The Rise of China in Academic Research*

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Abstract

Using data on over 300,000 scientific articles in 40 top journals across 6 scientific fields, we show that after the adoption of China's National Medium- and Long-Term Plan for the Development of Science and Technology (NMLP) in 2006, China's share of academic publications and citations increased gradually and significantly. The increase is most pronounced in scientific fields that were explicit focus areas of the NMLP (physics, chemistry, biology, and medicine), as opposed to fields that were ignored by the NMLP (mathematics and economics). Our evidence provides support to the notion that government spending can spur scientific progress, at least in a centrally planned economy.

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1 Introduction

For much of modern history, academic research has been dominated by European and American scientists (Adas 1989, 2008). What has received surprisingly little attention in the economics literature is that this has fundamentally changed in recent times with the rise of China as an economic powerhouse. Since China began to open its economy in 1978, it has experienced an average growth rate in GDP of close to 10 percent, and today it is the second largest economy in the world. Economic growth in China has been spurred by large-scale public investment in education and research, with the government spending immense resources on research and development (Van Noorden 2014; Sun and Cao 2014). Through a series of National Development Plans, China has consciously transformed itself into one of the world's leading research nations, dominating research output in many fields (Xie, Zhang, and Lai 2014; Brainard and Normile 2022). Today, China counts over 3,000 universities and over 1,200 highly cited researchers (Adams et al. 2023), having overtaken the United States in 2022 in terms of number of scientific publications (National Science Board of the National Science Foundation 2024).

A major impetus to the development of a domestic research capacity came in 2006 when the Chinese government launched its National Medium and Long-Term Plan (NMLP) for the Development of Science and Technology (Sun and Cao 2021). This ambitious plan envisioned to transform China into an innovation-oriented economy by 2050, pushing for scientific research in several technical fields of strategic importance and high-growth potential. The plan also included investments in mega-industrial projects, to reap synergies between research and development and practical experience, and reforms of the patents law to encourage the domestic patenting of ideas.

It is a priori not clear whether such government-led research and development initiatives are successful. On the one hand, technological progress is a core driver of long-term economic growth (Romer 1990; Aghion and Howitt 1990), and there is evidence that government spending can successfully spur innovation (Howell 2017). On the other hand, there is evidence of resource misallocation and rent-seeking in China, including in research and development expenditures (König, Storesletten, Song, and Zilibotti 2022; Hsieh and Klenow 2009; Wei, Xie, and Zhang 2017; Young 2000) and many Western scholars hold the view that top-down centralized planning in innovation is bound to fail (e.g., Abrami, Kirby, and McFarlan 2014).

In this paper, we examine how the rise of China has altered the publication of academic research across countries, across scientific fields, and over time. In which fields have Chinese scholars become dominant? What has been the role of government policies in bringing about this change? For identification, we exploit a shift in the supply of academic research caused by the launch of the 2006 NMLP in China. We focus our analysis on those fields that were targeted by the NMLP (physics, chemistry, and biology) and use mathematics and economics as the control group. We collect new bibliometric data on the global publication output in the top-10 academic journals in each of these academic fields from Elsevier's Scopus database, together with the citation count of each article, for the period 2000 to 2023. For each article we also collect the affiliations and geographical locations of the authors. This allows us to assign a "nationality" to each paper, based on the location of the researcher.

Our findings point to some striking trends over time in how China has come to dominate many of these research fields. We find that for the period following the NMLP, China has seen an upward trend in its publications output and citations record across all fields. This upward trend for China is most pronounced in those research fields that were targeted by the NMLP program. In contrast, there is no similar trend in the field of economics, where the US and to a lesser extent the UK and Continental Europe continue to dominate.

Our findings support the notion that research and development spending by the Chinese government has been highly successful in generating high-quality research in targeted research areas. This challenges the view held by many Western scholars prior to China's rise that innovation cannot be successfully led by centralized governments from the top down.

Our paper contributes to several strands of literature. First, our paper relates to the literature on innovation and economic growth in China. This literature has focused on the growth of R&D and patenting of technologies in China's rise to technological power (Bergeaud and Verluise 2022) and the implications of such innovation for economic growth (Song, Storesletten, and Zilibotti 2011). We contribute to this literature by analyzing the impact of government policy on China's academic performance in terms of publishing research.

Second, our paper relates to the literature on the production of academic research. This literature has focused on such issues as the drivers of publication success (Aydin, Yürük, Reisoğlu, and Goktas 2023; Jones 2009; Azoulay, Graff Zivin, and Wang 2010) and biases in citations (Wilhite and Fong 2012; Fong and Wilhite 2017). Few papers have focused on the academic performance of Chinese economists. An exception is (Xie and Freeman 2023) who focus on researchers of Chinese origin that are active in the US or have worked in the US but have returned to China and find that in both cases Chinese-born researchers outperform others in terms of research productivity. We contribute to this literature by analyzing how government interventions can spur the production of academic research.

Our paper proceeds as follows. Section 2 provides detailed background on the initiatives of the Chinese government to spur academic research in China. Section 3 presents the data. Section 4 presents the empirical methodology. Section 5 presents the empirical results. Section 6 concludes.

2 Institutional background

China has experimented with a top-down approach to innovation and science since it started reforming and opening its economy in 1978. Initially, its strategy focused on learning from the West and catching up. China started by allowing students and scholars to move abroad, to gain knowledge and foster research cooperation. In 1985, it passed a resolution to strengthen the role of applied research at the expense of fundamental research. The 1989 student protests culminated in the temporary break of ties with many Western institutions and a reorientation away from more liberal views. These political changes came at the expense of research in humanities and the social sciences and favored research in STEM disciplines. In the 1990s, government policy focused on promoting applied research and industrial development. These policies were complemented with programs to develop research-oriented universities and to attract more students. Over this period, the number of university students more than doubled Braun Střelcová, Christmann-Budian, and Ahlers 2022. In the early 2000s, China continued its promotion of research with a top-down setting of research topics in key technologies and industrial fields. However, it was not until 2006 that China changed its ambition from catching up to moving ahead of others.

In 2006, in a clear break with the past, China set out a strategy to turn the country into a global science superpower by 2050 (Braun Střelcová, Christmann-Budian, and Ahlers 2022). This strategy was articulated in China's National Medium- and Long-Term Plan for the Development of Science and Technology (State Council of the People's Republic of China 2006). This long-term strategy was to be implemented through five-year economic plans. The plan encompassed: 11 key areas for national economic and social development, with 68 priority topics; 16 major special projects; 27 cutting-edge technologies and 18 basic scientific issues in 8 technical fields; and 4 major scientific research plans, spanning the fields of: biotechnology and life sciences; quantum electronics and quantum computing; nanotechnology and nanomaterial science;

and reproductive biology, stem cell research, and genetics.

More generally, in the NMLP, China outlined 3 groups of objectives concerning scientific research:

- **Basic research in specific scientific fields.** This group includes cutting-edge scientific issues that can drive the development of basic science in China. Specifically, it includes quantitative research and system integration of life processes, condensed matter, deep structure of matter and the large-scale physical laws of the universe, core mathematics and its application in cross-fields, earth system processes and resources, environment and disaster effects, chemical processes for the creation and transformation of new substances, brain science and cognitive science, innovation in scientific experiments and observation methods, technologies and equipment.
- **Basic research concerning major national strategic needs.** This group includes research topics that have a strategic and long-term significance for the economic and social development of China. Specifically, it includes the biological basis of human health and disease, genetic improvement of agricultural organisms and sustainable agricultural development, the impact of human activities on the earth system, global changes and regional responses, catastrophe formation and predictive control, sustainable energy development, principles and methods of material design and preparation, the scientific basis of manufacturing under extreme environmental conditions, major mechanical issues in aerospace, and the scientific foundation supporting the development of information technology.
- **Major scientific research plans.** This includes research topics aligned with the world's scientific development trends, that can enhance China's international competitiveness. Specifically, it includes protein research, quantum control research, nano-study, and reproductive research.

Thus, the fields broadly covered the major natural sciences (physics, chemistry, biology, and medicine). Less in focus were the related major sciences of mathematics and economics.

Under this ambitious growth plan, China's research and development expenses grew rapidly, almost doubling by 2010. Initially, the rapid growth was met with skepticism, with many observers questioning the effectiveness of the top-down approach, which they argued was creating a system that valued quantity over quality and was not conducive to innovation (Abrami, Kirby, and McFarlan 2014). When Xi Jinping became China's president in 2013, he prioritized science, technology, and innovation policies as a cornerstone of the country's development strategy. Under his leadership, China established new funding organizations and research agencies to improve the efficiency with which research funds were allocated, and reduced its reliance on Western technology under the "Made in China 2025" initiative. China's international reputation in research started to rise, with the first Nobel prize in the natural sciences for a China-based Chinese scientist (Tu Youyou in 2015). The 13th Five Year Plan (2016-2020) set innovation-driven development as its central strategy, but this was perceived as coming at the expense of fundamental research. In response, the 14th Five Year Plan (2021-2025) raised the target for basic research to at least 8 percent of total research and development funding. By then, China had already become the top producer of academic research in many STEM fields.

3 Data

We focus our analysis on research published in top academic journals in STEM-related fields. Research published in these journals is an indication of research quality and global impact. We start by ranking all journals from SCImago (2023) across six scientific fields: physics, chemistry, biology, medicine, economics, and mathematics. The ranking is based on the combined ranking of two key metrics: the SCImago Journal

Rank (SJR) and the H-index. SJR accounts for the number of citations received by a journal and the prestige of the journals where the citations come from, while the H-index is used as a measure of scientific productivity and impact of individual scientists. This approach allows us to incorporate both the citation impact and the overall influence of the journal. The combined rank of each journal is computed by first calculating the sum of the SJR and H-index rank by field (where lower values denote better rankings), and then ranking this sum from lowest to highest by field. We exclude journals that mainly publish reviews from the ranking (such as the Journal of Economic Literature or Nature Reviews journals). Based on this combined ranking, we select the top-10 ranked journals in each of the six fields, for a total of 61 journals. Four of these journals cover both the fields of chemistry and physics. The complete list of journals that we consider in our analysis can be found in Appendix Table A1.

The data associated with these 61 journals is manually retrieved from the Scopus (2023) user interface. We extract information for all publications classified as 'Article' in Scopus (2023), totaling 784,579 unique articles.[1] The extracted data include the article title, identifiers (EID and DOI), citation count at the time of extraction, page count, author names and affiliations, and journal-specific information.

In natural science fields, the number of authors per publication can be extensive. To manage this, we focus on retrieving the affiliations of only the first three authors and the last author of each publication. We use the Python library pybliometrics of Rose and Kitchin (2019) to systematically extract each author's affiliation and country of affiliation. The process starts by identifying each article via the Abstract Retrieval API, using either the DOI or EID. For each article, the affiliation ID(s) at the time of publication is retrieved for the first three listed authors and the last author. The Affiliation Retrieval API is then used to extract detailed information, such as the affiliation name and country, based on the first affiliation ID.[2]

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[1] An article is defined in Scopus (2023) as an original research or opinion. This category excludes books, chapters, editorials, errata, letters, notes, reviews, etc.

[2] In cases where the first affiliation is NBER or CEPR, the query extracts the subsequent affiliation

Following this approach, we obtain affiliation information for 697,696 articles. For the analysis, we focus on long-standing journals that are well known in the profession by excluding journals that were established after 2000. This leaves us with 40 journals with information on 595,281 articles. The final list of journals included in the analysis is shown in Table 1. Because the historical coverage in Scopus (2023) is incomplete prior to 2000 we restrict the sample period for our analysis to the period 2000 to 2022 to ensure adequate coverage. The final sample includes 327,754 articles published between 2000 and 2022.

Table 1: Top Journals by Field

Field	**Journals**
Biology	Cell, Nature Genetics, Nature Biotechnology, Molecular Cell, Nature Cell Biology, Nucleic Acids Research, Genome Biology
Chemistry	J. Am. Chem. Society, Angewandte Chemie Int'l Edition, Appl. Catalysis B: Environmental
Physics	Advanced Materials, Materials Today, Physical Review Letters
Physics/Chemistry	Nature Materials
Medicine	New England J. Medicine, Nature Medicine, The Lancet, Immunity, Ca-A Cancer J. for Clinicians, Lancet Oncology, Nature Immunology, Annals of Oncology
Mathematics	Ann. Math., Ann. Stat., J. Am. Math. Soc,, Invent. Math., Publ. Math. Inst. Hautes Etudes Sci., J. R. Stat. Soc. Ser. B, Commun. Pure Appl. Math., Biometrika, Acta Math.
Economics	Am. Econ. Rev., Quarterly J. Econ., J. Finance, J. Pol. Econ., Econometrica, Rev. Fin. Studies, J. Fin. Econ., Rev. Econ. Studies, Rev. Econ. Stat.

Note: This table presents the journals included in the analysis, by field. Journals are ordered according to their combined ranking within field based on the SCImago rank and H-index. Sources: SCImago (2023) and Scopus (2023).

In addition, we collect country-specific variables. Population size and GDP per capita are sourced from World Bank (2023), while the education level (average years of schooling for the population aged 25 years and older) is obtained from UNESCO (2023). We log-transform these variables for use in the regression models.

The citations data in Scopus (2023) are cumulative citations as of the time of data extraction. For each article, we create a time series of citations by distributing the total number of citations evenly across all years since the publication of the article.

ID.

Specifically, if $Citations_T$ is the total citations at the time of download T, and t_0 is the year of publication for the article, then the age-adjusted citation count of the article in every year $t \in \{2001, 2002, ..., 2022\}$ is $\frac{Citations_T}{(T-t_0)}$, where T=2023 and $T - t_0$ is the age of the publication in years. This linear transformation of the cumulative citations assumes that citations grow linearly with age.

When constructing the final dataset, we aggregate the data at the country-field-year level for a total of 18,906 observations. Since many articles are co-authored by scholars from different countries, we weight each article according to the proportion of authors based in each country[3]. We aggregate the observations for countries within the European Union, which is treated as a single entity. Finally, we balance the panel dataset to address cases where countries have no research output in certain fields and years. As a result, the final dataset is a balanced panel, with an equal number of observations per country and field across years. The descriptive statistics of the main variables are reported in Table A2.

4 Empirical strategy

Our empirical analysis consists of two parts. First, we study the evolution over time of the difference in research output between China-based and non-China-based academics. We consider both the quantity and quality of research output, measured in terms of publications and citations. Second, we extend this analysis by distinguishing between fields that were targeted by the NMLP (physics, chemistry, biology, medicine) and fields that were not.

To analyze the first effect, we specify the following regression model to explain the number of research publications:

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[3] For instance, if an article has four authors, with three based in the United States and one in China, the article is counted with weights of 0.75 for the United States and 0.25 for China.

$$\begin{aligned} ln\left(1+\frac{Publications}{Population}\right)_{i,j,t} &= \sum_{t=2001}^{2022} \beta_n China_i \times Year_t + \gamma X_{i,t} \\ &+ \Psi_{i,j} + \Phi_{j,t} + \varepsilon_{i,j,t} \end{aligned} \tag{1}$$

where $Publications$ is the total number of academic publications in country i, field j, and year t, and $Population$ is the total population (in millions) in country i. We add a value of one to the dependent variable to avoid losing observations with zero publications when taking logs. $China_i$ is a dummy variable equal to one for publications by China-based researchers, and zero otherwise. $Year_t$ is a dummy variable equal to one for year t, with $t \in \{2001, 2002, ..., 2022\}$, and zero otherwise, with $t = 2000$ denoting the reference year. The coefficients of interest, β_t, for $t \in \{2001, 2002, ..., 2022\}$, measure the change in academic publications in years 2001 up to 2022, relative to 2000, for China compared to the rest of the world.

We saturate the empirical model in Equation 1 with country-field and field-year fixed effects. $\Psi_{i,j}$ captures the impact on academic publications of factors that are fixed at the country-field level, such as time-invariant differences in the quality of secondary education and field-specific comparative advantages. $\Phi_{j,t}$ controls for any factors that vary across fields and over time but are common to all countries, such as the recent growth in research activity in the field of biology. We also include a vector of country-specific time-varying controls $X_{i,t}$ which includes determinants of scientific prowess such as GDP per capita, population size, and average years of schooling.

To analyze the second effect, we extend the regression model in 1 as follows:

$$\begin{aligned} ln\left(1+\frac{Publications}{Population}\right)_{i,j,t} &= \sum_{t=2001}^{2022} \eta_t China_i \times MLP_j \times Year_t \\ &+ \Psi_{i,j} + \Phi_{i,t} + \Theta_{j,t} + \varepsilon_{i,j,t} \end{aligned} \tag{2}$$

where MLP_j is a dummy variable that is equal to one for the fields of physics, chemistry, biology, and medicine, and to zero for the fields of mathematics and economics. All other variables are as before. The coefficients of interest, η_t, for $n = 2001, ..., 2022$, measure the change in academic publications in years 2001 up to 2022, relative to 2000, for China compared to the rest of the world, and for a scientific field targeted by the NMLP, relative to other fields.

We saturate the empirical model in Equation 2 with country-field, country-time, and field-time fixed effects, denoted $\Psi_{i,j}$, $\Phi_{i,t}$ and $\Theta_{j,t}$. $\Psi_{i,j}$ accounts for any differences in the propensity to publish in top academic journals that vary at the country-field level, such as Germany traditionally being strong in the field of chemistry. $\Phi_{i,t}$ controls for any time-varying factors at the country level, such as national wealth or economic growth. Finally, $\Theta_{j,t}$ controls for field-specific time-varying factors that are common to all countries, such as the growth in research activity over our sample period in the field of biology.

To analyze the effects on impact of research, as measured in terms of number of citations, we replace the dependent variable in equations 1 and 2, respectively, with:

$$ln\left(1+\frac{Citations}{Population}\right)_{i,j,t}$$

where *Citations* is the age-adjusted citation count, summed over all articles in country i, field j, and year $t \in \{2001, 2002, ..., 2022\}$.

5 Empirical results

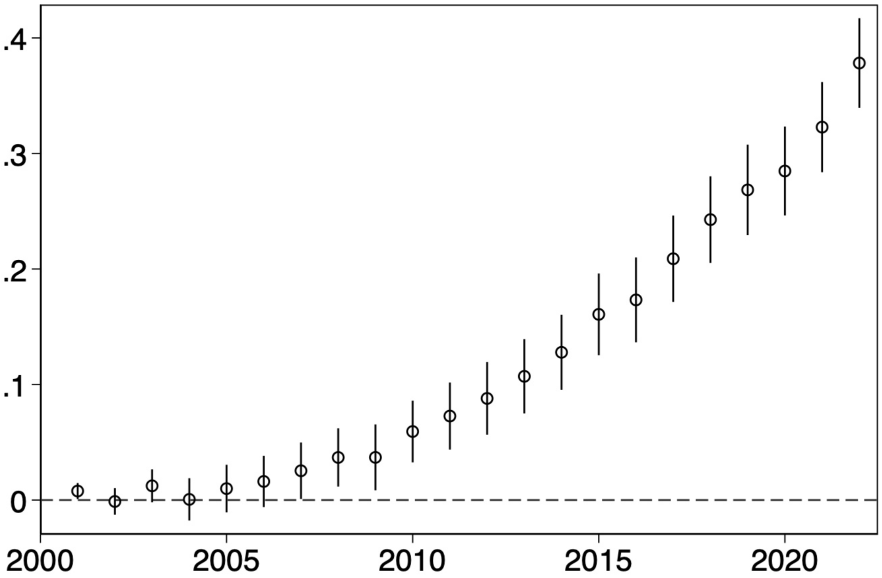
5.1 All fields

We start by estimating Equation 1 to obtain the differences in publications per capita between China and the rest of the world. Figure 1 plots the regression coefficients, β_t, over time, together with confidence intervals. Standard errors are clustered at the country level. We observe no material difference in publication output between China and other countries up until the adoption of the NMLP in 2006. After 2006, however, a publications gap opens up between China and other countries, and this gap widens over time.

The complete regression results, including alternative specifications of Equation 1, are reported in Appendix Table A3. The empirical results that correspond to those in Figure 1 are reported in column (3), where we control for per capita GDP, population size, and years of schooling. Results are robust to including no country-specific controls (column (1)) and to controlling only for per capita GDP (column (2)). Results are also qualitatively robust to limiting the sample to the main competing markets for China, namely the US (column (4)) and the 27 member states of the European Union (column (5)). In this case, the "rise of China" takes place somewhat later than in the full sample, consistent with the dominant role of the US and Europe in scientific research.

The economic effect is substantial: Based on our preferred specification in column (3), and given that the dependent variable is expressed in logs, a coefficient of 0.358 in 2022 implies that publications scaled by population are on average 43% higher for China-based researchers in 2022 than for the control group.

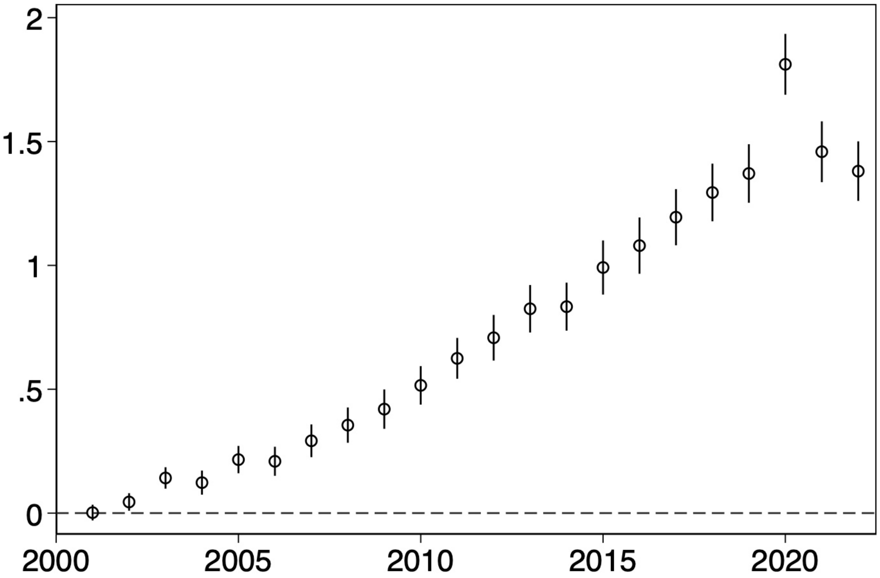
Figure 1: The trend in academic research output over time in China relative to the rest of the world, as measured by the number of publications.



The chart presents regression coefficients and confidence bands resulting from the regression of the natural logarithm of population-normalized publications in country i in field j in year t on the interaction $China_i * Year_n$. $China_i$ is a dummy variable equal to one for publications by China-based researchers. $Year_n$ is a dummy variable equal to one between year $n = 2001$ and year $n = 2022$, and to zero otherwise, with $n = 2000$ denoting the reference year. The regression controls for $ln\_gdp\_capita_{i,t}$, $ln\_population_{i,t}$, and $ln\_schooling_{i,t}$, and includes country-field and field-year fixed effects. Standard errors are clustered at the country level. The coefficients in this chart correspond to the estimates presented in column (3) of Table A3.

In Figure 2, we estimate Equation 1 with the citation count as dependent variable, and find that the same upward trend is present in citations, with the difference between articles produced by China-based researchers and others turning significant already in the early 2000s. Appendix Table A4 reports the full set of results for alternative specifications. Even when compared with US-based researchers (column (4)), we find that the citation count of research by China-based researchers increases in relative terms after the NMLP, starting around 2010. This suggests that China's catch-up is evident not only in the amount of research produced but also in the impact of this research.

Figure 2: The trend in academic research impact over time in China relative to the rest of the world, as measured by the number of citations received.



The chart presents regression coefficients and confidence bands resulting from the regression of the natural logarithm of citations for articles published in country i in field j in year t, adjusted for the population size and the age of the publication, on the interaction $China_i * Year_n$. $China_i$ is a dummy variable equal to one for publications by China-based researchers. $Year_n$ is a dummy variable equal to one between year $n = 2001$ and year $n = 2022$, and to zero otherwise, with $n = 2000$ denoting the reference year. The regression controls for $ln\_gdp\_capita_{i,t}$, $ln\_population_{i,t}$, and $ln\_schooling_{i,t}$, and includes country-field and field-year fixed effects. Standard errors are clustered at the country level. The coefficients in this chart correspond to the estimates presented in column (3) of Table A4.

5.2 Distinguishing between fields

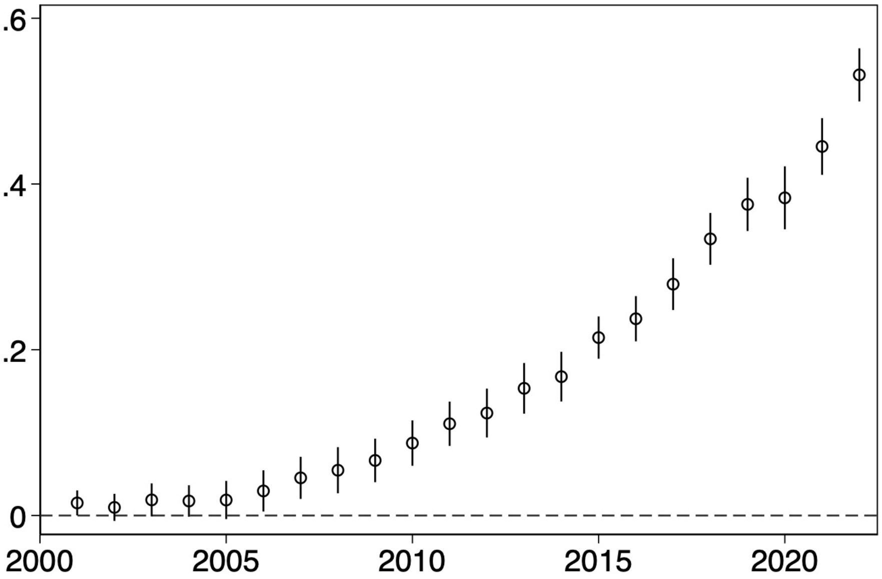
Next, we estimate Equation 2 to assess whether China's rise in publications is geared towards fields targeted by the NMLP (physics, chemistry, biology, and medicine), as opposed to fields that were not (mathematics and economics). Figure 3 plots the regression coefficients, alongside confidence intervals, of this estimation. To make sure that the effect is tightly identified, we control for country-year, country-field, and field-year fixed effects. The complete regression results, including alternative specifications of Equation 2, are reported in Appendix Table A5.

The evidence suggests that there were no statistical differences between researchers based in China and outside of China for publications in NMLP compared to non-NMLP fields until 2006, when the NMLP was adopted. After that, there is a clear and significant publication gap that widens over time.

The economic effect is substantial: the regression coefficient of 0.532 in 2022 implies that the number of publications per million population is on average 70.2% higher for China-based researchers in the fields targeted by the NMLP (physics, chemistry, biology and medicine) compared to the control group.

We continue to find this widening gap after the adoption of the NMLP when restricting the sample to a control group of only the US or the EU (see columns (2) and (3) of Table A5). Similar to before, we find that China's rise compared to these main scientific markets occurs somewhat later, in 2015.

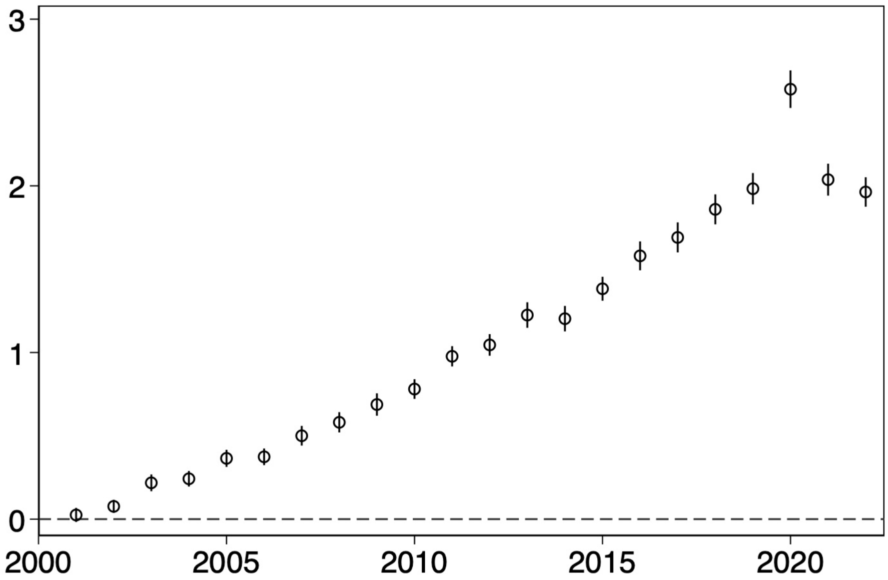
Figure 3: The trend in academic research output over time in China and in fields targeted by the NMLP, relative to other countries or fields, as measured by the number of publications.



The chart presents regression coefficients and confidence bands resulting from the regression of the natural logarithm of population-normalized publications in country i in field j in year t on the interaction $China_i * MLP_j * Year_n$. $China_i$ is a dummy variable equal to one for publications by China-based researchers. MLP_j is a dummy equal to one if the field is "physics", "chemistry", "biology", or "medicine", and it is equal to zero if the field is "mathematics" or "economics". $Year_n$ is a dummy variable equal to one between year $n = 2001$ and year $n = 2022$, and to zero otherwise, with $n = 2000$ denoting the reference year. The regression includes country-field, country-year and field-year fixed effects. Standard errors are clustered at the country level. The coefficients in this chart correspond to the estimates presented in column (3) of Table A5.

Figure 4 shows a similar trend for the citation count. Citations by Chinese-based researchers in the fields targeted by the NMLP start rising relative to the control group exactly in 2006, the year that the NMLP is adopted. Table A6 shows that this trend is robust to using a smaller control group of only the US or the EU. These results strongly indicate that the increasing dominance of China-based research in fields targeted by the NMLP coincides with China's large-scale public investment directed towards these fields.

Figure 4: The trend in academic research impact over time in China and in fields targeted by the NMLP, relative to other countries or fields, as measured by the number of citations received.



The chart presents regression coefficients and confidence bands resulting from the regression of the natural logarithm of citations for articles published in country i in field j in year t, adjusted for the population size and the age of the publication, on the interaction $China_i * MLP_j * Year_n$. $China_i$ is a dummy variable equal to one for publications by China-based researchers. MLP_j is a dummy equal to one if the field is "physics", "chemistry", "biology", or "medicine", and it is equal to zero if the field is "mathematics" or "economics". $Year_n$ is a dummy variable equal to one between year $n = 2001$ and year $n = 2022$, and to zero otherwise, with $n = 2000$ denoting the reference year. The regression includes country-field, country-year and field-year fixed effects. Standard errors are clustered at the country level. The coefficients in this chart correspond to the estimates presented in column (3) of Table A6.

6 Conclusions

Many economists are sceptical of the notion that government investment can spur scientific progress. This is especially true when it comes to a country like China that is characterized by top-down centralized planning and whose researchers were long seen as copycats and plunderers of Western intellectual property rather than as true innovators. At the same time, China's government has been open about its plans to support domestic research capacity and transform China into a scientific powerhouse. An early culmination of these efforts came with the National Medium and Long-Term Plan launched (NMLP) in 2006 which increased substantially investment in key scientific fields, namely physics, chemistry, biology, and medicine.

Based on a sample of over 300,000 scientific articles published in 40 top scientific journals between 2000 and 2022, we find that after the adoption of the NMLP, publications and citations per capita by China-based authors increased gradually and significantly. After being indistinguishable from the group of non-China-based researchers during the early 2000s, by 2022 publications per million population were on average 43% higher for China-based researchers. Crucially, this effect is observed solely for publications in the fields that were targeted by the NMLP, with publications per capita in these fields by China-based researchers higher by 70% in 2022, relative to the control group. Both effects remain when focusing on the main competing scientific markets–the US and Europe–and they obtain when controlling for standard determinants of scientific prowess, including per capita income, population size, and average schooling.

Our results suggest that government-led efforts may be successful in promoting scientific progress, as measured by research output and citations. In qualifying the rise of China as a research powerhouse, we also present evidence on the relative decline of Europe and the United States which have dominated the field of science for well over a century. The field of economics, however, is exceptional in that there has been no commensurate entry of China-based researchers in the past two decades. Whether this is primarily due to a lack of support for the economic science on the side of the Chinese government, or due to barriers to entry by researchers from non-traditional scientific markets, remains an open question.

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Supplemental Appendix

This Appendix contains supplementary material for the paper "The Rise of China in Academic Publications" by Catalina Cozariuc, Luc Laeven, and Alexander Popov.

Table A1: Journals Considered in the Analysis, by Field

Journal	**Field**	**Total Articles**		**Year**	**Rank**	**Included**
		total	since 2000			
Cell	Biology	15,858	7,401	1974	1	yes
Nucleic Acids Research	Biology	45,320	26,175	1974	8	yes
Nature Biotechnology	Biology	3,777	2,846	1989	3	yes
Nature Genetics	Biology	6,456	4,620	1992	2	yes
Molecular Cell	Biology	7,037	6,653	1997	5	yes
Nature Cell Biology	Biology	3,721	3,571	1999	5	yes
Genome Biology	Biology	3,626	3,626	2000	10	yes
Nature Methods	Biology	2,596	2,596	2004	4	no
Cell Metabolism	Biology	2,083	2,083	2005	7	no
Cell Host and Microbe	Biology	1,706	1,706	2007	9	no
Cell Stem Cell	Biology	1,543	1,543	2007	11	no
J. of the American Chemical Society	Chemistry	170,698	62,092	1879	2	yes
Angewandte Chemie - Int'l Edition	Chemistry	56,514	44,350	1962	4	yes
Applied Catalysis B: Environmental	Chemistry	14,023	13,446	1992	9	yes
Nature Chemistry	Chemistry	2,263	2,263	2009	5	no
ACS Energy Letters	Chemistry	2,574	2,574	2016	7	no
Chem	Chemistry	940	940	2016	11	no
Nature Catalysis	Chemistry	576	576	2018	9	no
Physical Review Letters	Physics	122,006	68,898	1958	11	yes
Advanced Materials	Physics	19,886	18,676	1989	2	yes
Materials Today	Physics	661	659	1999	8	yes
Nature Physics	Physics	2,959	2,959	2005	5	no
ACS Nano	Physics	18,068	18,068	2007	10	no
Nature Photonics	Physics	1,779	1,779	2007	4	no
Physical Review X	Physics	2,286	2,286	2011	8	no
Nature Electronics	Physics	417	417	2018	11	no
Advanced Functional Materials	Physics/Chemistry	17,400	17,400	2001	6	yes
Nature Materials	Physics/Chemistry	3,195	3,195	2002	1	no
Nature Nanotechnology	Physics/Chemistry	2,201	2,201	2006	3	no
Nature Communications	Physics/Chemistry	50,333	50,333	2010	6	no
The Lancet	Medicine	31,210	6,666	1826	3	yes

Journal	**Field**	**Total Articles**		**Year**	**Rank**	**Included**
		total	since 2000			
CA: A Cancer Journal for Clinicians	Medicine	1,429	226	1951	2	yes
New England Journal of Medicine	Medicine	18,955	10,135	1965	1	yes
Annals of Oncology	Medicine	7,689	6,418	1990	8	yes
Immunity	Medicine	3,910	3,176	1994	4	yes
Nature Medicine	Medicine	4,984	4,055	1995	2	yes
Nature Immunology	Medicine	3,062	3,062	2000	8	yes
The Lancet Oncology	Medicine	1,844	1,844	2000	6	yes
Cancer Cell	Medicine	1,969	1,969	2002	6	no
The Lancet Respiratory Medicine	Medicine	666	666	2013	10	no
Quarterly Journal of Economics	Economics	3,394	710	1888	2	yes
Review of Economic Studies	Economics	2,366	1,159	1933	7	yes
Journal of Finance	Economics	1,814	1,377	1946	3	yes
Journal of Political Economy	Economics	1,233	1,051	1969	4	yes
American Economic Review	Economics	3,098	2,154	1973	1	yes
Journal of Financial Economics	Economics	3,408	2,567	1974	7	yes
Econometrica	Economics	1,463	1,371	1978	5	yes
Review of Economics and Statistics	Economics	1,532	1,361	1980	9	yes
Review of Financial Studies	Economics	1,704	1,571	1996	6	yes
American Econ. J.: Applied Econ.	Economics	538	538	2009	10	no
Acta Mathematica	Mathematics	1,023	286	1887	9	yes
Biometrika	Mathematics	4,439	1,696	1908	8	yes
Communic. on Pure and Appl. Math.	Mathematics	2,213	1,071	1950	7	yes
Publ. Math. Inst. Hautes Études Sci.	Mathematics	342	145	1959	5	yes
Inventiones Mathematicae	Mathematics	4,373	1,586	1966	3	yes
J. of the American Math. Society	Mathematics	1,003	661	1988	3	yes
Annals of Mathematics	Mathematics	1,251	1,128	1996	1	yes
Annals of Statistics	Mathematics	2,674	2,287	1996	2	yes
J. of the Royal Stat. Society. Series B	Mathematics	1,180	1,031	1997	6	yes
Math. Programming Computation	Mathematics	232	232	2009	9	no
Annals of PDE	Mathematics	150	150	2015	9	no

Note: This table presents the journals considered for analysis, including their corresponding fields, article counts, year of establishment, and combined ranking based on the SCImago Journal Rank (SJR) and H-index rank. The column ”Included” indicates whether or not the journal is included in the final sample for analysis. Only journals established prior to 2001 are included in the analysis. Journals are ordered by field and by their year of establishment. Sources: SCImago (2023) and Scopus (2023).

Table A2: Summary statistics for the country-field dataset, 2000-2022

	N	Min	Mean	Max	p25	p50	p75	SD
publications	18,906	0.000	17.422	4243.833	0.000	0.000	0.250	127.214
citations	18,906	0.000	1681.279	276075.500	0.000	0.000	0.000	14504.720
ln_publ_pop	18,492	0.000	0.111	3.675	0.000	0.000	0.000	0.372
ln_cit_pop	18,492	0.000	0.312	7.201	0.000	0.000	0.000	0.914
china	18,906	0.000	0.007	1.000	0.000	0.000	0.000	0.085
mlp	18,906	0.000	0.667	1.000	0.000	1.000	1.000	0.471
ln_gdp_capita	18,390	4.705	8.269	12.392	7.025	8.201	9.276	1.573
ln_population	18,492	-3.448	2.310	7.256	1.290	2.384	3.504	1.913
ln_schooling	16,464	-1.470	1.804	2.633	1.500	2.039	2.350	0.733

Note: *publications* denotes the sum of total articles published in country i in field j in year t, *citations* denotes the sum of total citations (as of June 2023) received for the articles published in country i in field j in year t, *ln_publ_pop* denotes the natural logarithm of the population-normalized publications in country i in field j in year t, *ln_cit_pop* denotes the natural logarithm of citations for articles published in country i in field j in year t, adjusted for the population size and the age of the publication. *china* is a dummy variable equal to 1 if the country is China and 0 otherwise. *mlp* is a dummy variable equal to 1 if the field is regarded as a strategic objective in China's National Plan for Medium- and Long-Term Education Reform and Development, i.e., if the field is "physics", "chemistry", "biology", or "medicine", and *mlp* is equal to 0 if the field is "mathematics" or "economics". *ln_gdp_capita* denotes the natural logarithm of GDP per capita in country i in year t. *ln_population* is the natural logarithm of the total population of country i in year t. *ln_schooling* denotes the natural logarithm of the average years of schooling in country i in year t. The dataset includes 40 academic journals with complete coverage starting from the year 2000 and runs from 2000 to 2022. Sources: Scopus, World Bank, Unesco.

Table A3: The trend in academic research output over time in China relative to the rest of the world, as measured by the number of publications.

	(1) world	(2) world	(3) World	(4) China & US	(5) China & EU
china*2001	0.008**	0.010**	0.006	0.026***	0.010***
	(0.003)	(0.003)	(0.003)	(0.000)	(0.000)
china*2002	0.001	0.003	-0.004	-0.064***	-0.003***
	(0.004)	(0.005)	(0.006)	(0.000)	(0.000)
china*2003	0.015*	0.016**	0.008	-0.035***	-0.059***
	(0.006)	(0.006)	(0.008)	(0.000)	(0.000)
china*2004	0.007	0.009	-0.005	-0.112***	-0.114***
	(0.008)	(0.008)	(0.011)	(0.000)	(0.000)
china*2005	0.013	0.016	0.004	-0.137***	-0.156***
	(0.008)	(0.008)	(0.012)	(0.000)	(0.000)
china*2006	0.019*	0.022*	0.009	-0.143***	-0.163***
	(0.009)	(0.009)	(0.013)	(0.000)	(0.000)
china*2007	0.027*	0.031**	0.017	-0.150***	-0.150***
	(0.011)	(0.011)	(0.014)	(0.000)	(0.000)
china*2008	0.036**	0.042***	0.028	-0.141***	-0.154***
	(0.011)	(0.010)	(0.014)	(0.000)	(0.000)
china*2009	0.033**	0.041***	0.027	-0.164***	-0.195***
	(0.013)	(0.012)	(0.016)	(0.000)	(0.000)
china*2010	0.053***	0.061***	0.049***	-0.052***	-0.111***
	(0.012)	(0.011)	(0.014)	(0.000)	(0.000)
china*2011	0.065***	0.074***	0.061***	-0.089***	-0.128***
	(0.012)	(0.012)	(0.016)	(0.000)	(0.000)
china*2012	0.078***	0.089***	0.075***	-0.059***	-0.168***
	(0.013)	(0.013)	(0.017)	(0.000)	(0.000)
china*2013	0.095***	0.107***	0.093***	-0.074***	-0.137***
	(0.013)	(0.012)	(0.017)	(0.000)	(0.000)
china*2014	0.114***	0.126***	0.112***	0.001***	-0.085***
	(0.012)	(0.012)	(0.016)	(0.000)	(0.000)
china*2015	0.144***	0.159***	0.144***	0.078***	-0.024***
	(0.013)	(0.014)	(0.018)	(0.000)	(0.000)
china*2016	0.156***	0.170***	0.155***	0.130***	0.004***
	(0.012)	(0.013)	(0.017)	(0.000)	(0.000)
china*2017	0.190***	0.205***	0.189***	0.159***	0.028***
	(0.013)	(0.013)	(0.018)	(0.000)	(0.000)
china*2018	0.221***	0.237***	0.223***	0.177***	0.077***
	(0.014)	(0.014)	(0.018)	(0.000)	(0.000)
china*2019	0.246***	0.262***	0.248***	0.228***	0.129***
	(0.014)	(0.014)	(0.018)	(0.000)	(0.000)
china*2020	0.260***	0.277***	0.264***	0.237***	0.153***
	(0.015)	(0.014)	(0.018)	(0.000)	(0.000)
china*2021	0.298***	0.317***	0.302***	0.278***	0.152***
	(0.016)	(0.015)	(0.019)	(0.000)	(0.000)
china*2022	0.355***	0.372***	0.358***	0.374***	0.275***
	(0.014)	(0.014)	(0.018)	(0.000)	(0.000)
ln_gdp_capita		-0.013	-0.011		
		(0.007)	(0.007)		
ln_population			0.022		
			(0.031)		
ln_schooling			-0.015*		
			(0.007)		
N	18492	18390	16362	276	276
R-squared	0.896	0.897	0.906	0.979	0.977
Country x Field FE	yes	yes	yes	yes	yes
Field x Year FE	yes	yes	yes	yes	yes
Clustered Std. Errors	yes	yes	yes	yes	yes

Note: The table reports estimates from OLS regressions. The dependent variable is the natural logarithm of population-normalized publications in country i in field j in year t. $China_i$ is a dummy variable equal to one for publications by China-based researchers. $Year_n$ is a dummy variable equal to one between year $n = 2001$ and year $n = 2022$, and to zero otherwise, with $n = 2000$ denoting the reference year. $ln\_gdp\_capita_{i,t}$ denotes the natural logarithm of GDP per capita in country i in year t. $ln\_population_{i,t}$ is the natural logarithm of the total population size of country i in year t. $ln\_schooling_{i,t}$ denotes the natural logarithm of the average years of schooling in country i in year t. Columns (1), (2) and (3) include all countries in the world. Column (4) includes only China and the United States, and column (5) includes only China and the European Union (aggregated). Standard errors are clustered at the country level and are reported in parentheses, where *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A4: The trend in academic research impact over time in China relative to the rest of the world, as measured by the number of citations received.

	(1) world	(2) world	(3) world	(4) China & US	(5) China & EU
china*2001	0.006	0.010	-0.001	-0.074***	-0.002***
	(0.012)	(0.013)	(0.015)	(0.000)	(0.000)
china*2002	0.050***	0.055***	0.040*	-0.101***	0.064***
	(0.014)	(0.014)	(0.019)	(0.000)	(0.000)
china*2003	0.150***	0.156***	0.135***	0.023***	0.135***
	(0.018)	(0.018)	(0.024)	(0.000)	(0.000)
china*2004	0.149***	0.155***	0.113***	-0.101***	0.134***
	(0.019)	(0.019)	(0.027)	(0.000)	(0.000)
china*2005	0.235***	0.243***	0.204***	-0.128***	0.204***
	(0.020)	(0.020)	(0.030)	(0.000)	(0.000)
china*2006	0.230***	0.240***	0.195***	-0.164***	0.195***
	(0.023)	(0.022)	(0.033)	(0.000)	(0.000)
china*2007	0.312***	0.326***	0.276***	-0.042***	0.262***
	(0.028)	(0.026)	(0.037)	(0.000)	(0.000)
china*2008	0.369***	0.388***	0.338***	-0.050***	0.303***
	(0.028)	(0.026)	(0.037)	(0.000)	(0.000)
china*2009	0.424***	0.450***	0.401***	-0.038***	0.346***
	(0.032)	(0.030)	(0.043)	(0.000)	(0.000)
china*2010	0.513***	0.542***	0.496***	0.025***	0.430***
	(0.029)	(0.028)	(0.040)	(0.000)	(0.000)
china*2011	0.616***	0.649***	0.603***	0.134***	0.549***
	(0.029)	(0.029)	(0.041)	(0.000)	(0.000)
china*2012	0.694***	0.730***	0.683***	0.246***	0.576***
	(0.034)	(0.035)	(0.048)	(0.000)	(0.000)
china*2013	0.811***	0.851***	0.798***	0.296***	0.684***
	(0.035)	(0.034)	(0.046)	(0.000)	(0.000)
china*2014	0.815***	0.858***	0.804***	0.296***	0.701***
	(0.033)	(0.033)	(0.047)	(0.000)	(0.000)
china*2015	0.969***	1.018***	0.960***	0.458***	0.847***
	(0.036)	(0.038)	(0.052)	(0.000)	(0.000)
china*2016	1.057***	1.107***	1.046***	0.604***	0.964***
	(0.037)	(0.038)	(0.052)	(0.000)	(0.000)
china*2017	1.170***	1.221***	1.158***	0.736***	1.092***
	(0.038)	(0.039)	(0.054)	(0.000)	(0.000)
china*2018	1.257***	1.311***	1.257***	0.753***	1.093***
	(0.038)	(0.040)	(0.054)	(0.000)	(0.000)
china*2019	1.334***	1.389***	1.332***	0.927***	1.239***
	(0.039)	(0.041)	(0.055)	(0.000)	(0.000)
china*2020	1.766***	1.826***	1.773***	1.305***	1.652***
	(0.044)	(0.044)	(0.058)	(0.000)	(0.000)
china*2021	1.412***	1.475***	1.420***	1.153***	1.298***
	(0.039)	(0.043)	(0.056)	(0.000)	(0.000)
china*2022	1.335***	1.394***	1.343***	1.422***	1.342***
	(0.034)	(0.041)	(0.053)	(0.000)	(0.000)
ln_gdp_capita		-0.044	-0.045		
		(0.023)	(0.027)		
ln_population			0.052		
			(0.114)		
ln_schooling			-0.076**		
			(0.023)		
N	18492	18390	16362	276	276
R-squared	0.871	0.871	0.881	0.982	0.919
Country x Field FE	yes	yes	yes	yes	yes
Field x Year FE	yes	yes	yes	yes	yes
Clustered Std. Errors	yes	yes	yes	yes	yes

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table reports estimates from OLS regressions. The dependent variable is the natural logarithm of citations for articles published in country i in field j in year t, adjusted for the population size and the age of the publication. $China_i$ is a dummy variable equal to one for publications by China-based researchers. $Year_n$ is a dummy variable equal to one between year $n = 2001$ and year $n = 2022$, and to zero otherwise, with $n = 2000$ denoting the reference year. $ln\_gdp\_capita_{i,t}$ denotes the natural logarithm of GDP per capita in country i in year t. $ln\_population_{i,t}$ is the natural logarithm of the total population size of country i in year t. $ln\_schooling_{i,t}$ denotes the natural logarithm of the average years of schooling in country i in year t. Columns (1), (2) and (3) include all countries in the world. Column (4) includes only China and the United States, and column (5) includes only China and the European Union (aggregated). Standard errors are clustered at the country level and are reported in parentheses, where *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A5: The trend in academic research output over time in China and in fields targeted by the NMLP, relative to other countries or fields, as measured by the number of publications.

	(1) world	(2) China & US	(3) China & EU
mlp*china*2001	0.015*	0.082***	0.046***
	(0.008)	(0.000)	(0.000)
mlp*china*2002	0.010	0.010***	0.008***
	(0.008)	(0.000)	(0.000)
mlp*china*2003	0.019	-0.107***	-0.066***
	(0.010)	(0.000)	(0.000)
mlp*china*2004	0.018	-0.204***	-0.153***
	(0.010)	(0.000)	(0.000)
mlp*china*2005	0.019	-0.202***	-0.227***
	(0.012)	(0.000)	(0.000)
mlp*china*2006	0.030*	-0.194***	-0.204***
	(0.013)	(0.000)	(0.000)
mlp*china*2007	0.045***	-0.152***	-0.226***
	(0.013)	(0.000)	(0.000)
mlp*china*2008	0.055***	-0.105***	-0.177***
	(0.014)	(0.000)	(0.000)
mlp*china*2009	0.066***	-0.074***	-0.205***
	(0.013)	(0.000)	(0.000)
mlp*china*2010	0.087***	0.088***	-0.060***
	(0.014)	(0.000)	(0.000)
mlp*china*2011	0.111***	0.024***	-0.093***
	(0.014)	(0.000)	(0.000)
mlp*china*2012	0.124***	-0.064***	-0.169***
	(0.015)	(0.000)	(0.000)
mlp*china*2013	0.153***	0.001***	-0.109***
	(0.015)	(0.000)	(0.000)
mlp*china*2014	0.168***	-0.004***	-0.053***
	(0.015)	(0.000)	(0.000)
mlp*china*2015	0.215***	0.090***	0.028***
	(0.013)	(0.000)	(0.000)
mlp*china*2016	0.237***	0.183***	0.081***
	(0.014)	(0.000)	(0.000)
mlp*china*2017	0.279***	0.251***	0.147***
	(0.016)	(0.000)	(0.000)
mlp*china*2018	0.334***	0.330***	0.192***
	(0.016)	(0.000)	(0.000)
mlp*china*2019	0.375***	0.395***	0.276***
	(0.016)	(0.000)	(0.000)
mlp*china*2020	0.383***	0.464***	0.321***
	(0.019)	(0.000)	(0.000)
mlp*china*2021	0.445***	0.515***	0.365***
	(0.017)	(0.000)	(0.000)
mlp*china*2022	0.532***	0.709***	0.497***
	(0.016)	(0.000)	(0.000)
N	18492	276	276
R-squared	0.927	0.987	0.986
Country x Field FE	yes	yes	yes
Country x Year FE	yes	yes	yes
Field x Year FE	yes	yes	yes
Clustered Std. Errors	yes	yes	yes

Note: The table reports estimates from OLS regressions. The dependent variable is the natural logarithm of population-normalized publications in country i in field j in year t. MLP_j is a dummy equal to one if the field is regarded as a strategic objective in China's National Plan for Medium- and Long-Term Education Reform and Development, i.e., if the field is "physics", "chemistry", "biology", or "medicine", and it is equal to zero if the field is "mathematics" or "economics". $China_i$ is a dummy variable equal to one for publications by China-based researchers. $Year_n$ is a dummy variable equal to one between year $n = 2001$ and year $n = 2022$, and to zero otherwise, with $n = 2000$ denoting the reference year. Column (1) includes all countries in the world, column (2) includes only China and the United States, and column (3) includes only China and the European Union (aggregated). Standard errors are clustered at the country level and are reported in parentheses, where *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A6: The trend in academic research impact over time in China and in fields targeted by the NMLP, relative to other countries or fields, as measured by the number of citations received.

	(1) world	(2) China & US	(3) China & EU
mlp*china*2001	0.025	0.431***	-0.005***
	(0.021)	(0.000)	(0.000)
mlp*china*2002	0.077***	0.198***	0.089***
	(0.020)	(0.000)	(0.000)
mlp*china*2003	0.218***	0.044***	0.204***
	(0.025)	(0.000)	(0.000)
mlp*china*2004	0.242***	-0.045***	0.198***
	(0.024)	(0.000)	(0.000)
mlp*china*2005	0.365***	0.202***	0.287***
	(0.026)	(0.000)	(0.000)
mlp*china*2006	0.374***	0.256***	0.302***
	(0.025)	(0.000)	(0.000)
mlp*china*2007	0.501***	0.237***	0.373***
	(0.030)	(0.000)	(0.000)
mlp*china*2008	0.581***	0.424***	0.456***
	(0.031)	(0.000)	(0.000)
mlp*china*2009	0.688***	0.463***	0.513***
	(0.034)	(0.000)	(0.000)
mlp*china*2010	0.781***	0.552***	0.633***
	(0.030)	(0.000)	(0.000)
mlp*china*2011	0.977***	0.637***	0.829***
	(0.031)	(0.000)	(0.000)
mlp*china*2012	1.045***	0.446***	0.844***
	(0.033)	(0.000)	(0.000)
mlp*china*2013	1.225***	0.722***	1.012***
	(0.039)	(0.000)	(0.000)
mlp*china*2014	1.203***	0.677***	1.018***
	(0.039)	(0.000)	(0.000)
mlp*china*2015	1.383***	0.709***	1.182***
	(0.036)	(0.000)	(0.000)
mlp*china*2016	1.580***	0.950***	1.419***
	(0.044)	(0.000)	(0.000)
mlp*china*2017	1.691***	1.105***	1.568***
	(0.046)	(0.000)	(0.000)
mlp*china*2018	1.859***	1.171***	1.602***
	(0.045)	(0.000)	(0.000)
mlp*china*2019	1.983***	1.309***	1.816***
	(0.048)	(0.000)	(0.000)
mlp*china*2020	2.580***	1.896***	2.401***
	(0.057)	(0.000)	(0.000)
mlp*china*2021	2.037***	1.277***	1.853***
	(0.048)	(0.000)	(0.000)
mlp*china*2022	1.963***	1.522***	1.957***
	(0.045)	(0.000)	(0.000)
N	18492	276	276
R-squared	0.910	0.988	0.961
Country x Field FE	yes	yes	yes
Country x Year FE	yes	yes	yes
Field x Year FE	yes	yes	yes
Clustered Std. Errors	yes	yes	yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table reports estimates from OLS regressions. The dependent variable is the natural logarithm of citations for articles published in country i in field j in year t, adjusted for the population size and the age of the publication. MLP_j is a dummy equal to one if the field is regarded as a strategic objective in China's National Plan for Medium- and Long-Term Education Reform and Development, i.e., if the field is "physics", "chemistry", "biology", or "medicine", and it is equal to zero if the field is "mathematics" or "economics". $China_i$ is a dummy variable equal to one for publications by China-based researchers. $Year_n$ is a dummy variable equal to one between year $n = 2001$ and year $n = 2022$, and to zero otherwise, with $n = 2000$ denoting the reference year. Column (1) includes all countries in the world, column (2) includes only China and the United States, and column (3) includes only China and the European Union (aggregated). Standard errors are clustered at the country level and are reported in parentheses, where *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.