The Effects of China's Double First-class Initiative on Research Output and Coauthorship Network: Evidence from the Economics Discipline

Qingyang Han*

April 2, 2026

Abstract

This paper examines how China's "Double First-class Construction" (DFC) initiative affects research output and coauthorship networks in Economics. Using difference-in-differences, we find that DFC universities publish more economics papers after treatment than non-DFC universities, driven by a larger number of authors publishing in top journals. However, research quality, measured by citations, does not improve. Using dyadic treatment effect estimation, we also find more coauthorship links involving DFC universities, including more collaborations between DFC and non-DFC institutions. Overall, the policy appears to increase the publication presence of selected DFC institutions.

Keywords: Double First-class, Higher Education Policy, Dyadic Regression

JEL Codes: I23, I28

*Johns Hopkins University and Bates White LLC. Email: hanqecon@outlook.com. This paper subsumes the third chapter of my Ph.D. dissertation at the Johns Hopkins University. I am indebted to my advisors Robert Moffitt, Yingyao Hu, and Yujung Hwang for their guidance and support.

1 Introduction

The endogenous growth literature in the recent few decades has attributed the long-run economic growth to technological change. (Romer (1990), Grossman and Helpman (1991)) In particular, university research has a significant role on economic growth (Henderson et al. (1998), Caballero and Jaffe (1993)). Adams (1990) finds that knowledge is a major contributor to productivity growth, but it takes two decades before academic research eventually gets absorbed in the industry and translates into productivity growth. Such evidence indicates that the government has an incentive to invest in the higher education institutions, which are major producers of academic knowledge, to pick up the positive externality of academic research that will otherwise be under-invested from private sources.

In China, the "Reform and Opening-up" policy started in the late 1970s to reform its then Soviet-type planned economy. The Chinese leaders proposed a plan to achieve "four modernizations" (agriculture, industry, defense, and science and technology). For these purposes, the government has then implemented a series of initiatives in developing and sponsoring higher education institutions. The most well-known initiatives are "Project 211" and "Project 985" which were introduced in the 1990s. These projects typically select a list of "high quality" universities which will then receive preferential funding from both the central and the local governments.

For economists, it is thus important to study if these large-scale policies to invest in higher education produce sufficient impact on the research output. However, from an empirical point of view, the non-random selection process makes it difficult to identify the effects of such policies on the research output of the affected universities. The universities selected into these schemes are either already highly-ranked prestigious institutions, or leading universities in under-developed regions in China. Recently, a newly-implemented higher education development scheme in China makes it possible to realize the identification.

In 2016, China's Ministry of Education announced that both Project 211 and Project 985 will be abolished and replaced by a new scheme named "Double First-class Construction" (DFC) initiative, which was implemented in Late 2017. The DFC initiative aims to build some First-

class universities and some First-class academic disciplines, thus the name "Double First-class". While the first objective largely inherits the previous Project 211 and 985, the second objective is new. In selecting the set of First-class disciplines, the Ministry of Education faces two policy constraints: (1) Each previous Project 211 institution must have at least one "DFC" discipline, and (2) only a limited number of slots are available for a given discipline (e.g. Economics). These two constraints add to the randomness of the list of First-class disciplines, which even causes controversies after it was published in 2017 (Li and Xue (2021)). Among the list of DFC-designated disciplines, 8 universities' Economics disciplines were designated as DFC, but some similarly-qualified economics faculties from other universities were not selected. Such randomness makes it possible to apply difference-in-differences (DID) method to evaluate the treatment effect of the DFC initiative.

In this paper, we focus exclusively on the Economics discipline.[1] We hand collected publication records from seven leading Chinese economics journals published between 2008 and 2023. For each published paper, we document its authors, affiliated institutions, and citations as of March 2024. The affiliation information is further accompanied with university-level characteristics. The constructed university level panel dataset helps study the effect of the DFC policy on university-level research outcomes, measured by either quantity or quality. However, the collected dataset does not trace the career mobility of each researcher across different research institutions, therefore we do not observe if the authors publishing in top journals arrive at a university before or after the implementation of the DFC initiative.

Despite the limitations of the dataset, we can still evaluate the effect of DFC designation on the research output of the selected institutions and on the coauthorship network among selected and non-selected institutions. For the first purpose, we use standard two-way fixed effects approach and event-study approach to estimate the treatment effects of the policy. For the second purpose, we use dyadic regression (Graham (2020)) to estimate the dyadic treatment effects of the DFC policy on the coauthorship networks.

[1] Henceforth, DFC designation all refers to the Economics discipline.

Using difference-in-differences approach, we find that the DFC initiative increased the number of publications in top Chinese Economics journals associated with DFC-designated institutions, but the policy does not increase the number of citations or citations per paper. This result suggests a quantity effect instead of a quality effect of the policy. Further analyses on the sources of the increased quantity of publication shows that there are an increased number of authors that publish in top Economics journals following the policy implication, but the number of publications per author does not change. In terms of quality, we also do not find any evidence suggesting that citations per author increases in DFC institutions after the implementation in 2017. The dyadic treatment effect estimation reveals that the policy significantly increases the chances of collaboration within DFC institutions and slightly increases the collaboration between DFC and non-DFC institutions. These findings show an increased representation of DFC-designated institutions in top journal publications.

This paper connects to a few strands of economics and education literature. The first strand of literature concerns government funding on higher education. Matveeva et al. (2021) and Lovakov et al. (2021) study the effect of a similar government sponsorship policy in Russia named Russian University Excellence Initiative. Matveeva et al. (2021) finds that both quantity of publications and coauthorships involving authors from selected institutions increase after the treatment, and Lovakov et al. (2021) finds spillover effects of the policy on non-selected universities. Greenaway and Haynes (2003) documents that the decline in public funding on the UK's higher education has resulted in a series of negative consequences, including increased student-to-staff ratio and reduced research capacity. In the Chinese context, Zong and Zhang (2019) uses difference-in-differences approach to study the effect of Project 985 designation on the research output of the selected universities and finds substantial increase in publication from Project 985 universities. Ying (2011) finds similar effects of the Project 985, but adds that schools not selected have in many ways lost a fair opportunity to compete, suggesting a negative spillover effect of promotion policies that target only a selective set of universities.

The second literature studies the formation and the effects of research networks. Hagedoorn

et al. (2000) and Bozeman et al. (2013) review literature on research collaborations. There are two primary incentives for the formation of research collaboration, namely, knowledge focused and property focused. Specific to our context on the DFC policy, if the treated universities' research capacities improve, knowledge-based incentives to form coauthorship links with the DFC-designated universities should also improve. Regarding the relationship between research collaboration and research output, Ductor et al. (2014), Larivière et al. (2015) and Hsieh et al. (2018) find that an increase in the number of authors leads to an increase in research impact, while Gazni et al. (2012) finds that high-impact institutions are significantly more collaborative than others. Our analyses on the effect of DFC on research collaboration add to the research agenda. Methodologically, Graham (2020) proposes an analytical framework to analyze the treatment effects on the network structure. We adopt this approach in a difference-in-differences framework to draw the policy evaluation.

This paper is organized as follows. Section 2 describes the policy background, including an introduction of Project 211, Project 985, the Double First-class Construction Initiative, and China Discipline Evaluation. Section 3 introduces the dataset used in this paper. Section 4 lays out the econometric models. Section 5 presents the empirical results. Section 6 shows the results from the robustness check. Section 7 concludes the findings and discusses possible future research directions.

2 Policy Background

The majority of Chinese universities are public, and the government has pursued a centralized approach to build a group of high-quality research institutions through a series of strategic initiatives. These initiatives offer selected universities preferential treatments, including increased research funding, in order to improve their academic and research capacities, which will boost the productivity of the existing faculty members. The associated prestige of being chosen for these programs attracts top-tier students and scholars to these institutions, which improves the selected institution's research output due to an enlarged research team.

In the 1990s, the Chinese Central Government launched "Project 211" and "Project 985" with the goal of establishing a group of world-class universities. These projects have been replaced by the "Double First-class" (DFC) scheme introduced in 2016. Unlike its predecessors, the DFC scheme focuses on selecting specific disciplines within participating universities, which subsequently receive enhanced support and resources from the government.

Simultaneously, the Chinese Ministry of Education conducts periodic Discipline Evaluations, which comprehensively assess the research output, faculty qualifications, teaching standards, infrastructure, and international collaborations within each discipline and university. These evaluations provide information into the quality and performance of each discipline across different institutions. Besides the official discipline evaluation, a private company ShanghaiRanking publishes academic rankings of the economics faculties in China with a more transparent scoring system.

The following subsections describe the chronological evolution of China's higher education initiatives, the Discipline Evaluation process, and the economics ranking system conducted by ShanghaiRanking.

2.1 Project 211 and Project 985

Project 211, launched in 1995, is a comprehensive initiative undertaken by the Chinese government, whose name comes from the its objective "In preparation for the 21st century, successfully running 100 higher education institutions." These selected institutions are strategically distributed throughout China, encompassing a wide geographic range to ensure broad-based development and regional representation. Participating universities receive substantial government funding and support to upgrade their academic infrastructure, faculty qualifications, research capabilities, and teaching standards.

As of 2016, there were 116 universities designated under Project 211. The Project ensures that there is at least one university selected in each province in order to maintain a balanced distribution of resources and opportunities across different areas. Nevertheless, 36 out of these 116 universities are located in either Beijing or Shanghai.

Project 985 started as then President Jiang Zemin made the statement in May, 1998, that "our country must have several first-class universities with world-leading levels in order to achieve modernization." It is a higher education development scheme similar to Project 211, but its enrollment criteria are much more selective. Only 39 out of the 116 Project 211 enrollees were selected to Project 985. **Project 985 is thus a subset of Project 211.**

Project 985 universities are more concentrated compared to Project 211, both in terms of disciplines and locations. Most selected universities are comprehensive or science and technology focused. Specific to the Economics Discipline, five universities that are specialized in Economics and Finance were selected into Project 211[2], however, none of them were selected into Project 985. Many provinces do not have a Project 985 university, and only 7 out of the 39 are situated in Western China.

2.2 Double First-class Scheme

In 2016, the Ministry of Education of China announced that Project 211 and Project 985 had already been abolished and replaced by the Double First-Class Construction Initiative.[3] The term "Double First-class" refers to "World First-Class Universities and First-Class Academic Disciplines", meaning that the DFC initiative consists of two parts: First, a group of elite universities designated as DFC universities-a policy initiative that works similarly compared to the predecessor plans (Project 985 and 211). Second, for each selected DFC university, a selective set of disciplines are further designated as DFC disciplines.

Chen Baosheng, China's Minister of Education, stated in 2016 that the DFC initiative is not a replica, upgrade, or imitation of "Project 985" or "Project 211".[4] However, the original Project 211 universities are **all** selected into the DFC initiative, meaning that for each previous Project-211

[2]These five Project 211 universities specializing in Economics and Business are: Central University of Finance and Economics (CUFE), University of International Business and Economics (UIBE), Shanghai University of Finance and Economics (SHUFE), Southwestern University of Economics and Finance (SWUFE), Zhongnan University of Economics and Law (ZUEL).

[3]https://en.wikipedia.org/wiki/Double_First-Class_Construction.

[4]A web-link is provided documenting the speech.

university, at least one discipline is designated as a DFC discipline.

The first wave of DFC universities and disciplines are revealed in September, 2017. 465 disciplines associated with 140 universities are designated as DFC disciplines. According to Li and Xue (2021), the criteria for selecting the DFC disciplines were not transparent. Science and engineering subjects are more frequently selected than humanities and social sciences. The uneven distribution of disciplines selected into the DFC initiative suggests that the government resources are prioritized towards natural sciences and engineering. As for the Economics discipline, 8 universities' Economics disciplines were enlisted in DFC in 2017.

While the selection criteria are not publicly announced, from the ex post list of DFC disciplines, it can be seen that there are two major constraints faced by the policy maker:

1. For each Project 211 university, at least one discipline should be enlisted in DFC.

2. The total number of slots of Economics disciplines enlisted in DFC nationwide is fixed, so as the number of other disciplines.

Given the two constraints, the selected DFC Economics faculties may not necessarily represent the best Economics disciplines in China. For example, if a Project 211 university A's strongest field is Economics, with its other disciplines being relatively average, the Ministry of Education may be compelled to designate University A's Economics subject as a DFC discipline to fulfill the first constraint, thereby filling one slot within the total count of DFC Economics disciplines. Conversely, University B may be stronger in Economics than University A, but the Ministry might opt to prioritize other promising disciplines within University B for DFC designation, consequently leaving University B's Economics subject unlisted.

Table 1 shows the list of universities that are designated as DFC. Among the 8 universities whose Economics disciplines are selected, 4 of them are Former Project-211 Finance and Economics Universities, all of which have only one designated DFC discipline. In contrast, some comprehensive universities with strong Economics disciplines are not selected into DFC Economics discipline, such as Fudan University, Nankai University and Xiamen University.

2.3 China Discipline Evaluation

China Discipline Evaluation (CDE) is a non-profit initiative overseen by the China Academic Degrees and Graduate Education Development Centre (CDGDC) of the Ministry of Education, designed to assess the disciplines offered by universities and research institutions across mainland China. Organized into 14 domains and 113 first-level disciplines, CDE aims to provide society with information about the quality of both academic institutions and research establishments. Conducted every 4-5 years, CDE operates on a voluntary basis, with institutions offering doctoral or master's degrees in first-level disciplines eligible to apply for evaluation upon invitation from the CDGDC. Since its inception in 2002, four evaluation cycles have been successfully completed, with the ongoing fifth round presently underway.

In the fourth iteration, which was published in 2016, participating disciplines of each university are assigned one out of nine "letter grades", from "A+" to "C-". The top 2% is rated as "A+", 2%-5% is "A", 5%-10% is "A-", 10%-20% is "B+", $\cdots$, 60% to 70% is "C-", and the remaining universities are unrated (below C-).

There are two first-level disciplines related to Economics: Theoretical Economics (TE) and Applied Economics (AE). In Chinese universities, the Economics departments and schools are not divided by TE and AE. The economics related academic journals are also not separated by TE and AE. Therefore, we merge the two ratings for TE and AE together by assigning a numerical grade to each university's Economics discipline. For both TE and AE, we assign number 9 for an "A+" rating, 8 for an "A" rating, $\cdots$, 1 for an "C-" rating, and 0 for unrated disciplines. We sum up the two numerical ratings so that the overall economics rating range from 0 to 18.

Table 1 shows the comparison between the economics ratings and the DFC Economics disciplines. It can be seen that the selected DFC disciplines are not the highest ranked economics disciplines in China, although they all receive an overall evaluation of at least 11. The lowest ranked DFC Economics discipline is from Liaoning University, a Project 211 university situated in Northeastern China whose only DFC discipline is Economics. The notable universities whose Economics disciplines are not selected into DFC, for instance, Fudan, Nankai, Xiamen and Zhejiang,

all have multiple other disciplines enlisted to DFC. These universities' Economics disciplines are not listed in DFC possibly due to the existence of other, often stronger, discipline areas within the same university.

2.4 ShanghaiRanking Best Chinese Universities Ranking

ShanghaiRanking (SR henceforth) is a private company located in Shanghai, China, that publishes ranking for universities in China. SR is also known for publishing the Academic Ranking of World Universities (ARWU). In this analysis, I will use the ranking for the economics disciplines among Chinese universities in 2017, the year right before the DFC initiative was enacted. The SR subject ranking uses an indicator system that includes five categories: talent cultivation, platform projects, achievement awards, academic papers, and high-end talent. It uses over 70 quantitative indicators, which is accessible in the SR website.[5]

The SR Economics ranking is another ranking system over the economics disciplines in China. A notable difference is that it has a more transparent protocol compared to the Discipline Evaluation which is conducted by the government. Table 1 also shows the SR ranking results in 2017. The realized rankings from the two sources agree on the very top institutions, but they become less aligned for universities outside of the top 10. In this paper, I will select control groups based on either ranking system.

3 Data

Collection of Publication Records For the purposes of this paper, I hand-collected publication records of the top Economics journals in Chinese from 2008 to 2023 from CNKI (China National Knowledge Infrastructure), a comprehensive database of academic publications in Chinese. Of all economics journals in China, I selected seven "A-level" journals defined by the Ministry of

[5] https://www.shanghairanking.cn/methodology/bcsr/2017.

Education with the exception of *Social Sciences in China*[6], among which three are generally recognized as the top journals (Jia et al. (2019)). The three *top journals* include

- Economic Research Journal
- The Journal of World Economy
- China Economic Quarterly

The other four A-level journals include

- China Industrial Economics
- Journal of Financial Research
- Journal of Quantitative & Technological Economics
- Finance & Trade Economics

For the main part of the analyses, I only count publications from the top-3 journals. In the robustness check, I conduct the analyses using publications from the seven A-level journals.

For each published paper, we document its author and authors' affiliations (at the university/institution level). We therefore construct a balanced panel dataset telling the number of total publications associated with each university in a each year. The publication records exclude editorial announcements, advertisements, policy briefs, review articles, and other non-academic articles.

University Characteristics Characteristics of Chinese universities are obtained from the Ministry of Education of China[7]. We include information on each university's location and whether they are enlisted in Project 985 and/or Project 211. We also document their evaluation results in the fourth round of the Discipline Evaluation. We do not include publication records from military universities, police universities, universities outside mainland China, non-university research

[6] *Social Sciences in China* is a comprehensive journal covering all social sciences and some humanities subjects. There are only a small number of economics articles published in this journal, and these publications are tailored towards political agenda.

[7] https://hudong.moe.gov.cn/qggxmd/

institutions, governments, state-owned enterprises, or private sectors. We do not, however, have information about the total sizes of economics-related faculty at each institution, which are difficult to measure as many universities have multiple schools that are related to economics. Instead, we do have information about the total number of authors from each institution that publish in top journals each year, which helps to identify if the author sizes from a university increases after the DFC implementation in 2017.

Selection of Control Groups Due to the non-random nature of the DFC selection scheme, it is vital that we compare the outcomes of the DFC-selected universities with non-selected, yet equally qualified universities for comparison. We therefore considers four criteria to select the set of the control group, based on China's Discipline Evaluation and the ShanghaiRanking points.

Table 2 shows the descriptive statistics at the university level. The five columns refer to the five subsets of universities. Column 1 refers to the 8 universities whose economics subject is designated as DFC; they are thus labeled as the treated group. Column 2 refers to the universities whose economics subjects are at least rated in the Discipline Evaluation (receiving at least C- in either TE or AE), but not designated as DFC. Column 3 and 4 refer to universities whose economics subjects are rated above 8 and 12, respectively, but not designated as DFC. Column 5 refers to universities whose economics subjects obtained at least 300 points in the SR ranking system but were not selected into the DFC scheme.

In terms of quality in Economics, Column 4 universities are the closest to the treated DFC universities, telling from their similar number of publications, citations, and citations per paper. The DFC designated Economics disciplines are unproportionally concentrated in Beijing, the nation's capital, whereas none of the Column 4 universities are in Beijing. Column 2, Column 3 and Column 5 universities have a much lower average in terms of all outcome variables. The citation data should not be compared before and after the treatment in 2018 without controlling for year fixed effects, as citations increase as a paper gets older.

In the empirical analyses, we report results based selecting each of the four sets of control

groups.

Paper Level Statistics Table 3 shows the summary statistics at the level of each published paper in the three top journals. From 2008 to 2023, our database records 5,179 total published academic papers, among which the Journal of Economic Research publishes 2,386 papers, the largest number. The number of authors for each paper increases over year, suggesting more frequent coauthorships in top journals. Notably, collaborations between DFC designated and non-DFC designated universities become more frequent, whose share increased from 0.16 pre-treatment to 0.25 post-treatment. The papers that are written by authors exclusively from non-DFC universities decreased from 0.65 to 0.59. These facts show that we observe an increased representation of DFC universities in Economics publications post-treatment.

Table 1: List of universities with high rating in the Economics discipline

University	City	Double-First	EconRating	SR Points	Total Double-First Disciplines	Project985	Project211
China Renmin University	Beijing	Yes	18	2051	13	Yes	Yes
Peking University	Beijing	Yes	17	1807	40	Yes	Yes
Fudan University	Shanghai		16	1094	18	Yes	Yes
Central University of Finance and Economics	Beijing	Yes	15	1017	1		Yes
Nankai University	Tianjin		15	1120	5	Yes	Yes
Shanghai University of Finance and Economics	Shanghai		14	1167	1		Yes
Xiamen University	Xiamen		14	1062	5	Yes	Yes
Tsinghua University	Beijing	Yes	13	966	34	Yes	Yes
Zhejiang University	Hangzhou		13	562	18	Yes	Yes
University of International Business and Economics	Beijing	Yes	13	970	1		Yes
Dongbei University of Finance and Economics	Dalian		13	638	0		
Nanjing University	Nanjing		13	687	15	Yes	Yes
Southwestern University of Finance and Economics	Chengdu	Yes	13	830	0		Yes
Shandong University	Jinan		13	652	2	Yes	Yes
Wuhan University	Wuhan	Yes	13	1012	10	Yes	Yes
Sun Yat-sen University	Guangzhou		12	442	11	Yes	Yes
Huazhong University of Science and Technology	Wuhan		12	285	8	Yes	Yes
Jiangxi University of Finance and Economics	Nanchang		12	614	0		
Jilin University	Changchun		12	699	5	Yes	Yes
Zhongnan University of Finance and Economics	Wuhan		12	814	1		Yes
Liaoning University	Shenyang	Yes	11	311	1		Yes
Jinan University	Guangzhou		10	303	1		Yes
Northwest University	Xi'an		10	328	1		Yes
Hunan University	Changsha		10	373	2	Yes	Yes
Capital University of Business and Economics	Beijing		10	568	0		
Beijing Normal University	Beijing		10	659	11	Yes	Yes
Tianjin University of Finance and Economics	Tianjin		9	247	0		
Sichuan University	Chengdu		9	353	6	Yes	Yes

Notes. This table shows the list of universities with evaluation in the Economics discipline greater than 8. In 2016, the Chinese Ministry of Education evaluated the economics discipline of all universities and assigned nine letter ratings, from "A+" to "C-", to two sub-disciplines, Theoretical Economics (TE) and Applied Economics (AE). We assign numbers $9, \cdots, 1$ to the nine ratings and summed up the two numerical ratings to obtain the overall economics ratings of each university. The rating then ranges between 0 (both TE and AE are unrated) to 18 (both TE and AE are rated as A+). The column "Double-First" indicates whether a university's economics discipline (either TE or AE) are designated as a double-first class in December 2017. The column "SR Points" indicate the points assigned by the company ShanghaiRanking to economics subjects of Chinese universities in 2017. The column "Total Double-first Disciplines" shows the total number of disciplines designated as double-first class for each university. The last two columns show if the university is classified in "Project 985" and "Project 211". "Project 985" is a subset from "Project 211", which is generally regarded as the most prestigious universities in China.

Table 2: Descriptive statistics: universities

Sample / **Variables**	Treat	Control0	Control8	Control12	Control-SR
N Universities	8	97	20	8	24
Project 211	1.00	0.52	0.80	0.88	0.71
Project 985	0.50	0.23	0.60	0.75	0.54
Located in Beijing/Shanghai	0.63	0.18	0.20	0.25	0.21
N Publications, year<2018	16.06	2.30	8.32	13.51	7.32
	(1.34)	(0.15)	(0.55)	(0.92)	(0.48)
N Publications, year≥2018	20.71	3.13	10.63	15.65	9.58
	(1.86)	(0.24)	(0.82)	(1.22)	(0.71)
Citation, year<2018	3493.88	455.79	1700.91	2776.91	1474.29
	(331.12)	(35.93)	(138.15)	(261.76)	(119.57)
Citation, year≥2018	1462.44	211.95	766.42	1160.23	681.80
	(302.82)	(25.78)	(107.77)	(208.22)	(91.63)
Cite per paper, year<2018	198.91	98.38	183.78	197.30	179.97
	(12.29)	(5.61)	(10.02)	(11.72)	(10.42)
Cite per paper, year≥2018	79.03	38.42	73.16	80.85	73.78
	(11.76)	(2.97)	(8.94)	(13.31)	(7.91)

Notes. This table shows the descriptive statistics for the treated and control samples. "Control0" means the untreated universities with Economics Rating greater than 0. "Control8" and "Control12" are defined similarly. "Control SR" means the control group defined as obtaining over 300 points in the SR ranking system. Standard errors are shown in parentheses.

Table 3: Descriptive statistics: publications

	Top 3 journals		7 journals	
Variables	Statistics	s.e.	Statistics	s.e.
Total Papers	5179		14455	
Journal: Econ Research	2386			
Journal: China Econ. Quar.	1226			
Journal: World Econ.	1567			
Non top-3 Journals			9276	
N Author, year<2018	2.253	(0.016)	2.154	(0.009)
N Author, year≥2018	2.629	(0.019)	2.603	(0.012)
Collaborate DFC&NDFC, year<2018	0.160	(0.006)	0.118	(0.003)
Collaborate DFC&NDFC, year≥2018	0.245	(0.010)	0.211	(0.006)
Collaborate HR&NDFC, year<2018	0.412	(0.009)	0.382	(0.005)
Collaborate HR&NDFC, yea≥2018	0.428	(0.011)	0.392	(0.007)
NDFC exclusive, year<2018	0.650	(0.008)	0.716	(0.005)
NDFC exclusive, year≥2018	0.587	(0.011)	0.624	(0.007)
DFC exclusive, year<2018	0.190	(0.007)	0.166	(0.004)
DFC exclusive, year≥2018	0.168	(0.008)	0.165	(0.005)

Notes. This table shows the summary statistics about the papers that are published in top Economics journals. The abbreviations "DFC", "NDFC", and "HR" means Double First-class designated universities (in Economics), non-DFC designated universities, and universities whose Economics subjects receive high rating (above 8) in the Discipline Evaluation.

4 Econometric Methods

The empirical analyses of this paper consist of three parts. In the first part, we use the standard difference-in-differences approach to evaluate the treatment effects of DFC designation on the quantity and quality of treated universities' publications. In the second part, we use Probit regression to document if there is any observed change in the share of author affiliations. In the third part, we use the dyadic treatment effect approach suggested in Graham (2020) to analyze the policy effects on the coauthorship networks.

4.1 Treatment Effects on Publication Quantity and Quality

Following the introduction of the DFC initiative in Late 2017, 8 universities' economics subjects are designated as DFC disciplines. Due to the simultaneity of the treatment timing over all universities, we use standard two-way fixed effect (TWFE) approach to estimate the treatment effect (on the treated) of the DFC initiative.

$$Y_{it} = \beta DFC_i \times Post_t + \alpha_t + \alpha_i + \epsilon_{it} \tag{1}$$

In the TWFE specification 1, DFC_i is the treatment dummy indicating if university i is designated as DFC, $Post_t$ is the timing dummy indicating whether the year t is post-treatment (≥ 2018), α_i is the university fixed effect, and α_t is the year fixed effects. The outcome variables Y_{it} include number of publications, number of total citations, and number of citations per paper.

The balanced panel structure also allows a more flexible event-study design to check any pre-treatment trends in the outcome variables and to document dynamic patterns of the treatment effects. Equation 2 shows the event-study specification.

$$Y_{it} = \underbrace{\sum_{t=2008}^{2016} \beta_t DFC_i \times 1(\text{Year} = t)}_{\text{pre-trends}} + \underbrace{\sum_{t=2018}^{2023} \beta_t DFC_i \times 1(\text{Year} = t)}_{\text{dynamic treatment effects}} + \alpha_i + \alpha_t + \epsilon_{it} \tag{2}$$

In the event-study specification 2, Year 2017 is the baseline year, whereas 2018 is the first year of treatment.

Mechanism To further analyze the mechanisms of the treatment effects, if any, we conduct analyses using the same specifications in equations 1 and 2 on three different outcome variables, namely, the number of authors that ever published in the top journals, the number citations per author, and the number of publications per author. All three outcome variables are at the university-year level.

Notice that a change in the number of total publications from the DFC universities can be attributed to either a change in the number of authors that publish in top journals, or a change in the number of papers per author. The same decomposition applies to the number of citations. Therefore, doing these analyses is helpful in identifying the sources of the treatment effects.

4.2 Changes in Composition of Author Affiliation

The next exercise is to check if there is a change in the composition of author affiliations after the DFC initiative. In particular, we are interested to see if DFC university-affiliated authors become more represented after the treatment. For each published paper p, we construct four indicators $I_p^{(k)}, k = 1, \cdots, 4$ describing the composition of author affiliations.

1. $I_p^{(1)} = DFC\_exclusive$: If a paper is exclusively written by authors from DFC institutions
2. $I_p^{(2)} = Non-DFC\_exclusive$: If a paper is exclusively written by authors from Non-DFC institutions
3. $I_p^{(3)} = DFC\_NDFC$: If a paper is collaborated by authors from both DFC and Non-DFC institutions
4. $I_p^{(4)} = HR\_NoDFC$: If a paper has at least one author from a high rating institution (Discipline Evaluation ≥ 9), but none of the author(s) are from DFC institutions.

We use Probit approach to estimate the changes in the four indicators after the DFC initiative.

$$\Pr(I_p^{(k)} = 1) = \Phi(\text{Post}_t, \text{N\_author}_p, \text{Journal}_p, \nu_{pt}),\ k = 1, \cdots, 4 \tag{3}$$

In the Probit specification 3, $\Phi(\cdot)$ is the standard normal cumulative distribution function, Post_t is a dummy which takes the value of 1 if the year of the publication is in or after 2018, N_author_p is the number of authors for paper p, and Journal_p is the journal fixed effect.

4.3 Treatment Effects on Coauthorship Network

The last empirical exercise concerns the effect of the DFC initiative on coauthorship networks. For this purpose, we adopt the dyadic regression approach introduced in Graham (2020). Let i, j index two universities, and L_{ijt} be the total number of research links between the two universities in year t, measured by the number of coauthorship occurrences between the two universities. We only consider research collaboration between different universities, i.e. $i \neq j$.

The coauthorship network structure is undirected, meaning that $L_{ijt} \equiv L_{jit}$, which is a simplified version compared to the directed setup in Graham (2020). Nevertheless, the treatment can happen at university i, university j, or both. We therefore consider the following regression equation 4.

$$\begin{aligned} L_{ijt} =& \theta_1 \text{BothTreated}_{ij} \times \text{Post2018}_t + \theta_2 \text{OneTreated}_{ij} \times \text{Post2018}_t \\ &+ W_{ij}'\beta + (X_i + X_j)'\gamma + \alpha_i + \alpha_j + \alpha_t + \eta_{ijt} \end{aligned} \tag{4}$$

In this specification, coefficients θ_1 and θ_2 capture the two different treatment effects on the outcome variable L_{ijt}: the first is the effect of both universities being designated as DFC on the number of collaborations between them, and the second is the effect of only one university being designated as DFC on the number of collaborations between them. Vector W_{ij} includes a set of pair (i, j)-specific yet time-invariant characteristics, namely, if i and j belong to Project 211 and/or Project 985, the gap in Discipline Evaluations between them[8], and if they are located in the same province. X_i and

[8] measured by the square of the Discipline Evaluation difference between university i and j.

X_j include university specific characteristics, including their Discipline Evaluations. Because of the undirected nature of the network structure, the two variables X_i and X_j should share the same coefficient γ. $\alpha_i, \alpha_j, \alpha_t$ are fixed effects for university i, j, and year t, respectively.

5 Results

Publication Quantity and Quality Table 4 shows the results from the two-way fixed effect regression 1. The results are separated in four groups by the selection of control groups. For Columns 1 through 3, the control group is the set of universities that were at least rated in the Discipline Evaluation. For Columns 4 through 6 and 7 through 9, the control group is the set of universities that were rated above 8 and 12 in the Discipline Evaluation, respectively. For Columns 10 through 12, the control group is the set of universities that obtained at least 300 points in the SR ranking system. It is shown that DFC designation significantly increases the total number of publications from DFC-designated institutions, but it does not increase their number of total citations nor citations per paper. If we use the first control group, the treatment effect on number of citations (columns 2 and 3) are significantly negative, whereas the same effect is insignificantly negative if we use the third control group (columns 8 and 9).

These results suggest that the DFC policy boosts the number of publications for the selected university, but the policy per se does not increase the quality of their publications. It should be noted that a coauthored paper will be counted as one publication for all affiliations involved in the paper. The TWFE regression presented in Table 4, therefore, does not indicate if the increased number of publications for the DFC-designated institutions are a result of more coauthorships with other universities or more single-affiliation publications.

Figure 1 shows the results for the event-study design in Equation 2. Again, the twelve graphs are with respect to four control groups and three outcome variables. Looking at the first column, the treatment effects on the number of publications indicate a two-year lag, because the coefficients jump up since year 2020, 2 years after the DFC initiative was enacted. The effect is significant

for all follow-up years since 2020 if we use the first control group, and it becomes less significant if we keep a more selective control group. For the other two outcome variables, namely, citations and citations per paper, the treatment effects are never positive, and in some cases negative. For all outcome variables, we notice negligible pre-trends, suggesting that it is sensible to impose the parallel-trend assumption in the difference-in-differences estimation.

Mechanism Analyses Table 5 shows the further estimation results on the possible sources of the treatment effects found in the previous part.

For all three control sample choices, we found significantly positive effects of the DFC policy on the number of authors from the designated institutions that publish in top journals after 2018, suggested from Columns (1), (4), (7) and (10). However, from Columns (3), (6), (9) and (12), we found no effect of the policy on the number of publications per author. Results from Columns (2), (5), (8) and (11) further suggest that there is no policy effect on the quality of the faculty, as citations per author does not increase after 2018. These results suggest that the positive effect of the DFC policy on total number of publications which we found in Table 4 are driven by an increase of authors that publish in top journals. Future work needs to be done to further analyze the sources of the added authors. They may come from existing faculty members who are unable publish in top journals before the policy change, or from newly hired faculty members who can publish in top journals. If the former is true, this may suggest a network effect, as previously unproductive authors from the DFC institutions get more exposure to the journal editors. It may also suggest that these unproductive authors were equipped with better resources with the added funding from the DFC initiative, which helped them become more productive. If the latter is true, this may suggest that DFC universities used the added funding to hire more productive researchers. In either case, these findings show evidence that with the increased funding from the DFC, the designated universities improved their research productions by investing more on quantity, rather than quality.

Figure 2 shows the event-study plots of the treatment effects on the three outcome variables. We also do not find significant pre-trends that may otherwise invalidate the results shown in Table

5.

Affiliation Composition Table 6 shows the estimation results for the Probit equations 3. Because this set of Probit estimations is based on paper-level data, there is no control group; therefore, the results in Table 6 cannot be interpreted as causal. Nevertheless, these results still illustrate some changes in the patterns of affiliations of the publications after the DFC initiative.

Seemingly contradictory to the findings in the previous sections, papers are not more likely to be written solely by authors from DFC-designated institutions, as is found from column (1) of Table 3. Instead, in column (3), we observe much more collaboration between authors from DFC institutions and non-DFC institutions. The share of papers written by authors exclusively from non-DFC institutions drops, suggesting an increased representation of authors from DFC institutions. Column (4) shows that the share of papers written by authors from highly rated institutions yet without DFC authors does not change significantly.

Coauthorship Network Table 7 shows the estimation results for the dyadic regression 4. Similar to Table 4, we report results obtained from using four sets of control groups. We also compared the results by controlling different sets of university-pair-specific characteristics. In all specifications, we find significantly positive effects if the treatment (DFC designation) happens on both universities in a given pair. This suggests that the DFC increases the occurrences of research collaborations between two different DFC institutions. If only one university is designated as DFC, the research collaboration between this treated university and other non-treated university will also increase, if we add pair-specific controls. But this increase is much smaller in magnitude than that in cases where both universities are DFC designated.

The results show that after the DFC designation, there has been a larger representation of DFC-designated institutions in economics publications. DFC universities tends to collaborate more often with other DFC universities, which is a pattern of positive assortative matching.

Table 4: Two-way fixed effect regression (Top-3 journals)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variables	N Pub	N Citation	Cite/paper	N Pub	N Citation	Cite/paper	N Pub	N Citation	Cite/paper	N Pub	N Citation	Cite/paper
DFC×Post2018	3.809***	-1,787.6***	-59.925***	2.346**	-1,097.0***	-9.261	2.512**	-414.754	-3.429	2.387***	-1,238.944***	-13.687
	(0.993)	(349.6)	(16.369)	(1.055)	(352.8)	(18.830)	(1.257)	(410.080)	(19.856)	(0.851)	(273.797)	(25.759)
Year Fixed Effects (2008-2023)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
University Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Sample	Economics Rating > 0			Economics Rating > 8			Economics Rating > 12			SR Points > 300		
Universities	105	105	105	28	28	28	15	15	15	32	32	32
Observations	1,680	1,680	1,680	448	448	448	240	240	240	512	512	512
R-squared	0.894	0.691	0.235	0.848	0.618	0.217	0.792	0.573	0.276	0.857	0.660	0.324

Notes. This table shows the two-way fixed effect regression of outcome variables on the treatment status. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Two-way fixed effect regression concerning the number of authors per university

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variables	N faculty	Cite/author	Pub/author	N faculty	Cite/author	Pub/author	N faculty	Cite/author	Pub/author	N faculty	Cite/author	Pub/author
DFC×Post2018	6.571***	-83.536***	-0.045	4.683***	-9.032	-0.007	4.208**	-0.147	0.035	4.746***	-19.846	-0.012
	(0.659)	(27.185)	(0.078)	(1.317)	(30.960)	(0.054)	(1.861)	(29.677)	(0.042)	(1.219)	(30.269)	(0.054)
Observations	1,680	1,680	1,680	448	448	448	256	256	256	512	512	512
R-squared	0.884	0.287	0.508	0.826	0.364	0.264	0.776	0.501	0.465	0.837	0.347	0.284
Control Sample	Economics Rating > 0			Economics Rating > 8			Economics Rating > 12			SR Points > 300		
University Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects (2008-2023)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes. This table shows the two-way fixed effects regression results of the treatment effects on outcome variables that concern the number of authors in each treated and non-treated universities. The three outcome variables are "N author"=number of authors that have published in a top journal, "Cite/author"=number of citations per author, "Pub/author"=number of publications per author. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Probit regression of authorship indicators on treatment status (Top-3 journals)

	(1)	(2)	(3)	(4)
Variables	DFC Exclusive	NDFC Exclusive	DFC-NDFC	HighRating-No DFC
Post2018	-0.006	-0.086**	0.134***	0.043
	(0.043)	(0.037)	(0.043)	(0.037)
N Authors	-0.211***	-0.192***	0.496***	-0.002
	(0.024)	(0.020)	(0.025)	(0.020)
Journal: China Econ. Quarterly	-0.062	-0.110**	0.217***	-0.088*
	(0.056)	(0.049)	(0.057)	(0.048)
Journal: Econ. Research J.	-0.014	0.022	-0.023	-0.071*
	(0.048)	(0.042)	(0.050)	(0.041)
Observations	5,179	5,179	5,179	5,179
year FE	yes	yes	yes	yes

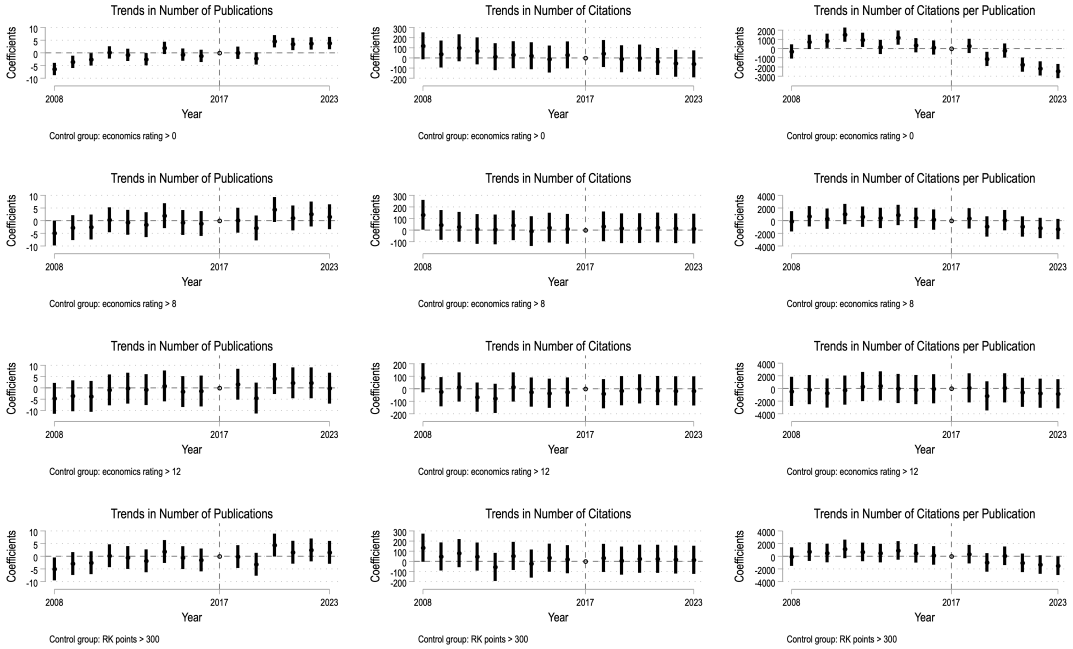
Notes. This table shows the Probit estimation results on how the treatment status affected the four authorship indicators in Section 4.

Table 7: Dyadic treatment effect estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Control Sample	Economics rating>0			Economics rating>8			Economics rating>12			SR Points > 300		
Both Double-First	0.910***	0.753***	0.751***	0.520***	0.419***	0.415***	0.485***	0.438***	0.439***	0.542***	0.427***	0.425***
	(0.119)	(0.114)	(0.114)	(0.116)	(0.099)	(0.099)	(0.159)	(0.138)	(0.138)	(0.115)	(0.101)	(0.101)
One Double-First	0.004	0.016**	0.016**	-0.036	0.023	0.025	-0.144**	0.137**	0.136**	-0.039	0.015	0.016
	(0.008)	(0.007)	(0.007)	(0.031)	(0.029)	(0.028)	(0.072)	(0.062)	(0.062)	(0.028)	(0.026)	(0.026)
Same Province		0.124***	0.124***		0.675***	0.676***		1.224***	1.211***		0.643***	0.642***
		(0.008)	(0.008)		(0.054)	(0.054)		(0.113)	(0.112)		(0.053)	(0.052)
Both Project 985			-0.012*			-0.049*			-0.134*			-0.035
			(0.006)			(0.026)			(0.073)			(0.023)
Both Project 211			-0.039***			-0.452***			0.141***			0.070
			(0.005)			(0.069)			(0.054)			(0.044)
One Project 211			-0.019***			-0.328***						0.004
			(0.002)			(0.042)						(0.025)
Rating		0.001*	0.001*		-0.032	0.116***		0.050**	0.082***		-0.002	-0.055***
		(0.001)	(0.001)		(0.027)	(0.015)		(0.022)	(0.027)		(0.025)	(0.008)
Rating Gap		-0.001***	-0.001***		-0.010***	-0.010***		-0.027***	-0.027***		-0.003***	-0.003***
		(0.000)	(0.000)		(0.001)	(0.001)		(0.006)	(0.006)		(0.000)	(0.000)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
University Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	87,360	87,360	87,360	6,048	6,048	6,048	1,680	1,680	1,680	7,440	7,440	7,440
R-squared	0.122	0.175	0.175	0.223	0.312	0.313	0.293	0.413	0.414	0.209	0.284	0.285

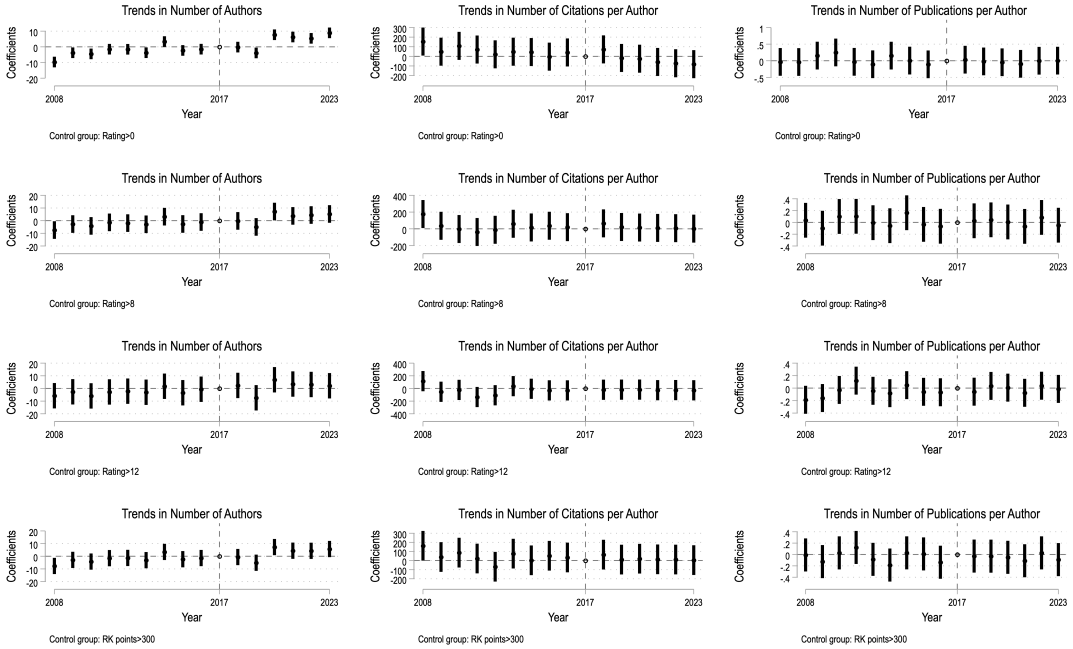
Notes. This table shows the dyadic regression results. The outcome variable in this specification is the number of publications coauthored between a pair of universities in a given year. The treatment indicators "Both DFC" means that both universities in a pair of collaboration relationship are Double-first, whereas "One DFC" means that only one of the pair is Double-first. "Rating" is the Discipline Evaluation rating of the two universities forming a pair; due to the undirected nature of the network structure, two universities' ratings share the same coefficient. "Rating Gap" is the difference of the two universities' ratings (squared).

Figure 1: Event study plots



Notes. This figure shows the event study plots illustrating the treatment effects of the Double-first class designation on the number of publications (Column 1), the number of citations (Column 2), and citations per publication (Column 3). Each row refers to a different selection of the control sample. Coefficient estimates in front of $Treat_i \times Year_t$ and their 95% confidence intervals are reported.

Figure 2: Event study plots: mechanism analyses



Notes. This figure shows the event study plots illustrating the treatment effects of the Double-first class designation on the number of authors per institution (Column 1), the number of citations per author (Column 2), and citations per author (Column 3). Each row refers to a different selection of the control sample. Coefficient estimates in front of $Treat_i \times Year_t$ and their 95% confidence intervals are reported.

6 Robustness Checks

In this section, we present two sets of robustness checks. In the first exercise, we consider the sensitivity of our main results to the choice of academic journals. Specifically, we now count publications from all seven A-level Economics journals and re-do the difference-in-differences and network analyses. In the second exercise, we compare whether the treatment effects are interacted with geographic factors. For that purpose, we categorize all universities into two groups: those located in Beijing or Shanghai, and those located in other cities. In the first robustness check, there is no quantitatively contrasting result from either robustness check. In the second robustness check, we find that the treatment effects obtained from the two-way fixed effect analyses in Table 4 are more salient in Beijing and Shanghai.

Considering More Journals In the first robustness check, we consider publications from all seven A-level journals which were designated by the Ministry of Education in 2016. Although the four non top-3 journals are less influential than the top-3 journals, publications in these journals still signal the research capacity of each institution. To keep the presentation of results brief, in the robustness exercises we do not tabulate over all possible control group selections; instead, we keep the most selective control sample: the institutions that receive a rating above 12.

In Table 8, we show the comparison of results by considering top-3 journals only or all 7 journals. The signs of the interested coefficients do not change significantly. The DFC initiative still boosts the publication in all 7 journals of the selected universities. In Table 9, we compare the results on paper coauthorship composition with and without considering all seven journals. All signs and significance levels preserve after we include all seven journals. In Table 10, we compare the difference on the dyadic regression results with and without considering all seven journals. Again, the signs and significance levels do not change.

Subsample Results Based on Location In the descriptive statistics table (2), we notice that the characteristics of the DFC institutions and the non-DFC institutions are not exactly the same, with

most DFC institutions situated in Beijing or Shanghai, the two largest and most developed cities of China. On the contrary, in the most selective control sample, only 2 out of 8 institutions are in these two cities. This finding raises questions that the estimated treatment effects in 4 may be contributed by geographic factors.

In this robustness check, we separately estimate the TWFE model using universities in Beijing/Shanghai, and universities not in these two cities, respectively. The underlying assumption is conditional independence: conditional on the location, the treatment status is orthogonal to the potential outcomes.

Table 11 shows the results. It is shown that the treatment effect on the number of publications is more pronounced for universities in Beijing or Shanghai, if we look at Column (1), (4), (7), and (10). As we move towards more selective control samples, however, the significance levels vanish as we were left with too few observations.

Table 8: Robustness analyses: Two-way fixed effect regression (all 7 journals)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	N Pub	N Citation	Cite/paper	N Pub	N Citation	Cite/paper
DFC×Post2018	2.512**	-414.754	-3.429	9.146***	48.400	0.103
	(1.269)	(418.761)	(21.646)	(2.032)	(596.481)	(10.662)
Year Fixed Effects (2008-2023)	Yes	Yes	Yes	Yes	Yes	Yes
University Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Control sample	Economics Rating > 12					
Publication	Top 3 journals			All 7 journals		
Observations	256	256	256	256	256	256
R-squared	0.816	0.644	0.533	0.855	0.688	0.664

Notes. This table shows the robustness analyses to Table 4 by considering publications from all seven A-level journals in Economics. For brevity, we only present results using as control sample the group of universities whose economics subject receive a rating of over 12 in the national discipline evaluation.

Table 9: Robustness analyses: Probit regression of authorship indicators on treatment status (All 7 journals)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	DF Exclusive	NDF Exclusive	DF-NDF	HighRating-No DF	DF Exclusive	NDF Exclusive	DF-NDF	HighRating-No DF
Publication	Top-3 journals				All 7 journals			
Post2018	-0.006	-0.086**	0.134***	0.043	0.036	-0.146***	0.187***	-0.003
	(0.043)	(0.037)	(0.043)	(0.037)	(0.027)	(0.024)	(0.028)	(0.023)
N Authors	-0.211***	-0.192***	0.496***	-0.002	-0.095***	-0.228***	0.475***	0.039***
	(0.024)	(0.020)	(0.025)	(0.020)	(0.015)	(0.013)	(0.017)	(0.013)
Journal FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,179	5,179	5,179	5,179	14,455	14,455	14,455	14,455
year FE	yes	yes	yes	yes	yes	yes	yes	yes

Notes. This table shows the robustness analyses to Table 6 by considering publications from all 7 A-level journals in Economics.

Table 10: Robust analyses: Dyadic treatment effect estimation

	(1)	(2)	(3)	(4)	(5)	(6)
Control Sample	Economics rating>12					
Publication	Top 3 journals			All 7 journals		
Both Double-First	0.485***	0.438***	0.439***	1.272***	0.993***	0.947***
	(0.159)	(0.138)	(0.138)	(0.246)	(0.201)	(0.201)
One Double-First	-0.144**	0.137**	0.136**	-0.193*	0.260***	0.246***
	(0.072)	(0.062)	(0.062)	(0.104)	(0.082)	(0.082)
Same Province		1.224***	1.211***		2.368***	2.385***
		(0.113)	(0.112)		(0.165)	(0.164)
Both Project 985			-0.134*			-0.241***
			(0.073)			(0.084)
Both Project 211			0.141***			0.302***
			(0.054)			(0.071)
Rating		0.050**	0.082***		0.113***	0.130***
		(0.022)	(0.027)		(0.027)	(0.028)
Rating Gap		-0.027***	-0.027***		-0.038***	-0.039***
		(0.006)	(0.006)		(0.009)	(0.009)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
University Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,680	1,680	1,680	1,680	1,680	1,680
R-squared	0.293	0.413	0.414	0.341	0.514	0.516

Notes. This table shows the robustness analyses to Table 7 by considering publications from all 7 A-level journals in economics. For brevity, we only present results using as control sample the group of universities whose economics subject receive a rating of over 12 in the national discipline evaluation.

Table 11: Robust analyses: treatment effect heterogeneity across locations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	N Pub	N Citation	Cite/paper	N Pub	N Citation	Cite/paper	N Pub	N Citation	Cite/paper	N Pub	N Citation	Cite/paper
Panel A: Universities in Beijing or Shanghai												
DFC×Post2018	4.846***	-2,413.289***	-105.840***	4.018**	-1,645.243***	-89.031***	3.527	-392.060	-34.243	4.573***	-1,651.987***	-63.881*
	(0.932)	(331.168)	(26.918)	(1.832)	(619.595)	(33.349)	(2.512)	(810.683)	(26.066)	(1.656)	(567.327)	(33.202)
N Universities	22	22	22	9	9	9	7	7	7	10	10	10
Observations	352	352	352	144	144	144	112	112	112	160	160	160
R-squared	0.916	0.744	0.401	0.827	0.680	0.461	0.738	0.667	0.721	0.845	0.682	0.428
Panel B: Universities not in Beijing or Shanghai												
DFC×Post2018	1.580**	-692.680***	-14.017	-0.028	-22.723	45.900	0.333	459.711	39.990	-0.126	-201.796	34.413
	(0.621)	(170.730)	(41.623)	(1.191)	(334.928)	(37.023)	(1.485)	(451.135)	(36.421)	(1.101)	(305.772)	(41.868)
N Universities	83	83	83	19	19	19	9	9	9	22	22	22
Observations	1,328	1,328	1,328	304	304	304	144	144	144	352	352	352
R-squared	0.840	0.584	0.248	0.793	0.545	0.383	0.773	0.535	0.452	0.805	0.563	0.309
Control Sample	Economics Rating > 0			Economics Rating > 8			Economics Rating > 12			SR points > 300		
Publication	Top 3 journals											
Year Fixed Effects (2008-2023)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
University Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes. This table shows results for the subsample treatment effect estimation by locations. Panel A only considers universities (either treated or untreated) in either Beijing or Shanghai, while Panel B only considers universities not located in Beijing or Shanghai.

7 Discussions and Conclusions

This paper analyzes the effect of the Double First-class initiative, enacted in late 2017, on the research output and coauthorship network. Difference-in-differences estimation shows a significantly positive effect of the policy on the number of publications associated with DFC-designated institutions. However, the effect of the policy on the quality of the papers, as is measured by citations or citations per paper, is non-positive. The research collaborations between different DFC-designated institutions increase significantly after the introduction of the policy, and the share of papers involving at least one author from a DFC-designated institution also rises.

These results show that the DFC initiative increase the representation of the selected DFC institutions in academic publications in economics. However, it does **not** necessarily suggest that academic publications become more concentrated towards DFC-designated institutions as the collaboration between DFC and Non-DFC institutions also rise as a result of the policy. More studies should be conducted to further understand this mechanism. As a starting point, this paper proposes two conjectures: (1) The academic publication process does indeed become more concentrated among DFC institutions, and as a result, authors from non-DFC institutions will find it difficult to publish their papers on top journals without collaborating with authors from DFC institutions. (2) As more resources are invested on DFC institutions, their research capacity increases. Due to a "halo effect", researchers from non-DFC institutions are more willing to collaborate with the DFC institutions in order to improve the quality of their papers and thus the chances of publishing in top journals.

Another potentially important channel of the policy is on the academic job market. With more investments from the state and the central government, the DFC-designated institutions have more resources to hire researchers either from peer institutions or from the rookie market/overseas. In the former case, non-DFC institutions may lose their faculty due to poaching offers made by DFC institutions, and as a result, their research capacity may be undermined. In the latter case, non-DFC universities may become less competitive when trying to hire new faculty from the rookie market/overseas. Under either scenario, there can be spillover effects of the DFC policy on the

non-treated universities. These effects, if true, will violate the identification assumptions of the difference-in-differences framework. Our results in Table 5 show that there is an increase in the number of authors from DFC-designated universities that published in top journals, but meanwhile, the per-author publications or citations do not increase. These findings may suggest that the DFC-designated universities use the additional funding from the government to hire more faculty who can publish in top journals. However, it remains to be investigated on the source of the added number of authors at DFC universities. They may come from existing faculty members who may otherwise be unable to publish in top journals without the DFC policy, new faculty members that the DFC universities hire from peer Chinese universities, or new faculty members that the DFC universities hired from the rookie/overseas market. To further analyze the plausibility of these three sources, future work will require a comprehensive job mobility data of researchers.

References

Adams, J. D. (1990). Fundamental stocks of knowledge and productivity growth. *Journal of Political Economy*, 98(4):673–702.

Bozeman, B., Fay, D., and Slade, C. P. (2013). Research collaboration in universities and academic entrepreneurship: the-state-of-the-art. *The Journal of Technology Transfer*, 38(1):1–67.

Caballero, R. J. and Jaffe, A. B. (1993). How high are the giants' shoulders: An empirical assessment of knowledge spillovers and creative destruction in a model of economic growth. *NBER macroeconomics annual*, 8:15–74.

Ductor, L., Fafchamps, M., Goyal, S., and Van der Leij, M. J. (2014). Social networks and research output. *Review of Economics and Statistics*, 96(5):936–948.

Gazni, A., Sugimoto, C. R., and Didegah, F. (2012). Mapping world scientific collaboration: Authors, institutions, and countries. *Journal of the American Society for Information Science and Technology*, 63(2):323–335.

Graham, B. S. (2020). Dyadic regression. *The Econometric Analysis of Network Data*, pages

23–40.

Greenaway, D. and Haynes, M. (2003). Funding higher education in the uk: The role of fees and loans. *The Economic Journal*, 113(485):F150–F166.

Grossman, G. M. and Helpman, E. (1991). *Innovation and growth in the global economy*. MIT press.

Hagedoorn, J., Link, A. N., and Vonortas, N. S. (2000). Research partnerships. *Research policy*, 29(4-5):567–586.

Henderson, R., Jaffe, A. B., and Trajtenberg, M. (1998). Universities as a source of commercial technology: a detailed analysis of university patenting, 1965–1988. *Review of Economics and statistics*, 80(1):119–127.

Hsieh, C.-S., Konig, M. D., Liu, X., and Zimmermann, C. (2018). Superstar economists: Coauthorship networks and research output.

Jia, R., Nie, H., and Xiao, W. (2019). Power and publications in chinese academia. *Journal of Comparative Economics*, 47(4):792–805.

Larivière, V., Gingras, Y., Sugimoto, C. R., and Tsou, A. (2015). Team size matters: Collaboration and scientific impact since 1900. *Journal of the Association for Information Science and Technology*, 66(7):1323–1332.

Li, J. and Xue, E. (2021). *Creating World-Class Universities in China: Ideas, Policies, and Efforts*. Springer Nature.

Lovakov, A., Panova, A., Sterligov, I., and Yudkevich, M. (2021). Does government support of a few leading universities have a broader impact on the higher education system? evaluation of the russian university excellence initiative. *Research Evaluation*, 30(3):240–255.

Matveeva, N., Sterligov, I., and Yudkevich, M. (2021). The effect of russian university excellence initiative on publications and collaboration patterns. *Journal of Informetrics*, 15(1):101110.

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, 98(5, Part 2):S71–S102.

Ying, C. (2011). A reflection on the effects of the 985 project. *Chinese Education & Society*,

44(5):19–30.

Zong, X. and Zhang, W. (2019). Establishing world-class universities in china: deploying a quasi-experimental design to evaluate the net effects of project 985. *Studies in Higher Education*, 44(3):417–431.