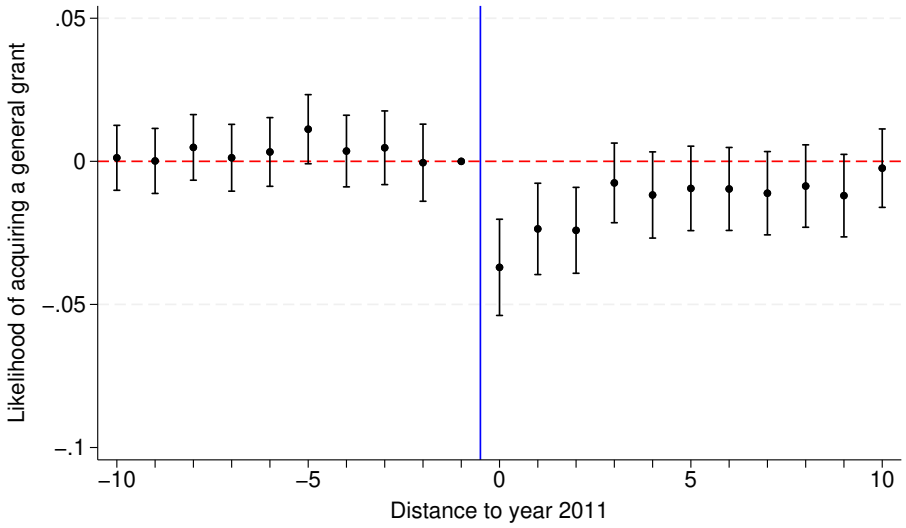


Figure A5 notes: this figure presents estimates of α^{τ} from equation 2, along with 95% confidence intervals. The outcome variable is a binary indicator at the scientist-year level, equal to one if the scientist received the general grant in that year. The running variable represents the number of years relative to 2011, the first year the policy was in effect. The sample includes only scientists recorded in the NSFC system.

Figure A6. Policy effects on receipt of the general grant: Female scientists in the 1970/1971 cohorts

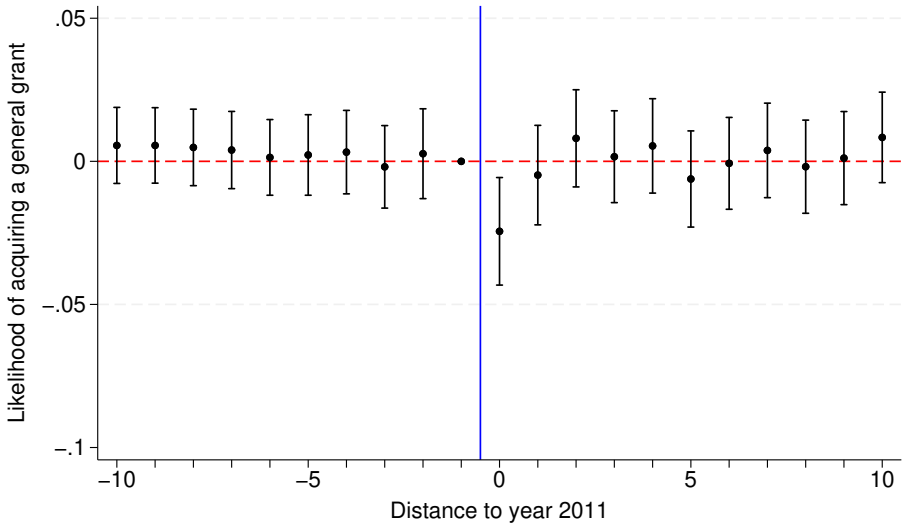


Figure A6 notes: this figure presents estimates of α^{τ} from equation 2, along with 95% confidence intervals. The outcome variable is a binary indicator at the scientist-year level, equal to one if the scientist received a general grant in that year. The running variable represents the number of years relative to 2011, the first year the policy was in effect. The sample includes only female scientists in the 1970 and 1971 birth cohorts, who are highly comparable.

Figure A7. Policy effects on receipt of the general grant: Placebo test using the 1961-1970 cohorts

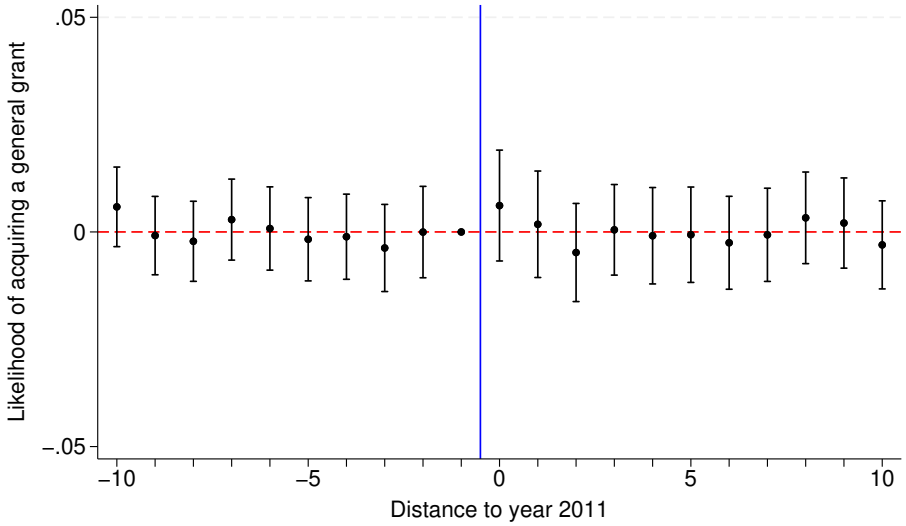


Figure A7 notes: this figure presents estimates of α^{τ} from equation 2, along with 95% confidence intervals. This placebo test treats the 1966–1970 cohorts as "treated" under the NSFC affirmative action policy and uses the 1961–1965 cohorts as the control group. The outcome variable is a binary indicator at the scientist-year level, equal to one if the scientist received the general grant in that year. The running variable represents the number of years relative to 2011, the first year the policy was in effect.

Figure A8. Policy effects on academic promotion: The 2001-2021 period

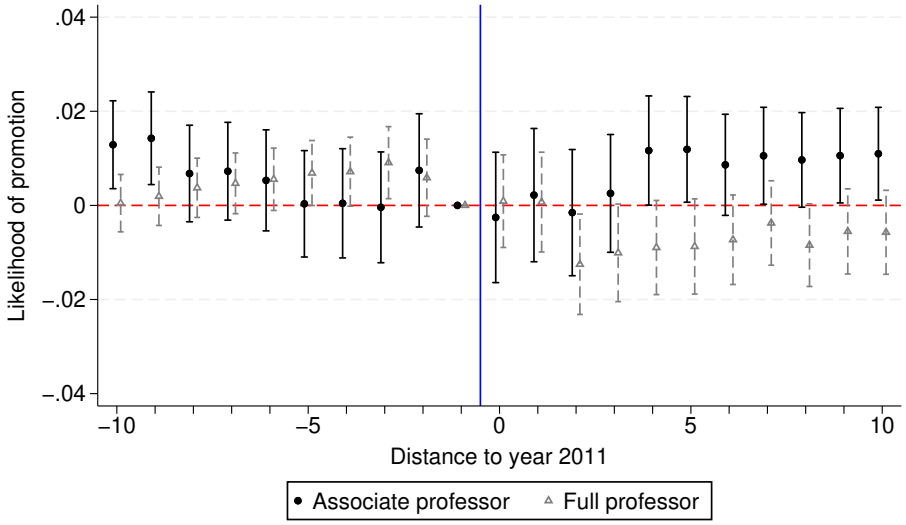
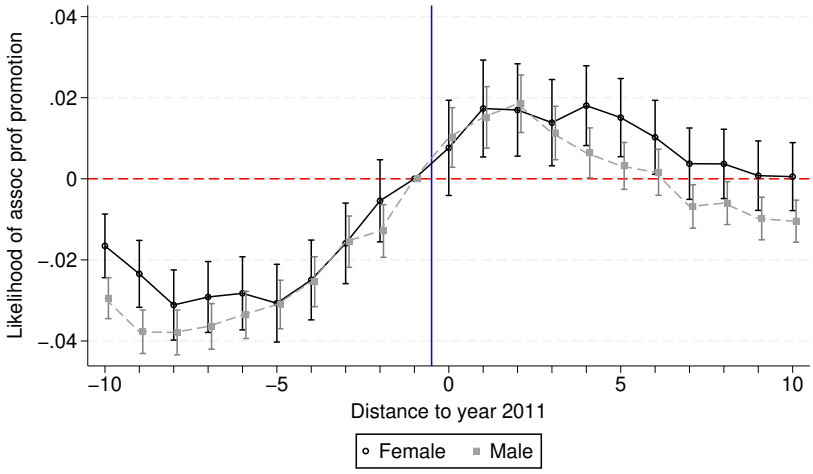


Figure A8 notes: this figure presents estimates of α^{τ} from equation 2, along with 95% confidence intervals. The outcome variables are binary indicators at the scientist-year level, equal to one if the scientist was promoted to associate or full professor in that year. The analysis sample is restricted to the 2001-2021 period.

Figure A9. Event-study estimates of the policy effect on academic promotion: Female vs. male scientists

(A) Associate professor



(B) Full professor

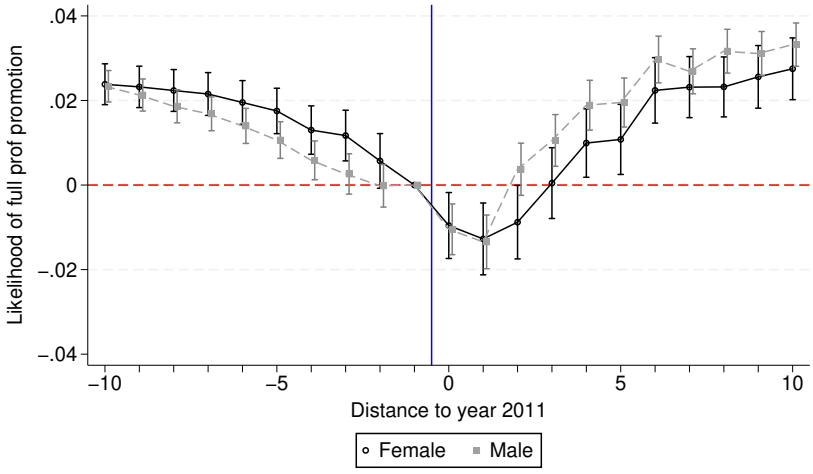


Figure A9 notes: this figure presents event-study estimates of α^{τ} from equation 2, along with 95% confidence intervals, for women and men separately. The outcome variables are a dummy variable for promotion to associate professor in a given year in Panel (a) and a dummy variable for promotion to full professor in a given year in Panel (b). The running variable represents the number of years relative to 2011, the first year the policy was in effect.

Figure A10. Policy effects on academic promotion: Scientists recorded in the NSFC system

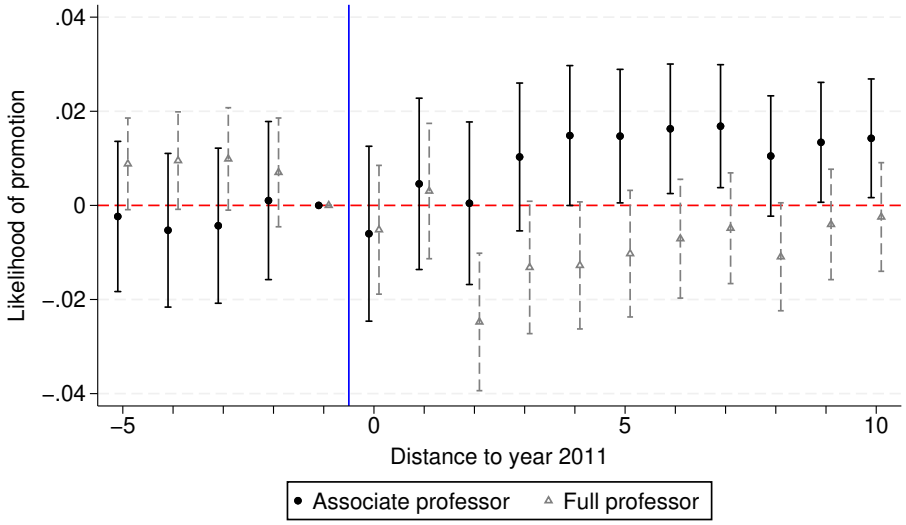


Figure A10 notes: this figure presents estimates of α^{τ} from equation 2, along with 95% confidence intervals. The outcome variables are binary indicators at the scientist-year level, equal to one if the scientist was promoted to associate or full professor in that year. The analysis sample is restricted to scientists recorded in the NSFC system.

Figure A11. Policy effects on academic promotion: Placebo test using the 1961-1970 cohorts

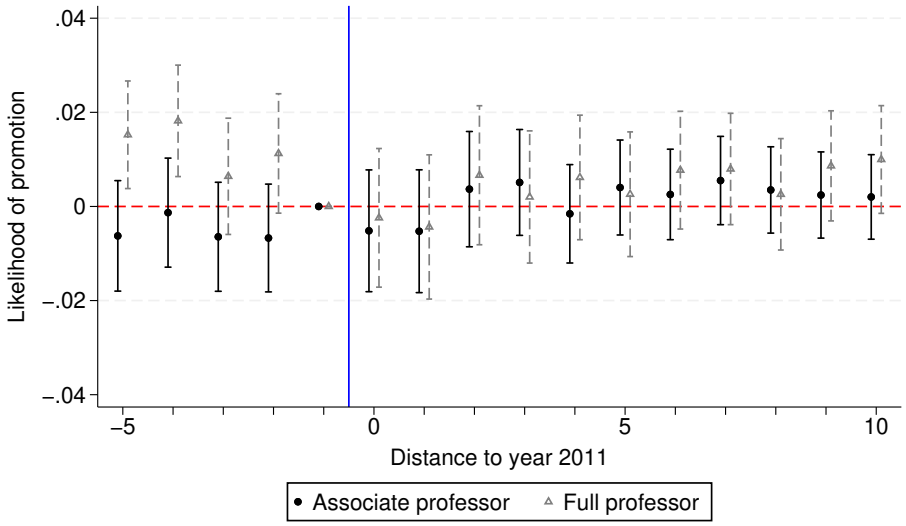
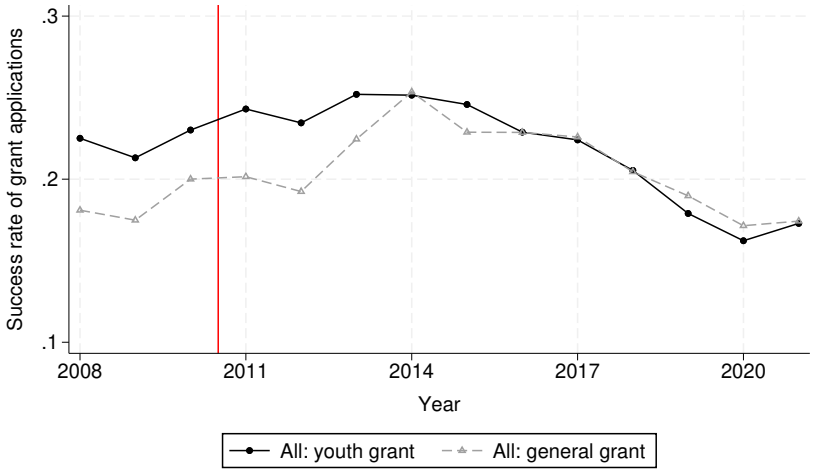


Figure A11 notes: this figure presents estimates of α^{τ} from equation 2, along with 95% confidence intervals. This placebo test treats the 1966–1970 cohorts as "treated" under the NSFC affirmative action policy and uses the 1961–1965 cohorts as the control group. The outcome variables are binary indicators at the scientist-year level, equal to one if the scientist was promoted to associate or full professor in that year.

Figure A12. Success rates of grant applications, by gender

(A) All



(B) By gender

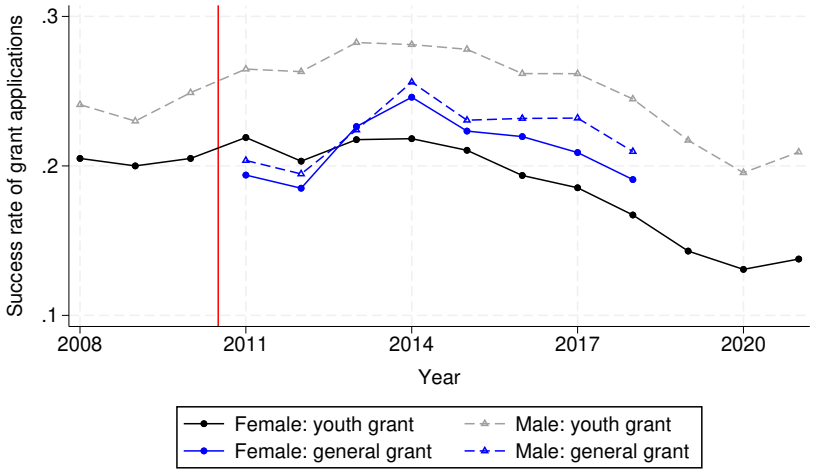


Figure A12 notes: this figure presents the likelihood of a grant submission's success in a given year, estimated by grant type and gender.

B Appendix Tables

Table A1. Characteristics across samples

	Sample		Young scientist grant awardees		
	CNKI scholars	Analysis sample	All	CNKI scholars	Analysis sample
Female	0.361	0.318	0.314	0.337	0.479
Institutions					
Elite univ.	0.282	0.261	0.307	0.321	0.444
Key univ.	0.212	0.180	0.159	0.207	0.183
Other univ.	0.360	0.393	0.346	0.356	0.287
CAS	0.052	0.043	0.096	0.040	0.043
Other research institutions	0.094	0.124	0.092	0.077	0.043
Fields					
Math/Physics	0.076	0.075	0.110	0.068	0.087
Chemistry	0.078	0.072	0.089	0.052	0.059
Life science	0.146	0.127	0.143	0.107	0.103
Earth	0.135	0.103	0.102	0.164	0.165
Engineering	0.317	0.302	0.175	0.321	0.299
Computer science	0.106	0.135	0.117	0.147	0.134
Economics/Management	0.038	0.053	0.045	0.056	0.065
Medical science	0.103	0.133	0.219	0.085	0.088
Observations	451,066	52,562	208,071	39,815	3,768

Table A1 notes: this table compares individual characteristics (gender, home institution type, and field) across samples. In the first two columns, we compare the main analysis sample (cohorts born between 1966 and 1975) to the whole CNKI scholar sample. In the final three columns, we focus only on NSFC young scientist grant awardees. "Elite univ." are China's top-tier 985-project universities which include 39 prestigious schools like Peking University and Tsinghua University. "Key univ." are a group of 211-project key Chinese universities, including 77 institutions that are second only to 985-project universities in prestige. The Chinese Academy of Sciences (CAS) is China's premier national research institution with more than 100 affiliated institutes and laboratories.

Table A2. Policy effect on receipt of the general grant: Period-specific estimates

	Full sample	Fields with female rep.		Scientists' productivity		Universities	
		Higher	Lower	Higher	Lower	High-tier	Lower-tier
Policy effect: [2011, 2015]	-0.014***	-0.010***	-0.016***	-0.026***	-0.006***	-0.023***	-0.007***
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
Policy effect: [2016, 2021]	-0.006***	-0.007***	-0.006***	-0.010***	-0.004***	-0.011***	-0.002
	(0.001)	(0.002)	(0.002)	(0.003)	(0.001)	(0.003)	(0.002)
Outcome mean	0.023	0.020	0.024	0.036	0.013	0.034	0.015
N	1,059,177	344,841	645,393	440,181	618,996	469,119	415,338

Table A2 notes: this table presents estimates of α_1 and α_2 from the following equation: $y_{itg} = \alpha_0 + \alpha_1 T_i P_{1t} F_g + \alpha_2 T_i P_{2t} F_g + \alpha_3 T_i P_{1t} g + \alpha_4 T_i P_{2t} + \alpha_5 P_{1t} F_g + \alpha_6 P_{2t} F_g + \gamma_i + \theta_t + \varepsilon_{itg}$. The outcome variable is a binary indicator at the scientist-year level, equal to one if the scientist received a general grant in that year. We estimate α_1 for the first five years after the policy announcement and α_2 for the subsequent five years. Column (1) presents estimates from the full sample. Columns (2) and (3) provide separate estimates for scientists in fields with higher versus lower female representation. Columns (4) and (5) present separate estimates for high-performing and lower-performing scientists, classified based on their pre-policy publication records. Columns (6) and (7) present separate estimates for scientists at high-tier vs. lower-tier universities. *** < 0.01, ** < 0.05, * < 0.1.

Table A3. Policy effect on total number of grants received annually

	Full sample	Fields with female rep.		Scientists' productivity		Universities	
		Higher	Lower	Higher	Lower	High-tier	Lower-tier
β_1: policy effect	0.002***	0.001	0.002***	0.002***	0.003*	-0.003***	0.009***
	(0.001)	(0.002)	(0.002)	(0.003)	(0.001)	(0.002)	(0.002)
Outcome mean	0.026	0.023	0.027	0.041	0.015	0.038	0.018
N	1,059,177	344,841	645,393	440,181	618,996	469,119	415,338

Table A3 notes: this table presents estimates of β_1 from equation 1. The outcome variable is the total number of grants a scientist received in a given year. Column (1) presents estimates from the full sample. Columns (2) and (3) provide separate estimates for scientists in fields with higher versus lower female representation. Columns (4) and (5) present separate estimates for high-performing and lower-performing scientists, classified based on their pre-policy publication records. Columns (6) and (7) present separate estimates for scientists at high-tier vs. lower-tier universities. *** < 0.01, ** < 0.05, * < 0.1.

Table A4. Impact of the policy on academic productivity: Restricted sample

	No. of publications				No. of citations
	All	First-authored	Last-authored	Top	
β_1: policy effect	-0.042***	0.136***	-0.200***	-0.141**	-0.009
	(0.032)	(0.041)	(0.068)	(0.061)	(0.069)
Outcome mean	1.370	0.261	0.355	0.543	22.793
N	535,904	425,840	400,928	401,328	519,408

Table A4 notes: this table presents estimates of β_1 from equation 1. The outcome variables are the total number of peer-reviewed journal articles published in a given year (column (1)), the number of first-authored journal articles (column (2)), the number of last-authored journal articles (column (3)), the number of top journal articles (column (4)), and the number of received citations (column (5)). *** < 0.01, ** < 0.05, * < 0.1. We limit the analysis to a 15-year period spanning from five years before to ten years after the policy.