

## REAL NUMBERS

# An Age of Disentangled Research?

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**I**nternational research collaboration has grown significantly since the 1980s, and until very recently the trend was considered unambiguously positive and likely to continue. By 2020, nearly a quarter of all published research involved international collaboration. One of the key engines of this rise was an increase in China's international scientific cooperation, especially with the United States.

Over this period, collaboration became tremendously important to the productivity of the scientific enterprise as a whole. Examining 25 million research articles between 1981 and 2012, research analyst Jonathan Adams found that the increase in the scientific output of the United States and Western European countries over this time period is largely explained by the increase in internationally coauthored papers. The impact is so profound that Adams characterized this phase of intensifying international collaboration as the “fourth age of research,” to recognize a distinct shift in the drivers of scientific output from previous ages, which he described as “the individual, the institutional, and the national.”

Recently, the number of papers coauthored by Chinese and US researchers has appeared to decline, and some European universities appear to be closing their doors to collaboration with China. What do these various signals mean? The tensions of the fourth age of research, as Adams noted, exist in nations' abilities to balance “the collaborative and domestic parts of the research base.” Today those tensions are at the fore, raising the question of whether the world is now entering a new, fifth age of research.

As European researchers at Lund University School of Economics and Management, we have been monitoring these bibliometric, policy, and cultural shifts to get a more nuanced picture of whether research disentanglement is truly happening between China and the West, and what the future might hold—not only for research collaborations, but for the mission of the scientific enterprise itself.

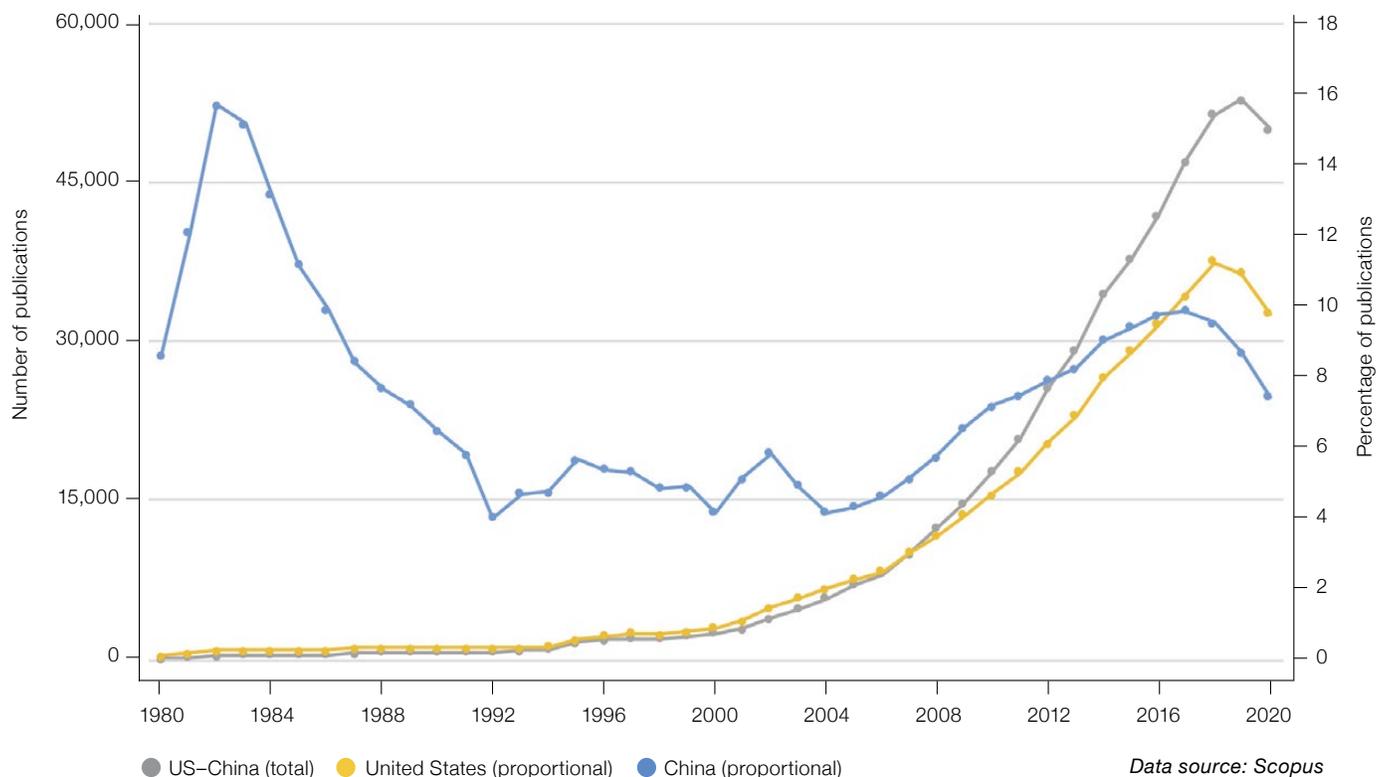
From the European perspective, trends in collaboration vary across different countries and disciplines, revealing different levels of engagement and cooperation. In particular, the recent downturn in US-China collaboration is not directly mirrored in Europe, despite actions by several European countries that seem to foreshadow a similar decline.

In considering international research collaboration trends, it's key to recognize that China has been a more important scientific collaboration partner for the United States than it has been for other liberal market economies that are members of the Organisation for Economic Co-operation and Development. The United States gained significantly from intensive collaboration across China's ascendent research ecosystem, which grew rapidly in production and prominence. In 2005, China surpassed the United States in total researchers and, by 2018, in contributions to international scientific publications as well. Since about 2017, US-China jointly coauthored articles accounted for a larger share of total articles in the United States than in China (see Figure 1).

Starting around 2018, the number of Sino-American copublications began to stagnate and decline, both in absolute terms and as a share of each country's total publications. However, not all academic disciplines have experienced the same trends. Jointly authored articles in materials science have dropped steeply, and similar trends can be observed in other fields.

In contrast, collaboration in arts and humanities was still increasing both in absolute terms and as a share of total publications, albeit from rather low levels when compared to science, technology, engineering, and mathematics (STEM) fields. In social sciences and psychology, jointly published articles were still growing in absolute terms but stagnating as a share of total publications. These trends suggest that the decoupling of US and Chinese research has begun, but it is not uniform across all disciplines.

Figure 1: PROPORTION OF SINO-AMERICAN COLLABORATIVE RESEARCH



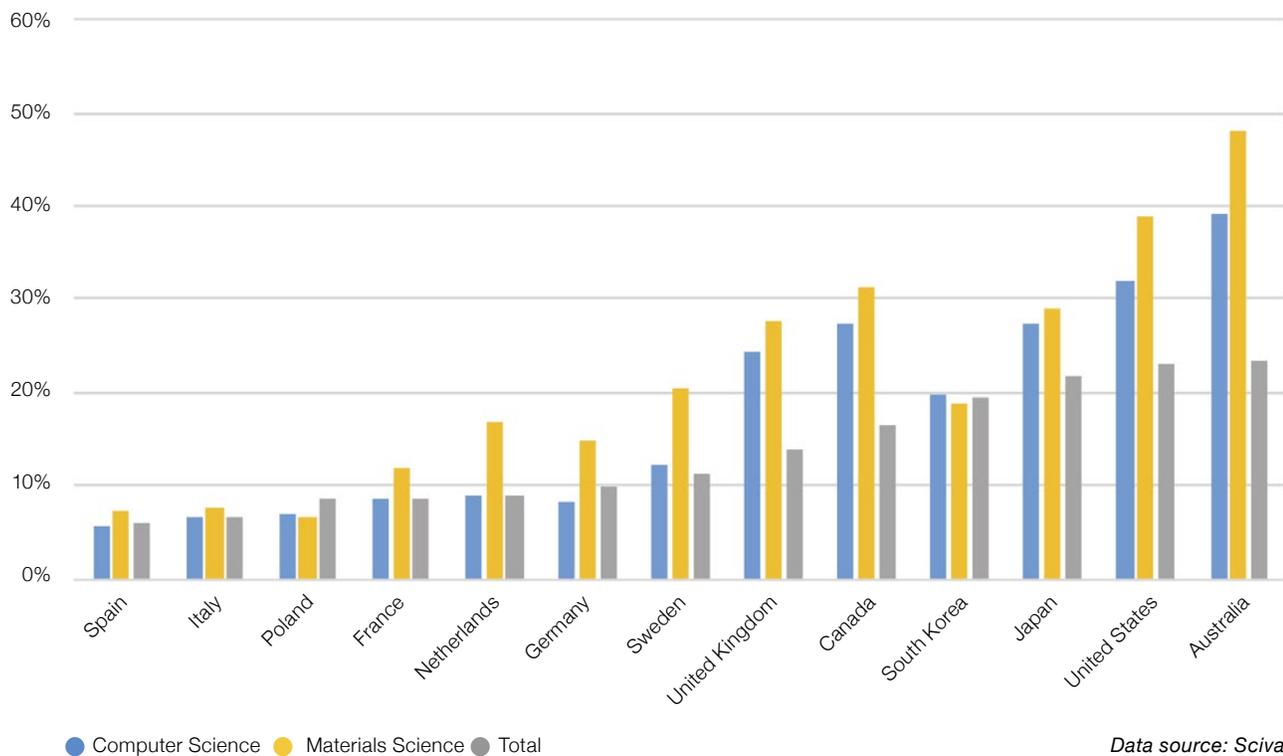
The decline in US-China scientific collaboration has been noted elsewhere, but the fate of scientific collaboration between China and other countries and regions has received less attention. Although copublications between China and selected European countries also increased steadily over the past four decades, as of 2022 they were not declining in absolute terms. However, measured as a share of countries' total copublications, trends across Europe vary (see Figure 2). There are indications that collaborations might be beginning to decline in the United Kingdom and stagnating in Germany, while continuing to increase in Sweden (see Figure 3). Looking at Sino-European collaborations by scientific discipline reveals that the share of copublications in STEM fields has either held steady or continued to rise, with a few exceptions. Where there is nascent stagnation or decline it generally begins after 2019.

In general, broader patterns in global collaborations do not seem to mirror the US trend. While European Union collaborations are holding steady, China's scientific collaborations with Japan and Korea, as well as the top ten research-producing countries in Africa and in Latin America are all on the rise (see Figure 4). Trends for collaborative research in Africa follow markedly different patterns (see Figure 5).

What accounts for the difference between the United States and other parts of the world? Decades of enmeshment between US universities and Chinese researchers have increased mutual knowledge and relationships, while also creating the conditions for mounting economic competition and growing fear of vulnerability to security threats. By contrast, European universities—apart from those in the United Kingdom—have had neither the same level of involvement nor the same concerns about vulnerability.

Though bibliometric data does not yet reveal a decline in Sino-European scientific collaborations, we predict that copublications will decrease in the coming years. First, we can already see a general decline in formal cooperation and exchanges between European and Chinese institutions, driven partly by increasing concern, criticism, and suspicion of these collaborations on the European side, as well as the COVID-19 pandemic's effect on international mobility. Second, there is increasing public scrutiny and criticism of European universities' cooperation with China, particularly in areas where the research has dual use implications. In response, many top European universities are considering or actively implementing new policies that restrict admitting students funded by the China Scholarship Council, and are avoiding hiring researchers from China.

Figure 2: COPUBLICATIONS WITH CHINA AS SHARE OF TOTAL COPUBLICATIONS, 2017–2021

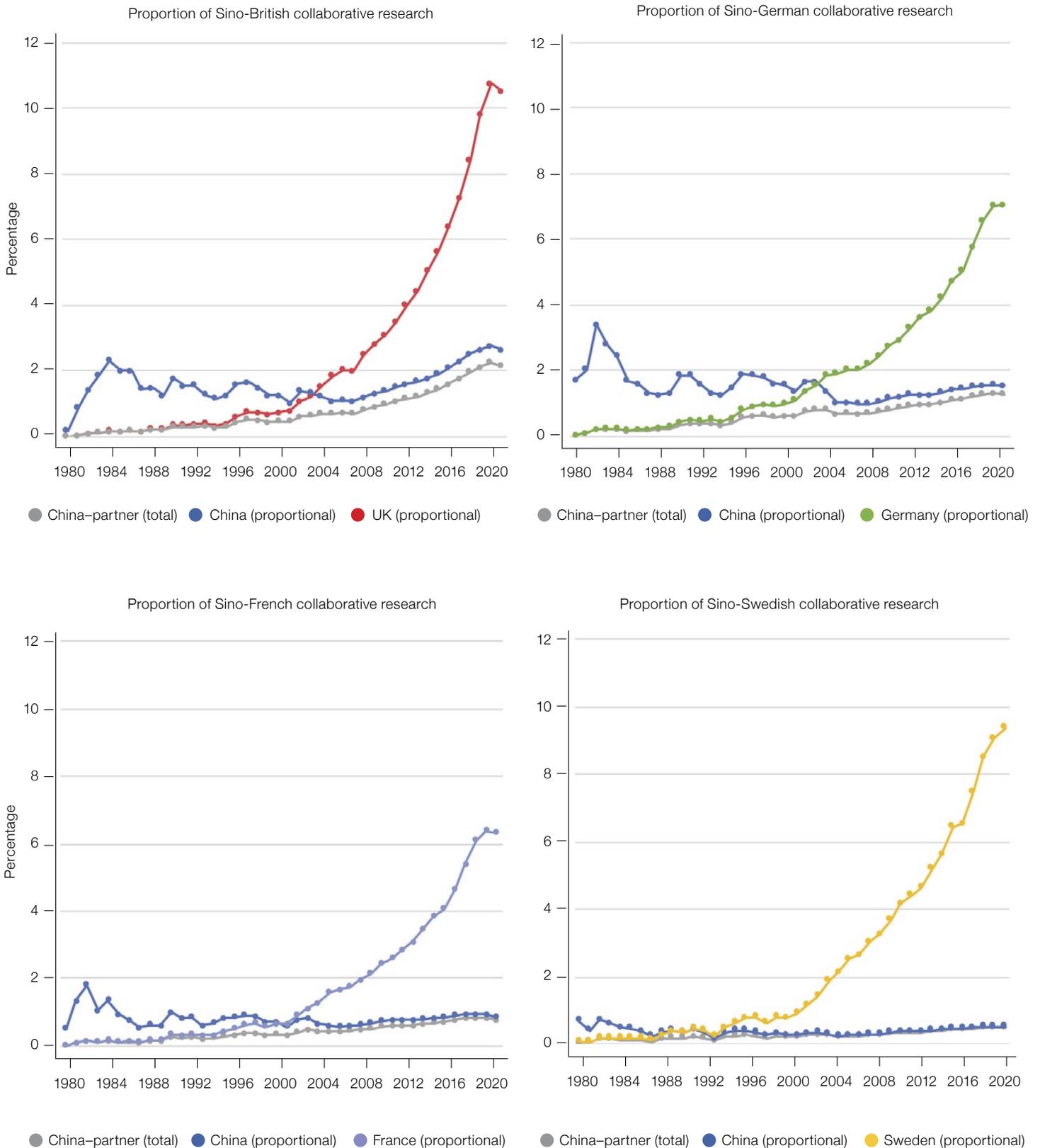


Finally, we can now see examples of governments implementing measures to assess, control, or hinder international academic collaboration and exchanges to avoid ethical or strategic risks. The Dutch government is considering legislation requiring universities to screen all foreign students in technical fields for security risks. The Swedish government recently shortened term limits for government-appointed university board memberships, with the justification that it needs to ensure that the boards have the necessary competence on geopolitical and national security issues, with a strong focus on China. The Norwegian government is considering applying export controls to knowledge, which would effectively require that anyone wishing to hire a PhD student from China obtain a permit from the Ministry of Foreign Affairs. These kinds of restrictions are promoting an attitude of suspicion and distrust, which we predict will lead researchers and universities to shrink back from engaging with China in general—and not only on projects that might be problematic from a national security, ethical, or strategic perspective. We argue that European academia is currently exceeding the actual rules and guidelines in its pullback from interactions with China.

As relations between global powers become more fractious, the academic community should ask itself how to manage the risks of collaboration without undermining the benefits of scientific development and cooperation. We acknowledge the reality of emerging risks to knowledge security and research integrity, and have encouraged the development of a nuanced, coordinated approach to addressing these risks. However, restrictions on collaboration undermine fundamental principles and assumptions about science as an indivisible public good with positive externalities, benefitting from inclusion, interaction, and iteration. Pulling away from collaborations with China risks cutting off access and insight into Chinese research and innovation just as China is becoming a world leader in certain areas.

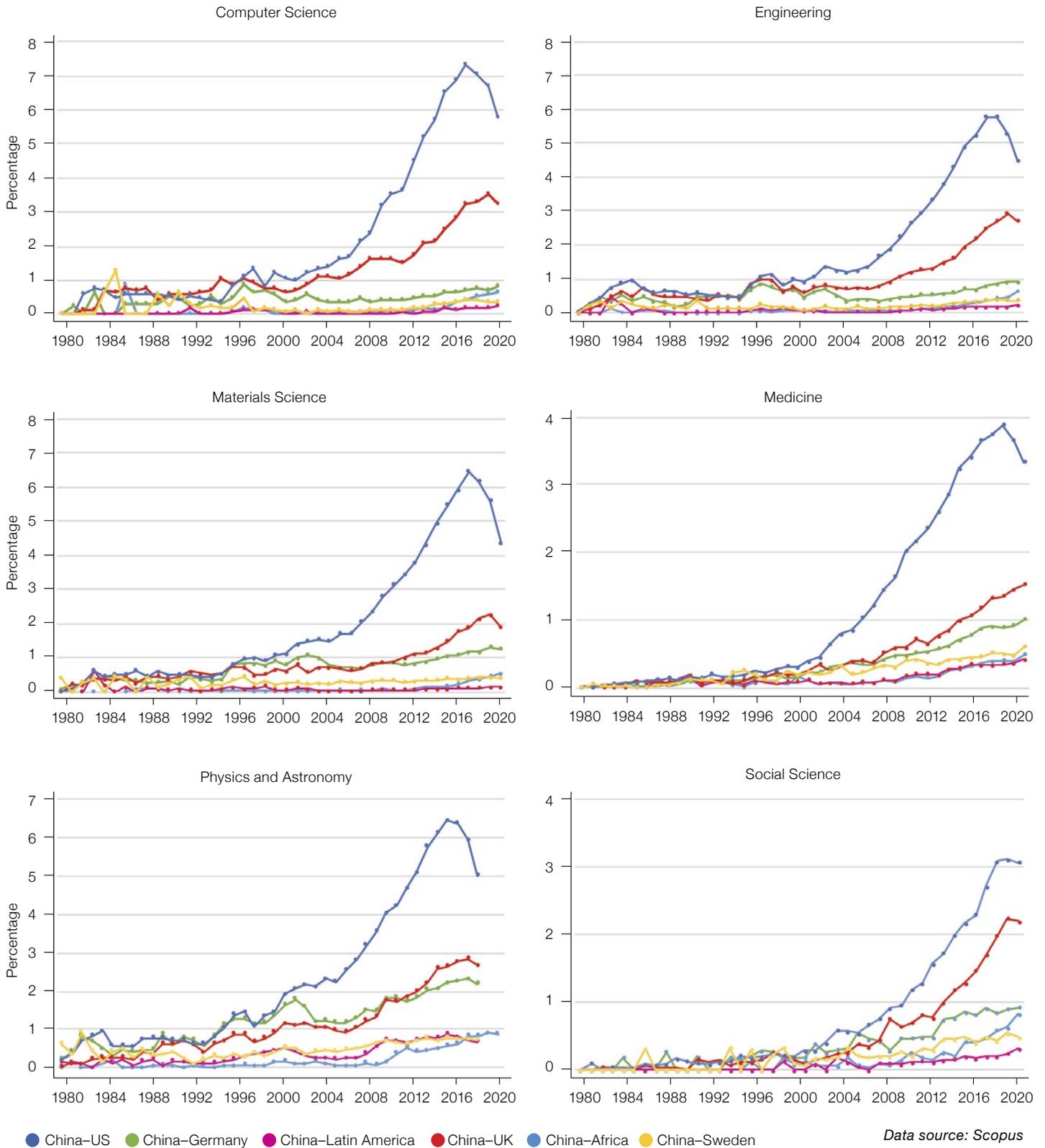
Our analysis indicates signs of a potential new era of research in which global science is divided into geopolitical blocs of comparable economic, scientific, and innovative strength. This transformation brings many unknowns related to global scientific collaboration—in particular, who will collaborate with whom? In what scientific and technological areas, and on whose terms? And, if the fourth era of research boosted global scientific productivity through collaboration, what effect will this new period have on science and society?

Figure 3: EVOLUTION OF PROPORTION OF SINO-AMERICAN RESEARCH COLLABORATIONS

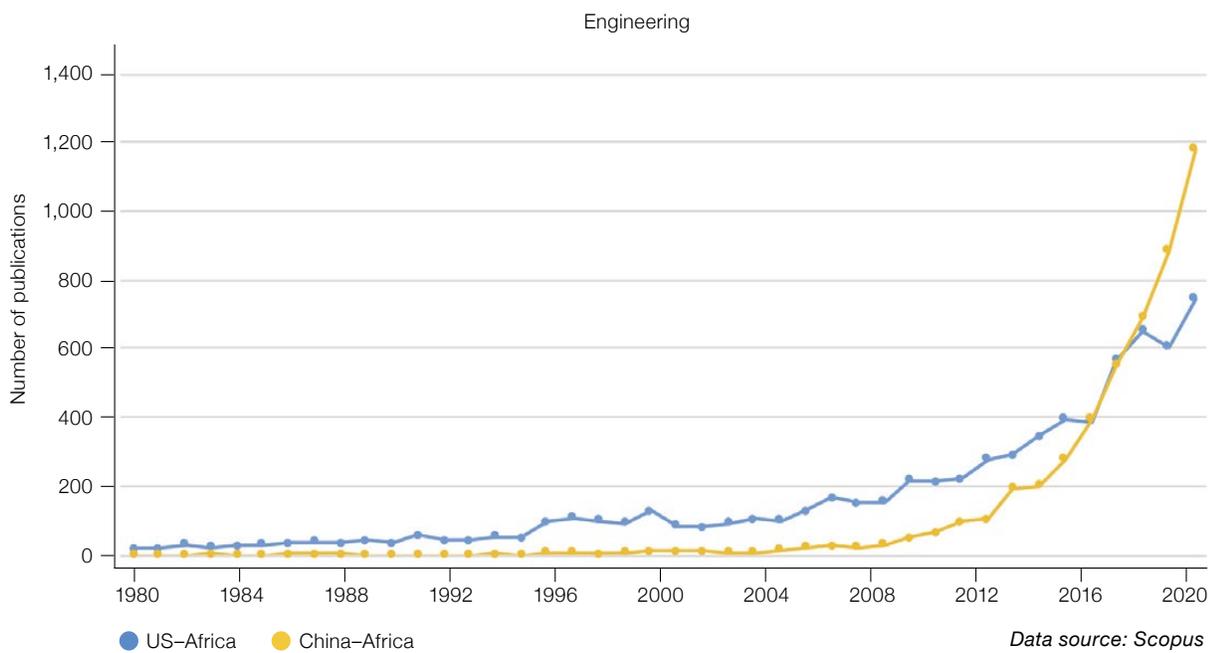
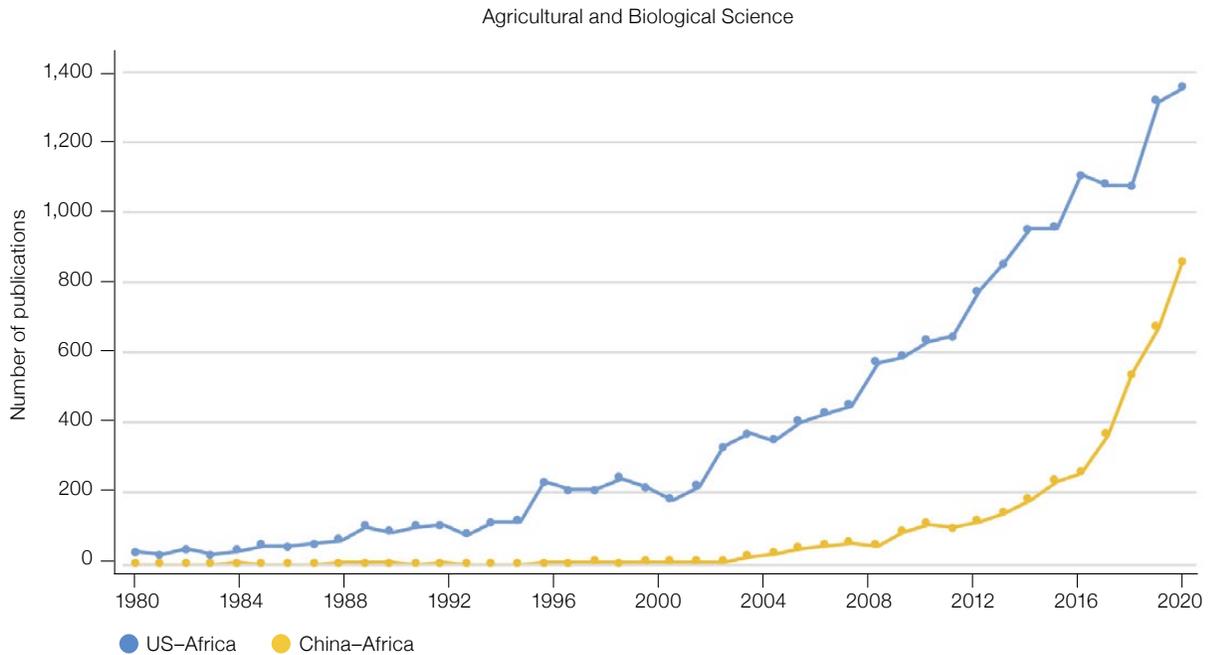


Data source: Scopus

**Figure 4: EVOLUTION OF RATES OF COLLABORATION WITH CHINA ACROSS SELECT SCIENTIFIC AND TECHNOLOGICAL DISCIPLINES**



**Figure 5: EVOLUTION OF TOTAL SINO-AFRICAN AND AFRO-AMERICAN COPUBLICATIONS IN ENGINEERING AND AGRICULTURE**



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