

**Testimony of**

**Robert D. Atkinson**  
**President**

**Information Technology and Innovation Foundation**

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Good afternoon Chairman Hurd, Ranking Member Kelly and members of the Committee; thank you for inviting me to share the views of the Information Technology and Innovation Foundation (ITIF) on the issue of unfair Chinese trade and technology policies and practices and what the U.S. government should do in response.

The Information Technology and Innovation Foundation is a non-partisan think tank whose mission is to formulate and promote public policies to advance technological innovation and productivity internationally, in Washington, and in the states. Recognizing the vital role of technology in ensuring prosperity, ITIF focuses on innovation, productivity, and digital economy issues. ITF has long focused on the issue of how unfair foreign policies and practices, particularly Chinese, negatively impact the U.S. economy. I very much appreciate the opportunity to comment on these issues today.

### **The Technology Threat From Unfair Chinese Technology and Trade Policies**

Ever since the first industrial revolution advanced countries have worried about technology transfer to foreign nations. For example, it was against the law to transfer technology designs outside of Britain; something that Samuel Slater did when he memorized the plans for textile machines before immigrating to the United States and establishing the first U.S. textile mill in Rhode Island.

Today the United States leads in the so-called fifth industrial revolution (information technology) and hopes to lead in the 6th (artificial intelligence, robotics, etc.), but a major threat to our leadership is from China's unfair and harmful trade and technology policies. China is seeking global technology dominance in an array of advanced technology industries, including in information technology, through an unprecedented array of predatory economic and trade policies and practices, including theft of U.S. technology and coerced transfer thereof. The world has never seen a country like China before, with its organized and strategic system of authoritarian state capitalism. It is not a market economy where firms largely dictate their own strategy and behavior. It is not a country governed by the rule of law. It is not a country constrained by global norms of acceptable economic and trade behavior. It is a country where the government is concerned with one and only one economic goal: winning in advanced technology industries by any means possible.

As ITIF has documented across a series of reports—including “False Promises: The Yawning Gap Between China's WTO Commitments and Practices,” “Enough is Enough: Confronting Chinese Innovation Mercantilism,” and “Stopping China's Mercantilism: A Doctrine of Constructive, Alliance-Backed Confrontation”—China has deployed a vast panoply of innovation mercantilist practices that seek to unfairly advantage Chinese advanced-industry producers over foreign competitors.<sup>1</sup> These practices have included forced technology transfer and forced local production as a condition of market access; theft of foreign intellectual property (IP); curtailment and even outright denial of access to Chinese markets in certain sectors; manipulation of technology standards; special benefits for state-owned enterprises; capricious cases to force foreign companies to license technology at a discount; government subsidies of Chinese companies, and government-subsidized acquisitions of foreign enterprises. U.S. and foreign enterprises across virtually every advanced technology sector—from aerospace and biotechnology to information and communications technology (ICT) products, Internet, clean energy, and digital media—have been harmed by China's

aggressive use of these types of innovation mercantilist policies and will continue to be harmed if China cannot be pressured to roll back its egregious predatory practices.

In the last few years, though, the focus of China's efforts has shifted. In 2015, Chinese President Xi Jinping unabashedly trumpeted a goal of making China the "master of its own technologies."<sup>2</sup> China's arrival at that point resulted from the evolution of Chinese economic policy over the past two decades. Up to the mid-2000s, China's economic development strategy sought principally to induce foreign multinationals to shift relatively low- and moderate-value production to China.<sup>3</sup> It used an array of unfair tactics, including currency manipulation, massive subsidies, and limits on imports. That strategy changed in 2006 as China moved to a "China Inc." development model of indigenous innovation which focused on helping Chinese firms, especially those in advanced, innovation-based industries, often at the expense of foreign firms. Marking the shift was a seminal document called the "National Medium- and Long-term Program for Science and Technology Development (2006-2020)," the so-called "MLP," which called on China to master 402 core technologies, everything from intelligent automobiles to integrated circuits and high-performance computers.

The MLP announced that modern Chinese economic strategy sought absolute advantage across virtually all advanced technology industries. It rejected the notion of comparative advantage: which holds that nations should specialize in the production of products or services at which they are the most efficient and trade for the rest. Instead, China now wishes to dominate in the production of a wide array of advanced technology products and services including jet airplanes, semiconductors, computers, machine tools, robots, electric vehicles, artificial intelligence software, cloud computing and pharmaceuticals. Essentially, Chinese policymakers wish to autarkically supply Chinese markets for advanced technology products with their own production while still benefitting from unfettered access to global markets for their technology exports and foreign direct investment.

In recent years President Xi has doubled down on this approach, through new promulgations such as the "Made in China 2025 Strategy," the "13th Five-Year Plan for Science and Technology," the "13th Five-Year Plan for National Informatization," and "The National Cybersecurity Strategy," among other policies. The "Made in China 2025 Strategy," for instance, calls for 70 percent local content in manufacturing components in China, while policies enumerated in documents such as the "13th Five-Year Plan for National Informatization" and "The National Cybersecurity Strategy" effectively deny access to U.S. enterprises seeking to compete in emerging ICT industries such as cloud computing in China. The "National Cybersecurity Strategy" further outlines a goal for China to become a strong cyber power by 2020, and that includes mastering core technologies, many of which the United States is currently the international leader in, such as operating systems, integrated circuits, big data, cloud computing, large-scale software services, the Internet of Things, 5G wireless systems, etc., as the country increasingly pursues a strategy of shutting out foreign competitors in the interest of advantaging domestic enterprises and industries. As the Mercator Institute for China Studies in Germany writes, "Made in China 2025 in its current form [means that] China's leadership systematically intervenes in domestic markets so as to benefit and facilitate the economic dominance of Chinese enterprises and to disadvantage foreign competitors."<sup>4</sup> For instance, with regard to ICT-enabled manufacturing (i.e., "smart manufacturing") the strategy calls for 80 percent domestic market share of high-end computer numeric controlled machines by 2025; 70 percent for robots and robot core

components; 60 percent for big data; 60 percent for IT for smart manufacturing; and 50 percent for industrial software.<sup>5</sup>

### **Foreign Technology Acquisition Underpins “Made in China 2025”**

At the heart of China’s strategy is foreign technology acquisition. The Chinese leadership knows that if it just relies on market forces few if any foreign technology leaders will provide them with the technology Chinese firms need. And domestic Chinese firms, while making progress, lag behind the global technology leaders. As a result, China has deployed a panoply of tools to unfairly obtain needed foreign technology.

#### **Intellectual Property Theft:**

Intellectual property theft is one important tool in the Chinese arsenal. China has deployed industrial spies to obtain foreign secrets. As the *New York Times* documented, a leading Chinese computer chip maker allegedly paid employees of a Taiwanese chip company working with the U.S. company Micron to steal valuable chip designs.<sup>6</sup>

Another vector is cyber theft. Seven percent of U.S. firms operating in China listed cyber theft as a problem, a number that presumably would be higher if every firm that had faced an intrusion was aware of it.<sup>7</sup> The *IP Commission Report on the Theft of U.S. Intellectual Property* found that China accounted for nearly 80 percent of all IP thefts from U.S.-headquartered organizations in 2013, amounting to an estimated \$300 billion in lost business annually.<sup>8</sup> An updated 2017 Commission report put the figure at \$600 billion.<sup>9</sup> Then NSA Director Keith Alexander has called Chinese IP theft, “the greatest transfer of wealth in history.”<sup>10</sup> Even though President Xi made “commitments” to end Chinese cyber-theft, there is little evidence that the Chinese have followed through on this promise. As the China the National Counterintelligence and Security Center stated in its “2018 Foreign Economic Espionage in Cyberspace” report:

China has expansive efforts in place to acquire U.S. technology to include sensitive trade secrets and proprietary information. It continues to use cyber espionage to support its strategic development goals—science and technology advancement, military modernization, and economic policy objectives. China’s cyberspace operations are part of a complex, multipronged technology development strategy that uses licit and illicit methods to achieve its goals.<sup>11</sup>

Meanwhile, China still has one of the highest rates of unlicensed software usage in the world, with 74 percent of the software in use unlicensed and the market value of unlicensed software usage exceeding \$8.7 billion in 2013.<sup>12</sup> Then-Microsoft CEO Steve Ballmer once estimated that as much as 95 percent of the copies of Microsoft’s Office software and 80 percent of its Windows operating systems in China were pirated.<sup>13</sup> 240,000 Internet cafés in China rely on illegal copies of entertainment software.<sup>14</sup> Chinese firms even sell technology to allow users to circumvent encryption protection so they can pirate video games. In fact, China has factories that produce and sell video game circumvention devices around the world.

Another vector for purloined intellectual property is to trick companies in the United States into thinking that a Chinese firm wants to invest in them. A seemingly independent Chinese investment fund will approach a small to mid-sized U.S. technology company and indicate a willingness to invest needed capital in the

company. But before the Chinese company can do this, they must do due diligence and they send in employees, who turn out to work for a state-owned Chinese company, to obtain key information about the company, including trade secrets. The firm never hears back from the investment company again.

Another path is through exchange visits and student enrollments in U.S. universities. At least at one time, it was common for Chinese exchange visitors to the United States to use opportunities to visit factories and other facilities to engage in industrial espionage, including measuring equipment, taking photos and writing detailed technical notes to bring back to China. And as Daniel Golden writes in *Spy Schools* there have been cases where Chinese graduate students enrolled in U.S. universities use their access to valuable scientific and engineering information to bring that back and provide it to Chinese companies.<sup>15</sup>

Chinese trade secret theft also represents an increasing challenge. A prime example is Boston-based American Superconductor (AMSC), which provides software, design, and hardware solutions for wind manufacturers and energy providers. American Superconductor's top customer, the Chinese-based wind turbine manufacturer Sinovel Wind Group, faced criminal and civil actions for paying an AMSC employee to steal proprietary power-converter and control-system software, which it then used illegally in its wind turbines to meet electricity grid standards.<sup>16</sup> The employee, an engineer at one of AMSC's subsidiary's, was recently found guilty of industrial espionage in Austria. In another telling case, the global agriculture firm Monsanto decided to open production and research facilities for advanced corn technology in China and proceeded to develop experimental fields growing genetically enhanced corn. It wasn't long before the advanced corn was systematically stolen, clearly an effort by the Chinese government to gain access to the IP embedded in Monsanto's corn.<sup>17</sup>

#### **Weak IP Enforcement:**

Weak enforcement of IP law is another vector. Chinese firms can often copy and reengineer foreign technologies with impunity (what they call introducing, digesting, absorbing and re-innovating), even those technologies protected by patents. As a *MIT Sloan Management Review* article, "Protecting Intellectual Property in China," noted, "Intellectual property protection is the No. 1 challenge for multinational corporations operating in China."<sup>18</sup> According to the U.S. International Trade Commission, in 2009, U.S. IP-intensive enterprises conducting business in China reported losses of approximately \$48.2 billion in sales, royalties, or license fees due to Chinese IPR infringement.<sup>19</sup> In 2018, according to the American Chamber of Commerce in China, one-quarter of surveyed U.S. companies cited "Insufficient protection offered by text of IP-related laws and regulations," while 24 percent cited, "Difficulty prosecuting IP infringements in court or via administrative measures" as significant challenges.<sup>20</sup>

Interestingly, there is new evidence that China favors domestic over foreign patent applicants when it comes to strategic industries. As the report "Technology Protectionism and the Patent System: Strategic Technologies in China," published in 2016 by Gaétan da Rassenfosse and Emilio Raiteri finds, "Foreign applications in technology fields that are of strategic importance to China (as defined by being listed on the MLP) are 4 to 7 percentage points less likely to be approved than local applications, all else equal."<sup>21</sup> As they note, "While much analysis has focused on unequal enforcement of IP rights in China, this is the first study to find systematic evidence of bias in the granting of patents against foreigners in China. Given the

importance of industrial policy in China and the country's strong focus on indigenous innovation and intellectual property, the empirical results provide a case of technology protectionism by means of the patent system."<sup>22</sup>

### **State-Backed Purchases of U.S. Technology Companies:**

An increasingly important way for Chinese firms to gain access to needed technology is to simply buy up U.S. technology companies or invest in high-tech startups. Indeed, until recently, a not-insignificant share of Chinese foreign direct investment into the United States was in technology industries. According to Select USA, the top four industrial categories in terms of numbers of Chinese FDI projects from 2003 to 2015 were electronics, industrial machinery, software and information technology services, and communications.<sup>23</sup> The Rhodium Group reports that over the last 16 years there has been roughly \$18 billion of Chinese FDI into ICT and electronics industries deals, with most of that in just the last few years. Of the \$4.9 billion invested in electronics, \$4.2 billion was invested in 2016, with 99.99 percent of that going to buy U.S. firms.<sup>24</sup> Of the \$14.2 billion invested in ICT, 74 percent was made from 2014 to 2016, with more than 95 percent going to acquisitions.<sup>25</sup> These numbers would have been considerably larger if the federal government had not informally or formally blocked some deals through the Committee on Foreign Investment in the United States (CFIUS). Fortunately, Chinese inward FDI has dramatically fallen in the last two years as it became clear that the U.S. government would take a harder look at their attempts to buy U.S. technology. And of course, the recent enactment of the Foreign Investment Risk Review Modernization Act (FIRRMA) will hopefully help even more going forward.

The role of Chinese government money in U.S. deals is underreported in part because of the opaque nature of this support. As Wang and Wang note, many Chinese firms lack transparency, making it difficult for host countries to know enough about the investing firm.<sup>26</sup> This was evident for example in the attempted purchase of German semiconductor equipment firm Aixtron by a Chinese investor where there were "a web of relations among the customer, the buyer, and the Chinese state."<sup>27</sup> Moreover, the Chinese government channels funds to supposedly private investment bodies, making it look as if these deals are commercial.

The main purpose of most Chinese technology companies buying U.S. technology companies is not to make a profit, but to take U.S. technology to upgrade their own technology capabilities. The Rhodium Group notes that in the aviation sector, "The dominant player is aviation conglomerate AVIC, which is looking to the US market to upgrade its technology and other capabilities."<sup>28</sup> Likewise, in the electronics and electrical equipment sector, "Chinese investors are drawn to the US electronics and electrical equipment sector for building their brands, expanding their sales and distribution channels, and upgrading their innovative capacity and technology portfolios."<sup>29</sup> Investments in pharmaceuticals and biotechnology are "often driven by upgrading technology (such as Wuxi's acquisition of AppTec, a laboratory services firm)."<sup>30</sup> As one study of Chinese FDI estimated, 30 percent of the private firm deals and 46 percent of the SOE deals are motivated by technology acquisition.<sup>31</sup> The authors go on to state that Chinese acquisition of overseas firms "has become the most widely used methods [of investing overseas] for Chinese firms, largely because it provides rapid access to proprietary technology."<sup>32</sup>

China has also ramped up its efforts to buy into early-stage U.S. technology start-ups. A recent report from DOD's Defense Innovation Unit Experimental (DIUx) finds that "Chinese participation in venture-backed startups is at a record level of 10-16% of all [U.S.] venture deals (2015-2017) and has grown quite rapidly in the past seven years."<sup>33</sup> And some of this investment comes from venture firms that are backed by Chinese governments (federal or provincial). For example, the Zhongguancun Development Group, a state-owned enterprise headquartered in Beijing has set up "Danhua capital" to promote the strategy of "Zhongguancun capital going global and bringing in overseas advanced technology and talents."<sup>34</sup> Likewise, Shenzen Capital Group, a purportedly private venture capital firm that has invested in at least one advanced U.S. technology company,<sup>35</sup> has actually received about 80 percent of its invested capital from the Chinese government,<sup>36</sup> and its investments are focused, not surprisingly, to match the central governments key targeted industries. The firm even boasts a chart that compares the technology allocation of its investments and how it compares to the governments priorities.<sup>37</sup>

FDI acquisition is not the only path to U.S. technology capabilities. For example, China is investing in U.S. research universities to gain access to their research, often with U.S. state government-backing. For example, Maryland is committing nearly \$600,000 over three years to build up the Maryland International Incubator, in a bid to attract high-tech companies from China and elsewhere to collaborate with University of Maryland researchers. Of the 18 companies in the incubator, nine are from China, with most of these being biotech companies.<sup>38</sup> In addition, Chinese firms have become investors in early stage U.S. technology companies. These include the venture capital arms of Chinese Internet companies such as Alibaba or Tencent. The idea is to invest in start-ups and use that as a way to bring technology and knowledge back to China. Indeed, at least a few Silicon Valley experts report that they are seeing a significant uptick in Chinese venture investment in Silicon Valley. This trend could very well increase in coming years as China sees that its traditional acquisition route becomes more difficult. We see this pattern in other nations as well. 40 percent of venture capital in Israel in 2015 reportedly came from China.<sup>39</sup>

### **Forced Technology Transfer as a Key Weapon in the Chinese Arsenal**

Dwarfing these tools is forced technology transfer. Although China's World Trade Organization (WTO) accession agreement contains rules constraining it from tying foreign direct investment or market access to requirements to transfer technology to the country,<sup>40</sup> China routinely requires firms to transfer technology in exchange for being granted the ability to invest, operate, or sell in China.<sup>41</sup> As Harvard Business School professors Thomas Hout and Pankaj Ghemawat document in "China vs the World: Whose Technology Is It?," Chinese technology transfer requirements as a condition of market access have affected scores of companies in industries as diverse as aviation, automotive, chemicals, renewable energy, and high-speed rail.<sup>42</sup> To be sure, because such conditions usually contravene China's WTO commitments, officials are careful not to put such requirements in writing, usually resorting to oral communications to pressure foreign firms to transfer technology.<sup>43</sup> In 2011, then-U.S. Treasury Secretary Timothy Geithner laid such concerns about China's technology transfer requirements, stating that "we're seeing China continue to be very, very aggressive in a strategy they started several decades ago, which goes like this: you want to sell to our country, we want you to come produce here. If you want to come produce here, you need to transfer your technology to us."<sup>44</sup> In 2012, 23 percent of the value of all foreign direct investment projects were joint ventures.<sup>45</sup> And the U.S.-China Business Council's "2014 China Business Environment Survey" reports that 62 percent of companies

had concerns about transferring technology to China, while 20 percent reported that they had been requested to transfer technology to China within the past three years.<sup>46</sup>

Forced technology transfer is not new. A 1987 Congressional Office of Technology Assessment report states, “Although most U.S. firms approach the China market with the intent to sell products, many find they must include technology transfer if they wish to gain access to the China market.”<sup>47</sup> But what is new are two things. First, there are more foreign companies seeking to get in the Chinese market, such that the scale of forced technology transfer is much larger than it was two decades ago. In 2015 for example, 6,000 new international joint ventures, amounting to \$27.8 billion of FDI inflows, were established in China.<sup>48</sup>

Second, the sophistication and value of the technology the Chinese government is now demanding is significantly higher than in decades past when U.S. companies could afford to give their Chinese “partners” older generations of technology, confident that the U.S. firms could innovate faster. Now for many foreign advanced industry companies, doing business in China requires transferring ever-more valuable technology to Chinese joint venture partners. In 2013, 35 percent of U.S. business respondents in China said that tech transfer requirements were a concern, and 42 percent in advanced technology industries voiced this concern.<sup>49</sup> Fifty-six percent of survey respondents who gave a response thought that tech transfer requirements were increasing.<sup>50</sup> And as USTR points out in its 301 report on China, it is likely that these numbers are under-reported.<sup>51</sup>

For example, the CEO of a large multinational telecommunications equipment company shared with ITIF that he opened up a large R&D facility in Beijing that employs over 500 scientists and engineers. When asked if he did this to access Chinese engineering talent, he responded bluntly: “Unless I promised the Chinese Government that I would open up an advanced technology lab there, I was told that I would not be able to sell to the Chinese telecommunications providers,” (most of which are de facto controlled by the Chinese government).

The Chinese government has employed the weapon of forced technology transfer to gain technological know-how in a variety of industries. A well-known case in point concerns high-speed rail. Over the past 15 years China built the largest high-speed rail network in the world. That massive purchase of rolling stock, signal systems, and related equipment was something no foreign rail producer could afford to ignore. As such, the Chinese government had enormous leverage to pressure foreign producers to give the Chinese state-owned enterprise competitors key technology and IP. The Chinese term for this is “exchanging market for technology.”<sup>52</sup> As Chen and Haynes document, in 2004 the State Council of China adopted a new railway development strategy that shifted from just subsidizing domestic producers in order to help them improve their technology to one where they “introduce advanced technology through joint design and manufacturing, [with an ultimate objective to] to build a Chinese brand.”<sup>53</sup> After that the state Ministry of Railways (MOR) launched three tenders for foreign high-speed electric trains and in each one MOR stipulated that foreign companies had to collaborate with domestic partners in the competition and had to transfer key technologies to achieve localization.<sup>16</sup> The tender included two key conditions: to win, the bidder had to transfer technology to China and the final products had to be marketed under the Chinese state-owned enterprise rail car brand. This was all in support of the government’s “Action Plan for the Independent Innovation of Chinese High-Speed Trains.” As a result, multiple foreign train companies were pressured to transfer valuable



technology to the Chinese companies (now principally one company due to the central government forcing the two main companies to merge into a powerful national champion, Chinese Railway Construction Corporation, now the largest rail producer in the world.) As Chen and Haynes write, “The result is a new HSR [high speed rail] industry in China has emerged which now serves the new vast HSR network and looks externally to export its new skill in HSR production and its new cutting-edge activity in HSR innovations.” Not only are CRCC and related Chinese companies virtually guaranteed all Chinese rail projects, but CRCC is now aggressively exporting trains and train systems containing advanced foreign technology to other nations, backed with generous export subsidies from the central government. For example, the China Export-Import Bank (a state agency) announced in 2017 the equivalent of \$30 billion in financing assistance for CRCC exports.<sup>54</sup> (Surprisingly, the U.S. Department of Commerce International Trade Administration, in its document promoting U.S. rail export opportunities to China, makes no mention of the fact that the lion’s share of these opportunities come with forced technology transfer requirements.<sup>55</sup>)

The Chinese have employed different tactics to the same end in the biopharmaceutical industry, where various policies enable Chinese firms to get access to U.S. technology. For example, the relatively short six-year term for data exclusivity, coupled with the lack of a formal definition of a “new chemical entity,” means the Chinese government can pressure U.S. firms to turn over important data to Chinese generic drug firms. Similarly, the Chinese government requires that any drugs sold in China must go through Chinese clinical trials, even if they are approved in the United States. This extends the time for sales before a company can sell a drug by as much as 8 years, meaning that the company has only 12 years left of patent-protected sales in China before a Chinese generic company can copy the drug. Moreover, in China, unlike the United States and Europe, there is no extension of marketing exclusivity at the back end to take into account long clinical trial delays. Moreover, China also issues compulsory licenses for the intellectual property for particular drugs.<sup>56</sup> Finally, it presses foreign biopharmaceutical companies to form joint ventures if they want their drugs more easily put on the government list of drugs to qualify for reimbursement.<sup>57</sup>

We also see this in cloud computing. China requires companies running cloud-computing operations to be locally controlled. This means that if a company like Amazon Web Services or Microsoft wants to serve the rapidly growing Chinese market it must partner with a Chinese company and sell their services under the Chinese company brand. And as part of this partnership the expectation is that the foreign cloud provider will provide the Chinese firm with technology and know-how.<sup>58</sup> Chinese cloud providers, like Aliyun, the cloud services unit of Alibaba, is able to establish its own data centers in the United States without any similar requirements.

The Chinese have long had policies in place requiring joint ventures with local firms in order for foreign companies to produce automobiles in China.<sup>59</sup> And many of those production JV requirements also include joint R&D facility requirements. The government is now doubling down on this approach in order to be the global leader in electric vehicles. For example, Renault-Nissan and Ford Motor have established joint electric-car ventures in China.<sup>60</sup> Indeed, the New Energy Vehicles program under Made in China 2025 strategy requires foreign companies wishing to sell in China to disclose and share valuable technology with their local joint venture partner.<sup>61</sup> We see this pattern in many other advanced technology industries, including wind turbines.<sup>62</sup>

### **Tools to Force Technology Transfer:**

The Chinese have a host of tactics with which they use to pressure foreign companies to transfer technology. All involve “making them an offer they can’t refuse.” The first and most important is to set up industries that are off-limits to fully-owned foreign direct investment. China’s “Catalogue of Industries for Foreign Direct Investment” classifies industries based on categories: “encouraged,” “restricted,” “prohibited.” Other industries are considered to be “permitted.” It is in the restricted category, (which includes 35 sectors, such as automobiles, commercial aircraft, and high-value added telecommunications services) that foreign firms are legally required to partner with a domestic firm in a joint venture.

China wields a host of other weapons to help foreign firms understand that it is in their interest to share their technology. One is to bring bogus anti-trust charges against foreign advanced industry companies and then as part of the settlement make it clear that they must transfer technology to local Chinese partners.<sup>63</sup> And with Chinese courts largely rubber-stamping the government’s dictates, foreign companies have little choice but to comply. And, all too often, complying means changing their terms of business so that they sell to the Chinese for less and/or transfer even more IP and technology to Chinese-owned companies, often after paying substantial fines to the government.<sup>64</sup>

Another tool is to force foreign companies operating in China to store data about Chinese users in China and turn over encryption keys and source code for inspection. Likewise, in some industries companies must disclose trade secrets as a precondition for receiving regulatory approvals for investments. Still another is to tie regulatory and licensing approvals needed for operation in China to technology transfer. Still another is to tie purchases by the state, including state-owned enterprises, to technology transfer. For example, the Commercial Aircraft Corporation of China (COMAC) requires foreign suppliers to enter into JVs with Chinese suppliers if they want to sell to COMAC.<sup>65</sup>

China’s anti-monopoly law has been designed so the government can use it to force foreign companies to license technology at favorable rates to Chinese firms. Article 55 states, “This Law is not applicable to undertakings’ conduct in exercise of intellectual property rights pursuant to provisions of laws and administrative regulations relating to intellectual property rights; but this Law is applicable to undertakings’ conduct that eliminates or restricts competition by abusing their intellectual property rights.”<sup>66</sup> Yet, for the Chinese government, “abuse” means charging market-based IP licensing fees to Chinese companies. This provision has been used to take legal action against companies whose only “crime” is to be innovative and hold patents. Indeed, the Chinese law allows compulsory licensing of IP by a “dominant” company that refuses to license its intellectual property (IP) if access to it is “essential for others to effectively compete and innovate.”<sup>67</sup> And with Chinese courts largely rubber-stamping the government’s dictates, foreign companies have little choice but to comply. All too often, complying means changing their terms of business so that they sell to the Chinese for less and/or transfer even more IP and technology to Chinese-owned companies, often after paying substantial fines to the government.<sup>68</sup>

Separately, there exists growing concern that “secure and controllable” measures mandated by China’s National Security Law and Cybersecurity Law may force source code (i.e., intellectual property) disclosure and may also induce or force the localization of design or manufacturing processes of ICT products such as semiconductors or servers. Specifically, on November 7, 2016, China enacted a new Cybersecurity Law that introduces (further) restrictive requirements on foreign technology companies: *The Economist* aptly described it as a “techno-nationalist Trojan horse.”<sup>69</sup> China’s new cybersecurity law—through discriminatory standards and forced local data-storage requirements—reinforces existing policies that segment its citizens and tech firms, in addition to its broader Internet ecosystem, from the rest of the world. The law is significant, as it represents China’s first enactment of rules on the collection and use of personal data. The law forces companies in “critical information infrastructure” to store users’ “personal information and other important business data” in China, a concept known as “forced localization.”<sup>70</sup>

China may use the law to expand an existing—and controversial—cybersecurity regulation that is highly discriminatory toward foreign tech firms and products. The cybersecurity law states that China will introduce a cybersecurity multilevel protection scheme (MLPS) for ICT products used in network security by CII sectors. This requirement is perhaps based off an existing MLPS that China has applied for information security (although this is unclear from the wording in the law).<sup>71</sup> This potential relationship raises serious concerns for foreign technology companies, as this earlier MLPS was highly discriminatory—it prohibited certain sectors from using foreign IT products and forced foreign companies to transfer IP and source code to China for review.<sup>72</sup>

Equally troubling is the potential for China to use the law to revive the use of a highly discriminatory standard for IT products—the so-called “secure and controllable” concept—and intrusive security audits, both of which can be used to discriminate against foreign firms and to force the disclosure of valuable intellectual property. The law calls for the use of “secure and trusted” network services and productions, without defining the term. Current deliberations by China’s National Information Security Standards Technical Committee (NISSTC) on what this concept means (see below) and past Chinese government policy proposals point toward its mercantilist intent.<sup>73</sup> This concept, along with its analogous “independent and controllable,” “secure and controllable,” or “indigenous and controllable” terms have been a part of Chinese technology policymaking debates ever since the country backed down on implementing such a rule as part of a banking law in 2015. (That proposed banking law used a “secure and controllable” provision as part of an explicit aim to replace foreign technology goods with local ones. China decided to “withdraw” this provision after it generated significant opposition from tech companies and trading partners, especially the United States.)<sup>74</sup> Essentially, China wants to force software companies, network-equipment makers, and other tech companies to disclose source code to supposedly prove their products can’t be compromised by hackers.<sup>75</sup> Source code—the instructions that make a computer program run—enable technology to do the amazing things it does. For companies developing software, protecting source code is necessary to prevent other entities from stealing and free riding on the large research and development costs associated with software development. Source code is at the heart of a company’s competitive advantage, but being digital, it is at heightened risk of duplication. Given China’s poor protection of IP, not to mention its role in the cybertheft of foreign trade secrets, it’s unsurprising that foreign firms and trading partners, such as the United States, have reasonable fears that such intrusive inspections are simply a way to access and steal valuable intellectual property.

## Other Steps to Gain Technology Dominance

Once Chinese firms gain access to needed foreign technology, the next step of the Chinese strategy is to ensure that they have the capital needed to scale up. This involves direct and indirect subsidies and also designing markets protected from foreign competition so the Chinese firms can accumulate capital. Once firms have the technology, competencies and scale to go global, the government often subsidizes global market expansion, such as through the China Export-Import Bank (an entity the World Bank has funded) and China's Export and Credit Insurance Corporation (Sinosure).<sup>76</sup> Moreover, by leading to global overcapacity and selling below cost, China uses that overcapacity as a cudgel to disrupt the economics of innovation-based industries (i.e., subsidized competition prevents foreign competitors from earning reasonable profits from one generation of innovation to reinvest in future generations of innovation) and thus weaken foreign competitors, enabling Chinese firms to gain even more global market share.

The Chinese government also works to limit foreign competition for its budding national champions. For example, in the high-end equipment manufacturing sector, China maintains a program that conditions the receipt of a subsidy on an enterprise's use of at least 60 percent Chinese-made components when producing intelligent manufacturing equipment.<sup>77</sup> And despite the fact that China "clarified and underscored ... that it agreed that enterprises are free to base technology transfer decisions on business and market considerations" at a December 2014 meeting of the United States-China Joint Commission on Commerce and Trade (JCCT), USTR notes that China has "announced two measures relating to [local procurement of] information technology equipment used in the banking services sector and in providing Internet- or telecommunications-based services more generally."<sup>78</sup>

China also lavishes Chinese firms that have obtained foreign technology with massive subsidies. As George and Usha Haley document in their book, *Subsidies to Chinese Industry: State Capitalism, Business Strategy, and Trade Policy*, China's game plan has long been to "aggressively subsidize targeted industries to dominate global markets." As they document, in the 2000s, China provided almost \$100 billion in subsidies to just three industries alone: \$33 billion for paper, \$28 billion for auto parts, and \$27 billion for steel.<sup>79</sup> China's share of global solar panel exports grew from just 5 percent in the mid-2000s to 67 percent today, with Chinese solar output turbocharged by at least \$42 billion of subsidies from 2010 to 2012 alone.<sup>80</sup> China now wants to replicate this strategy in other advanced-technology industries, such as semiconductors and electric batteries.<sup>81</sup> For instance, China's National Integrated Circuit (IC) Strategy calls for at least \$160 billion in subsidies to create a completely closed-loop semiconductor industry in China, including explicit plans to halve Chinese imports of U.S.-manufactured semiconductors by 2025 and eliminate them entirely by 2035. The "Made in China 2025 Strategy" is supported by some 800 state-guided funds to the tune of more than \$350 billion, including advanced-battery manufacturing, wide-body aircraft, and robotics.

China has also made the development of indigenous technology standards, particularly for information and communications technology products, a core component of its industrial development and economic growth strategy. China has committed to developing unique national standards for dozens of high technology and ICT products—in many cases where international standards already exist—developing homegrown standards for everything from mobile telecommunications services and wireless local area networks to encryption technologies and the Internet of Things.<sup>82</sup> In some cases, such as with WAPI (the Wireless Local Area

Network Application and Privacy Infrastructure standard that China developed as an alternative to the WiFi standard), China attempted to require that all wireless networking products sold in China would have to be WAPI-compliant and use its encryption method, in contravention of its commitment to let foreign enterprises use desired technologies in the provision of telecommunication services.<sup>83</sup> As USTR notes, “China has continued to pursue unique national standards in a number of high technology areas where international standards already exist, such as 3G and 4G telecommunications standards, Wi-Fi standards and information security standards.”<sup>84</sup> More commonly, however, Chinese officials “pressure foreign companies seeking to participate in the standards-setting process to license their technology or intellectual property on unfavorable terms.”<sup>85</sup> Clearly, China has not met its commitments in the telecommunications sector, either in terms of market access or in refraining from promulgating technology standards that allow companies “to use any technology they choose to provide telecommunications services.”<sup>86</sup>

### **What is at Stake?**

Given China’s Made in China 2025 plan, it is no exaggeration to suggest that, without aggressive action, the United States may face a world within two decades where U.S. jobs in industries as diverse as semiconductors, computers, biopharmaceuticals, aerospace, Internet, digital media, and automobiles are significantly reduced due to Chinese policies unabashedly targeting domestic and global market share in those industries.

It is important to understand that the challenge to America’s leadership in technology-based industries is much different than the process of losing more commodity-based, low-skilled industries to China in the 2000s. If, for example, the value of the dollar was to fall significantly related to the yuan (and other currencies), it is possible that America could regain at least some of the production lost to China in industries like textiles and apparel, furniture, metal parts, and other similar low- and medium-value added products. Companies could simply buy machines, set up factories, and restart production domestically in a cost-effective way. But if America’s technology companies were severely weakened or even put out business, no currency decline could bring them back because competitiveness in technology industries is based less on cost and more on a complex array of competencies at the firm- and ecosystem-level. For example, a firm cannot simply buy some semiconductor equipment and start producing chips. To do that would require not just machines but deep and complex tacit knowledge embedded in the firm in workers (from the shop floor to scientists to managers) coupled with an innovation ecosystem (universities training the right talent, a network of suppliers, etc.). Once those capabilities are lost, they are essentially gone, and are very difficult to resurrect absent massive government intervention.

There is an additional reason why losing advanced technology industries is problematic. Most technology-based industries have high barriers to entry. In contrast to the t-shirt industry where entry largely requires just capital to buy sewing machines, entry into innovation-based industries requires both physical and intellectual capital. In an industry like semiconductors, for example, firms spend hundreds of millions, if not billions, of dollars developing technical capabilities to enable production. Producing the first chip of a particular generation is incredibly expensive because of the amount of R&D involved. Producing the second chip is much cheaper because only the material and labor costs are involved. In this sense, fixed costs are extremely high, but marginal costs are low. In these innovation-based industries losing market share to unfairly competing firms supported by their innovation mercantilist governments means two things. First, sales fall.

This is true because global sales are largely fixed (there is only so much demand for semiconductors, jet airplanes, and other similar advanced products), and if a mercantilist-supported competitor gains market share, the market-based competitor loses share. Second, because profits decline more than sales, it is now more difficult for the market-based innovator to reinvest revenues in the next generation of products or services, meaning that the mercantilist-supported entrant has an advantage in the next generation of products. This can lead to a death spiral whereby the market-based leader can lose complete market share.

A loss of advanced technology industries has two major negative impacts on the U.S. economy. The first is on prosperity, as the average wage in these industries is approximately 75 percent higher than average U.S. wages.<sup>87</sup> The second is on national security and the defense industrial base. U.S. defense superiority is based in large part on technological superiority. Our service men and women go into any conflict with the advantage of fielding technologically superior weapons systems. But maintaining that advantage depends on the U.S. economy maintaining global technological superiority, not just in defense-specific technologies but in a wide array of dual-use technologies. To the extent the United States continues to lose technological capabilities to China, U.S. technological advantage in defense over China will diminish, if not evaporate, as U.S. capabilities whither and Chinese ones strengthen. It is certainly a highly risky proposition to assume that the United States can continue its weapons systems superiority over the Chinese if: 1) the Chinese continue to advance, largely through unfair, predatory practices at the pace they are; and 2) the United States loses a moderate to significant share of its advanced technology innovation and production capabilities. As ITIF wrote in 2014, “The United States defense system is still the most innovative in the world, but that leadership is not assured and is in danger of failing. This decline is not only impacting defense innovation and capabilities, but also overall commercial innovation and U.S. competitiveness.”<sup>88</sup>

### **What the U.S. Government Should Do?**

The main approach currently to pressure the Chinese government to behave as a more responsible global actors is the imposition of tariffs under Section 301 authority. The Trump administration has placed tariffs on a wide array of Chinese exports in an effort to bring the Chinese government to the negotiating table. It is not clear if this approach will succeed.

Regardless, there are additional tools the federal government should consider employing. But perhaps the most important step is to develop joint campaign with our allies. The United States should be doing much more to develop such a coordinated agenda with like-minded allies as that will help create pressure that will make it more likely that China feels like it has no choice but to play more by the rules.

In any case, the U.S. government can and should take a number of steps on its own. And there are steps Congress could take to help roll back Chinese innovation mercantilism.

The first relates to boosting the institutional capacity of the federal government to understand and address these issues. **The House should introduce and pass a companion to the National Economic Security Strategy Act of 2018 (S 2757).** By requiring the administration to develop a national economic strategy to support the national security strategy, the legislation will not only help the administration make stronger connections between economic security and national security, it will help identify challenges and policy needs. By focusing

attention not only on the strengths and weaknesses within American industry related to national security broadly defined, but also on the threats from other nations, policymakers will be better prepared to take the decisive steps that are required.

**Congress should instruct USTR to bring a WTO case against China over its ongoing failure to publish thousands of trade-related final measures, including subsidies, in a single official journal as it's required to do under WTO rules.** One reason it's been difficult to bring subsidy cases against China at the WTO is that China fails to properly publish its subsidies. Getting the WTO to enforce China's publication requirements would make it possible to bring additional WTO cases for subsidy or other violations, such as forced IP or technology transfer.

The United States also needs a new regime to contest China's strict technology-licensing laws. Under Chinese contract law and technology import-export regulations (or TIER), a foreign licensor into China is obligated to offer an indemnity against third-party infringement to the Chinese licensee.<sup>89</sup> In other words, a foreign licensor licensing into China has to provide insurance that practicing the licensed technology does not infringe any IP held by a third party. But, under TIER, this legal obligation only attaches to "technology import contracts." That is, this obligation only attaches to a foreigner licensing technologies into China; the Chinese licensor has no such obligation. This discriminates against foreign licensors. The foreign licensor is legally bound to offer something that the Chinese licensee is not, making it difficult for small companies, companies which may experience high litigation risks in China's litigious environment, and companies engaged in collaborative research and development (such as cross-licensing, open-source licensing, and charitable activities) to arrive at mutually beneficial licensing agreements. TIER makes it almost impossible for small companies, such as start-ups, to license their breakthrough technologies in China, because no start-ups (due to their limited resources) would be able to conduct the complex analysis required by China's high-litigation environment and industrial policies that limit the value of foreign IP in order to offer insurance against third-party infringement disputes. While large multinational companies could avoid this issue by licensing technology (e.g., through their China-based subsidiaries), start-up companies cannot do so because they typically do not have subsidiaries in China. Consequently, the impact of the mandatory indemnification requirement on small- and medium-sized companies, and especially start-ups, is particularly acute.

Another provision in TIER mandates that in technology-import contracts, improvements belong to the party making the improvements, which typically is the Chinese licensee. Thus, foreign licensors, including U.S. firms, cannot negotiate to own any improvements or to share the improvements with Chinese licensees, even if both licensing parties desire for the improvements to be shared or owned by the foreign licensors. Moreover, TIER prohibits any technology-import contracts to "unreasonably restrict the export channels" of the Chinese licensee, thereby impeding the ability of the two licensing parties to allocate markets as they see mutually beneficial. Put simply, U.S. companies are obligated under TIER to let Chinese firms own the improvements and cannot freely negotiate with Chinese entities.

To address this discrimination, **Congress should enact a regime whereby if Chinese entities seek licenses in the United States, then the Chinese enterprise must license on the same terms by which foreigners are required to license into China.** Such legislation would specifically require the Chinese licensor to offer an indemnity

against infringement by the U.S. licensee and to stipulate that the U.S. licensees are entitled to own the improvements they make and receive a reasonable market allocation under the licenses. Another possible approach would be for Congress to pass legislation requiring that the U.S. company whose original technology was improved by the Chinese entity receives an automatic exclusive license to use that improved technology [in the United States], such that the full potential of the original technology owned by the U.S. companies is not encumbered by improvements owned by the Chinese entity. Although technology-licensing law is usually a matter of state contract law, the legislation would be enacted pursuant to Congress's power to legislate international commerce.

There are other ideas that are at least worth considering and developing further.

**Tighten the process of issuing student visas from students coming from China and strengthen FBI-university partnerships to limit inappropriate IP transfer.** This would also serve the purpose of limiting intellectual property theft from U.S. universities sometimes carried out by Chinese graduate students sent to the United States for that purpose. At minimum, the FBI should engage in a stronger partnership with U.S. research universities to help them better understand how to take steps to better identify students here for the purpose of intellectual property transfer and how to limit such access. The point is not to just limit access and transfer of sensitive military technology subject to deemed export controls, but also advanced technology that can help China compete with the United States.

**Limit ongoing science and technology cooperation with China.** It makes little sense to engage in S&T cooperation with China, especially considering that much of that cooperation is lopsided with the United States contributing more than the Chinese.

**Take a hard line on limiting most Chinese investment in the United States, including in Chinese-backed tech accelerators.**<sup>90</sup> With the passage of FIRREA and the Export Control Act it will be easier for the administration to do this, but Congress should use oversight to ensure that they are taking advantage of these new authorities.

**Prohibit Chinese firms that are stealing IP from accessing the U.S. banking and financial system.** The administration could deny Chinese-headquartered enterprises access to listing on U.S. stock exchanges if they fail to provide financial statements in line with generally accepted accounting principles.

**Build an "inspection wall" against counterfeit and pirated Chinese goods, with the goal of stopping them all.** China accounts for 87 percent of counterfeit goods seized each year, with costs estimated to be between \$30 and \$40 billion.<sup>91</sup> Tougher border enforcement would harm Chinese exporters illegally shipping goods to the United States.

**Prevent foreign governments from abusing America's "foreign sovereign compulsion" defense for mercantilist ends.** China and other countries in recent years have abused the doctrine of "foreign sovereign compulsion" to justify anticompetitive behavior that has harmed U.S. interests even though it has passed muster in U.S. courts. For instance, the U.S. Second Court of Federal Appeals in 2016 threw out a case against Chinese vitamin C makers alleged to have conspired to fix prices and limit supplies in international markets, including



in the United States, on grounds that the behavior was directed by the Chinese government and thus wasn't actionable under U.S. antitrust law because deference must be given to the official policies of foreign governments (i.e., the foreign sovereign compulsion defense). While this verdict was recently reversed by the U.S. Supreme Court, Congress should curb foreign governments' ability to abuse the foreign sovereign compulsion defense for these kinds of mercantilist ends.<sup>92</sup> One way to do so would be to require courts to give consideration to the implications for U.S. industries' global competitiveness in cases involving the foreign sovereign compulsion defense.<sup>93</sup> Congress should also eliminate a regulation that exempts mergers involving Chinese state-owned enterprises from having to be announced in accordance with U.S. antitrust law.

**Pass legislation that allows firms to ask the Department of Justice for an exemption to coordinate actions regarding technology transfer and investment to other nations.** One of the key levers China has is that it's a monopolist: its market is so large it can essentially compel foreign companies to hand over technology in order to sell their products in China. But if companies in a similar industry can agree that none of them will transfer technology to China in order to gain market access, then the Chinese government will have less leverage over them. The same would be true if companies agreed that they would not invest in China until China improved its IP protections. Such an amendment to antitrust law would be similar to the 1984 Cooperative R&D Act, which allowed firms to apply to form pre-competitive R&D consortia.

**Stand up a new arm of DOJ's antitrust division focused on foreign government-enabled and led antitrust violations.** Currently, DOJ can bring actions against foreign firms if they are found to be acting in an anticompetitive manner. DOJ needs to not only be able to but be willing to bring actions against foreign firms if their actions are helped by their state in a way that leads to anticompetitive results. In the case of China, its subsidies, forced technology transfer, IP theft, and other unfair actions give Chinese firms unfair advantages that distort markets in an anticompetitive manner. DOJ should be able to investigate cases and if they found a violation, bring those to an administrative law judge who would adjudicate the case and the damages the U.S. government could impose on the Chinese companies that benefited from the anti-competitive Chinese government policies or practices. The challenge will be that not all Chinese companies likely to have cases brought against them are involved in the U.S. market. But some are, and for the ones that aren't such a ruling would effectively preclude them from entering the U.S. market.

**Take stronger actions to make the United States more competitive.** Finally, it is important to note that while policies and actions to roll back foreign mercantilist actions are critical, the United States does need to do much more to boost U.S. competitiveness at home. Among other steps this includes expending lending authorities for the Export-Import Bank;<sup>94</sup> increased funding for pre-competitive research, including for the Manufacturing USA program; increased efforts to develop STEM talent, a more generous R&D tax credit and other steps. For example, at least 26 other nations field a more generous R&D tax incentive, 21 other nations fund more university-based R&D and many more nations invest more in industrially-relevant R&D.<sup>95</sup> As such American needs its own Made in USA 2028 program where the federal government identifies the technologies most important to America's national and economic security and allocates at least an additional \$25 billion annually to support their development.<sup>96</sup> Moreover, the federal government should work to establish a deeper North American supply chain, as at least somewhat of an alternative to the Chinese

supply chain. This would entail maintaining (if not improving) NAFTA and expanding it to other Latin American nations.

In summary, taking firms and strategic action against Chinese predatory, mercantilist practices is long overdue. Whether or not such actions can be successful is an open question. But one thing is clear: not taking action will make it much easier for the Chinese government to achieve their goal of dominating global technology industries.

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