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At Risk Research

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Identifying Researchers and IP at Risk of the PRC's Technology Transfer Program

EXECUTIVE SUMMARY:

The purpose of this study is to use data to understand the wider cooperation in research and academia between the United States and the People's Republic of China (PRC). Using publicly available data, macro and micro analysis can identify who and what is at greatest risk of the PRC's Technology Acquisition Program.

To understand the People's Republic of China's talent and intellectual property acquisition programs, we conducted a macro and micro analysis of all publicly available journal articles and patents published from 1981 to 2022 that were co-funded with the United States and by at least one PRC government agency. This study identified 327,201 journal articles published by US authors co-funded by a PRC government agency.

Research Goal: This study aims to understand the scope and size of the academic cooperation to support the creation of safeguards (vetting processes) for US industry, university administrators, faculty, academic and technology who are at risk.



Total # of Articles Published by Year

Figure 1. Number of US co-authored published articles funded by at least one PRC government agency*

Notably, the requirement to track funding for published articles did not begin until 2008. In our assessment this may make the results for the years 2004 to 2008 underreported.

Since 2008 though there has been a clear, upward trend of US co-authored published articles cofunded by at least one PRC government agency (as seen in Figure 1). In 2019, this trend peaked at 43,459 articles, but has since been trending downwards. In our assessment this is a result of

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US Government's policy to reduce the People's Republic of China's talent and intellectual property acquisition programs.

Networks

Authors often collaborate on journal articles and have joint funding from institutions, laboratories, research centers, universities, and government agencies. As a result, denser networks of authors and institutions develop over time. To see this we processed the data based on institution, affiliation and publisher.



Total # Articles Published by Funding Agency

Figure 2. Number of US co-authored published articles funded by at least one PRC government agency*

Top funding agencies by number of articles published (Figure 2): National Natural Science Foundation of China (261,097); United States National Science Foundation (48,945); United States Department of Health Human Services (34,377); National Basic Research Program of China – 973 Program (34,121); National Institutes of Health USA (34,109); China Scholarship Council (30,790); Fundamental Research Funds for the Central Universities (27,402); National Key Research and Development Program of China (25,707); United States Department of Energy (21,352); Chinese Academy of Sciences (17,131); China Postdoctoral Science Foundation (14,148); and the Ministry of Science and Technology (10,572).



The National Natural Science Foundation of China (NSFC) surpasses any other PRC funding agency in the number of its total publications. This indicates the NSFC is likely the main governmental entity that directs the majority of science/education funding through its various programs and entities. Articles that are published with the assistance of the NSFC typically list it as a funding organization, alongside a specific program. Similarly to the United States National Institute of Health, which falls under the umbrella of the United States Department of Health and Human Services, it is likely that the National Basic Research Program of China; China Scholarship Council; Fundamental Funds for the Central Universities; the National Key Research and Development Program of China; China Postdoctoral Science Foundation; and the Thousand Talents Program all fall under the National Natural Science Foundation of China.





Figure 3. Number of US co-authored published articles funded by at least one PRC government agency*

By virtue of the number of co-authored papers funded by PRC entities, the following US academic institutions provide the greatest opportunity by volume for PRC technology acquisition:

- University of California System (30,692 articles);
- University of Texas System (16,392 articles);
- Pennsylvania Commonwealth System of Higher Education (12,606 articles);
- State University System of Florida (12,558 articles);
- University System of Georgia (11,852 articles); and
- Harvard University (11,234 articles).

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By the same measure, the Top US Departments provide the greatest opportunity for PRC technology acquisition efforts:

- National Science Foundation (48,945 articles);
- Department of Health and Human Services (34,377 articles);
 - National Institutes of Health NIH (32,109 articles)
 - National Cancer Institute NCI (6,961 articles)
- Department of Energy (21,352 articles);
- Department of Defense (4,755 articles) and the
- National Aeronautics and Space Administration NASA (2,992 articles).



Total # of Articles Published by Publisher

Figure 4. Number of US co-authored published articles funded by at least one PRC government agency*

Top publishers (Figure 4): Elsevier (82,311); Springer Nature (39,419); IEEE (29,021); Wiley (25,013); Amer Chemical Soc (16,763); Royal Soc Chemistry (9,614); Amer Physical Soc (8,611); Taylor & Francis (7,672); and the Iop Publishing Ltd (7,425).

Top journals: Scientific Reports (4,308); PLOS One (4,288); Nature Communications (2,609); Physical Review B (2,096); ACS Applied Materials Interfaces (1,992); Astrophysical Journal (1,865); United States National Academy of Sciences (1,799); Physical Review D (1,791); IEEE Access (1,701); Science of the Total Environment (1,691); Journal of the American Chemical Society (1,387); and the Applied Physics Letters (1,345).

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Total # of Articles Published by Journal

Figure 5. Number of US co-authored published articles funded by at least one PRC government agency*



Estimating the jointly held funding costs between China the United States

Figure 6. Estimated Combined Cost of Funding per Year of total # of articles published as per figure 1. Data is normalized to USD for Oct 2016.

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In 2019 at the height of research cooperation between the United States and the PRC it is estimated that between USD1.5 trillion (low estimate) and USD2 trillion (high estimate) was spent in total by both countries. This represents total funding between both parties and is based on estimates from figure 6.

Precise funding amounts per project are not reported in the dataset. To estimate the funding we relied on three separate studies (two in 2016) to make an estimation of the total funding amount for the data in Figure 1. These estimates are graphed in figure 6. Research conducted by Xianwen Wang in "Science funding and research output: A study on 10 countries"¹ indicates that per grant the US produces 2.95 published articles and China produces 2.93 published articles. The National Science foundation in 2016² median grant size was USD\$141,000. The probable cost per published article for the National Science Foundation is estimated at USD\$48,259 when the data is normalized to the year 2016 in US dollars. A separate study in Australia³ separated university institutions between R1 Institutions (Top 8 in Australia or Ivy League) and community or state universities. The cost range widened between the type of institution with community or state universities paying between USD\$30,477 to USD\$33,332 and R1 Institutions paying USD\$50,796 to USD\$55,500. From this research we can estimate the low and high figures of probable total spending on joint research.

US Endowments and Top Research Institutions

Understandably, the PRC also seeks to collaborate with the top research institutions in the United States (R1 Institutions): PRC Foreign Gifts and Endowments have an R-Squared of 0.38 (P-value: 0.0001). For Private US Universities in receipt of PRC Gifts in relation to Endowment is an R-Squared of 0.45 (P-value: 0.0003)



Figure 7. US institutions by research rank, type (public or private) and PRC gift amount.

 $^{{}^{1}}https://www.researchgate.net/publication/236629051_Science_funding_and_research_output_A_study_on_10_countries$

² https://www.nsf.gov/about/budget/fy2018/pdf/04_fy2018.pdf

³ https://truii.com/data-curio-blog/business-insights/how-much-does-research-cost/

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