World Trade Review (2021), **20**, 152–168
doi:10.1017/S1474745620000567

ORIGINAL ARTICLE

Re-emergence of Great Power Conflict and US Economic Statecraft

Linda Weiss

Department of Government & International Relations University of Sydney, Australia
Email: linda.weiss@sydney.edu.au

(Received 11 March 2020; accepted 2 November 2020; first published online 7 January 2021)

Abstract
After almost two decades of dealing with asymmetric threats, America's strategic focus on technological superiority carefully honed during the Cold War, began to fracture, eroding its military and economic advantage. But China's recent emergence as a credible geopolitical rival has reinvigorated US efforts to sustain high-tech leadership as the basis of its military primacy. At the center of these efforts are the defense and defense-related agencies of the national security state (NSS) whose mission is to dominate the new technological frontiers of military power and achieve future competitive advantage. Alongside the quest for breakthroughs in foundational technologies, NSS agencies are seeking to correct long neglected deficiencies in advanced manufacturing, by rebuilding the industrial ecosystem's supply chains depleted after decades of offshoring. With this suite of initiatives, the US is following a course of action more consistent with the exercise of (economic) statecraft than industrial policy. However, unlike its authoritarian rival, the US faces the challenge of having to balance security imperatives with commercial interests and, not least, having to contend with a dysfunctional and maladapted presidency.

> We're a frontier nation, we make things. It's really how we think about ourselves. And so getting this right and not losing this capability and not having it atrophy is an existential issue for us as a nation … prosperity and security are intertwined, and the wellspring of both I believe is the industrial commons.
>
> *Jeffrey Wilcox, Vice President, Digital Transformation Lockheed Martin Corporation Keynote Speech at Study Workshop, 28 January 2019*

1. Introduction

Barely six years ago, Peter Katzenstein posed the question: why didn't the United States view China as a peer adversary, a threat to be reckoned with in the same way it had perceived the Soviet Union during the Cold War era? The question still made sense in late 2013, when China's push for global dominance was emergent rather than explicit and visible, and its technological prowess and geopolitical ambitions remained unclear. Katzenstein's question was directly motivated by the argument made in my draft for a book, subsequently published in 2014. There I argue that great power conflict is key to understanding how the United States became the world's high-tech hegemon after 1945. Conflict between the United States and Soviet Russia was paramount in driving the creation and expansion of the 'innovation and enterprise engine' embedded in America's national security state (NSS). In Soviet aggression, Washington perceived an existential threat from a well-matched adversary, and this sense of vulnerability catalyzed a national push for technological dominance.

Sustained geopolitical rivalry motivated Pentagon planners to pursue high-tech supremacy as a national security imperative. That strategy imbued a cluster of national security agencies with a mission to pursue trail-blazing innovations and a tolerance for costly long-term investments. It is those efforts, the result of concerted national security policymaking, which have spawned numerous radical general-purpose technologies that not only underpin US military primacy, but also power the modern economy (think computing and software, semiconductors, communications satellites, the internet, GPS, and autonomous vehicles). And who can say that Silicon Valley would have flourished and grown to adulthood without decades of nurturing NSS investments and early demand for its innovations (O'Mara, 2005)?

Geopolitical conflict between two well-matched adversaries was important also for the domestic political consensus it encouraged, as well as the laser-like focus it lent to the NSS innovation engine in pursuit of technological superiority (so-called 'overmatch' in current terminology). However, both the bipartisan support for and the strategic focus of the NSS innovation enterprise were eventually fractured by the removal of that external challenge. The effect of these changes, together with the emergence of new asymmetric threats from the late 1990s onwards, served to disrupt the NSS innovation focus, diluting its larger strategic priorities in favour of more short-term goals. As the Department of Defense (DOD) recently admitted in reflecting on this trajectory, 'Today, we are emerging from a period of strategic atrophy, aware that our competitive military advantage has been eroding' (United States Department of Defense, 2018).

Indeed, as the United States entered the twenty-first century, it appeared to a number of analysts that the heyday of major government-sponsored innovation breakthroughs – the general-purpose technologies that delivered US military and commercial superiority – was numbered, if not entirely over (Ruttan, 2006, for a critique see Weiss, 2014, chapter 7).

This brings us back to our opening question: why wasn't China then seen in the same light, as a threat to keep the US on its technological toes? (A related question we return to below is whether technological wizardry in itself is sufficient to sustain military and commercial leadership.) Japan after all, even as an ally, presented a pressing challenge to US technology leadership through the late 1970s and 1980s. By impinging on the US strategic imperative to dominate the technology space, Japan's rise helped keep the innovation engine running to produce new breakthrough initiatives, even as the Cold War thawed. By contrast, at the time I was writing in 2013, China's technological (as opposed to its manufacturing) capabilities were not seen as sufficiently advanced to challenge US techno-superiority. In particular, the crown jewels of US innovation – its microelectronics (semiconductor) technology – still remained largely in US (and to some extent in European and Japanese) hands. Indeed, until very recently many commentators saw China less as a potentially threatening superpower than as a strong regional and rising economic power that was containable with diplomacy and economic cooperation (see, for example, the 2015 National Security Strategy).

This picture of apparent US equanimity towards China has now shifted decisively as Beijing more openly flexes its military and economic muscles. Increasingly, numerous reports draw attention to Beijing's panoply of aggressive and illegal strategies to obtain high-technology by way of 'forced' transfer[1] and cyber espionage, to its menacing military maneuvers throughout the Southeast Asian region, and to its globally expansionist projects that create ties of economic dependence and resource access through its belt-and-road strategy. Above all, it is the Chinese Communist Party's 2015 launch of its Made in China 2025 plan, in combination with its 13th Five Year Plan of 2016–2020, and its Mega Project Priorities that have brought home to

[1]Forced technology transfer is prohibited by the World Trade Organization rules. Yet, as some have noted, no one is holding a gun to foreign companies' heads to hand over their intellectual property. It is a choice they make in exchange for market access.

https://doi.org/10.1017/S1474745620000567 Published online by Cambridge University Press

Washington the scope and seamlessness of Beijing's geopolitical and geoeconomic ambitions.[2] The United States is now paying attention.[3] Reflecting this year on the 2014 Pentagon initiative known as the 'Third Offset'[4] (emphasizing innovation at the frontier and more agile procurement practices to secure military advantage), former Deputy Defense secretary Robert Work lamented the document's failure to specify the Chinese threat and thereby inject a more heightened sense of urgency. In his words: 'I would have said, "The Chinese are coming, the Chinese are coming, the Chinese are coming"' (in Brennan, 2019). Now that the United States recognizes that the Chinese are indeed coming, the competitive dynamics between the two are likely to intensify as Chinese companies increasingly dominate global production networks.

2. Re-emergence of Great Power Competition

Though dormant for a time, the notion of great-power competition came into its own with Washington's release of its National Security Strategy in 2017, shortly followed by publication of the Pentagon's National Defense Strategy (NDS). The NDS document emphasizes 'the re-emergence of long-term strategic competition' as the 'central challenge to US prosperity and security' and the principal priority for the DOD, requiring both 'increased and sustained investment' (United States Department of Defense, 2018, 1–2).

While intelligence reports single out both China and Russia as the nation's strategic competitors, it is clearly China that is seen as the 'number one threat' on a global scale (Defense One Staff, 2019). In a recent Congressional testimony, DOD officials gave prominence to the China threat, declaring that 'China, in particular, has made it a national goal to acquire foreign technologies to advance its economy and to modernize its military'. They noted that China is 'comprehensively targeting advanced US technologies and the people, the information, businesses and research institutions that underpin them'; it is also implementing industrial policies at such a scale as to 'pose a multifaceted threat' that is putting at risk 'the entire national security innovation base' (in Ferdinando, 2018).[5] In this assessment of China's reach into America's economy and society, we see a more expansive concept of national security that speaks to a heightened sense of US vulnerability.

With great power potential in both military and commercial arenas, it seems clear that – unlike Russia – China can bake its cake and eat it too. While Russia has built strong S&T capabilities that make it a well-matched *military* adversary for the United States (not least in cyber technology), it still falls far short on the economic side. By contrast, China's fusion of central political command with a market-style economy has created capabilities that unleash the potential to prevail in both military and economic arenas. Tellingly, for the first time in 150 years, the US now faces the

[2]A recent Defense report on China's industrial policy outlined five major methods China uses to acquire US technologies and intellectual property, including: (1) industrial espionage and sabotage through traditional spycraft, cyber espionage, and reverse engineering, counterfeiting, and piracy; (2) evasion of US restrictions on technology transfers; (3) coercive regulatory gambits to force technology transfers from US companies, typically in exchange for limited access to the Chinese market; (4) state-sponsored strategic Chinese investment in the US through vehicles such as acquisitions, greenfield investment, and VC financing, often using elaborate front companies and opaque investor networks; and (5) the harvesting of America's national security innovation base through a massive open source collection campaign; the presence of large cadres of state-directed Chinese nationals at America's universities, national labs, and other centers of innovation; and a highly coordinated and government-financed program of talent recruitment aimed at business, finance, science, and technology experts. For discussion, see the White House Office of Trade and Manufacturing Policy (2018) report on Chinese economic aggression.

[3]Even Australia, though heavily dependent on China's demand for mineral resources, appears to be awakening from its 'she'll-be-right-mate' slumber as multiple aspects of China's 'silent invasion' have recently come to light (see Hamilton, 2018; Hastie, 2019).

[4]Though the DOD no longer favours the term itself, its core ideas still linger in the National Defense Strategy's reorientation to great power competition (see McCormick et al., 2018).

[5]Drawn from testimony of several Defense officials to the House Armed Services Committee's military personnel subcommittee.

challenge of competing ‘with an economic rival that could be larger than its own economy’ (Brown and Singh, 2018).

The implication of this difference is clear. In light of China’s challenge to its technological pre-eminence, the United States can no longer afford to be complacent about its techno-industrial slide. US military power is still intact, but this relies on the ability to reinforce its technological and economic prowess to sustain that advantage. For commentators both inside and outside the NSS, there is now urgency to this endeavour. After reviewing what the Chinese military have already accomplished in the last two decades and what they are planning to do over the next decade, former deputy secretary of Defense, Robert Work, declared that ‘any objective assessment … must conclude that the US joint force is perilously close to being the victim of a very patient, exquisitely targeted and robustly resourced … offset strategy’ (Work and Grant, 2019).

A key question is whether – and how – the United States can secure its technological and commercial superiority in the face of China’s own prowess and determined leadership. Many known and unknown factors are at play in ensuring that outcome, not least of which is the impact of polarized domestic politics and a shambolic national leadership. There is also a good deal of lost time to recoup. For as we see next, what goes up can also come down.

3. Fall and Rise of US Techno-Strategy

3.1 Fall: From an Era of High-Level Innovation to a Relative Stalling of the Innovation Engine

In the past, the American people and its leadership had the advantage of what has come to be known as its ‘Sputnik’ moment. Russia’s demonstration of its superior satellite technology in 1957 sent shock waves that reverberated throughout the country. This world-first achievement was met in the US with a mix of fear and awe and its impact was momentous – broad, deep, and lasting. It was a galvanizing force like no other in the post-war period. Set against America’s own failed effort to launch a satellite (fast-tracked by the Navy), the success of its geopolitical rival had a devastating impact on morale and led to a period of ‘genuine consternation, followed by a veritable orgy of national self-examination and self-criticism’ (Watson in Stuart, 2008, 321).[6] As a result, Sputnik sparked an innovation panic that triggered the so-called space age and a new era of institution (and nation) building. To boost innovation efforts, the federal government founded two new research and technology-oriented agencies (the Defense Advanced Research Projects Agency (DARPA) and the National Aeronautics and Space Administration (NASA), expanded the National Institutes of Health (NIH), centralized DOD science and technology policy by creating the position of Deputy Director of Research and Engineering, and created a hybrid institution to seed a modern venture capital industry: the Small Business Investment Corporation (SBIC). SBIC spearheaded a network of government-backed venture funds by prompting the federal government to fill a gap in the investment infrastructure for high-risk innovation (Weiss, 2014). As historian Walter McDougall (1982, 1011) writes, ‘Sputnik triggered an abrupt discontinuity’, transforming governments into ‘self-conscious promoters, not just of technological change but of perpetual technological revolution’. In sum, the catalytic effect of Sputnik was to propel the fledgling NSS into a sustained race for technological supremacy, and in a way that transcended partisan rivalries.[7]

By contrast, China’s new high-tech capabilities have triggered no such whole-of- government reaction. As analysts at the Center for a New American Security observe, ‘The United States may very well be in a new space race, but … has not yet experienced a true ‘Sputnik moment” from the perspective of the broader public and policymakers’ (Horowitz et al., 2018) No single event has framed the threat from China in such a dramatic way as did the Soviet success in launching the world’s first satellite. Instead, China’s rise as a high-tech power has taken shape much more

[6]On the psychological and cultural impact of the Sputnik launches see McDougall (1982).

[7]For the detailed discussion of the origins and evolution of the NSS as a technology enterprise, see Weiss (2014), chapter 2.

gradually and somewhat less visibly, bringing to mind the proverbial frog unaware of the rising temperature of the water. It is as if Deng Xiaoping's foreign policy guidelines transmogrified into a Party slogan: 'Keep a low profile and bide our time, while actively getting something accomplished' (*Taoguang Yanghui, Yousuo Zuowei*).

While China was biding its time, US energies were being consumed by war and conflict in the Middle East. Technology projects increasingly aimed at addressing the short-term needs of contingency operations in overseas campaigns. Other changes too impacted on the NSS technology enterprise. Most generally and perhaps most importantly was the demise of its powerful geopolitical rival and the emergence of new asymmetric threats. The end of the Cold War removed the perception of an existential threat, only to be replaced by multiple threats from lesser adversaries. This had the two-fold effect of displacing the strategic focus on advancing the US technological frontier and reducing the external pressure that made science and technology innovation a national security priority for *both* sides of politics.

In addition, from the 1990s through the 2000s, structural changes in domestic markets became less conducive to the catalytic role of the defense sector. A large government market and sizable research and development (R&D) budget, relative to those of the private sector, once gave the national security mission agencies considerable influence over the direction of technology, leading to a host of revolutionary general-purpose innovations for both defense and commerce.[8] But as the new century wore on, public–private shifts in R&D spending and the rapid explosion of commercial innovation in the private sector began to erode the technology edge essential to US military strategy. Many Silicon Valley firms that were nurtured on NSS contracts began turning away from government to exploit more profitable commercial markets, and innovations in the private sector (especially in software) rapidly outpaced capabilities in the traditional defense sector.

Military leaders and technology analysts feared that the NSS innovation engine had begun to sputter, and with it, the source of so many transformative innovations that powered US military and commercial leadership throughout the Cold War and beyond (Ruttan, 2006).[9] Whatever the precise combination of factors, by no means least important was the disappearance of a major geopolitical rival. All this was about to change in the mid-2010s as China stepped into that role. As security scholars have noted, until approximately 2015, 'US policy was based on the view that it could remain considerably ahead of China, both militarily and economically; that US businesses and society more generally could benefit from trade with China; and that economic interdependence would eventually lead China to liberalize politically and economically, thereby dampening China's incentives to challenge US primacy'. This view was articulated in Obama's National Security Strategy released in February 2015. Almost every aspect of this view came under challenge during the final period of the Obama administration and increasingly during the Trump administration (Foot and King, 2019).

3.2 Rise: Resurgence of the US Innovation Engine

After two decades of responding to terrorism and counterinsurgency, the NSS has come to perceive in its new peer adversary a clear geopolitical threat and strategic target on which to focus its technological endeavours. If there had been any doubt beforehand, China's 2015 announcement of its *Made In China (MIC) 2025 Plan* – backed by an industrial policy with massive financing, and subsidies in the hundreds of billions of dollars – helped crystallize the view in Washington that Beijing was determined to displace the US as the world's technological and military

[8] Even though the US government remains the single largest spender on R&D in the world, its share of total US R&D spending has declined from a high of 53.9% in 1953 to 24.1% in 2016, according to Santacreu et al. (2018).

[9] Ruttan was also concerned that the relative decline of the defense market and R&D support vis-à-vis that of the private sector, had reduced the sway that national security mission agencies once had on the direction of technology.

https://doi.org/10.1017/S1474745620000567 Published online by Cambridge University Press

superpower. Particularly influential in reshaping US thinking was the DOD's so-called 'DIUx Report' which revealed that for the first time the US had lost ground to China in a key emerging technology such as artificial intelligence (AI) (Laskai and Sacks, 2018). Moreover, US–China economic and strategic competition is intensifying at the same time as a range of emerging technologies – not least AI and quantum computing – are poised to transform the character of strategic interstate conflict, potentially disrupting the military status quo (Kania, 2018a, 2). But if China is to surpass the US on the quantum and AI fronts, it must master microelectronics. This is why one area China has targeted for global leadership is the design and production of semiconductors – a strategy reliant on large-scale spending (estimated at $150 billion) to boost R&D, design and manufacturing, in addition to subsidizing foreign acquisitions and investment over a 10-year period (Brown and Singh, 2018, 11).

Since technology for the US can never be simply a commercial matter, the China project has had the effect of completely re-energizing the drive for technological superiority within the NSS. Indeed, China's whole-of-nation strategy of military–civil fusion (see Kania 2018b) – which aims to create and leverage synergies between defense and commercial developments in dual-use sectors – has lit a fire under the entire US political and national security establishment. The most immediately visible (and tangible) response has been an outpouring of official reports, legislation, and initiatives for recapturing US leadership in a host of sectors that have generated bipartisan support. Examples include the 'United States 5G Leadership Act of 2019'; the US 'Global Leadership in Advanced Manufacturing Act' (2019); the Executive Order on Maintaining American Leadership in Artificial Intelligence (2019); 'Winning the Future: A Blueprint for Sustained US Leadership in Semiconductor Technology (2019)'; the American Super Computing Leadership Act of 2017; and the American Innovation Act (2017) that authorizes large expansions in funding for sustained national investment in basic science research at key federal agencies.

Following through on these specific statements of policy, it would appear that a clear shift is now underway with the launch of new programs that cover everything from High Performance and Quantum Computing to Artificial Intelligence, Microelectronics, and Advanced Manufacturing. (As an aside, the question remains as to whether the funding will be adequate.) Microelectronics is especially important because silicon chips are a key enabler of superior hardware and software. As an earlier report observed: '[I]f there is any single industry whose technological progress and competitiveness are critical to the economic growth and national security of the United States, it is electronics.'[10] Currently semiconductors underpin the Pentagon's top technology focus on artificial intelligence, machine learning, robotics, autonomous and unmanned systems, advanced manufacturing, quantum computing, cyber, space, and biotechnology.

In this game-changing technology for both commerce and national security, China still lags. Reflecting earlier on why China had not sparked the techno rivalry seen with Soviet Russia, and then Japan, I ventured that Chinese firms were still perceived to be far from the frontier and especially 'far from mastering the design of semiconductor technology, which the Pentagon views as the litmus test of technology leadership' (Weiss, 2014, 232). In January 2017, an influential analysis from the President's Council of Advisors on Science and Technology (PCAST) reported that 'after more than a decade of failed attempts … Chinese manufacturing of advanced-logic chips is significantly behind the state of the art in the United States, Taiwan, and elsewhere' (President's Council of Advisors on Science and Technology (PCAST), 2017, 7). Even efforts to reverse engineer advanced chip technology would take a number of years, by which time, the technology would have moved on. This consideration perhaps goes some way to explaining the degree of complacency (or hubris?) that persisted in the face of numerous NSS warnings about the worsening state of US domestic capabilities in advanced microelectronics, material shortages, counterfeit

[10]So remarked the OTA in 1983 at the height of Japan's challenge to the US semiconductor industry. It catalyzed the creation of Sematech, the DOD-led partnership with Silicon Valley companies to revitalize the industry (Van Atta and Slusarczuk, 2012).

https://doi.org/10.1017/S1474745620000567 Published online by Cambridge University Press

issues arising from reliance on foreign suppliers, and diminishing manufacturing sources. In spite of all the calls for action, little remedial action was undertaken (Defense Science Board (DSB) 1987, 2005; United States Government Accountability Office (GAO), 2015; PCAST, 2017). With the benefit of hindsight, what seems clear is that an external impetus for remedial action in this critical arena has been lacking – until now. Whether even that impetus will prove sufficient to compensate for the incoherent, maladapted leadership of the Trump administration is far from clear.

These obstacles aside, Beijing's big drive to achieve global leadership in the design and production of semiconductors – key to advancing its geostrategic ambitions – has helped to jump-start new US programs. These new programs are intended to address long-standing concerns stemming from the offshoring of its supply base and the slowdown of innovation in chip design. The need to build or, rather, rebuild an onshore capability is a prominent theme in both initiatives. These remedial efforts stem from a recognition that the broader community is potentially impacted not just through direct actions of external adversaries, but also through the vectors of foreign supply chains in which Chinese companies dominate. On this issue, Cohen and Rogers and Evenett (this issue) speak to the broader commercial and policy concerns around Chinese supply-chain dominance. Although still strong in design and manufacturing of integrated circuits, US companies are increasingly investing in design and fabrication services offshore. The problem with offshoring, a recent report concluded, is that it threatens DOD's access to a trusted and assured supply and gives adversaries the ability to '[manipulate] supply chain control to their advantage and our detriment'. Of particular concern is the decline in the amount of hardware being built in the United States. Pentagon officials note that while Taiwan, an ally, produces up to 80% of the microelectronics used in the United States, the small island sits 'uncomfortably close to a nation that has in many ways declared itself to be an adversary to the United States' (Griffin in McLeary, 2018). A related concern is that if Taiwan's microelectronic manufacturing succumbed to a cyberattack, it would undermine the ability of both the Pentagon and private sector to replace existing systems.

To address these current threats to its leadership in microelectronics and prepare for future needs, DOD has launched two major new programs. The first is the Microelectronics Innovation for National Security and Economic Competitiveness (MINSEC) strategy launched in 2018. With a budget of $1.55 billion over five years, MINSEC's task is to sponsor advanced microelectronics for both government and commercial national security applications – not just to maintain US leadership, but also to create a secure domestic microelectronics ecosystem, and develop a competitive industrial base of onshore suppliers (Muldavin, 2017).

The rationale for MINSEC articulates the more expansive view of national security that informs current policy in this new era of digital transformation. Although defense-driven, the program is designed with a 'broader national security community' in mind.[11] This community includes commercial industry, financial institutions, and critical infrastructure, and shares with defense an exposure to the risks of overseas fabrication. Accordingly, MINSEC addresses several problems of national concern: options for trusted domestic manufacture of custom DOD electronics are diminishing; most commercial off-the-shelf electronics are made overseas, hence at 'significant risk' from tampering; the shift in electronics fabrication also creates potential for overseas control and this in turn undermines electronics based growth delivered by a commercially competitive industry. Thus, a core aim is to restore and build up a US-based microelectronics ecosystem, one that can manufacture custom DOD electronics and expand government access to trusted chip supplies.

The other important response to the challenge from Beijing is DARPA's Electronics Resurgence Initiative (ERI) launched a year earlier than MINSEC. ERI's cluster of programs

[11]Feng and Laskai (2019) argue that sensitivity to a wide array of potential threats which is now widely shared across the political divide, encompasses 'the economic livelihood of the United States, the integrity of its citizens personal data, and the country's technological advantage'. Congressional responses to China's technology transfer efforts, in particular, include efforts to overhaul foreign investment rules governing acquisitions of US companies, and tighten export licensing of dual-use technologies.

aims to counter 'two common enemies – the decline of Moore's Law and the rise of China' (Merritt, 2018). Its investments, estimated at $1.5 billion over five years, focus on developing next generation technology with matching funds from industry. To that end, DARPA is collaborating with a broad range of defense, academic, and commercial semiconductor partners, all based in the United States. A core objective is to vault beyond the soaring costs and complexity of building new electronic devices by revolutionizing both chip design and manufacturing. DARPA's initiative intends to support domestic manufacturing options, which could provide both application-specific and general integrated circuits and thus cater to diverse needs and users in both the defense and commercial sectors.[12] However, the ERI initiative involves hard technologies that need scaling up and manufacturing, and DARPA has traditionally relied heavily on entrepreneurial start-ups for this process. But the sidelining of hardware start-ups by US venture capital and the severe decline of the manufacturing base (discussed below) now poses a significant challenge for DARPA at the implementation stage (Bonvillian, 2018, 912).

The need for these move-ahead efforts suggests that US–China technological competition is no longer steeply tilted in America's favour. Indeed, one analyst of China's defense policy goes further, suggesting that compared with its undisputed first-mover military advantages in high technology, 'the terrain of US–China technological competition' in the emerging technologies of artificial intelligence and quantum computing technologies 'is far more level'; and in this context 'the Chinese leadership appears to recognize a critical opportunity' to surpass the United States (Kania, 2018a, 5).

In order to do that however, China must master the nuts-and-bolts enablers of chip technology. As to whether the US semiconductor industry can withstand the challenge that China poses, according to Laura Tyson, that will ultimately depend 'not on America's success in curbing China's progress, but rather on its ability to sustain and support innovation by US companies' (Tyson, 2018).[13] Compared with China's efforts however ($120 billion over five years), US funding for these two initiatives (slightly exceeding $3 billion over the same period), may need to be at least an order of magnitude greater to achieve that outcome.

3.3 Rebuilding the Industrial Commons: Advanced Manufacturing

A recent (if widely overlooked) question is whether 'innovation' – investment in next-generation technology – is sufficient to sustain leadership. If so, what obstacles might prevent or slow innovation? And how is the NSS responding? Is the quest for more breakthroughs enough? Or is there need for greater proficiency in advanced manufacturing in the US? Breakthroughs may be anticipated through the continuing efforts of DARPA and other risk-taking agencies within the NSS. But increased proficiency in producing advanced technologies would at the very least require a substantial shift in US business models, which are still based on 'design at home, produce abroad' (Bonvillian, 2018).

The problem already discussed is that over the course of several decades, the massive migration of advanced manufacturing offshore has left the US continent with a seriously depleted industrial ecosystem. In the first decade of this century, America's manufacturing workforce declined from 17 million to just over 11 million; manufacturing's share of gross domestic product (GDP) halved over the period 1950 to 2010, and the trade balance in *advanced* technology products turned

[12]One such program, Software-defined Hardware (SDH), aims to create chips that can be reconfigured in real-time to reap the advantages of specialized applications without the enormous input of time and expenditure. DARPA states that if successful, ERI will revolutionize chip production and drive the semiconductor industry forward 'at a time when traditional silicon scaling is showing diminishing returns' (Meritt, 2019).

[13]Nevertheless, Chinese industrial policies for acquisition and cyber theft are recognized as posing 'real threats to semiconductor innovation and US national security' (Brown and Singh, 2018); also comments by Defense Secretary Mark Esper who stated in an interview that China has engaged in the 'greatest theft of intellectual property in human history' (Pawlyk, 2019).

https://doi.org/10.1017/S1474745620000567 Published online by Cambridge University Press

negative for the first time in 2002, as deficits rose from $16.5 bn to just over $128 bn in 2018. Almost three decades ago, defense officials reported that 'the loss of technological leadership in key manufacturing technologies [was occurring] at an increasing rate', and predicted that this would have 'extremely adverse potential for [US] long-term security interests' (Under Secretary of Defense (Acquisition), 1988, 47). That prediction has now come home to roost. Entire industries have since moved abroad, and with them many of the capabilities that once powered high-technology innovation and manufacturing. The local supply chains necessary for converting ideas from the lab into highly advanced and commercially viable products are now much diminished. The issue has for many years been well surveyed and widely documented (Berger, 2013; Bonvillian and Singer, 2018).

The notion that 'serving potato chips is the same as making micro-chips' (paraphrased by Smil, 2013) has persisted in broad segments of the policy community, explaining perhaps the relaxed attitude towards the massive divestment and relocation of manufacturing abroad (enabled by a favourable tax code, see Thomhave, 2019; Clausing and Hassett, 2005). Despite numerous warnings against its neglect, advanced manufacturing did not become a policy priority until Obama was in the Whitehouse. A brutal decade of offshoring – bookended by the Great Recession of 2008–2009 and rising mass unemployment – drew the Obama administration's attention to underlying structural problems stemming from the major decline in manufacturing and its depleted ecosystem. In response to these (domestic) challenges, the Whitehouse established the manufacturing institutes program, which took shape between 2011 and 2014. Its focus on production technologies was designed to fill a major gap in America's research-and-development-led innovation system. The neglect of production-led innovation was underscored in the 1980s as Japanese companies Wrested market share from their American counterparts (Bonvillian, 2017b). China's economic rise followed a similar production-centred pattern, propelling it onto the global economic stage.

It is worth emphasizing that to the extent that the Obama administration was concerned about China's rise and sought to respond to it, the focus was chiefly economic. Obama's main containment strategy centred on the Trans-Pacific Partnership (TPP), which would allow the US to set the rules of the regional economic game. Although Obama's manufacturing institutes coincided with China's growing economic influence, they were intended primarily to address domestic rather than geostrategic concerns. But as China announced its geostrategic 'great power' ambitions (in the policy documents mentioned above), the Pentagon's long-standing concerns about the migration of high-tech industry found a more receptive (bipartisan) audience in Congress.

The upshot of China's increasing geopolitical assertiveness was to prompt a 'major shift' in US technology policy in which support for onshore manufacturing is now a key focus (Bonvillian, 2017a, 23). The National Security Strategy acknowledges that the manufacturing sector is 'the backbone of US military technical advantage' as well as being a major contributor to the US economy.[14] It emphasizes the importance of a vibrant manufacturing sector to comprehensive national power, and warns of the dangers inherent in the weakening of America's manufacturing base.

We have already seen an intimation of this policy shift in the MINSEC program described above. Department of Energy (DOE) officials have also added their voice to the onshore manufacturing movement. The DOE's Office of Energy Efficiency and Renewable Energy for example, now requires applicants for funding to submit a *US Manufacturing Plan,* which (loopholes aside) must include specific and measurable commitments to support onshore production (United States Government Accountability Office (GAO), 2017, 41–49).[15] This policy shift rests on the growing recognition that innovation is not confined to what happens in the lab but is rather a

[14]Accounting for 9% of employment, 12% of GDP, 60% of exports, 55% of patents, and 70% of US R&D (Interagency Task Force in Fulfillment of Executive Order 13806, 2018, 24).

[15]Having worked its way through Congress however, there are several escape clauses that potentially water down the agency's original plan.

whole-of-cycle outcome encompassing invention, design, testing, production, and supply of new products and services (see Breznitz and Murphree, 2013). Following through on this understanding means promoting the 'production' front end, where prototyping, scale up, and manufacturing processes are critical.

Technology experts find that when production and its supply chains are removed offshore, an entire local ecosystem for advanced manufacturing and the prospects for future innovation are forfeited. The lesson from such studies seems to be: *offload production and eventually innovation starts to dry up*. An exemplary case of this disconnect and its harmful effects is detailed in Fuchs and Kirchain's work on optoelectronics, a dual-use technology that is critical for defense, as well as having numerous commercial applications. Their research finds that if the production is not local, firms cannot continue to push the technological frontier; when they shift the location offshore this changes the incentives for innovation, making it no longer profitable to pursue certain products. Moreover, public companies responsive to short- term shareholder interest, increasingly face incentives to produce old technologies overseas and abandon the development of new technologies in the United States (Fuchs and Kirchain, 2010). Making a similar point from a different perspective, Suzanne Berger observes that the Chinese have risen to become the world's top exporters of information technology equipment because they promote co-location synergies, 'not because of low-cost labor'. Firms master scale up and mass manufacturing 'because of their ability to move complex advanced product designs into production and commercialization' (Berger, 2013). By contrast, it matters little how many start-up firms are being spun out of US research labs and universities if they cannot reach the manufacturers to test their designs in the iterative process of prototyping and scale up. Influential (and outdated) arguments that the domestic economy can continue to prosper indefinitely by specializing in services 'ignores both the co-location synergies with manufacturing and the fact that other economies are now aggressively integrating forward into high-tech services'.[46]

For at least a decade, many have been warning of the consequences of this 'disconnect', not least for US national security (Fuchs, 2014; Pisano and Shih, 2011; Bonvillian, 2018). The National Security Strategy now takes a similar position, articulating an expanded notion of national security in proclaiming that '[s]upport for a vibrant domestic manufacturing sector, a solid defense industrial base, and resilient supply chains is a national priority', and that priority actions must include the promotion of 'policies and incentives that return key national security industries to American shores' (National Security Strategy, 2017, 30).

An early step in that direction emerged as the economic ramifications of the 2008 financial crisis unfolded. Predating the challenge from China, the impact of the crisis served to underline the importance of an advanced US manufacturing industry for the nation's security and livelihood. That view found a receptive audience in the Obama administration, which proposed the creation of a network of Advanced Manufacturing Innovation Institutes (known as Manufacturing USA, Sargent, 2012). Concerned about the alarming depletion of advanced manufacturing capabilities, the Obama administration in 2014 launched a $1.5 billion initiative to establish Advanced Manufacturing Innovation Institutes across the country. Government funding was guaranteed for a minimum of five years with the potential of renewal for a total of ten years.

The pilot initiative and first wave of institutes was spearheaded by the DOD, which is currently responsible for eight of the 14 entities, the DOE for five, and Department of Commerce for one. DOD-led institutes combine $600 million in federal investment with $1.2 billion in matching funds from industry and non-federal sources. Collaborative research and pre-competitive development bring together academic and private sector researchers and entrepreneurs with the intention of creating – and in some cases regenerating – an 'industrial commons' or ecosystem of supply chains.

Manufacturing USA's long-range objective is to create a US-based ecosystem of dual- use supply chains in emerging technology sectors that will lead to the local manufacture of advanced industry products. DOD sees the institutes as 'game-changing catalysts' and engages as both a

https://doi.org/10.1017/S1474745620000567 Published online by Cambridge University Press

co-investor with industry and as a customer that can tap into capabilities in these sectors for defense projects (National Academies of Sciences, Engineering and Medicine, 2019, chapter 4). For their part, private sector partners have a stake in the project through their cost-shared participation and early access to the commercially viable products that may result.[16] Barely five years in the making, the institutes are still evolving; nevertheless, their partnership structure is a well-established vehicle for implementing NSS policy. In the DOD case, that policy is designed to yield 'dual public–private benefit, offering large commercial market potential while meeting key US defense industrial preparedness and operational needs' (National Academies of Sciences, Engineering and Medicine, 2019, chapter 1). As in all cost-shared collaboration, industry has significant input into the technical side of a program that is tasked with accelerating the delivery of both defense relevant and commercially promising technologies (United States GAO, 2019). Although these public/private partnerships address both commercial and defense manufacturing needs, they do so within specific, defense-relevant technology areas; these dual-use areas include photonics, advanced fabrics, robotics, flexible hybrid (wearable) electronics, additive manufacturing, digital manufacturing and design, tissue biofabrication, and lightweight metal manufacturing. As such, the DOD Manufacturing USA institutes follow a familiar pattern of commercial involvement in support of national security objectives.

4. Expanding Partnerships and Commercial Involvement

The NSS has a long track record of relying on domestic partnerships with non-state actors in US research institutions and private enterprise, amply documented elsewhere.[17] At their most productive, such partnerships are synergistic. Neither top down nor bottom up, they draw on the strengths and requirements of each side of the commercial–national security divide. The revival of the US High-Performance Computing (HPC) industry, battered by Japanese competition through the 1980s, is an exemplary case. Its regeneration derived from DOE's 1995 Accelerated Strategic Computing Initiative (ASCI), a ten-year $5 billion project to manage the nuclear stockpile. The project's core objective was to provide an alternative to underground nuclear testing, following the signing of the Comprehensive Test Ban Treaty in 1996. ASCI was one of the largest (hugely successful) military–civilian technology development programs ever implemented. The DOE needed a viable HPC industry that could meet its national security mission; the industry in turn needed the DOE's investment and procurement power to re-establish its competitiveness. Input from both sides ensured a successful outcome. Though initiated and invested with national security goals in mind, this dual-use program has generated substantial commercial payoffs (Larzelere, 2009). Similarly broad benefits are anticipated from the DOE's latest investments in exascale computing for DOE's National Nuclear Security Administration.[18] The same can be said of many other programs examined in earlier work.

Beyond the case of the high-performance computing industry, many companies in other sectors have found working for the federal government an attractive proposition – at least in the earlier postwar period. But as mentioned earlier, as the relative size of government R&D and procurement markets shrank and the profits and products for commercial and defense markets increasingly diverged from the 1980s onwards, innovative companies saw fewer incentives and became more reluctant to work with government. Private-sector reluctance has at times created headaches for defense strategists as many of the innovations needed to ensure military primacy

[16]The partnerships forming the institutes must commit non-federal resources that equal or exceed the federal contribution during a five- to seven-year establishment period. To date, more than $3 billion has been invested in the Manufacturing USA institutes with more than $2 billion from industry and non-federal government sources. Only the DOD institutes will continue to be funded beyond the start- up period.

[17]For the detailed argument relating to the ASCI case outlined here, see Weiss (2014, 110–113).

[18]Exascale refers to computing systems that can achieve a billion billion (or quintillion) calculations per second. On the benefits, see Council on Competitiveness (2014).

https://doi.org/10.1017/S1474745620000567 Published online by Cambridge University Press

now occurs outside the traditional defense industry sector. As highlighted in the Pentagon's 2019 budget document: 'DOD's ability to access commercial technology for its custom, secure, trusted and assured needs is diminishing as SOTA [state-of-the-art] suppliers become fewer and more focused on serving the global commercial market' (Office of the Secretary of Defense, 2019).

Seeing a need to offer new incentives, the NSS has for several decades taken to incorporating dual-use in the design of its technology programs. It has also added the carrot of venture-capital funds such as the CIA's InQTel (1999–) and the Army's AVCI (2002–), hybrid public–private investment vehicles that can walk and talk the language of Silicon Valley while prioritizing technological goals of the NSS.[19] Through these and other incentives (such as fast-track procurement) DOD seeks early access to the innovative capabilities of the commercial sector and an opportunity to influence the direction of its emerging technologies. As information technology is a critical enabler of today's defense systems, a competitive commercial sector is thus vital to the national security strategy.

But it is also a problem. Take the case of AI, a pivotal frontier technology for securing future military primacy. For one thing, industry has sucked up the lion's share of the limited expertise in this cutting-edge area of technology. 'We are in an AI arms race, and it's happening in industry, in the Big Five [Alpha, Apple, Amazon, Facebook, Microsoft] … The computer science departments of our major universities are wiped out because the professors are all on sabbatical doing this work [for the Big Five]' (Peniston, 2017). If one considers also that Beijing has plans to train 5,000 people in AI, while the Trump Administration currently has no such national education or industry strategy, then one must conclude that meeting the challenges ahead will pose significant difficulties for America.

5. Economic Statecraft vs Industrial Policy: Concluding Remarks

In this context, what gives China the edge is that it has a no-holds barred approach to industrial policy to improve its competitive position in the international arena. That approach makes full use of the government's panoply of policy tools and directional thrust from the centre. Here the US–China contrast could not be greater: Each country has radically different views about the appropriate relationship between government and the private sector. For America, the very idea of industrial policy is one that raises red flags, typically inviting antipathy and controversy. Although it is sometimes claimed that the US has long pursued an industrial policy, the very same claimants often lament that what passes for 'industrial policy' is a hodge podge of disconnected initiatives that beg a coordinating strategy. It is therefore tempting to conclude that whereas industrial policy is America's Achilles heel, for China industrial policy is more like the wings of Hermes.

There is however an important caveat and distinction to be made. The term 'industrial policy' is now widely used to label any kind of support delivered by the state to economic actors – from garden variety tax breaks and tariffs all the way to corporate bailouts and job-creating initiatives. Arguably, this indiscriminate application to a diffuse range of activities and objectives results in a conceptual flabbiness that undermines the term's analytical value.[20] Some analysts even go so far as to view the Pentagon as the source of an industrial policy that is pursued 'beneath the radar'. Industrial policy is of course a useful analytical lens, 'if it helps to explain why a country chooses [to pursue] particular policies and contributes to our understanding of why particular industries located in that country do well' (Ketels, 2007). The main point to emphasize is that in the US context, where the economic impacts of NSS-led technology programs have been commercially

[19]On InQTel and AVCI and other venture initiatives see Weiss (2014, chapter 3). As its website states, AVCI is the venture activity of the US Army and Department of Defense chartered by Congress to invest in companies developing cutting-edge technologies 'addressing the needs of the commercial market that will also meet priority warfighter needs'.

[20]For a representative example of this expansive application of the label to the United States see Wade (2017) on US 'industry policy'.

significant, these are side-effects of policies chosen for strategic geopolitical objectives. Economic competitiveness has not been their primary concern. This does not exclude an interest in commercial competitiveness. On the contrary, as already emphasized, by virtue of its increasing reliance on technological advances from the private sector, NSS interest in a competitive industrial sector has necessarily tightened the economic–security nexus (Ketels, 2007).

Paying attention to quintessential state purpose is key to understanding the differences between industrial policy and statecraft. Industrial policy may or may not be a government's targeted response to international competitive pressures. By contrast, the exercise of statecraft is always a response to challenges arising from the international arena, whether such pressures are geopolitical or geoeconomic in nature. In the US case examined here, the drivers of statecraft are geopolitical, but the policy focus is *domestic*: achieving and sustaining technological superiority in the home base.[21] I call this economic statecraft, here contrasted with the more conventional usage of the term.[22] A statecraft analysis provides a corrective to two influential views. First is the standard view that America's postwar technological pre-eminence was the simple product of free-market entrepreneurship. In contrast to this claim – and in spite of its famed 'anti-statism' (Friedberg 2000) – it was the exercise of statecraft that enabled the United States to emerge after the Second World War as the world's undisputed high-tech hegemon, spinning out virtually all the radical innovations that drive the modern industrial economy and underpin its prosperity. Second is the conventional minority view which posits that the US pursues an industrial policy as a 'hidden developmental state' (Block, 2008; Mazzucato, 2013; Wade, 2014). Close analysis of key projects over several decades reveals a very different story. The NSS typically initiates programs for technology leadership to sustain its military advantage. It also values a commercially competitive industrial base that can help develop, test, scale up, and deliver security-relevant (and typically dual-use) technologies. But if an industrial sector has little or no relevance to the broader national security enterprise, it is unlikely to attract serious or sustained government support.[23] In other words, NSS agencies selectively support initiatives in the commercial space primarily because of the perceived strategic imperatives at stake, not to improve economic 'competitiveness' per se.[24]

By paying attention to the principal drivers and ambitions that motivate the relevant policy agents, one is thereby led to emphasize an important comparative point: the US may have a poor inclination for, and track record in, industrial policy, but it possesses an outstanding predisposition and capacity for the exercise of (economic) statecraft. In its American incarnation, economic statecraft prioritizes technological superiority as a strategic imperative and enlists in that pursuit the relevant private sector partners and agencies tasked with national security missions.[25] As already mentioned, and discussed in depth elsewhere, the revolutionary innovations resulting from these endeavours have spawned globally competitive US industries. What makes America's domestically focused techno-industry programs a distinctive form of statecraft, however, is not their significant economic payoffs, it is that, in spite of the significant economic benefits of these programs, they have been geopolitically driven, strategically motivated,

[21]In the international relations literature, statecraft typically refers to a state's foreign policy measures – financial sanctions, export controls, trade and investment restrictions, development aid, etc. – which are externally targeted at specific countries either to coerce change or provide positive inducements.

[22]For a comparative discussion of South Korean and US forms of economic statecraft, see Weiss and Thurbon (2020).

[23]Cybertechnology policy is an obvious example. See Aggarwal and Reddie (2018).

[24]It is instructive to examine a range of NSS views on the subject. As a typical example, managers of DOE's defense programs once viewed commercialization as a distraction from the agency's mission to supply the military's needs, but over time DOE 'has come to believe that the military would benefit from stronger civilian industries'. See Congress of the United States, Office of Technology Assessment (1990, 187). That thinking is now mainstream.

[25]Conventionally, the concept of statecraft is something applied externally via foreign policy measures – financial sanctions, export controls, trade and investment restrictions, development aid, etc. – which are targeted at specific countries either to coerce behavioural change or provide positive inducements.

collaboratively implemented, and designed to outmaneuver a clearly identified set of foreign rivals. Unlike your garden variety industrial policy, economic 'statecraft' implies an acute awareness of the geopolitical challenges facing the nation and a set of strategic actions in the domestic techno-industrial arena designed to meet those pressures head on.[26]

In this light, what passes for China's 'industrial policy' may need to be reframed since it seems far removed from a standard quest for improved economic competitiveness. In some respects, it leans towards the collaborative public–private model in the American version of statecraft. Indeed, an assumption in official circles that may need rethinking is the view that America's collaborative model 'gives the US an edge over more authoritarian regimes that favor a "top–down, industrial approach" to research and development'. So states the White House Deputy Chief Technology Officer, Michael Kratsios. Convinced of the superior advantages of the US system for achieving global dominance in AI, Kratsios declares that he is 'always going to bet on the American innovation ecosystem' (Kratsios in Corrigan, 2018).

It turns out that China is a diligent student of the US system and according to experts, its innovation ecosystem might not stray too far from America's, at least not as far as some believe. According to one specialist in Chinese technological development, 'The American model of innovation is unique, but at the same time we are starting to see a number of these elements also emerging in China's approach to development' (Kania, 2019). In AI research for example, Chinese businesses are partnering with academia and creating joint laboratories to commercialize results. China also understands the significance of possessing globally competitive commercial industries for its national security and technological leadership. Recent efforts by one of its state-owned companies to steal US semiconductor technology underlined this commercial priority (discussed in Allen, 2019, 14). More generally, military–commercial fusion in China does not mean that commerce is simply the servant of the military (though the potential is there through the legal requirement of its national champions to collaborate). Clearly, China is mindful of the need to avoid Soviet-style stagnation. In its *AI Development Plan* strategy document, for example, China's approach is articulated in the following way:

> Follow the rules of the market … accelerate the commercialization of AI technology and results and create a competitive advantage. *Grasp well the division of labor between government and the market*. (Allen, 2019, emphasis added)

If China can indeed grasp well that division, it can multiply the advantages of a massive domestic market, a large trade surplus, high-level policy ambition, and an autocratic leadership able to manipulate economic and financial levers. One must add to that China's dominance in global value chains and mastery of the manufacturing process give it the ability to prototype and scale at mass. This line up of China's advantages would not be complete without reference to the US disadvantages posed by the travesty of Donald Trump's leadership. For these reasons, as astute observers point out, underestimating China may prove costly. There is no guarantee that the current advantages of the US innovation system will endure or be sufficient on their own to meet the military–economic challenge that China poses. US leadership in the technologies of the future will depend in part on serious efforts to foster the domestic supply chains that can help reconnect production and innovation. This will prove very challenging since, unlike its authoritarian adversary, the US must weigh national security imperatives against private commercial interests. Given, the high cost of breaking up global supply chains, such measures are likely to be unpopular and have limited results. If NSS economic statecraft can redress some deficiencies in supply chains, it is most likely to apply to highly strategic technologies like microelectronics. The prospects for that effort to succeed are more likely to be realised by the incoming Biden administration than by its dysfunctional predecessor.

[26]For a geoeconomic version of economic statecraft in the South Korean setting, see Thurbon and Weiss (2019).

References

Aggarwal, V. K. and A. W. Reddie (2018) 'Comparative Industrial Policy and Cybersecurity: The US Case', *Journal of Cyber Policy* **3**(3), 445–466, ODI: 10.1080/23738871.2018.1551910.

Allen, G C. (2019) 'Understanding China's AI Strategy: Clues to Chinese Strategic Thinking on Artificial Intelligence and National Security', Center for a New American Security, February', https://nsiteam.com/social/wpcontent/uploads/2019/05/CNAS-Understanding-Chinas-AI-Strategy-Gregory-C.-Allen-FINAL-2.15.19.pdf.

Berger, S. (2013) *Making in America: From Innovation to Market*. Cambridge, MA: MIT Press.

Block, F. (2008) 'Swimming against the Current: The Rise of a Hidden Developmental State in the United States', *Politics and Society* **36**(2), 169–206, ODI: 10.1177/003232920831871.

Bonvillian, W. B. (2017a) 'Advanced Manufacturing: A New Policy Challenge', *Annals of Science and Technology Policy* **1**(1), 1–131, DOI: 10.1561/110.00000001.

Bonvillian, W. B. (2017b) 'The Rise of Advanced Manufacturing Institutes in the United States', *The Next Production Revolution: Implications for Governments and Business*. Paris: OECD.

Bonvillian, W. B. (2018) 'DARPA and Its ARPA-E and IARPA Clones: A Unique Innovation Organization Model', *Industrial and Corporate Change* **27**(5), 897–914, DOI: 10.1093/icc/dty026.

Bonvillian, W. B. and P. L. Singer (2018) *Advanced Manufacturing: The New American Innovation Policies*. Cambridge, MA: The MIT Press.

Brennan, D. (2019) 'China's Military Technology Now Close to Parity with US, Report Warns', *Newsweek*, 6 June, www.newsweek.com/china-military-technology-parity-us-report-research-investment-pentagon-1442565.

Breznitz, D. and M. Murphree (2013) 'China's Run – Economic Growth, Policy, Interdependencies, and Implications for Diverse Innovation Policies in a World of Fragmented Production', in D. Breznitz and J. Zysman (eds.), *The Third Globalization: Can Wealthy Nations Stay Rich in the Twenty-First Century?* New York: Oxford University Press, pp. 35–56.

Brown, M. and P. Singh (2018) 'China's Technology Transfer Strategy: How Chinese Investments in Emerging Technology Enable a Strategic Competitor to Access the Crown Jewels of US Innovation', Defense Innovation Unit Experimental (DIUx), January, https://admin.govexec.com/media/diux_chinatechnologytransferstudy_jan_2018_(1).pdf.

Clausing, K. A. and K. A. Hassett (2005) 'The Role of US Tax Policy in Offshoring [with Comment and Discussion]', Brookings Trade Forum, 457–490, www.jstor.org/stable/25058776.

Congress of the United States, Office of Technology Assessment (1990) *Making Things Better: Competing in Manufacturing* (OTA-ITE-443), February, Washington, DC: US Government Printing Office, http://govinfo.library.unt.edu/ota/Ota_2/DATA/1990/9028.PDF.

Corrigan, J. (2018) 'White House Official: Bet on US to Win the AI War', *Nextgov*, 10 July, www.nextgov.com/emerging-tech/2018/07/white-house-official-bet-us-win-ai-war/149591/.

Council on Competitiveness (2014) 'The Exascale Effect: The Benefits of Supercomputing Investment for US Industry', Washington, DC, www.compete.org/storage/images/uploads/File/PDF%20Files/Solve_Report_Final.pdf.

Defense One (2019) 'Beyond South China Sea Tensions, Part One: The Tinderbox', *Defense One*, 8 February, www.defenseone.com/ideas/2019/02/ep-37-beyond-south-china-sea-tensions-part-one-tinderbox/154753/.

Defense Science Board (1987) 'Report of the Defense Science Board Task Force on Defense Semiconductor Dependency', Washington, DC.

Defense Science Board (2005) 'Report of the Defense Science Board Task Force on High Performance Microchip Supply', Washington, DC.

Feng, A. and L. Laskai (2019) 'Welcome to the New Phase of US–China Tech Competition', Center for a New American Security, 3 September, www.cnas.org/publications/commentary/welcome-to-the-new-phase-of-us-china-tech-competition.

Ferdinando, L. (2018) 'DOD Officials: Chinese Actions Threaten US Technological, Industrial Base', United States Department of Defense, 21 June, www.defense.gov/Newsroom/News/Article/Article/1557188/DOD-officials-chinese-actions-threaten-us-technological-industrial-base/.

Foot, R. and A. King (2019) 'Assessing the Deterioration in China–US Relations: US Governmental Perspectives on the Economic–Security Nexus', *China International Strategy Review* **1**, 39–50, https://doi.org/10.1007/s42533-019-00005-y

Friedberg, A. L. (2000) *In the Shadow of the Garrison State: America's Anti-Statism and Its Cold War Grand Strategy*. Princeton, NJ: Princeton University Press.

Fuchs, E. R. H. and R. Kirchain (2010) 'Design for Location? The Impact of Manufacturing Offshore on Technology Competitiveness in the Optoelectronics Industry', *Management Science* **56**(12), 2323–2349, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1545027.

Fuchs, E. R. (2014) 'Global Manufacturing and the Future of Technology', *Science* **345**(6196), 519–20, DOI:10.1126/science.1250193.

Hamilton, C. (2018) *Silent Invasion: China's Influence in Australia*, Melbourne: Hardie Grant.

Hastie, A. (2019) 'We Must See China – the Opportunities and the Threats – with Clear Eyes', *The Sydney Morning Herald*, 8 August, www.smh.com.au/politics/federal/we-must-see-china-the-opportunities-and-the-threats-with-clear-eyes-20190807-p52eon.html.

Horowitz, M., E. B. Kania, G. C. Allen, and P. Scharre (2018) 'Strategic Competition in an Era of Artificial Intelligence', Center for a New American Security, 25 July, https://s3.amazonaws.com/files.cnas.org/documents/CNAS-Strategic-Competition-in-an-Era-of-AI-July-2018_v2.pdf?mtime=20180716122000.

Interagency Task Force in Fulfillment of Executive Order 13806 (2018) 'Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States', September. Report to President Donald J. Trump, https://media.defense.gov/2018/Oct/05/2002048904/-1/-1/1/ASSESSING-AND-STRENGTHENING-THE-MANUFACTURING-AND%20DEFENSE-INDUSTRIAL-BASE-AND-SUPPLY-CHAIN-RESILIENCY.PDF.

Kania, E. B. (2018a) 'China's Threat to American Government and Private Sector Research and Innovation Leadership. Testimony before the House Permanent Select Committee on Intelligence', Center for a New American Security, 19 July, www.cnas.org/publications/congressional-testimony/testimony-before-the-house-permanent-select-committee-on-intelligence.

Kania, E. B. (2018b) 'Tsinghua's Approach to Military–Civil Fusion in Artificial Intelligence', Center for a New American Security, 12 July, www.cnas.org/publications/commentary/tsinghuas-approach-to-military-civil-fusion-in-artificial-intelligence.

Kania, E. B. (2019) 'In Military–Civil Fusion, China is Learning Lessons from the United States and Starting to Innovate', *The Strategy Bridge*, 27 August, https://thestrategybridge.org/the-bridge/2019/8/27/in-military-civil-fusion-china-is-learning-lessons-from-the-united-states-and-starting-to-innovate.

Ketels, C. H. M. (2007) 'Industrial Policy in the United States', *Journal of Industry Competition and Trade* **7**(3), 147–167, DOI: 10.1007/s10842-007-0017-7.

Larzelere, A. R. (2009) *Delivering Insight: The History of the Accelerated Strategic Computing Initiative (ASCI)*. Lawrence, CA: Lawrence Livermore National Laboratory.

Laskai, L. and S. Sacks (2018) 'The Right Way to Protect America's Innovation Advantage', *Foreign Affairs*, www.foreignaffairs.com/articles/2018-10-23/right-way-protect-americas-innovation-advantage.

Mazzucato, M. (2013) *The Entrepreneurial State: Debunking Public vs. Private Sector Myths*. London: Anthem Press.

McCormick, R., S. Cohen, G. Sanders, and A. P. Hunter (2018) 'Acquisition Trends 2018: Defense Contract Spending Bounces Back Executive Summary', CSIS Briefs, 13 September, https://csis-prod.s3.amazonaws.com/s3fs-public/publication/180913_AquisitionTrends2018.pdf.

McDougall, W. A. (1982) 'Technocracy and Statecraft in the Space Age – Toward the History of a Saltation', *American Historical Review* **87**(4), 1010–1040.

McLeary, P. (2018) 'Pentagon, Intel Agencies Set Up New AI Joint Office', *Breaking Defense*, 13 April, https://breakingdefense.com/2018/04/pentagon-intel-agencies-set-up-new-ai-joint-office/.

Merritt, R. (2018) 'Moore's Law, China vs. Team USA', *EE Times*, 27 July, www.eetimes.com/document.asp?doc_id=1333519.

Muldavin, J. (2017) 'Assuring Microelectronics Innovation for National Security and Economic Competitiveness (MINSEC)', *Trusted and Assured Microelectronics (TAME) Forum*, 29 November, Gainesville, Florida.

National Security Strategy (2015) 'National Security Strategy of the United States', February, Washington DC, https://obamawhitehouse.archives.gov/sites/default/files/docs/2015_national_security_strategy_2.pdf.

National Security Strategy (2017) 'National Security Strategy of the United States', December, Washington DC, www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf.

National Academies of Sciences, Engineering and Medicine (2019) *Strategic Long-Term Participation by DOD in Its Manufacturing USA Institutes*. Washington, DC: National Academies Press, DOI: 10.17226/25417.

Office of the Secretary of Defense (2019) 'Department of Defense Fiscal Year (FY) 2020 Budget Estimates', Defense-Wide Justification Book Volume 3 out of 5, March. Washington, DC, https://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2020/budget_justification/pdfs/03_RDT_and_E/RDTE_Vol3_OSD_RDTE_PB20_Justification_Book.pdf.

O'Mara, M. P. (2005) *Cities of Knowledge: Cold War Science and the Search for the Next Silicon Valley*. Princeton, NJ and Oxford: Princeton University Press.

Pawlyk, O. (2019) 'Pentagon to Debut Intellectual Property Protection Team', *Military.com*, 26 August, /www.military.com/daily-news/2019/08/26/pentagon-debut-intellectual-property-protection-team.html.

Peniston, B. (2017) 'How Will the Pentagon Create Its AIs? The Algorithmic- Warfare Team Is Charting a Path;, *Defense One*, 13 July, www.defenseone.com/technology/2017/07/artificial-intelligence-pentagon/139402/.

Pisano, G. P. and W. C. Shih (2011) *Producing Prosperity: Why America Needs a Manufacturing Renaissance*. Boston, MA: Harvard Business Review Press.

President's Council of Advisors on Science and Technology (2017) 'Ensuring Long-Term US Leadership in Semiconductors', Report to the President, January, Washington DC, https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_ensuring_long-term_us_leadership_in_semiconductors.pdf.

Ruttan, V. W. (2006) *Is War Necessary for Economic Growth?: Military Procurement and Technology Development*. New York: Oxford University Press.

Santacreu, A. M. and H. Zhu (2018) 'R&D: Business Spending Up, Government Spending Flat', Federal Reserve Bank of St. Louis, 14 May, www.stlouisfed.org/on-the-economy/2018/may/rd-business-spending-up-government-spending-flat.

Sargent, J. F. Jr. (2012) 'The Obama Administration's Proposal to Establish a National Network for Manufacturing Innovation', 24 July, Washington, DC: Congressional Research Service, https://digitalcommons.ilr.cornell.edu/cgi/viewcontent.cgi?article=1931&context=key_workplace.

Smil, V. (2013) *Made in the USA: The Rise and Retreat of American Manufacturing*. Cambridge, MA: The MIT Press.

Stuart, D. T. (2008) *Creating the National Security State: A History of the Law that Transformed America*. Princeton, NJ and Oxford: Princeton University Press.

Thomhave, K. (2019) 'New Legislation Would Rein in Corporate Offshoring', *The American Prospect,* 18 March, https://prospect.org/economy/new-legislation-rein-corporate-offshoring/.

Thurbon, E. and L. Weiss (2019) 'Economic Statecraft at the Frontier: Korea's Drive for Intelligent Robotics', *Review of International Political Economy*, ODI: 10.1080/09692290.2019.1655084.

Tyson, L. (2018) 'Avoiding the Sino-American Technology Trap', *Project Syndicate*, 18 June, www.project-syndicate.org/commentary/china-trump-tariffs-technology-competition-by-laura-tyson-2018-06?barrier=accesspaylog.

Under Secretary of Defense (Aquisition) (1988) 'Bolstering Defense Industrial Competitiveness: Preserving Our Heritage Base Securing Our Future', Report to the Secretary of Defense, 15 July, Washington, DC, https://apps.dtic.mil/dtic/tr/fulltext/u2/a202840.pdf.

United States Department of Defense (2018) *National Defense Strategy of the United States of America*, January, www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf.

United States Government Accountability Office (2015) 'Trusted Defense Microelectronics: Future Access and Capabilities Are Uncertain (GAO-16-185T)', Testimony before the Subcommittee on Oversight and Investigations, Committee on Armed Services, House of Representatives, 28 October, Washington, DC, www.gao.gov/assets/680/673401.pdf.

United States Government Accountability Office (2017) 'US Manufacturing: Federal Programs Reported Providing Support and Addressing Trends (GAO-17-240)', Report to Congressional Requesters, March, Washington, DC, www.gao.gov/assets/690/683753.pdf.

United States Government Accountability Office (2019) 'Advanced Manufacturing: Innovation Institutes Have Demonstrated Initial Accomplishments, but Challenges Remain in Measuring Performance and Ensuring Sustainability (GAO-19-409)', Report to Congressional Committees, May, Washington, DC, www.gao.gov/assets/700/699310.pdf.

Van Atta, R., and M. M. G. Slusarczuk (2012) 'The Tunnel at the End of the Light: The Future of the US Semiconductor Industry', *Issues in Science and Technology* **28**(3), 53–60, https://issues.org/van_atta/.

Wade, R. H. (2014) 'The Paradox of US Industrial Policy: The Developmental State in Disguise', in *Transforming Economies: Making Industrial Policy Work for Growth, Jobs and Development*, International Labor Organization, 379–400, www.ilo.org/wcmsp5/groups/public/---dgreports/---inst/documents/publication/wcms_315679.pdf.

Wade, R. H. (2017) 'The American Paradox: Ideology of Free Markets and the Hidden Practice of Directional Thrust', *Cambridge Journal of Economics* **41**(3), 859–880, DOI: 10.1093/cje/bew064.

Weiss, L. (2014) *America Inc? Innovation and Enterprise in the National Security State*. Ithaca and London: Cornell University Press.

Weiss, L. and E. Thurbon (2020) 'Developmental State or Economic Statecraft? Where, Why and How the Difference Matters', *New Political Economy* 1–18. https://doi.org/10.1080/13563467.2020.1766431

White House Office of Trade and Manufacturing Policy (2018) *How China's Economic Aggression Threatens the Technologies and Intellectual Property of the United States and the World*, June, www.whitehouse.gov/wp-content/uploads/2018/10/Advanced-Manufacturing-Strategic-Plan-2018.pdf.

Work, R. O. and G. Grant (2019) 'Beating the Americans at Their Own Game: An Offset Strategy with Chinese Characteristics', Center for a New American Security, 6 June, www.cnas.org/publications/reports/beating-the-americans-at-their-own-game.

Cite this article: Weiss L (2021). Re-emergence of Great Power Conflict and US Economic Statecraft. *World Trade Review* **20**, 152–168. https://doi.org/10.1017/S1474745620000567