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**THE NATIONAL SECURITY INSTITUTE**  
At George Mason University's Antonin Scalia Law School



# ADDRESSING THE NATIONAL SECURITY THREAT OF CHINESE TECHNOLOGICAL INNOVATION

By Jamil N. Jaffer, *NSI Founder and Executive Director*

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## THIS PAPER:

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### SUMMARIZES

China's multi-faceted efforts to take a global lead in the technology domain.

2

### DETAILS

U.S. responses to date in response to the growing U.S.-China tech competition.

3

### DESCRIBES

how the U.S. government and our allies can best resource and promote long-term technological innovation.

4

### PROVIDES

recommendations on U.S. and allied policies that support innovation.

## THE PRC'S TECHNOLOGY PRIORITIES

- **The Big Picture.** The defining national security challenge facing the United States over the next decade or two is virtually certain to be the threat posed by a rising People's Republic of China (PRC), controlled by the Chinese Communist Party (CCP).
  - At the core of the competition between the United States and its closest near-peer rival—whether in the economic, political, or social spheres—will be technological innovation.<sup>1</sup>
- **Beyond an Economic Power.** In recent decades, the CCP has made aggressive moves to build its own economic base in this area,<sup>2</sup> and now seeks to expand its capabilities across the technology and innovation domains.<sup>3</sup>
  - The PRC began this effort by actively seeking to dominate the manufacturing market for technology goods, producing equipment at costs well below those achievable in most other economies.<sup>4</sup>
  - Over time, the PRC came to rely upon the theft of U.S. intellectual property at industrial scale—referred to as the greatest transfer of wealth in modern human history<sup>5</sup>—to create an entire industry of state-owned and state-influenced enterprises that, when combined today, generate a tremendous amount of the technology products and capabilities sold around the globe.<sup>6</sup>
  - China is now going well beyond manufacturing-at-scale and is creating innovation on top of stolen IP, as it recognizes that whichever nation dominates the technology revolution—particularly in emerging technology areas like quantum computing, biotechnology, and artificial intelligence, to name just a few—will likely also win the larger geopolitical competition.
- **Made in China 2025.** A key aspect of the PRC's effort to lead in the technology domain is its centralized planning efforts that have been in place for well over a decade. In 2015, the China State Council issued Made in China 2025 (“PRC 2025”), a “broad set of industrial plans that aim to boost competitiveness by advancing China's position in the global manufacturing value chain, ‘leapfrogging’ into emerging technologies, and reducing reliance on foreign firms.”<sup>7</sup>
  - PRC 2025 aims to enable China to “make major technology breakthroughs, lead innovation in specific industries, and set global standards” by 2035 and “[l]ead global manufacturing and innovation with a competitive position in advanced technology and industrial systems” by 2049, with key areas of focus including next generation IT and telecommunications capabilities, high performance computing, advanced robotics, and artificial intelligence.<sup>8</sup>
- **Getting to 2025.** While ostensibly emphasizing domestic development, the PRC plans to also rely on the “acquisition, absorption, and adaptation of foreign technology by PRC entities that recast these capabilities as their own,”<sup>9</sup> and to build on these stolen technologies to create additional innovation.
  - The PRC uses a range of methods to obtain U.S. and allied technologies: (1) outright theft of intellectual property;<sup>10</sup> (2) forced technology transfer from new entrants to the Chinese market;<sup>11</sup> (3) requiring new entrants to establish joint ventures with PRC companies;<sup>12</sup> (4) requiring sensitive IP to be kept in China;<sup>13</sup> (5) tax incentives to get production and R&D moved to China;<sup>14</sup> (6) acquisition of American and allied companies with sensitive technologies directly or through bankruptcy proceedings;<sup>15</sup> (7) corporate and government partnerships with U.S. companies, universities, and individual experts or academics, including through PRC talent programs and educational pipeline work;<sup>16</sup> and (8) joining and (often) leading international standards setting bodies.<sup>17</sup>
    - The PRC's Five-Year Plan for 2021-2025 indicates that China's foreign research ties are key to developing the PRC's capabilities in technology, and notes that it is the intent of the PRC government to also use regulatory measures in areas like antitrust, IP, and standards to promote its own exports.<sup>18</sup>

- In addition, the PRC government intends to make massive direct investments into key industries, including quantum computing, robotics, artificial intelligence, and cybersecurity,<sup>19</sup> and employs low-interest and no-interest loans and massive state-driven subsidies—totaling well-over a trillion dollars—to allow its companies to compete more favorably in the marketplace,<sup>20</sup> while also obtaining board seats to ensure sufficient influence over company decision-making.<sup>21</sup>
- In March 2015, China also announced a Digital Silk Road (DSR) effort to provide aid to other nations and using key Chinese industrial giants, like Huawei, to ostensibly improve telecom networks, AI capabilities, cloud computing, and surveillance technology, among other things,<sup>22</sup> which puts Chinese national champion equipment at the heart of those networks.<sup>23</sup>
- China is also increasing its investments in building up a STEM workforce—as it has for a while—and having already passed the U.S. in the number of Ph.Ds in 2007, some estimate that the PRC may graduate nearly twice as many STEM Ph.Ds two years from now;<sup>24</sup> in addition, China is also proactively recruiting leading STEM players from around the world.<sup>25</sup>
- All of these efforts are buttressed by China’s longer-term efforts to secure its access to critical minerals and energy resources, from production to processing,<sup>26</sup> and its parallel efforts to exclude U.S. and allied partners from access to such resources.<sup>27</sup>

## THE U.S. RESPONSE TO CHINA’S INCREASING TECH FOCUS

- **Ramping Up U.S. Reaction.** To date, the United States has sought to use significant trade measures to punish unfair PRC practices, including IP theft, forced technology transfers and the like,<sup>28</sup> “ramped up law enforcement to counter China’s theft of U.S. IP, restricted certain PRC firms from U.S. infrastructure, started to scrutinize China’s role in federally funded research,”<sup>29</sup> and focused efforts on stopping the PRC’s exploitation of U.S. technology researchers in academia and industry.<sup>30</sup>
  - The U.S. has also worked with allies, like the EU, to engage in targeted limitations on technology transfer to China in areas like aerospace<sup>31</sup> and semiconductors,<sup>32</sup> and Congress has also sought to tighten its review of Chinese transactions in the United States<sup>33</sup> and enhanced American export control laws.<sup>34</sup>
  - Congress has also made major new R&D and production investments and commitments to fund new efforts in areas like semiconductors,<sup>35</sup> critical minerals,<sup>36</sup> basic science research,<sup>37</sup> OPEN-RAN,<sup>38</sup> and other emerging technologies under the CHIPS and Science Act.<sup>39</sup>



## » Author's Views And Recommendations

### RESOURCING LONG-TERM U.S. TECHNOLOGICAL INNOVATION

- **The Importance of Basic Science Research.** The U.S. government has long been one of the key seed funders of critical basic science research in American universities and industry, and this has led to major breakthroughs in areas where the PRC now seeks to compete including in biotechnology, high-performance computing, quantum computing, and artificial intelligence.<sup>40</sup>
  - Such basic science research can benefit from government funding because the economic and business use cases may not immediately be obvious enough to garner the scale and scope of dedicated private funding to reach the breakthrough point;<sup>41</sup> given that basic science research focuses on core capability development, not final goods, such funding doesn't generally implicate concerns about direct government intervention in private markets.
  - Indeed, the federal government has long engaged in funding areas critical to the national interest, from defense technology to telecommunications, so there is strong precedent to continue and expand on these efforts.
  - Moreover, funding efforts like these also help develop the core STEM workforce that America needs to compete with a rapidly expanding PRC footprint.
- **Funding Basic Science and Workforce Development.** Given the above, it is important that the government make good on funding some of the critical basic science research and workforce programs authorized in legislation like the CHIPS and Science Act,<sup>42</sup> including providing funding for next generation communications technologies and artificial intelligence,<sup>43</sup> and avoid past failures to provide authorized funding, as happened with the America COMPETES Act of 2007.<sup>44</sup>
- **Scope of Private Sector Research & Development.** Today, private sector research and development funding represents 70% of all R&D expenditures in the United States,<sup>45</sup> with technology companies leading the way, making up seven of the top ten R&D spenders, including all of the top five.<sup>46</sup>
  - It is this expenditure on core R&D that makes the U.S. the technology innovation hub of the globe and that enables the practical implementation of the basic science research being conducted in labs and universities across the nation.
    - Likewise, it is R&D expenditures—and the ability to rapidly iterate and innovate, enabled by a permissive economic and legal environment, and the availability of significant amounts of venture and growth capital as well as a highly-skilled workforce—that has made the United States a global leader in the development of most modern technology, including computing hardware and software.
    - These capabilities are not only at the heart of America's economic success, they are also a core reason why our national defense capabilities remain relatively unmatched across the globe today.
  - If we are to compete effectively with the CCP-directed spending and technology buildout being conducted in the PRC, the U.S. and our allies must ensure that we continue to be the principal global hotbed of R&D and innovation.
    - As such, rather than taking action to limit the capabilities of the top R&D investors in the U.S., including the technology companies that are in the top five R&D spenders in the nation, it is precisely this R&D spend that the U.S. government and our allies ought be encouraging to scale up.
    - Likewise, as noted below, to ensure the U.S. remains a leader in creating innovation, we must keep in place the kind of economic incentives and regulatory structures that have worked so well thus far, and must avoid the temptation to artificially restrain successful innovators in the absence of actual, demonstrable bad behavior.
- **Increasing Private R&D Investment in Key National Security Areas.** To ensure the U.S. is able to effectively compete in this new environment, the government should provide tax and other economic incentives for increased private R&D

investment—both for new entrants as well as others that can scale at significant rates and therefore effectively compete with PRC national champions—in:

- 1) Continued development of high-performance computing capabilities and quantum technology;
- 2) Further development of AI/ML capabilities, including generative AI, as well as capabilities to enhance the trust, safety, and security of AI-enabled systems;
- 3) Design and production, in the United States and allied nations, of bleeding-edge semiconductor capabilities, including for artificial intelligence and other critical applications;
- 4) Production and processing, in the United States and allied nations, of critical minerals necessary for national security and technology applications; and
- 5) Enhanced cybersecurity efforts and protection of intellectual property.

○ At the same time as it is incentivizing such investments, the U.S. government, and those of our allies, should also ensure that they are not actively taking action that would undermine the ability of key American and allied companies to scale their capabilities and take advantage of these innovations in a manner that allows us to actively stay ahead of the PRC.

■ **The Criticality of the Global Technology Infrastructure.** Expanding the U.S. innovation footprint means not only focusing on the critical national security-related technology areas described above, but also ensuring that the United States is the primary provider of the core global technology and communications infrastructure.

○ For the better part of the last six decades, the United States has benefited significantly from being the core hub of the global telecommunications infrastructure.

- As the place where much of the world's telecommunications systems come together, particularly when it comes to global Internet traffic, the United States has been able to innovate rapidly and gain both economic and national security benefits from this convergence.<sup>47</sup>
- Today, however, PRC companies like Huawei and ZTE have become major players in communications infrastructure buildout, and there is the potential for the U.S. and our allies to lose our current lead as the primary provider of cloud, edge, and AI-computing capabilities to the world if a concerted effort is not made to ensure that this lead is retained.

○ The very presence of a robust communications and computing infrastructure here in the United States (and the provision of American and allied capabilities globally) also has the benefit of driving further innovation in the U.S. and allied nations and putting computing capacity in the hands of those that can do the most with it from an economic success and development perspective.

■ **Incentivizing Technology Infrastructure Investment.** It is critical that the government provide the right incentives for industry to build out both domestic and allied computing and communications infrastructure and invest in the capacity and innovation to deliver such capabilities globally.

○ To that end, the government should provide tax and other economic incentives for increased private investment in the development of such technologies and the broader deployment of large-scale computing infrastructure—in the United States and in allied nations—to support cloud and edge computing and to expand the accessibility of AI capabilities to U.S. and allied innovators.

○ As discussed further below, the government should also be cautious to not actively disincentivize—whether through overregulation or otherwise—such technology buildout.

■ **Maintaining Capacity for Innovation.** Ensuring that the United States is able to access the underlying manufacturing capacity and workforce necessary to support a modern technology and communications infrastructure—including consistent access to semiconductors, critical minerals, and other core materials necessary to support major technological innovation—will also be of strategic importance to the United States in the coming years.

- It is critical that government and industry work together to create the right tax and regulatory incentives to ensure that American and allied companies invest their money here (and in allied nations) to create much-needed capacity and to ensure that we have the skilled workers necessary to build and maintain this capacity.
  - For example, while the CHIPS Act’s funding for semiconductor facilities will help the U.S. begin to break free from its existing reliance on a handful of sources for high-end semiconductors,<sup>48</sup> more attention needs to be paid to commodity chips as well,<sup>49</sup> an area that the PRC is focused upon,<sup>50</sup> and incentives provided to ensure U.S. and allied production of these semiconductors.
  - While proper funding is critical, Congress should continue to insist on strong, economically effective guardrails in certain areas,<sup>51</sup> including to ensure the government does not fund companies that are spending capital on advanced capabilities in competitor nations or transferring advanced technology to such nations, like the PRC.<sup>52</sup>
- Given the massive subsidies being provided by the PRC to its national champions, the government should also work to ensure that low-cost capital is available for critical industries at the heart of the technological innovation economy so that we can bring this manufacturing and other capacity—and the jobs that come with it—back to the United States and allied nations.<sup>53</sup>
  - Likewise, it is important that the government fully fund efforts authorized in prior legislation, like the Commerce Department’s establishment of technology and innovation hubs, that would help create jobs and strengthen manufacturing in critical industries like those discussed above.<sup>54</sup>

## ■ AVOIDING HARMFUL REGULATIONS

- **Be Careful Congress.** To ensure that the United States remains a leader in technology innovation, particularly as the PRC seeks to actively take the lead, it is critical that the United States avoid adopting significant new regulatory or administrative policies—including enacting new laws or targeting enforcement efforts to focus on a narrow set of technology leaders—that would undermine the ability of the United States to effectively compete on a global scale.
  - Recent efforts on Capitol Hill to amend longstanding and highly effective antitrust laws that have served our economy well for decades<sup>55</sup> are a key example of the kind of new policies that would be highly detrimental in the context of the ongoing economic and national security competition with China.
    - These efforts seek to specifically target a handful of technology companies based on the nature and scale of their business and to create new laws that apply only to them.<sup>56</sup>
    - Such efforts—which appear principally driven on both sides of the aisle by policy issues largely unrelated to innovation or competition<sup>57</sup>—would likely have the effect of undermining the very companies that have the largest potential to benefit the United States and our allies by posing the biggest threat to the PRC’s effort to win the technology competition.<sup>58</sup>
      - To the extent there are concerns that market power actually is being used to undermine competition, there is little reason to believe that existing law—and the longstanding consumer welfare standard that undergirds them—when used appropriately, cannot effectively address these concerns and ensure the presence of free and fair markets.<sup>59</sup>
      - To the contrary, enacting selective legislation like that currently being considered by Congress simply sends exactly the wrong message to new entrants, including innovators and creators: namely, that if small, innovative businesses thrive and become highly successful, expanding not through unfair competition, but through market success, the government might seek to target them for special attention, creating laws to cut them down to size.<sup>60</sup>

- The same is true of enforcement efforts driven not by actual evidence of the misuse of market power but based on perceived inequities in a given market.
- And requiring successful American technology companies to give foreign competitors deep access to their hardware and software, bypassing traditional security controls, could create a massive nightmare and undermine our economic and national security.<sup>61</sup>
- Such post hoc legislation and focused regulatory and targeted administrative actions disincentivize aspiring market entrants from joining the fray and likewise caution investors against putting up the capital needed to grow such businesses.
  - Regulators and legislators ought instead focus on true competition-related matters, such as whether market power is being utilized to gain an unfair and unlawful advantage or whether new entrants are actively being undermined using inappropriate forms of market dominance or influence.
  - If, instead, laws are changed abruptly to focus on highly successful companies without clear evidence of the kind of anticompetitive behavior that would otherwise traditionally be actionable under existing law, the end result could be massively problematic when it comes to the competition with PRC.

## BEING “BEHIND” EUROPE IS A GOOD THING WHEN IT COMES TO REGULATION

- **What is Going on In Europe?** Europe has continued to utilize aggressive regulatory legislation—most recently enacting the Digital Markets Act and the Digital Services Act—to tackle what some European politicians perceive as a too-powerful U.S.-led technology industry.
  - While these laws appear to be evenhanded as between American and EU companies, public pronouncements<sup>62</sup> and recent enforcement actions under other laws, like the GDPR,<sup>63</sup> make clear that that European legislators and regulators are more interested in taking down large, highly capable American tech companies, than actually creating a new legislative structure to address real competition concerns on the continent.<sup>64</sup>
  - There are those who argue that not having similar laws in the United States puts the United States “behind” our EU allies and that we ought play catch-up by rapidly enacting similar measures and pressing up on enforcement efforts.<sup>65</sup>
    - Unfortunately for these advocates, the economic and innovation scoreboard as between the United States and Europe—when looking at GDP growth,<sup>66</sup> the creation of highly successful, highly innovative businesses,<sup>67</sup> or building private companies whose technology innovations have a massive benefit for national and economic security<sup>68</sup>—tilts decisively in favor of the U.S. today, as it has for the last five decades at least.
    - The reason for the relative economic success of the United States over Europe, is straightforward: rather than seeking to drive specific market outcomes based on the way we think the economic world ought organize itself or targeting private sector actors for engaging in disfavored political speech or policy decisions that elected leaders might disagree with, the United States has sought instead to institute a broadly applicable set of rules designed to ensure that all market participants compete fairly.<sup>69</sup>
      - These laws, which are designed to focus on fair competition, do not constrain companies from growing to a certain size or garnering significant market share, so long as they do so fairly without actively undermining competition; rather, they focus on behavior that actually undermines the proper functioning of markets.
- **Undermining Ourselves Relative to China.** While heavy governmental enforcement and regulatory actions with respect to technology companies may have some political purchase both at home in the U.S. and abroad with our allies, the reality is that such actions are likely to significantly undermine our ability to compete with the PRC.



- The EU's heavy-handed policies—as well as recent proposed legislation to modify antitrust laws here in the U.S.—not only target some of our most successful players that contribute directly to our national security<sup>70</sup> and that have the ability and scale to push back on Chinese predation,<sup>71</sup> but they also leave Chinese competitors, who already benefit from government-scale IP theft and massive subsidies in the form of direct grant programs and low- and no-interest loans, untouched and free to operate.<sup>72</sup>

■ **And What About AI?** Likewise with respect to artificial intelligence, the approach that best protects U.S. national and economic security is one that allows innovation to flourish, stepping cautiously to address legitimate concerns where regulation is warranted and appropriate, based on traditional considerations like a demonstrable market failure.

- Rather than rushing to broad-based regulation, as the European Parliament is about to,<sup>73</sup> and limiting AI capabilities or applications,<sup>74</sup> the wiser approach, consistent with the American approach to innovation, would be to identify potential regulatory need, assesses whether regulation is necessary and appropriate, and prioritize the voluntary adoption of industry-driven frameworks,<sup>75</sup> before moving to a regulatory posture, which in turn would build upon the voluntary frameworks.
- This is all the more important in rapidly moving areas of technology innovation like AI and quantum computing, where a key consideration is ensuring that government regulation does not crush innovation and deprive society their potentially massive benefits.
  - For example, while much has been written about the potential of AI to cause significant harm—with some claims being so overwrought and lacking in substance so as to undermine their own credibility<sup>76</sup> and a flurry of claims about machine behavior<sup>77</sup> that later are determined to be wildly inaccurate<sup>78</sup>—the fact is that AI has the potential to have a transformative effect on human society, raising all boats and allowing a broad range of workers to do mundane tasks more efficiently while freeing innovators to create even more productive tools and capabilities.<sup>79</sup>
  - The same can be said about quantum computing's effect on encryption and privacy; while many have written on the threat to traditional cryptography from quantum-capable computers<sup>80</sup>—a very real problem to be sure—it is also important to consider the opportunities that quantum computing itself offers for privacy, including through quantum key distribution,<sup>81</sup> and the development of quantum-resistant encryption algorithms.<sup>82</sup>

■ **Caution is the Word on AI Regulation.** Given all this, while Congress may be in something of a regulatory mood,<sup>83</sup> the better approach on AI may be the more cautious one: encouraging those closest to the actual creation of the technology to craft potential frameworks and industry best practices that might guide the trusted, safe, and secure development and implementation of these technologies.

- Congress can assist in this effort by getting itself smart on technology and working across the aisle to identify potential issues that might need to be addressed—as the Senate is doing today<sup>84</sup>—and stepping cautiously before introducing actual text and, to the extent it does act, providing safe harbors for the implementation of industry best practices and compliance with voluntary, industry-led standards might be a good place to start.

## WORKING WITH PARTNERS AND ALLIES

■ **Ensuring U.S. and Allied Independence from the PRC.** The joint experience of the U.S. and many allies during the pandemic of being reliant on the PRC for critical supplies, whether personal protective equipment (PPE) or pharmaceutical precursors, has made clear—at least with respect to certain key supply chains, including semiconductors, rare earths, and other critical minerals—that we are going to need to work with our allies and partners to develop significant independence from the PRC.

- It is now clear, more than ever, that the PRC is engaged in a concerted effort not only to acquire their own independent access to these commodities and the underlying capability to make and process them, but also to force the United States and our allies to be reliant upon the PRC for access to them as well.<sup>85</sup>

- This, of course, is an unacceptable state of affairs: one in which our major peer competitor has us by the throat with respect to the very capabilities at the heart of our national defense and our economic competitiveness.
  - Congress and two consecutive Presidential administrations, recognizing these facts, have begun to take action to rectify matters, including through the enactment of the CHIPS and Science Act,<sup>86</sup> the imposition of strict controls on semiconductor technology to the PRC,<sup>87</sup> and provisions to address critical mineral extraction and processing in the Bipartisan Infrastructure Law,<sup>88</sup> to name just a few.
- But going beyond purely domestic investments—which are undoubtedly important—there is also a growing recognition that we will also need to ally-shore some of the capability to obtain and process these materials and create finished goods, as well as that we will need to protect the technology that makes this possible.
  - Doing this alone is untenable; it is critical that the U.S. and our allies work hand-in-hand to address these challenges.
  - There is simply not enough capacity or capability in any one country (including large blocks like the African Union or the EU) to effectively stave off the depredations of the PRC.
    - To the contrary, in recent years we have seen nations that are notionally in the allied bloc starting to shift their allegiances and policies towards the PRC.<sup>89</sup>

■ **Buttressing the Alliance Through Joint Action.** To that end, it is critical that we find a way to make common cause with our longstanding allies in both Europe and in the Indo-Pacific, as well as the Middle East and Africa, as appropriate.

- To do so will be no small feat; increasingly, as noted above, we see efforts in the EU block,<sup>90</sup> as well as in key countries in the Indo-Pacific, like India,<sup>91</sup> to legislate and act in ways that have a significant impact on our overall relationship, including across national security and technology.
  - Specifically, some of these pieces of legislation, as discussed previously, seek to target American companies and undermine their ability to effectively compete abroad.<sup>92</sup>
- Such measures make little sense at a time when the key threat to our nations collectively, comes not from within the alliance, but from a rising superpower controlled by the CCP that is actively hostile to the very notions underlying the world order crafted by the alliance.
  - We must push back against efforts that undermine the strength of these alliances and partnerships and focus instead on the larger threat that we all face in common.
  - To that end, while it would have been better had the EU been successfully cautioned against enactment of the DMA and DSA, it is now all the more critical that their implementation be carefully guided and not allowed to overreach.
- There is strong support amongst citizens of allied nations for the U.S. and Europe working closely together on the response to adversary nations, like the PRC.
  - For example, a survey conducted last year by the American Edge Project revealed that American and European citizens in various countries: (1) believe that the transatlantic partners share values significantly more than do China and Russia; (2) see those nations as economic and security threats that must be checked, particularly on the technology front; and (3) want to see close collaboration between the U.S. and Europe to confront the PRC and Russia on technology and security issues.<sup>93</sup>
  - Moreover, democratic values are solidified when the allied nations work together to make sure that impact of their own decisions on these complicated issues do not improperly undermine the capabilities of one another.
- All of these facts, taken together, make it all the more important that our nations work together, jointly, to get to the right allied outcome, which also benefits each member nation individually.

## GETTING OUR HOUSE IN ORDER AS WELL

- **U.S. Investment in the PRC is a Problem.** In 2022, the total U.S. foreign direct investment in China was \$126.1 billion, an increase of more than \$10 billion from the prior year.<sup>94</sup>
  - Not only does this investment come from private companies, investment managers, and individuals, but also in the form of major corporate and government pension fund investment, including the federal retirement program, the Thrift Savings Plan.<sup>95</sup>
  - While some of this investment may actually benefit American and allied consumers, including in non-critical industries, there is little question that some portion of this investment—and potentially a significant portion—is going towards capabilities and companies that significantly benefit the PRC in a way that undermines U.S. national and economic security.
    - For example, American companies have made major investments in leading-edge Chinese companies, including in the artificial intelligence arena.<sup>96</sup>
    - By one metric, U.S. investors “accounted for nearly a fifth of investment deals in Chinese AI/ML companies from 2015 to 2021.”<sup>97</sup>
  - The Biden Administration has long been rumored to have a draft outbound investment Executive Order in the interagency process for vetting,<sup>98</sup> but multiple reports have also indicated that opposition in parts of the U.S. investment community has stalled further progress.<sup>99</sup>
    - Congressional engagement on the issue could help push the effort along by pressuring the Biden Administration to act now and might also result in an appropriate policy that provides clear authority and direction to the White House to act, and both limits the CCP benefitting from undermining U.S. national security while allowing less problematic investments to continue forward, as appropriate.
- **Limiting Outbound Investment in the PRC.** Countering the PRC’s effort to establish technology supremacy also requires starving the CCP of its economic lifeblood, capital from abroad, particularly in the form of U.S. investment capital which, while perhaps a small relative amount, nonetheless provides a key signaling function to others.
  - Limits on outbound investment from the U.S., particularly in critical industries at the heart of U.S. national security like high performance computing, semiconductors, critical minerals, cloud computing, artificial intelligence, and quantum computing, to name a few, ought to be established by statute.
    - At a minimum, the Executive Branch should be provided clear authority to impose focused, national security-driving restrictions accompanied by strong legislative direction to do so forthwith.
  - To that end, Congress ought take up and enact legislation that would appropriately limit U.S. persons (including entities and individuals)—and in particular, U.S. federal government funds—from investing in the PRC, whether directly or indirectly, in industries that are critical to our economic and national security, such as artificial intelligence.
- **Growing a STEM-Capable Workforce.** There is no question that the United States is falling behind the rest of the world—in particular the PRC—when it comes to STEM-education for our current and future workforce.<sup>100</sup>
  - Given this, the U.S. must take action to grow our STEM workforce, including funding the workforce-related programs authorized in the CHIPS and Science Act.<sup>101</sup>
  - In addition, Congress should consider redirecting existing resources and providing new resources to states in the form of block grants,<sup>102</sup> and encouraging them to deploy these grants through public schools, public charter schools (some of which have highly innovative curricula in the technology domain),<sup>103</sup> and, as appropriate, private institutions.
  - This effort must be partnered with programs that provide incentives to our current students and workforce to encourage them to stay here and develop their new technology and build businesses in the United States over the long-term.

- These incentives could include tax benefits for entrepreneurs that look to build new startups in the U.S. and hire American workers to develop their code.

■ **Leveraging Those That Study Here.** The effort to grow a modern domestic workforce that can deliver on the jobs of the future is admittedly a long-term plan. Given this, it is critical that that the U.S. government act now to fill the gap,<sup>104</sup> and reform our broken immigration system to also ensure that we are recruiting and retaining the best and brightest students the world has to offer.

- One of the nation’s most enduring achievements historically, is our “ability to attract and retain some of the world’s best STEM talent...[that can] drive research and development efforts.”<sup>105</sup>
- Yet our current immigration system makes little sense, in that it allows a wide range of undergraduate and graduate students to benefit from our world-class higher education system, but then—with exception of the small number that are able to obtain H-1B visas or otherwise stay in the United States—requires them to return home to build businesses abroad.<sup>106</sup>
  - Indeed, this poorly thought-out policy actually forces American companies to hire high-skilled workers abroad and deprives our own economy of the benefits of their employment here, including the tax revenues and spending of these high-skilled, high-wage workers.<sup>107</sup>
- To be sure, any program that creates a path to work—and permanent residency for those that build their businesses here—should have stringent pre-admission vetting to address potential IP theft and foreign intelligence concerns, and would stand in sharp contrast to the system currently in place, which benefits our adversaries at our expense.

■ **Retaining High-Skilled Talent from Abroad.** Given this, there can be little question that our approach to immigration and education could use harmonization to promote American leadership and economic success.

- A recent CSIS report—citing work by a pair of Harvard Business School professors—makes key immigrations recommendations that are worth considering, including:
  - 1) Removing the caps on employment-based permanent resident status;
  - 2) Ensuring that USCIS distributes all of the green cards already allotted by Congress;
  - 3) Significantly increasing the number of H-1B visas (by at least 50%);
  - 4) Improving the Optional Practical Training (OPT) system by significantly increasing eligible years of work for graduates;
  - 5) Removing the requirement that foreign students’ work be directly related to their specific field of study;
  - 6) Exempting participants in the OPT system from the H-1B lottery process; and
  - 7) Creating a dedicated startup visa program for foreign entrepreneurs and students currently studying in the U.S., a concept that appeared in a more limited form in earlier versions of the CHIPS and Science Act.<sup>108</sup>
- Other approaches that have garnered bipartisan support—and deserve more—include issuing more green cards, shortening wait times for green cards for foreign STEM students who get their Ph.Ds. at U.S. universities, and the like.<sup>109</sup>
- The ongoing failure to address the immediate problem created by our immigration system today as well as the long-term challenge in our educational system when it comes to STEM education is, without a doubt, creating significant national security risk at a time when the U.S. can least afford it, particularly as our adversaries look to take advantage.

## » Conclusion

- For at least a half century, if not significantly longer, the United States has been the world's leading engine of innovation, driving much of the growth and development of the global information infrastructure, including the Internet as we know it today.
  - The innovation has benefitted the United States both economically and militarily, providing innovation and capabilities that have cemented the United States as a global superpower.
- Today, however, the PRC poses a major strategic challenge to America and our allies, including across the entire economic and national security landscape.
  - There is little chance that standing alone, any one nation or current bloc of nations will successfully be able to confront and beat China when it comes to economics and (soon) military might.
  - Given the centrality of technology innovation to our economic and military success going forward, it is critical that the United States act now to quickly and significantly shore up its ability to ensure it remains the tech capital of the globe, and that we and our allies, working together, are able to leverage joint technology innovation, research, and development, as well as combined production capabilities to gain a significant measure of economic independence from the PRC.
- This will require major muscle movements within all allied countries, including the United States, as well as working across the Atlantic and Pacific Oceans, to make common cause when it comes to technology innovation.
  - For the U.S. government, this means making long-term, sustained investment in basic science research and growing an organic, highly educated, STEM-oriented workforce.
    - It also means limiting outbound investment from the U.S. into China in critical national security technology areas.
  - For policymakers in the U.S., it means providing investment and tax incentives for: (1) increased private sector R&D; (2) building innovative U.S.-based startups that are hiring Americans at home; and (3) building the next generation of the world's tech and telecommunications infrastructure here.
    - It also means undertaking affirmative efforts to retain the highly skilled talent from around the globe that comes to the U.S. to study but is often forced out of the United States following schooling.
  - And for policymakers on all sides of the world's two largest oceans, it means not undertaking policies that would undermine the ability of or incentive for private sector actors to build, grow, and scale companies, and to instead focus on problems that actually harm competition.
    - That means not targeting our most-innovative companies with economic threats to their survival simply because: they are "too big"; they are not based in the European Union; or because their business policies—unrelated to competition—raise political concerns.
    - Rather, it means making common cause across the public-private divide and across national borders to help address the very real challenge we all face from an expanding, aggressive PRC.
    - It also means stepping cautiously on AI and, while taking affirmative steps to ensure that trust, safety, and security is at the core of AI development and implementation, not stepping out so far as to hamper innovation with overregulation.
- While the challenge ahead will no doubt be difficult to overcome, the allied coalition certainly has the capabilities to succeed; the only question is whether we will allow ourselves to take advantage of them.

## » Endnotes

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1 See, e.g., The White House, *National Security Strategy* (Oct. 2002), at 23, available online at <<https://www.whitehouse.gov/wp-content/uploads/2022/10/Biden-Harris-Administrations-National-Security-Strategy-10.2022.pdf>> (“The PRC is the only competitor with both the intent to reshape the international order and, increasingly, the economic, diplomatic, military, and technological power to do it...It is using its technological capacity and increasing influence over international institutions to create more permissive conditions for its own authoritarian model, and to mold global technology use and norms to privilege its interests and values.”); Xi Jinping, *Speech to Members of the Chinese Academy of Sciences, the Chinese Academy of Engineering, and the National Congress of China Association for Science and Technology* (May 28, 2021) (translated by Zichen Wang), available online at <<https://www.pekingnology.com/p/xi-jinpings-speech-on-science-and-technology>> (“[S]cientific and technological innovation has become the main battlefield of the international strategic game, and the competition around the commanding heights of science and technology is unprecedentedly fierce.”).

2 See, e.g., Tarun Chhabra, et al., *Executive Summary – Global China: Assessing China’s Growing Role in the World*, Brookings Institution (Apr. 2020), available online at <<https://www.brookings.edu/articles/global-china-technology/>> (“China’s rapid technological advances are playing a leading role in contemporary geopolitical competition...While the U.S. has maintained its position as the technologically dominant power for decades, China has made enormous investments and implemented policies that have contributed significantly to its economic growth, military capability, and global influence. In some areas, China has eclipsed, or is on the verge of eclipsing, the United States — particularly in the rapid deployment of certain technologies.”).

3 See, e.g., Bloomberg News, *How China Aims to Counter US ‘Containment’ Efforts in Tech*, Washington Post (Mar. 30, 2023), available online at <[https://www.washingtonpost.com/business/2023/03/30/explainer-how-china-aims-to-counter-us-containment-efforts-in-tech/cea71f0c-cf1d-11ed-8907-156f0390d081\\_story.html](https://www.washingtonpost.com/business/2023/03/30/explainer-how-china-aims-to-counter-us-containment-efforts-in-tech/cea71f0c-cf1d-11ed-8907-156f0390d081_story.html)> (“Chinese President Xi Jinping...and his new lieutenants are deploying what they call a “whole nation” system: marshaling resources and companies from across the country — and trillions of dollars — to drive research and development.”); see also Jason Hsu & Marco Yau, *Winds of Change Favour China’s Advanced Tech Companies*, Allianz Global Investors (Sept. 26, 2022), available online at <<https://www.allianzgi.com/en/insights/outlook-and-commentary/winds-of-change-favour-china-s-advanced-tech-companies>> (“Notably the [PRC] government has adopted a policy of channeling investment and resources into industrial tech over consumer tech....China accounts for the highest number of patent and trademark applications globally; in 2020, the country accounted for 45.7% of all patent filings and 54.3% of trademarks.”).

4 See Wayne M. Morrison, *China’s Economic Rise: History, Trends, Challenges, and Implications for the United States*, Congressional Research Service (June 25, 2019), at 23, available online at <<https://crsreports.congress.gov/product/pdf/RL/RL33534>> (“China’s abundance of low-cost labor has made it internationally competitive in many low-cost, labor-intensive manufactures. As a result, manufactured products constitute a significant share of China’s trade. A substantial amount of China’s imports is comprised of parts and components that are assembled into finished products, such as consumer electronic products and computers, and then exported.”)

5 See, e.g., Keith B. Alexander, *Prepared Statement of GEN (Ret) Keith B. Alexander, A Borderless Battle: Defending Against Cyber Threats*, House Committee on Homeland Security (Mar. 22, 2017), available online at <<https://www.congress.gov/115/meeting/house/105741/witnesses/HHRG-115-HM00-Wstate-AlexanderK-20170322.pdf>> (“[T]he ongoing theft of intellectual property from American companies...continues to represent the greatest transfer of wealth in human history.”); Senator Carl Levin, *Opening Statement of Chairman Carl Levin in Hearing to Receive Testimony on U.S. Strategic Command and U.S. Cyber Command in Review of the Defense Authorization Request for Fiscal Year 2013 and the Future Years Defense Program*, Senate Armed Services Committee (Mar. 27, 2012), at 3, available online at <<https://www.armed-services.senate.gov/imo/media/doc/12-19%20-%203-27-12.pdf>> (“General Alexander has stated that the relentless industrial espionage being waged against U.S. industry and Government chiefly by China constitute ‘the largest transfer of wealth in history.’”).

6 See, e.g., John Miller & Sacha Wunsch-Vincent, *High-Tech Trade Rebounded Strongly in the Second Half of 2020, with New Asian Exporters Benefiting* (Mar. 15, 2021), available online at <[https://www.wipo.int/pressroom/en/news/2021/news\\_0001.html](https://www.wipo.int/pressroom/en/news/2021/news_0001.html)>.

7 See Karen M. Sutter, *“Made in China 2025” Industrial Policies: Issues for Congress*, Congressional Research Service (Mar. 10, 2023), at 1, available online at <<https://crsreports.congress.gov/product/pdf/IF/IF10964>>.

8 *Id.*

9 *Id.* (emphasis in text added)

10 See, e.g., Office of the U.S. Trade Representative, *2023 Special 301 Report*, Executive Office of the President, The White House (Apr. 2023), at 9, 22-23, 45-47, available online at <<https://ustr.gov/sites/default/files/2023-04/2023Special301Report.pdf>>; see also Keith B. Alexander and Jamil N. Jaffer, *China Is Waging Economic War on America. The Pandemic Is an Opportunity to Turn the Fight Around*, Barron’s (August 4, 2020), available online at <<https://www.barrons.com/articles/china-is-waging-cyber-enabled-economic-war-on-the-u-s-how-to-fight-back-51596587400>>.

11 *Id.*

12 See, e.g., Sean O’Connor, *How Chinese Companies Facilitate Technology Transfer from the United States*, U.S.-China Economic Security Review Commission, at 7 (May 6, 2019), available online at <<https://www.uscc.gov/sites/default/files/Research/HowChineseCompaniesFacilitateTechTransferfromtheUS.pdf>>.

13 *Id.* at 8.

14 See e.g., Erica York et al., *Comparing the Corporate Tax System in the U.S. & China*, Tax Foundation, at 4 (May 2022), available online at <<https://files.taxfoundation.org/20220502152914/Comparing-the-Corporate-Tax-Systems-in-the-United-States-and-China.pdf>>.

15 See, e.g., Cory Bennet & Bryan Bender, *How China Acquires 'The Crown Jewels' of U.S. Technology*, Politico (May 22, 2018), available online at <<https://www.politico.com/story/2018/05/22/china-us-tech-companies-ctius-572413>>; Camille A. Stewart, *Full Court Press: Preventing Foreign Adversaries from Exfiltrating National Security Technologies Through Bankruptcy Proceedings*, 10 J. Nat'l Security L. & Pol'y 277, 279-82 (2019).

16 See, e.g., Alison Snyder, *China Talent Program Increased Young Scientists' Productivity, Study Says*, Axios (Jan. 10, 2023), available online at <<https://www.axios.com/2023/01/10/china-funding-young-scientists-productivity>> (describing the Youth Thousand Talents Program (YTT), which offers more than 3,500 young researchers—both Chinese nationals and foreign-born scientists—funding and benefits to relocate full-time to China and also describing the Thousand Talents Program, a large effort that began in 2008 with the goal of recruiting top-caliber scientists to work with China; a part of that effort often allowed or even encouraged recruits to remain at their U.S. institutions while also working with the PRC); see also Emily S. Weinstein, *Chinese Talent Program Tracker*, Center for Security and Emerging Technology, Georgetown University (Nov. 2020), available online at <<https://cset.georgetown.edu/publication/chinese-talent-program-tracker/>> (noting that Chinese talent initiatives include 43 national-level programs and 200 talent programs at sub-national levels, numbers that are growing as the PRC “seeks to retain, manage, and recruit talent globally”); Federal Bureau of Investigation, *The China Threat - Chinese Talent Plans Encourage Trade Secret Theft, Economic Espionage*, Federal Bureau of Investigation, available online at <<https://www.fbi.gov/investigate/counterintelligence/the-china-threat/chinese-talent-plans>> (describing hundreds of talent programs that incentivize their members to “steal foreign technologies needed to advance China’s national, military, and economic goals” including work on key programs like military technologies, nuclear energy, wind tunnel design, and advanced lasers, and noting that talent plan participants “enter into a contract with a Chinese university or company—often affiliated with the Chinese government—that usually requires them to [be] subject [] to Chinese laws, to share new technology developments or breakthroughs...[and to] recruit other experts into the program”).

17 See, e.g., Arjun Gargeyas, *China's '2035 Standards' Quest to Dominate Global Standard-Setting*, Hinrich Foundation (Feb. 21, 2023), available online at <<https://www.hinrichfoundation.com/research/article/trade-and-geopolitics/china-2035-standards-project-restructure-global-economy/>>.

18 Sutter, *Made in China 2025*, *supra* n. 7 at 2 (“Similarly, the FYP calls for an expanded use of antitrust, IP, and standards tools—in China and extraterritorially—to set market terms and promote the export of MIC2025 goods and services now coming to market. The FYP also emphasizes the value of China’s foreign research ties in developing China’s own competencies in a range of MIC2025 technology areas.”)

19 See *id.*

20 See, e.g., Jill C. Gallagher, *U.S. Restrictions on Huawei Technologies: National Security, Foreign Policy, and Economic Interests*, Congressional Research Service (Jan. 5, 2022), at 7-8, available online at <<https://crsreports.congress.gov/product/pdf/R/R47012/2>> (describing how “[n]ational champions [in China], including Huawei, received preferential policy treatment, access to low-cost financing, R&D funding, and tax benefits”); see also, e.g., Ann Harrison, et al., *Can a Tiger Change Its Stripes? Reform of Chinese State-Owned Enterprises in the Penumbra of the State*, NBER Working Paper No. 25475 (Jan. 2019), at 24, available online at <[https://www.nber.org/system/files/working\\_papers/w25475/w25475.pdf](https://www.nber.org/system/files/working_papers/w25475/w25475.pdf)> (noting that former Chinese state-owned enterprises, like SOEs generally “retain ready access to large loans, concessionary interest rates, and outright subsidies”).

21 See, e.g., Scott Livingston, *The New Challenge of Communist Corporate Governance*, Center for Strategic & International Studies (Jan. 2021), at 2-4, available online at <[https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/210114\\_Livingston\\_New\\_Challenge.pdf](https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/210114_Livingston_New_Challenge.pdf)>.

22 See Joshua Kurlantzick, *Assessing China's Digital Silk Road Initiative*, Council on Foreign Relations (Dec. 18, 2020), available online at <<https://www.cfr.org/china-digital-silk-road/>>.

23 See Chang Che and John Liu, *'De-Americanize': How China Is Remaking Its Chip Business*, New York Times (May 11, 2023), available online at <<https://www.nytimes.com/2023/05/11/technology/china-us-chip-controls.html>>.

24 See, e.g., Karin Fischer, *China Outpaces U.S. in STEM*, Georgetown Center for Security and Emerging Technology, Latitudes (Aug. 9, 2021), available online at <<https://cset.georgetown.edu/article/china-outpaces-u-s-in-stem/>> (“China could graduate nearly twice as many STEM PhDs as the United States by 2025...China overtook the U.S. in PhD production in 2007 and has steadily increased its lead ever since.”)

25 See, e.g., Eric Schmidt, *To Compete With China on Tech, America Needs to Fix Its Immigration System*, Foreign Affairs (May 16, 2023), available online at <<https://www.foreignaffairs.com/united-states/eric-schmidt-compete-china-tech-america-needs-fix-its-immigration-system>> (“While the United States’ dysfunctional system increasingly deters the world’s top scientists, researchers, and entrepreneurs, other countries are proactively recruiting them. China is particularly active in doing so, with direction coming from the very top.”)

26 See Jane Nakano, *The Geopolitics of Critical Minerals Supply Chains*, Center for Strategic & International Studies, at 5 (March 2021), available online at <[https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/210311\\_Nakano\\_Critical\\_Minerals.pdf](https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/210311_Nakano_Critical_Minerals.pdf)>.

27 See, e.g., Arjun Kharpal, *What are Gallium and Germanium? China Curbs Exports of Metals Critical to Chips and Other Tech*, CNBC (July 4, 2023), available online at <<https://www.cnbc.com/2023/07/04/what-are-gallium-and-germanium-china-curbs-exports-of-metals-for-tech.html>>; see also Mai Nguyen, *China's Rare Earths Dominance in Focus After it Limits Germanium & Gallium Exports*, Reuters (July 5, 2023), available online at <<https://www.reuters.com/markets/commodities/chinas-rare-earths-dominance-focus-after-mineral-export-curbs-2023-07-05/>>.

28 See, e.g., Office of the U.S. Trade Representative, *Section 301 Investigation Fact Sheet*, Executive Office of the President, The White House (June 2018), available online at <<https://ustr.gov/about-us/policy-offices/press-office/fact-sheets/2018/june/section-301-investigation-fact-sheet>> (noting that the Trump Administration invoked Section 301 authorities and imposed tariffs on most imports from China in response to findings that China’s IP policies harmed U.S. stakeholders); see also Sutter, *Made in China 2025*, *supra* n. 7 at 2 (noting that a January 2020 bilateral economic and trade agreement resulted in some IP and technology transfer commitments by China but left most U.S. concerns unresolved).

29 Sutter, *Made in China 2025*, *supra* n. 7 at 2; see also, e.g., Ana Swanson, *Trump's Trade War With China is Officially Underway*, New York Times (July 5, 2018), available online at <<https://www.nytimes.com/2018/07/05/business/china-us-trade-war-trump-tariffs.html>>.

30 See, e.g., Snyder, *China Talent Program*, *supra* n. 16.

31 See Sutter, *Made in China 2025*, *supra* n. 7 at 2.

32 See, e.g., Tim Kelly, et al., *Japan, Netherlands to Join U.S. in Restricting Chip Equipment Exports to China*, Bloomberg Reports, Reuters (Jan. 27, 2023), available online at <<https://www.reuters.com/technology/japan-netherlands-join-us-china-chip-controls-bloomberg-2023-01-27/>>.

33 See John S. McCain National Defense Authorization Act for Fiscal Year 2019, Pub. L. No. 115-232, §§ 1701-28 (2018) (Foreign Investment Risk Review Modernization Act of 2018).

34 See, e.g., Michael Geffroy and Andy Keiser, *NSI Policy Brief: Restricting U.S. Outbound Investment to Targeted Chinese Sectors*, National Security Institute, George Mason University Scalia Law School (May 2023), available online at <<https://nationalecurity.gmu.edu/restricting-u-s-outbound-investment-to-targeted-chinese-sectors/>> (discussing export control authorities and the importance of stepping cautiously).

35 See CHIPS Act of 2022, Pub. L. No. 117-167, § 103 (2022).

36 See, e.g., Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, §§ 40206, 40210 (2021).

37 See, e.g., Pub. L. No. 117-167, §§ 10102-103, 10105-113, 10348-362 (2022).

38 See CHIPS Act, *supra* n. 35, § 106; see also National Telecommunications and Information Administration, *Wireless Innovation Fund Notice of Funding Opportunity*, U.S. Dept. of Commerce (Apr. 12, 2023), available online at <<https://www.ntia.gov/issues/innovation-fund/notice-of-funding-opportunity>>.

39 See, e.g., Pub. L. No. 117-167, §§ 10104, 10230, 10374 (2022).

40 See James Manyika et al., *Innovation and National Security - Keeping Our Edge*, Council on Foreign Relations (Sep. 2019), at 2, 19, available online at <[https://www.cfr.org/report/keeping-our-edge/pdf/TFR\\_Innovation\\_Strategy.pdf](https://www.cfr.org/report/keeping-our-edge/pdf/TFR_Innovation_Strategy.pdf)> (“Federally supported R&D had a dramatic impact on U.S. competitiveness and national security. According to a 2019 study, starting in the 2010s nearly one-third of patented U.S. inventions relied on federally funded science []. Touch screens, the Global Positioning System (GPS), and internet technologies central to the smartphone are all products of Defense Department research...Between 1988 and 2010, \$3.8 billion of federal investment in genomic research generated an economic impact of \$796 billion and created 310,000 jobs. A new wave of support for basic research could have similar economic and military benefits.”); see also Jamie Gaida et al., *ASPI’s Critical Technology Tracker: The Global Race for Future Power*, Australian Strategic Policy Institute (Feb. 2023), at 1, available online at <[https://ad-aspi.s3.ap-southeast-2.amazonaws.com/2023-03/ASPIs%20Critical%20Technology%20Tracker\\_0.pdf](https://ad-aspi.s3.ap-southeast-2.amazonaws.com/2023-03/ASPIs%20Critical%20Technology%20Tracker_0.pdf)> (noting that “China’s global lead extends to 37 out of 44 technologies that ASPI is now tracking, covering a range of crucial technology fields spanning defence, space, robotics, energy, the environment, biotechnology, artificial intelligence (AI), advanced materials and key quantum technology areas”).

41 See *id.* at 21 (“Public spending on basic science drives discoveries that would have been too big and risky for a private company to undertake. In effect, federal investment funds R&D with national economic, strategic, and social returns, while private sector R&D is motivated by commercial returns. Moreover, public R&D creates spillovers that benefit the entire economy and incentivize greater R&D funding in the private sector.”)

42 See, e.g., Pub. L. No. 117-167, §§ 10101-114 (basic science); §§ 10221-235 (basic science); §§ 10311-321 (STEM education & workforce) & §§ 10501-526 (STEM education & workforce).

43 See Madeline Ngo, *CHIPS Act Funding for Science and Research Falls Short*, New York Times (May 30, 2023), available online at <<https://www.nytimes.com/2023/05/30/us/politics/chips-act-science-funding.html>> (“The total funding for research agencies was nearly \$3 billion short of authorized levels this year, according to a recent Brookings Institution analysis...[T]he director of the National Science Foundation...[and] could also help the agency expand A.I. research and training programs aimed at building up the nation’s STEM work force, which agency officials said were critical since the country is facing a shortage of workers to build semiconductors.”); see also Matt Hourihan, *Analysis: As Congress Considers COMPETES, How Short Are We From The Old COMPETES?*, American Association for the Advancement of Science (Feb. 22, 2022), available online at <[https://www.aaas.org/sites/default/files/2022-02/AAAS%20COMPETES%20Shortfalls%20Feb%202022\\_0.pdf](https://www.aaas.org/sites/default/files/2022-02/AAAS%20COMPETES%20Shortfalls%20Feb%202022_0.pdf)>.

44 See Ngo, *CHIPS Act Funding*, *supra* n. 43 (“Key research agencies would have received about \$77 billion in additional funding if Congress had followed the path of funding authorized by the America COMPETES Act of 2007, according to a 2022 analysis from the American Association for the Advancement of Science.”); see also Hourihan, *Analysis: As Congress Considers COMPETES*, *supra* n. 43, at 2.

45 See Jamil N. Jaffer, *NSI Background: The Role of American Technology Sector in Safeguarding U.S. Economic and National Security*, National Security Institute, GMU Scalia Law School (Dec. 2022), at 1 & n. 6, available online at <<https://nationalecurity.gmu.edu/the-role-of-american-technology-sector-in-safeguarding-u-s-economic-and-national-security/>> (citing John F. Sargent, *U.S. Research and Development Funding and Performance: Fact Sheet*, Congressional Research Service (Sept. 13, 2022), available online at <<https://crsreports.congress.gov/product/pdf/R/R44307/18>>).

46 See *id.* at 1 & n. 5 (citing Prableen Bajpai, *Which Companies Spend the Most in Research and Development (R&D)?*, Nasdaq (June 21, 2021), available online at <<https://www.nasdaq.com/articles/which-companies-spend-the-most-in-research-and-development-rd-2021-06-21>>).

47 Cf. Manyika et al., *Innovation and National Security*, *supra* n. 40 at 2, 19, available online at <[https://www.cfr.org/report/keeping-our-edge/pdf/TFR\\_Innovation\\_Strategy.pdf](https://www.cfr.org/report/keeping-our-edge/pdf/TFR_Innovation_Strategy.pdf)> (“This seventy-year strength arose from the expansion of economic opportunities at home through substantial investments in education and infrastructure, unmatched innovation and talent ecosystems, and the opportunities and competition created by the opening of new markets and the global expansion of trade.”).

48 Bill Evanina & Jamil N. Jaffer, *The Semiconductor Bill Will Give the U.S. an Edge Against China*, Barron’s (July 28, 2022), available online at <<https://www.barrons.com/articles/semiconductor-bill-china-competition-51659015986>>.

49 Emily Kilcrease & Sarah V. Stewart, *How Congress Can Ensure CHIPS Act Funding Advances National Security Interests*, Lawfare (Feb. 24, 2022), available online at <<https://www.lawfaremedia.org/article/how-congress-can-ensure-chips-act-funding-advances-national-security-interests>> (describing commodity chips as those larger chips that are used in all manner of common application); see also Manpreet Singh, et al., *Semiconductors and the Semiconductor Industry*, Congressional Research Service (Apr. 19, 2023), available online at <<https://crsreports.congress.gov/product/pdf/R/R47508>>.

50 Gregory C. Allen, *China’s New Strategy Waging the Microchip Tech War*, Center for Strategic & International Studs. (May 2023), available online at <[https://csis-website-prod.s3.amazonaws.com/s3fs-public/2023-05/230503\\_Allen\\_Microchip\\_War.pdf](https://csis-website-prod.s3.amazonaws.com/s3fs-public/2023-05/230503_Allen_Microchip_War.pdf)>.

51 See 15 U.S.C. § 4652(a)(5)-(6).

52 See *id.*; see also National Inst. for Standards & Technology, *Proposed Rule: Preventing the Improper Use of CHIPS Act Funding*, 88 FR 17439 (Mar. 23, 2023), available online at <<https://www.federalregister.gov/d/2023-05869>>; Various Authors, *Comments on Proposed Rule: Preventing the Improper Use of CHIPS Act Funding*, available online at <<https://www.regulations.gov/docket/NIST-2023-0001/comments>>.

53 See Alexander & Jaffer, *China Is Waging Economic War on America*, *supra* n. 10.

54 See Ngo, *CHIPS Act Funding*, *supra* n. 43 (noting that “[t]he Commerce Department’s \$10 billion effort to invest in areas with the potential to ‘become globally competitive’ through the creation of at least 20 ‘technology and innovation hubs’ across the country has received only 5 percent of funding so far” and describing the program as being aimed at “revitalizing regions by creating jobs and strengthening the capacity to manufacture and deploy critical technologies”).



55 See, e.g., American Innovation and Choice Online Act, S.2992, 117th Cong. (2021); Open App Markets Act, S.2710, 117th Cong. (2021).

56 See e.g., *id.*; Bill Evanina & Jamil N. Jaffer, *Kneecapping U.S. Tech Companies Is a Recipe for Economic Disaster*, *Barron's* (June 17, 2022), available online at <<https://www.barrons.com/articles/kneecapping-u-s-tech-firms-is-a-recipe-for-economic-disaster-51655480902>>.

57 See Evanina & Jaffer, *Kneecapping U.S. Tech Companies*, *supra* n. 56 (“Conservatives are often worried—sometimes for good reason—that certain social or mainstream media companies might actively seek to suppress or quiet conservative voices. On the liberal side, there are a range of legitimate concerns with technology companies, including the displacement of traditional labor in the new gig economy... Yet rather than tackling these concerns directly by going after the specific behaviors or actions that trouble ordinary Americans, politicians in Washington have chosen instead to vilify some of our most successful companies and to go after them economically.”); see also David R. Henderson, *A Populist Attack On Big Tech*, *The Hoover Institution* (Mar. 3, 2022), available online at <<https://www.hoover.org/research/populist-attack-big-tech-0>>.

58 Klion Kitchen & Jamil Jaffer, *The American Innovation & Choice Online Act Is A Mistake*, *The Kitchen Sync* (Jan. 19, 2022), available online at <<https://www.thekitchensync.tech/p/the-american-innovation-and-choice>>.

59 See Henderson, *A Populist Attack on Big Tech*, *supra* n. 57; Evanina & Jaffer, *Kneecapping U.S. Tech Companies*, *supra* n. 56.

60 Kitchen & Jaffer, *The American Innovation & Choice Online Act*, *supra* n. 58 (“Going after our technology companies, particularly a targeted shot at certain big ones, sends the wrong message to startups and investors alike; it tells them that if you are innovative enough to be successful and grow significantly larger, you may be targeted for different treatment...This undermines not only the companies that are likely to be investing in R&D over the next decade and generating some of the key innovations that will contribute to our national security, it also undermines a central proposition that has created a robust tech ecosystem in this country: take risk, innovate, fail fast and often, and when you succeed, reap the rewards so long as you don’t exploit your position to gain unfair advantage.”); Evanina & Jaffer, *Kneecapping U.S. Tech Companies*, *supra* n. 60 (“Picking and choosing individual companies to be treated differently than others under our antitrust laws is inconsistent with the heart of our economic system, which seeks to reward innovation and success, not penalize them.”).

61 See *id.*; Evanina & Jaffer, *Kneecapping U.S. Tech Companies*, *supra* n. 56.

62 See, e.g., Javier Espinoza, *EU Should Focus on Top 5 Tech Companies, Says Leading MEP*, *Financial Times* (May 31, 2021), available online at <<https://www.ft.com/content/49f3d7f2-30d5-4336-87ad-eea0ee0ecc7b>> (“The EU lawmaker who will steer the EU’s flagship tech regulation through the European parliament has said it should focus on the largest five US tech companies. Andreas Schwab, a German MEP and longtime critic of Google, spoke after France and Germany both called for the EU to be tougher on Big Tech. He said Google, Apple, Amazon, Facebook and Microsoft, were the ‘biggest problems’ for EU competition policy.”).

63 See Adam Satariano, *Meta Fined \$1.3 Billion for Violating E.U. Data Privacy Rules*, *New York Times* (May 22, 2022), available online at <<https://www.nytimes.com/2023/05/22/business/meta-facebook-eu-privacy-fine.html>>.

64 See, e.g., Rep. Darin LaHood, et al., *Bipartisan Letter from 47 Members of the U.S. to President Biden* (June 22, 2023), available online at <[https://lahood.house.gov/\\_cache/files/6/8/681fc5f3-dacf-458e-9096-0943b2bb2d1f/685FC0EBDAF0D803ED514345D8FEF91A.final-letter-to-president-biden-on-eu-digital-trade-concerns---june-2023.pdf](https://lahood.house.gov/_cache/files/6/8/681fc5f3-dacf-458e-9096-0943b2bb2d1f/685FC0EBDAF0D803ED514345D8FEF91A.final-letter-to-president-biden-on-eu-digital-trade-concerns---june-2023.pdf)> (describing efforts by the EU “to regulate the digital economy in ways that harm American companies and workers” and arguing that “the discriminatory elements of these policies will weaken American competitiveness by unfairly advantaging domestic European firms and inadvertently benefitting Chinese, Russian, and other foreign-owned competitors”).

65 See Cecilia Kang, *As Europe Approves New Tech Laws, the U.S. Falls Further Behind*, *New York Times* (April 22, 2022), available online at <<https://www.nytimes.com/2022/04/22/technology/tech-regulation-europe-us.html>>.

66 See Jan Rybnicek, *Innovation in the United States and Europe, in Report on the Digital Economy*, *Global Antitrust Institute* (2020), available online at <<https://gaidigitalreport.com/2020/08/25/innovation-in-the-united-states-and-europe/>> (“The United States also has greater and faster GDP growth than Europe. Although not a perfect metric, it gives some sense of the contributions that innovative firms have brought to the U.S. economy over time.”); International Monetary Fund, *GDP Per Capita, Current Prices: U.S. Dollars Per Capita* (2023), available online at <<https://www.imf.org/external/datamapper/NGDPDPC@WEO/EU/USA>> .

67 See *id.* (“The United States is home to the most innovative companies that span numerous industries. This includes the most successful global tech firms at the forefront of technological change. These companies consistently outspend their European counterparts on research and development, a key indicator of product improvement and development.”); Michael Ringel et al., *The Most Innovative Companies 2020, The Serial Innovation Imperative*, *Boston Consulting Group*, at 16 (June 2020), available online at <[https://web-assets.bcg.com/img-src/BCG-Most-Innovative-Companies-2020-Jun-2020-R-4\\_tcm9-251007.pdf](https://web-assets.bcg.com/img-src/BCG-Most-Innovative-Companies-2020-Jun-2020-R-4_tcm9-251007.pdf)>.

68 See, e.g., Loren Thompson, *Why Reining In Big Tech Could Be Bad News For U.S. National Security*, *Forbes* (July 7, 2022), available online at <<https://www.forbes.com/sites/lorenthompson/2022/07/07/why-breaking-up-big-tech-could-be-bad-news-for-us-national-security/?sh=1e40190d32bd>>; Jaffer, *The Role of American Technology Sector*, *supra* n. 45.

69 Evanina & Jaffer, *Kneecapping U.S. Tech Companies*, *supra* n. 56 (“Our antitrust laws—based at their core on promoting consumer welfare—have long been agnostic on the specific companies they address, looking not to the size of corporate revenue or profits nor alleged bad behavior in areas outside the economic domain, but rather to whether they use their market power to unfairly exclude others or harm competition.”)

70 Jaffer, *The Role of American Technology Sector*, *supra* n. 45 (“U.S. technology companies, including more established players and newer entrants alike, are also a critical resource in the fight against cyberattacks, including ransomware attacks conducted by hostile nation-states and their proxies. For example, in August 2021, tech giants, Apple, Google, and Microsoft teamed up with the Biden Administration to improve public-private cybersecurity cooperation, pledging more than \$30 billion to reinforce U.S. cybersecurity defenses.”).

71 Kitchen & Jaffer, *The American Innovation & Choice Online Act Is A Mistake*, *supra* n. 58.

72 Jamil N. Jaffer, *To Counter China, Allied Nations Must Cooperate on Technology Innovation*, *The Hill* (May 1, 2021), available online at <<https://thehill.com/opinion/technology/555788-to-counter-china-allied-nations-must-cooperate-on-technology-innovation/>>.

73 Ryan Browne, *Europe Takes Aim at ChatGPT With What Might Soon be the West’s First A.I. Law. Here’s What It Means*, *CNBC* (May 15, 2023), available online at <<https://www.cnn.com/2023/05/15/eu-ai-act-europe-takes-aim-at-chatgpt-with-landmark-regulation.html>> (“A key committee of lawmakers in the European Parliament have approved a first-of-its-kind artificial intelligence regulation — making it closer to becoming law. The approval marks a landmark development in the race among authorities to get a handle on AI, which is evolving with breakneck speed.”).

74 *Id.* (“The AI Act categorizes applications of AI into four levels of risk: unacceptable risk, high risk, limited risk and minimal or no risk. Unacceptable risk applications are banned by default and cannot be deployed in the bloc.”).

75 Cf. *Framework for Improving Critical Infrastructure Cybersecurity*, National Institute of Standards & Technology (Apr. 16, 2018), available online at <<https://nvlpubs.nist.gov/nistpubs/CSWP/NIST.CSWP.04162018.pdf>>.

76 See, e.g., Geoffrey Hinton, et al., *Statement on AI Risk: AI Experts and Public Figures Express their Concern About AI Risk*, Center for AI Risk (May 30, 2023), available online at <<https://www.safe.ai/statement-on-ai-risk#open-letter>> (“Mitigating the risk of extinction from AI should be a global priority alongside other societal-scale risks such as pandemics and nuclear war.”); Max Zahn, *AI Leaders Warn the Technology Poses ‘Risk of Extinction’ Like Pandemics and Nuclear War*, ABC News (May 30, 2023), available online at <<https://abcnews.go.com/Technology/ai-leaders-warn-technology-poses-risk-extinction-pandemics/story?id=99690874>>.

77 See Will Knight, *Why the Story of an AI Drone Trying to Kill Its Operator Seems So True*, Wired (June 8, 2023), available online at <<https://www.wired.com/story/business-fast-forward/>> .

78 *Id.*

79 See, e.g., Michael Chui, et al., *Generative AI is Here: How Tools Like ChatGPT Could Change Your Business*, McKinsey & Co. (Dec. 20, 2022), available online at <<https://www.mckinsey.com/capabilities/quantumblack/our-insights/generative-ai-is-here-how-tools-like-chatgpt-could-change-your-business>>; see also Danny Hajek, et al., *What Is AI and How Will It Change Our Lives? NPR Explains*. (May 25, 2023), available online at <<https://www.npr.org/2023/05/25/1177700852/ai-future-dangers-benefits>>; Megan Brown & James B. Burchfield, *NSI Law & Policy Paper: Privacy Regulation and Unintended Consequences for Security*, National Security Institute, GMU Scalia Law School (Aug. 2019), at 10 available online at <<https://nationalecurity.gmu.edu/privacy-regulation-and-unintended-consequences-for-security/>> (“AI will be central to security advances, ‘Just as cybersecurity analytics help to predict cyberattacks before they occur, AI techniques such as machine learning and deep learning can be used to find vulnerabilities that may be difficult for the security team to find’”).

80 See, e.g., Markus Pflichtsch, *Quantum Computers Could Make Today’s Encryption Defenseless*, Forbes (May 4, 2023), available online at <<https://www.forbes.com/sites/forbestechcouncil/2023/05/04/quantum-computers-could-make-todays-encryption-defenseless/?sh=289f5ea78556>>.

81 See, e.g., Victor Lovic, *Quantum Key Distribution: Advantages, Challenges & Policy*, Cambridge Journal of Science & Policy, Vol. 1, Issue 2 (2020), at 126-28 available online at <[https://www.cuspe.org/wp-content/uploads/2020/10/12\\_v1\\_2.pdf](https://www.cuspe.org/wp-content/uploads/2020/10/12_v1_2.pdf)>.

82 See National Security Agency, *Announcing the Commercial National Security Algorithm Suite 2.0* (Sep. 7, 2022), available online at <[https://media.defense.gov/2022/Sep/07/2003071834/-1/-1/0/CSA\\_CNSA\\_2.0\\_ALGORITHMS\\_.PDF](https://media.defense.gov/2022/Sep/07/2003071834/-1/-1/0/CSA_CNSA_2.0_ALGORITHMS_.PDF)>.

83 See Mary Clare Jalonick & The Associated Press, *Congress is Looking to Regulate Tech from TikTok to A.I. Here Are the Bills Under Consideration*, Fortune (May 8, 2023), available online at <<https://fortune.com/2023/05/08/congress-regulate-tech-tiktok-ai-data-privacy-kids-bills-under-consideration/>>; Ashley Capoot, *More Social Media Regulation is Coming in 2023, Members of Congress Say*, CNBC (Jan 1, 2023), available online at <<https://www.cnbc.com/2023/01/01/more-social-media-regulation-is-coming-in-2023-members-of-congress-say.html>>.

84 See Sen. Charles E. Schumer, et al., *Congressional Letter* (June 6, 2023), available online at <<https://www.democrats.senate.gov/imo/media/doc/06062023dearcolleagueforaibriefingsfinal.pdf>> (writing to fellow U.S. Senators encouraging them to attend three bipartisan Senators-only briefings on AI).

85 See, e.g., Nakano, *The Geopolitics of Critical Minerals*, *supra* n. 26, at 5; Kharpal, *What are Gallium and Germanium?*, *supra* n. 27; Nguyen, *China’s Rare Earths Dominance*, *supra* n. 27.

86 See Pub. L. No. 117-167 (2022).

87 See Bureau of Industry & Commerce, *Commerce Implements New Export Controls on Advanced Computing and Semiconductor Manufacturing Items to the People’s Republic of China (PRC)*, U.S. Dept. of Commerce (Oct. 7, 2022), available online at <<https://www.bis.doc.gov/index.php/documents/about-bis/newsroom/press-releases/3158-2022-10-07-bis-press-release-advanced-computing-and-semiconductor-manufacturing-controls-final/file>>.

88 See e.g., Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, §§ 40201-211.

89 Eric Cheung, *Honduras Establishes Diplomatic Ties with China, Severs Them With Taiwan*, CNN (Mar. 26, 2023), available online at <<https://edition.cnn.com/2023/03/25/asia/honduras-cuts-diplomatic-ties-with-taiwan-intl-hnk/index.html>>; Enrique Garcia, *Guatemalan Presidential Contender Pitches Closer China Ties*, Reuters (June 28, 2023), available online at <<https://www.reuters.com/world/americas/surprise-guatemalan-presidential-contender-pitches-closer-china-ties-2023-06-27/>>.

90 See, e.g., General Data Protection Regulation, Council Regulation 2016/679, 2016 O.J. (L 119) 1 (EU); Single Market For Digital Services (Digital Services Act), Council Regulation 2022/2065, 2022 O.J. (L 277) 1 (EU); Contestable and Fair Markets in the Digital Sector (Digital Markets Act), Council Regulation 2022/1925, 2022 O.J. (L 265) 1 (EU).

91 See, e.g., The Digital Personal Data Protection Bill, 2022, §§ 1-30, available online at <[https://www.meity.gov.in/writereaddata/files/The%20Digital%20Personal%20Data%20Potection%20Bill%2C%202022\\_0.pdf](https://www.meity.gov.in/writereaddata/files/The%20Digital%20Personal%20Data%20Potection%20Bill%2C%202022_0.pdf)>; Proposed Digital India Act, 2023, available online at <[https://www.meity.gov.in/writereaddata/files/DIA\\_Presentation\\_09.03.2023\\_Final.pdf](https://www.meity.gov.in/writereaddata/files/DIA_Presentation_09.03.2023_Final.pdf)>; Shivani Bazaz, *Explained: India’s Upcoming Digital Competition Act & What is the Debate Around it All About*, CNBC (Jul. 14, 2023), available online at <<https://www.cnbcvt18.com/technology/explained-indias-upcoming-digital-competition-act-and-what-is-the-debate-around-it-all-about-17222501.htm>>.

92 See *supra* n. 62-64 and accompanying text.

93 See American Edge Project, *U.S. and European Views of the Tech Industry* (Sept. 2022), available online at <<https://americanedgeproject.org/wp-content/uploads/2022/09/AEP-US-EU-Survey-Insights-F9.12.22.pdf>>

94 See Bureau of Economic Analysis, *Direct Investment by Country and Industry, 2022*, U.S. Dept. of Commerce (July 20, 2023), available online at <<https://www.bea.gov/sites/default/files/2023-07/dici0723.pdf>>.

95 Valerie Bauman & Didi Kirsten Tatlow, *Chinese Firms that Threaten U.S. Security Can Get Investments from Federal Employees*, Newsweek (May 22, 2023) available online at <<https://www.newsweek.com/federal-retirement-plan-allows-investment-sanctioned-chinese-companies-1798690>> (“Since June 2022, the federal government’s employee retirement plan—the largest in the world with \$720 billion in assets—has offered its 6.8 million members the option to invest some of their savings in an account containing about 5,000 mutual funds, some of which have holdings in [30] Chinese companies that are on at least nine U.S. government sanctions or watch lists... Among the sanctioned Chinese companies are Aero Engine Corporation of China (AECC), China’s leading developer of fighter engines, and the Aviation Industry Corporation of China (AVIC), a defense and aerospace conglomerate.”)

96 Emily S. Weinstein & Ngor Luong, *U.S. Outbound Investment into Chinese AI Companies*, Georgetown University Center for Security & Emerging Technology (Feb. 2023), at 11-13, available online at <<https://cset.georgetown.edu/wp-content/uploads/CSET-U.S.-Outbound-Investment-into-Chinese-AI-Companies.pdf>>; see also Alexandra Alper, *U.S. Investors Have Plowed Billions into China's AI sector, Report Shows*, Reuters (Feb. 1, 2023), available online at <<https://www.reuters.com/technology/us-investors-have-plowed-billions-into-chinas-ai-sector-report-shows-2023-02-01/>>.

97 Alper, *U.S. Investors*, *supra* n. 96; see Weinstein & Luong, *U.S. Outbound Investment*, *supra* n. 96, at 11-12 (showing that 167 U.S. investors took part in 401 transactions, or roughly 17% of the investments into Chinese AI companies in the period; those transactions, in total, represented a total \$40.2 billion in investment, or 37% of the total raised by Chinese AI companies in the 6-year period; it is unclear how much of that amount is attributable to U.S. investors).

98 See Gavin Bade, *White House Nears Unprecedented Action on U.S. Investment in China*, Politico (Apr. 18, 2023), available online at <<https://www.politico.com/news/2023/04/18/biden-china-trade-00092421>>.

99 Jack Stone Truitt, *Biden Executive Order on Investments in China Faces Hurdles*, Nikkei Asia (June 10, 2023), available online at <<https://asia.nikkei.com/Politics/International-relations/US-China-tensions/Biden-executive-order-on-investments-in-China-faces-hurdles>>.

100 See Fischer, *China Outpaces the U.S.*, *supra* n. 24.

101 See McKinsey & Co., *The CHIPS and Science Act: Here's What's in It* (Oct. 4, 2022), available online at <<https://www.mckinsey.com/industries/public-sector/our-insights/the-chips-and-science-act-heres-whats-in-it>> (noting that the CHIPS and Science Act "authorizes (but does not yet appropriate) \$174 billion over the next five years to various federal science agencies to invest in STEM, workforce development, and R&D, with some \$80 billion earmarked for the National Science Foundation").

102 Cf. National Science Teachers Association, *FACT SHEET: Title IV, Part A of ESSA: Student Support and Academic Enrichment Grants and Science/STEM Education*, available online at <<https://static.nsta.org/pdfs/ESSATitleIV-ScienceSTEMFactSheet.pdf>> (describing the \$1.65 billion Student Support and Academic Enrichment block grant program under The Every Student Succeeds Act (ESSA) enacted in 2014, which consolidated the Math and Science Partnership Grants, which is described as "the largest single program at the Department of Education devoted exclusively to science/STEM-related classroom purposes," having "received \$152.7M in FY2016 before it was eliminated").

103 See, e.g., Digital Pioneers Academy, *Our Academic Model*, available online at <<https://www.digitalpioneersacademy.org/enroll/academic-model>> (describing the D.C. charter school's unique model of two teachers per classroom and requiring one hour of computer science per day for students at all grade levels); Digital Pioneers Academy, *Computer Science Model*, available online at <<https://www.digitalpioneersacademy.org/enroll/csmodel>> (describing the Digital Pioneer's curriculum as requiring students to "[t]ake and pass the Computer Science Advanced Placement exam in 10th grade [and] [m]aster two programming languages by 12th grade.").

104 See Schmidt, *To Compete with China on Tech*, *supra* n. 25 ("According to current projections, U.S. semiconductor companies will have 300,000 unfilled vacancies for skilled engineers by 2030. Targeting, training, and recruiting hundreds of thousands of U.S. citizens will be impossible in such a compressed time frame. The only way to meet this demand is to recruit many more skilled workers from abroad.").

105 See William Alan Reinsch & Thibault Denamiel, *Immigration Policy's Role in Bolstering the U.S. Technology Edge*, Center for Strategic & International Studs. (Feb. 6, 2023), available online at <<https://www.csis.org/analysis/immigration-policys-role-bolstering-us-technology-edge>>; see also Gina M. Raimondo, *Remarks by U.S. Sec'y of Com. Gina Raimondo on the U.S. Competitiveness and the China Challenge*, U.S. Department of Commerce (Nov. 20, 2022), available online at <<https://www.commerce.gov/news/speeches/2022/11/remarks-us-secretary-commerce-gina-raimondo-us-competitiveness-and-china>>.

106 See Schmidt, *To Compete with China on Tech*, *supra* n. 25 ("[T]he United States has long relied on its companies and universities to attract the world's best and brightest. Brilliant engineers from all around the world helped me turn Google into a world-leading technology company. But this did not happen because of the U.S. immigration system. It happened in spite of it.").

107 See Paayal Zaveri, *America's Immigration System is a Nightmare & it's Forcing Tech Companies to Move Jobs Outside of the Country*, Business Insider (Mar. 14, 2023), available online at <<https://www.businessinsider.com/us-tech-firms-offshoring-immigration-labor-shortage-issues-remote-work-2023-3>> ("[T]he difficulties in bringing immigrants into the US is pushing companies to instead hire them to work in other countries. That, in turn, is encouraging those same companies to open branch offices in other countries and recruit there, staffing them with people who might otherwise have come to the US to work[.]").

108 Reinsch & Denamiel, *Immigration Policy's Role*, *supra* n. 105; see also William R. Kerr & Sari Pekkala Kerr, *Immigration Policy Levers for U.S. Innovation & Startups*, Harvard Business School, Working Paper 20-105 (Apr. 2020), available online at <[https://www.hbs.edu/ris/Publication Files/20-105\\_aac0d5ae-e6e3-4570-8225-31bcc127f693.pdf](https://www.hbs.edu/ris/Publication%20Files/20-105_aac0d5ae-e6e3-4570-8225-31bcc127f693.pdf)>.

109 See H. Comm. On Rules, H.R. 7900, Amend. 117-54 (July 12, 2022), <[https://amendments-rules.house.gov/amendments/LOFGRE\\_036\\_xml220705125918927.pdf](https://amendments-rules.house.gov/amendments/LOFGRE_036_xml220705125918927.pdf)> (showing an unenacted amendment by Congresswoman Lofgren (CA-18)); see also Reinsch & Denamiel, *Immigration Policy's Role*, *supra* n. 105 ("Last year, there was bipartisan support for making available additional green cards with shorter wait times for STEM Ph.D.'s. Yet ultimately this initiative was stripped from the final National Defense Authorization Act.").



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