

Driven to Self-Reliance: Technological Interdependence and the Chinese Innovation Ecosystem

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States face a dilemma on how to balance gains from technological advancement with the risks of dependence. Technology is central to government objectives of security and growth. As innovation systems become globalized, countries cooperate to catch up and stay at the innovation frontier. Interdependence, however, also exposes states to potential coercion. We argue that a state's position vis-à-vis technological interdependence is not primarily derived from international structures. Rather, knowledge shocks shape how states balance the trade-offs between innovation gains and security risks. These shocks provide a focal point for complex state structures to overcome an internal coordination challenge in realigning national positions. Such trade-offs are clearest in US–China relations. We test our argument firstly with an analysis of over half a million Chinese newspaper articles from 2005 to 2021. We then analyze an original corpus of policy documents to examine institutional shifts. We find that US shocks—the Snowden revelations and technology restrictions—produce a shift away from technological interdependence, toward security-focused self-reliance. Our paper contributes to understanding the process through which great powers change positions on technological interdependence, and the ways in which domestic innovation strategies are shaped by international interactions.

Los Estados se enfrentan a un dilema que consiste en cómo equilibrar los beneficios de los avances tecnológicos con los riesgos de la dependencia que estos generan. La tecnología resulta fundamental para los objetivos gubernamentales en materia de seguridad y crecimiento. A medida que los sistemas de innovación se globalizan, los países cooperan con el fin de ponerse al día y mantenerse en la frontera de la innovación. Sin embargo, esta interdependencia también expone a los Estados a una posible coerción. Argumentamos que la posición de un Estado con respecto a la interdependencia tecnológica no se deriva principalmente de las estructuras internacionales, sino que, más bien, son los *shocks* en materia de conocimiento los que dan forma a la manera en que los Estados equilibran las compensaciones entre los beneficios de la innovación y los riesgos en materia de seguridad. Estos *shocks* proporcionan un punto focal para que las estructuras estatales complejas superen un desafío en materia de coordinación interna en el realineamiento de las posiciones nacionales. Estas compensaciones se pueden ver de forma más clara en las relaciones entre Estados Unidos y China. Ponemos a prueba nuestra hipótesis utilizando, en primer lugar, un análisis de más de medio millón de artículos de periódicos chinos entre 2005 y 2021. A continuación, analizamos un *corpus* original de documentos sobre políticas con el fin de estudiar los cambios institucionales. Concluimos que los shocks sufridos por EE. UU. (las revelaciones de Snowden y las restricciones tecnológicas) producen un alejamiento de la interdependencia tecnológica y un giro hacia la autosuficiencia centrada en la seguridad. Nuestro artículo contribuye a comprender el proceso a través del cual las grandes potencias cambian sus posiciones en materia de interdependencia tecnológica, y las formas en que las estrategias nacionales de innovación son moldeadas por las interacciones internacionales.

Les États sont confrontés à un dilemme entre les avantages des avancées technologiques et les risques de la dépendance. La technologie occupe un rôle central dans les objectifs du gouvernement de sécurité et de croissance. Alors que les systèmes

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d'innovation se mondialisent, les pays coopèrent pour rattraper leur retard et se maintenir à la frontière de l'innovation. Toutefois, l'interdépendance expose aussi les États à de potentielles coercitions. Nous affirmons que la position d'un État vis-à-vis de l'interdépendance technologique ne procède pas directement des structures internationales. Ce sont plutôt les crises de connaissances qui façonnent la gestion des compromis entre les avantages de l'innovation et les risques pour la sécurité par les États. Ces crises constituent un point de focalisation pour les structures étatiques complexes quand il s'agit de surmonter les défis de coordination interne dans le réaligement des positions nationales. Ces genres de compromis apparaissent très clairement dans les relations entre la Chine et les États-Unis. Nous évaluons d'abord notre argument à l'aide d'une analyse de plus d'un demi-million d'articles de journaux chinois entre 2005 et 2021. Nous analysons ensuite un corpus inédit de documents politiques pour examiner les transformations institutionnelles. À la suite des crises américaines (révélations d'Edward Snowden et restrictions technologiques), nous remarquons un abandon progressif de l'interdépendance technologique pour adopter une autosuffisance focalisée sur la sécurité. Notre article vient enrichir la compréhension du processus par lequel les grandes puissances modifient leur position à l'égard de l'interdépendance technologique, mais aussi du façonnement des stratégies d'innovation nationales par les interactions internationales.

Introduction

How do states balance the benefits and costs of technological interdependence? As with many crucial questions about international relations and technology, we have few good answers. On the one hand, countries embedded in global technological infrastructures will be better able to tap into and build upon leading-edge innovations, supporting core state objectives of security and development (Kennedy 1989; Moe 2007; Taylor 2016). On the other hand, technological interdependence may involve a risky reliance on technologies that are rooted in other, potentially hostile jurisdictions. These trade-offs are particularly acute for large emerging economies, which must decide how best to protect their interests in a global innovation system that has been shaped by the dominant state and other advanced economies.

Standard accounts disagree over how states might resolve the broader trade-offs. Realists see economic dependence as a sucker's bet, which will inevitably expose the weaker party to exploitation by status quo powers (Barbieri 2002; Mearsheimer 2021). Liberals argue instead that economic exchanges (trade and investments) bind emerging states into a liberal international order, raising the costs of revanchism and building a set of domestic political interests that undergird a positive-sum view of the world (Oneal and Russett 2001; Maoz 2009; Ikenberry 2014). Both approaches suggest we can derive state approaches to interdependence from global structures, but disagree on whether those structures involve enduring state distrust, or a liberal order that will appeal to all.

The empirical record for one key case suggests evidence of both. For roughly three decades, China combined integration into global innovation networks across territorial boundaries with domestic support of open and collaborative innovation, as liberals might have expected (Deng and Moore 2004; Weede 2010; Leon 2017). In recent years, the Chinese state has turned more to self-help solutions, which rely on internal development of technological resources on a much grander scale (Brunnermeier, Doshi, and James 2018; Kennedy and Lim 2018). The problem is that neither argument can explain the other period nor how, when, or why this change occurred (Legro 2007).

In this article, we invoke alternative causal factors to explain the puzzle, and harness new evidence to illuminate the actual dynamic of change. The processes involved for any state to alter its national posture—emphasizing interdependence over self-reliance or vice versa—are nontrivial. Specifically, China's shift of policy can be attributed to processes of state learning and coordination that are undervalued in both liberal and realist accounts. Our explanation

emphasizes the heterogeneity of beliefs within large emerging states like China, which, like all complex political systems, are organized into specialized agencies with different priorities and understandings of the trade-offs of technological interdependence. Changes in national position can only take place when internal coordination challenges between these competing agencies are overcome. We address longstanding theoretical concerns that "arguments about the relationship between interdependence and conflict typically have an air of universality, applying to all actors in all times and places" (Mansfield and Pollins 2001, 844), seeking instead to make claims that better address the contextual "contingencies," despite difficulties with the "paucity of data on forms of economic exchange" and the lack of "adequate indicators" (Mansfield and Pollins 2001, 847).

Our approach stresses the importance of knowledge shocks in driving change. The sheer complexity of the global innovation ecosystem means that states operate primarily in an environment of uncertainty. States learn through interactions with status quo power(s) that dominate the technology frontier (Deutsch 1949, 2003; Johnson 2003; Pearson, Rithmire, and Tsai 2022) and the global arrangements that it (they) has created, deriving lessons as to whether technological interdependence is primarily a source of gain or vulnerability. During periods where relatively little novel information about interdependence is being transmitted to state actors, the salience of opportunities or risks associated with technology integration is low, leading to an environment of apparent equilibrium. Knowledge shocks—unexpected events that appear to provide important new information about the nature of technological interdependence—raise the salience of either vulnerability or gains in the global innovation environment. The heightened salience of either new risks or new opportunities provides a focal point that leaders can use to coordinate disparate agencies within the state around an updated understanding of technological interdependence. A state's understanding of technological interdependence, therefore, is not defined solely by systemic conditions. Rather, it is filtered through learning and coordination as state agencies attempt to make sense of a complex international environmental context and align positions across the government (Jervis 1997).

To understand how China's perspective on technological interdependence has shifted over time, we analyze Chinese media discourse and policy changes in science and technology issues for the last decade and a half. Specifically, we use descriptive text-as-data to analyze roughly half a million science and technology articles from over 650 Chinese news-

papers in the CNKI database from 2005 to 2021. We map the change in official discourse to substantive institutional restructuring, using targeted analyses of official policies and leader speeches in the same period.

We find significant evidence that knowledge shocks raised the salience of critical risks in the external innovation environment, providing a focal point around which the state could realign sentiments in favor of self-reliance. Specifically, novel information about the potential vulnerabilities produced by technological interdependence—the Snowden revelations of 2013 and the US administration’s isolation of Chinese technology companies from 2018 onward—raised the salience of security-focused self-reliance and shifted away from a period of technological indigenization, which had combined development goals with technological interdependence. The mobilization against interdependence was accompanied by a reconfiguration of domestic institutions emphasizing resilience and centralized control.

While our case focuses on China’s process of reconfiguring its technology posture, our argument implies that rival states are simultaneously engaged in their own updating based on new knowledge about China’s behavior.¹ Hence, although our cases focus on China’s responses to US actions, some US behavior undoubtedly also reflects a revised view within the US government, regarding the relative benefits and costs of interdependence with China.

The paper makes three contributions. First, our study shows the importance of specifying unique features of technological interdependence within broader debates on economic interdependence. While weapons systems have long held pride of place in security studies research and international political economy (IPE) studies have focused on the security spillovers of trade and investment cooperation, surprisingly little attention has been paid to the broader context of innovation. Policymakers see technology interdependence and innovation as a core problem of great power relations (Sullivan 2022; Xi 2022; Ding 2024), but scholars have (so far) contributed relatively little. Our paper, then, brings technology policy to the center of geopolitics.

Second, we demonstrate how structural accounts of interdependence fail to explain variation over time in how China understands its interests in connecting to or decoupling from a US-dominated global technological infrastructure. We illustrate the importance of knowledge shocks, in which previously unknown or underappreciated aspects of the innovation environment alter the salience of specific vulnerability or gains, leading to an internal realignment from one understanding of interdependence to another.² We argue that this focus on states’ changing understanding of a complex environment can help push forward research on interdependence more generally.

Third, we show how descriptive text-as-data can be applied to observe internal state efforts to coordinate behavior, especially in complex, contested, and opaque government structures. We certainly do not claim that a single case study, even in so significant a context as the US–China relationship, can definitively map the contours of technological interdependence. Still, by delineating specific relationships in fine-grained detail, we open the way for broader and more comprehensive research across space and time.

Technological Interdependence

Advanced technology allows states to achieve core economic and security objectives (Kennedy 1989; Moe 2007; Taylor 2016). Rapid transport networks, flight, nuclear energy, and information technologies such as the Internet and artificial intelligence shape both a country’s growth trajectory and its military capabilities. Previously, these innovation systems were mostly national in scope (Kitschelt 1991; Nelson 1993; Saxenian 1996). In the 1980s, Japan and the United States, for example, organized innovation very differently. However, the fragmentation of production and its reorganization into global value chains have privileged international innovation systems over domestic ones, and moved the cutting edge of innovation from the national to the global level (Ernst and Kim 2002; Saxenian 2007; Pietrobelli and Rabelotti 2011).

This raises particularly vexing issues for states seeking to reach the technological frontier because autarkic technology systems are less innovative, while relying on global networks is risky. Primarily domestic innovation networks may increase short-term security but weaken access to global leading-edge innovation, leading to long-term vulnerabilities as the state falls behind the global innovation frontier. The sheer complexity of global innovation systems obliges states to operate in an environment of uncertainty when trying to resolve these trade-offs.

Technology Interdependence and State Sentiments

The extensive literature on economic interdependence offers some predictions as to how states might address the trade-offs of reliance on a global economy that is dominated by existing powers (Hamilton 1791; Snyder 2013; Stephen 2014; Paul 2016; Murray 2018). In trade as in technology, states have to weigh the prospect of greater joint gains against the risks of becoming dependent on external trade relationships that can be leveraged against them.

Liberal scholarship on trade interdependence focuses on the self-reinforcing nature of cooperative interactions (Oneal and Russett 1999; Maoz 2009). Open trade facilitates comparative advantage, weakening the domestic opponents of openness, while the shadow of the future mitigates the vulnerabilities associated with increased interdependence. Liberals have usually treated technological interdependence under the broader logic of economic interdependence. On the cusp of the current era of transformation, John Ikenberry argued that states faced with a choice of joining or rejecting international structures will “embrace the underlying logic of ... openness,” which “gives them access to trade, investment, and technology from other societies” (Ikenberry 2014, 88). The liberal bet, then, is that latecomer states will continue to adhere to openness, which allows them to take full advantage of the benefits of interdependence. States and businesses will continue to compete in an open innovation ecosystem, but they will also exchange scientific information, while skilled labor and information will move across borders with relatively little friction. The liberal expectation has been that states will embrace open innovation, and become increasingly dependent on it over time.

Realists too have thought of technology adoption as a particular application of a broader systemic logic. As Waltz (1979) famously pointed out, realism implies that states cannot really take proper advantage of the division of labor—there is no functional specialization. Any cross-border diffusion of innovation will benefit other states, including most

¹See, for example, Pearson, Rithmire, and Tsai (2022) on the security dilemma arising from China’s efforts to enhance its regime durability.

²Knowledge shocks may be external or internal events that provide new information about the nature of technological interdependence (see Farrell and Newman 2018).

importantly the established power, creating difficult relative gains problems.

Realists expect that states will confine R&D activity within national borders and subject it to centralized control, privileging national security over economic or scientific gain (Montresor 2001; Nelson 1993). Collaboration within national boundaries will be encouraged, while collaboration across national boundaries will be limited and fractious. Global economic and information networks and supply chains will be treated with a high degree of suspicion. Thus, the *realist expectation* is that states will confine innovation within their own borders as best as they can, turning primarily to their own resources to generate new knowledge, only collaborating across borders when they have little other choice.³

The liberal and realist logics share a common assumption that the trade-offs of technological interdependence are highly visible, dictating either openness or closure, respectively, as stable outcomes. Both also treat states as largely unitary decision-makers. Copeland (2014) explains how states may change their stance toward economic interdependence, depending on whether they believe that their rivals are more or less willing to trade into the future, but still treat the state as a unified actor capable of assessing the long-term trajectory of interdependent relations.

As the supply shocks of COVID-19 laid bare, interdependence generates latent vulnerabilities that may not be associated with advanced technology. And, any given vulnerability can be exploited by states for coercive ends, even in the case of basic raw materials (e.g., China's export controls on rare earth minerals). Nevertheless, despite similarities with economic interdependence, technological interdependence differs in important ways. For one, trade and production vulnerabilities are, at least in principle, visible and calculable. By contrast, cutting-edge technological innovation depends on complex feedback loops with unpredictable interactions, relationships, and consequences (Jervis 1997). This means that benefits and risks associated with technological dependencies are not readily calculable, such that it will be hard to predict which technologies are critical to future trajectories of development, and which are not. Furthermore, vulnerabilities are less visible because advanced technological innovations build upon other innovations in a technological "stack," such that crucial vulnerabilities may be hidden deep within technologies. The highly specialized engineering knowledge required to understand each element within a technology stack adds another layer of incalculability, as no individual firm, let alone government agency or policymaker, has the combined expertise required to precisely estimate the risk profile of a given technology (Thun et al. 2022).

Innovation is not only itself complex, but has complex implications for national security as well. Norris (2016) has argued that interdependence can generate important security externalities. Such security externalities would extend beyond, but also include technological leakage or dual-use systems. While some of these externalities may be knowable to policymakers, many are not, generating an additional level of policy uncertainty around technological interdependence (Vaynman and Volpe 2023).

In our alternative account, states have to make uncertain bets on the consequences of current technological choices for future technological trajectories, whether commercial, military, or both. They cannot be sure whether they are in

a world where the benefits of technological independence outweigh those of interdependence, or vice versa.

Furthermore, aspiring powers like China are not unitary actors, but complex states, where a wide variety of agencies and ministries have semi-independent powers (Tan 2021). Policymaking processes involve these multitudes of actors, who may disagree among themselves on whether liberal optimism or realist skepticism about technological interdependence is warranted. In such complex polities, it is not enough simply to persuade a unitary rational decision-maker; rather, changing course will require coordination of expectations across a large number of semi-independent actors.

State views of technological interdependence will not involve a unified—or accurately calculated—understanding of the structural advantages or disadvantages of reliance on global networks. Like other actors navigating complex spaces of interdependent decision-making, states will update their positions imperfectly through experience (Deutsch 1949, 2003; Johnson 2003), and will furthermore have to align sentiments across various state agencies with a spectrum of views.⁴

Both the challenges of operating in a complex environment and the need for coordination within the state mean that knowledge shocks—unexpected events that provide novel information about the underlying state of the world—are likely to play a particularly important role in shaping state approaches.

Where disagreements exist within the bureaucracy, major changes in technology strategy may be difficult to achieve. Unexpected knowledge shocks that clearly raise the salience of either the risks or the rewards of technological interdependence may allow the state to overcome an internal coordination problem. By providing a focal point that makes clear a specific point of vulnerability (or opportunity), the knowledge shock may make it easier to coordinate a shared consensus emphasizing the balance of sentiments closer to one ideal point rather than another (creating a shared narrative or set of goals around which policymakers have incentives to converge). While never absolute, such a consensus represents a rebalancing of goals. The move to a new consensus may reflect the formation of shared beliefs, or the relative disempowerment of one set of agencies vis-à-vis their rivals. In practice, it will usually be impossible to disentangle the two, but this may not matter very much, so long as the various effects point in the same general direction to produce an apparent consensus (Farrell and Quiggin 2017).

We provide data and indicators for a crucial test case for scholarship and policy—China's changing approach to technological interdependence (Deng and Moore 2004; Losacker and Liefner 2020). In contrast to arguments that might locate the source of those tensions either in changes in the relative balance of power between the two states or the shift in Chinese domestic politics toward greater authoritarianism under Xi Jinping, we examine how revelations about technological vulnerabilities have altered domestic political discourse and institutions in China over science and technology policy. Specifically, this leads us to the following expectation about the process of change:

New information about the underlying risks (opportunities) of interdependence can serve as a knowledge shock that coordinates dispersed state sentiments toward (away from) support for technology security and self-reliance.

³States with closed innovation ecosystem might still look to steal information from abroad, but that is harder than it at first appears. See Gilli and Gilli (2019).

⁴While literature has focused on learning among elites (e.g., Levy 1994) or individuals in experimental settings (e.g., Kertzer et al. 2020), we know less about how to aggregate from the individual-level to track national-level changes across complex bureaucracies (Hafner-Burton et al. 2017).

Shocks to the Innovation System

Our analysis runs from 2005 to 2021, a period where China's policy changed in important ways. In the initial phase, China's innovation strategy emphasized technological interdependence, encouraging external collaboration, integrating with global production networks, and encouraging foreign capital investment in domestic innovation. State policies fostered indigenous innovation, but premised the strategy on accessing global networks and international technology cooperation.⁵ Such policies encouraged foreign investment and R&D centers in technology-intensive industries, and cooperation with multinational firms in order to access and absorb advanced foreign technology and knowledge. Engagement with the international innovation system was seen as integral to the overall upgrading of China's industrial structure.

During this first period, China's guiding documents such as the 2006 Eleventh Five-Year Plan (FYP) paid less attention to the security risks of technology collaboration. In the early 2000s, therefore, international innovation cooperation is not framed primarily as a source of vulnerability, but rather a path for economic and national advancement. From 2014 on, however, Chinese innovation policy has increasingly been dominated by fears of the security risks of interdependence. National policies increasingly emphasize the risks of reliance on foreign technology.

We find good evidence that this change involved learning and coordination, as China discovered in two successive instances how the US government could exploit its asymmetric power in global innovation systems for national foreign policy goals. The first is a global knowledge shock, which while not directed specifically at China or the Chinese government, revealed the potential risk to China of participating in a US-centric innovation infrastructure. In June 2013, the UK-based newspaper, *The Guardian* released the first documents in the Snowden revelations. Edward Snowden, a former contractor for the US National Security Agency, made public previously classified documents, outlining secret surveillance systems. These revelations—which emerged over a period of months—provided China and other countries with detailed information on how US information technology and telecommunications firms helped the US government spy on its global adversaries (and often allies too) (Farrell and Finnemore 2013; Weinstein 2014; Farrell and Newman 2019).

The second knowledge shock began in April 2018, when the United States threatened to deny core technologies to the Chinese telecommunications giant ZTE. ZTE, as well as being one of the five largest global mobile phone vendors, is partially owned by the Chinese state and is a major global producer of telecommunications equipment. After breaching a compliance agreement with the US government related to sanctions violations, it was barred from purchasing essential US semiconductors, leading to an existential crisis. The event marked the beginning of a series of coercive actions taken against not just ZTE but also Huawei, China's other telecommunications national champion, and many other Chinese high-tech firms.

Both these revelations were unanticipated knowledge shocks. Prior to Snowden's revelations, few countries realized the extent of US surveillance activities and capabilities, and in particular the role that *private US technology companies*

played in generating vulnerabilities. US technology controls were also a shock, as a new signal was sent that the United States was no longer adhering to its post-Cold War policy of primarily allowing free market, rather than geostrategic principles to guide the sale of technology overseas.⁶ The export controls also spread new awareness about the extent of US government willingness to weaponize its dominant position to deny access to high-end technologies. The US government's use of the foreign direct product rule (FDPR) was a further revelation of the world's underlying reliance on key American technologies.⁷

To assess whether and how these shocks triggered China's party-state to coordinate around a new set of sentiments, we draw on over half a million articles related to science and technology published in China's official newspapers from January 2005 to December 2021. Our analysis shows an elevation of official discourse emphasizing technology security that coincides with the unanticipated knowledge shocks of 2013 and 2018. We find the same discursive shift in newspapers aimed at the mass public, as well as in specialized periodicals, aimed internally at Communist Party cadres.

We show an accompanying restructuring of China's innovation institutions aimed at mitigating China's points of vulnerability, and also efforts to overcome disagreements by creating more centralized institutions governing science and technology. Finally, we explain why these media and policy shifts cannot simply be attributed to domestic politics (specifically—General Secretary Xi's consolidation of power) or larger macrostructural trends such as changes in the relative balance of power or shifts in international cultural phenomenon. This approach allows us to map out a detailed process of change, both the mobilization to coordinate new sentiments toward technological interdependence and the institutional move toward a more closed—and centralized—technology policy.

Coordinating State Positions on Technological Interdependence

The different parts of China's sprawling party-state have historically held contrasting views on how the country's innovation system should be structured. While government concerns with external threats predated the knowledge shocks we focus on, numerous large and powerful agencies in Beijing held different views on the relative threats and opportunities associated with interdependence. Some, such as the National Reform and Development Commission and the People's Liberation Army (PLA), embraced a more "techno-nationalist" outlook emphasizing security concerns, while others, such as the Ministry of Commerce and Ministry of Foreign Affairs, adopted a "techno-globalist" approach seeking to reap the benefits associated with globalization (Suttmeier and Yao 2004; Cheung 2018). A dispersion of authority for technology policy across multiple bodies (discussed in the "Policy Centralization and Institutional Coordination" section) added to the internal diversity of views. Understanding major changes to China's na-

⁶The unexpected nature of these US controls can be gauged by China's legislative and regulatory reactions. China was quick to respond to American technology coercion, passing a new Export Control Law, two counter-sanction regulations and a new counter-sanction law, all between 2020 and 2021. These either did not exist or had not been updated significantly since created in the 1990s. Some proposals were introduced 2 weeks after the controls imposed on Huawei in May 2019. If US coercion had been anticipated by China, we would have expected these legislations to have been updated earlier.

⁷The FDPR restricts sales of specific products to Chinese companies if those products were made using de minimis US-origin technologies, even if those products were manufactured outside of the United States, or even by non-US companies.

⁵While indigenous innovation is sometimes referred to as a policy privileging domestic firms at the expense of foreign firms, a close read of official policies reveals that China continued to embrace globalization as a source of advanced knowledge that would help, rather than hurt, indigenous innovation efforts.

tional posture on technology therefore requires insight into how the party-state overcomes this coordination problem. We look to China's official newspapers for evidence of how knowledge shocks enable coordination across the bureaucracy by raising the salience of specific aspects of technology interdependence.

State control over the media means that China's official newspapers are charged with reflecting views within the party-state rather than those of society or private interest groups (Stockmann 2013). These publications, which include general interest as well as issue-specific periodicals, are sponsored by different parts of the governing apparatus, spanning central and subnational governments. While general dailies are aimed at the mass public, many others are targeted at internal party-state audiences. Examples include the *Study Times* published by the Communist Party's elite training institute (the Central Party School), whose readership is primarily composed of Party cadres, as well as the *People's Liberation Army Daily*, a publication of China Central Military Commission whose target audience is members of the military.

An analysis of state media content therefore allows us greater insight into how the elite ranks of China's political system seek to communicate the importance of the Snowden and US technology restrictions to the rest of its bureaucracy and society at large. These articles provide a valuable metric of change, since they are published daily and at relatively high volumes. This approach allows us to distinguish between sentiments specific to knowledge shocks and other developments, both over time and across different parts of the party-state.

Our main analysis draws on a corpus of media articles collected by web-scraping the CNKI China Core Newspapers Full-text Database, which contains articles from over 650 newspapers in China. To capture our articles of interest (those addressing technology), we collected only those articles whose titles contain the Chinese words for "innovation," "science and technology," or "technology," from 2005 to 2021. This search process resulted in a corpus containing 482,220 articles.⁸ Supplementary Appendix A contains descriptive statistics showing the distribution of articles across sponsoring authority and substantive focus, as well as over time.

We test our argument by analyzing the prevalence of key words related to technology security and economic decoupling. To assess the potential impact of domestic factors such as China's leadership changeover in 2012, we further included analysis of key words related to Xi Jinping. These key words were assembled by a research assistant, who read through articles in the *People's Daily* related to science and technology and parsed out noteworthy terms.

We group individual terms that are closely related into specific themes and analyze the prevalence of these themes in our corpus of articles over time. The first theme is focused on technology security, and contains the terms "information security," "network security," and "data sovereignty."⁹ We expect this theme's prevalence to have been sharply amplified by the Snowden revelations beginning in June

2013 and lasting until around May 2014, which revealed major vulnerabilities in China's information security. The second major theme is concerned with economic decoupling, and contains the terms "chokepoint," "self-reliance," "indigenous research," and "technological independence and strengthening." We expect this theme to have been sharply amplified by the US government's technology restrictions against China beginning with the denial order against ZTE in April 2018, which illustrated China's dependence on US-controlled technology. In our first theme, the discourse around "technology security" advocates the adoption of indigenous technology and the closing off of technology systems to guard against foreign surveillance and cyberattacks. The second theme focuses on decoupling, which advocates self-reliance in critical technology to guard against foreign forces choking off China's ability to innovate.

Figure 1 shows the trends in the monthly prevalence of these two themes over the 2005–2021 period. Overall, the trends in the figure match our expectations, with each knowledge shock corresponding closely with an increase in salience of our two technology themes. The prevalence of terms related to technology security appears to shift sharply in the expected timeframe, and is persistently higher in the post-Snowden period compared to before.¹⁰ Similarly, the prevalence of terms related to decoupling increases dramatically after the onset of the US government's technology restrictions. The timing and sudden shift in sentiment suggest that macrostructural arguments invoking either changes to the relative balance of power or slow-moving cultural processes are insufficient to explain the phenomenon that we observe. Neither the material balance of power nor enduring cultural patterns change quickly.

Closer analysis of the articles shows how these knowledge shocks not only raise the salience of potential vulnerabilities associated with interdependence, but also serve as a focal point for state media to advocate for a change in technology posture. In the wake of the Snowden revelations, articles in our corpus show greater support for indigenizing and securitizing China's IT networks. For example, a piece in *Xinhua Daily Telegraph* discusses the news about German Chancellor Angela Merkel's phone being tapped, highlighting the risks of technology interdependence, and advocating for a closed approach so as to ensure national security:

(t)he lesson of European countries is profound enough: in terms of economic volume, the EU is a "giant," but in the key field of information technology is subject to the control of others, making their own information security and "data sovereignty" difficult to guarantee. ... Only by vigorously promoting independent intellectual property rights and S&T innovation, and attaining "technological autonomy", can we maintain the nation's "data sovereignty." (Huang and Chen 2013)

We also find similar lines of argument in specialized publications targeted at internal state audiences. For example, the *Study Times*, the official newspaper of the Central Party School, published an article in April 2014 noting that:

The "Snowden incident" once again brought significant shock to China: we cannot always be tenants in cyberspace; we must make breakthroughs in key technologies and essential defense measures, building an

⁸As some newspapers are not consistently included in the CNKI database, we restrict the data to only those publications that are reported throughout the full period of study. In order to avoid picking up articles related to the COVID-19 pandemic, we dropped any articles with the terms "vaccine," "COVID-19," or "coronavirus" in the text.

⁹This term is sometimes translated as "cybersecurity." This paper uses the term "network security," which encompasses but is not restricted to issues related to cyberspace security. For the importance of data sovereignty to China's self-reliance strategy, see Creemers (2023) and Hofmann and Pawlak (2023).

¹⁰The inclusion of "information security" in our set of terms in the technology security theme might pick up changes in discourse related to domestic events. As a robustness check, Supplementary Figure B1 shows a consistent trend if we restrict the analysis to only "network security."

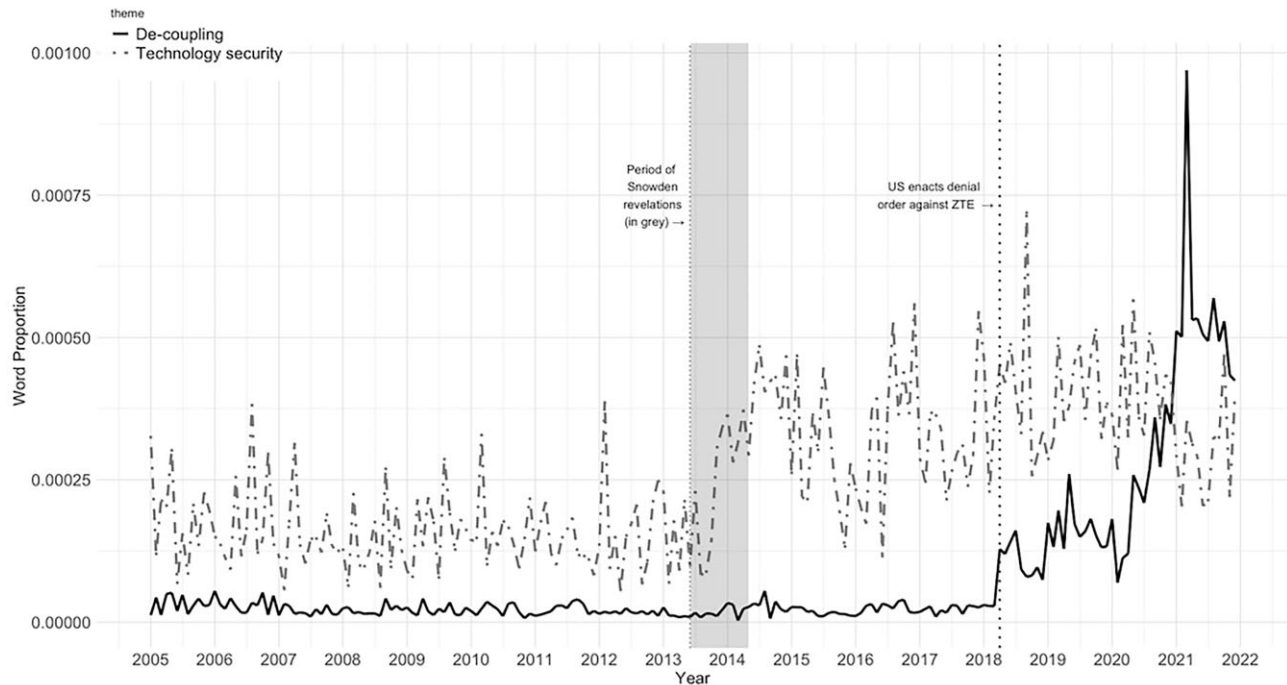


Figure 1. Monthly prevalence of terms related to technology security and decoupling. Vertical lines indicate beginning of key knowledge shocks.

independent and trustworthy national network security defense system. (Cheng 2014)

The *People's Liberation Army Daily*, run by the Central Military Commission and aimed primarily at military personnel, published an article noting that “the exposure of ‘Prism’ undoubtedly sounded an alarm for the international community.” In response to this dominance, “walking the path of independent innovation and development must become (China’s) unwavering belief and goal” (Zhang 2013). The altered security perspective arguably colored China’s subsequent interactions with foreign technology companies (Ante, Mozur, and Ovide 2013; Miller 2014). As Liu Jinghua, a former PLA colonel argues, “What we read from the Snowden files showed that almost all the big companies in China were actually collaborating with the American intelligence agencies ... That made China feel really insecure using all these components from American companies” (Binder and Northrop 2020). Such sentiments suggest that the knowledge shock affected China’s perception of the relative balance of threats and opportunities, leading officials to rapidly revise their interpretation of the implications of technological interdependence.

The revelations further meant that a cooperative embrace of foreign technology could be framed as a source of vulnerability rather than joint gains. A July 2013 article in *Government Procurement Information* (governed by the Ministry of Finance) notes:

the “Prism Gate” incident will become a landmark event in government procurement, prompting us to conduct a deep reflection ... we need to completely extricate ourselves from being subject to the influence of foreign enterprises and foreign powers, which means we must encourage domestic network, software and other high-tech enterprises to strengthen

their scientific and technological research and development. (Yu 2013)

This heightened attention to vulnerabilities is not driven by one subset of newspapers, but rather generalizes across different publications, reflecting an overall coordination effort by the state media apparatus to unify previously dispersed positions on innovation. [Supplementary Figure B2](#) shows that in the pre-Snowden period, security-focused publications place more emphasis on technology security concerns compared to those covering general affairs, economics, and technology. In the post-Snowden period, there is rise in salience of technology security discourse across newspapers regardless of their substantive type, highlighting the impact of this knowledge shock in driving a convergence of previously dispersed intrastate sentiments. As discussed earlier, these shifts might be driven by multiple mutually reinforcing mechanisms. Our aim is not to identify each pathway, but rather to show the heightened focus around technology vulnerability and coordination toward a new consensus.

A similar trend can be seen in the wake of the United States’ deployment of technology controls against China from 2018 onward, as shown in [Figure 1](#). The first month that discourse around decoupling increases in our media corpus is April 2018, the same month that the United States enacts a denial order on ZTE. Articles published that month emphasize the shock of the order and call for self-reliance as a matter of national urgency, in response to being “choked” by the United States. For example, a *People’s Daily* article citing the ZTE denial order notes that “(w)e urgently need to open a new wave of indigenous innovation in a global perspective, so that chips, operating systems, high-end manufacturing equipment and other core areas are no longer subject to the hidden concerns of being ‘choked’” (Yu 2018).

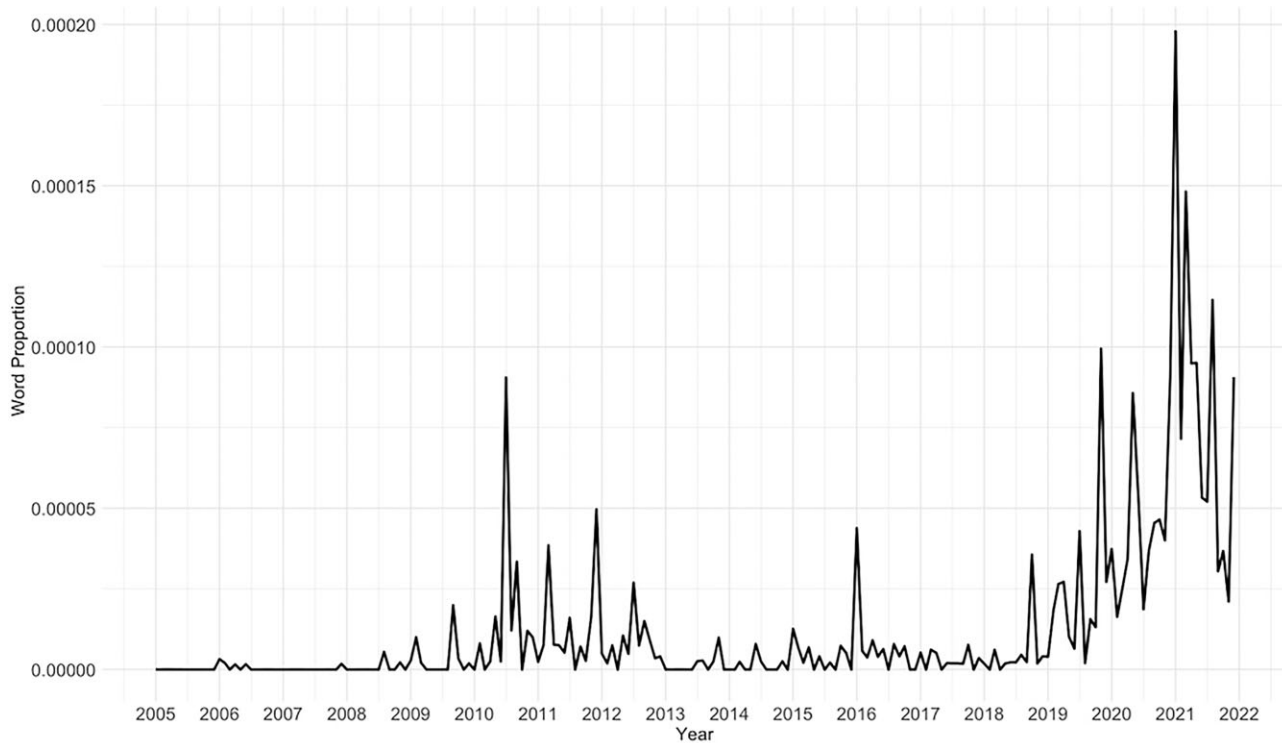


Figure 2. Monthly prevalence of the term “whole-of-nation system” in S&T media articles.

As with the Snowden shock, we find these arguments in favor of self-reliance not just in general dailies, but also those targeted at internal audiences. One example is an article in the *Science and Technology Daily* (governed by the Ministry of Science and Technology) that depicts open innovation as “illusory” thinking akin to relying on the charity of strangers, noting:

The U.S. Department of Commerce’s seven-year comprehensive sales ban against ZTE has given us a wake-up call. It woke us up: it’s time to train up our internal strength and harden our wings, and let us never be choked by others ... We can either continue relying on begging for alms to get core technology, or abandon the illusion, recognize the reality, and become our own boss, the answer is self-explanatory. (Keji Ribao 2018)

Similarly, the *Study Times* refers to the ZTE ban as “sounding the biggest ‘alarm’ for China’s industrial and technological security since the beginning of reform and opening up, providing a profound ‘experience’ of the problems arising from not controlling core technology” (Li 2018). This shift in sentiment did not reflect internal developments such as a shift toward Chinese technological superiority, but apparent surprise and a perceived need to rapidly catch up so as to avoid further risks.

Another key event associated with a spike in discourse on decoupling is the addition of telecommunications giant Huawei to the US entity list in May 2019. A piece in the *Guangming Daily* quotes a Central Party School official as saying: “it is clear that the strategic intention of the current U.S. administration is to curb China’s high-tech development” (Guangming Ribao 2019). The articles consistently argue that China should move toward a more closed innovation

ecosystem. For example, an article in the *Economic Information News* articulates the change in strategic thinking:

In the past, some views held that with the current state of globalization ... a country does not need have mastery over all the key core technologies. ... However, harsh reality tells us that with today’s rampant trade protectionism and anti-globalization, if a large country does not hold the key technologies of important industries in its own hands, it will often be subject to “targeted attacks” by others, leading the relevant industries and enterprises to face a crisis of survival. ... Lessons from reality have repeatedly shown that technology involving the core competitiveness of a country cannot be bought by money, and the path of exchanging market for technology is also not feasible. We have to abandon such illusory thinking. Only by mastering key core technologies can we truly become an industrial and economic powerhouse. (Wu 2019)

Our analysis further reveals calls for China to move toward tighter internal coordination in technology advancement. This can be seen in Figure 2 showing a surge in language advocating a new “whole-of-nation system” for science and technology from mid-2018 onward, to bring greater internal alignment of actors involved in innovation.¹¹ Articles explicitly link the need for stronger coordination with external coercion. For example, a 2019 article in the *Study Times* describes the deployment of this whole-of-nation system as a way for China to respond to the problem of chokepoints in core advanced technologies (Xuexi Shibao 2019).

Concurrent with this advocacy for greater reliance on domestic innovation efforts, we find a fall in the use of terms

¹¹This phrase refers to a system where a diversity of actors, from government and firms to laboratories and researchers, are acting in coordination to further a national quest for technology advancement.

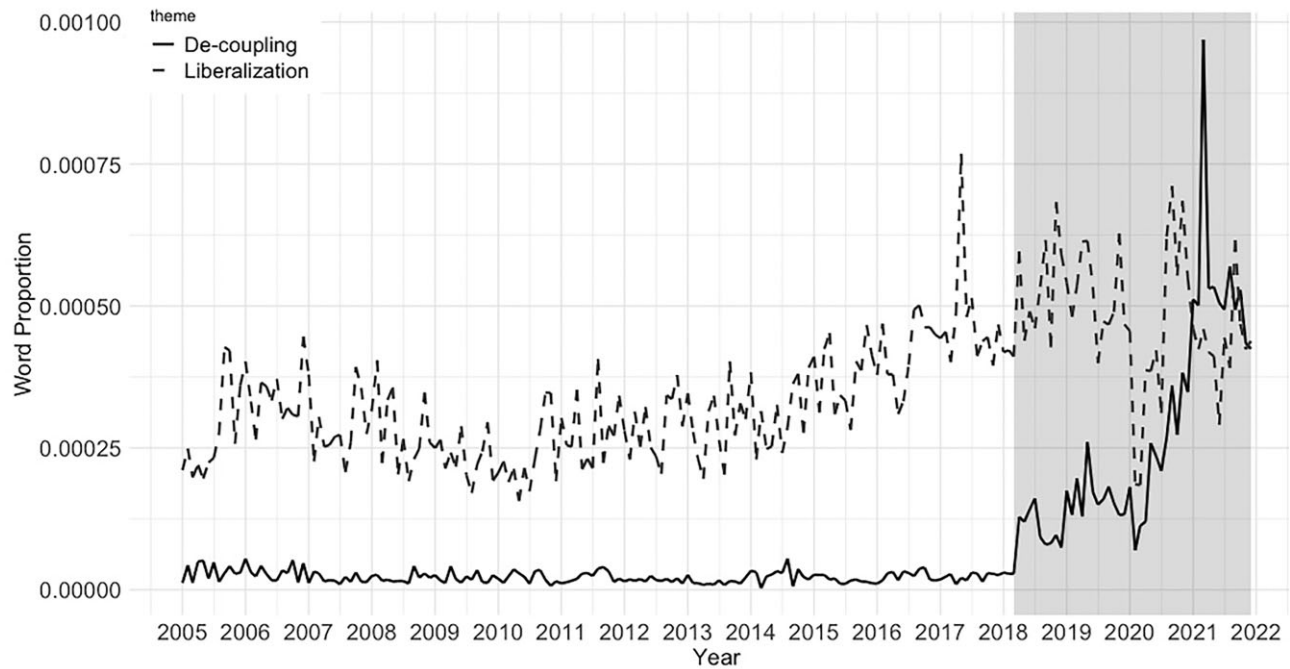


Figure 3. Monthly prevalence of decoupling and external liberalization themes (2005–2021). *Note: The external liberalization theme comprises the terms “external liberalization” and “international cooperation.”*

supportive of open global collaboration. Figure 3 shows a flattening and decline in the use of the terms “international cooperation” and “external liberalization” from 2018 onward, even as language related to decoupling grows.

As with the Snowden revelations, the call for China to protect itself against US technology restrictions was repeated widely across different parts of the official media landscape, reflecting an effort to coordinate and realign dispersed positions across the party-state. Supplementary Figure B3 shows that prior to 2018, only security-focused publications showed any significant concern with technological decoupling, and even then only sporadically. After 2018, we see a rise in discourse related to decoupling across a wide variety of publication types, from general dailies to economics and industry periodicals, as well as more specialized publications. This movement of discourse in favor of decoupling can be observed not just across, but also within, publication. As shown in Supplementary Figure B4, the *Science and Technology Daily* placed far greater emphasis in international cooperation and external liberalization prior to the onset of the US technology restriction. From 2018 onward, however, articles published in this daily showed a greater concern with decoupling, with the prevalence of decoupling discourse at times outstripping that for cross-border cooperation.

Policy Centralization and Institutional Coordination

We now turn to shifts in domestic institutions and policies. This section serves two purposes: first, it addresses concerns that the media analysis might reflect mere rhetoric, rather than a genuine change in approaches to innovation. Second, it underscores the institutional restructuring involved when a state switches its technological emphasis away from interdependence and toward self-reliance. Drawing on an original dataset of Chinese laws and policies, we find that

each knowledge shock is followed by a major institutional reconfiguration to strengthen central guidance over innovation and increase alignment of previously uncoordinated behavior.

Using a comprehensive database of Chinese laws and policies, we collect all documents issued by the Chinese Communist Party (CCP) Central Committee, the National People’s Congress (NPC), and the State Council, which contain the term “network security” (Snowden shock) and “chokepoint” and “whole-of-nation system” (US technology shock) from 2005 to 2021.¹² As Figure 4 shows, the Snowden revelations are followed by an elevated policy emphasis on technology security in China’s political, legislative, and executive documents.

This intensified policy concern over network security reflects the party leadership’s efforts at overcoming internal disagreements on technology policy within China’s complex governance structure. These disagreements were exacerbated by the fact that authority over network security was dispersed across “fiercely competing state and national security bureaucracies,” each of which “had control of different portions of the information and cybersecurity sectors” (Cheung 2018, 316). Influential actors ranged from the Ministry of Public Security to the Ministry of State Security, the Ministry of Industry, Information and Technology, and the PLA, as well as the State Encryption Bureau and the State Secrets Bureau. Technology security policy-making, therefore, was “highly contested and fragmented” (Segal 2014). Policies were the product of “turf battles” between competing state agencies with overlapping authorities over network security (Creemers et al. 2018).

In the aftermath of the Snowden revelations, China’s political leadership led a major institutional restructuring aimed at strengthening central guidance over the trade-

¹²We do not include the lower-level policies issued by ministries or associations.

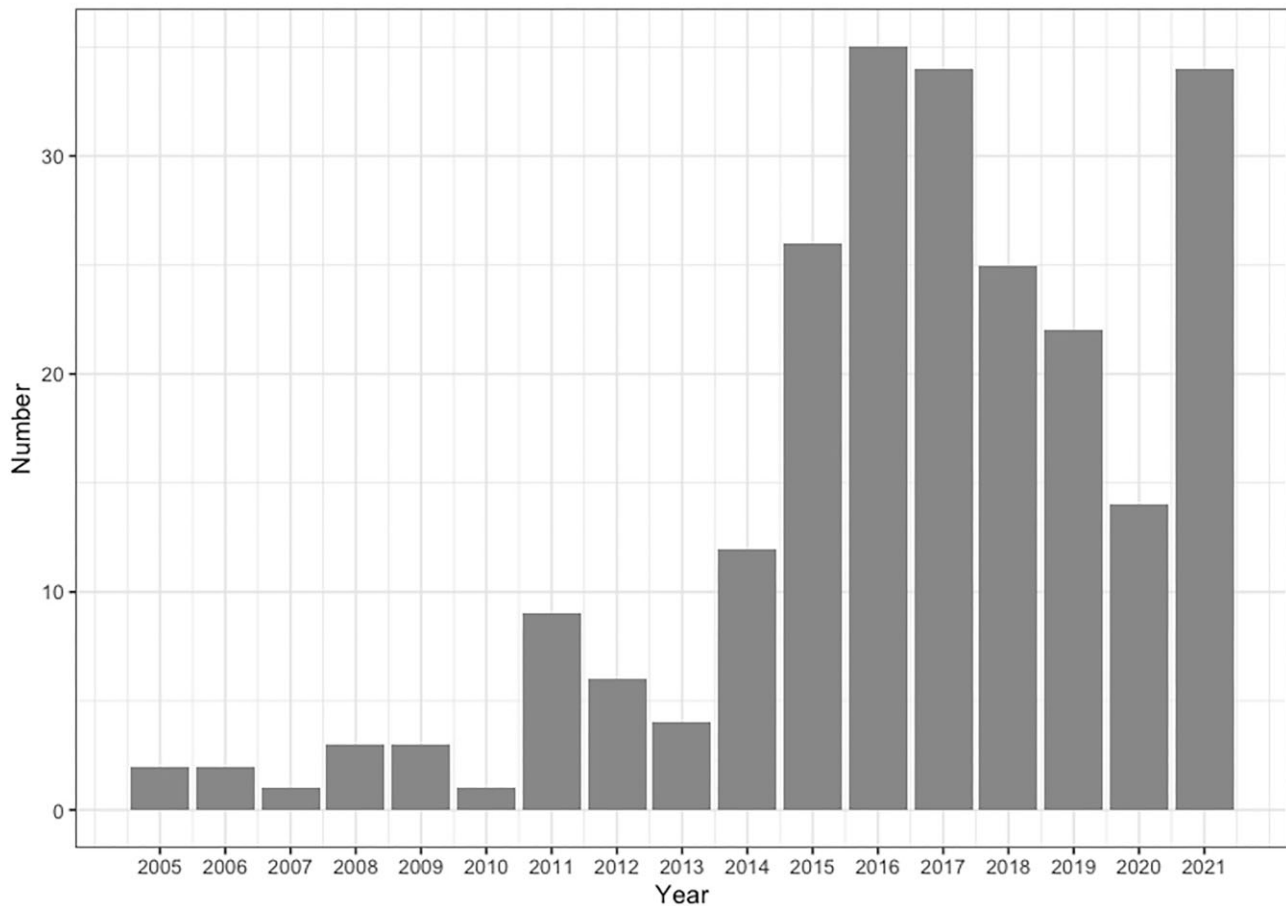


Figure 4. Number of party, legislative, and executive documents mentioning the term “network security.” *Source:* pkulaw.com

offs between external vulnerability and interdependence. As Creemers (2021) notes, “(b)etween 2013 and the present, (China) created an entirely new *xitong* (system) to deal with (network security and informatization) (p. 3).” Xi cites Snowden’s revelations of the US surveillance activities as evidence of external threats. At a speech at the national work conference on propaganda thought in August 2013, Xi notes that:

Anti-Chinese forces in the West have always endeavored to take down China with the internet. ... From America’s PRISM and the XKeyscore surveillance plans, it’s clear that their internet activity ability and scale have far exceeded people’s imagination. Whether we can hold our ground and win on the battlefield of the internet is directly connected to our country’s ideological and political security. (China Digital Times 2013)

The following year, a Leading Small Group (LSG) on Network Security and Informatization in 2014, chaired by Xi Jinping, is established, signaling the elevation of network security to a key political priority. The high-level authority of the LSG aligns divergent positions within the party-state, such that “stand-offs between competing groups can be resolved and policy moved forward” (Segal 2014) and “marks the end of the fragmented management approach in dealing with the complexities of the Internet” (Cheng 2014).

State officials also make an explicit link between the Snowden shocks and China’s policy restructuring. For ex-

ample, an Ministry of Industry and Information Technology (MIIT) official is quoted in a September 2014 article noting that “After the ‘Prism Gate’ incident last year, the importance that the country attached to network security was raised to a new height. On 27 February 2014, the establishment of the Central Leading Group on Network Security and Informatization was announced” (Xie 2014).

This institutional reconfiguration is undergirded by a strengthening of the legal framework for network security. For instance, a 2015 amendment to the criminal law includes a new article (#286) setting out information network security guidelines and penalties for network service providers. The network security law, enacted in 2016, further establishes a comprehensive framework setting out the responsibilities of network and critical infrastructure providers, and national security review, as well as data protection and certification processes.

The legislative shifts are accompanied by high-level policies highlighting concerns with China’s reliance on external technologies. For example, the 2016 National Informatization Strategy mentions the term “network security” 27 times, noting that one of the key problems facing China is that its core technologies and equipment make China “subject to the control of others,” and that “network security faces severe challenges and cyberspace governance construction urgently needs strengthening” (Xinhua News Agency 2016a). The 2016 National Innovation Policy lists one of China’s strategic objectives as altering “the passive situation where

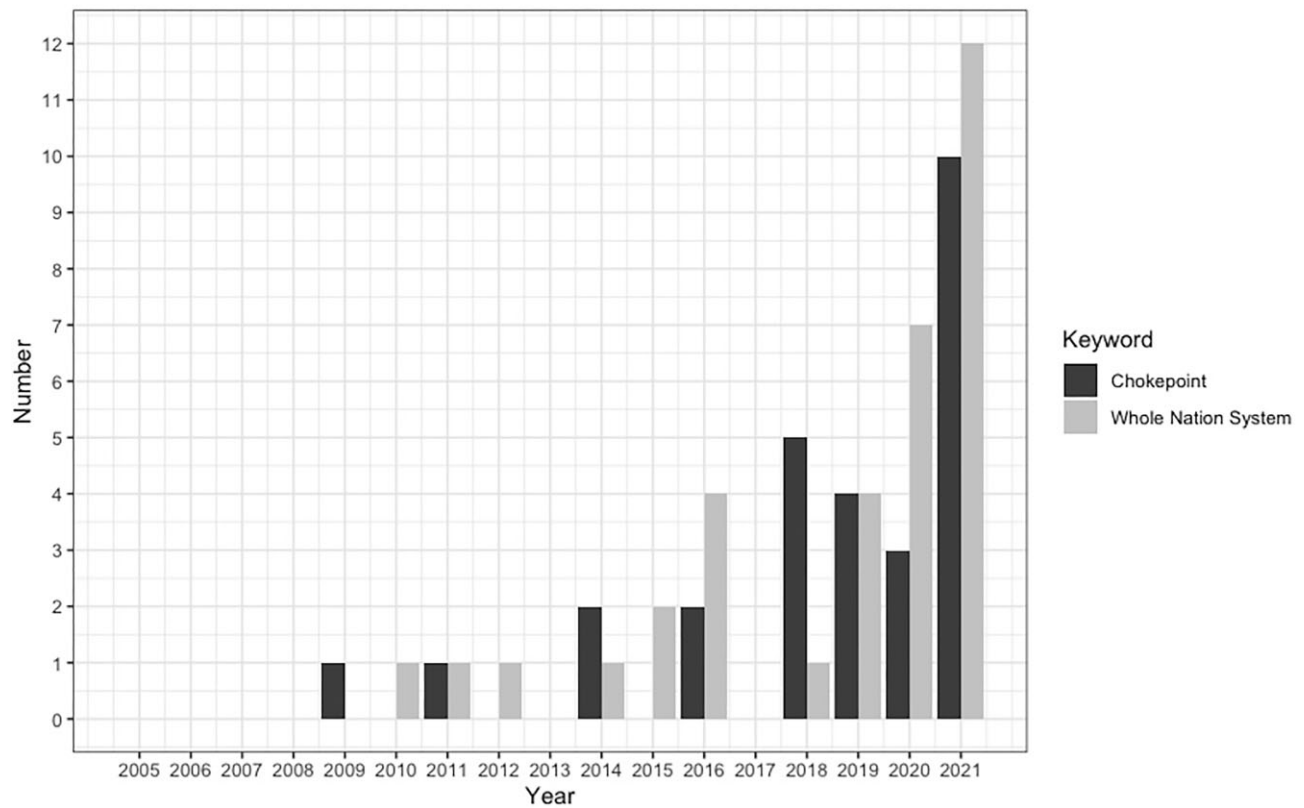


Figure 5. Number of party, legislative, and executive documents containing the terms “chokepoint” or “whole-of-nation system”. Source: pkulaw.com

critical core technologies have long been subject to the control of others,” and to develop an “independent and controllable” industrial technology system (Xinhua News Agency 2016b).

The Snowden leaks were by no means the only event driving the shift in China’s technology policy. As Cunningham (2022) notes, the US bombing of the Chinese embassy in Belgrade in 1999, and the establishment of the US Cyber Command in 2009, also shaped China’s security strategy. That said, our media and policy analysis show that 2014 was a clear turning point. As a former US ambassador to China, Max Baucus, concludes, “The Snowden leaks dramatically changed Chinese policy towards the internet, its own people, the United States, and the world, with respect to the internet and cyber security ... It was a watershed development” (Binder and Northrop 2020).

The US targeting of ZTE and subsequent technology restrictions have similarly led to an increased emphasis on security in Chinese policies. Figure 5 shows the number of party, legislative, and executive documents containing the terms “chokepoint” and “whole-of-nation system” from 2005 to 2021. The trend matches our media analysis, where sentiments supportive of decoupling and self-reliance jump up from 2018 onward.

Similar to the Snowden shock, US technology restrictions triggered a surge of high-level political attention to China’s vulnerabilities. A Party guidance in 2018 emphasizes the need to “accelerate the construction of an *independent and controllable* industrial technology system, to focus on sorting out key areas of ‘chokepoint’ technologies, systematically tackle the key problem where critical technolo-

gies are *subject to the control of others*, so as to provide scientific and technological guarantees for China’s industrial security” (emphases ours) (Science and Technology Party leadership group 2018). The guidance goes on to emphasize the need to draw out the advantages associated with a “whole-of-nation system” approach, and to “adhere to self-reliance.”

This heightened focus on external vulnerability reverberated to many different issue areas, as seen by the diversity of high-level policy documents from 2018 on that point to the need to overcome “chokepoints” in China’s economy. These guidances cover not just well-known dependencies in products such as semiconductors and aircraft engines, but also technologies for deep sea and deep earth resource discovery (Natural Resources Party leadership group 2018), germplasm resources (National People’s Congress Standing Committee 2021), and agricultural technology (State Council 2018).

The ensuing securitization of China’s development strategy can be seen by comparing China’s thirteenth and fourteenth FYPs, the economic guidances setting out the nation’s medium- and long-term priorities. The two plans were released in 2016 and 2021, respectively, i.e., before and after the start of US–China technology tensions. Whereas national security is discussed in connection with technology once in Xi’s speech for the thirteenth FYP, and in terms that reiterate the 2015 “Made in China 2025” industrial policy for high-tech sectors (Xi 2015), Xi’s speech for the fourteenth FYP signals a shift in overall strategy by highlighting the need to “coordinate development and security,” emphasizing that “security is a prerequisite for development, and

development is a guarantee of security.” He justifies this new approach by pointing to the heightened level of risks, underscoring the role of national strength in “preventing and resolving various types of risks and hazards, and actively responding to the challenge of shocks brought about by shifts in the external environment” (Xi 2020).

The party-state also turns its attention toward high-level coordination. For example, the CCP’s Fourth Plenum held in 2019 reiterated the importance of a new “whole-of-nation system” to achieve technology advancement (Xinhua News Agency 2019b). The focus on coordination is supported fiscally by a 2021 NPC budget resolution calling for funds to “vigorously support scientific and technological self-reliance and self-strengthening,” with particular focus on “chokepoint” technologies (National People’s Congress 2021). Policies are also enacted to support the development of Chinese (as opposed to foreign) capital markets for high-tech firms (State Council 2020). A 2019 State Council guidance encourages collaboration between firms and universities in special high-tech zones, so as to make “breakthroughs in major ‘chokepoint’ technologies and products” (State Council General Office 2019).

In the spring of 2023, China’s leadership further restructured national institutions overseeing science and technology. The reconfiguration was aimed at strengthening central coordination over the “whole-of-nation” system for innovation, and to reduce existing bureaucratic fragmentation (Zhang et al. 2023). A Central Committee commission on science and technology work was established, bringing central oversight over the country’s innovation efforts and signaling the elevation of technology development to a high-level political priority. The responsibilities of the Ministry of Science and Technology were also streamlined to focus on overall coordination. The State Council describes these changes as strengthening the “centralized and unified leadership” of the CCP, and cast the need for stronger coordination given “the severe situation of international technological competition and external containment and suppression” (State Council 2023).

The timeline also suggests that structural explanations concerned either with changes in the relative balance of power or ideational shifts are insufficient to explain the timing of the policy responses (centered around 2014 for the Snowden affair and 2017 for the ZTE incident). Of course, structural shifts may have consequences for policy, but those consequences are mediated through policymakers’ convergent knowledge about a complex global environment that they cannot perceive directly. The data (both quantitative and qualitative) demonstrate how the knowledge shocks can reverberate through a state administration, shaping officials’ understanding of their macrostructural context.

Addressing Changes in Party Leadership

It is difficult to explain the trend toward securitization of China’s innovation policy by invoking the leadership change in 2012 and elite preferences associated with the Xi Jinping era alone, although they do interact with shifts in leadership structure. Major changes in China’s national security apparatus have occurred under Xi (Cheung 2022). However, as Figure 1 shows, there is no immediate change in media discourse after Xi takes power at the end of 2012. Rather, the timing of our documented shift in technology discourse and policymaking is more strongly correlated with the Snowden revelations. Media articles in our corpus further point to “Prism gate” as triggering a reassessment of China’s approach to innovation.

A close study of Xi’s speeches related to science and technology suggests that securitization was not a preexisting concern for the leader. Xi’s speeches at the start of his term emphasize the importance of accelerating the “informatization” of China’s military capabilities and using information systems to strengthen China’s combat strength, but do not mention network or information security (Renmingwang 2012, 2013). His speeches on technology stress the importance of indigenous innovation and controlling core technology, but also note the need for open cooperation and do not mention either information or network security. For example, Xi’s speech at a science and technology meeting on March 4, 2013, stresses the need to “actively expand exchanges with foreign technology, and to work hard on utilizing both international and domestic science and technology resources” (Party Literature Research Center of the CPC Central Committee, 2016).

It is in August of 2013 (9 months after his assumption of the CCP General Secretary position and in the midst of the Snowden leaks) that Xi’s speeches shift to active mentions of information security and network security. After the establishment of the network security LSG, Xi’s speeches regularly touch on the importance of information and network security (China Digital Times 2013; Xinhua News Agency 2013, 2016c, 2016d, 2016e, 2018, 2019a). That said, the changeover in leadership has plausibly reshaped discourse around science and technology in other aspects, most notably around the rejuvenation of the Chinese nation. As part of this theme, Xi has called for China to become a “science and technology power” and a “network power.” This shift toward decoupling, then, is no doubt additionally filtered through the Xi administration’s emphasis on national rejuvenation, and the two trends should be seen as interactive rather than operating in isolation.

Conclusion

States seeking economic and technology advancement face an existential trade-off between pushing their capabilities to the cutting edge by integrating into collaborative innovation networks, and protecting their core interests from external coercion by securitizing and closing off their innovation ecosystem. The stakes are high as the decision on how to structure innovation systems will shape a country’s future prosperity, while also impacting its military capabilities and strategic autonomy.

The dominant liberal and realist explanations of interdependence have difficulty in accounting for change in state strategies. Instead, our evidence suggests that knowledge shocks change the relative salience of risks and benefits of technological interdependence, providing a focal point for complex state systems to internally coordinate a shift in stance. Using descriptive text-as-data, our analysis provides good reason to believe that two distinct shocks over the 15-year period, from 2005 to 2021, led to substantial and mutually reinforcing changes in the positioning of various parts of the Chinese state in balancing the trade-offs of technological interdependence. Analysis of government documents shows heightened policy concern with technology security and a move toward centralized coordination. The Snowden shocks of 2013/2014 led to a securitization of China’s network and cyberspace policies, while the technology sanctions from 2018 onward drove a broader withdrawal of Chinese engagement with global networks in favor of a whole-of-nation system of self-reliance. Both shifts were undergirded by institutional restructuring that strengthened the central government’s internal coordination capabilities.

There are natural limits to the generalizability of our approach focusing on the China–US dynamic in the case of the two identified shocks. That said, there are clear indications that at least on face, the dynamic travels to other sectors and countries. In the China–US relationship, for example, there is significant circumstantial evidence that US sanctions policy and weaponization of the SWIFT financial messaging system reframed domestic debates in China around the threats associated with financial market interdependence. This knowledge shift ultimately drove policy change, leading the party-state to work on its own domestic financial messaging system (Farrell and Newman 2023).

Moreover, the dynamic that we identify does not appear to be limited to the China–US interaction. Research has demonstrated that the knowledge shock associated with the Snowden revelations affected Europe as well as China. While the impact was naturally moderated by the transatlantic security relationship, it similarly elevated the salience of the threat of technological interdependence and resulted in significant change in framing and policy (i.e., the rise of data sovereignty and the passage of data privacy legislation) (Kalyanpur and Newman 2019).

We expect that the types of interactions we describe will be most prevalent between economically powerful states that have the capability to support a strategy emphasizing self-reliance. It will also be more likely in those technological domains, which are marked by higher levels of complexity and uncertainty as to their relative security externality (Norris 2016; Vaynman and Volpe 2023). While it is uncertain whether all such technologies are equally vulnerable to weaponization, major governments are undertaking efforts to get ahead of future unexpected knowledge shocks, by seeking to uncover potential chokepoints that might make them vulnerable to coercion.¹³ More research will be necessary to further tease out the boundary conditions of the causal relationship as well as demonstrate the phenomenon in additional empirical domains.

Our findings have a number of important implications. They contribute to a growing body of literature bridging the gap between international relations and the study of innovation. Given the critical role that technology plays in the development of civilization and conflict, this seems long overdue. Work by Taylor (2016), for example, has shown how security threats may generate new political pressure to increase spending on research and development. Our findings suggest that such threats may not only affect the amount of funding but also the nature of global innovation systems themselves, as aspiring states participate or withdraw. As technological production and use has become increasingly global, the future of the Internet or semiconductor innovation may be shaped as much by great power politics as the technological frontier.

We hope that our work will contribute to theoretical debates on interdependence in international affairs more generally. Existing work has tended either to stress the self-reinforcing dynamics of joint gains or the self-undermining nature of zero-sum competition. States and analysts are uncertain, however, as to which dominates in technological interdependence. Technological interdependence serves as a potential proof of concept that such uncertainty may affect other domains of interdependence as well. Recent shocks associated with COVID and the financial crisis have demonstrated the remarkable level of complexity in the supply chains and financial exchanges that trade relies on. Actors

embedded in such interdependent relationships will likely face similar dilemmas to those we identify in the domain of technological interdependence. By integrating the dynamics of knowledge shocks and state coordination into studies of interdependence more generally, then, we can better explain how interactions may shift beliefs about the relative benefits and cost of openness. And more important, we may develop better insight into the growing drivers of economic closure. For decades, scholars have emphasized the forces that promote greater openness in the global economy and technological relationships: now we must update our accounts to understand when and how openness may not only be weakened but sometimes reversed.

Supplementary Information

Supplementary information is available in the *International Studies Quarterly* data archive.

References

- ANTE, SPENCER E., PAUL MOZUR, AND SHIRA OVIDE. 2013. "NSA Fallout: Tech Firms Feel a Chill inside China." *The Wall Street Journal*, November 14. Accessed March 30, 2022. <https://www.wsj.com/articles/SB10001424052702303789604579198370093354680>.
- BARBIERI, KATHERINE. 2002. *The Liberal Illusion: Does Trade Promote Peace?* Ann Arbor, MI: University of Michigan Press.
- BINDER, ELI, AND KATRINA NORTROP. 2020. "The Snowden Effect." *The Wire China*, 2020. Accessed December 14, 2020. <https://www.thewirechina.com/2020/12/06/the-snowden-effect/>.
- BRUNNERMEIER, MARKUS, RUSH DOSHI, AND HAROLD JAMES. 2018. "Beijing's Bismarckian Ghosts: How Great Powers Compete Economically." *The Washington Quarterly* 41 (3): 161–76.
- CHENG, YU. 2014. "Using 'Logic Bombs' to Reflect on the Risks Introduced by Technology." *Xuexi Shibao*, April 28. Accessed February 3, 2023. http://www.diwuchanye.com/zhitu/zhitu_post_detail.jsp?ShowPage=5&PostId=1915.
- CHEUNG, TAI MING. 2018. "The Rise of China as a Cybersecurity Industrial Power: Balancing National Security, Geopolitical, and Development Priorities." *Journal of Cyber Policy* 3 (3): 306–26.
- . 2022. *Innovate to Dominate: The Rise of the Chinese Techno-Security State*. Ithaca, NY: Cornell University Press.
- CHINA DIGITAL TIMES. 2013. "The Full Text of Xi Jinping's August 19 Speech: in Terms of Speech, We Must Dare to Control, and Dare to Show the Sword." *China Digital Times*, November 4. Accessed March 23, 2022. <https://chinadigitaltimes.net/chinese/321001.html>.
- COPELAND, DALE. 2014. *Economic Interdependence and War*. Princeton, NJ: Princeton University Press.
- CREEMERS, ROGIER, PAUL TRIOLO, SAMM SACKS, GRAHAM WEBSTER, AND XIAOMENG LU. 2018. "China's Cyberspace Authorities Set to Gain Clout in Reorganization." *DigiChina*. Accessed June 29, 2022. <https://digichina.stanford.edu/work/chinas-cyberspace-authorities-set-to-gain-clout-in-reorganization/>.
- CREEMERS, ROGIER. 2021. "China's Cyber Governance Institutions." Leiden Asia Centre. January. Accessed June 29, 2022. <https://leidenasiacentre.nl/wp-content/uploads/2021/01/Chinas-Cyber-Governance-Institutions-Layout-geconverteerd-2.pdf>.
- . 2023. "The Chinese Conception of Cybersecurity: a Conceptual, Institutional, and Regulatory Genealogy." *Journal of Contemporary China* 33 (146): 173–88.
- CUNNINGHAM, FIONA. 2022. "Strategic Substitutions: China's Search for Coercive Leverage in the Information Age." *International Security* 47 (1): 46–92.
- DENG, YONG, AND THOMAS G. MOORE. 2004. "China Views Globalization: Toward a New Great-power Politics?" *The Washington Quarterly* 27 (3): 115–36.
- DEUTSCH, MORTON. 1949. "A Theory of Co-Operation and Competition." *Human Relations* 2 (2): 129–52.
- . 2003. "Cooperation and Conflict: A Personal Perspective on the History of the Social Psychological Study of Conflict Resolution." In *Inter-*

¹³China, for example, has sought to identify specific technology dependencies that might leave it vulnerable to coercion (Murphy 2022).

- national Handbook of Organizational Teamwork and Cooperative Working, 9–43. Singapore: John Wiley & Sons, Ltd.
- DING, JEFFREY. 2024. *Technology and the Rise of Great Powers: How Diffusion Shapes Economic Competition*. Princeton, NJ: Princeton University Press.
- ERNST, DIETER, AND LINSU KIM. 2002. "Global Production Networks, Knowledge Diffusion, and Local Capability Formation." *Research Policy* 31 (8–9): 1417–29.
- FARRELL, HENRY, AND MARTHA FINNEMORE. 2013. "The End of Hypocrisy: American Foreign Policy in the Age of Leaks." *Foreign Affairs* 92 (6): 22–7.
- FARRELL, HENRY, AND ABRAHAM NEWMAN. 2018. "Linkage Politics and Complex Governance in Transatlantic Surveillance" *World Politics* 70 (4): 515–54.
- . 2019. *Of Privacy and Power: The Transatlantic Struggle over Freedom and Security*. Illustrated ed.. Princeton, NJ: Princeton University Press.
- . 2023. *Underground Empire: How America Weaponized the World Economy*. New York, NY: Holt.
- FARRELL, HENRY, AND JOHN QUIGGIN. 2017. "Consensus, Dissensus, and Economic Ideas: Economic Crisis and the Rise and Fall of Keynesianism." *International Studies Quarterly* 61: 269–83.
- GILLI, ANDREA, AND MAURO. GILLI 2019. "Why China Has Not Caught Up Yet: Military-Technological Superiority and the Limits of Imitation, Reverse Engineering, and Cyber Espionage," *International Security* 43 (3): 141–89.
- GUANGMING RIBAO. 2019. "Not Afraid of Restraint, Unremitting Innovation, Winning the Technological Arena." *Guangmingwang*, May 29. Accessed May 9, 2023. https://epaper.gmw.cn/gmrb/html/2019-05/29/nw.D110000gmrb_20190529_1-07.htm.
- HAFNER-BURTON, EMILIE M., STEPHAN HAGGARD, DAVID A. LAKE, AND DAVID G. VICTOR. 2017. "the Behavioral Revolution and International Relations." *International Organization* 71 (S1): S1–31.
- HAMILTON, ALEXANDER. 1791. "Report on the Subject of Manufactures." In *The Papers of Alexander Hamilton 10*, edited by HC Syrett, 230–340. New York: Columbia University Press, 1966.
- HOFMANN, STEPHANIE C., AND PATRYK PAWLAK. 2023. "Governing Cyberspace: Policy Boundary Politics across Organizations." *Review of International Political Economy* 30 (6): 2122–49.
- HUANG, KUN, AND YONG CHEN. 2013. "Maintain Data Sovereignty with Independent Innovation." October 28. Accessed November 3, 2021. http://views.ce.cn/view/ent/201310/28/t20131028_1675758.shtml.
- IKENBERRY, JOHN. 2014. "The Illusion of Geopolitics: the Enduring Power of the Liberal Order." *Foreign Affairs* 93 (3): 80–90.
- JERVIS, ROBERT. 1997. "Complexity and the Analysis of Political and Social Life." *Political Science Quarterly* 112 (4): 569–93.
- JOHNSON, DAVID. 2003. "Social Interdependence: Interrelationships Among Theory, Research, and Practice." *American Psychologist* 58 (11): 934–45.
- KALYANPUR, NIKHIL, AND ABRAHAM NEWMAN. 2019. "The MNC-Coalition Paradox: Issue Salience, Foreign Firms and the General Data Protection Regulation." *JCMS: Journal of Common Market Studies* 57 (3): 448–67.
- KEJI RIBAO. 2018. "We Cannot Access Core Technology through Begging for Alms." *Science and Technology Daily*. April 19. Accessed May 9, 2023. https://www.kepuchina.cn/djt/201804/t20180419_586449.shtml.
- KENNEDY, ANDREW, AND DARREN LIM. 2018. "The Innovation Imperative: Technology and US–China Rivalry in the Twenty-First Century." *International Affairs* 94 (3): 553–72.
- KENNEDY, PAUL. 1989. *The Rise and Fall of the Great Powers: Economic Change and Military Conflict from 1500 to 2000*. 1st Vintage Bks ed., January. New York, NY: Vintage.
- KERTZER, JOSHUA D., BRIAN C. RATHBUN, AND NINA SRINIVASAN RATHBUN. 2020. "The Price of Peace: Motivated Reasoning and Costly Signaling in International Relations." *International Organization* 74 (1): 95–118.
- KITSCHOLT, HERBERT. 1991. "Industrial Governance Structures, Innovation Strategies, and the Case of Japan: Sectoral or Cross-National Comparative Analysis?" *International Organization* 45 (4): 453–93.
- LEGRO, JEFFREY. 2007. "What China Will Want: The Future Intentions of a Rising Power." *Perspectives on Politics* 5 (3): 515–34.
- LEON, DAVID PAK YUE. 2017. "Economic Interdependence and International Conflict: Situating China's Economic and Military Rise." *Asian Politics & Policy* 9 (1): 9–30.
- LEVY, JACK S. 1994. "Learning and Foreign Policy: Sweeping a Conceptual Minefield." *International Organization* 48 (2): 279–12.
- LI, WAN. 2018. "Accelerate the Formation of a Major Country's Innovation Ecosystem that Controls Core 'Chip' Technology." *Xuexi Shibao*, May 9. Accessed July 5, 2022. http://www.jsthinktank.com/zhikuyanjiu/201805/t20180509_5370502.shtml
- LOSACKER, SEBASTIAN, AND INGO LIEFNER. 2020. "Implications of China's Innovation Policy Shift: Does 'Indigenous' Mean Closed?" *Growth and Change* 51 (3): 1124–41.
- MANSFIELD, EDWARD, AND BRIAN POLLINS. 2001. "The Study of Interdependence and Conflict: Recent Advances, Open Questions, and Directions for Future Research." *Journal of Conflict Resolution* 45 (6): 834–59.
- MAOZ, ZEEV. 2009. "The Effects of Strategic and Economic Interdependence on International Conflict across Levels of Analysis." *American Journal of Political Science* 53 (1): 223–40.
- MEARSHEIMER, JOHN. 2021. "The Inevitable Rivalry: America, China, and the Tragedy of Great-Power Politics." *Foreign Affairs* 100: 48.
- MILLER, MATTHEW. 2014. "In China, U.S. Tech Firms Weigh 'Snowden Effect.'" *Reuters*, January 21. Accessed August 8, 2021. <https://www.reuters.com/article/uk-ibm-china/in-china-u-s-tech-firms-weigh-snowden-effect-idUKBREAO0K0G120140121>.
- MOE, ESPEN. 2007. "The Economic Rise and Fall of the Great Powers: Technological and Industrial Leadership Since the Industrial Revolution." *World Political Science* 3 (2): 1–37.
- MONTRESOR, SANDRO. 2001. "Techno-Globalism, Techno-Nationalism and Technological Systems: Organizing the Evidence." *Technovation* 21 (7): 399–412.
- MURPHY, BEN. 2022. "Chokepoints: China's Self-Identified Strategic Technology Import Dependencies." Center for Security and Emerging Technology, May. Accessed December 17, 2024. <https://cset.georgetown.edu/publication/chokepoints/>
- MURRAY, MICHELLE. 2018. *The Struggle for Recognition in International Relations: Status, Revisionism, and Rising Powers*. Oxford, UK: Oxford University Press.
- NATIONAL PEOPLE'S CONGRESS STANDING COMMITTEE. 2021. "Decision of the Standing Committee of the National People's Congress on Amending the 'Seed Law of the People's Republic of China.'" *Gov.cn*. December 25. Accessed July 8, 2022. http://www.gov.cn/xinwen/2021-12/25/content_5664477.htm.
- NATIONAL PEOPLE'S CONGRESS. 2021. "Resolution of the Fourth Session of the 13th National People's Congress on the Report on the Implementation of the Central and Local Budgets for 2020 and on the Central and Local Budgets for 2021." Accessed July 8, 2022. https://www.pkulaw.com/en_law/583a88e804122204bdfb.html.
- NATURAL RESOURCES PARTY LEADERSHIP GROUP. 2018. "Implementation Opinions of the Leadership Group of the Ministry of Natural Resources of the Communist Party of China on Deepening the Reform of the Science and Technology System and Improving the Efficiency of Science and Technology Innovation." Natural Resources Party leadership group, (2018) No.31. November 1. Accessed July 6, 2022. <https://www.pkulaw.com/chl/cb344a1871a0f676bdfb.html?keyword=%E4%B8%AD%E5%9B%BD%E7%A7%91%E5%AD%A6%202018%E5%B9%B4%2031%E5%8F%B7%20&way=listView>.
- NELSON, RICHARD. ed., 1993. *National Innovation Systems: a Comparative Analysis*. Oxford, UK: Oxford University Press.
- NORRIS, WILLIAM J. 2016. *Chinese Economic Statecraft: Commercial Actors, Grand Strategy, and State Control*. Ithaca, NY: Cornell University Press.
- ONEAL, JOHN R., AND BRUCE RUSSETT. 1999. "The Kantian Peace: the Pacific Benefits of Democracy, Interdependence, and International Organizations, 1885–1992." *World Politics* 52 (1): 1–37.
- . 2001. "Clear and Clean: the Fixed Effects of the Liberal Peace." *International Organization* 55 (2): 469–85.
- PARTY LITERATURE RESEARCH CENTER OF THE CPC CENTRAL COMMITTEE, ed. 2016. *Excerpts of Xi Jinping's Discussions on Scientific and Technological Innovation*. Beijing: Central Party Literature Press.
- PAUL, T. V. 2016. *Accommodating Rising Powers: Past, Present, and Future*. Cambridge, UK: Cambridge University Press.
- PEARSON, MARGARET, MEG RITHMIRE, AND KELLE T. TSAI. 2022. "China's Party-State Capitalism and International Backlash: From Interdependence to Insecurity." *International Security* 47 (2): 135–76.
- PIETROBELLI, CARLO, AND ROBERTA RABELLOTTI. 2011. "Global Value Chains Meet Innovation Systems: Are There Learning Opportunities for Developing Countries?" *World Development* 39 (7): 1261–9.
- RENMINWANG. 2012. "Hu Jintao and Xi Jinping Attend the Expansion Conference of the Central Military Commission and Deliver Important Speeches." November 18. Accessed September 30, 2020. <http://cpc.people.com.cn/n/2012/1118/c64094-19612150-1.html>.
- . 2013. "Xi Jinping Visited the Jiuquan Satellite Launch Center of a Base of the Air Force and Officers and Soldiers of the Lanzhou

- Military Region." February 7. Accessed August 31, 2020. <http://cpc.people.com.cn/n/2013/0207/c64094-20456431.html>.
- SAXENIAN, ANNALEE. 1996. *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*. Cambridge, MA: Harvard University Press.
- . 2007. *The New Argonauts: Regional Advantage in a Global Economy*. Cambridge, MA: Harvard University Press.
- SCIENCE AND TECHNOLOGY PARTY LEADERSHIP GROUP. 2018. "Opinion of the Party Group of the Ministry of Science and Technology of the Communist Party of China on Adhering to the Guidance of Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, Promoting Major Tasks of Scientific and Technological Innovation, Implementing and Deepening Institutional Reform, and Accelerating the Construction of an Innovative Country." Science and Technology Party leadership group (2018) No.1. May 16. Accessed July 30, 2022. https://most.gov.cn/xxgk/xinxifenlei/fdzdgnr/fgzc/gfxwj/gfxwj2018/201805/t20180522_139604.html.
- SEGAL, ADAM. 2014. "China's New Small Leading Group on Cybersecurity and Internet Management." *Council on Foreign Relations*, February 27. Accessed June 21, 2022. <https://www.cfr.org/blog/chinas-new-small-leading-group-cybersecurity-and-internet-management>.
- SNYDER, QUDDUS. 2013. "Integrating Rising Powers: Liberal Systemic Theory and the Mechanism of Competition." *Review of International Studies* 39 (1): 209–31.
- STATE COUNCIL GENERAL OFFICE. 2019. "Guiding Opinions of the General Office of the State Council on Supporting National-Level New Areas to Deepen Reform and Innovation and Accelerate High-quality Development." State Council General Office (2019) No. 58. December 31. Accessed July 15, 2022. <https://www.pkulaw.com/chl/287355294eda2d22bdfb.html?keyword=%E5%9B%BD%E5%8A%A1%E9%99%A2%202019%E5%B9%B4%2058%E5%8F%B7&way=listView>.
- STATE COUNCIL. 2018. "Guiding Opinions of the State Council on Accelerating the Transformation and Upgrading of Agricultural Mechanization and Agricultural Machinery Equipment Industry." State Council (2018) No. 42, December 21. Accessed July 15, 2022. <https://www.pkulaw.com/chl/518c90c9595791aebdfb.html?keyword=%E5%9B%BD%E5%8A%A1%E9%99%A2%202018%E5%B9%B4%2042%E5%8F%B7&way=listView>.
- . 2020. "Report on the Work Situation of the State Council Regarding the Reform of the Stock Issuance Registration System." October 15. Accessed June 29, 2022. <http://www.npc.gov.cn/npc/c30834/202010/a8cdd4b7f694bc7a6b3719df029df6a.shtml>.
- . 2023. "Explanation of the State Council Institutional Reform Plan, March 7, 2023, at the First Meeting of the 14th National People's Congress." Accessed April 30, 2023. https://www.gov.cn/guowuyuan/2023-03/08/content_5745356.htm.
- STEPHEN, MATTHEW. 2014. "Rising Powers, Global Capitalism and Liberal Global Governance: A Historical Materialist Account of the Brics Challenge." *European Journal of International Relations* 20 (4): 912–38.
- STOCKMANN, DANIELA. 2013. *Media Commercialization and Authoritarian Rule in China*. New York, NY: Cambridge University Press.
- SULLIVAN, JAKE. 2022. "On-the-Record Press Call by National Security Advisor Jake Sullivan Previewing the Biden-Harris Administration's National Security Strategy." The White House. October 12. Accessed March 4, 2025. <https://bidenwhitehouse.archives.gov/briefing-room/press-briefings/2022/10/12/on-the-record-press-call-by-national-security-advisor-jake-sullivan-previewing-the-biden-harris-administrations-national-security-strategy/>.
- SUTTMEIER, RICHARD, AND XIANGKUI YAO. 2004. "China's Post-WTO Technology Policy: Standards, Software, and the Changing Nature of Techno-Nationalism." The National Bureau of Asian Research (NBR). May 1. Accessed June 29, 2022. <https://www.nbr.org/publication/chinas-post-wto-technology-policy-standards-software-and-the-changing-nature-of-techno-nationalism/>.
- TAN, YELING. 2021. *Disaggregating China, Inc: State Strategies in the Liberal Economic Order*. Ithaca, NY: Cornell University Press Studies In Political Economy Series.
- TAYLOR, MARK. 2016. *The Politics of Innovation: Why some Countries Are Better than Others at Science and Technology*. New York, MNY: Oxford Univeristy Press.
- THUN, ERIC, DARIA TAGLIONI, TIMOTHY STURGEON, AND MARK P. DALLAS. 2022. "Massive Modularity: Understanding Industry Organization in the Digital Age." Policy Research working paper; no. WPS 10164. Washington, D.C.: World Bank Group.
- VAYNMAN, JANE, AND TRISTAN A. VOLPE. 2023. "Dual Use Deception: How Technology Shapes Cooperation in International Relations." *International Organization* 77 (3): 599–32.
- WALTZ, KENNETH. 1979. *Theory of International Politics*. New York, NW: McGraw-Hill.
- WEEDE, ERICH. 2010. "The Capitalist Peace and the Rise of China: Establishing Global Harmony by Economic Interdependence." *International Interactions* 36 (2): 206–13.
- WEINSTEIN, DAVE. 2014. "Snowden and U.S. Cyber Power Forum: A Post-Snowden Cyberspace." *Georgetown Journal of International Affairs* 15 (Special Issue): 4–11.
- WU, LIHUA. 2019. "Achieve Strategic Breakthroughs in Key Areas through Independent Innovation." *Economic Information Daily*. May 2. Accessed May 9, 2023. http://www.jjckb.cn/2019-05/21/c_138075404.htm.
- XI, JINPING. 2015. "Explanation on the Central Committee of the Communist Party of China on the Formulation of National Economic and Social Development Proposals for the Thirteenth Five-Year Plan." November 4. Accessed June 28, 2022. <https://www.ndrc.gov.cn/fggz/fzlggh/gjfgzh/201605/P020191029595712120771.pdf>.
- . 2020. "Explanation on 'the Central Committee of the Communist Party of China's Proposals on Formulating the Fourteenth Five-Year Plan for National Economic and Social Development and the Long-term Goals for 2035.'" November 4. Accessed June 28, 2022. <http://cpc.people.com.cn/n1/2020/1104/c64094-31917783.html>.
- . 2022. "Accelerate the Construction of a Scientific and Technological Power to Achieve High-Level Self-Reliance in Science and Technology." *Qinshiwang*. April 30. Accessed July 17, 2022. http://www.qstheory.cn/dukan/qs/2022-04/30/c_1128607366.htm.
- XIE, FEIBO. 2014. "Xie Feibo: Vigorously Promote the Localization of Wireless Frequency Tube Technical Equipment." September 16. Accessed May 12, 2023. <https://www.eetop.cn/communication/45451.html>.
- XINHUA NEWS AGENCY. 2013. "CPC Central Committee's Decision on the Key Issue of Deepening Reform at All Levels." November 15. Accessed May 24, 2023. http://www.gov.cn/jrzq/2013-11/15/content_2528179.htm.
- . 2016a. "The General Office of the Central Committee of the Communist Party of China and the General Office of the State Council Issued the 'National Informatization Development Strategy Outline.'" July 27. Accessed June 15, 2022. http://www.gov.cn/zhengce/2016-07/27/content_5095336.htm.
- . 2016b. "The Central Committee of the Communist Party of China and the State Council Issued the 'National Innovation-Driven Development Strategy Outline.'" May 19. Accessed July 17, 2022. http://www.gov.cn/zhengce/2016-05/19/content_5074812.htm.
- . 2016c. "Xi Jinping Presided Over a Symposium on Network Security and Informatization Work in Beijing." April 19. Accessed September 30, 2020. http://www.gov.cn/xinwen/2016-04/19/content_5065897.htm.
- . 2016d. "The National Science and Technology Innovation Conference, the Academician Conference of the Chinese Academy of Sciences and the Chinese Academy of Sciences, and the Ninth National Congress of the China Association for Science and Technology were Held in Beijing." May 30. Accessed June 23, 2022. http://www.gov.cn/xinwen/2016-05/30/content_5078085.htm#1.
- . 2016e. "The Political Bureau of the Central Committee of the Communist Party of China Conducts the 36th Collective Study on the Implementation of the Strategy of Strengthening the Country through the Internet." October 9. Accessed July 17, 2022. http://www.gov.cn/xinwen/2016-10/09/content_5116444.htm.
- . 2018. "Xi Jinping Attends the National Network Security and Informatization Work Conference and Delivers an Important Speech." April 21. Accessed September 30, 2020. http://www.gov.cn/xinwen/2018-04/21/content_5284783.htm.
- . 2019a. "Xi Jinping Presided Over the 12th Collective Study of the Political Bureau of the CPC Central Committee and Delivered an Important Speech." January 25. Accessed September 30, 2020. http://www.gov.cn/xinwen/2019-01/25/content_5361197.htm.
- . 2019b. "The 'Decision' of the Fourth Plenary Session of the 19th CPC Central Committee." *Huanqiuwang*. November 5. Accessed July 17, 2022. <https://china.huanqiu.com/article/9CaKrnKnC4J>.

- XU, XI SHIBAO. 2019. "Moving Better and Faster towards a Strong Science and Technology Nation—Interview with Bai Chunli, Party Secretary and President of the Chinese Academy of Sciences." *Study Times*. March 13. Accessed May 7, 2022. https://www.cas.cn/zkyzs/2019/03/191/cmsm/201903/t20190319_4685762.shtml.
- YU, JIANBIN. 2018. "Start a Wave of Innovation from a Global Perspective." *People's Daily Online*. April 25. Accessed Jun 2, 2022. <http://opinion.people.com.cn/n1/2018/0425/c1003-29947992.html>.
- YU, ZHONGYUAN. 2013. "Be Alert to PRISM and Promote the Localization of Core Technologies." *Government Procurement Information*. July 5. Accessed May 17, 2021. <https://m.caigou2003.com/article/yllzc?articleId=387756278635560960>.
- ZHANG, HUIWU. 2013. "Reminder: Do Not Forget about Independent Innovation." *Liberation Army Daily*. September 9. Accessed May 26, 2023. <http://mil.news.sina.com.cn/2013-09-09/0500739456.html>.
- ZHANG, JIAN, FAN RUI, FAN SHUO, AND WANG MENGXIN. 2023. "the Logic and Significance of the Reorganization of the Ministry of Science and Technology." *Caijing E-Law*. March 11. Accessed April 11, 2023. https://news.caijingmobile.com/article/detail/487627?source_id=40.