When Time Windows Widen: Fertility Timing and Women's Career Trajectories in Academic Science

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Abstract

Female scientists continue to face structural barriers in academia, where traditional family-support policies often fail to alleviate the time conflicts between fertility and early-career development. We study a rare preemptive policy intervention in China that extended the eligibility age for a prestigious early-career research grant from 35 to 40 for women—a stage when biological and professional timelines frequently collide. Leveraging a uniquely constructed dataset, we show that the reform shifted behavior among younger women: they delayed grant applications and were more likely to prioritize family formation, leading to slower trajectories in later-stage grant success and research output. We interpret these patterns as intertemporal trade-offs made more visible by relaxed institutional constraints. Our findings highlight the importance of designing complementary support mechanisms that recognize scholars' broader life-course optimization, especially when flexibility is introduced during high-stakes career stages.

Keywords: Gender disparities in academia, motherhood penalty, research grant competition, young scientist grant, age discrimination, NSF China

JEL Codes: J16, I23, J13

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1 Introduction

Gender disparities in academia remain persistent across countries and disciplines, particularly during the early-career years when research productivity and family formation coincide most tightly (Ley and Hamilton, 2008; Pohlhaus et al., 2011; Ginther et al., 2016; Lerchenmueller and Sorenson, 2018). Traditional family-supporting policies—such as parental leave or tenure-clock extensions—are reactive by design: they activate only after childbirth and therefore do not help women manage pre-birth planning or the structural overlap between their biological clock and early-career deadlines (Antecol et al., 2018; Malisch et al., 2020). These limitations underscore the importance of studying preemptive, birth-agnostic, gender-specific policies that intervene earlier in the career–family timing cycle.

The 2011 reform of the National Natural Science Foundation of China (NSFC) Young Scientist Grant (YSG) provides an unusually clean setting to study such a policy. Before 2011, all applicants had to apply before age 35; after the reform, women became eligible until age 40, while the age limit remained for men. In China's natural sciences and engineering fields, securing a YSG is not only advantageous but is frequently required for promotion at research universities. YSG attainment thus plays a gatekeeping role in career advancement. By extending eligibility for women without increasing the number of available grants, the reform created a gender-specific expansion in the time window during which women could enter the early-career funding pipeline. This institutional shift provides a clear quasi-experimental opportunity to examine how additional eligibility time alters early-career decisions.

This expansion changed the timing constraints facing younger female scholars. Before the reform, the fertility window and the YSG application window overlapped closely, forcing women to combine childbearing and early-career grant competition within the same narrow period. The additional five years of eligibility relaxed this overlap and reduced the immediate cost of postponing YSG applications.

Younger women could now delay their initial applications and reallocate time toward earlier childbearing without incurring the same career penalties as before. These adjustments in application and fertility timing had direct implications for later outcomes: a later start in the YSG sequence reduced opportunities for repeated attempts, slowed entry into subsequent grant streams such as general grants, and shifted the trajectory of early-career publications and promotion milestones. Importantly, this setting allows us to observe the process through which women resequence fertility and early-career research effort when timing constraints are relaxed.

The key to identification is that the reform fundamentally altered timing constraints only for women in natural science and engineering fields, where YSG attainment is evaluated as part of promotion and tenure and where NSFC funding is essential for sustaining research agendas. Non-STEM fields—such as management, psychology, and related social sciences—serve as a natural comparison group. Scholars in these fields may apply for NSFC grants, but NSFC performance is not central to their evaluation, and alternative funding channels are widely available. This institutional distinction implies that only women in STEM experienced a meaningful shift in the overlap between fertility timing and career evaluation. To estimate the policy's indirect effects on application behavior, fertility timing, and the resulting grant and career outcomes, we exploit variation across gender, STEM versus non-STEM fields, and time. This structure motivates our triple-differences event-study design, which allows us to trace the full sequence of behavioral responses to the expanded eligibility window.

Our empirical analysis draws on several novel administrative datasets that allow us to jointly observe application behavior, fertility decisions, and downstream academic outcomes. We use administrative application records from two major research universities, containing detailed CV information, proposal titles and abstracts, research field classifications, and annual YSG application decisions. We link these records to administrative fertility data from one of these universities, enabling

us to directly connect changes in application behavior to changes in fertility timing for the same individuals. To evaluate downstream consequences, we combine these data with the universe of NSFC grant records from 1987 to 2021 and publication histories from the OpenAlex database. This linked structure allows us to study the full decision sequence—from effort allocation and family planning to grant attainment and early-career research productivity.

We find that, following the age-eligibility expansion of the YSG, early-career stage female scholars delayed their YSG applications and shifted childbearing earlier relative to their pre-reform trend, whereas men exhibited no comparable fertility change and did not delay their applications. Specifically, the policy reduced the likelihood of applying for the YSG for female scholars below 35 by 0.15–0.2, translating to a 70%–95% reduction compared to the overall mean. Moreover, among the early-career applicants, female's proposal similarities (measured by proposal's titles and abstracts) increased by 1.0 (1.2%) in terms of word similarity and 1.2 (1.4%) in terms of content similarity, suggesting that, even among applicants, female's effort of application reduced after the reform. The application behavior corresponds to their fertility patterns: we observed that the first birth planning for female faculty in natural sciences and engineering fields increased by 25 percentage points right after the reform in 2011. These shifts reduced younger women's YSG success rates, lowered their access to the upper-level research grants (i.e., the general grants from NSFC), and delayed the age at which they secured their first major research award. Over time, these delays corresponded to weaker early-career publication records—particularly in top-journal work—and slower progression toward promotion milestones. Taken together, the results suggest that the reform's effects on early-career women stem not from intensified competition or changes in funding availability, but from a reorganization of the timing decisions that structure the early stages of a scientific career.

Our paper contributes to three strands of existing literature. First, we contribute to the literature on motherhood penalties and career-family tradeoffs in high-skill

labor markets, particularly in academia (Mason and Goulden, 2004; Cech and Blair-Loy, 2019). Kim and Moser (2025) show that women scientists during the U.S. baby boom era who became mothers reached their peak productivity significantly later than peers and were far less likely to obtain tenure. Their findings suggest that the rigid timeline of scientific evaluation, especially in the early career stage, disproportionately disadvantages mothers. Our study builds on this literature by examining a policy reform that relaxed an early-career timing constraint, allowing us to observe how women in science re-optimized the sequencing of fertility and research activity in response to institutional change. While Kim and Moser (2025) diagnose the consequences of inflexible timelines, our setting enables a rare causal test of how adjusting such constraints affects both family formation and research careers. Beyond academia, our study also contributes to the broader motherhood-penalty literature that examines how childbirth affects women's labor market outcomes across a range of occupations (Bertrand et al., 2010; Goldin, 2014; Kleven et al., 2019). This literature highlights the large and persistent child penalties in women's labor market trajectories. However, in most settings, researchers can observe only employment or wage changes after childbirth, making it difficult to capture the full extent of productivity declines and their dynamic nature. Academia, however, offers an unusually precise environment in which individual-level productivity is directly observable through publications and grant activity, allowing us to measure motherhood-related productivity adjustments with far greater accuracy. By leveraging this high-resolution setting, our analysis provides insights that complement and strengthen the broader understanding of child penalties in the general labor market.

Second, our study contributes to the economics of science by examining how early-career funding structures shape the allocation of scientific talent and affect gender gaps in productivity and participation. Recent work shows that gender disparities in science are driven not by per-year productivity differences, but by differential career durations and attrition rates (Holman et al., 2018; Charlesworth and

Banaji, 2019; Huang et al., 2020). The NSFC Young Scientist Grant (YSG) is a career-critical resource in China, with strict age-based eligibility. The 2011 policy reform extended the eligibility age from 35 to 40 for women only. We leverage this institutional change to causally identify how expanding temporal flexibility influences women's application behavior, retention in science, and research output. Additionally, our results speak to broader concerns about women's underrepresentation in STEM fields (Cheryan et al., 2017; Cimpian et al., 2020; Casad et al., 2021) and the opportunity cost of underutilized female talent in innovation, as highlighted by studies on gendered patterns in invention and topic selection (Koning et al., 2021).

Third, we contribute to the literature on institutional policy design under structural constraints. Policies such as gender-neutral tenure clock extensions have often backfired, unintentionally benefiting men more than women and exacerbating gender gaps (Antecol et al., 2018; Malisch et al., 2020). In contrast, the NSFC reform represents a rare example of a gender-specific, birth-agnostic, and preemptive policy intervention designed to address career–family overlap. Because this type of reform would be politically or legally infeasible in most Western democracies, the Chinese setting provides a unique natural experiment to evaluate its causal effects. Our linked administrative data—combining application records, fertility information, grant histories, and publication outcomes—allow us to directly trace the behavioral and career consequences of the policy. The evidence suggests that rather than improving equity through expanded opportunity, the reform nudged younger women to prioritize fertility over grant competition, contributing to lower grant success and leadership rates in the long run.

The rest of the paper proceeds as follows. Section 2 provides institutional background and describes the NSFC reform and its implications for career timing. Section 3 introduces the data sources and construction. Section 4 outlines the empirical strategy. Section 5 presents the main results on application timing, fertility behavior, and grant outcomes. Section 6 discusses heterogeneity, robustness, and interpretation. Section 7 concludes by reflecting on policy design implications and directions

for future research.

2 Background

2.1 Scientific Funding from the NSFC

Established in 1986, the National Natural Science Foundation of China (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). In recent years, the NSFC has become the world's largest research funder in terms of applications received: in 2024, the NSFC received nearly 380,000 applications, four times the combined total of two major US funding agencies, the NSF and the National Institutes of Health (NIH), in that year.[1]

The NSFC has two flagship funding mechanisms—the Young Scientist Grant and the General Grant. These two programs account for more than 80% of the NSFC's total funding, but differ in several key aspects. First, the Young Scientist Grant targets 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 receive only 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. Together, these distinctions highlight the 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.

[1]Sources: https://www.nsfc.gov.cn/p1/3381/2824/66854.html, https://report.nih.gov/nihdatabook/category/10, https://www.nsf.gov/about/about-nsf-by-the-numbers. Accessed October 8, 2025.

2.2 Young Scientist Grant Age-Eligibility Policy

As in many other countries (Shen, 2013; Ceci et al., 2014), 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 disproportionately small share of more prestigious positions (Gu, 2021). For instance, in 2023, female scientists accounted for only six percent of members of the Chinese Academy of Sciences and five percent of members of the Chinese Academy of Engineering.

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), in collaboration with the All-China Women's Federation, introduced a policy in 2011 aimed at alleviating constraints faced by early-career women whose childbearing years overlap with critical periods of research development. The policy extended the upper age limit for women applying for the Young Scientist Grant from 35 to 40, while the age limit for men remained unchanged at 35. Additionally, the policy allowed female awardees to extend the duration of their projects during breastfeeding periods, reducing the adverse impact of motherhood on their academic progression.

The policy had an immediate and substantial impact. According to NSFC statistics (Yu and Gao, 2023), the number of female grant applicants surged by 94% in 2011, the first year of implementation, rising from 13,244 in 2010 to 25,694 in 2011. By comparison, male applicants increased by only 23.2% during the same period. The success rate for female applicants also improved significantly, with 5,676 women receiving youth grant funding in 2011—a 106.5% increase from the previous year—compared to a 33.7% increase for male recipients. Among these female recipients, 1,829 grants were awarded to women aged 36 to 40, representing 32.2%

of all female recipients.

These effects persisted over the next decade. From 2011 to 2021, applications from women aged 36 to 40 more than doubled, generating over 138,000 additional submissions and about 18,000 grants awarded, accounting for 23.2% of all female recipients. These additional recipients received approximately 4.05 billion RMB in funding. The policy has been widely lauded for its success in expanding research opportunities for women balancing family and professional responsibilities (Ma et al., 2018).

Yet the broader consequences are more ambiguous. Although the policy substantially benefited the newly eligible women, it is unclear how it affects the younger female cohort in the long run. Consistent with this uncertainty, as shown in Figure A1, the gender gap in the Young Scientist Grant success rate continued to widen between 2009 and 2018, pointing to more complex equilibrium effects than the immediate gains alone suggest.

3 Data and Summary Statistics

Our data are constructed by combining original data from four data sources: 1) the universe of NSFC-granted projects provided by NSFC's official website, 2) the curriculum vitae of researchers in science and engineering disciplines from all 39 "985" project universities along with the Chinese Academy of Science and 10 randomly selected "211" project universities, and 3) the universe of publication from the OpenAlex. 4) the information on the application for the NSFC from two of these research universities, as well as the timing of childbirth of all the employees from one of these two universities.

3.1 NSFC Granted Projects

We first employ publicly accessible data from the official website of the National Natural Science Foundation of China (NSFC). The dataset documents all approved

and completed projects funded by the NSFC from 1987 to 2021. The data provides a comprehensive view of research funding allocation, capturing detailed information on each funded project, including project identifiers, applicant institution names, project titles, principal investigator names, 1- to 3-digit discipline codes, project funding, project category (Young Scientists Fund, General Fund, Key Fund, Major Fund, etc.), and more. This rich dataset allows for both cross-sectional and longitudinal analyses of funding patterns, including trends in research funding allocation by factors such as gender, age, institution, and subject area, particularly in the context of the 2011 policy change extending grant eligibility for women, and facilitates an in-depth understanding of funding outcomes in Chinese academia.

The dataset includes several key variables that allow for a detailed examination of funding patterns and trends over time. Each funded project is identified by a unique project ID, and the year records the specific year of funding, enabling a temporal analysis of research support. Regional aspects of funding can be explored through the Province (province) variable, which indicates the provincial location of the recipient institution. Information on the institution name now captures both the applying and currently registered names of the PI's institutions, respectively, allowing for longitudinal tracking of institutional funding and the relocation of researchers. The series of subject code variables provides a hierarchical classification of each project into specific subject areas (level 1 to level 4), supporting subject-specific funding analysis. The Principal Investigator's name is recorded for each project, together with subject code and institution names, enabling us to crosswalk to the researchers' CVs and publications. Additionally, each project has a Project Title that offers insight into the scope and focus of the funded research, providing a potential opportunity to use text analysis for research focus more detailed than the subject. Finally, the Funding Status variable indicates whether a project successfully received funding, facilitating differentiation between funded and unfunded applications where relevant.

The dataset also contains metadata on project updates and administrative de-

tails, which provide information on when the data was last updated. This dataset enables a detailed examination of the trends and patterns in research funding by gender, age, institution, and subject area. Additionally, by utilizing this data in combination with policy change indicators, we can assess the impact of the 2011 policy extending youth grant eligibility for women, allowing for both cross-sectional and longitudinal analyses of funding outcomes in Chinese academia.

3.2 Curriculum Vitae Data

We semi-automatically collected the resumes of faculty members in science and engineering disciplines from 39 universities under the “985" Project, the Chinese Academy of Sciences research institutions, and randomly selected 10 universities from among the 73 “211" Project universities that are not part of the “985" Project[2] These CVs are retrieved by June 2023.

Based on the departmental structure of each university, we manually identified and screened science and engineering departments. Then, for each confirmed science and engineering department, we developed specific web crawler codes according to the varying webpage structures of each department’s official website, and collected faculty resumes department by department, saving them by university and college names. It finally yields over 100,000 original and non-structured resumes of science and engineering faculty.

In addition, as for resumes of non-science and engineering faculty, we primarily scraped the resumes of faculty in economics and management disciplines from all 985 and 211 universities,including around 20,000 rough non-structured data. There are two main reasons for this data construction. first, for applications to the National Natural Science Foundation, besides science and engineering disci-

[2]The “985" Project univeristies and “211" Project universites are key higher education initiatives in China aimed at developing world-class universities and high-level institutions. They represent the core strength and top-tier research capabilities of Chinese higher education and research, particularly of the “985" Project universities. The Chinese Academy of Sciences is the highest academic institution and a comprehensive research and development center in natural sciences in China. And its subordinate research institutions and universities serve as the primary force for basic research and high-tech innovation in China, representing the national-level standard of scientific research in the country.

plines, only the Management Science Department is open to faculty in economics and management-related fields. Secondly, however, faculty in economics and management can apply not only for the National Natural Science Foundation but also for the National Social Science Foundation. Both types of projects hold equal importance for faculty in these disciplines.

Due to significant variations in resume formats across different universities, departments, and even individual faculty members, we performed data cleaning using a semi-manual approach combined with large language models, and standardized key information such as faculty members' age, gender, hukou registration, work experience, educational background, and promotion history.

3.3 Administrative Data on NSFC Application and Grant from Two Schools

First, with the authorization from the science and technology departments of two research universities, we obtained detailed information on all faculty of these two universities regarding their applications for NSFC from 2003 to 2025. Specifically, the application information includes the annual project application numbers, project application names, project application summaries, the personal characteristics of the applicants and their research teams (age, gender, title, and department), and the approval status of the projects. Furthermore, by compiling the curriculum vitae of faculty members across all departments in these two universities, we supplemented information on applicants' educational backgrounds, work experience, and career advancement, while also constructing a control group of non-STEM faculty for our empirical analysis.

We filled in the years without application records for each faculty of these two universities and defined these years as unapplied, resulting in a balanced panel data construction for the NSFC application. Besides the application quantity, we also construct application quality measures based on the similarity between the words and contents of the pre- and post-applied project titles and summaries, respectively.

We will employ two estimation strategies to analyze the policy impact on female applicants' behaviors: 1) Difference in Difference between female and male faculty in STEM; 2) the difference-in-differences in application behaviors between male and female faculty, further differences across STEM and non-STEM disciplines.

3.4 Administrative Data on Fertility Timing from One School

Second, with authorization from the Human Resources department of one of these two research universities, we obtain detailed fertility information on all historical faculty and staff members of that university. Specifically, these fertility details record the year of each faculty and staff member's marriage, marital status, the date each child was born, the child's gender, as well as the department of work background information, and the year of employment start. Similar to the application data, we will also rely on the CV to supplement the faculty's other background data. Due to this data, we can investigate the onset of (first) birth planning of female faculty in response to the eligibility age of applying NSFC being extended to 40 years by multiple empirical strategies:1) Difference in difference between female and male faculty in STEM; 2) the difference-in-differences in outcomes between male and female faculty, further differenced across STEM and non-STEM disciplines; 3) the difference-in-differences in onset of (first) birth planning between male and female, further differenced across STEM faculty and staff. We will report the estimation results in further detail in a later section.

3.5 Research Outcomes Data

To provide the research output and collaboration networks of the faculty members mentioned above, along with their CV information, we have collected all articles published in English from 1980 to 2023 from the OpenAlex database. OpenAlex serves as a publicly accessible alternative to proprietary academic databases such as Elsevier's Scopus and Clarivate's Web of Science. Each publication record includes the name of the journal, the title of the article, the publication date, citation

information, the author's name, and corresponding institutional affiliation, among other details. To ensure a focus on high-quality, peer-reviewed work, we excluded conference papers, working papers, books, and other non-peer-reviewed entries, retaining only peer-reviewed journal articles. We then excluded authors affiliated with non-academic institutions, such as firms and government agencies, retaining only those affiliated with Chinese or foreign universities. After collecting all journal articles, we aggregated the number of publications per scholar over time based on the author's name, institutional affiliation, and publication date.

Research quantity output is measured by the average annual number of publications per scholar. We adopt two measures for the research quality. One is the average cumulative citations of articles published in the current year up to 2023. As Huang et al. (2022) discussed, the number of citations is arguably an accurate indicator of the paper's scientific merit, reflecting the wisdom of crowds rather than the views of a few. The other is the annual publications in a first-tier journal, which is classified based on the JCR standard.

Using coauthor information from publication records, we constructed a panel dataset that captures the evolution of scholars' collaboration networks over time. The dataset includes each scholar's name, institutional affiliation, and detailed information on all academic coauthors. To quantify each individual's coauthor network for a given year, we construct the network based on the publications of the past three years (i.e., the current year and the previous two years). This is mainly due to a significant time lag between paper submission and publication (Ellison, 2002; Doctor et al., 2015). Specifically, for each paper of the given scholar within this three-year window, we will identify all the co-authors who appeared on any publication and summarize them. This three-year rolling window ensures that the coauthor network reflects the dynamic and evolving nature of research collaborations, capturing both ongoing and new connections.

Specifically, for a given scholar, we construct several indicators to capture the characteristics of the co-author network within each three-year window, including

(1) the average co-authorship frequency at the paper level, which is calculated by dividing the total frequency of co-authors by the number of papers. 2) We also measured the co-author size, that is, the number of non-duplicate co-authors in each three-year window. In addition, we classified the scale of collaborators into 985 project universities, 211 project universities, and other universities based on the university rankings of these non-repeated co-authors.

3.6 Key Variables Construction

In our study, age and gender are the two primary independent variables. For the administrative data on applications and fertility timing from the sub-sampled research universities, both age and gender are fully recorded. However, for the grant data, age and gender information could only be obtained from CVs. Specifically, age information for NSFC grants was derived from two sources. Approximately 15,000 scholars (27% of the sample) reported their birth years directly in their CVs. For the remaining scholars, age was imputed based on the reported year of starting their bachelor's degree. This imputation follows the assumption that scholars began primary school at the age of six, in accordance with China's Compulsory Education Law, effective July 1, 1986, which regulates the primary school enrollment age.

We acknowledge that using the bachelor's degree start year as an age proxy might introduce some measurement error. However, Chinese scholars typically follow a structured educational path without gap years until after their undergraduate studies. Although rare cases of grade-skipping may exist, these are likely idiosyncratic and involve unobserved parental connections with local schools or government authorities. Thus, we argue that using the bachelor's degree start year is a reasonable approximation for scholars' age.[3]

In terms of gender, we can directly identify the gender both from self-reported

[3]Given that our analysis sample is concentrated among scholars born between 1965 and 1976, identification bias may arise. To address this, we plan to use Propensity Score Matching (PSM) to adjust age estimations based on self-reported birth years as a reference, and to conduct robustness checks to mitigate this potential bias.

CV information and the CV photos. For the remaining two-thirds, based on the technique of Bayesian machine learning, we follow Chen (2024) to predict the inventors' gender according to their names. Essentially, Chen's algorithm is trained on a large proprietary dataset that simultaneously contains information on Chinese names and their corresponding genders. The Bayesian model provides a conditional probability of the name's gender being male. A "name" is assigned to be female if the "probability" is less than 0.5. To test its validity, we apply it to predict the genders of more than 10,000 faculty members, whose actual genders are known to us. This check turns out to be surprisingly that more than 94.5% predictions are aligned with the actual cases, which strengthens our confidence in the accuracy of this algorithm. The final cleaned dataset, which includes scholars' gender and age, consists of 34,202 observations.

3.7 Sample Restriction and Summary Statistics

This study aims to disentangle how the policy of extending the application eligibility age for female researchers from 35 to 40 affects their probability of securing YSG by decoupling fertility decisions and application timing. The extension of the eligible age essentially alleviates the previously tightly intertwined conflict between family planning and grant applications for individuals under the age of 35. To examine the impact of this policy on application behavior and fertility decisions, we impose the following two-dimensional sample restrictions: 1) We restrict the empirical sample to decisions made before the age of 35. To ensure the identification of policy effects, for individuals who were employed before the policy was implemented and remained under 35 after the policy took effect, we retain only their pre-policy observations to avoid estimation bias caused by confounding pre- and post-policy states.

In this section, we describe our analysis dataset by comparing application and success rates between genders and across calendar years. Figure 1 illustrates the trends in the number and share of female applicants and awardees for the Young

Scientists Fund (YSF) of the NSFC from 2007 to 2021, providing insights into the impact of the 2011 policy reform that extended the age eligibility for female applicants from 35 to 40 years. Although we are subject to a subsample of NSFC applicants, this trend is highly consistent with the figure reported by NSFC (see Appendix Figure A2).

Following the 2011 reform, the number of female applicants (gray bars) rose sharply, reflecting the inclusion of women aged 36 to 40 who became newly eligible under the revised policy. This growth was accompanied by a steady rise in the female share of applicants (black line), signaling that more women were participating in the grant competition. By 2021, the female share of applicants had continued to grow, underscoring the sustained effect of the policy in reducing barriers for women in academia and encouraging their participation in research funding opportunities.

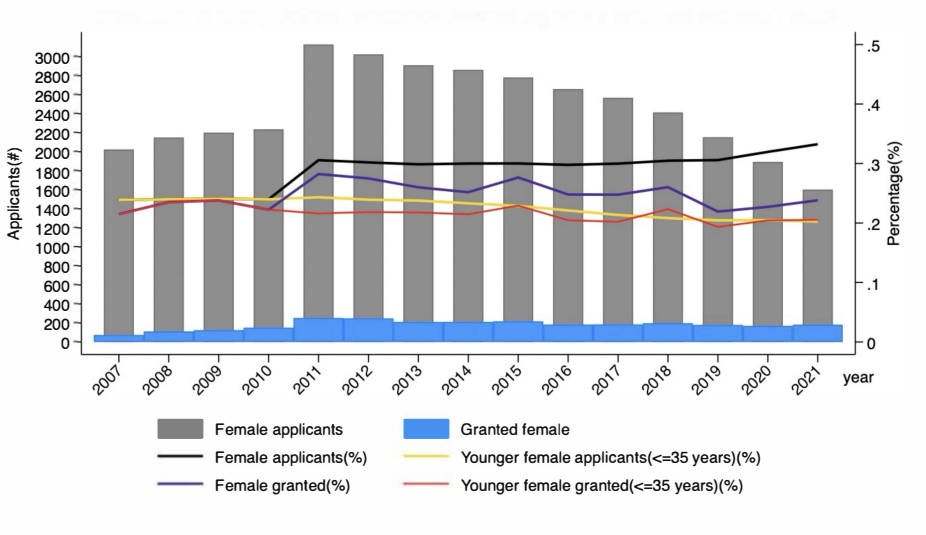


Figure 1: Female Share and Gender Gap in Young Scientists Grant

However, a notable divergence emerges when comparing the female share of applicants (black line) with the female share of awardees (purple line). While the female share of applicants increased steadily over the years, the female share of awardees remained relatively stable, leading to a widening gap between the two lines. This disparity indicates that as more women enter the competition, their success rates have not kept pace with their growing representation. In fact, the data suggests that the gender gap in success rates may have widened after 2011,

with women facing relatively lower success rates compared to men despite their increased participation.

This widening gap can be attributed to several factors. First, the expansion of age eligibility brought a significant number of older female applicants (aged 36–40) into the pool, intensifying competition among women. While this was a key goal of the reform, the relatively stable share of female awardees suggests that this increased competition may have diluted success rates for women as a group. Second, structural barriers and biases in the grant evaluation process may persist, disadvantaging female applicants even as their numbers rise. For instance, implicit biases in assessing research productivity or perceived career interruptions due to family responsibilities could play a role in limiting women's success in securing grants.

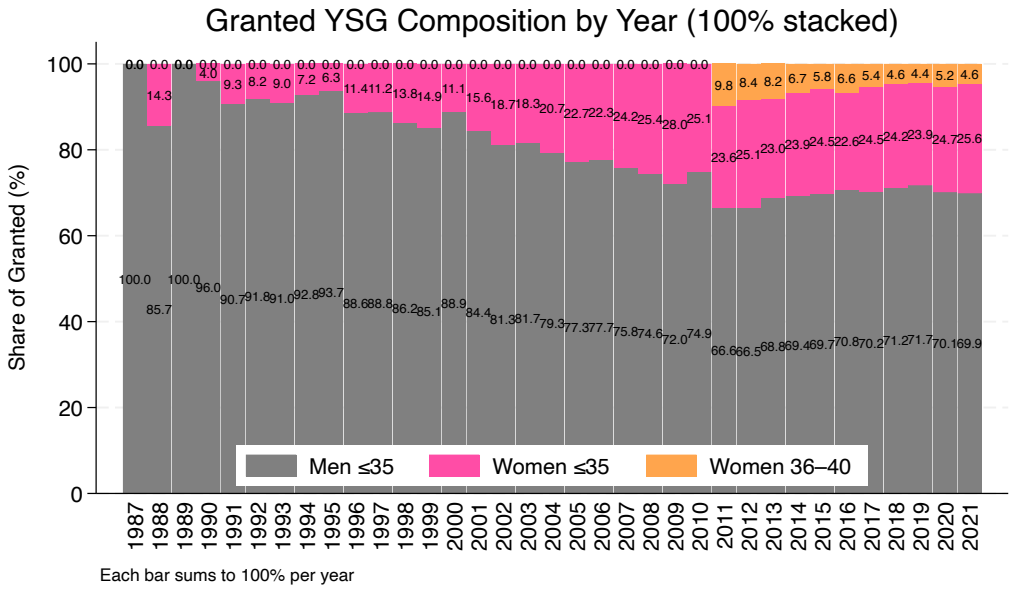


Figure 2: The Share of Winners of the Young Scientists Grant

Figure 2 plots the composition of granted YSG awards by year. Before the 2011 reform, the share of awards going to women aged $\leq$ 35 rises steadily, indicating a gradual narrowing of the gender gap among early-career awardees. After the reform takes effect in 2011, however, the share of awards going to women aged $\leq$ 35 stops increasing and even edges down. This change coincides with the entry of a new group—women aged 36–40, who become newly eligible under the

policy—and this group immediately accounts for a nontrivial fraction of granted awards. Importantly, the 36–40 female share then declines year by year after 2011, consistent with a one-time "stock" effect: the reform temporarily releases pent-up demand from cohorts of women who were previously age-ineligible but remained active applicants, and some of these newly eligible applicants initially capture a portion of the fixed award slots. As this backlog is exhausted, the shrinking award share for women aged 36–40—and the absence of further gains for women aged $\leq$ 35—suggests that the reform altered application behavior and competitive dynamics across age groups, with implications for how gender gaps evolve in the post-reform equilibrium.

Overall, the 2011 policy reform achieved its objective of expanding access to research funding for women, particularly for those in their late 30s. The increase in both the absolute number and the share of female applicants highlights the success of the policy in encouraging female participation. However, the comparison between the female share of applicants and awardees points to an important challenge: the growing participation of women has not translated into equitable funding outcomes. To address this, targeted interventions may be needed, such as adjustments in evaluation criteria, mentorship programs for female scholars, or implicit bias training for reviewers. These measures could help ensure that the increased representation of women in the applicant pool leads to more equitable success rates, advancing gender equity in research funding.

In terms of the YSG grant, the analysis sample summarized in Table 1 shows that we have information for scholars born between 1960–1995. There are 26% female scholars and 28% foreign-trained scholars. In these scholars' careers so far, 51% have eventually received the YSG, and more than half have received at least one general grant. Individual-year level publication counts show large variation, where most scholars produced at least one first-authored and one last-authored paper each year. Our sample includes projects funded by the Youth Science Foundation from 2007 to 2021, classified across several subject codes. Engineering and

Table 1: Summary Statistics of the Full Analysis Sample

	Mean	Std. Dev.	Min	Max	N
Individual-level Variables					
YSG	.5158387	.4997543	0	1	47,889
GG	.5457581	.4979125	0	1	47,889
#General Grants	1.013055	1.309987	0	11	47,889
Amount of General Grants (10,000 RMB)	56.23074	71.76151	0	522	47,889
Age at First General Grant	.5087321	.4999344	0	1	47,889
Female	.2655796	.441646	0	1	47,889
Years of Birth	1978.154	8.826149	1960	1995	47,889
PhD Foreign	.2813539	.4496731	0	1	47,889
BA School Ranking	171.86	239.6184	1	626	47,889
Individual-year-level Variables					
General Grant					
Total Publication Count	.0398439	.4631708	0	34	1,676,115
First-authored Publication Count	.008083	.1275074	0	11	1,676,115
Corresponding-authored Publication Count	.009201	.1827336	0	21	1,676,115
High-quality Publication Count	.0263848	.3496139	0	28	1,676,115

Materials Science represent the largest proportion of funded projects, accounting for 32.34% of the total sample, followed by Information Science (16.55%) and Mathematics (15.49%). Other notable fields include Chemistry (10.13%), Earth Science (9.47%), and Life Science (6.28%). Due to the fact that the NSFC re-categorize its subject code, Medical Sciences was part of life science before 2010 and separated out as an individual subject thus accounting for a smaller portion here (2.67%). Approximately 7.07% of the projects are classified as "Unknown" due to missing subject code data, particularly from the year 2021. The total number of funded projects in the sample is 10,750. This distribution highlights the significant emphasis placed on Engineering, Information Science, and Mathematics within the Youth Science Foundation's funding priorities.

Tables 2 and 3 provide summary statistics separately for the STEM and non-STEM groups. Among scholars in STEM fields (Table 2), approximately 16% have applied for the YSG at least once, and around one-third applied within a three-year window surrounding eligibility. A substantial share—about 82%—were under age 35 at the time of application, reflecting the youth-oriented design of the program. STEM scholars are relatively young overall, with an average age of 30, and 42% are female. They also demonstrate higher research productivity: the average cumulative publication count is 4.46 papers, including nearly one corresponding-author

publication and about one first-author publication. About 40% of STEM scholars are married, and 27% have at least one child by the time of observation.

In contrast, the non-STEM group summarized in Table 3 exhibits markedly different characteristics. Application rates are lower, with only 13% ever applying and fewer than 12% applying within the three-year eligibility window. Research output is also substantially lower compared to STEM scholars: both annual and cumulative publication counts are small, and corresponding-author or first-author publications are considerably less common. The demographic structure of the non-STEM group differs as well. Women represent a significantly larger share of this population (74%), and overall research experience appears more limited, as indicated by lower cumulative publication measures. Marriage and fertility rates are also substantially lower, with only 1–2% being married or married before age 35. These contrasts between STEM and non-STEM scholars highlight systematic differences in career stage, family structure, and research productivity that may influence both YSG application decisions and grant success.

Table 2: Summary Statistics of the Subsample with Application (STEMM = 1 Group)

	Obs	Mean	Std. Dev.	Min	Max
Apply yes=1	14403	0.113	0.317	0	1
Apply count(3-year window,dummy)	14403	0.431	0.846	0	7
Apply=1(3-year window,alt)	12772	0.128	0.241	0	1
Enter year	14403	2013	5.420	1993	2023
Age	14403	30.172	2.825	26	35
Female=1	14339	0.411	0.492	0	1
Pubnum	14403	0.989	1.974	0	21
Pubnum(correesponding)	14403	0.102	0.489	0	11
Pubnum(first auhtor)	14403	0.221	0.601	0	8
Pubnum(high quality)	14403	0.722	1.642	0	21
Cumulative pubnum	14403	2.742	6.495	0	86
Cumulative pubnum(cor)	14403	0.232	1.064	0	26
Cumulative pubnum(first)	14403	0.730	1.764	0	22
Cumulative pubnum(high)	14403	1.904	4.996	0	71
Married before 35=1	7703	0.658	0.474	0	1
Married Pre-Apply	7703	0.462	0.499	0	1
Have child=1	6808	0.332	0.530	0	2

Married Pre-Apply: An indicator variable (1 = married in the year of application; 0 = otherwise).

Table 3: Summary Statistics of the Subsample with Application (STEMM = 0 Group)

	Obs	Mean	Std. Dev.	Min	Max
Apply yes=1	6183	0.063	0.242	0	1
Apply count(3-year window,dummy)	6183	0.226	0.634	0	5
Apply=1(3-year window,alt)	5496	0.069	0.183	0	1
Enter year	6183	2013	5.846	2000	2023
Age	6183	30.215	2.834	26	35
Female=1	6183	0.542	0.498	0	1
Pubnum	6183	0.460	1.110	0	14
Pubnum(correesponding)	6183	0.079	0.345	0	4
Pubnum(first auhtor)	6183	0.150	0.482	0	5
Pubnum(high quality)	6183	0.308	0.846	0	13
Cumulative pubnum	6183	0.863	2.811	0	35
Cumulative pubnum(cor)	6183	0.121	0.577	0	8
Cumulative pubnum(first)	6183	0.309	1.108	0	14
Cumulative pubnum(high)	6183	0.542	1.920	0	25
Married before 35=1	3082	0.674	0.469	0	1
Married Pre-Apply	3082	0.473	0.499	0	1
Have child=1	2669	0.335	0.541	0	2

Married Pre-Apply: An indicator variable (1 = married in the year of application; 0 = otherwise).

Tables 4 and 5 report descriptive statistics for faculty members and staff, showing that the two groups are broadly comparable in terms of demographic composition and career stage. Both populations consist primarily of early-career individuals, with average ages around 30 and relatively small age variation. The timing of organizational entry is also similar across the two groups, reflecting parallel recruitment patterns within the institution. Family characteristics show comparable distributions as well: the proportions married or married before age 35 are close across faculty and staff, and both groups have relatively low rates of first childbirth during the observation window. Although the gender composition differs to some extent—staff roles include a larger share of women—this does not translate into meaningful differences in age structure, marital status, or childbearing patterns.

Taken together, the descriptive statistics indicate that faculty and staff form two closely aligned cohorts in terms of life-cycle stage, household formation, and institutional tenure. This comparability suggests that subsequent analyses leveraging these two groups can be interpreted without concerns about large underlying de-

mographic or career-stage differences. Their broadly similar profiles make faculty and staff suitable reference populations for examining fertility timing, grant application behavior, and early-career dynamics in a unified analytic framework.

Table 4: Summary Statistics on the Fertility Sample: Faculty Group

Variable	Obs	Mean	Std. Dev.	Min	Max
First Child	11,883	0.050	0.218	0	1
Have Child	11,883	0.090	0.287	0	1
Female	11,883	0.416	0.493	0	1
Entry Year	11,535	2016.203	4.977	1999	2024
Age	11,883	30.072	2.779	26	35
Married before 35	11,883	0.714	0.452	0	1

Table 5: Summary Statistics on the Fertility Sample: Staff Group

Variable	Obs	Mean	Std. Dev.	Min	Max
First Child	11,638	0.037	0.189	0	1
Have Child	13,409	0.058	0.234	0	1
Female	16,477	0.690	0.463	0	1
Entry Year	15,167	2014.558	5.604	1995	2025
Age	16,477	29.738	2.698	26	35
Married before 35	16,477	0.575	0.494	0	1

4 Empirical Strategy

To estimate how the 2011 NSFC age-limit reform reshaped young female scholars' fertility and application behavior—and its downstream implications for grant success and academic trajectories—we implement a differences-in-differences-in-difference (DDD) event study design that leverages variation across gender, discipline, and time. The reform primarily altered the timing constraints of YSG eligibility for women in natural science, technology, engineering, mathematics, and medicine (STEMM), where obtaining NSFC grants is essential for tenure-track advancement and sustaining research agendas in China's top-tier universities. In contrast, scholars in non-STEMM fields, such as management, economics, psychology, and other interdisciplinary fields, were eligible to apply for NSFC funding but typ-

ically faced weaker dependence on it due to alternative funding sources and different evaluation benchmarks. This structural distinction allows non-STEM fields to serve as a natural comparison group.

Our approach focuses on scholars under age 35 during the reform period, for whom the policy changed the alignment between biological and institutional clocks. We track whether this shift altered the sequencing of fertility and grant application behavior during early career years, and whether these behavioral changes led to longer-term differences in research outcomes, such as grant success, publication patterns, and promotion. Specifically, we estimate the following equation:

$$\begin{aligned} Y_{icfst} = \sum_{k=-8}^{10} \tau_k \times Female_i \times STEMM_f \times \mathbb{1}(Year_t - 2011 = k) + \\ \beta_1 Female_i + \beta_2 STEMM_f + \beta_3 Female_i \times STEMM_f \\ + \eta_t + \eta_t^{female} + \eta_t^{STEMM} + \delta_c + \theta_f + \gamma_s + S_{it}'\Lambda + \varepsilon_{icfst} \end{aligned} \tag{1}$$

where Y_{icfst} is the outcome of interest for individual (i), from birth cohort (c), in field (f), school (s), and year (t). The outcomes include YSG application events (indicators of applying or not), fertility events (indicators of the onset of each birth), YSG success (indicators of obtaining YSG or not), publication patterns (a series of publication measures including total number of publication, number of first-authored publications, number of corresponding-authored publications, number of top-journal publications, etc.), and promotion (indicators of became associate/full professor or not). The parameters (τ_k) trace dynamic effects in event time—relative to the reform year—specifically for women in STEM fields. We include leads and lags to examine pre-trends and temporal responses.

The specification includes year fixed effects (η_t), year-by-gender fixed effects (η_t^{female}), year-by-STEM fixed effects (η_t^{STEMM}), birth cohort fixed effects (δ_c), research field fixed effects (θ_f), and school fixed effects (γ_s). The vector (S_{it}') captures time-varying individual-level controls—including prior publication records, under-

graduate and doctoral institution tier and ranking, and other background variables. Standard errors are clustered at the individual level.

This empirical framework allows us to assess whether expanding the YSG eligibility window changed how young women navigated the trade-off between fertility and career-building during a critical stage of academic development, and to track the consequences of these behavioral shifts for longer-term academic success.

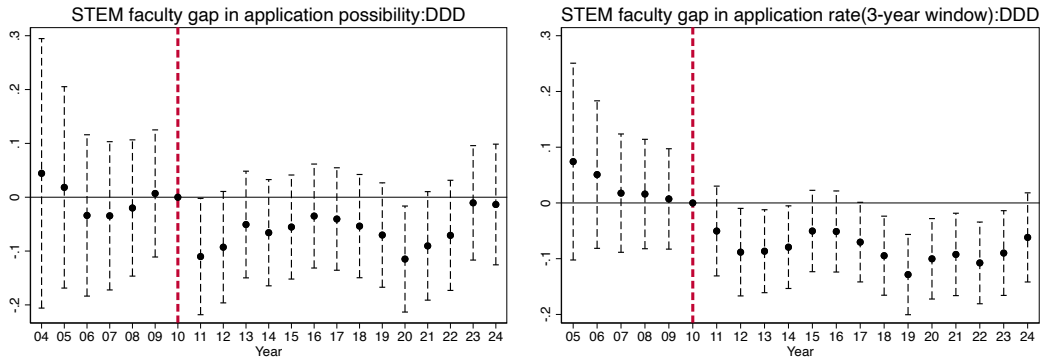
The key coefficients of interest are the event-time interactions τ_k, which trace how the behavior of young women in STEM fields evolved before and after the policy relative to men and non-STEM peers. For YSG application timing, we expect to observe a delay in applications immediately following the reform, reflecting the relaxed urgency due to the extended eligibility window. For fertility timing, we expect to see an increase in early childbearing among treated women, as the policy reduced the career cost of prioritizing fertility before age 35. If these behavioral shifts restructured early-career investment, we may observe reduced YSG success rates, slower entry into subsequent grant streams, and weaker early publication performance among treated cohorts. In each case, the sign and persistence of the estimated τ_k coefficients help assess whether institutional flexibility merely reorders career decisions or introduces long-run academic trade-offs.

5 Main Findings

5.1 Application to the Young Scientist Grant

We begin by examining whether the reform changed the timing or likelihood of YSG applications among young women in STEMM fields. Figure 3a plots the triple-difference event study estimates of the gender gap in the probability of submitting any YSG application in a given year. The coefficients are close to zero prior to 2011, indicating no differential pre-trends, but become negative in the years following the reform. Specifically, for most years post-reform, the likelihood of application decreased by 0.15–0.2, translating to a 70% to 95% decrease to the mean.

To account for the fact that preparing a grant proposal is costly—and that applicants frequently resubmit revised versions of the same proposal in the following years if not initially successful—Figure 3b presents a three-year average of application behavior. It reports the share of eligible individuals who submitted a YSG proposal within a moving three-year window. The estimated gender gap in application rate widens significantly after 2011, peaking roughly four to five years later, suggesting that younger women deferred proposal writing or postponed engagement in the funding process altogether. The gap reaches a trough around 2022 and remains negative thereafter.



(a) Yearly (b) 3-Year Average

Figure 3: Policy's Effects on Application

Notes: These figures plot estimates of τ_k from Equation (1). Outcome variable definitions: (Left panel) A binary indicator that equals 1 for a YSG application in year k and otherwise 0; (Right panel) The three-year rolling average of application frequency.

Beyond aggregate application behavior, we also examine how the content of submitted YSG proposals evolved following the reform.

Table 6 presents descriptive statistics for four measures of text similarity constructed from applicants' submission materials. The first two variables capture similarity in the abstracts of applications. Specifically, `sim-abs_words` measures the lexical similarity of two applications submitted by the same scholar at different points in time, while `sim-abs_contents` reflects their semantic similarity based on the meaning and context of the abstract text. The next two variables extend the same idea to project titles. `sim-title_words` measures word-level similarity between past and current titles, whereas `sim-title_contents` captures their

semantic similarity. Because project titles become observable only after an application is submitted, these two title-based measures are constructed using the set of projects for which title information is available.

Across the 1,913 observations in the sample, all four similarity indices appear relatively high on average—around 86 on a 0–100 scale—while still exhibiting substantial variation (standard deviations around 33). This pattern indicates that although applicants often reuse similar wording or thematic concepts across submissions, there remains considerable heterogeneity in how much they revise or adapt their abstracts and titles over time.

Table 6: Descriptive Statistics – Application

Variable	Obs	Mean	Std. Dev.	Min	Max
sim-abs_words	1,913	86.010	33.592	0	100
sim-abs_contents	1,913	86.649	32.914	0	100
sim-title_words	1,913	86.232	33.314	0	100
sim-title_contents	1,913	86.719	32.816	0	100

Table 7 reports within-individual changes in text similarity across proposals. We find that treated women, those in STEM under age 35, exhibited significantly higher similarity in both word usage and content structure post-reform. Specifically, their abstracts and full proposal texts were more similar to their own prior submissions, indicating lower variance across versions. This suggests that, conditional on applying, younger women may have revised their applications less intensively, potentially reflecting reduced effort or investment in grant preparation once the urgency of the pre-35 deadline was removed.

5.2 Timing of Fertility

Did the delay in YSG application coincide with earlier family formation? We next investigate whether the expanded application window altered family formation decisions during the early-career stage.

First, Figure 4a presents a difference-in-differences (DD) estimate using the STEMM faculty subsample, comparing women and men in terms of the timing of first-

Table 7: Effect of Policy Reform on Application Text Similarity

	(1) Word Abst	(2) Cont Abst	(3) Word Text	(4) Cont Text
female × post × stem	0.985**	1.226**	0.956**	1.180**
	(2.22)	(2.18)	(2.12)	(2.10)
N	1913	1913	1913	1913
R^2	0.470	0.495	0.481	0.504
Adj. R^2	0.188	0.227	0.205	0.240

t-statistics in parentheses

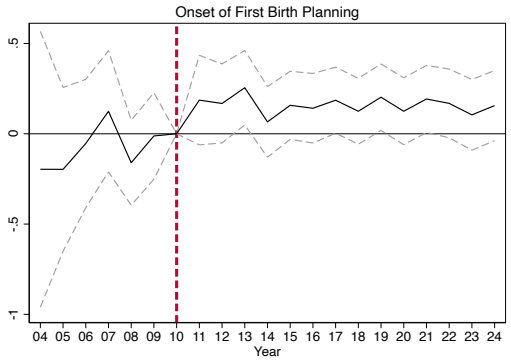
$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

birth planning. The dependent variable equals one if an individual gives birth to their first child ten months after the observed calendar year, and zero otherwise—including those with no observed childbirth. The results show a significant increase in birth planning among women in STEM fields beginning right after the reform, with effects peaking around 2013 and stay positive.

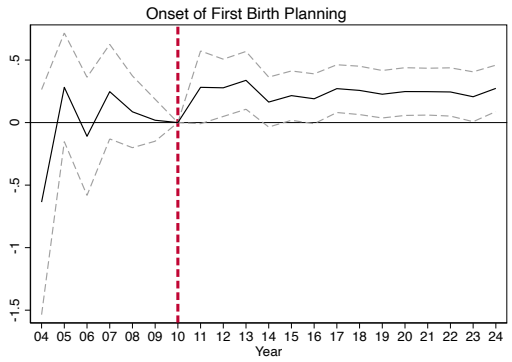
Figure 4b presents a triple-differences (DDD) specification based on the entire faculty population, comparing female versus male birth timing across STEMM and non-STEMM fields. Because non-STEMM fields were formally eligible but functionally less dependent on NSFC grants, they serve as an appropriate comparison group for STEMM faculty. Consistent with the DD and prior DDD estimates, we observe a sharp post-reform increase in early childbirth among treated women.

Figure 4c uses an alternative DDD that extends the comparison to all staff and STEMM faculty. Here, we compare female versus male birth timing across administrative staff (for whom grant competition is not binding) and STEMM faculty (for whom the reform affected both funding competition and evaluation norms). This design further isolates the effect of institutional funding constraints by leveraging variation across job types.

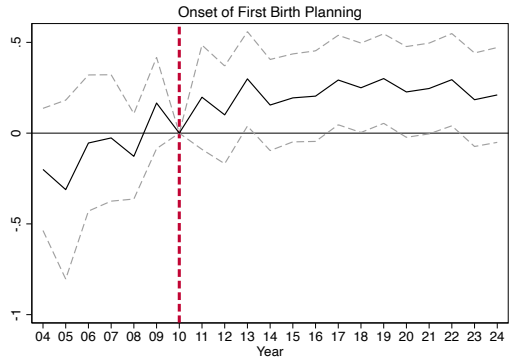
Together, these three analyses point to a consistent pattern: the reform appears to have nudged younger women to prioritize family formation earlier in their academic careers, aligning with the delay in application timing documented above. Assuming that early-career years are a binding constraint in academia, such defer-



(a) Female Faculty (v.s. Male Faculty) in STEMM across Time



(b) Female Faculty (v.s. Male Faculty) in STEMM (v.s. non-STEMM) across Time



(c) STEMM Female (v.s. STEMM Male) Faculty (v.s. Staff) across Time

Figure 4: Policy's Effects on Fertility

Notes: These figures plot estimates of τ_k from Equation (1). The outcome variable is a dummy which equals 1 if there is a first-birth planning (imputed from birth record–10 months prior to the first-birth) in year k and 0 otherwise.

ral of grant application would not be expected absent a compelling reason. The synchronization of increased fertility planning with reduced application urgency suggests that the expanded eligibility window relaxed the career–family tradeoff by loosening the institutional deadlines that previously forced women to choose between research advancement and childbearing. We further illustrate this grant-fertility trade-off using a simple conceptual model in Appendix B. This timing shift underscores how structural constraints can shape intertemporal choices over family and career formation, particularly in high-stakes academic environments.

5.3 The Young Scientist Grant Success

We next explore whether the observed changes in application and fertility behavior translated into the young scientist grant success, then the down-stream grant outcomes (e.g. the “general grant") and publication outcomes.

We first report the outcomes of grant success from our administrative sample, where we directly observe application-linked outcomes. In Figure 5, we plot the DDD event-study estimates of the 2011 eligibility expansion on women’s YSG success outcomes. Consistent with the identification strategy laid out in the Methods section, the DDD structure differences out (i) common time shocks to YSG outcomes and (ii) gender-specific changes that are not unique to STEMM by using non-STEMM faculty as an explicit control group.

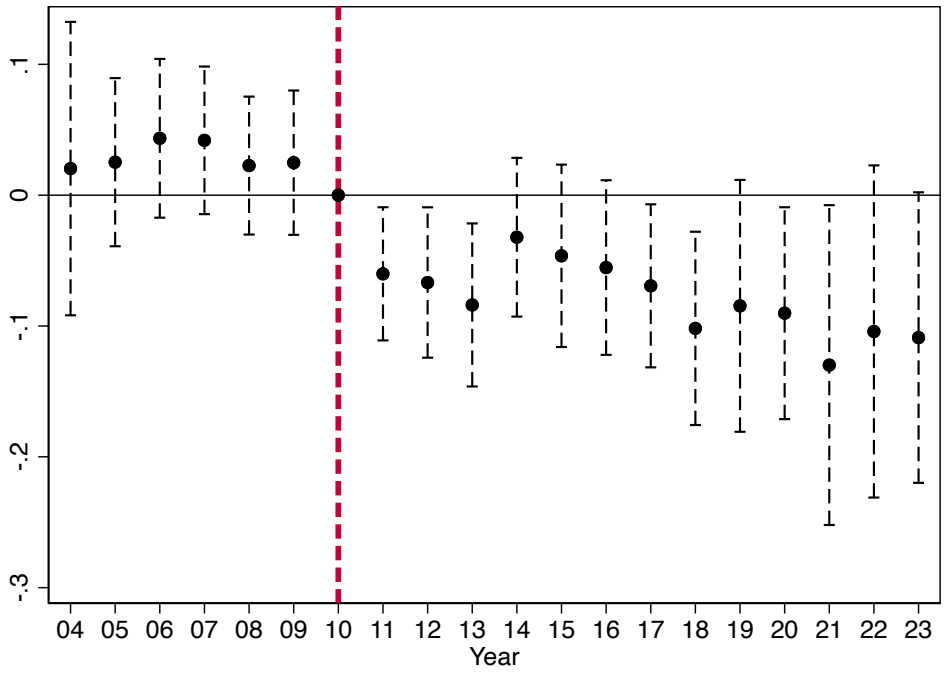


Figure 5: Young Scientist Grant Success (Admin Sample with Applications)
Notes: This figure plot estimates of τ_k from Equation (1). The outcome variable is a dummy, which takes 1 if wining YSG in year k while takes 0 if not yet won while eligible, missing otherwise.

The pre-policy coefficients (2004–2010) fluctuate around zero without a systematic trend, supporting the identifying assumption that, relative to non-STEMM, STEMM women and men were on similar trajectories prior to the reform. Strik-

ingly, the first post-reform coefficient in 2011 drops immediately below zero, indicating an abrupt widening of the STEM gender gap in YSG success right at the time women's eligibility was extended. The negative effects persist throughout the post period, with point estimates remaining below zero in subsequent years, consistent with a sustained deterioration in women's relative success in STEM rather than a short-lived transition shock.

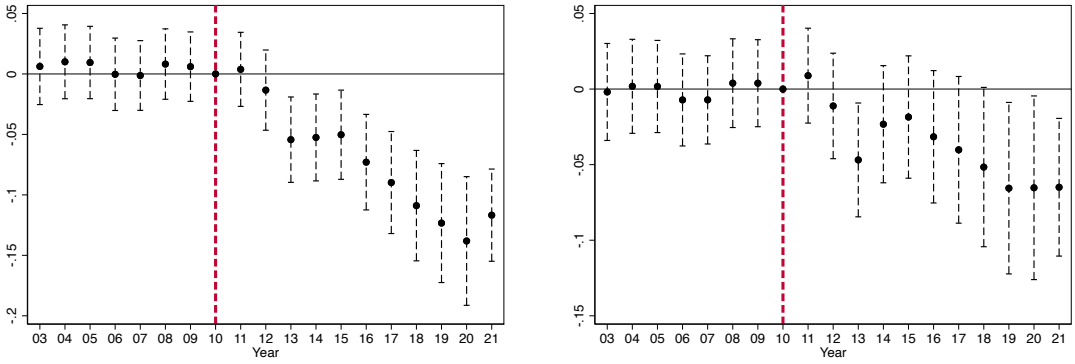
A key advantage of this administrative sample is that we can more tightly net out compositional and measurement concerns that often confound long panels: we observe the start of employment and track professional titles accurately over time, allowing us to control for cohort-by-career-stage changes and to align success outcomes with the appropriate rank/tenure timing. Taken together, the admin evidence suggests that the policy change generated an immediate and enduring increase in the relative disadvantage of STEM women in YSG success, consistent with intensified competition following the eligibility expansion.

To assess external validity and national representativeness beyond the administrative setting, we next replicate the same DDD event-study framework in a much larger dataset covering roughly 50 institutions, which allows us to verify whether the dynamic pattern observed here generalizes in a broader, nationally representative sample.

Figures 6a–6b report the dynamic treatment effects from our DDD event-study design using two subsamples. The left panel uses the full applicant-age window implied by the policy rules: it includes all male applicants who are age-eligible for the YSG (under 35 throughout the period), all female applicants under 35, and—starting in 2011 only—female applicants ages 36–40 who become newly eligible after the reform. The right panel restricts attention to a constant early-career applicant group that is unaffected by the eligibility expansion in terms of age composition: we keep only applicants ages 26–35 for both genders in all years. This restriction holds fixed the age window around the pre- and post-policy periods, so any post-2011 changes in the estimated STEM gender gap in the right panel reflect shifts within the sta-

ble early-career applicant pool rather than the mechanical re-entry of older female applicants.

In both panels, the pre-reform coefficients are small and statistically indistinguishable from zero, providing support for parallel pre-trends in the STEM gender gap relative to the non-STEM benchmark. After the reform, the estimated gender gap in STEM success outcomes becomes increasingly negative over time, with the magnitude of the post-period decline markedly larger when we define the sample as ages 26–40 (Figure 6a) than when we restrict attention to the constant early-career window ages 26–35 (Figure 6b).



(a) Age Group 26-40 (b) Age Group 26-35

Figure 6: Young Scientist Grant Success

Notes: These figures plot estimates of τ_k from Equation (1). The outcome variable is a dummy, which takes 1 if wining YSG in year k while takes 0 if not yet won while eligible, missing otherwise. Left panel sample: the entire sample of applicants including female applicants aged 36-40 after 2011. Right panel sample: the subsample with only age 26-36 applicants.

This pattern is informative about competitive dynamics: the 26–40 window captures the full mechanical consequence of re-admitting ages 36–40 women into the YSG competition—an older group that is, on average, less competitive on observable and unobservable dimensions—thereby lowering average female success rates in STEM and amplifying the measured post-reform decline in the relative gap. By contrast, the 26–35 estimates isolate the cohort whose eligibility definition is stable across pre- and post-reform periods and whose grant outcomes most directly correspond to decisions made during the early-career phase that is salient for fertility planning. Notably, the coefficients immediately after the policy change (2011–2012) show little movement, consistent with a short-run "stock" effect: pre-

viously ineligible 36–40 women re-enter the applicant pool and compete for a fixed number of award slots, muting detectable changes for younger cohorts in the first years. As this stock of returning applicants dissipates, the divergence becomes more pronounced in later years, which we interpret as reflecting longer-run adjustments in application and career-timing behavior among younger female STEM scholars—consistent with the reform altering the incentives to align fertility and grant-seeking decisions before age 35.

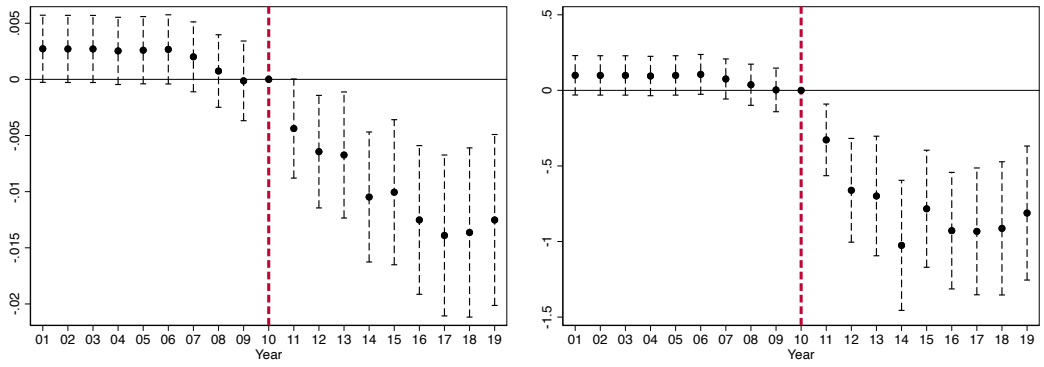
This trend in gender gap aligns with descriptive trends reported in the NSFC's official statistical yearbooks (Yu et al., 2020), which consistently document lower grant success rates for early-career women in STEM fields. Our results also echo Eble and Hu (2025), who show—using nationally representative data—that female scholars face greater barriers in project approval, particularly at early stages of the funding pipeline.

5.4 The Down-stream Grants

We next examine whether the policy's influence on early-career timing extended to downstream grant outcomes—specifically, success in securing general grants, which serve as the primary funding mechanism for established researchers in China. Analogous to R01 grants in the U.S. NIH system, general grants represent a key marker of research independence and are often used to evaluate promotion and tenure-readiness in STEM fields. Since the Young Scientist Grant (YSG) is typically a stepping stone toward these larger grants, any shifts in early-career behavior may have implications for later-stage funding outcomes.

Figure 7 presents estimates of the reform's effect on access to general grants. Panel (a) shows a decline in the likelihood of receiving any general grant in a given year for treated women, beginning several years after the policy reform and growing in magnitude over time. While smaller than the drop observed for YSG success, the effect is still notable, particularly as it accumulates over successive years. Panel (b) shows a parallel decline in the amount of general grant funding received, further

indicating a shift in research trajectories.



(a) General Grant Access (b) Amount of General Grant Received

Figure 7: Policy Effect on the General Grant

Notes: These figures plot estimates of τ_k from Equation (1). The outcome variable takes 1 if a scholar obtained any general grant in year k, 0 otherwise. A general grant can be repeatedly applied and granted in any age.

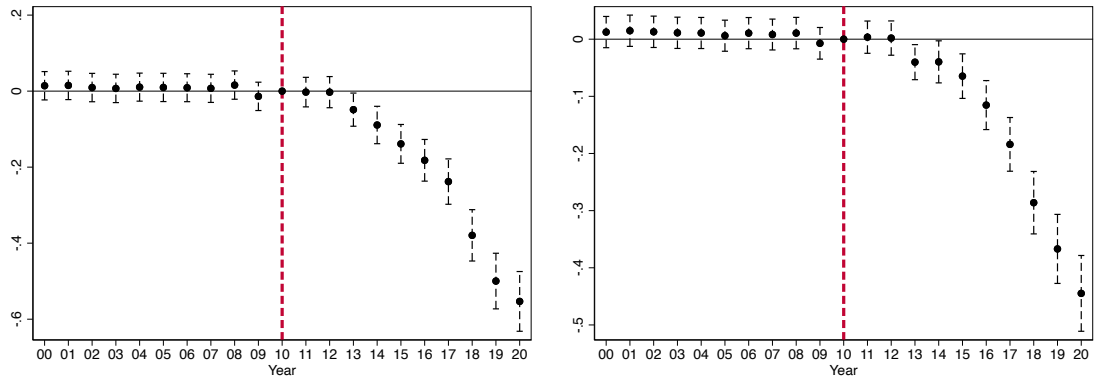
These trends suggest that early-career choices influenced by the reform—such as delaying grant applications or prioritizing family formation—may translate into reduced momentum toward establishing an independent research profile. As with the publication outcomes, we interpret this pattern not as a policy failure, but as evidence of a structural trade-off. The expanded eligibility window allowed greater temporal flexibility, which some women appear to have used to shift their focus during the most compressed career-family conflict years. In doing so, they may reach major research milestones, such as general grant attainment, on a slower trajectory.

5.5 Publication Patterns

Turning to publication outcomes, Figure 8 shows a substantial and sustained decline in research productivity among younger women in STEM fields following the 2011 reform. Panel (a) plots the effect on the total number of yearly publications and reveals a sharp and accelerating drop starting around 2013. The magnitude grows steadily through 2020, with a cumulative effect of roughly -0.6 publications per year. This pattern suggests a broad erosion of research output over time.

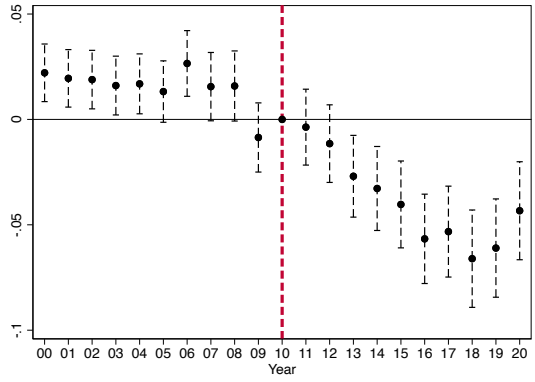
Panel (b) examines top publications—those appearing in high-impact journals—and displays a similar trajectory, albeit with slightly smaller magnitudes. The decline begins in the same post-reform window and reaches about -0.45 publications per year by 2020, indicating that the negative productivity effects extend to both quantity and quality of output.

Panels (c) and (d) differentiate the nature of this decline by authorship role. Panel (c) shows a modest decrease in first-authored publications (approximately -0.07 per year), which typically signal a scholar's independent work and early-career contribution. In contrast, panel (d) shows a more substantial drop in corresponding-authored publications—falling by nearly -0.25 per year by the end of the period. This outcome is particularly concerning as it captures leadership roles in collaborative research, suggesting that the policy may have undermined women's ability to secure and sustain senior authorship positions.

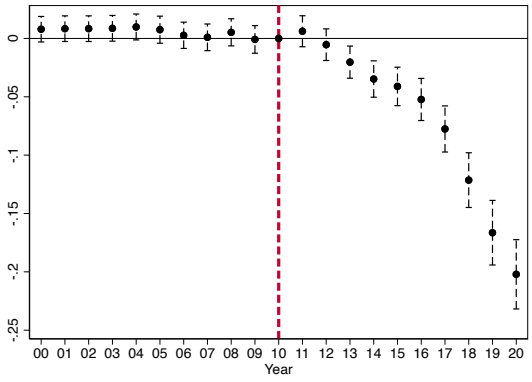


(a) Yearly #Publications

(b) Yearly #Top Publications



(c) Yearly #First-authored Publications



(d) Yearly #Corresponding-authored

Figure 8: Policy Effect on Publication

Together, these results suggest that the reform facilitated a meaningful shift in how early-career women navigate competing priorities, particularly between family formation and academic advancement. The observed declines in various publication outcomes—ranging from total output to authorship roles—appear consistent with a reallocation of effort away from intensive research engagement during the early-career period. Rather than interpreting this as a failure of the policy, we view it as evidence of a behavioral trade-off: when institutional constraints are relaxed, some women may choose to prioritize family, leading to a temporary slowdown in research output. These patterns reflect the complex interplay between personal choices and professional trajectories, emphasizing the need to understand success on broader terms than productivity metrics alone.

6 Discussion and Conclusion

6.1 What we learn from the 2011 eligibility extension

At the center of this paper lies a longstanding tension: how women in science navigate overlapping timelines of fertility and career progression when the most demanding early-career years coincide with biological constraints. We study this question through a rare institutional shift: the 2011 reform to China's Young Scientist Grant (YSG), which extended women's eligibility by five years without conditioning on childbirth. This policy change provides a revealing window into how early-career scholars respond when a salient temporal constraint is eased while competitive pressures remain high.

We find that the reform reduced the urgency for younger women to apply for early-career grants and coincided with earlier family formation. These shifts were not merely symbolic. They translated into a slower trajectory through key academic milestones, including grant attainment and research productivity. Downstream grant access (general grants that fund established scholars) fell for women in more competitive, funding-reliant fields. Publication output also declined, with

more pronounced drops in leadership roles as measured by corresponding authorship.

Taken together, the 2011 YSG eligibility extension for women provides rare evidence on how early-career scientists re-sequence career investments and family formation when a binding temporal constraint is relaxed. The results underscore a broader lesson: relaxing one clock can change behavior, but sustained progress depends on how multiple clocks—eligibility thresholds, recent-output screening, and career advancement deadlines—interact over the academic life course.

6.2 Interpreting behavioral responses

These patterns can be interpreted as choices made under a new set of constraints and opportunities. Faced with greater temporal flexibility, some women may have shifted effort toward family formation during the early-career period, aware of potential trade-offs for their academic trajectories. Such adjustments need not reflect diminished ambition or missed opportunities; they may reflect broader dimensions of utility and well-being that extend beyond publication counts and grant awards.

Importantly, our results do not imply that women "benefit" or "lose" from the reform in a welfare sense. Rather, the evidence highlights how life-cycle constraints and institutional timelines jointly shape behavior. When one deadline is relaxed (the eligibility cutoff), scholars may re-sequence investments across career and family, yet remain exposed to other forms of competitive screening and cumulative advantage.

6.3 Anecdotal evidence on the "double-clock" constraint

Our empirical analysis isolates behavioral responses to a specific policy reform, but the underlying constraint is often described more broadly in public discourse as a "double-clock" pressure for women in research: age-bounded eligibility and recent-output screening in grant competitions coincide with high-stakes promotion and hiring timelines that can function as an "up-or-out" clock (the Chinese version of

the tenure clock), all while marriage and childbearing remain concentrated in the same life stage.

We bring two pieces of anecdotal evidence here—a "Top-Down" (media discourse) and a "Bottom-Up" (direct practitioner testimony) perspective—to illustrate this structural problem in Chinese academia. A recent media report by Lai (2024) from *Nanfengchuang* provides a concrete illustration of these interacting clocks.[4] The report describes how funding and hiring evaluations may emphasize age-bounded eligibility and recent-output records, making short interruptions especially salient for early-career women, and discusses how pregnancy can constrain research activity in ways that amplify concerns about falling behind evaluation windows. We use this source as contextual illustration rather than causal evidence. It emphasizes that early-career evaluation is not only governed by a formal age threshold; it is also shaped by implicit "recency" expectations that reward uninterrupted production. In this environment, pregnancy and childbirth are framed not merely as time-consuming events but as periods that can directly restrict research activity, particularly in lab-intensive settings. These narratives align with a mechanism consistent with our findings: easing the eligibility cutoff can alter early-career sequencing, but persistent screening based on recent outputs and downstream career deadlines can still penalize temporary slowdowns, contributing to delayed grant attainment and reduced measured productivity.

Complementing this top-down narrative, a 2025 discussion thread on Xiaohongshu (also known as "Rednote") offers a bottom-up view of how early-career women internalize and strategize around the same "double-clock" constraint.[5] Strikingly, participants do not frame fertility timing as a private preference problem; instead, they map it explicitly onto institutional milestones and evaluation rules. Some comments advance an extreme "earliest possible" logic (e.g., undergraduate years), ar-

[4]Nanfengchuang (or South Review) is a well-known biweekly politics and economics magazine based in Guangzhou, China.

[5]We draw on a selected Xiaohongshu thread titled "When is the best fertility window for female scientific researchers?" and its comment replies. Appendix C presents original Chinese excerpts with author translations and a thematic synthesis. As with the media account, these materials are illustrative and not intended to be representative.

guing that later stages impose too high an opportunity cost once grant deadlines and performance metrics become binding. Others propose a narrow "student-status" window (PhD or postdoc) as the least damaging period, while simultaneously noting that in China postdoctoral appointments can carry high KPI requirements tied to faculty job-market competitiveness. A third cluster explicitly coordinates childbirth around grant cycles and "up-or-out" reviews (e.g., timing birth to the year of submitting a Youth Fund application), underscoring that the relevant constraint is not merely the formal eligibility cutoff, but the need to preserve continuity and signal momentum within evaluation windows.

The practitioner testimony also highlights mechanisms that our administrative outcomes cannot directly observe but help interpret them. Commenters repeatedly emphasize field-specific constraints in lab-intensive disciplines (e.g., avoiding chemical exposure during pregnancy) and the physiological toll of sustained academic stress, suggesting that the effective cost of a childbirth-related interruption may exceed the nominal time granted by formal policies. Together, the media narrative and practitioner testimony converge on the same point: time-compensation policies may shift early-career sequencing by relaxing a salient eligibility deadline, yet they do not eliminate the broader set of constraints that operate through recency-based evaluation, promotion clocks, and the difficulty of rebuilding research momentum after childbirth.

Such anecdotal evidence cannot establish causal effects, nor does it speak to representativeness. However, it helps interpret why time-compensation policies may change the timing of applications and family formation without eliminating longer-run structural constraints that operate through evaluation windows, promotion clocks, and the costs of rebuilding research momentum after childbirth.

6.4 Implications, limits, and directions for future research

From a policy perspective, our findings suggest that age-limit extensions may remove one salient barrier while leaving other constraints unchanged. If post-birth

rebuilding costs and recent-output screening remain central to evaluation, then complementary measures may be needed to align time-compensation policies with sustained professional advancement. Examples include mechanisms that reduce the penalty from short research interruptions or that support re-entry and catch-up (e.g., bridge funding, flexible evaluation windows, or targeted support for re-establishing research teams and pipelines).

Several limitations are important. First, our outcomes are measured through observable academic milestones (applications, funding, and publications) that capture only part of welfare and do not directly measure well-being, family outcomes, or subjective career satisfaction. Second, while the reform provides a compelling quasi-experimental setting, institutional responses and academic competition may evolve over time, potentially shaping the mapping from eligibility to long-run trajectories. Third, heterogeneity across fields and institutions indicates that the same eligibility change may have different implications depending on funding dependence, publication norms, and the intensity of promotion screening.

Future work could combine administrative data with survey or qualitative evidence to better measure welfare-relevant outcomes and decision-making constraints, explore institutional adjustments in hiring and promotion in response to eligibility rules, and evaluate complementary policies designed to support post-birth rebuilding in high-competition research environments.

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A Additional Figures and Tables

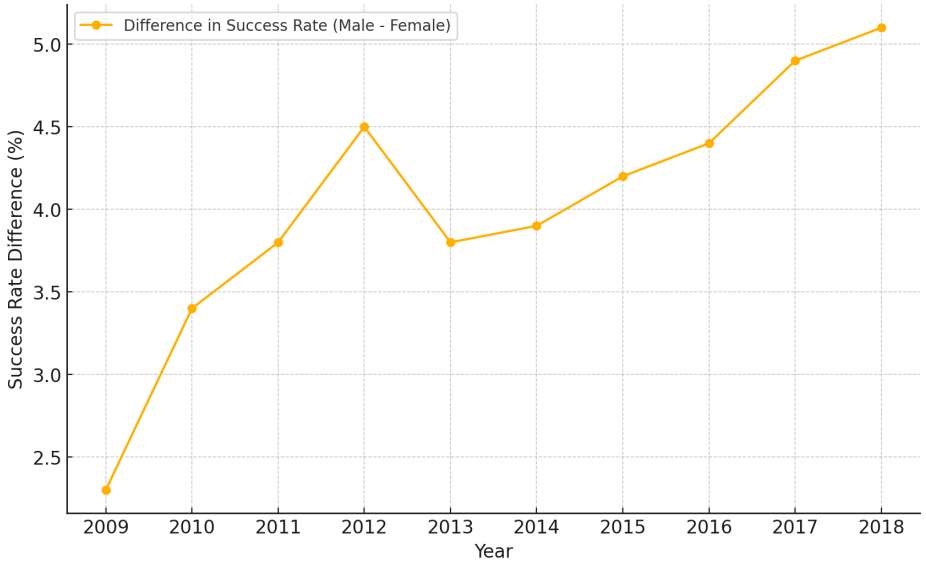


Figure A1: Gender Gap in Success Rate of the Young Scientist Grant (Aged 30-35)
Notes: Data come from the NSFC's statistics report (Yu et al., 2020).

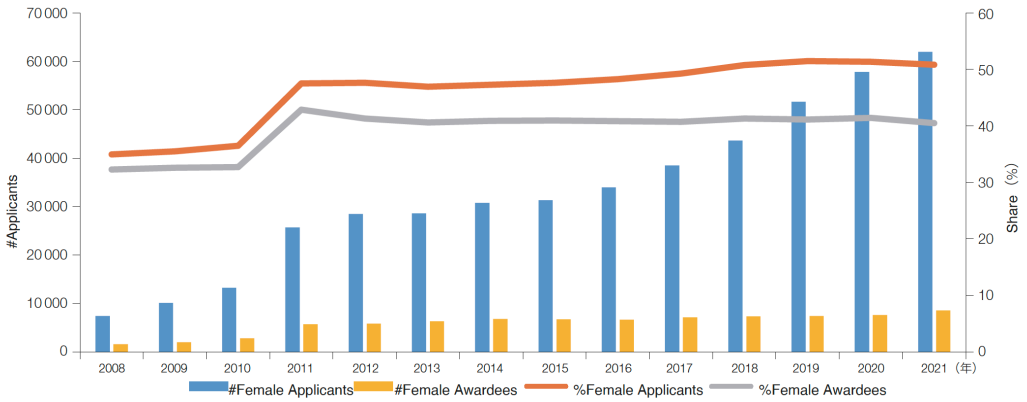


Figure A2: Female Scholars in the Young Scientist Grant Application (All Age)
Notes: Data come from the NSFC's statistics report (Yu and Gao, 2023).

B A Simple Model of Grant-Fertility Trade-offs

To interpret the contrasting behaviors of two generations of female researchers—those who came of age before the policy reform and those after—we need a simple economic model that captures the core trade-offs they face. While the policy intended to support work-family balance by expanding grant eligibility for women, it simultaneously reshaped the competitive landscape across cohorts. A formal model helps clarify how women weigh the costs of delaying childbirth versus delaying grant applications under changing institutional rules, and how increased competition from older entrants may unintentionally alter the incentives and outcomes for younger scholars. This framework is essential for understanding both the direct and unintended effects of gender-targeted time-based policy interventions.

Environment

A female researcher faces two time periods:

- $t = 1$: age 30–35
- $t = 2$: age 36–40 (available only after the 2011 NSFC reform)

She chooses both:

- When to apply for a Young Scientist Grant (YSG): $a_t \in \{0, 1\}$, with $\sum_t a_t \leq 1$
- When to have a child: $b_t \in \{0, 1\}$, with $\sum_t b_t \leq 1$

Grant Success and Productivity

- $\bar{\pi}$: baseline research productivity
- $\lambda > 0$: productivity loss if grant and childbirth occur in same period
- p: reverse pre-reform grant competition
- p_1, p_2: reverse post-reform competition in $t = 1$ and $t = 2$

Success probability in period t is:

$$s_t = (\bar{\pi} - \lambda \cdot b_t) \cdot p_t$$

Utility and Parameters

- V: value of winning the YSG
- C: cost of having a child (economic and emotional burden)
- δ: cost of delaying childbirth (biological and psychological)

Total utility depends on timing of application and childbirth.

Pre-Reform Problem (Born leq1975)

Before 2011, women could apply for YSG only at age ≤ 35. The strategic options are:

(U_1^{pre}) Delay childbirth until after grant application:

$$U_1^{\text{pre}} = V \cdot \bar{\pi} \cdot p - C - \delta$$

(U_2^{pre}) Have child during grant application window:

$$U_2^{\text{pre}} = V \cdot (\bar{\pi} - \lambda) \cdot p - C$$

Trade-off condition:

$$U_1^{\text{pre}} \geq U_2^{\text{pre}} \quad \Longleftrightarrow \quad V\lambda p \geq \delta$$

Interpretation: A woman delays childbirth if the expected productivity loss from childbearing during the grant period ($V\lambda p$) exceeds the disutility of delaying childbirth (δ). This explains delayed fertility observed among older cohorts.

Post-Reform Problem (Born $>$ 1975)

After 2011, women can apply up to age 40. The strategy set expands:

(U_1) Delay childbirth to apply early (age 30–35):

$$U_1 = V \cdot \bar{\pi} \cdot p_1 - C - \delta$$

(U_3) Have child first, apply later (age 36–40):

$$U_3 = V \cdot \bar{\pi} \cdot p_2 - C$$

(U_4) No grant application:

$$U_4 = -C$$

Note: Option U_2 (grant + childbirth in $t = 1$) is dominated by U_3 or U_1 in most cases.

Trade-off condition:

$$U_3 \geq U_1 \quad \Longleftrightarrow \quad p_2 \geq p_1 - \frac{\delta}{V\bar{\pi}}$$

Interpretation: As p_2 (postponed application success rate) declines due to crowd-in, fewer women will delay grant application. Even with expanded eligibility, intensified competition may discourage younger women from taking advantage of the flexibility.

Summary

- **Pre-reform cohorts** chose between delaying childbirth (U_1^{pre}) or enduring productivity loss (U_2^{pre}), based on p and δ.
- **Post-reform cohorts** weigh a new choice between applying early (U_1) or delaying application (U_3), shaped by p_1, p_2, and unchanged δ.

- The model explains observed shifts in fertility timing and grant outcomes, highlighting how second-order competition effects can reduce the policy's intended benefits.

Linking Theory to Empirical Findings

The model explains key cohort-based differences in behavior observed in the data. In particular, it rationalizes how changes in policy constraints and option sets affect both grant application timing and fertility decisions.

Table B1: Empirical Patterns and Their Theoretical Interpretation

Empirical Finding	**Theoretical Explanation**
1. Pre-reform women apply earlier for YSG (mostly age $\leq$35)	Before 2011, women had no eligibility beyond age 35. The only choice was when to have children. Optimal strategy under high productivity cost (λ) and grant value (V) was to delay childbirth and apply early (strategy U_1^{pre}).
2. Pre-reform women have children later	In the pre-reform regime, delaying childbirth was preferred if $V \cdot \lambda \cdot p \geq \delta$. Many chose U_1^{pre}, delaying childbirth to avoid productivity loss during grant application.
3. Post-reform women apply later (more dispersed grant timing)	The post-2011 reform introduced a second grant window (age 36–40). When competition in that window (p_2) was not too high, women could choose U_3 (child first, grant later), leading to delayed or more distributed application timing.
4. Post-reform women have children earlier	With flexible eligibility and the option to apply post-childbirth, many younger women chose to avoid delay cost (δ) and had children earlier (strategy U_3), consistent with a shift away from the old delay-child norm.

C Public discourse sources (illustrative)

C.1 A Media Report by the Well-known *"Nanfengchuang"*

The original Chinese report is《被"圈养"的女博士，打破婚育藩篱》by Lai (2024) published on Nanfengchuang (2024-06-17) as cover story "女士赛先生"（Female Scientists). Table C1 provides some selected direct quotes from the report and complement with English translations.

Table C1: Selected Quotes from the Report

Original Chinese Text	**English Translation**
"当社会中有关青年教师"非升即走"压力的讨论越来越多时，女性科研人员还面临着另外一层压力—她们也恰好处于社会所认知的"最佳生育年龄"时期。当社会时钟嘀嗒嘀嗒转动时，她们好似必须在此刻做出自己的选择—这个时段里到底选科研，还是选婚育？"	When discussion of the "up-or-out" pressure facing young faculty becomes increasingly common, female researchers confront an additional layer of pressure: they happen to be in what society regards as the "optimal childbearing age." As the social clock keeps ticking, they can feel compelled to make an immediate choice—during this period, should they choose research, or marriage and childbearing?
"而生育则有三难，占用时间，消耗精力，损耗身体。与此同时，有生育计划的女性科研者自己也会犹豫，高龄生育是否会对自己和孩子的身体健康造成影响。"	Childbearing entails three difficulties: it takes time, drains energy, and imposes physical costs. At the same time, women researchers who plan to have children may hesitate, worrying whether later-age childbearing could affect the health of themselves and their children.
"但无论是国家自然科学基金项目还是博士科研启动基金项目的申请，都有年龄限制。能不能通过申请，还需要考量过去几年的科研成果。"	Yet applications for both National Natural Science Foundation of China (NSFC) grants and doctoral start-up research funds are subject to age limits. Whether an applicant can succeed also depends on their research record over the past several years.
"后来入职高校的时候，对方也顾虑我快35岁了，好在国家延长了女性申请国家自然科学基金的时间，所以我当时说我可以申到40岁，这么看我还小。"	When I was later hired by a university, they were concerned that I was close to 35. Fortunately, the state extended the eligibility age for women applying to the NSFC, so I told them that I could apply until 40—by that logic, I was still 'young'.

C.2 A Thread on Career-Fertility Trade-offs from “Xiaohongshu"

This section provides a detailed mapping of the “double-clock” constraint as discussed by practitioners on social media. The data is drawn from a 2025 thread by account "boon的小本子" on one of the most popular Chinese social commerce apps (*Xiaohongshu, or Little Red Book*), where female researchers discussed the “optimal fertility window” in the context of China’s academic evaluation system. The original post title: “提问：女性科研工作者最佳生育窗口是什么时候？”(Question: When is the best fertility window for female scientific researchers?). The thread involves PhD students and early-career researchers in Chinese academia discussing the trade-offs between biological constraints and academic milestones. Figures B1-B3 provide screenshots of the original thread while Tables B1-B4 provide selected comments with English translations.

In short, the testimonies in Tables C2-C5 align closely with institutional analyses in the media report by (Lai, 2024). While media reports focus on the **age-bounded eligibility** (the formal clock), the practitioners focus on the **implicit recency expectation** (the informal clock). For example, while a policy may grant a one-year extension for birth, the practitioner’s fear of “falling behind” or “losing research momentum” in a lab-intensive setting suggests that the effective penalty of an interruption exceeds the formal time allotted by the policy.

As detailed in the Appendix tables, respondents evaluate various windows of opportunity based on shifting opportunity costs and institutional pressures: the undergraduate years are perceived as a period of high physical resilience and minimal career disruption despite financial precariousness (Table C2), while the PhD and postdoctoral stages offer a level of flexibility that can be leveraged to provide positive signals to hiring committees regarding "completed" fertility (Table C3). Upon entering the formal labor market, the conflict between biological and professional timelines intensifies, forcing researchers to synchronize childbearing with administrative "dead periods"—such as the National Natural Science Foundation of China

(NSFC) grant review cycles—to mitigate the "recency" penalties of the "up-or-out" tenure clock (Table C4). This strategic behavior is ultimately underscored by severe physical and biological costs, including laboratory-specific hazards in STEM fields and stress-induced reproductive health issues, which highlight the profound friction between institutional evaluation windows and biological realities (Table C5).

Table C2: The “Optimal" Fertility Timing

User	**Original Chinese Text**	**English Translation**
bb猪	说不好听点，但是确实是，本科。	To put it bluntly, it’s actually during undergraduate years.
一排鱼	现在回过头真的觉得是本科，身体好，精力好，只不过感情不稳定，收入不稳定。但是对自己的事业没影响。	Looking back, it really is undergrad. You have health and energy; it’s just that relationships and income are unstable. But it has zero impact on your career.
中薯炸得焦脆	生化环材很难... 去掉年龄大怀孕风险增加，那么就剩：本科。	BCEE* fields are hard... Subtracting the risks of advanced maternal age, the only thing left is: Undergrad.

*Note: “生化环材” (BCEE) refers to Biology, Chemistry, Environment, and Materials Science, fields often cited for high lab hazards.

Table C3: The "PhD / Post-Doctoral" Window

User	Original Chinese Text	English Translation
Eva	我刚生，是博二升博三的暑假生的... 因为已婚已育所以被面试的时候居然还是加分项。	I just gave birth in the summer between my 2nd and 3rd year of PhD... Because I was already married with children, it was actually a "plus" during job interviews.
拉雷	感觉研二或者博士开完题生是最好的时间... 不耽误毕业。	I feel the best time is after the thesis proposal in the 2nd year of Master's or PhD... It doesn't delay graduation.
wowo	我目前遇到的所有女老师都是在博士或是博士后期间生的孩子... 可能对于坚定走学术道路的人来说，这两个阶段是最轻松的?	Every female professor I've met had their kids during PhD or Postdoc... Maybe for those committed to academia, these two stages are the "easiest"?
momo	还是建议博后，因为没有博士的毕业压力。	I'd still suggest the Postdoc stage, because there isn't the pressure of the PhD graduation [requirements].
冬冬	一看就是海外。国内博后要完成很高KPI才能找教职。	[Reply to above] You must be overseas. In China, postdocs have to hit very high KPIs just to qualify for a faculty position.

Table C4: The "Grants & Tenure" Window

User	Original Chinese Text	English Translation
露露	我感觉递交年初青基申请书等结果的那一年是最合适... 那时候接近临盆或者刚生完不耽误。	I feel the year you submit your "Youth Fund" (NSFC) application and wait for results is best... You'd be near delivery or just finished, so it doesn't cause a delay.
momo	读博觉得太忙不行，博后忙着找工作不行，工作了有非升即走考核不行...	PhD is too busy; Postdoc is too busy job hunting; once you start working, the "Up-or-Out" (Tenure-track) evaluation makes it impossible...

Table C5: The "Physical & Biological" Cost

User	Original Chinese Text	English Translation
露露	对于生化环材这类学科孕期是影响最大的，因为必须要停止做实验不接触化学品。	For BCEE fields, pregnancy has the biggest impact because you must stop all experiments to avoid chemical exposure.
Liz	女科研工作者这么累能怀上都不错了，还能自己选择窗口吗?	Female researchers are so exhausted it's a miracle they even get pregnant. Do we even get to "choose" a window?
毛毛力	笑鼠，根本不来月经。	[Laughing] I don't even get my period anymore [due to stress].
momo	职称标准达到了发现自己长期压力导致不排卵了。	By the time you meet the standards for promotion, you find that long-term stress has caused you to stop ovulating.
鸿雁	最佳可能是不生吧。	The "best" window might just be not having kids at all.



Figure C1: Screenshots of the Original Thread (1/3)



Figure C2: Screenshots of the Original Thread (2/3)

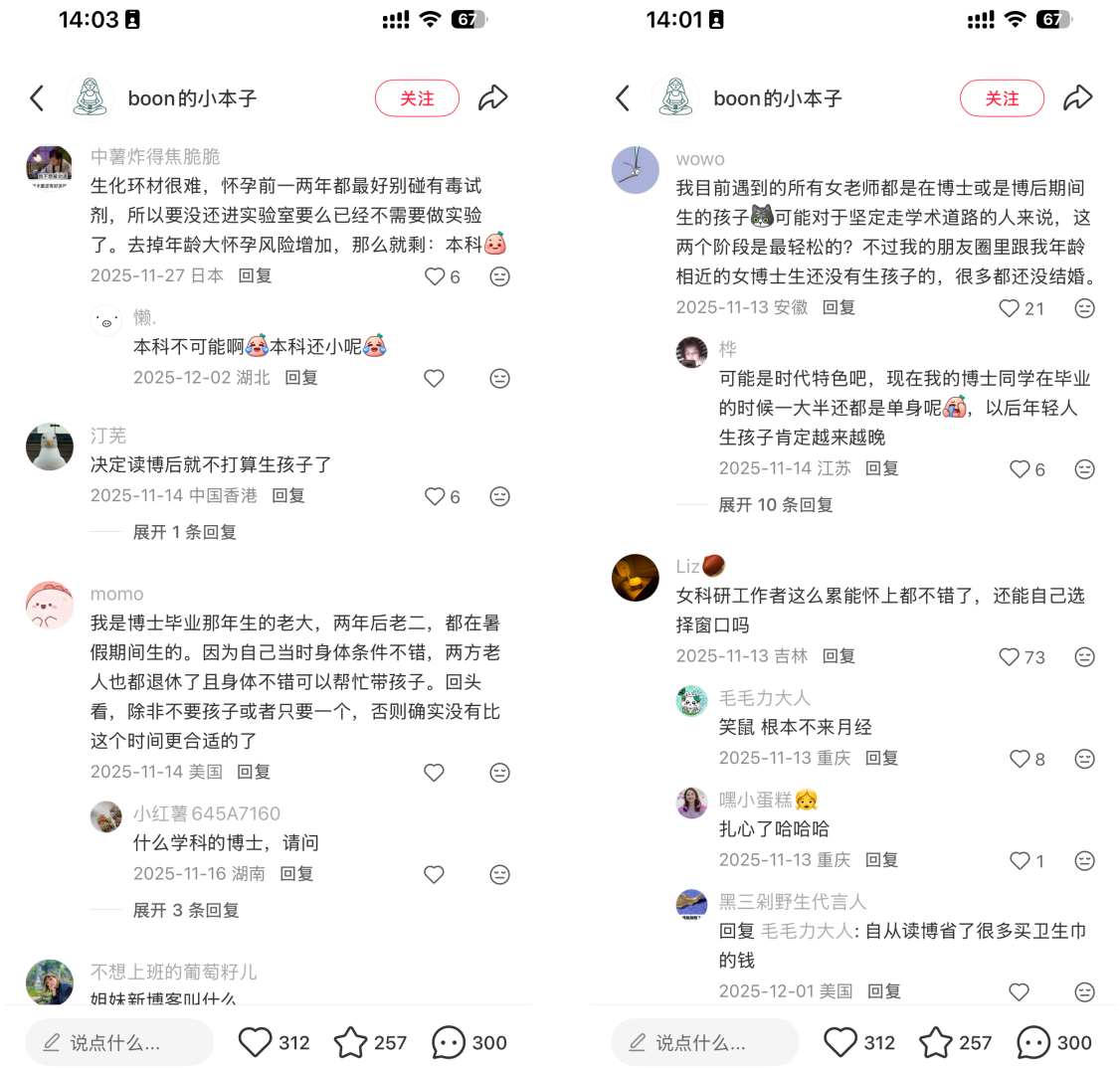


Figure C3: Screenshots of the Original Thread (3/3)