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Perspective

Decoupling in science and education: A collateral damage beyond deteriorating US–China relations

Li Tang [1,†], Cong Cao[2,†], Zheng Wang [3,4,*] and Zhuo Zhou[5]

[1]School of International Relations and Public Affairs, Fudan University, Shanghai, 200433, China, [2]Nottingham University Business School (China), University of Nottingham Ningbo China, Ningbo, 315100, China, [3]Department of Economics and Marketing, De Montfort University, Leicester, LE1 9BH, UK, [4]Research Centre on Globalisation and Economic Policy, University of Nottingham, Nottingham, NG7 2RD, UK and [5]Institute of International Economy, Shanghai Academy of Social Sciences, Shanghai, 200025, China

[†]Co-first authors who contribute equally to the work.
*Corresponding author. E-mail: zheng.wang@dmu.ac.uk

Abstract

Deteriorating relations between the USA and China since 2018 have extended to education and scientific research arenas. We put the US–China science and education in a historical perspective and describe the win–win situation when both countries collaborated. We discuss an ongoing loss–loss scenario of the decoupling and speculate its far-reaching adverse impacts beyond bilateral territories. We call for actions to be taken for a brighter future by the leaderships in both countries.

Key words: decoupling, US–China relations, science diplomacy

1. Introduction

The world's two largest scientific communities are now witnessing unprecedented yet escalating tensions ever since the Cold War. Starting from 2018, dozens of prominent scientists in the US, most of Chinese origin, have been fired or investigated for undisclosed ties with China (Hao and Guo, 2021; Mervis 2020). These, combined with continuing shuttering of Confucius Institutes on US university campuses, strict limits on Chinese nationals studying or conducting research in science, technology, engineering, and mathematics (STEM) fields, revocations of visas for Chinese scholars who are already studying in the US, the closures of Chinese Consulate in Houston and the US Consulate in Chengdu in succession, and the recent Strategic Competition Act of 2021 and the United States Innovation and Competition Act of 2021 (USICA), are casting long shadows on the US–China scientific relationship.

2. US–China relationship in science and education

2.1 A historical perspective

In spite of ups and downs of the bilateral relations, science and education had played a largely positive role in bridging the two nations. In 1854, Yung Wing became the first Chinese to be awarded a bachelor's degree from Yale University. In 1872, under his suggestion and supervision, the first batch of Chinese teenage boys was sent to the US, shouldering the hope of absorbing western academic ideas and making China civilized and prosperous.

Funded by the Boxer Indemnity Scholarship and other programs top Chinese returnees from America staffed Chinese universities in the early 20th century, contributing to the institutionalization of higher education and scientific research in China. Historically, of the twenty-three scientists who were responsible for developing China's strategic weapons programs, nineteen had foreign study and/or work experience, including ten in the US (Simon and Cao, 2009).

Since China and the US established a formal diplomatic relationship in 1979, an increasing number of China's best and brightest minds traveled west to study advanced science and technology. Today the US has remained the most favorable destination for Chinese students to pursue their studies. According to the most recent data released by the Institute for International Education, in the 2018/19 academic year, some 370,000 Chinese students attended American universities, on top of which, 48,000 Chinese scholars were conducting research in the US, with Chinese accounting for about one-third of the international students and scholars in the US and surpassing those from any other foreign countries (Institute for International Education 2020). As of early 2020, the total number of Chinese in foreign countries as international students reached 1.6 million with at least a quarter in the US (National Science Board, National Science Foundation 2020). Conversely, with the rapid development of the Chinese economy, more American students and

scholars travel eastward, temporarily or permanently, to undertake research in Chinese universities. As reported by the Ministry of Education of China, more than 492,000 international students and scholars studied in China in 2018, of which 20,996 were from the US (Ministry of Education, 2019).

2.2 The present situation

All these were in jeopardy under the Trump Administration. The US–China trade war, soon after it started in 2018, has spread to technology and talent areas (Fig. 1 chronologizes the major events of US–China relations since 2018). Consequently, the barriers for Chinese students and academics to study and work in the US had become more tacit and politicized. China's proactive efforts of attracting talent through high-end talent recruitment programs had seen the pushback from the US government under Trump, which initiated the investigations into the involvement of America-based scientists in such programs. Some American politicians also have called for banning Chinese students from studying STEM subjects at American universities. In a word, the US seeks to decouple with China in not only trade but also technologies and talents. American people also have turned more negative toward the presence of Chinese, but not necessarily international, students on American university campuses.

The US shifting view of China from an 'economic and strategic rivalry' to a 'foreign adversary' signaled its rising concerns over issues from China's access to core technologies such as chips, alleged inappropriate use of intellectual property rights through forced technology transfer, and technology theft and espionage, to national security at the front of 5G technology and cybersecurity (Schneider-Petsinger et al., 2019). Ultimately, the difficult technological relationship between the two countries boils down to intellectual exchange and scientific collaboration. There have been no signs of a quick reversal of the relationship after the change of the leadership in the US in January 2021.

3. Impacts on the two countries and beyond

3.1 Win–win in the past

Despite the current frictions, there was a long cozy period of US–China collaboration that brought a win–win situation of knowledge

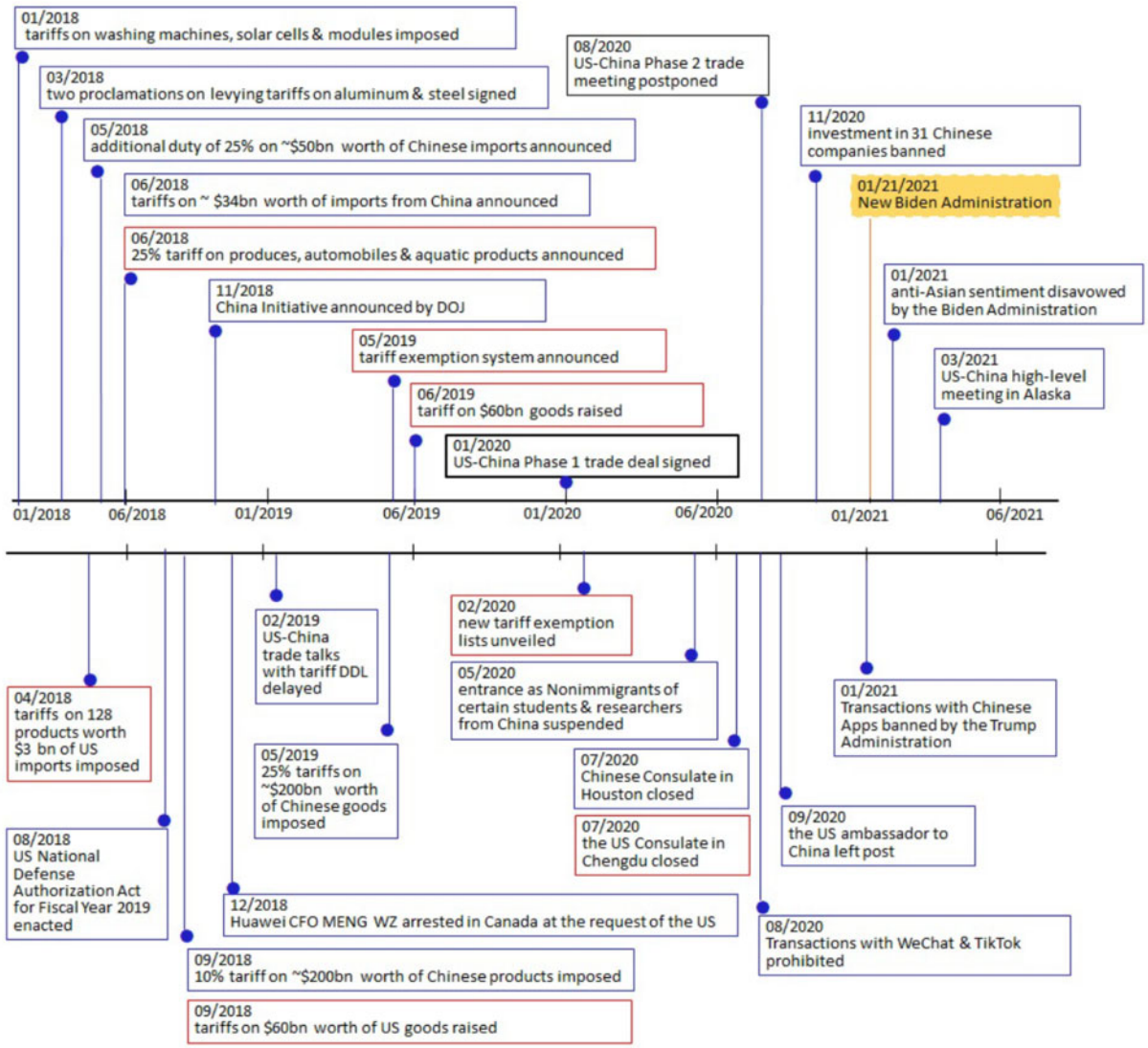

Figure 1. A chronology of major events of US–China relations (January 2018–March 2021).

creation, sharing, diffusion, and innovation on both sides. Studies show that the foreign-born and educated have contributed disproportionately to the advancement of US innovation and science supremacy (van Holm et al., 2019). From 2003 to 2017, as the largest source country of US science and engineering (S&E) doctorates, over 80 per cent of the Chinese recipients remain in the US workforce and continue their contribution to the American economy five years after receiving their doctorate degree. In 2018 over one-quarter of US internationally collaborated S&E articles had contributors from China (National Science Board, National Science Foundation 2020).

On the Chinese side, in addition to its remarkable decades-long economic development, rapid accumulation of human capital, and technocratic policy push, China's rise in science owns a great degree to international academic exchange and ensuing collaboration with advanced economies, especially with the US. Our analysis reveals that joint publications between the US and China jumped from only 57 articles in 1980 to 51,583 in 2019 with an annual growth rate of 20 per cent over forty years. Combined, journal articles involving Chinese or American scholars make up 47.4 per cent of the global knowledge production indexed in the Science Citation Index database.[1] Chinese knowledge moderators with training in developed countries, including the US, had contributed tremendously to China's rise in science and technology (Tang 2013). Within the unbalanced collaboration network, learning-by-collaborating elevated China's status in vital scientific and technological fields with surprising rapidity (Leung 2013; Freeman 2014).

America also benefits greatly from educating and collaborating with international students, scholars, and entrepreneurs. Looking back into history, the scientific, technological, and economical supremacy of the US has been deeply rooted in its capacity of tapping into the pool of global talents via the conduits of foreign-born scientists and New Argonauts (Saxenian 2007). In particular, over the last decades, the US has been able to retain a significant amount of US-trained talent, especially those at the high-end measured by the possession of an American PhD degree. In some cutting-edge fields such as artificial intelligence, the top Chinese-origin minds are conducting world-class research in the US (Mozur and Metz, 2020). Such collaborations between the two countries play a significant part in pushing forward the frontiers of knowledge for the entire world.

3.2 The ongoing loss–loss scenario

While it will be years before we know the full effect of the current US–China tensions on scientific exchange and innovation network between the two countries, such effect could be felt in various aspects.

The impacts on China are significant. On the one hand, China may benefit from the push from the US side leading to an increasing and accelerating return of the Chinese academics and other professionals from the US. As talent is always scarce in number and unbalanced in terms of training, utilization, and distribution, both pull and push factors could change the redistribution of talent on a global scale (Bansak et al., 2015). While a significant number of Chinese-origin students and scholars, especially those with US research degrees, tend to seek local employment and permanent residency after graduation, recent decade has also witnessed an increasing number of students and scholars returning to China upon finishing their stints in the US owing to opportunities provided by China's faster economic growth, increasing attention paid to R&D and higher education, and government and universities' preferable policy toward returnees.

On the other hand, in addition to the overwhelming amount of high-end talent still residing in the US, the turning away of Chinese students and scholars by leading American universities and high-tech enterprises may mean a gradual cutoff of China from the world's leading edge in science and technology. Together, they may slow down China's ambition to become an innovation-driven nation and a world's scientific superpower, which may ultimately reconstruct global value chain and geopolitical order unfavorable to China's modernizations (Lee et al., 2020; Wyne, 2020).

Decoupling China in science and education could be detrimental to the US as well. The US has been dependent upon the mobility of talent from countries such as China to sustain the development of its scientific and educational enterprise. The loss of international students first means financial hardship for some American universities, many of which are heavily funded by the tuition paid by international students. The sheer scale of Chinese students and scholars contributed about $14 billion to the US economy and created 153,000 local jobs in the US during the 2018/19 academic year (NAFSA, 2020). The amount of money is non-trivial, especially amid the Covid-19 pandemic which already has put tremendous pressures on American universities and the US society.

The chilling US–China relations could also cause innovation deficiency which is looming at many institutions where there has been significant dependency on international graduate students and academics, particularly those from China. Partly fueled by the timing of a series of criminal investigations on scientists with Chinese background or links as well as accounts on tightened visa rules against Chinese applicants, many American universities, despite being politically neutral and providing continued support to Chinese students and scholars, are not short of anecdotal evidence suggesting that political hostility has been felt by the community of Chinese students and academics at various levels. This increasingly unwelcoming atmosphere felt by these Chinese could push them away from American universities, R&D institutions, and high-tech enterprises.

Decoupling in science and education is also eroding trust and respect from the people on one side, scientific communities included, toward the other side of government. The unfriendly political environment and great uncertainties in bilateral relationship are enticing unfavorable public opinion toward each other. The more severely the collateral bias, suspicion, and even hostility between two nations require years to amend, or even reach a point of no return.

3.3 The decoupling may not be justified

Studies have proposed a myriad of speculations for Sino-US potential confrontations and decoupling in science and education, ranging from national security concerns, economic and technological competitiveness, global leadership (Schneider-Petsinger et al., 2019; Wyne, 2020; Sekiyama, 2019). Amid the complex and multifaceted reasons is the US adamant belief that China has been reaping more through research collaboration and globalization on an unfair ground. In fact, the US concerns over China's enhanced research capabilities are not new. Over the last two decades, the consensus achieved among the upper echelons of the US has been that American global leadership in science and technology is declining vis-a-vis Asian nations—especially China. China's global talents recruitment plan and Made in China 2025 Strategy further solidified the stereotype of China as a nation posing unprecedented challenges to American technological leadership and global supremacy.

Be that as it may, the decoupling is still not justified. As noted in *The Art of War* by Sun Tzu, killing 1,000 enemies is often at the cost of own 800 soldiers wounded. Confrontations could not resolve international disputes, at least not in the most rational and effective way.

3.4 Far-reaching impacts beyond bilateral relations

The weight of the US and China in the global economy and scientific research means the deteriorating relationship between them is a global issue. It not only hurts the two countries but also wounds the rest of the world.

The ongoing comprehensive technology decoupling between the US and China would wreak havoc on the commercial and scientific bonds between the two countries that had thickened over some four decades and may end up with having two distinct digital and technology jurisdictions. For example, the Internet might be turned into 'splinternets' and there might be two 5G networks. This would have significant and more likely adverse implications for both China and the US and the rest of the world in technology and innovation and beyond. Therefore, there is urgency to reduce the scope and scale of the conflicts and instead further expand cooperation in scientific research and education between the two countries and other countries. This is not just for the benefit of a specific country, such as China's economic development and technological upgrading, but a shared development of humankind with the power of science and technology.

Global production of knowledge is becoming the norm in many scientific areas. The long-term ripple effect of the decoupling can also damage the collaboration in the international research community, especially in meeting the global challenges in areas from public health, food security, climate change, energy, to sustainable development, whose adverse effects could be felt globally. The lack of effective cooperation between the two major participants could significantly delay the advancement of many of the above global projects and eventually cause harms to all nations. The outcome could be even worse if other countries are forced to choose sides between the two powers for research partnership.

Most importantly, we should not let the parochial mentality of national competitiveness blind all nations' shared vision of sustainable development as a human community. We should encourage competition but should not turn the competition into a zero-sum game.

4. Look forward into the future

More than a century ago, in conveying his vision to build strong ties with China through education, University of Illinois President Edmund James wrote: 'China is upon the verge of a revolution ... The nation which succeeds in educating the young Chinese of the present generation will be the nation which for a given expenditure of effort will reap the largest possible returns in moral, intellectual and commercial influence.' One century since, the Center for Science Diplomacy of AAAS explicitly states on its website, '... science can build bridges between societies where official relationships may be strained.'

No bilateral disputes can be resolved without both sides meeting halfway. Preventing further worsening of the US–China relationship calls for the political wisdom of the leaders who take actions to recouple education and science as a way of seeking common ground while reserving differences. Rebuilding mutual trust and respect is the key paving the way for a turning point of the US–China relationship.

On the US side, the Biden Administration needs to take immediate steps to prevent any possible and unintended disruption to the country's scientific research and higher education due to actions aimed to cut off China from its research network with America. On the Chinese side, efforts need to make in protecting intellectual property rights. To give its credit, China amended the Patent Law and issued a new Foreign Investment Law in 2020. For the former, the amendment, the fourth time, aims, among others, to strengthen the protection of intellectual properties by increasing statutory damages, introducing punitive damages, and shifting the burden of proving damages in patent infringement actions. And the latter law gets more serious about protecting investor's rights, including their IPs. More can be done in terms of credible commitment and consistent law enforcement. China may also need to contemplate both domestic and international concerns over a *de facto* decoupling on the Internet by lifting the restriction placed on the access to Google, Dropbox, and many other Internet sites for academic use. At this critical moment, natural and social scientists in both countries need to be more proactive in promoting research collaboration and fostering bilateral relationship. Global issues ranging from the ongoing pandemic and future health crises, global warming, environmental degradation, terrorism, and governance of dual-use emerging technologies such as artificial intellence, human phenomics, and synthetic biology, all call for scientific collaboration and governmental cooperation of the two scientific and economic powers and other nations.

As the issue of education is that of future generations, youngsters in the US and China and indeed worldwide should join forces and contribute to creating a more livable human community by nurturing an atmosphere of encouraging cooperation without discrimination and by sharing knowledge and cultures without prejudice.

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Conflict of interest statement

There are no conflicts of interest. The authors are responsible for any errors.

Notes

1. Authors' own calculation. Data are available upon request.

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