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# CHINA'S TECHNOLOGICAL RISE: CHALLENGES TO U.S. INNOVATION AND SECURITY

## HEARING

BEFORE THE

SUBCOMMITTEE ON ASIA AND THE PACIFIC

OF THE

COMMITTEE ON FOREIGN AFFAIRS
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# CHINA'S TECHNOLOGICAL RISE: CHALLENGES TO U.S. INNOVATION AND SECURITY

**WEDNESDAY, APRIL 26, 2017**

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ASIA AND THE PACIFIC,
COMMITTEE ON FOREIGN AFFAIRS,
*Washington, DC.*

The subcommittee met, pursuant to notice, at 2:32 p.m., in room 2172, Rayburn House Office Building, Hon. Ted Yoho (chairman of the subcommittee) presiding.

Mr. YOHO. All right. The subcommittee will come to order. Members present will be permitted to submit written statements to be included in the official hearing record. Without objection, the hearing record will remain open for 5 calendar days to allow statements, questions, and extraneous materials for record, subject to length, limitations, and the rules.

China's growth as a technological powerhouse is one of a number of momentous changes taking place in the U.S.-China relationship. Some changes are driven by pressing threats, like North Korea's belligerence and the resulting close communications between President Trump and President Xi. Others like the President's executive order on steel imports are simply the result of our change in administration. Still more, like the impending launch of China's first indigenous produced aircraft carrier, are symbolic of China's growing power.

These changes will demand policy adjustments, which is no easy task. Our bilateral relationship is the most consequential in the world. We can't set policy based solely on short-term commitments by China to reign in its dangerous North Korean trading partner or predatory trade practices. During this time of recalculation, the United States must account for the complete picture, taking into account broader long-term trends. China's policies toward high technology and its conduct in the high-technology sectors make up concerning pieces of this picture.

China is relentlessly pursuing long-term degradation of U.S. strategic and economic interests through its high-tech policies. As China has risen, it has not integrated itself into the existing rules and structures for global leadership and trade as many have hoped. In high-tech sectors and more broadly, China has undertaken mercantilist industrial policies to advance its business interests at the expense of others and pursued asymmetric strategic capabilities that erode traditional understandings of military operations.

China has undertaken a comprehensive industrial strategy to advance domestic high-tech industry through nonmarket means. Massive state subsidies and zero sum tactics degrade foreign competitiveness, and the systematic and widespread theft of intellectual property and forced transfers of technology destroys innovation and research investments. Today is World Intellectual Property Day, a fitting time for a reminder that protecting U.S. innovation must be an inviolable part of our national strategy toward China.

These predatory industrial policies are in full display in China's ongoing attempts to dominate critical high-technology supply chains such as semiconductor production. The economic stakes are high. The United States is the world's leader in semiconductors. The industry employs more Americans than the steel industry, and semiconductors are our fourth most valuable export.

But the security concerns are also significant. Semiconductors are the enabling technology of all electronics, and a comprised supply chain could contaminate sensitive military technology with secret back doors.

China's high-tech policy is also challenging U.S. leadership in space. China is expanding its scientific exploration and space-based military capabilities at a rate that may credibly make outer space into a bipolar domain. This is a significant strategic threat as top U.S. military strategists predict that space-based capabilities will be the key to all future conflicts. Under the status quo, China will own the Earth's only manned space station and will beat the United States back to the Moon in the coming years.

Future conflicts also highlight the threat posed by China's cyber capabilities. It is believed that the U.S. critical infrastructure has already penetrated numerous times, putting it at risk if a conflict were to occur. The ability to threaten U.S. energy grids and utilities network mean that the homeland could suffer serious costs from conflicts that would otherwise be limited and regional.

China's cloud has grown along with its economic power, but China has not matched its growing influence with behavior expected of a global leader. This is particularly concerning in high-tech fields which will be critical to future economic gains.

China is the world's second largest economy, but in pursuing dominance in high-tech sectors, it regularly violates or disregards the practices that have contributed to global economic growth. The emerging strategic commons of cyberspace and outer space are critical for global security. But China's action in these domains and its track record in the South China Sea raises serious doubts that China can be trusted to act responsibly and follow international law in shared spaces.

I thank the panel for joining us today to discuss the challenges to U.S. innovation and security presented by China's high-tech policies in these critical areas. I look forward to hearing your recommendations for U.S. policies.

And without objection, the witnesses' written statements will be entered into the hearing record. I now am going to turn to our ranking member for any remarks he may have.

[The prepared statement of Mr. Yoho follows:]

**China's Technological Rise: Challenges to U.S. Innovation and Security**
Subcommittee on Asia and the Pacific
House Committee on Foreign Affairs
Wednesday, April 26, 2017, 2:30 p.m.
**Opening Statement of Chairman Ted Yoho**

China's growth as a technological powerhouse is one of a number of momentous changes taking place in the U.S.-China relationship. Some changes are driven by pressing threats, like North Korea's belligerence and the resulting close communication between President Trump and President Xi. Others, like the President's executive order on steel imports, are simply the result of our change in administration. Still more, like the impending launch of China's first indigenously-produced aircraft carrier, are symbolic of China's growing power.

These changes will demand policy adjustments, which is no easy task. Our bilateral relationship is the most consequential in the world. We can't set policy based solely on short term commitments by China to rein in its dangerous North Korean client state or predatory trade practices. During this time of recalculation, the United States must account for the complete picture, taking into account broader long term trends. China's policies towards high-technology and its conduct in high-tech sectors make up a concerning piece of this picture.

China is relentlessly pursuing long-term degradation of U.S. strategic and economic interests through its high tech policies. As China has risen, it has not integrated itself into the existing rules and structures for global leadership and trade, as many hoped. In high-tech sectors and more broadly, China has undertaken mercantilist industrial policies to advance its business interests at the expense of others and pursued asymmetric strategic capabilities that erode traditional understandings of military operations.

China has undertaken a comprehensive industrial strategy to advance domestic high-tech industries through non-market means. Massive state subsidies and zero-sum tactics degrade foreign competitiveness, and the systematic and widespread theft of intellectual property and forced transfer of technology destroys innovation and research investments. Today is World Intellectual Property Day, a fitting time for a reminder that protecting U.S. innovation must be an inviolable part of our national strategy towards China.

These predatory industrial policies are in full display in China's ongoing attempts to dominate critical high-tech supply chains such as semiconductor production. The economic stakes are high—the United States is the world's leader in semiconductors, the industry employees more Americans than the steel industry, and semiconductors are *our fourth most valuable* export.

But the security concerns are also significant. Semiconductors are the enabling technology of all electronics, and a compromised supply chain could contaminate sensitive military technology with secret backdoors.

China's high-tech policy is also challenging U.S. leadership in space. China is expanding its scientific exploration and space-based military capabilities at a rate that may credibly make outer space into a bipolar domain. This is a significant strategic threat, as top U.S. military strategists predict that space-based capabilities will be *the key* to all future conflicts. Under the status quo, China will own the Earth's only manned space station and will beat the United States back to the moon in the coming years.

Future conflicts also highlight the threat posed by China's cyber capabilities. It is believed that U.S. critical infrastructure has already been penetrated numerous times, putting it at risk if a conflict were to occur. The ability to threaten U.S. energy grids and utilities networks means that the homeland could suffer serious costs from conflicts that would otherwise be limited and regional.

China's clout has grown along with its economic power, but China has not matched its growing influence with the behavior expected of a global leader. This is particularly concerning in high-tech fields which will be critical to future economic gains.

China is the world's second-largest economy, but in pursuing dominance in high-tech sectors, it regularly violates or discards the practices that have contributed to global economic growth. The emerging strategic commons of cyberspace and outer space are critical for global security, but China's actions in these domains and its track record in the South China Sea raise serious doubts that China can be trusted to act responsibly and follow international law in shared spaces.

I thank the panel for joining us today to discuss the challenges to U.S. innovation and security presented by China's high-tech policies in these critical areas, and I look forward to hearing your recommendations for U.S. policy.

Mr. SHERMAN. And believe it or not, I have a few.

Friends trade with each other on a balanced and fair basis. I am glad to have another hearing focused on their trade relationship with China. Recently, we saw a phenomenal event at Mar-a-Lago, the total capitulation to President Xi on all economic issues. So much else was going on in the world that the press didn't bother to cover it, but the fact is that a President that promised to be tough on China trade let President Xi go home thinking we would do absolutely nothing.

Now supposedly, this is in return for a promise that China's going to help us with regard to North Korea. First, what kind of friend needs to be bought off with American jobs in order to stop subsidizing and supporting a lunatic that wants to develop the capacity to incinerate American cities. That is not something that we should have to pay for in American jobs.

But second, China isn't doing it. Refinement of uranium and creation of plutonium continues in North Korea. The missile tests take place every time there is the anniversary of one of the leader's forbearers. And China delays the purchase of one or two trains of coal. Of course, the country with perhaps the most polluted urban areas in the world when it comes to air might want to cut back on its coal imports anyway. This is an utter capitulation to China in return for basically nothing and certainly nothing that has made us safer.

We are the global leader in technology and science. The recent budgetary proposals to cut back on scientific development aren't going to help that. China's Made in China 2025 proposal is designed to take—to make the trade balance even more unbalanced by replacing those products that they import from us and exporting more to us. China's trade practices include, first and foremost, a rejection of the concept that there should be fair and balanced trade with the United States, and include historic currency manipulation, propping up state-owned enterprises, intellectual property, theft, forced technology transfer, dumping, barriers to importation, nontransparent trade laws and regulations, subsidies leading to overcapacity, et cetera, et cetera.

Now, the—we had a $310 billion trade deficit with China. This is the largest persistent trade deficit in the history of the world. In 2015, it was $336 billion. We are told by the Washington/Walmart/Wall Street axis a variety of things. First, we are told it doesn't matter. Well, it does, because every billion dollar trade deficit translates into losing 10,000 jobs. We are told our unemployment rate is low. Our unemployment rate is not low enough to create the labor shortage necessary so that Wall Street has to raise wages. Until we see a massive increase in wages, we need every good job we can get, and every billion dollars of unbalanced trade is 10,000 jobs.

We are told that the trade deficit stems from a fair system, and that of course is absolutely false. And we now see that with advanced technological products, where China should be importing more from the United States, we ran a $114 billion trade deficit with China last year, and it's only going to get worse.

Now, as to its practices, China's coproduction agreements—I mean, if China were to say, there is a 20-percent tariff on planes

sent from the United States to China, oh, we would say, oh, that is a tariff. But if instead they say you can't sell a single plane until you build a fuselage factory here in China, we say, oh, we don't know what to make of that, so we will ignore it. Coproduction agreements are the theft of jobs and with regard to China, the theft of intellectual property. We allow them because the Wall Street/Walmart/Washington axis does not support the American working family.

We can go on and look at the General Motors situation where we can't sell cars there unless we move the factories there. I have talked about how Boeing has set to open up its first factory line in China, not because of fair economics, but because we are not able to sell planes in China unless they extort that from us. So one would have to wonder on what basis we claim that China has given us most-favored nation status.

So what is Trump going to do about it? He won the Midwest from Pittsburgh to Milwaukee saying he was going to solve this problem. Current law allows him to impose, depending, 10 percent, another 15 percent, another 15 percent tariffs on Chinese imports or to threaten to do so. He has done neither. The trade deficit is running today as it has run in the past. There was a blip because of Chinese New Years, but that is a blip we would expect every time there is a Lunar New Year.

So he's got the power, and the most obvious thing he can do is designate China a currency manipulator. Now, you can say, well, maybe they are not manipulating the currency today. How many factories have they built? What competitive advantage have they stolen from the currency manipulation in the past? Since when are you not a currency? That is like saying, I didn't murder anybody today; therefore, I am not a murderer. They benefit from their past currency manipulation.

So the President told us he would do something. He campaigned—when it came to China, he campaigned with a big mouth and he governs with small hands.

I yield back.

Mr. YOHO. And you worked that in there.

We are going to extend a minute to each of the members that want to speak, and we will start with Mr. Dana Rohrabacher out of California.

Mr. ROHRABACHER. One of the things I am proudest of is that I, early on in my career here in Congress, led the floor fight against most-favored nation status for China, and all those folks on the other side of the debate were telling us how making sure that China prospered by having the right kind of economic relationship would bring liberalism in a more peaceful world. Now we now what baloney that is and what baloney we have been fed about China all these years.

China is an emerging threat to the United States and an emerging threat to people who want to live at peace in the world. They have more land claims and territorial claims than most any other country in the world against various other countries, which we ignore. And we now, of course, hear that our President now has not been tough enough with this visit of this Chinese leader. Let me just wait and see. I said, let's wait and see. Let's see if indeed these

Chinese who have not done anything but steal and rob from us, undermining our national security all these years, let's see if they help us at least with this problem in North Korea, which is a horrendous problem. If they do, our President has accomplished a great accomplishment. So let's not just turn this into a totally political brouhaha.

Mr. YOHO. Thank you.

Next, we will go to Mr. Chabot from Ohio.

Mr. CHABOT. I thank the gentleman.

Having been a past chair of this committee, we have had hearings like this in the past, and China just—and Mr. Sherman is nodding—we have been through this before a number of times. And now as chair of the Small Business Committee, we have seen things that are affecting small businesses all over the country relative to what China's shenanigans are.

U.S. security contractors discovered preinstalled software in Android phones belonging to American cities. This software enabled them to effectively keep tabs not only on the owners' whereabouts but on their private conversations with friends and family members and business partners, et cetera. This unauthorized and private information was then silently transmitted back to a server located in China.

I have only got a minute, so I can't go on nearly long enough on this. But China has been one of the bad actors on the world globe for far too long, and I am very, very looking forward to hearing—we had a couple of witnesses before, when I was chair, and we have got some good witnesses here. So I commend the chairman for bringing this panel together, and I yield back.

Mr. YOHO. Thank you, sir.

And I just want to remind members that votes are going to be called between 3 o'clock to 3:10, and we are going to have to take a break. If you guys would hold on, if you can, it is going to take us probably 20 to 30 minutes to do that and we can finish up. And if you can't, we understand.

But with us today—and I am very thankful for this. I look to you guys as the experts to help us guide—to guide us to get policies that we can pass on to the State Department and this new administration to help direct policies on how we deal with an emerging China.

And with us today we have Mr. Dean Cheng, senior research fellow at The Heritage Foundation, Asian Studies Center; Dr. Robert Atkinson, president of the Information Technology and Innovation Foundation; and Dr. Robert Scott, senior economist and director of trade and manufacturing policy research at the Economic Policy Institute.

We thank the panel for joining us today. I really do look forward to hearing your testimonies because this is what—you know, as Chairman Chabot brought up, we have been here before. What I don't want to do is come back a year from now or 2 years from now and say, man, we talked about this 2 years ago. What did we do in the interim? I want to have some action items that we can go back and we can create legislation to have action statements.

Mr. Cheng, we are going to start with you. Press your red button to speak, and your timer. I am going to try to hold you guys to 5

minutes. I know that is sometimes tough, but I do appreciate it. And so go ahead. Thank you.

**STATEMENT OF MR. DEAN CHENG, SENIOR RESEARCH FELLOW, ASIAN STUDIES CENTER, THE HERITAGE FOUNDATION**

Mr. CHENG. Chairman Yoho, Ranking Member Sherman, members of the House Foreign Affairs Committee, my name is Dean Cheng, I am the senior research fellow for Chinese political and security affairs at The Heritage Foundation. Please let me note I am not an economist. I am honored to be here and testifying before you but must note that my testimony reflects only my opinions and do not represent those of The Heritage Foundation.

Before addressing the specifics of the issues that are laid out before us, I think it is important to recognize a couple of framework aspects, one of which is that innovation in particular can often come in very different forms. We as Americans tend to focus on technological innovation, but there are other examples of innovation, including fundamental scientific breakthroughs, what are sometimes termed paradigm shifts; innovations in terms of organization; and innovation in terms of processes, especially production or delivery methods.

This is important because it is also important to recognize that others have successfully innovated in the past, often building on top of our own breakthroughs. The best example here, of course, is Japan, who in the 1980s built on the American invention of VCRs by making significant innovations in the production processes so that they could manufacture VCRs more cheaply, and yet they would be much more reliable than those that were produced by the United States at the time.

In this regards then, when we look at China in innovation, it is important to also recognize how much China is focused on information-related technologies. And this is in part because the Chinese leadership believes that we are now living in an information age. So the very nature of international power, the currency of international power has shifted from traditional industry, per se, the shareability to manufacture tanks or steel or generate power, toward the ability to gather information, analyze information, and exploit information.

As a result, China believes that in a sense the global balance of power has been reset back to zero where everyone is starting from the same starting point and China can therefore catch up much more easily. At the same time, China has also recognized that this has implications for regime stability as well as national security.

We see, for example, significant Chinese efforts at innovation in their space effort. Too often we are working off the very wrong perception the China space program is entirely rooted upon copying from others when, in fact, to begin with, China's space program really took off when it was isolated from all other players. It entered the space age in the 1960s when it had no relations with either the United States or the Soviet Union. Often, Chinese equipment, while externally similar, is in fact significantly different from the ostensible source. The Shenzhou manned spacecraft is bigger. Its power-generating capacity is significantly larger than the Soyuz to which it bears a superficial resemblance.

And finally, we are seeing genuine Chinese innovation in space. They deployed the first quantum communication satellite, which is—probably enjoys unbreakable encryption. They have developed a direct descent antisatellite capability to threaten targets in the geosynchronous belt. No other country has developed that. They are deploying a communications satellite at Lagrange point 2 to support a mission to the far side of the Moon, which no other nation has done. And finally, their BeiDou Navigation Satellite has a backup communications capability. Again, a setup that no other country has done.

We see the same actual innovation in terms of Chinese cyber. The great firewall of China is a form of innovation. It is something that obviously strikes at values like the free flow of information, but that is a values issue, not an innovation issue. PRC telecoms have demonstrated the ability to selectively shut down things like text messaging while—without shutting down mobile phone service. And the great canon allows China to selectively target different entities for DDOS, for distributed denial of service attacks, which no other country, frankly, has developed.

China has also developed an organization involving hundreds of thousands of human censors to censor the internet within China. Again, not something that we would support, but it is a form of innovation.

None of this is to argue that China does not engage in cyber espionage or that China does not engage in unfair trade practices. Rather, it is to suggest that it is important to recognize that they do those things, but that they also promote innovation within China. They are trying to catch up, including in terms of innovation in key areas such as space and cyber. One of the key areas that they are likely to follow up on is to push for access through venture capital and other entities in the United States that they will have had a hand in setting up.

And I would strongly recommend to this committee thinking about a follow-on to the CFIUS process where we are not just simply limiting Chinese entry into our markets but what happens after they have already entered.

Thank you very much.

[The prepared statement of Mr. Cheng follows:]

# INFORMATION DOMINANCE:
# THE IMPORTANCE OF INFORMATION AND OUTER SPACE IN CHINESE THINKING

Chairman Yoho, Ranking Member Sherman, and Members of the House Foreign Affairs Committee. Thank you for the opportunity to testify to you this afternoon.

My name is Dean Cheng and I am Senior Research Fellow in the Asian Studies Center of the Davis Institute for National Security and Foreign Policy at The Heritage Foundation. My comments today are purely my own and should not be construed as representing any official position of The Heritage Foundation.

My comments today focus on the evolving views of the People's Republic of China (PRC) regarding the role and importance of information. Note that this is not only a matter of the role of information in open warfare, but also its place in the strategic competition in which the United States and the PRC already find themselves.

## Growing Role of Information in War and Peace

From the Chinese perspective, these changes in the role of information are based on the fundamental shift in global socioeconomic conditions. The 20th Century was characterized by the Industrial Age. The very fundamentals of power were rooted in industrial capacity. Nations were measured and compared by their industrial capacity. Wars were won, not only by masses of tanks, ships, and aircraft, but the possession of the industrial base necessary to produce those weapons.

By contrast, in the Chinese view, the 21st Century is marked by the Information Age. Where national power was once a function of gigawatts of generating capacity and tons of iron smelted, it is now more a function of the ability to gather, analyze, and exploit information. The rise of telecommunications, the global Internet, and massive advances in computing power now provide unprecedented global access to information—and therefore the ability to inform but also to influence. This increasing centrality of information is termed "informationization" (*xinxihua*; 信息化).

Just as informationization has affected global economy and society, it has also influenced the nature of war. War, from the PRC's perspective, is a function of not just military forces and politics, but also reflects larger social, economic, and technological trends. The rise of the Information Age, marked by the widespread integration of information and information technology into all aspects of modern society and economics, also affects the nature of conflict, leading to "informationized warfare" (*xinxihua zhanzheng*; 信息化战争).

What is essential to recognize is that, for the Chinese, both information extraction and information exploitation, which are central to establishing information dominance:

- Are essential to modern warfare;
- Must occur in peacetime, in order to be useful in wartime; and
- Go far beyond purely military-related information, and includes economic and political information.

**The PLA and Information**

A key player in Chinese efforts to compete in an informationized world is the People's Liberation Army (PLA). The PLA is not a national military, but is first and foremost a ***Party army***. Indeed, the PLA is the armed wing of the Chinese Communist Party (CCP). Therefore, it does the Party's bidding, including keeping the Party in power.

Its actions are therefore not those of a "rogue" military. As important, they are undertaken in support of broader national goals and polices, as set forth by the CCP, in support of expanding the power of both the Chinese state and the Party itself. Thus, it is entirely consistent with the roles and missions of the PLA for it to be tasked with obtaining industrial and economic information, as well as military codes and war plans.

Furthermore, this is not "your father's PLA." This is no longer a PLA that is focused primarily on quantity. It is, instead, a learning organization that has paid close attention to other peoples' wars, in part because it has not fought one itself since 1979. As a learning organization, it has been adapting to the changing circumstances of modern warfare, adopting fundamentally new approaches to conflict.

Consequently, the PLA has been increasingly focusing on high technology and high-tech wars, dating back to at least the first Gulf War. From that conflict, and the Balkan wars of the 1990s, the PLA concluded that future wars would be joint, not only involving the ground forces, navy, and air force, but involving operations across the domains of land, sea, air, outer space, and information space (which includes cyberspace).

As the PLA observed in subsequent conflicts including those in Afghanistan and Iraq, however, their views of future warfare further evolved. In order to operate effectively across the various domains, the PLA would need to establish common situational awareness. Jointness was no longer a matter of getting air, land, and sea forces in the same operational volume, but it involved allowing ground forces to get targeting information from air units, and naval forces to support air and land forces. For the PLA, this meant that not all high technology was created equal—the most important technologies were those associated with information, including telecommunications, computing, and space.

This shift reflected the informationization of warfare, where information was applied to all aspects of warfare. This includes not just weapons, but logistics, personnel selection and management, and decision making.

**Informationization of Conflict**

According to the PLA's volume on terminology, informationized warfare is warfare where there is widespread use of informationized weapons and equipment and networked information systems, employing suitable tactics, in joint operations in the land, sea, air, outer space, and electromagnetic domains, as well as the cognitive arena. Informationized warfare in turn involves informationized militaries, which will operate through networked combat systems, command-and-control systems, and logistics and support systems, as part of the systems-of-systems construct.

The focus of informationized warfare is establishing "information dominance" (*zhi xinxi quan*; 制信息权). This is the ability to establish control of information and information flow at a particular

time and within a particular space.[1] It entails the ability to collect more information, manage and analyze it faster, and employ it more precisely than the adversary.[2] In doing so, in the Chinese view, the side that enjoys information dominance can seize and retain the initiative, and force the adversary into a reactive mode. This exploits a key difference between mechanized warfare of the Industrial Age, and informationized warfare of the Information Age. "Mechanized warfare focuses on physically and materially destroying an opponent, whereas informationized warfare focuses on inducing the collapse of the opponent's psychology and will."[3]

Establishing information dominance entails efforts that span the strategic to the tactical level. It is not simply a wartime requirement, but involves intelligence gathering throughout peacetime. Because of the rapid, decisive nature of "local wars under informationized conditions," it is not possible to wait until the formal commencement of hostilities to begin preparations. At a minimum, identifying opposition capabilities and weaknesses must be undertaken in peacetime.

Nor can this be solely a military function. As the world has informationized, the Chinese economy has had to informationize; similarly, as warfare has informationized, the Chinese military has had to evolve to prepare to fight such conflicts. Although the PLA plays a major role, though, such preparations involve all the various elements of the Chinese government and broader society and economy. Because of the interconnected nature of modern information networks, and their extensive permeation, information dominance involves gaining access not only to the adversary's military networks but to decision makers and the broader population, while defending against their efforts to do the same. As important, since information itself can be used as a weapon (beyond the incorporation of viruses and malware) by influencing its consumers, it is essential that information itself be monitored and information flow be tightly controlled, from a defensive perspective.

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[1]All Army Military Terminology Management Commission, *Chinese People's Liberation Army Terminology* (Unabridged Volume) (Beijing, PRC: Military Science Publishing House, 2011), p. 79.

[2]Chinese Military Encyclopedia 2nd Edition Editorial Committee, *PLA Encyclopedia*, 2nd Edition, *Military Strategy* (Beijing, PRC: China Encyclopedia Publishing House, 2007), p. 68.

[3]Fan Gaoming, "Public Opinion Warfare, Psychological Warfare, and Legal Warfare, the Three Major Combat Methods to Rapidly Achieving Victory in War," *Global Times* (March 8, 2005), http://big5.xinhuanet.com/gate/big5/news.xinhuanet.com/mil/2005-03/08/content_2666475.htm (accessed April 21, 2017).

Similarly, establishing information dominance involves a multi-pronged effort, addressing all aspects of information. Not only is it necessary to target an adversary's data, but also the systems involved in data collection and management, as well as the users and analysts of data. Similarly, it requires defending all three aspects of one's own information architecture, i.e., data, systems, and users.

The human element is especially important in informationized warfare. Chinese analysts note that the advent of more advanced weapons technologies did not necessarily lead to a change in the basic nature of war. Instead, the core of informationized warfare is the expanded range of abilities to influence and control an opponent's judgment and will to fight.[4] The ability to influence people, in terms of their politics, their thinking, their morale and spirit, and their psychology can be as decisive and effective as the ability to interfere with databases or computer networks. The ability to influence an adversary through the proper application of suitable information is embodied in the Chinese concept of political warfare.

Thus, at the strategic level, informationized conflict means using information to influence perceptions of the PRC and the United States. Is China engaging in aggression in the South China Sea, or is it defending its long-standing historic claims? The answer is based upon one's perceptions of China and China's actions, and influencing those perceptions is the focus of Chinese political warfare efforts.

In particular, political warfare for the PRC includes the "three warfares." These are the hardest forms of soft power, used to affect the thinking and psychology of the domestic Chinese audience, the adversary's leadership and population, and the views of third parties. Each of the three "warfares" employs information in a different manner to achieve these goals, but reinforces the other two.

Psychological warfare exploits information by drawing upon the political, economic, and cultural, as well as military elements of power. Information of each type can serve as a powerful weapon,

[4]Chang Long, "Tightly Grasping the Trends of the New Military Transformation—Reflections and Outlook from the Gulf War to the Iraq War," *PLA Daily*, October 28, 2003, http://www.xslx.com/htm/gjzl/jsgc/2003-10-38-15176.htm (accessed April 21, 2017).

influencing values, concepts, emotions, and context.[5] Legal warfare can build psychological support and sympathy among bystanders, and erode an opponent's will by constraining their preferred courses of action for fear of legal repercussions. Public opinion warfare can directly build support, persuading domestic and foreign audiences of the justice of one's own cause and the success of one's own efforts, while undermining an adversary's attempts to do the same. In particular, the growth and expanded reach of media of various sorts makes public opinion warfare especially important, as it can have global effects. Broad domestic and international support, in turn, will generate psychological benefits for oneself and adversely affect the enemy.

Chinese analysts see "public opinion warfare" (*yulun zhan*; 舆论战) as a special part of informationized warfare. Because of the wide permeation of information technology, public opinion warfare has global reach, extends to every part of society, and has an especially wide impact. The goal of public opinion warfare is to shape public and decision-maker perceptions and opinion, so as to shift the perception of overall balance of strength between oneself and one's opponent.[6] To this end, it is especially important that communications efforts associated with public opinion warfare be mutually reconciled and coordinated, so that specific messages are clearly transmitted, in support of specific goals. While the news media plays an important role in the Chinese conception of public opinion warfare, it is only a subset of the larger set of means available for influencing public opinion.[7]

Public opinion warfare supports psychological warfare. This pressures an opponent by employing information to affect their thinking, to create damaging or deleterious habits and ways of thinking, to reduce their will to resist.[8] At the same time, it seeks to limit the effect of enemy psychological warfare operations on one's own troops, population, and leadership, building morale, encouraging greater resistance and effort, and strengthening will.

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[5]Tan Wenfang, "The Impact of Information Technology on Modern Psychological Warfare," *National Defense Science and Technology* No. 5, 2009, p. 73.

[6]Academy of Military Sciences Operations Theory and Regulations Research Department and Informationalized Operations Theory Research Office, *Informationalized Operations Theory Study Guide* (Beijing, PRC: AMS Press, November, 2005), p. 405, and Liu Gaoping, *Study Volume on Public Opinion Warfare* (Beijing, PRC: NDU Press, 2005), pp. 16–17.

[7]Liu, *Study Volume on Public Opinion Warfare*, p. 5.

[8]Tan Wenfang, "The Impact of Information Technology on Modern Psychological Warfare," p. 76.

Psychological operations are seen as an essential part of future conflicts, affecting and influencing, at a basic level, the very perceptions that inform decision making, from the context to the biases. Successful psychological operations in informationized warfare will therefore have repercussions at strategic, operational, and tactical levels of operations, influencing both military and civilian leaders as well as the masses, and thereby affecting the course of the conflict.

Legal warfare questions the basic legitimacy of adversary actions. It involves "controlling the enemy through the law, or using the law to constrain the enemy (*yifa zhidi huo yong fa zhi di*; 以法制敌 或 用法制敌)."[9]

Legal warfare depicts "one's own side is obeying the law, criticizing the other side for violating the law (*weifa*; 违法), and making arguments for one's own side in cases where there are also violations of the law."[10] The ultimate goal is to secure the initiative in time of conflict, by gaining the legal high ground, portraying oneself as the side more firmly grounded in legal standing, and implicitly as being more virtuous and just.

Information warfare is the operational application and realization of informationized warfare. It is the conduct of warfare through the application of information and information technology in modern warfare. The priorities are on "network warfare," which is not just cyber, but all types of networks, and electronic warfare, which goes beyond jamming radars and radios. Indeed, the Chinese see the two as fundamentally linked, in the form of "integrated network and electronic warfare."

This is supplemented by psychological warfare. Here, it is an effort to influence the adversary's thoughts, emotions, knowledge, perspectives, and attitudes.[11] Through the application of various forms of information, psychological warfare strives to alter the adversary's interpretations of

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[9]Zong Wenshen, *Legal Warfare: Discussion of 100 Examples and Solutions* (Beijing, PRC: PLA Publishing House, 2004), p. 5.

[10]Han Yanrong, "Legal Warfare: Military Legal Work's High Ground: An Interview with Chinese Politics and Law University Military Legal Research Center Special Researcher Xun Dandong," *Legal Daily* (PRC), February 12, 2006.

[11]All Army Military Terminology Management Commission, *Chinese People's Liberation Army Terminology* (Unabridged Volume), (Beijing, PRC: Military Science Publishing House, 2011), p. 456, and Ye Zheng, *Science of Information Operations Teaching Materials* (Beijing, PRC: Military Science Publishing House, 2013), pp. 25–26.

information, including their context and frame of reference, as well as to undermine their will.[12] The purpose of psychological warfare at the operational level is to buckle the adversary's will and martial spirit, induce confusion in their command and decision-making processes, especially for military functions, and shake their confidence in their capabilities and ability to win, so as to reduce their combat effectiveness.[13]

In addition to electronic warfare, network warfare, and psychological warfare, there has been a growing discussion in the Chinese literature of "command and control warfare" and "intelligence warfare." The idea is that the key electronics, networks, and decision makers are those that are part of the intelligence network and the command-and-control structure.

At the tactical level, the Chinese conduct information operations. This includes the combination of hard-kill and soft-kill techniques. Just as information warfare sees "integrated network-electronic warfare," Chinese views of information operations include "integrated firepower-information attacks." The physical infrastructure is seen as important, alongside the computers and data. Some targets may be jammed, others hacked or infected with viruses, but in some cases, it might involve physical destruction of a server farm or a command-and-control center. This might involve special operations forces or it might involve precision-guided munitions.

This places China's increasing role in the construction of the physical part of the Internet in a different light. The ability of China to build information systems in Africa, South America, Central Asia, and Europe means that, in the future, China will have insight, and possibly access, to much of the physical infrastructure over which information passes. At the same time, including Chinese laptops and smart phones in critical communications networks means that the point of connecting to the network is also more and more often "made in China."

**China's Growing Space Capabilities**

An important part of the physical infrastructure for information-space is outer space. Space is a central means of obtaining information, including not only support to military operations, but for

[12]Wu Renhe, *Theory of Informationized Conflict* (Beijing, PRC: Military Science Publishing House, 2004), p. 192.

[13]Chinese Military Encyclopedia 2nd Edition Editorial Committee, *PLA Encyclopedia*, 2nd Edition, *Military Psychology* (Beijing, PRC: China Encyclopedia Publishing House, 2007), p. 67.

agricultural, industrial, and commercial purposes. Indeed, it has been suggested that 95 percent of space technology is dual-use in nature.[14] Space plays an essential role in the Information Age for military and civilian functions.

Along these lines, PLA analyses suggest that it views space in a very holistic fashion. Chinese writings note that the overall space system encompasses not only satellites in orbit, but also terrestrial launch, mission control, and tracking, telemetry and control (TT&C) facilities, as well as the data links that tie the space and Earth-bound portions together. Consequently, efforts aimed at establishing space dominance must incorporate offensive and defensive measures covering this full range of targets (orbiting systems, ground-based systems, data). "Space dominance" (*zhitian quan*; 制天权) is defined as "the ability by one side in a conflict to control [or dominate] a certain portion of outer space at a given time." The goal is to secure the advantage in space, ensuring that one's own side has freedom of action in space, while constraining the other side's comparable freedom of action in space.[15]

The Chinese interest in space dominance has been noted in the assessments of American intelligence agencies. General Vincent Stewart of the Defense Intelligence Agency testified in 2015 that several nations, including China, are developing counter-space capabilities.

> The threat to U.S. space systems and services will increase as potential adversaries pursue disruptive and destructive counterspace capabilities.... Chinese and Russian military leaders understand the unique information advantages afforded by space systems and are developing capabilities to deny U.S. use of space in the event of a conflict. Chinese military writings specifically highlight the need to interfere with, damage, and destroy reconnaissance, navigation, and communication satellites.[16]

The importance of being able to guarantee Chinese interests in the space domain was underscored in the "new historic missions" that Hu Jintao charged the PLA. In his 2004 speech,

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[14]Roger Cliff, *The Military Potential of China's Commercial Technology* (Santa Monica, CA: RAND Corporation, 2001), p. 27, https://www.rand.org/content/dam/rand/pubs/monograph_reports/2001/MR1292.pdf (accessed April 21, 2017).

[15]Chinese Military Encyclopedia 2nd Edition Editorial Committee, *Military Strategy, Chinese Military Encyclopedia* (Beijing, PRC: China Encyclopedia Publishing House, 2007), p. 211.

[16]Ltg Vincent R. Stewart, "Worldwide Threat Assessment 2015," testimony before the Armed Services Committee, U.S. House of Representatives, February 3, 2015, http://www.dia.mil/News/SpeechesandTestimonies/tabid/7031/Article/13225/worldwide-threat-assessment.aspx (accessed April 21, 2017).

Hu stated that one of the new missions for the PLA is to provide strong strategic support for maintaining national interests. In light of national development and broader global trends, Hu observed that China's national interests and security had gone beyond the traditional land, sea, and air and shifted towards the oceans, space, and the electromagnetic domain. "Maritime security, space security, electromagnetic spectrum security," he noted, "are already vital regions for national security," where a small number of major powers are seeking to secure the advantage. Hu elevates space security, along with maritime security and electromagnetic security, to the equivalent of the security of land, sea, and air territories.[17]

Subsequent Chinese writings have reflected this growing importance of space. The 2013 volume *The Science of Military Strategy*, published by the Chinese Academy of Military Science, for example, includes a chapter devoted to discussing military conflict in the space and cyber (as well as nuclear) domains. In this extensive revision of the 2001 version, it is noted that the importance of space has grown significantly for both military and broader national purposes.[18] The competition to dominate space is steadily intensifying, involving not only major powers, but even mid-size powers. Successful military strategy therefore demands the ability to successfully conduct space information support, space deterrent activities, and both offensive and defensive operations in space. Moreover, space deterrence, to be credible, must include offensive capabilities. Similarly, fielding offensive, as well as defensive, capabilities in space strengthens space deterrence.

Similarly, the new 2007 edition of the *PLA Encyclopedia* also discusses space dominance. It notes that space dominance is "a vital factor in securing air dominance, maritime dominance, and electromagnetic dominance, and will directly affect the course and outcome of wars."[19]

Military space operations, including the need to secure space dominance, are also discussed in other Chinese materials. In a volume jointly authored by the Academy of Military Science Operations Theory and Regulations Research Department and the Informationized Operations

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[17]Hu Jintao, "Understanding Our Military's New Historic Missions in the New Phase of the New Century," December 24, 2004, http://gfjy.jxnews.com.cn/system/2010/04/16/011353408.shtml (accessed April 21, 2017).

[18]AMS Military Strategy Research Department, *The Science of Military Strategy* (Beijing, PRC: Military Science Publishing House, 2013), pp. 178–188.

[19]Chinese Military Encyclopedia 2nd Edition Editorial Committee, *Military Strategy, Chinese Military Encyclopedia* (Beijing, PRC: China Encyclopedia Publishing House, 2007), p. 211.

Theory Research Office, it is noted that "in future informationized wars, securing the space advantage, obtaining space dominance, will be the prerequisite for securing the initiative in the war."[20] Similarly, PLA teaching materials on joint campaigns observe that "without space dominance, it is difficult to assure the smooth operation of space information systems, which will make it hard to assure the smooth operation of military information systems, which in the end will mean that it is difficult to secure battlefield information dominance."[21]

**Chinese Space Weapons Developments.** China's interest in military space activities are not limited to hypothetical analyses. China has conducted a number of weapons tests and other activities that suggest an ongoing array of weapons development efforts. These include a number of different anti-satellite vehicles, as well as possible directed energy weapons (e.g., lasers). Chinese cyber capabilities may also have anti-satellite functions (among others); similarly, Chinese conventional modernization may allow them to hold some of the terrestrial elements of the American (and allied) space infrastructure at risk.

*Ground-Launched Anti-Satellite Systems.* In January 2007, China tested a direct-ascent kinetic kill vehicle against a defunct FY-1C weather satellite, resulting in one of the worst debris-generating events in space history. This test, according to Paula DeSutter, then Assistant Secretary of State for Verification, Compliance, and Implementation, was not the first test, however, but followed two earlier non-destructive tests of the same system.[22] This ongoing development program does not appear to have ended, although there have not been any comparable tests since 2007.

Since then, however, China ***has*** conducted three tests of a ballistic missile defense system that might also have anti-satellite applications. In 2010, the Chinese "conducted a test on ground-based midcourse missile interception technology within its territory."[23] As American defense

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[20]Academy of Military Science Operations Theory and Regulations Research Department and Informationized Operations Theory Research Office, *Informationized Operations Theory Study Guide—400 Questions on Informationized Operations* (Beijing, PRC: Military Science Publishing House, 2005), p. 278.

[21]Li Yousheng, *Joint Campaign Teaching Materials* (Beijing, PRC: Military Science Publishing House, 2012), p. 69.

[22]Lon Rains and Colin Clark, "Profile: Keeping a Watch on U.S. Interests," *Space News*, March 1, 2007, http://spacenews.com/profile-keeping-watch-us-interests/ (accessed April 21, 2017).

[23]"China Reaffirms Its Missile Test Defensive," *Xinhua*, January 12, 2010, http://news.xinhuanet.com/english/2010-01/12/content_12797459.htm (accessed April 21, 2017).

officials noted, "We detected two geographically separated missile launch events with an exo-atmospheric collision also being observed by space-based sensors."[24] The Chinese conducted another missile defense test in January 2013, and used almost the exact same language to describe it, i.e., a midcourse missile interception. In July 2014, the Chinese conducted another test, which it has termed a missile defense test, but which the United States characterized as a non-destructive anti-satellite test.[25] It should be noted that these tests resemble the American interception of the satellite US193 with an AEGIS missile.

While these earlier tests were engaging targets in low-earth orbit (160–2,000 kilometers altitude), in 2013, China has also tested a ground-launched anti-satellite system that would appear to be able to threaten satellites in geosynchronous orbit (36,000 kilometers altitude).[26] This constitutes a substantial expansion of the potential threat posed by Chinese anti-satellite capabilities. As important, it would hold at risk a range of key satellites, including communications and missile early warning systems.

*Co-Orbital Anti-Satellite Systems.* The ability of satellites to maneuver together has both peaceful and military potential. Docking maneuvers are integral to such actions as resupply of the International Space Station and were fundamental to the American Moon landings. At the same time, however, any satellite, if it has sufficient fuel and can be finely controlled while guided by a sufficiently discerning tracking system, can serve as a co-orbital anti-satellite system; in effect, it would be a space kamikaze. Recent Chinese developments in small satellites and space robots, as well as manned space missions, have demonstrated an ability to maneuver satellites together.

In 2010, two Chinese small satellites, SJ-06F and SJ-12, engaged in a series of maneuvers that suggest a controlled conjunction, in which the two satellites "bumped."[27] The ability to

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[24]"China: Missile Defense System Test Successful," *USAToday*, January 11, 2010, http://usatoday30.usatoday.com/news/world/2010-01-11-china-missile-defense_N.htm (accessed April 21, 2017).

[25]Mike Gruss, "U.S. State Department: China Tested Anti-Satellite Weapon," *Space News*, July 28, 2014, http://spacenews.com/41413us-state-department-china-tested-anti-satellite-weapon/ (accessed April 21, 2017).

[26]Brian Weeden, "Through a Glass, Darkly," Secure World Foundation, March 17, 2014, http://swfound.org/media/167224/Through_a_Glass_Darkly_March2014.pdf (accessed April 21, 2017).

[27]Brian Weeden, "Dancing in the Dark: The Orbital Rendezvous of SJ-06F and SJ-12," *The Space Review*, August 30, 2010, http://www.thespacereview.com/article/1689/1 (accessed April 21, 2017).

undertake controlled approaches reflects a nascent ability to steer a satellite, and to bring it into contact with another space system. Similarly, China's controlled docking maneuvers by the Shenzhou-VIII, Shenzhou-IX, and Shenzhou-X space capsules with the Tiangong space lab demonstrate China's ability to closely monitor spacecraft operations, including approach and contact. That Shenzhou-VIII was remotely docked via ground control also reflects Chinese ability to bring spacecraft into carefully controlled contact with each other.

In August 2013, China again demonstrated an ability to maneuver satellites in close proximity, as several Chinese satellites apparently maneuvered in a manner that again suggests that they may have physically contacted each other. One of the satellites may have been equipped with a robotic arm, adding an additional capability for servicing satellites—or damaging them while in orbit.[28]

*Directed Energy Weapons.* Chinese kinetic kill vehicles (KKV) tests have garnered significant commentary and discussion; less is known about Beijing's development of directed energy weapons (DEW). In 2006, China apparently fired lasers at American satellites passing overhead. Contemporary reporting indicated that this was one of a series of events involving Chinese lasers and American military or intelligence satellites.[29] While the United States expressed concern over what was then described as an anti-satellite system, subsequent reporting suggested that it was not clear whether these were, in fact, weapons, or laser ranging devices.[30] Other reports suggest an ongoing research effort into developing lasers for a variety of defense purposes, including anti-satellite functions.[31]

*Cyber Capabilities.* As noted earlier, the Chinese interest in counter-space is not limited to developing systems to attack orbiting satellites, but also extends to the ability to degrade or

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[28]Kevin Pollpeter, "China's Space Robotic Arms Programs," Study of Innovation and Technology in China Project, October 2013, http://igcc.ucsd.edu/assets/001/505021.pdf (accessed April 21, 2017).

[29]Vago Muradian, "China Attempted to Blind U.S. Satellites with Laser," *Defense News*, September 25, 2006.

[30]"NRO Confirms Chinese Laser Test Illuminated US Spacecraft," *Space News*, October 3, 2006, http://spacenews.com/nro-confirms-chinese-laser-test-illuminated-us-spacecraft/ (accessed April 21, 2017), and "China Jamming Test Sparks US Concern," *USAToday*, October 5, 2006, http://usatoday30.usatoday.com/tech/news/2006-10-05-satellite-laser_x.htm (accessed April 21, 2017).

[31]Wendell Minnick, "China Pursues Systems to Keep US Forces at Bay," *Defense News*, September 17, 2013, http://archive.defensenews.com/article/20130917/DEFREG03/309160021/China-Pursues-Systems-Keep-US-Forces-Bay (accessed April 21, 2017).

damage datalinks that connect satellites to ground stations. Space dominance can be achieved if a key satellite is shut down, its mission payload is pointed in the wrong direction, or it is unable to communicate at critical moments, as if it had been destroyed by an anti-satellite system. Indeed, this may be a preferable outcome, since attribution may be difficult and such approaches are unlikely to generate space debris (and attendant political and diplomatic criticism). Consequently, Chinese cyber capabilities should be considered an integral part of China's "counterspace capabilities."

Several cyber incidents involving space systems have been attributed to the PRC, suggesting that they are actively exploring vulnerability in space information systems. Hacking incidents in 2007 and 2008 against the LANDSAT-7 and Terra AM-1 EOS (Earth Observation System) satellites reportedly allowed cyber-intruders to gain control over all functions of these satellites for several minutes.[32] The attacks have been attributed to the PRC. Other reports suggest that China is responsible for hacking into the National Oceanic and Atmospheric Administration's weather satellite system.[33]

These cyber activities are a reminder that the Chinese see cyber operations as a part of information operations, and that space networks are part of the broader information networks that the Chinese seek to disrupt. The focus is on ***information***, not just cyber or space.

The integrated manner in which China thinks of information operations and space activities is reflected in Chinese military developments of the past several years, which are themselves the culmination of nearly a quarter century of thought regarding the shape and requirements of future warfare. The recently announced Chinese military reforms, including the creation of the PLA Strategic Support Force (PLASSF), highlights this. The PLASSF includes China's space, cyber, and network warfare forces. It is fair to argue that it is better described as China's "information warfare" force.

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[32]Tony Capaccio and Jeff Bliss, "Chinese Military Suspected in Hacker Attacks on U.S. Satellites," Bloomberg News, October 27, 2011, http://www.bloomberg.com/news/2011-10-27/chinese-military-suspected-in-hacker-attacks-on-u-s-satellites.html (accessed April 21, 2017).

[33]Mary Pat Flaherty, Jason Samenow, and Lisa Rein, "Chinese Hack Weather Systems, Satellite Network," *The Washington Post*, November 12, 2014, http://www.washingtonpost.com/local/chinese-hack-us-weather-systems-satellite-network/2014/11/12/bef1206a-68e9-11e4-b053-65cea7903f2e_story.html (accessed April 21, 2017).

Mr. YOHO. Thank you.

Dr. Atkinson.

And they have just called votes, so we have got about 12 minutes before we have to leave, then we will come back.

**STATEMENT OF ROBERT D. ATKINSON, PH.D., PRESIDENT, INFORMATION TECHNOLOGY AND INNOVATION FOUNDATION**

Mr. ATKINSON. Thank you Chairman Yoho, Ranking Member Sherman, and other members of the committee. It is a pleasure to be here.

ITIF is a think tank here in Washington. We have focused on what we term Chinese innovation mercantilism for a number of years.

I want to postulate that the challenge today is a little different than it has been for the last 15 years with regard to China. That challenge was largely about U.S. low- and mid-tech manufacturing on a commodity based goods, where they were able to hollow out U.S. manufacturing in a serious way, largely by currency, subsidies, other kinds of measures. And that does matter. I agree that the trade deficit does matter to our Nation's prosperity. But I would argue that the emerging challenge is somewhat different.

The emerging challenge now is about the Chinese Government enacting a suite of policies to go after the U.S. leadership in our core advanced technologies. It is one thing to lose textiles, I feel bad for the textile workers and the textile communities, but the U.S. real core advantages in advanced industries, that is what the Chinese are going after. I think we should look at a world or at least consider a world where in 15 years, U.S. technology jobs in industries like aerospace, chemicals, computers, motor vehicles, medical equipment, pharmaceuticals, software, semiconductors, are dramatically reduced from where they are today. I think that is the risk we have to look at.

More importantly—or as importantly, once those are gone, the dollar could fall dramatically and we are not going to get them back. We can get a lot of commodity things back if the dollar falls enough, because it is not that hard to recreate them. Once you've lost an industry like semiconductors or aerospace, it is really, really hard to get it back.

So the Chinese have a goal of mastering their own technologies, a very different goal than most countries which is around comparative advantage, and they are doing that in a wide variety of areas. Other members have mentioned some of the tactics. I have that in my testimony so I won't go into that.

But let me talk briefly about the case of semiconductors. This is a leading U.S. industry. We enjoy a $420 billion trade surplus, more—or equally importantly, we specialize in the higher value added segments in industry, R&D design and advanced manufacturing. So that is a real core strength for us.

The Chinese have a strategy now to eliminate semiconductor imports completely within 20 years and to grow their own national champions to come out and take market share away from U.S. companies. A key tactic in their 2014 strategy for national guidelines for development of promotion of integrated circuit industry is a $160 billion fund to basically subsidize their companies. For exam-

ple, there is a company called XMC, which is a contract chip producer. It is owned by a Chinese provincial government. It has received fairly significant subsidies to build a massive 1 square kilometer plant to produce up to 300,000 RAM flash memory units per month. If they are able to do that, and they are already a third of the way through building that plant, they will flood the memory market, and they will significantly disrupt that, probably leading to some bankruptcies in foreign countries.

So what do we need to do? I think first of all we need to do two things when it comes to trade. One is we need to limit the Chinese access to our crown jewels. The main way they try to get that is either through forced tech transfer or through acquisitions, and I will talk in a moment about CFIUS. And then secondly, to attempt to roll back. We are not going to eliminate, but we can and should roll back some of their innovation mercantilist practices.

I think what that means, when it comes to trade policy for Congress and the administration, is that, I know it sounds simple, but to focus on China. That really is the biggest challenge in our trade policy. It is not other countries who are our allies where we might experience minor irritants over certain kinds of products; it is really China. And to the extent we get engaged in other kinds of trade sites, we reduce the ability of our allies to join with us to push back against China. A good example of that, both the Japanese and the Korean Governments are quite concerned with the same kinds of policies that I have talked about here, and they should be natural allies with us to do that.

Secondly, with regard to our China policy, I would argue we really need to focus on advanced industries. That is the biggest threat. That is where the puck is going towards. While other industries are, you know, important certainly to their users, this is an important area.

Third, we need to develop stronger organizational capabilities in the Federal Government. We still haven't translated some of the Chinese documents for their industry strategy. We don't even know what they say because we don't have enough Chinese translators or money to just translate these simple documents. I would argue also that within the National Intelligence Council, we need a dedicated unit that we have termed the national industrial intelligence unit; somebody in the Federal Government who tracks exactly what China is doing, what are the technologies they are going after.

Two last quick things. I know my time is up. One, given that you have oversight of the State Department, I think the State Department is a challenge here in these negotiations. State is oftentimes the placater. The USTR is the one that tries to push hard. State is often the one that is trying to get USTR to back off or back down. I think that is a serious problem.

And lastly, CFIUS. We need to update CFIUS. The Chinese Government essentially does not let U.S. firms go in and buy Chinese firms. I would argue that we need a similar level of reciprocity, particularly around advanced technology firms.

Thank you.

[The prepared statement of Mr. Atkinson follows:]

ITIF | INFORMATION TECHNOLOGY & INNOVATION FOUNDATION

**Testimony of**

**Robert D. Atkinson**

**President**

**Information Technology and Innovation Foundation**

**Before the**

**House Committee on Foreign Affairs**
**Subcommittee on Asia and the Pacific**

**Hearing on**

**China's Technological Rise:**
**Challenges to U.S. Innovation and Security**

April 26, 2017

Washington, DC

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Good morning Chairman Yoho, Ranking Member Sherman, and members of the Committee; thank you for inviting me to share the views of the Information Technology and Innovation Foundation (ITIF) on the challenge from China to America's innovation and security. 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 been involved in the issue of U.S.-China trade policy, writing extensively about "innovation mercantilist" policies China uses to unfairly compete economically with the United States. I very much appreciate the opportunity to comment on these issues today.

**The Challenge from Chinese Innovation Mercantilism**

There is a growing understanding that China is an outlier when it comes to the global norms and rules governing trade, investment, and economic policy, and that the "innovation mercantilist" behavior on the part of the Chinese government represents a threat not only to the U.S. economy, and increasingly to its advanced-technology industries, but also to the global economy.

Previous U.S. administrations sought engagement and dialogue with Chinese leaders in the hope that this would lead the Chinese government to retreat from its mercantilist path. But rather than reform, China has doubled down on its unfair, mercantilist strategies and is now seeking global dominance in a wide array of advanced industries that are key to U.S. economic and national security interests. And it should be clear what the end game is: Chinese-owned companies in a wide array of advanced industries gaining significant global market share at the expense of American (and European and Japanese) firms' market share. If successful, the end game could be significantly less U.S. technological capabilities in a range of advanced industries from information technology (semiconductors all the way to devices), aerospace, instruments, life sciences, and software.

As such, unless U.S. policymakers want to accept such an outcome as beyond their control, it's time for a new approach to Chinese innovation mercantilism that moves beyond the push for continued dialogue, and instead makes it clear to Chinese leaders that such unfair, harmful policies cannot be practiced with impunity. Yet this fight cannot be about individual tactics, for the Chinese government has shown itself to be quite adept at abandoning certain tactics when they become discredited globally, only to adopt new ones in service of its overall mercantilist strategy. Any new China trade focus needs to be not just on tactical wins, but more broadly on rolling back the entire Chinese innovation mercantilist strategy and getting China to finally become a responsible player in the global trading system.

The Trump administration has now a key opportunity to press Chinese leaders for a fundamental economic policy reset that will move the world economy back toward the rule of law and market-based policies. However, to succeed, such a new policy will need to be pursued with great care and sophistication. The Chinese government is not without retaliatory weapons and it has shown a willingness to use them to fight back against legitimate efforts to stop China's manipulation of the global trading system. And because of the lack of the rule of law in China, Chinese officials could very well use their powers to retaliate against U.S.

firms doing business in China. Let there be no doubt: such an outcome would be bad for the U.S. economy and U.S. jobs.

As such, Congress should encourage the Trump administration to make clear that any new China trade strategy is based not on punishing China or seeking to hold it down; but rather on restoring the global trading system to a rules-based one. In essence, the Trump administration should make it clear that it is acting more "in sorrow, than in anger," and that any punitive actions directed toward China are only in place until the Chinese government makes needed reforms.

While tougher action on the part of the U.S. government will be needed, the time when U.S. unilateral action could suffice has passed. The last time that was possible was perhaps during the first term of the Obama administration when the United States possessed enough leverage to press China on its own. But after at least two decades of mercantilist policies, China is no longer as dependent on the United States economically and has considerably more degrees of freedom. As such, any action toward China on trade needs to be through a strong and unified coalition, particularly with nations like Australia, Canada, Germany, Japan, and the United Kingdom. All of these nations' economies have been hurt by Chinese mercantilism and are even more likely to be hurt going forward as China ramps up a robust innovation mercantilism designed to obtain global technology leadership. By working together, China will have many fewer options to avoid modifying its mercantilist strategy.

Finally, the most important strategic factor that should guide the Trump administration's policy toward China is to differentiate between protectionism and prosecution. In other words, trade enforcement, including tariffs, should be a tool designed to fight foreign protectionism, not a tool to reduce competitive pressures on firms in the United States. This may sound like a semantic difference, and indeed, most in the Washington trade establishment refuse to accept the difference (seeing any stepping up against Chinese trade practices as U.S. protectionism). But there is a critical difference. The goal for America should not be to withdraw from the global trading system and emulate the mercantilists. High and permanent tariffs would do that and would constitute protectionism. Rather, the goal should be for the United States to be willing to fight for the soul of the global trading system by taking needed steps to pressure China into significantly reducing its use of mercantilist policies. That would be prosecution in the service of free trade.

### Why Chinese Innovation Mercantilism Matters

Chinese trade imbalances have generated a significant deleterious impact on U.S. employment and output, particularly in manufacturing. For example, Justin Pierce of the Federal Reserve Board of Governors and Peter Schott of the Yale School of Management link PNTR (permanent trade relations) with China in 2000 with "the sharp decline in U.S. manufacturing employment beginning in 2001."[1] MIT economists David Autor, David Dorn, and Gordon Hanson estimate that the United States lost 982,000 manufacturing jobs between 2000 and 2007 because of Chinese import competition.[2] ITIF has found that when U.S. manufacturing output growth is accurately measured, it becomes clear that the growing overall U.S. trade deficit was responsible for almost two-thirds of jobs lost in the 2000s (e.g., approximately 3.8 million jobs), with a significant share of this the result of unbalanced trade with China.[3]

But the challenge regarding Chinese mercantilism going forward is different than it was over the last 15 years. That challenge was largely to U.S. low- and mid-tech manufacturing, where Chinese policies hollowed out traditional U.S. manufacturing. The current and emerging challenge will be around advanced industries that the United States currently leads or holds strong global positions in, because those are the industries China is now targeting for dominance. I urge you to consider what a world would look like in 15 years where U.S. technology jobs in industries as diverse as aerospace, chemicals, computers, instruments, motor vehicles, medical equipment, pharmaceuticals, semiconductors, and software and Internet are significantly reduced due to Chinese policies focused on gaining 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 were to fall significantly related to the yuan, it is certainly possible that America could regain a not-insignificant share of the production lost to China in the 2000s 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 in the United States. But if America's technology base was substantially lost, no adjustment of currency decline could bring it back because national strength 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 could not simply buy some semiconductor equipment and start cranking out 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 research and development (R&D) scientists coupled with an innovation ecosystem (universities training the right talent, a network of suppliers of materials, etc.). Once those capabilities are lost, they are essentially gone, and are very difficult to resurrect.

There is an additional reason why losing advanced tech industries is more 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 and build a factory, entry into innovation-based industries requires not just physical capital but also 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; close to zero in the case of software. In these kind of innovation 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 or jet airplanes), and if a mercantilist-supported competitor gains global market share, the market-based competitor loses market share. Moreover, that firm's revenues go down much more than its costs. 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.

Thus, the loss of advanced tech 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 overall U.S.

wages. The second is on national security and the defense industrial base. U.S. global defense leadership is based not principally on the size of our nation or on the amount of money America spends on defense; it is based first and foremost on U.S. technology leadership. Our service men and women go into any conflict with the advantage of fielding technologically superior weapons systems. But that advantage depends on the U.S. economy having global technological superiority, not just in defense-specific technologies but also 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.

### The Goals of Chinese Innovation Mercantilism

In 2015, Chinese President Xi Jinping unabashedly trumpeted a goal of making China the "master of its own technologies."[4] 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 attract foreign direct investment (FDI) and to induce foreign multinational corporations to shift production to China.[5] It used an array of unfair tactics to achieve that goal, including systemic currency manipulation, massive subsidies to firms to move production to China, 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 essentially announced that modern Chinese economic strategy sought *absolute advantage* across virtually all advanced technology industries. It fundamentally 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 wishes to dominate in production of both advanced technology products such as airplanes, semiconductors, and pharmaceuticals *and* commodity manufacturing. 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, Chinese President Xi Jinping 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 industries. As the Mercator Institute for China Studies in Germany writes in its report, "Made in China 2025: The Making of a High-Tech Superpower and Consequences for Industrial Countries," "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."[6] And as discussed below, the Chinese government is also targeting semiconductors.

Thus, it's no exaggeration to suggest that, without aggressive action, the United States may face a world within two decades years 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. This not only has potentially serious implications for America's future economic security, it has perhaps even more serious implications for America's national security and military superiority

**Chinese Innovation Mercantilism Tactics**

As the Information Technology and Innovation Foundation 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 "The Worst Innovation Mercantilist Policies of 2016"—China has deployed a vast panoply of innovation mercantilist practices that seek to unfairly advantage Chinese advanced-industry producers over foreign competitors.[7] 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; 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.

Most of these policies and practices are oriented around one overriding goal: acquiring foreign technology know-how. For Chinese government leaders are well aware that they cannot meet their indigenous innovation objectives on the time scale they have set without aggressively acquiring foreign expertise and knowledge. A principal way Chinese officials attempt to meet this goal is through forced technology transfer. Although China's World Trade Organization (WTO) accession agreement contains rules forbidding the country from tying foreign direct investment or market access to requirements to transfer technology to the country, it remains commonplace that China requires firms to transfer technology in exchange for being granted the ability to invest, operate, or sell in China.[8] As Harvard Business School professors Thomas Hout and Pankaj Ghemawat document in their report "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.[9] To be sure, because such

conditions contravene China's WTO commitments, officials are careful not to put such requirements in writing, often resorting to oral communications to pressure foreign firms to transfer technology.[10] In 2011, then-U.S. Treasury Secretary Timothy Geithner laid such concerns about China's technology transfer requirements in the open, 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."[11] Indeed, 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.[12] Likewise, a 2012 American Chamber of Commerce in China survey reported that 33 percent of its respondents stated that technology transfer requirements were negatively affecting their businesses.[13] Put simply, technology transfer requirements as a condition of doing business in China remain a key pillar of China's innovation mercantilist strategy. Moreover, over the last five years, China has ratcheted up its demands. Now for many foreign advanced industry companies, doing business in China requires transferring ever-more valuable technology to Chinese joint venture "partners".

In addition, China's anti-monopoly law has been designed in a way 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."[14] 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 IP if access to it is "essential for others to effectively compete and innovate."[15] 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.[16]

Another way China acquires technology and intellectual property is to steal it. As a recent *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."[17] According to the U.S. International Trade Commission (ITC), 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.[18] That figure has continued to increase. Subsequently, *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.[19] Likewise, a recent European Union-commissioned study found that, among European manufacturers, the loss of IP in China reduces their potential profits by 20 percent annually.[20] 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.[21] In a recent survey of the

business environment in China conducted by the U.S.-China Business Council, 98 percent of companies surveyed report that intellectual property rights enforcement in China remains a concern for them.[22]

Around three years ago, the Chinese government added a new tactic directly attacking foreign companies. One basis of the attacks is that U.S. technology products were asserted to not be secure and therefore the Chinese government had the right to intervene. One tool of these attacks is a propaganda campaign carried out in the state-controlled media, with multiple articles claiming that U.S. tech company products were not secure, with one government blog threatening "to severely punish the pawns of the villain." These attacks happened at the same time Chinese President Xi Jinping took over the reins of a new Communist Party-led committee on cybersecurity. It's hard to underestimate the role of Edward Snowden's National Security Administration (NSA) revelations in this change of tactic. Before Snowden, the Chinese government was reticent to play this intimidation card. But Snowden gave the Chinese government the cover it needed to claim the moral high ground and go after U.S. tech companies on trumped-up charges of lack of security. In 2014, the Chinese central government ruled that government offices were prohibited from running Windows 8 (although many, if not most, Chinese government offices steal, rather than purchase Windows anyway). Soon after, investigators from China's State Administration for Industry and Commerce raided Microsoft facilities in four Chinese cities, claiming it was investigating whether Microsoft violated China's anti-monopoly laws. The Microsoft case was not the first attack on U.S. technology companies. Over the last several years, virtually every leading American ICT company has found itself in the Chinese cross hairs. Apple CEO Tim Cook was forced to publicly apologize for purported problems with iPhone warranties. Next up was Qualcomm and Cisco, with the National Development and Reform Commission claiming that both were monopolists. Around the same time, the Chinese government announced a "De-IOE" campaign designed to pressure Chinese companies into replacing their IBM, Oracle, and EMC products with Chinese-made ones. The harassment of Microsoft appeared to be a tit-for-tat response to the Justice Department indictment in 2014 of five Chinese military offices for hacking into U.S. companies' computers to steal trade secrets. Indeed, the Chinese government has shown time after time that it doesn't just act to even the score when the United States takes action against China; it responds with overwhelming force.

An increasingly important way for Chinese firms to gain access to needed technology is to simply buy up U.S. technology companies. Indeed, a not-insignificant share of Chinese FDI into the United States is now in technology industries. According to Select USA, the top four industrial categories in terms of numbers for Chinese FDI projects from 2003 to 2015 were electronics, industrial machinery, software and information technology services, and communications.[23] The Rhodium Group reports that over the last 16 years there were 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.[24] Of the $14.2 billion invested in ICT, 74 percent was made from 2014 to 2016, with more than 95 percent going to acquisitions.[25] 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).

Much Chinese FDI comes from state-owned enterprises that often have different motives than simply maximizing profits. Rather, their investments are often to serve state goals. According to the Rhodium Group,

from 2002 to 2016, of the 582 acquisition deals, about 20 percent (116) were made by government-owned corporations, accounting for about 30 percent of the total monetary value.[26] Information and communications technology and electronics industries deals totaled roughly $18 billion, with government-backed deals accounting for roughly $5 billion of this amount. Moreover, the lines between public and private in Chinese firms is opaque, with many "private" firms having deep financial and other ties to the Chinese government.

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.[27] 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."[28] Moreover, the Chinese government channels funds to supposedly private investment bodies, making it look as if these deals are commercial. One Center for Strategic and International Studies report admits that "in order to successfully lobby the Ministry and receive adequate financial resources, the private enterprises have to link corporate goals with national government initiatives, otherwise the Ministry will be reluctant to endorse the companies' OFDI initiatives."[29]

Thus, 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 in order 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."[30] 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."[31] Investments in pharmaceuticals and biotechnology are "often driven by upgrading technology (such as Wuxi's acquisition of AppTec, a laboratory services firm)."[32] 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.[33] 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…"[34]

And as the German Mercator Center for Chinese Studies notes:

> Chinese high-tech investments need to be interpreted as building blocks of an overarching political programme. It aims to systematically acquire cutting-edge technology and generate large-scale technology transfer. In the long term, China wants to obtain control over the most profitable segments of global supply chains and production networks. If successful, Made in China 2025 could accelerate the erosion of industrial countries' current technological leadership across industrial sectors.[35]

The report goes on to note that, "There are strong indications that the absorption of advanced technology is an increasingly prevalent motive for the state's push for outbound FDI. From this perspective, Made in China 2025 can be read as a grand strategy for technology-seeking investment."[36] As the report continues:

> The Chinese state promotes investment in leading foreign technology enterprises with the aim of systematically acquiring cutting-edge technology and generating large-scale technology transfer. Since state-led FDI in high-tech sectors is a new phenomenon, its full extent and precise effects are not yet entirely clear. But it is a realistic scenario that the widespread technology absorption by China will contribute to the erosion of industrial countries' technological leadership in specific industries.[37]

In other words, Chinese tech-based FDI acquisitions are just one tactic in a comprehensive strategy of global knowledge acquisition in order to catch and ultimately surpass current technology leaders, including the United States. As one study of Chinese acquisitions of German firms noted, "Cherry picking strategic assets of hidden champions, knowledge absorption, and gaining access to high-end markets are major strategic intentions behind the M&As."[38] The report goes on to note that "[what] most acquirers were targeting was the inherent knowledge of the target firms held by the employees in the form of engineering capabilities or process know-how, the knowledge embodied in its technological assets like products, machines and plants, the brand in terms of reputation and customer relationships as well as the worldwide distribution and service assets."[39] The report concludes that this is different than most FDI from other nations where the acquirer seeks integration, synergy, and efficiencies.

China uses other tactics as well to gain global market share in technology industries. The Chinese government enforces a wide array of domestic content requirements in advanced industry products as a way to favor domestic technology companies. 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.[40] 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."[41]

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.[42] 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.[43] 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."[44] 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."[45] 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."[46]

Chinese technology firms also have an advantage over U.S. firms in their ability to suffer losses in foreign markets, both for their investments and sales. As Wang and Wang write, "China itself is a huge market, which means that firms losing profits in overseas markets can be compensated by selling their goods in the domestic market. For instance, Chinese consumer electronics producer TCL has been losing profits in overseas markets, but it survives with the profits from selling in the domestic market."[47] This then explains the fundamental difference between state-backed and purely commercial FDI acquisitions. When a corporation from Canada, Germany, or any other market-based economy looks to acquire a U.S. technology firm they have to balance the purchase price with the benefit to them, and in many cases acquisitions do not make financial sense. But when the principal goal is not profit, but national economic advancement and attaining military capabilities, many more deals make sense, especially when the Chinese government is footing at least part of the bill.

Finally, the Chinese government has limited exports of rare earth elements (REE) which are a group of seventeen minerals that are widely used in high-technology products such as hybrid cars, tablet computers, high performance magnets, and light-emitting diodes. Realizing that they controlled significant sources of REE global production and that this could be used as a leverage point, in July 2010, the Chinese government significantly reduced its export quotas on rare earth elements, causing world prices to greatly increase compared to domestic Chinese prices. For example, in April 2010 the price for cerium oxide was $5/kg, but after the export controls the price skyrocketed to $151 Kg in May 2011. At the same time domestic prices were just $29/kg. Moreover, the Chinese government made it clear to industrial consumers of REE's that they could have all they wanted at a cheap price if they just moved their factories to China. Both as the central source of extraction and by restrictively controlling the exports of many rare earth elements vital to the production of high-tech products, China tries to force the manufacturing of those products to center in China. As further inducement, it makes those elements available at a far cheaper price to in-country manufacturers. At least as recently as 2015, China was estimated to control 89 percent of global rare earth production.[48]

### The Case of Semiconductors

Semiconductors are the "steel" of the digital economy; the core building blocks of innovation in a wide array of other industries and applications. As such, continued innovation in semiconductors is critical for continued global innovation in the digital economy. And strong domestic capacity is critical to U.S. national security. The United States invented semiconductors and related technologies and government support, including through funding for research universities and defense procurement, played a key role in enabling U.S. leadership. However, starting in the 1970s, aggressive government policies, including large government subsidies, from the "Asian Tigers of Japan, Korea, and Taiwan enabled the creation of robust competitors to the United States. And in some cases, these subsidies led to significant overcapacity in the industry, driving down margins and hurting investment in the next generation of innovation. Moreover, in all nations the industry is substantially globalized with different parts of the supply chain in different nations. But

notwithstanding both factors, according the U.S. Commerce Department, the industry is the top U.S. exporting industry, and ran a $42 billion trade surplus in 2012.[49] Equally importantly, the United States specializes in higher value added segments of the semiconductor industry (R&D, design, advanced manufacturing).

Now China has taking a page out of the Tigers' play book and attempting to build its own domestic semiconductor industry. While China has long seen the semiconductor industry as a key industry for development it was not until recently that it made a serious play to grow the industry. China's government has set ambitious, long-term national guidelines for the development of its semiconductor industry, including specific revenue targets of 20 percent compound annual growth and increasing the industry's size to $140 billion by 2020.[50] The strategy also calls for China to reduce imports of U.S. semiconductors by half in 10 years and to eliminate them entirely within 20 years and make China the world's leader in IC manufacturing by 2030. As part of this plan, China wants 70 percent of the semiconductor chips used by companies operating in China to be domestically produced by the year 2025.[51] China justifies this strategy on the basis that integrated circuits are the nation's largest import. But as ITIF has shown, the only reason for this is because China runs a massive trade surplus in products that include semiconductors. Indeed, over half of the semiconductors imported to China are reexported.[52]

A key tactic in their 2014 strategy "National Guidelines for Development and Promotion of the Integrated Circuit (IC) Industry" was to charter a National Integrated Circuits Industry Investment Corporation that intends to invest more than $100 billion in China's semiconductor industry over the next decade with the goal of creating a completely closed-loop semiconductor ecosystem, from design and prototyping to manufacturing, assembly, packaging and test, materials, and equipment.[53] Between national and provincial government funds, the industry is expected to be supported with as much as $160 billion of government-backed funds.[54] The direction is clear, as in statements such as "Make up our mind, push forward persistently; Focus on the bottleneck, innovation is the route; Stress the focal point, coordinate in development; Companies are the players, market is the direction; and Concentrate resources to make world-class companies" and "Set up state leading group for development of integrated circuit industry, push forward the coordination of works with an emphasis on top planning."[55]

To defend against charges of inappropriate government subsidies, the Chinese government claims that its China Integrated Circuit Industry Investment Fund Co. Ltd., is actually a private sector entity operating according to market principles. In reality it is a fund established by MIIT, staffed in large part by former MIIT officials, and funded by the Ministry of Finance and Chinese SOEs—including China Mobile, China Tobacco, and the China Development Bank—presumably because the latter were "asked" to do so by MIIT and the State Council.[56] MIIT presumably established the fund this way, as opposed to simply funneling subsidies through MIIT, in order to avoid any potential WTO challenge against unfair government subsidies. But this laundered money does not make it any less of a subsidy. Chinese central government officials also supported the creation of a number of local semiconductor subsidy funds which also are used to subsidize foreign acquisitions. Thus, when Chinese officials assert that this is a new kind of IC strategy based not on government subsidies, but rather on market principles, they are obscuring the fact that the new strategy is still based on government subsidies, but in this case usually in the form of equity investments that may or not get

ever paid back. Indeed, many of these Chinese firms would be unable to acquire foreign IC firms without such subsidies, as their balance sheets would be inadequate.

For example, Jiangsu Changjiang Electronics Technology Co. used $300 million from the national IC fund to help pay for the $780 million acquisition of Singapore's STATs Chip Pac Ltd., a leading provider of semiconductor packaging design assembly and test solutions.[57] The IC fund backed the buyout firm seeking to buy U.S.-based Lattice Semiconductor Corp.[58] And they were purportedly behind the purchase of Germany's Aixtron.[59] In some cases, these deals are truly perverse, as in the case of Chinese firm Apex Microelectronics buying the U.S. printer company Lexmark. Prior to the acquisition, Apex had been accused of producing counterfeit printer cartridges and infringing the patents of U.S. printer companies, including Lexmark.[60] And despite having revenues about one-tenth those of Lexmark, Apex was able to purchase Lexmark at a 17 percent premium over listed stock price, in part because it received funding from the Chinese national IC fund.[61] Indeed, the company is now 5 percent owned by the IC fund.[62]

China's government intends to pull a wide array of industry policy levers in its pursuit of building up its semiconductor sector. For example, the IC Promotion Guidelines call for public and state-owned enterprise (SOE) procurement decisions in sectors such as telecommunications and Internet service providers to be "based on projects aimed at expanding domestic demand" and "based on secure and reliable" software and hardware products. China's integrated circuit industry will also benefit from preferential research and development subsidy programs, including "national megaprojects" that subsidize the commercial R&D and product development undertaken by Chinese semiconductor companies and special grants from government agencies that allow Chinese semiconductor firms to fund and operate their R&D programs with direct government support through a "national enterprise technology center program."[63]

The Chinese government is also orchestrating efforts to acquire foreign technology. Chinese government leaders, including at the Ministry of Industry and Information Technology (MIIT), are well aware that they cannot meet the IC plan's objectives without buying up the expertise and knowledge they need through foreign acquisitions. Indeed, as a report from Bain Consulting counseling Chinese IC companies stated, "Since reaching scale through organic growth would be an almost insurmountable challenge, domestic Chinese players should look for partnerships (often with followers with strong IP that could benefit from funding and access to China's market) and takeover opportunities of companies looking to leave the industry or divest, both inside and outside of China."[64] Likewise, as a report from a major integrated circuit conference in Shanghai noted, "clearly there will be a focus on [foreign] M&A [mergers and acquisitions] to achieve the rapid technological scale up necessary to realize the vision of the new national policy."[65]

That is why China has been on a global buying spree to try buy up companies all along the IC value chain including Spreadtrum Communications, RDA Microelectronics, and Micron.[66] As the Mercator Center for Chinese Studies notes:

> Since 2014, new policies by the Chinese government to promote the development of China's semiconductor industry have fueled a boom in acquisitions in this segment. The first major deals were completed in 2015, including the purchase of Integrated Silicon Solutions for about $736

> million. Total investment in semiconductors has reached more than $1 billion, but semiconductor deals have received considerable scrutiny from the Committee on Foreign Investment in the United States (CFIUS), dampening the prospects for several announced acquisitions.[67]

For example, China tried to buy its way into a leading U.S. semiconductor company, Western Digital. The Western Digital deal was one of a string of numerous acquisitions that Chinese firms have attempted along the semiconductor value chain.[68] Notably, China's Tsinghua Unigroup—a state-owned enterprise once headed by the son of former Chinese President Hu Jintao—bid $23 billion for Idaho-based Micron Technologies. That deal fell apart after Senators Orrin Hatch (R-UT) and Chuck Schumer (D-NY) raised national security concerns. So Unigroup pivoted, working through its Unisplendour subsidiary to try to acquire a 15 percent stake in Western Digital. Interestingly, before China's Ministry of Commerce then suddenly approved Western Digital's 2012 acquisition of Hitatchi, Ltd.'s hard drive business—a deal that competition authorities in the United States, Europe, Australia, and Japan all had studied and approved, but China had slow walked, thereby preventing Western Digital from achieving $400 million in savings. Western Digital is now the third global information technology company to accept investments from Chinese state-owned corporations in order to win such antitrust regulatory blessing. However, the investment was later withdrawn after it became clear that CFIUS would not approve the deal.

In the short run, China's efforts in semiconductors are not likely to have a significant negative impact on other players, including US firms. This is in large part because unlike other industries, such as solar panels, LED lighting and liquid crystal displays (LCD) That are much simpler to produce (largely based on buying complex and expensive equipment and running it), mastery of semiconductor technology is more complex. Yet, the long-term implications have the potential to be significantly negative for the United States. With technologies like solar, LED lights and LCDs, massive Chinese subsidies led to significant global oversupply with the result being that many firms not backed by their governments were either forced out of the business or lost significant market share. This not only hurt market-based developed nations, it significantly hurt global innovation in these areas since Chinese firms were less innovative and spent less on R&D than firms in developed nations.[69]

There is a very real risk that this dynamic will happen in semiconductors, particularly in memory (DRAM and NAND), which is more of a commodity and where price (and quality) determine market share. The semiconductor industry is somewhat unique in that capital and energy costs account for as much as 60 percent of total production costs, and therefore Chinese subsidies for capital and energy, can provide a major advantage, amounting to a large, nontariff barrier. For example, XMC, a contract chip producer owned by the Chinese Hubei provincial government, who had partnered with U.S. flash-memory maker Spansion in 2015,[70] is building a massive plant (almost 1 square kilometer of production space). The plant, funded by the Chinese IC fund and the provincial government, will produce up to 300,000 64 layer 3D NAND (the latest version of flash memory chips) units per month. But experts suggest that success is not assured and if XMC is successful that this will not happen overnight; it might be five years before real overcapacity occurs. Overall, the Chinese still lag in technology behind the leaders. But one advantage they have, besides massive subsidies and the ability of their firms to burn cash (e.g., sustain losses) for many years in order to gain market share, is that they Chinese government is forcing consolidation around a few national champions, particularly

Tsinghua Unigroup, that will be able to gain the scale needed to effectively challenge the global leaders. China's path the significant global market share would be significantly accelerated if they could acquire or form a joint venture with a leading foreign semiconductor firm, hence their focus on acquisitions and forced technology transfer. In short, China's going to do whatever it takes to build a world-class domestic semiconductor industry, and if they are successful, this will not only take market share away from U.S. firms, it will harm global semiconductor innovation by leading to lower margins and less R&D investment.

**What Congress and the Trump Administration Can Do**

Limiting China's ability to harm U.S. advanced technology industries, including the semiconductor industry, will require two main kinds of actions. The first is to limit's ability to access the most important U.S. and other foreign technologies (e.g., the "crown jewels"), while also rolling back their broader unfair innovation mercantilist practices, including subsidies. The second is to develop and implement a U.S. advanced technology development strategy. I will focus mostly on the former but offer a few thoughts on the latter.

**Policies Toward China:** ITIF recently issued a report, "Stopping China's Mercantilism: A Doctrine of Constructive, Alliance-Backed Confrontation," with a detailed set of recommendations.[71] Based on that let me suggest several steps here. First, neither U.S. domestic law, or our free trade agreements (FTAs) and bilateral investment treaties (BITs) as currently configured, nor multilateral WTO approaches are working; China will not systematically ameliorate its mercantilist strategies and policies unless it is proactively compelled to do so by outside pressure that goes beyond the narrow, legalistic limits of the WTO. That means this contest will be won, first and foremost, not in the tribunals of Geneva, but in the court of global opinion. Accordingly, Congress should charge USTR and the State Department with building a "bill of particulars" clearly and comprehensively enumerating the vast extent of Chinese innovation-mercantilist policies. This should not be about recycling the China chapter from the annual USTR National Trade Estimate report. Rather, this bill of particulars should comprehensively detail the array of unfair, mercantilist practices China engages in and concretely demonstrate how those practices harm the United States and the entire world economy, rich and poor nations alike. At the same time, Congress should require the State Department, USAID, and other relevant federal agencies and departments with producing research that documents how Chinese mercantilism has hurt developing nations' economic growth.

We also need stronger organizational capabilities within the federal government. One reason why is that the United States largely continues to consider specific instances of Chinese innovation mercantilism—such as the challenge of Chinese acquisition of U.S. technology enterprises—on an ad hoc, case-by-case basis. There is no entity in government charged with considering the challenge from a holistic, strategic perspective across agencies to analyze, understand, anticipate, and respond. In particular, no entity analyzes China's capacity to absorb knowledge, to understand its determination to do something with it, or to understand the sources of its technology. A glaring example of this is that it took the U.S. government four years to recognize that China had articulated, and then to get translated into English, its "National Medium- and Long-Term Program for Science and Technology Development," and begin to understand what its implications might be for U.S. industry. And it has been nearly two years since China announced its Manufacturing 2025 plan and yet we've not seen concrete steps by the United States to effectively counter this development.

To remedy this deficiency, the president should establish and staff a new National Industrial Intelligence Unit (which could be housed within the existing National Intelligence Council) charged with developing a better process and structure to understand the specifics and long-term implications of other nations' economic development strategies, particularly China's, so that the United States can respond more effectively. In particular, this group would develop a better process and structure to understand the long-term implications of China's economic development strategy on U.S. competitiveness. It would also develop approaches to better leverage intelligence assets to boost the competitiveness of U.S. companies. This would not constitute industrial espionage, but rather sharing knowledge in the public domain (such as the MLP) about the competitiveness strategies of Chinese enterprises and industries as well as developing better intelligence on the true source of Chinese government involvement in and financing of Chinese companies and the front organizations they set up in the United States, as was the case in the attempted Canyon Bridge acquisition of Lattice Semiconductor.[72] And as part of the Council's mission, it should be charged with sharing commercial intelligence on China with our allies, particularly those in Europe, as they have much less developed capabilities vis-à-vis China. The National Industrial Intelligence Unit should also prepare a report examining the extent to which Chinese innovation-mercantilist policies—such as forced joint ventures, forced tech and IP transfer, and completed or attempted Chinese acquisitions of U.S. advanced-technology enterprises—have contributed to the outsourcing of manufacturing and other activities to China and is leading to the hollowing out of the U.S. defense industrial base. As suggested in the *U.S.-China Economic and Security Review Commission's 2016 Report to Congress*, such a report "should detail the national security implications of a diminished domestic industrial base (including assessing any impact on U.S. military readiness), compromised U.S. military supply chains, and reduced capability to manufacture state-of-the-art military systems and equipment."[73]

Congress should also call on the Department of Commerce to publish reports on strategic economic and trade issues regarding China, including comprehensive review of China's "Made in China 2025" and Internet Plus initiatives, including their forced localization of R&D and manufacturing requirements, to determine their potential impact on domestic U.S. production and market access for U.S. firms.

The federal government also needs stronger processes to contest Chinese innovation mercantilism. This should start by elevating trade enforcement across the interagency process. U.S. trade agencies are often unable to respond to cases where China has broken trade rules because other government agencies, including the State Department—many with their own engagement with Chinese counterparts and agency-specific interests—veto stronger action. The growing range of issues discussed in bilateral engagement and the intersection of trade with many of these interests means that there are many agencies involved in the bilateral relationship. Each agency has its own specific interests in China, which are often either ignorant of China's economic strategy or have a desire not to rock the boat. Those agencies devoted to engaging with foreign nations on diplomatic, security, and financial concerns (such as the Departments of State, Judiciary, and Treasury) should be relegated to an advisory capacity in the interagency trade process. Enforcement should be left to those agencies that are equipped to do it best and have the largest stake in a strong and globally competitive U.S. economy, in particular, the Department of Commerce, USTR, and the new White House Trade Council.[74]

The administration also needs to strengthen the rules of engagement in negotiations with Chinese negotiators. The increasingly diverse set of bilateral issues the United States has with China means that many agencies and officials have been drawn into the framework over time, making it difficult to have a single and consistent message and approach on key issues. If the bilateral framework for managing the relationship is not focused on getting outcomes on core issues, China will continue to rely on the disorganization of the U.S. government to use the complexity of the bilateral relationship to obfuscate and make minor trade-offs, all the while failing to focus on or respond to core U.S. interests. The Trump administration should therefore prioritize issues, attention, and resources and weigh the value of each engagement based on progress toward outcomes. The ever-growing range of issues involved in the bilateral relationship is diluting and diverting attention from achieving outcomes on the most significant trade and economic issues at stake. The current bilateral framework for trade and economic issues—the U.S.-China Joint Commission on Commerce and Trade and the U.S.-China Strategic and Economic Dialogue, as well as the high-level cybersecurity dialogue—needs streamlining and strict management to ensure that only core issues get addressed in the short periods in which senior officials are directly involved.

Moreover, China all too often uses these forums as way to play a rope-a-dope, delaying strategy. Either there is real tangible progress from the Chinese government from these dialogues or the Trump administration should put them on hold until there is. And all agencies involved—from State to Treasury—should receive strict marching orders from the White House on strategy and tactics, so they are all working toward common goals, just as is the case with Chinese government agencies when they are involved in these dialogues. Furthermore, the prevailing focus on presidential summits—though useful—threatens the ability to efficiently deal with the broad array of issues in the relationship. Too often, issues are passed up to respective leaders to resolve, as lower-level discussions prove unproductive. Such emphasis benefits the opaque Chinese system and China's strategy to delay and defer action, as the upward referral of issues is intended principally to stall and to prevent progress. For the relationship to function, these lower-level dialogues should be expected to achieve results at a speed that reflects the maturity and capabilities of each side and which reflects the need for efficiency in addressing trade and economic issues that can have a significant impact during long-, drawn-out processes that depend on the principals.

Congress should also press the administration to focus on improved monitoring and transparency. The Chinese government has consistently failed to provide the WTO and its trading partners with required information, translated into English (or another official WTO language), regarding policies related to trade in goods, services, intellectual property, subsidies, and foreign investment. Such transparency requirements may appear mundane and bureaucratic, but they are critically important to judging whether a country is abiding by its WTO commitments and whether grounds exist for a trade dispute. In fact, USTR should bring a WTO case regarding this enduring lack of transparency. Moreover, the lack of transparency is part of the reason why USTR needs more people on the ground: to better monitor Chinese government actions. The lack of transparency is part of the reason why USTR needs more people on the ground—to better monitor Chinese government actions. China's governance system is notoriously opaque, complex, and multi-layered with overlapping and often inconsistent national, provincial, and municipal government policies. While such an approach is unnecessary for most trade partners, there is an ongoing need for more USTR officials in China, as USTR has repeatedly reported that many aspects of Chinese policy are hidden away in unpublished

measures (including legally unrecognized normative or regulatory documents), oral directives, and Communist Party secret red letter documents. These transparency concerns extend to the provincial and municipal governments which also regularly fail to publish their measures.[75] Furthermore, China regularly fails to provide at least a 30-day period for public comment on drafts of trade- and economic-related regulations and rules as it agreed to at the U.S.-China Strategic and Economic Dialogue in 2008 and 2011. And Chinese agencies frequently adopt measures that take effect immediately when China's WTO obligations require it to allow comments by other agencies and then to translate the measures into a WTO official language and officially publish them before implementation, except in certain cases (such as emergency).

Multiple USTR reports show that China's repeated failures to be transparent are part of a consistent pattern to avoid scrutiny for discriminatory and trade-distorting regulations rules and other measures involving subsidies, preferences, anti-competitive government practices, etc. A specific example is China's extensive use of subsidies and its blatant disregard for WTO required transparency regarding such measures, as well as its failure to release detailed information in the government's budget, the state capital operating budget (SCOB). Despite WTO commitments to submit regular notifications on what subsidies it provides, China did not file its first notification after WTO accession (in 2001) until 2006. Five years later, in 2011, it submitted a second notification for subsidies provided during the period 2005 to 2008. In 2015, it provided a third notification for the period 2009 to 2014. Beyond the delay, all three notifications were significantly incomplete and excluded numerous subsidies that the United States knows the Chinese central government provides, and none of these notifications included any of the extensive subsidies provided by provincial or local governments.[76] Since 2011, the United States has made formal requests (e.g., counter-notifications) for information from China regarding over 350 unreported Chinese subsidy measures. China has failed to provide a complete and comprehensive response. This speaks to the need for a strengthened and emboldened USTR that can quickly respond to China's failure to abide by WTO transparency obligations and bilateral commitments. A revamped and properly resourced USTR, supported by strong interagency and U.S. embassy and consulate teams, should have the capability to identify, analyze, and publicly respond each and every single time China fails to play by the rules it has agreed to uphold. In this way, USTR can play a role in increasing transparency regarding China's innovation mercantilism, which the country purposely tries to obscure through the use of unaccountable federal or provincial government bodies issuing administrative orders or policies, sometimes informally, to foreign companies on a whole host of issues. This transparency focus should form part of a broader effort to build support among likeminded countries for a tougher response. The objective should be to not just rely on naming-and-shaming, but on identifying actionable cases. Literally, USTR should put out a statement each and every time China fails to deliver proper notification. And, as noted above, USTR should go even further, by compiling a comprehensive "bill of particulars" listing all of the mercantilist actions China takes, including all the ways in which it is not complying with the letter or spirit of its WTO obligations, and then working to make U.S. allies, the media, and the world aware of just how out of line Chinese policies are.

To complement larger USTR and Department of Commerce teams in China, the U.S. government should increase funding specifically for English-language translations of relevant documents, including key Chinese industrial-strategy publications. The language barrier adds another level of opacity around Chinese trade and economic policy. WTO reports on China's trade-policy regime have repeatedly stated that it was not possible

to explain a Chinese policy or to confirm a statement made by the Chinese authorities because the underlying documents were only available in the Chinese language.[77] Yet China has an obligation to publish in a WTO language, and such a translation undertaking is not unique: the European Union translates all of its official documents, including those related to trade, into 24 languages, and other countries also have similar translation burdens (e.g., Canada, Belgium, and Switzerland).

Also, I urge Congress to update CFIUS to reflect the nature of Chinese government influence. A core component of liberalized trade is liberalized foreign direct investment, yet it is clear that U.S. FDI into China faces significantly different conditions than Chinese FDI faces in the United States. As noted, in many cases, U.S. firms seeking market access in China, particularly ones with sophisticated technology, must engage in a joint venture with a Chinese firm. As one industry article advising U.S. companies wrote, "To participate in China's industry ecosystem, it is essential to establish connections with the stakeholders in China, such as government, customers, suppliers, and even competitors, and to seek opportunities in cooperation and development through mutual understanding and engagement."[78] With regard to the life-sciences market in China, an industry analyst writes that, "To enter the Chinese market, you may come in by licensing an asset, which we have done, or you can create a joint venture, which we have also done. But you cannot go in by yourself."[79] And as the U.S. Congressional Research Service reports, "The OECD's 2014 FDI Regulatory Restrictiveness Index, which measures statutory restrictions on foreign direct investment in 57 countries (including all OECD and G20 countries, and covering 22 sectors), ranked China's FDI regime as the most restrictive, based on foreign equity limitations, screening or approval mechanisms, restrictions on the employment of foreigners as key personnel, and operational restrictions (such as restrictions on branching, capital repatriation, and land ownership)."[80] Chinese investment in the United States faces vastly fewer restrictions. Because of this steep divergence, Congress and the Trump administration should insist on a level playing field, and mutual access should be a core principle. As a report on Chinese acquisitions of German firms noted, the "EU should emphasize … the need for mutuality: if Chinese firms are given free access to more and more 'crown 7 jewels' of German industry, China … would have to further open up their FDI regime and the possibilities for M&A in their territories."[81] In other words, as long as China restricts U.S. investment in China, largely to take technology, the federal government should feel few constraints to use stricter investment review as a tool to insist upon better behavior from the Chinese government.

Since Chinese efforts to intentionally target U.S. advanced-industry enterprises across a range of high-value-added sectors only continues to intensify, the procedures of the Committee on Foreign Investment in the United States (CFIUS) need to be strengthened to ensure that Chinese entities, particularly those guided or backed by Chinese-government influence or funding, are not able to acquire U.S. companies or technology that could damage America's economic or national security. According to the Foreign Investment and National Security Act (FINSA) of 2007 (P.L. 110-149), CFIUS may conduct an investigation on the effect of an investment transaction on national security if the covered transaction is a foreign government-controlled transaction (in addition to if the transaction threatens to impair national security, or results in the control of a critical piece of U.S. infrastructure by a foreign person). CFIUS has worked fairly effectively in some technology areas, especially semiconductors, as attempted acquisitions of Fairchild, Micron, GCS, Lumileds, Western Digital, and Aixtron have been stopped either formally or informally.[82] However, it has not prevented all acquisitions. For example, a Chinese investor group bought Silicon Valley semiconductor firm

ISSI in 2015. Moreover, Chinese firms are getting more sophisticated about attempted acquisitions, including hiring the best U.S. legal, financial, and public relations talent to advocate for their U.S. technology acquisitions, and obscuring their involvement in U.S. shell companies, as they did with the attempted acquisition of Lattice Semiconductor.[83]

As such, there is a need for CFIUS reform. Congress should, at a minimum, update the charter of CFIUS to address the realities of modern-age state capitalism.[84] Other nations, and particularly China, have put in place coordinated strategies to systemically target key defense and industrial technologies resident in U.S. enterprises and attempt to acquire them by having state-owned or -financed enterprises purchase the U.S. entity, using the veneer that these are "market-based" transactions. Because the threat to both the U.S. defense industrial base and the U.S. industrial base is systemic, the charter of CFIUS needs to be updated to allow reviewers to move beyond case-by-case examinations to assess and gauge systemic threats and examine covered transactions in a broader context. They have arguably done this with semiconductors, but they should expand that scope. CFIUS also needs greater capacity to review attempted acquisitions by Chinese firms of small and young U.S. technology firms that might reflect promising future technology capabilities for the nation.

Moreover, CFIUS reviewers often do not have adequate time to complete a serious analysis, having only 30 calendar days to approve transactions or move them to a second-stage investigation (although there is an ability to extend an investigation for 45 days on top of the original 30). Therefore, Congress should increase the time period permitted for the initial CFIUS review and also better equip CFIUS with additional personnel and financial resources to support more thorough reviews. Congress should also require mandatory notification for deals involving state-owned or state-financed entities by countries of concern such as China and Russia. Attempted acquisitions made by Chinese state-owned or state subsidized enterprises should be blocked outright, as recommended by the U.S.-China Economic and Security Review Commission.[85] Congress should also reform CFIUS so that it can block acquisitions from nations like China and Russia of any U.S. technology companies, including ones that are only indirectly defense-related.

It's also important that as CFIUS committees consider whether the entity in question will come under "foreign control" that they consider "nontraditional" forms of control, such as joint ventures or novel licensing transactions that seek to achieve the same effect as the outright acquisition of a U.S. company. For instance, Chinese acquirers may be exploiting a loophole in CFIUS by designing licensing transactions that, when combined with the associated follow-on agreements that utilize U.S.-based assets to operationalize the licensed intellectual property, are substantively the same outcome as if the Chinese company had simply purchased the U.S. business that holds the intellectual property. CFIUS reform should make clear that these types of deals are "covered transactions" that could be investigated.

The CFIUS chair should also be transferred from the Treasury Department to another department, perhaps the Department of Commerce. Treasury has an important role in tracking investment and other financial flows, but Treasury largely hews closely to the lines of the Washington trade consensus, seeing all or most inward FDI as an unalloyed good. Commerce is better suited to focus on the implications of a given foreign investment on the industrial economy and America's innovation system. But while CFIUS reform is a

minimum, Congress should move beyond the relatively narrow CFIUS process to create a more comprehensive foreign investment review process, as many other nations, including Australia, Canada, and the United Kingdom, have instituted. Indeed, a number of other nations have taken much more proactive measures to prevent the hollowing out of their key industries. For example, both South Korea and Taiwan have essentially banned Chinese acquisition of their domestic semiconductor firms. Under current law, CFIUS can only restrict investments that could adversely affect the United States' national security. As the civilian industrial base has become an ever-more central part of the defense industrial base, however, the current limitations on CFIUS need to be reexamined and a broader national-interest standard established. To be clear, the goal of any foreign investment review scheme should not be to give in to domestic protectionist interests, but to effectively differentiate between foreign direct investment that operates according to market-driven principles and that which operates according to state-directed, mercantilist principles. In other words, when a Chinese company, backed and directed by the Chinese government, attempts to buy an American technology company with the main goal of expropriating its intellectual property and moving it (or the company's operations) to China, that is clearly not in the interest of the United States. It would be important for any such expanded regime not to apply to investments from allies who are designated by the U.S. government as operating largely according to market principles (e.g., nations such as Canada, Germany, Mexico, etc.). Those would continue to operate under the current criteria of effect on national security. Rather, the more stringent review regime would be for nations that operate according to mercantilist principles. In these cases, all inward FDI would at least be reviewed and potentially rejected if deemed harmful to U.S. innovation and competitiveness. If such a regime had been in place, for example, CFIUS would not have approved the Apex acquisition of the U.S. printer company Lexmark, given that Apex was accused of IP theft by U.S. printer companies and was backed by Chinese government money. Some will argue that instituting such a regime would just be emulating the Chinese and thereby closing our economy. On the contrary, it's doing exactly the opposite. It is about working to ensure that China rolls back its mercantilist policies. Indeed, if implemented properly, it would be a measure to improve the integrity of the global trade and investment climate.

**Domestic Actions:** With regard to domestic actions, it is important to understand that in the new world of intense "race for global innovation advantage" where our competitors are putting in place a host of fair and unfair policies to win in advanced industries, including semiconductors, that the notion that the United States can win by simply having government getting out of the way is an anachronistic notion.[86] U.S. technology firms now compete against other firms backed by their governments, either directly or indirectly. This does not mean, nor should it mean some kind of heavy handed, statist picking of particular winning firms. But it does mean Congress taking the global innovation competitiveness challenge seriously. The fact that the at least 26 other nations field a more generous R&D tax incentive or that 21 other nations fund more university-based R&D or that many more nations invest more in industrially-relevant R&D should be a wake-up call to Congress.[87]

The status quo will no longer cut it. A liberal redistribution strategy that ignores global competition in favor of compensating U.S. workers directly and indirectly will not improve U.S. competitiveness. If U.S. advanced industry firms can't be competitive they will employ fewer high wage workers in the U.S. A conservative supply side strategy that focuses on individual tax cuts and broad-based rollback of regulations will not

improve U.S. competitiveness. Individual tax rates have almost nothing to do with U.S. technology firm competitiveness and while smarter regulations are always needed, poor U.S. regulations are not the principal cause of U.S. competitiveness challenges in advanced technology industries. And a new economic nationalism that closes our markets and pressures companies to bring back work will not improve U.S. competitiveness. Forcing companies to bring back all or most work in their supply chains, especially low value added work, would at the end of the day reduce, not increase, U.S. jobs by making U.S. companies less competitive internationally.

Rather, it is time for both parties to work together to embrace a national innovation-based competitiveness strategy.[88] For the semiconductor industry specifically, this would likely include measures such as a significant increase in the R&D credit and expanding the coverage to include development, not just research; significant expansion of scientific funding in areas related to semiconductors, such as nano-technology and quantum computing; significant expansion of funding for industry-led R&D partnerships, like the Semiconductor Technology Advanced Research Network (STARnet), a partnership between DARPA and semiconductor firms; and liberalizing immigration of advanced STEM workers.

**Conclusion:**

In summary, now is the time for Congress and the administration to act to not only challenge the Chinese government's innovation mercantilist practices but to put in place a true national innovation-based competiveness strategy. Implementing a China strategy a strategic, measured, and above all respectful way, will not only level the playing field so American companies can effectively compete in China and with Chinese companies outside of China, it will help restore faith in the integrity of the global trading system. Implementing a national innovation strategy will help ensure that U.S. technology firms will maintain global market share, securing not just good U.S. jobs, but U.S. defense capabilities. hank for you inviting me to testify before the Committee today.

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Mr. YOHO. Thank you, sir.

And, Dr. Scott, if you would, please.

**STATEMENT OF ROBERT E. SCOTT, PH.D., SENIOR ECONOMIST, DIRECTOR OF TRADE AND MANUFACTURING POLICY RESEARCH, ECONOMIC POLICY INSTITUTE**

Mr. SCOTT. Thank you very much, Chairman Yoho, Ranking Member Sherman, and all the members of the committee. I am honored to testify here today. My name is Robert Scott, I am a senior economist with the Economic Policy Institute. We are a think tank focused on the impact of the economy and government policies and low- and middle-income workers in America.

In my testimony today I am going to focus on the impact of the trade deficit with China and how it has affected the U.S. economy and on the issues raised in the hearing today. In particular, China's rapidly growing technical capabilities, fueled by hundreds of billions of dollars of public investment and channeled through its increasingly sophisticated industrial planning systems represents a tremendous challenge to U.S. high-tech industries and to the security of the United States.

I want to call your attention to the following points: Starting with the economics, the rapid growth of U.S. trade deficits with China after that country's entry into the WTO eliminated 3.4 million U.S. jobs between 2001 and 2015. Nearly three-quarters of those—2.6 million—were in manufacturing.

The largest growth in the trade deficits by industry was in computers, and electronic parts, where we lost 1.2 million jobs in that same period. As already noted, China has a massive trade surplus in advanced technology products, which in 2015, reached $120 billion with the United States.

Now, these job losses that I have been talking about are just the tip of the iceberg when it comes to the negative impact of trade with China on the United States.

Wage losses have hurt—much more. They have hurt many, many more people; in fact, all workers who don't have a college degree. There are roughly 100 million such workers in the United States. Growing competition with imports from China and other low wage countries has reduced the wages of all of these noncollege graduates by, in total, about $180 billion a year in 2011 alone, or about $1,800 per worker, the median.

Now, the reasons for China's large and growing surpluses with the U.S. go far beyond the free market, as you know and as you have expressed here today. China subsidizes and dumps mass quantities of exports. It blocks imports, pirates software and technology, invests in massive amounts of excess production capacity in a range of basic industries, often through state-owned enterprises, which leads to massive dumping. China has engaged in extensive and sustained currency manipulation over the past two decades, which has resulted in persistent currency misalignments. I emphasize that is a different concept, misalignment versus manipulation. We need to distinguish the two.

I want to make two points here not raised in my written statement. First, the rapid growth of U.S. computer imports represents a threat to national security because it is connected to the

outsourcing of U.S. defense products, as has been explained in a book and articles by Brigadier General John Adams. This outsourcing has eroded our capability for producing products for the defense base and has reduced our ability to engage in cost innovation, knowledge generation, and domestic employment.

Secondly, China's support for its domestic champion firms and industries does threaten the U.S. industrial base, as we have already heard here today. China engages in forced technology transfer with foreign terms and theft of intellectual property. It also blocks or discourages imports, and it has of course become much less welcoming to foreign investors in recent years.

Now, turning to policy solutions. China's actions do call for direct policy responses. We certainly need to begin by aggressively enforcing all fair trade laws and treaty obligations. We should self-initiate dumping and countervailing duty cases. We should make elimination of China's excess production capacity a priority in bilateral negotiations.

In addition, the United States should continue to treat China as a nonmarket economy in fair trade enforcement, because if we stop doing that, it will allow China to flood this country with dumped imports. China should not be rewarded for market distortions with a bilateral investment treaty.

And lastly, the United States must maintain currency vigilance. We must consider negotiating a new Plaza Accord to rebalance global trade and currencies. I would like to talk about how we might do that perhaps when we have time after the break.

[The prepared statement of Mr. Scott follows:]

Economic
Policy
Institute

# Testimony before the Subcommittee on Asia and the Pacific of the House Subcommittee on Foreign Affairs

## China's Technological Rise—Challenges to U.S. Innovation and Security

**Testimony** • By Robert E. Scott • April 26, 2017

I'd like to thank Chairman Royce and Ranking Member Sherman for their invitation to testify, and all Members of the Committee. It is a pleasure to appear before you today to discuss these important issues. My name is Dr. Robert E. Scott and I am a Senior Economist with the Economic Policy Institute, where I am also the Director of Trade and Manufacturing Policy Research. The Economic Policy Institute (EPI) is a non-profit, non-partisan think tank based in Washington D.C. that studies the economy and government policies, and particularly analyzes the impact on low- and middle-income workers in America.

My testimony today will focus on the impact of the trade deficit with China and how it has impacted the U.S. economy, including in industries where the U.S. has typically held a competitive advantage. Growing trade with China, following its entry into the World Trade Organization in 2001 has eliminated millions of good U.S. jobs and depressed the wages of roughly one hundred million non-college educated workers in the United States. China's rapidly growing technological capabilities, fueled by hundreds of billions of dollars of public investment, channeled through its increasingly sophisticated industrial planning systems, represents a tremendous challenge to U.S. high tech industries and to the national security of the United States. I would like to call your attention to the following points:

- **Rapid growth of the U.S. trade deficit with China after that country's entry into the WTO eliminated 3.4 million U.S. jobs between 2001 and 2015 alone.** Nearly three-fourths (74.3 percent) of the jobs lost were in manufacturing (2.6 million). The hardest hit states were Oregon, California, New Hampshire, Minnesota and North Carolina.
- **The trade deficit in the computer and electronic parts industry grew the most**, and 1,238,300 jobs were lost or displaced, 36.0 percent of the 2001–2015 total.
- **Global trade in advanced technology products—often discussed as a source of comparative advantage for the United States—is instead dominated by China.**In 2015, the United States had a $120.7 billion deficit in advanced technology products with China, and this deficit was responsible for 32.9 percent of the total U.S.–China goods trade deficit. In contrast, the United States had a $28.9 billion surplus in advanced technology products with the rest of the world in 2015.
- Job losses are just the tip of the iceberg when it comes to the negative impacts of US trade with China. **Wage losses have hurt not just manufacturing workers but all workers who don't have a college degree.** Between 2001 and 2011 alone, growing trade deficits reduced the incomes of directly impacted workers by $37 billion per year, and growing competition with imports from China and other low wage countries reduced the wages of all non–college graduates by $180 billion per year.
- **There are reasons for China's large and growing trade surpluses with the United States and the world that go far beyond the free market.** China both subsidizes and dumps massive quantities of exports. Specifically it blocks imports, pirates software and technology from foreign producers, invests in massive amounts of excess production capacity in a range of basic industries, often through state owned enterprises (SOEs) (investments that lead to dumping), and operates as a refuse lot for

carbon and other industrial pollutants. China has also engaged in extensive and sustained currency manipulation over the past two decades, resulting in persistent currency misalignments.

- **China's actions call for direct policy responses.** To adequately respond to these threats, I propose that the Subcommittee make the following recommendations:
  - Congress and the President enhance enforcement of all fair trade laws and treaty obligations (through anti-dumping, countervailing duty, and WTO case filings) and implement better early warning systems and mechanisms for responding to import surges.
  - The United States should also make Chinese excess production capacity a priority to address in bilateral negotiations as it is this excess capacity that fuels dumping of exports in the United States. In particular, overcapacity should be addressed by reforming state-owned enterprises, barring China from all U.S. government procurement contracts, and prohibiting SOEs and most Chinese companies from foreign direct investment in U.S. manufacturing or high tech companies, including through enhanced Committee on Foreign Investment in the U.S. (CFIUS) review processes.
  - The United States should also consider imposing a border-adjustable carbon fee on imports produced by energy-intensive industries.
  - In addition, the United States should continue to treat China as a nonmarket economy in fair trade enforcement, because decades of subsidies and market distortions render Chinese market prices meaningless, and because granting China market-economy status would curb the ability to impose tariffs on dumped goods and thus allow Chinese companies to undercut domestic production by flooding WTO nation markets with cheap goods.
  - China should not be rewarded for its market distortions with a bilateral investment treaty. I appreciate Ranking Member Sherman's past proposals to revoke Most Favored Nation status for China, and to refocus on a trading relationship designed to eliminate the trade imbalance.
  - Lastly, the United States must maintain currency vigilance and consider negotiating a new Plaza Accord to rebalance currencies and global trade.
- **China's high-tech and industrial policies pose grave threats to the future of U.S. technological leadership, economic growth, and national security.** According to the President's Council of Advisors on Science and Technology (PCAST), China is now exerting a "concerted push ... to reshape the semiconductor market in its favor, using industrial policies backed by over one hundred billion dollars in government-directed funds, [which] threatens the competitiveness of U.S. industry." At the same time, China is advancing a "made in China 2025" plan to accelerate technological innovation and domestic content in 10 broad industries which will be supported by plans to invest $300 billion for low-interest loans, assistance in buying competitors and research subsidies. Overall, the U.S. has fallen behind China in total, late-stage development research, according to a recent report from the Boston Consulting Group. By 2018,

China could spend up to twice as much as the U.S. on development research, threatening U.S. leadership in a wide array of manufacturing industries.

- **Growing foreign investment in U.S. manufacturing firms, especially by Chinese multinationals, threatens U.S. national security, control of sensitive financial data and control of key technologies, and is likely to lead to increases in U.S. imports and the trade deficit because foreign multinationals have been responsible for growing U.S. trade deficits, and at least forty percent of the total U.S. trade deficit in every year since 2007.** Foreign investments by Chinese firms, often state-owned, such as Zhongwang's proposed purchase of Aleris Aluminum have been challenged out of concern over the loss of sensitive research data used to make key defense materials such as high-strength alloys and light armor material. Likewise, the Chongqing Casin Enterprise Group, a Chinese firm with possible ties to the Chinese government is preparing to purchase the Chicago Stock Exchange. This purchases poses potential threats to both National Security and to individual firms listed on the Chicago Exchange which are required to share sensitive data in order to be listed on the exchange, information which could be compromised by this foreign investor. Finally, more than fifty members of Congress recently signed a letter to the Treasury Secretary requesting that he initiate a CFIUS review of the purchase of Vertex Railcar Corporation by China Railroad Rolling Stock Corporation (CRRC) and Majestic Legend holdings. CRRC is government owned and subsidized, and the Chinese government could use this purchase to compete unfairly in the US market. CRRC has used subsidized financing to underbid domestic firms on railcar contracts in Boston and Chicago. American suppliers of products such as steel for railcars must now compete against the resources of the Chinese government. These cases illustrate why enhanced CFIUS review is critical for limiting the negative impacts of FDI by Chinese firms in the United States.
- **Thank you again for the opportunity to testify before you today. I look forward to your questions.**

# The growing trade deficit with China has led to U.S. job losses[1]

From 2001 to 2015, imports from China increased dramatically, rising from $102.3 billion in 2001 to $483.2 billion in 2015, as shown in **Table 1**. U.S. exports to China rose at a rapid rate from 2001 to 2015, but from a much smaller base, from $19.2 billion in 2001 to $116.1 billion in 2015. As a result, China's exports to the United States in 2015 were more than four times greater than U.S. exports to China. These trade figures make the China trade relationship the United States' most imbalanced trade relationship by far.

## The trade deficit and job losses, by industry

The composition of imports from China is changing in fundamental ways, with significant, negative implications for certain kinds of high-skill, high-wage jobs once thought to be the

hallmark of the U.S. economy. China is moving rapidly "upscale," from low-tech, low-skilled, labor-intensive industries such as apparel, footwear, and basic electronics to more capital- and skills-intensive industries such as computers, electrical machinery, and motor vehicle parts. It has developed a rapidly growing trade surplus in these specific industries and in high-technology products in general.

The import data (shown in my report, but not reproduced here) reflect China's rapid expansion into higher-value-added commodities once considered strengths of the United States, such as computer and electronic parts, which accounted for 36.5 percent ($176.6 billion) of U.S. imports from China in 2015. This growth is apparent in the shifting trade balance in advanced technology products (ATP), a broad category of high-end technology goods trade tracked by the U.S. Census Bureau. ATP includes the more advanced elements of the computer and electronic parts industry as well as other sectors such as biotechnology, life sciences, aerospace, nuclear technology, and flexible manufacturing. The ATP sector includes some auto parts; China is one of the top suppliers of auto parts to the United States, having surpassed Germany.

In 2015, the United States had a $120.7 billion trade deficit with China in ATP, reflecting a tenfold increase from $11.8 billion in 2002. This ATP deficit was responsible for 32.9 percent of the total U.S.–China trade deficit in 2015. It dwarfs the $28.9 billion surplus in ATP that the United States had with the rest of the world in 2015. As a result of the U.S. ATP deficit with China, the United States ran an overall deficit in ATP products in 2015 (of $91.8 billion), as it has in every year since 2002.

Job loss or displacement by industry is directly related to trade flows by industry, as shown in **Table 2.** The growing trade deficit with China eliminated 2,557,100 manufacturing jobs between 2001 and 2015, nearly three-fourths (74.3 percent) of the total. By far the largest job displacements occurred in the computer and electronic parts industry, which lost 1,238,300 jobs (36.0 percent of the 3.4 million jobs displaced overall). This industry includes computer and peripheral equipment (670,800 jobs, or 19.5 percent of the overall jobs displaced), semiconductors and components (282,500 jobs, or 8.2 percent), and communications, audio, and video equipment (267,000 jobs, or 7.8 percent). Other hard-hit industries included apparel (204,900 jobs displaced, equal to 6.0 percent of the total), fabricated metal products (161,800, or 4.7 percent), textile mills and textile product mills (117,800, or 3.4 percent), miscellaneous manufactured commodities (127,000, or 3.7 percent), furniture and related products (115,900, or 3.4 percent), plastics and rubber products (78,800, or 2.3 percent), and motor vehicles and motor vehicle parts (49,600, or 1.4 percent). Several service industries, which provide key inputs to traded-goods production, experienced significant job displacement, including administrative and support and waste management and remediation services (211,500 jobs, or 6.1 percent) and professional, scientific, and technical services (183,000 jobs, or 5.3 percent).

## Unfair trade deals lower wages of US workers

Job losses are just the tip of the iceberg when it comes to the negative impacts of US trade with China. Wage losses have hurt not just manufacturing workers but all workers who don't have a college degree.[2] Globalization and unfair trade deals have lowered the wages of U.S. workers by displacing jobs and weakening the bargaining position of low- and middle-wage workers in two main ways.

First, increased U.S. trade deficits push jobs out of better-paid tradeable sectors. Jobs displaced by growing trade deficits result in lost wages as workers who leave high-paying import-competing industries such as computer and electronic parts manufacturing take jobs in lower-paying non-tradable industries. Even when jobs in importing industries are replaced in part by jobs in exporting industries such as agriculture or food products, the result is wage losses from rising trade deficits.

Second, even if trade deficits do not rise, increased trade changes the composition of jobs, and the new patterns of employment lead to reduced demand for labor and downward pressure on wages. As the United States increases production (and increases exports) of capital-intensive goods and reduces production (and increases imports) of labor-intensive goods, this leads directly to a reduced demand for labor, even if exports and imports measured in dollars balance. Further, as imports displace workers from tradeable sectors (such as manufacturing), these laid-off workers need to accept lower wages to obtain work in other sectors (such as landscaping or construction), and this competition helps to lower the wages of similar workers already employed in these sectors. In short, while it is impossible to replace a waitress (a job in the non-tradable restaurant sector) with imports, her wages are harmed by having to compete with apparel workers who have lost jobs due to increased trade flows. Standard trade models indicate that expanded trade has reduced the annual wages of a full-time American worker without a four-year college degree who earns the median wage by $1,800 per year.[3] Given that there are roughly 100 million non-college-educated workers in the U.S. economy, the scale of wage losses suffered by this group likely translates into close to a full 1 percent of GDP—roughly $180 billion.

## It's Not an Accident: Addressing The Causes of Trade-Related Job Losses

The job and wage losses from the growing U.S. trade deficit with China—and the national security vulnerabilities—should be unacceptable to U.S. policymakers. Especially since this is a solvable problem: The increase in the U.S.–China trade deficit is caused by specific Chinese policies that U.S. policy can address.

## Subsidies that fuel excess capacity and lead to dumping

Extensive government subsidies and the rapid growth of state-owned enterprises have generated a massive buildup of excess capacity in a range of Chinese industries. Excess capacity means that China's factories are churning out quantities of basic commodity products such as steel products, aluminum, machinery, rubber and plastics and stone, cement, glass, and solar panels that far exceed the demand for these products in China's domestic economy. To prop up these overcapacity industries, these products are sold in other markets at below market rates (dumping). The United States bears a uniquely large burden, suffering more than other countries from subsidized and dumped imports in these industries.

Much of this Chinese overcapacity has been developed by SOE's, which channel financial support to companies in these industries through state banks. But direct support from the Chinese government in the form of subsidized prices for energy and natural resource inputs also plays a significant role. The U.S.–China Economic Security and Review Commission concluded in its 2016 annual report that:

> Rather than restructuring the state sector to reduce corporate debt and increase efficiency, the Chinese government continues to prop up nonviable companies with government subsidies, discounted production inputs, and favorable lending from state banks. As a result, the SOEs remain the driving force behind key sectors of the Chinese economy despite incurring significant losses. Under President Xi, the Chinese government has not only expanded its control over SOEs, but also exerted its influence over private companies. By enhancing government oversight ... Beijing is able to direct both private and public firms to promote state goals.

The proliferation of subsidies (along with currency manipulation, discussed in the next section) has for most of the past 15 years acted like a subsidy to all of China's exports and a tax on everything that China imports. These subsidies have contributed to the tremendous growth of excess capacity in steel and other primary product industries in that country. Indeed, China has been found guilty of dumping in 759 cases (covering all products) between 1995 and 2014.

China's actions to prop up its steel industry serve as an example. China's steel production capacity increased tenfold from 2000, when it had roughly the same capacity as the United States, to 2014, when its production capacity reached 1.2 billion tons, while U.S. capacity remained largely unchanged at roughly 100 million tons. China went from being a net steel importer to a net exporter of over 100 million tons of dumped and subsidized steel, worldwide, in 2015. U.S. steel producers absorbed net losses of $1.43 billion in the fourth quarter of 2015 and $233 million in the first quarter of 2016. Domestic steel producers were forced to "reduce capital expenditures" and "shutter capacity and lay off employees," with nearly 19,000 U.S. steel and iron ore miners facing layoffs "as a result of Chinese overcapacity.

## Lax environmental laws that "subsidize" Chinese products

China has become one of the world's biggest polluters and much of this is due to increased emissions from steel and other industries. China operates as a dumping ground for carbon and other key air, water, and waste pollutants. China now produces more sulfur dioxide and carbon dioxide than any other country in the world. For example, China's steel industry now accounts for 50 percent of the world's production of carbon dioxide from steelmaking.

## Repression of labor rights

China extensively suppresses labor rights, which lowers production costs within China. A 2006 AFL-CIO study estimated that repression of labor rights by the Chinese government had lowered manufacturing wages of Chinese workers by between 47 percent and 85 percent.

## Policies that block imports and foreign competition

Indirectly, China's broad network of subsidies and policy supports for favored companies and industries (discussed above) acts as substantial barriers to import penetration, putting international firms that wish to export to China at a substantial disadvantage.

For one, China imposes forced technology transfer on foreign firms wishing to invest in China and it engages in cyber-enabled theft of intellectual property. Thus foreign firms are reluctant to do business in China for fear of endangering technology that is critical to their patents' proprietary technologies and sources of competitive edge in global markets.

China also blocks or discourages imports via import substitution policies. These policies impose tariffs, quotas and other direct restrictions on imports, and explicitly favor Chinese domestic producers of commodities that would otherwise be imported, reducing demand for U.S. exports.

China is also become less welcoming to foreign investors, and imposes many restrictions on their activities. Its anti-competitive laws prohibit foreign participation in broad sectors of the domestic economy and give preferences to domestic, Chinese companies. China has made it clear that it does not allow foreign competition to occur, via imports or foreign direct investment, in what it views as key sectors of its economy.

## The crucial missing link of foreign direct investment and outsourcing

Proponents of trade deals such as the agreement to endorse China's admission to the World Trade Organization usually focus on the impacts of these deals on tariff and nontariff barriers to trade. China agreed to make major tariff reductions as a condition of entry into the WTO. President Clinton and many others argued that since U.S. tariff barriers were already low, the agreement would do more to increase U.S. exports to China than to increase U.S. imports from China.

### But proponents failed to anticipate the effect of China's entry on foreign direct investment (FDI) and outsourcing

Foreign direct investment is an investment by a company or individual in one country that is made in business interests in another country. It can take the form of establishing business operations or acquiring business assets in the other country, such as ownership or controlling interest in a foreign company. Unlike portfolio investments, in which an investor merely purchases equities of foreign-based companies, foreign direct investment establishes effective control of, or at least substantial influence over, the decision making of a foreign business.

FDI has played a key role in the growth of China's manufacturing sector. China is the largest recipient of FDI of all developing countries and is the third-largest recipient of FDI over the past three decades, trailing only the United States and the United Kingdom. For many years, foreign-invested enterprises (both joint ventures and wholly owned subsidiaries) were responsible for roughly two-thirds of China's global trade surplus. However, due to China's indigenous innovation policies and other measures that have pushed out foreign investors, often through forced takeovers and illegal theft of intellectual property, this share has fallen sharply to only one-third in 2015. Nonetheless, outsourcing by U.S. entities—through foreign direct investment in factories that make goods for export to the United States—has played a key role in the shift of manufacturing production and jobs from the United States to China since China entered the WTO in 2001.

## Currency manipulation and misalignment are the major causes of the trade deficit

Finally, misalignment of the U.S. dollar and the legacy of currency manipulation by China (and other countries) are major causes of the U.S. trade deficit and of manufacturing job loss. While some countries are still manipulating, as traditionally defined, China is not, and yet we are left with this massive overhang of a trade deficit. The Chinese yuan and other currencies of current and former manipulators are still substantially misaligned, and this hangover is a big cause of U.S. and global trade imbalances.

Recent EPI reports have explained how currency manipulation by China and other East

Asian nations has led to rising trade surpluses by currency manipulators and thus global trade imbalances, hitting the United States particularly hard.

## China's actions call for direct policy responses

To adequately respond to these threats, Congress and the president should enhance enforcement of all fair trade laws and treaty obligations (through anti-dumping, countervailing duty, and WTO case filings) and implement better early warning systems and mechanisms for responding to import surges. The United States should also make Chinese excess production capacity a priority to address in bilateral negotiations as it is this excess capacity that fuels dumping of exports in the United States. In particular, overcapacity should be addressed by reforming state-owned enterprises, barring China from all U.S. government procurement contracts, and prohibiting SOEs and most Chinese companies from foreign direct investment in U.S. manufacturing or high tech companies, including through enhanced Committee on Foreign Investment in the United States (CFIUS) review processes.[4] The United States should also consider imposing a border-adjustable carbon fee on imports produced by energy-intensive industries. In addition, the United States should continue to treat China as a nonmarket economy in fair trade enforcement, because decades of subsidies and market distortions render Chinese market prices meaningless, and because granting China market-economy status would curb the ability to impose tariffs on dumped goods and thus allow Chinese companies to undercut domestic production by flooding WTO nation markets with cheap goods. Also, China should not be rewarded for its market distortions with a bilateral investment treaty. Lastly, the United States must maintain currency vigilance and consider negotiating a new Plaza Accord to rebalance currencies and global trade.

## China's high-tech and industrial policies pose grave threats to the future of U.S. technological leadership, economic growth, and national security

According to the President's Council of Advisors on Science and Technology (PCAST), China is now exerting a "concerted push ... to reshape the semiconductor market in its favor, using industrial policies backed by over one hundred billion dollars in government-directed funds, [which] threatens the competitiveness of U.S. industry."[5] The PCAST report found that Chinese policies are reducing U.S. market share in semiconductor industries, undermining innovation and putting U.S. national security at risk. They recommend a three-pronged approach to respond to the Chinese challenge in semiconductors. First,

work in bilateral and multilateral forums to improve the transparency about Chinese policies, coordinate investment security and export controls, and respond to Chinese violation of international agreements. Second, increase funding for basic research and development, talent attraction and reform of tax law and permitting practices. Finally, they propose a series of "moonshots" designed to develop transformative innovations in areas such as biodefense, and cutting edge medical technologies.[6]

At the same time, China is advancing a "made in China 2025" plan to accelerate technological innovation and domestic content in 10 broad industries which will be supported by plans to invest $300 billion for low-interest loans, assistance in buying competitors and research subsidies.[7] The industries targeted include new materials, artificial intelligence, integrated circuits, and 5G mobile technology, as well as aircraft, robots, electric cars, rail equipment, ships and agricultural machinery. China hopes to raise domestic content in these industries to 40 percent in 2020 and at least 70 percent in 2025. The plan calls for using hi-tech investments to "systematically acquire cutting edge technology and generate large-scale technology transfer," according to a German report on the 2025 program.[8]

Overall, the U.S. has fallen behind China in total, late-stage development research, according to a recent report from the Boston Consulting Group. By 2018, China could spend up to twice as much as the U.S. on development research, threatening U.S. leadership in a wide array of manufacturing industries.[9]

## Growing foreign investment in U.S. manufacturing firms, especially by Chinese multinationals, threatens U.S. national security, control of sensitive financial data and control of key technologies, and is likely to lead to increases in U.S. imports and the trade deficit.

Foreign multinationals have been responsible for growing U.S. trade deficits, as shown in **Figure B**, and at least forty percent of the total U.S. trade deficit in every year since 2007 (author's estimates).

Foreign investments by Chinese firms, often state-owned, such as Zhongwang's proposed purchase of Aleris Aluminum have been challenged out of concern over the loss of sensitive research data used to make key defense materials such as high-strength alloys and light armor material.[10] Likewise, the Chongqing Casin Enterprise Group, a Chinese firm

with possible ties to the Chinese government is preparing to purchase the Chicago Stock Exchange.[11] This purchases poses potential threats to both National Security and to individual firms listed on the Chicago Exchange which are required to share sensitive data in order to be listed on the exchange, information which could be compromised by this foreign investor. Finally, more than fifty members of Congress recently signed a letter to the Treasury Secretary requesting that he initiate a CFIUS review of the purchase of Vertex Railcar Corporation by China Railroad Rolling Stock Corporation (CRRC) and Majestic Legend holdings.[12] CRRC is government owned and subsidized, and the Chinese government could use this purchase to compete unfairly in the US market. CRRC has used subsidized financing to underbid domestic firms on railcar contracts in Boston and Chicago. American suppliers of products such as steel for railcars must now compete against the resources of the Chinese government. These cases illustrate why enhanced CFIUS review is critical for limiting the negative impacts of FDI by Chinese firms in the United States.

# Acknowledgements

The author thanks **Samantha Sanders** for comments, and **Zane Mokhiber** for technical and research assistance.

# Endnotes

1. References for data and statements of fact are included here in hyperlinks, and in Scott, Robert E. 2017. Growth in U.S.—China trade deficit between 2001 and 2015 cost 3.4 million jobs: Here's how to rebalance trade and rebuild American manufacturing. Washington D.C.: Economic Policy Institute.

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5. The President's Council of Advisors on Science and Technology (PCAST). 2017. Report to the President: Ensuring Long-Term U.S. Leadership in Semiconductors. Executive office of the President of the United States.

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8. Bradsher, Keith and Paul Mozur. 2017. China's Plan to Build Its Own High-Tech Industries Worries Western Businesses. *New York Times*, March 17.

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12. Representative Peter DeFazio, *et al.* 2016 Letter to Tressury Secretary Jacob Lew on pending transfer of Vertex Railcar Corporation to China Railroad Rolling Stock Corporation (CRRC) and Majestic Legend Holdings. July 15. [PDF].

Table 1

## U.S.–China goods trade and job displacement, 2001–2015

| | 2001 | 2008 | 2015 | Change ($billions) 2001–2015 | Change ($billions) 2008–2015 | Percent change 2001–2015 |
|---|---|---|---|---|---|---|
| U.S. goods trade with China ($ billions, nominal) | | | | | | |
| *U.S. total exports** | $19.2 | $71.5 | $116.1 | $96.8 | $44.6 | 503.4% |
| *U.S. general imports* | $102.3 | $337.8 | $483.2 | $381.0 | $145.5 | 372.5% |
| *U.S. trade balance* | $83.0 | $266.3 | $367.2 | $284.1 | $100.8 | 342.1% |
| *Average annual change in the trade balance* | | | | $20.2 | $14.4 | 11.2% |
| | | | | Change (thousands of jobs) | | Percent change |
| U.S. trade-related jobs supported and displaced (thousands of jobs) | | | | | | |
| *U.S. total exports–jobs supported* | 171.9 | 544.2 | 826.6 | 654.7 | 282.4 | 380.8% |
| *U.S. general imports–jobs displaced* | 1,129.6 | 3,621.2 | 5,227.6 | 4,098.0 | 1,606.4 | 362.8% |
| *U.S. trade deficit–net jobs displaced* | 957.7 | 3,077.0 | 4,401.0 | 3,443.3 | 1,324.0 | 359.6% |
| *Average annual change in net jobs displaced* | | | | 246.0 | 189.1 | 11.5% |

* Total exports as reported by the U.S. International Trade Commission include re-exports. Domestic exports are goods produced in the United States and exclude goods produced in other countries and shipped through the United States (known as foreign exports or re-exports). Domestic exports were estimated to be $107.7 billion in 2015. The employment estimates shown here are based on total exports. See footnote 3 for additional details.

**Source:** Author's analysis of U.S. Census Bureau (2013), U.S. International Trade Commission (USITC 2016a), Bureau of Labor Statistics (BLS 2016e), and BLS Employment Projections program (BLS-EP 2014a and 2014b). For a more detailed explanation of data sources and computations, see the appendix.

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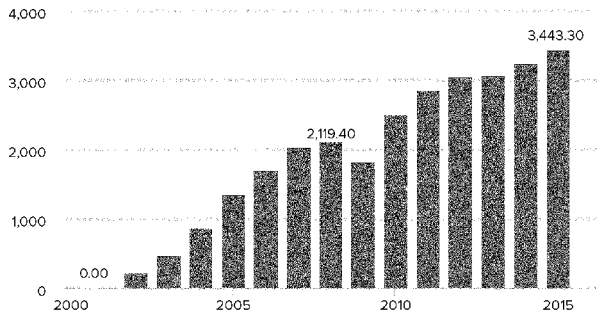
Figure A

**U.S. jobs displaced by the growing goods trade deficit with China since 2001 (in thousands of jobs)**




**Source:** Author's analysis of U.S. Census Bureau (2013), U.S. International Trade Commission (USITC 2016a), Bureau of Labor Statistics (BLS 2016e), and BLS Employment Projections program (BLS-EP 2014a and 2014b). For a more detailed explanation of data sources and computations, see the appendix.

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Table 2

## Net U.S. jobs created or displaced by goods trade with China, by industry, 2001–2015

| | Total | Share of total jobs displaced |
|---|---|---|
| *Total** | -3,443,300 | |
| *Subtotal, nonmanufacturing* | -886,200 | 25.7% |
| *Agriculture, forestry, fishing, and hunting* | 43,400 | -1.3% |
| *Mining* | -4,700 | 0.1% |
| Oil and gas | -700 | 0.0% |
| Minerals and ores | -4,000 | 0.1% |
| *Utilities* | -12,700 | 0.4% |
| *Construction* | -16,600 | 0.5% |
| *Manufacturing* | -2,557,100 | 74.3% |
| Nondurable goods | -391,200 | 11.4% |
| *Food* | -11,600 | 0.3% |
| *Beverage and tobacco products* | 3,000 | -0.1% |
| *Textile mills and textile product mills* | -117,800 | 3.4% |
| *Apparel* | -204,900 | 6.0% |
| *Leather and allied products* | -60,000 | 1.7% |
| Industrial supplies | -233,600 | 6.8% |
| *Wood products* | -28,400 | 0.8% |
| *Paper* | -29,200 | 0.8% |
| *Printed matter and related products* | -35,000 | 1.0% |
| *Petroleum and coal products* | -1,200 | 0.0% |
| *Chemicals* | -27,600 | 0.8% |
| *Plastics and rubber products* | -78,800 | 2.3% |
| *Nonmetallic mineral products* | -33,400 | 1.0% |
| Durable goods | -1,932,200 | 56.1% |
| *Primary metal* | -57,100 | 1.7% |
| *Fabricated metal products* | -161,800 | 4.7% |
| *Machinery* | -94,800 | 2.8% |
| *Computer and electronic parts* | -1,238,300 | 36.0% |
| *Computer and peripheral equipment* | -670,800 | 19.5% |
| *Communications, audio, and video equipment* | -267,000 | 7.8% |
| *Navigational, measuring, electromedical, and control instruments* | -18,000 | 0.5% |

Table 2 (cont.)

| | Total | Share of total jobs displaced |
|---|---|---|
| *Semiconductors and other electronic components, and reproducing magnetic and optical media* | -282,500 | 8.2% |
| *Electrical equipment, appliances, and components* | -116,000 | 3.4% |
| *Transportation equipment* | -21,500 | 0.6% |
| *Motorvehicles and motor vehicle parts* | -49,600 | 1.4% |
| *Aerospace products and parts* | -32,700 | 0.9% |
| *Railroad, ship, and other transportation equipment* | -4,500 | 0.1% |
| *Furniture and related products* | -115,900 | 3.4% |
| *Miscellaneous manufactured commodities* | -127,000 | 3.7% |
| ***Wholesale trade*** | 0 | 0.0% |
| ***Retail trade*** | 0 | 0.0% |
| ***Transportation and warehousing*** | -106,000 | 3.1% |
| ***Information*** | -84,200 | 2.4% |
| ***Finance and insurance*** | -45,500 | 1.3% |
| ***Real estate and rental and leasing*** | -27,200 | 0.8% |
| ***Professional, scientific, and technical services*** | -183,000 | 5.3% |
| ***Management of companies and enterprises*** | -119,700 | 3.5% |
| ***Administrative and support and waste management and remediation services*** | -211,500 | 6.1% |
| ***Education services*** | -2,800 | 0.1% |
| ***Healthcare and social assistance*** | 1,700 | 0.0% |
| ***Arts, entertainment, and recreation*** | -13,100 | 0.4% |
| ***Accomodation and food services*** | -51,700 | 1.5% |
| ***Other services (except public administration)*** | -30,500 | 0.9% |
| ***Public administration*** | -18,600 | 0.5% |

*Subcategory and overall totals may vary slightly due to rounding.

**Source:** Author's analysis of U.S. Census Bureau (2013), U.S. International Trade Commission (USITC 2016a), Bureau of Labor Statistics (BLS 2016e), and BLS Employment Projections program (BLS-EP 2014a and 2014b). For a more detailed explanation of data sources and computations, see the appendix.

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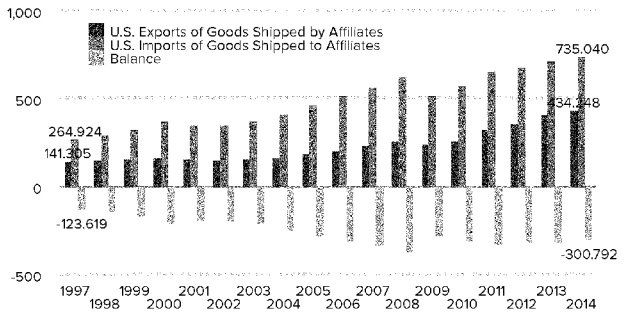
Figure B

## Goods trade balance

US affiliates of foreign MNCs, 1997–2014 (billions of dollars)




**Note:** The increase in most US MNC activities from 2013 to 2014 reflect improved coverage in the 2014 benchmark survey of US Direct Investment Abroad

**Source:** BEA International Data tables

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Mr. YOHO. And I really appreciate that.

And I want to thank our witnesses for the testimony.

We stand in recess, and we will reconvene directly after votes.

I am going to offer to you if you want to go in the back here, I think there is some coffee back there, for you guys, anyway. The rest of you can't have it.

But we will be back as quick as we can, because I want to follow up on this. I mean, it is such an important topic. I look forward to gaining the information to where we can come up with policies that stick.

Thank you.

[Recess.]

Mr. YOHO. We are going to call the meeting back to order. We have got people coming in. And respecting your time, we will start moving on. Being the chairman, it is nice because I get to ask opening questions.

Dr. Scott, you brought up something very important talking about the way China subsidizes and kind of just rolls in and takes over different industries through subsidies. If we look at the past activity of people of nations, we can predict future actions. I sit on the Ag Committee also, and if we look at what they have done with, you know, cotton, they heavily subsidized that at $1.63 a pound, roughly. Cotton prices over here have plummeted, and they have kind of cornered the market on cotton. And we have seen that with other commodities, other industries. I wouldn't—I would think that this would be no different.

So we know what the past is, we can kind of predict the future on past activities. So with that, my question to you is, the building blocks of the semiconductor industry, you made the reference to steel with automotives and the supply chain, but if we know they are doing that with semiconductors, my question to you, and all three of you really, is if we look at what happened in the past here in the last 2 years of the Obama administration, they approved at least 13 semiconductor acquisitions in the U.S. Has there been any studies to see what effect these acquisitions had on U.S. competitiveness, semiconductor supply, that supply chain? What industry sector were they in: Banking, military, other? And have these purchases by the Chinese Government-backed businesses jeopardized or weaken national security in any way?

We will start with you, Dr. Scott, if you would be so kind.

Mr. SCOTT. Thank you very much, Mr. Chairman. I have not studied these 13 specific acquisitions. I have studied general patterns of the impacts of foreign acquisitions of U.S. companies by foreign multinationals. I can say that it is almost universally true, that when foreign companies come into the United States and take over domestic firms, they are looking for two things. They are looking to have access to a distribution center for their own products that they are producing in their home markets, and they want to have access to technology.

In my prepared testimony, I produced a chart which showed the trade trends of foreign—of U.S. subsidiaries of foreign multinationals, and that includes large numbers of firms that have been taken over by foreign multinationals. It showed those companies have a growing trade deficit with the United States. They are re-

sponsible for a deficit that reached about $300 billion in 2014, up from about 200 billion in 2000—I am sorry—in 1997. So—I am sorry. The actual balance figures were—I am sorry, I was wrong. The deficit increased from $124 billion in 1997 to over $300 billion in 2014. By 2014, responsible for about 40 percent of U.S. trade deficits.

So companies buy up U.S. firms, they hollow them out, they export the technology. I think that is especially true in semiconductors, and I know that Dr. Atkinson has looked at this industry in some detail.

Mr. YOHO. Right. And we have seen that even with the Apple industry. They came over and learned the technology, take it over there, and they take over the market. And so I think this is something that we really need to pay stronger attention to.

And President Xi has prioritized advancing China's space program to strengthen national security. I know in some of the testimonies, we know that future conflicts or future disagreements between nations, we have to look at shutting down power grids. But why is this considered strengthening national security? And they seem to be really pushing this stronger than what I would think any other nation would—and I think it was you, Dr. Atkinson, talking about going to the backside of the Moon, or was that you Dr. Scott?

Dean, it was you? So why is this so important for them to continue down this path? When you look at the previous nations that have been in space, we have had multinational collaboration in the space station for the future of development of science, it seems like. This seems more nationalistic, and it seems like a scary way. Do you want to comment on that?

Mr. CHENG. China views space as something that they term very dense in high technology. When you look at space, it touches on such advanced areas as computing, telecommunications, advanced materials, high-carbon composites, high-tensile metals. It also involves systems engineering and systems integration, two skill sets that the Chinese themselves recognize that they are weak in.

And they see it as an inspiration, that this will inspire the next generation of Chinese young people to go and become aerospace engineers and systems engineers and systems integrators. So developing space, they believe, is going to serve very much like a locomotive to pull the rest of China's economy forward, to train a new generation of Chinese workers in precision manufacturing and the like.

But it also is important because it touches on information. Information is acquired from space; militarily, that is fairly obvious, but also even just day to day. More and more industry relies on things like precision navigation and timing functions, which for us is provided by GPS, and China wants it displaced through BeiDou.

So all of these are skills—all of these are technologies and areas that, as China develops its space capabilities, it can then turn around and exploit better in terms of both exporting its own satellites, which it already does in competition with the United States, but also, for them, hopefully, they would like to then compete in advanced materials and computers and all of these areas.

In terms of supply chains, it also provides a guarantee for all of the domestic industries that China is subsidizing and fostering that there will be this very large market of Chinese satellites, Chinese aerospace companies that are going to be basically saying, absolutely, I want to buy it, and, of course, I am going to prefer Chinese products.

Mr. YOHO. Right.

And I think I have heard both—maybe all three of you talk about how China—and we know this. I was at a briefing one time, and the NSA was there, and this is common knowledge there. He said, if you are on the internet, just assume China is in your computer. If we know that and we know they have put in backdoors in some of the phones and those systems—we were talking earlier about CFIUS, and maybe it is time for a second play on that, to make it stricter.

Dr. Atkinson, do you have any ideas or any recommendations on how would you go about setting up information if a Chinese company came in legitimately and they got approved to buy here—you know, once they are here, that technology that they have acquired they start exporting. The military risk or the national security risk, how do we block that in a friendly way but preserving our IP, the intellectual property, and national security? Any recommendations?

Mr. ATKINSON. Yes. The Chinese acquire U.S. technology companies for one and only one reason, and that is to take the technology. They don't do it for market share or anything; it is about getting the technology. They are behind us in technology. If they acquire leading-edge technology and incorporate it into their production, they do better.

There are multiple challenges with CFIUS, and I laid some out in my report. There is a longer report we wrote recently that incorporated a lot of CFIUS recommendations.

One of the challenges in CFIUS is the Chinese don't look at technology the way we do. We tend to look at it as it is either military or it is not military. And so a lot of things get through the cracks in CFIUS that are "not military" and yet, when you connect the dots and you put the capabilities together, it ends up enabling their military capability. We don't look at it that way because it is not pure military.

So I think CFIUS needs much, much stronger abilities to just simply deny Chinese technology acquisition, particularly ones that are backed by the Chinese Government.

A case in point that CFIUS approved was a company called Lexmark, one of the global printer companies. The Chinese Government went to a Chinese printer company, who, by the way, was under several cases for violating the Lexmark and HP, Hewlett-Packard, patents on printer cartridges—they went to them and gave them $2.6 billion and told them to buy up Lexmark and become the dominant global printer company. In our view, this shouldn't have been approved because it wasn't a market-based capitalist transaction; it was a government strategy to take that technology.

Mr. YOHO. I am going to give you free range to send recommendations to this committee through our committee staff here, and I would sure love to incorporate that in the next go-around.

And, with that, I am going to yield to the ranking member, my good friend, Mr. Sherman.

Mr. SHERMAN. Thank you.

I would point out that culture can also be of strategic interest. The Chinese have bought, I believe, the second-largest movie exhibiter in the United States. Richard Gere will never make another movie about Tibet. They control our free speech through their ownership, and they control our free speech in China through all the devices that you have identified.

Now, before the hearing, I talked—and two of the three witnesses said that they would have a solution, something that would eliminate or at least cut in half the trade deficit with China.

Maybe I heard you wrong. Mr. Cheng is off the hook because he didn't make the promise. Do either of the two doctors here have a plan that would cut our trade deficits very substantially?

Mr. ATKINSON. Yeah. ITIF issued a report in late January, early February that was targeted to whoever the new President was going to be, President Clinton or President Trump——

Mr. SHERMAN. What is in that plan that would cut the trade deficit in half?

Mr. ATKINSON. I wish I could give you a simple answer. Let me say two things. The first part of that is: Going through the WTO, doing these kind of legalistic procedure things isn't going to work. Much of what the Chinese are doing gets through the cracks of WTO——

Mr. SHERMAN. I have got such just limited time. Do you have a plan that you think will cut the trade deficit in half within a few years?

Mr. ATKINSON. We have to work with our allies to inflict real pain on China if they don't change and make them——

Mr. SHERMAN. How about just a 20-percent tariff on everything to start as opening stakes?

But I will go to Dr. Scott.

What do you got?

Mr. SCOTT. I think that is moving in the right direction, but I think you need a broader plan. I think the first element of the plan has to be realigning exchange rates. The Chinese currency remains substantially undervalued. There have been calculations that show that in order to——

Mr. SHERMAN. If it is undervalued, why is it that China has to intervene in the markets to cause its currency not to go down?

Mr. SCOTT. Well, the United States has essentially given China carte blanche to open up its capital markets. In fact, we have been pressuring them to open their capital markets.

What this has done is, since the Chinese savers have nowhere else to put their money, they are pouring it in the United States. We also have the Chinese Government pouring their money into the United States to buy up Chinese companies.

All of it bids up the demand for the U.S. dollar, which has risen 25 percent in real terms in the last 3 years. That makes our goods much, much less competitive. Calculations have shown that in order to rebalance global trade, the Chinese RMB needs to rise perhaps as much as 35 or 40 percent.

But I think we also have to look at other countries that have large surpluses, like China and the European Union. They also have large global surpluses. This is not just a China problem. I think if we focus on that, there may be less a problem——

Mr. SHERMAN. Have the Chinese ever acknowledged that balanced trade over a period of time, not in any one year, is an appropriate goal? Or do they look at these trade deficits and say, that is healthy, that is the way they should continue? Or do they just avoid mentioning that they do have a trade surplus with the United States?

Dr. Scott or anyone else?

Mr. SCOTT. I think the Chinese claim that they are playing the game the way it should be played and that they are not engaging in unfair trade practices——

Mr. SHERMAN. And, therefore, the resulting trade deficits are incredibly healthy because they result from a system that doesn't have all the things that you and I know that it has.

Mr. SCOTT. Exactly.

Mr. SHERMAN. Okay. So if we impose to start off with a 15-percent tariff on all their imports to the United States, with a proviso that if they were to retaliate then we would go to 30 percent, what would be their reaction?

Mr. SCOTT. Well, we saw an example of that in 1985 with the Plaza Accord. Congressmen Gephardt and Rostenkowski put forth a bill in this House, which was passed twice, which would impose a tariff of 27½ percent on imports from Japan and Europe. The bill passed the House twice, never got through the Senate, was never signed by the President.

But it caused such concern to the finance ministers of those countries that they came to us, they came to James Baker and said, we have to find a solution, and that is why we negotiated the Plaza Accord. So we never——

Mr. SHERMAN. I understand.

I believe my time has expired. Thank you.

Mr. SCOTT. I apologize.

Mr. YOHO. Thank you.

We will go to Mr. Dana Rohrabacher from California.

Mr. ROHRABACHER. Thank you, Mr. Chairman, and thank you, Mr. Ranking Member. I appreciate it. I have another thing that I have to run off to, so I appreciate the courtesy.

Let me just state right off the bat that, Dean Cheng—is it mister? It is not doctor, but it is—right. Okay. Let me just say that I have a fundamental difference in analysis than you do. You seem to be giving credit to the Chinese Government and the Chinese people who are now under that government for many of the advances that I do not believe they deserve credit for.

Let me just note that, again, I have been here 30 years now, as I have seen this come and go. But I remember full well in the 1990s when, during the Clinton administration, you had some of his biggest political backers who were channeling money from the aerospace industries in China to the Clinton campaign, and they were then transferring vitally important technologies to the Chinese.

There is a fellow shaking his head back there. I investigated this for 6 months on my own. And while I found, for example—and the reason I was tipped off is I went to a meeting of aerospace workers who told me they had been in China solving China's rocket problem. They didn't even have stage separation, the engineers. Well, who sent them over there? I will tell you. Hughes Aircraft sent them over there. And then the Chinese, without any money for research and development, ended up being able to send things into the air MIRV'd, meaning carrying more than one warhead or one payload.

No, I think that when you take a look at the advances that have been made in China, it has been made because you have people who have no R&D cost at the fundamental level. What we have is Chinese graduate students in our major universities, and they are saying, oh, well, you can't bring the records back with you, or you have to make sure they are in the security drawers. No, no, they remember.

Just putting them through these courses have given billions of dollars, billions and billions of dollars of technological know-how that the American people and our companies have had to pay for, now transferred to what is not a benevolent government that evolved into benevolence by becoming so prosperous, as we were told would happen, but, no, a government today that is the world's worst human rights abuser, in the sense that they are the biggest human rights abuser on the planet, and a country that has, as we say, claims against neighboring countries, territorial claims, that are very damaging to the peace of the world.

I would suggest that what we are talking about here—I am going to ask one question, because—okay. I believe the incredible enrichment and increasing power that we have provided since Bill Clinton's day as President of the United States, since those days, has resulted in the fact that America and free countries of the world and even the Chinese people themselves, who are in less a secure situation for their own potential freedom, that we are worse off, way worse off, because of this.

Now, what I want to ask you—and I will be very quick. Are there groups of Americans, like the ones who were giving money to the Bill Clinton campaign, who have profited from this transfer of technology and continue—that they are not breaking the law, however; people who, without breaking the law, are now engaged in bolstering the strength and power of this rotten dictatorship in China, this crony capitalism that threatens their part of the world. Are there Americans that you can identify for us that are—not by name but by category—that have profited from this horrendous outcome?

We will start with Mr. Scott—well, no, no, no. Mr. Cheng, go ahead.

Mr. CHENG. Well, sir, I mean, given that we are talking about trade relations, presumably there are people who benefit, I guess starting with the lobbyists who work on behalf of the PRC Government. Certainly, they are going to benefit from being paid by the Chinese Government.

Mr. ROHRABACHER. How about levels of management in our corporations, that they benefit, and then we don't have—and that the

people at the lower level of corporate structure in America is just damaged dramatically. Is that possible?

Mr. CHENG. It is certainly possible, Representative. I am afraid I don't——

Mr. ROHRABACHER. Okay. Maybe Mr. Atkinson and then Mr. Scott.

Mr. ATKINSON. Yeah. I guess I would agree with Mr. Cheng. There is trade with China. I think the way to think about this, that I would urge you to think about, would be: The Chinese Government forces U.S. companies to do things, and if a CEO is unwilling to do it, they are going to pay a price. And, in my view, it is a little bit like the bully in the school and you need a bodyguard. I think the problem is the U.S. Government has refused or been unwilling to be the bodyguard and to stop the pressure, stop that kind of extortion.

Mr. ROHRABACHER. Well, could it be that the people in the management of our companies have short-term personal profit interest at heart, even though it has long-term horrible implications for their working people in the United States?

Mr. Scott, go right ahead.

Mr. SCOTT. I think I can answer that. My answer goes to that question. I think the people who benefit most from corporate takeovers—for example, Lenovo's purchase of IBM and the Chinese purchaser of the NextGear auto parts manufacturer, those directly benefit stockholders, they benefit the managers of those companies who get large bonuses for the sale of those companies, but my research has shown that millions of jobs have been eliminated through the purchase of these companies that buy them up and they hollow them out and then they ship parts here under those companies. That is the way it works.

Mr. ROHRABACHER. This is a lot deeper issue than that, but thank you very much.

Sorry to take an extra minute.

Mr. YOHO. Thank you, sir.

We will next go to Mr. Scott Perry from Pennsylvania.

Mr. PERRY. Thank you, Mr. Chairman.

Mr. Cheng, long time, no see.

I don't know if the American people are aware of this, and I just want to have a conversation with you about the Chinese space program. It would be my assertion that they followed us into space but they are ahead of us in a couple different ways that Americans aren't aware of, and I think it has manifested in a couple different ways, which is a more aggressive use of space as a warfighting domain, a state-of-the-art technological breakthrough domain, and through groundbreaking civil space initiatives that have serious military implications. I don't know if you will agree with those, but I am hoping, if you don't, that you will explain that.

I just want to ask you about a couple of things regarding their strategy, not the least of which is their quantum communications satellite. I don't know the science of these electrons that react to one another, whether they are on the other side of the galaxy or not, but, as I understand it, it is unhackable and unjammable. We are not in that domain at all, as far as I understand it.

And then, when I understand that they are mapping the other side of the moon, they plan on going to the poles, I think they have satellites in orbit around the moon, I think that they are ostensibly for civil purposes, but I want to know if you can discuss the military implications.

If you can verify what I said are the three, kind of, domains that they are operating in that we are behind them in.

Mr. CHENG. Well, sir, to begin with, you left one out, which is manned space. At this point, the United States cannot put its own astronaut into space. We rely on the Russians. The Chinese do not rely on the Russians; they are able to send their own people up into space. That is a very sorry state for our manned space program to be in.

In terms of warfighting, the Chinese military has reorganized itself to include now an information warfare service that specifically includes the space component. So it is very clear based on their doctrinal writings that they expect the next conflict to be about information, and space is a key means of acquiring and transmitting information.

This is also where quantum computing comes in, because information needs to be secure. It needs to be secure physically, in terms of the servers and routers. It also needs to be secure in terms of being able to be hacked and tampered with. Quantum computing—which I must admit, I also am not a physicist, and I don't pretend to even play one on TV—nonetheless, does seem to have a set of capabilities. The Chinese want a quantum computing capability in orbit, which says something about their ability to miniaturize it, their ability to shield it from cosmic rays and other aspects.

The Chinese are making a conscious push in terms of the array of capabilities that they have developed to be able to engage in military operations in space, everything from direct-ascent kinetic-kill vehicles, which you fire from Earth, which can reach all the way out to geosynchronous orbit, to lasers, which have been fired at American satellites, to cyber and jamming capabilities.

And, finally, it is important to note that China's space program is essentially run through the People's Liberation Army. Every major space facility is manned by the People's Liberation Army, including through this new service. The idea that we could cooperate with China's space program, which I know has been an issue raised before this and other committees here on the Hill, means, at the end of the day, getting in bed with the People's Liberation Army.

We have talked here about American security and is there a threat from Chinese acquisition of companies. I would suggest that openly getting in bed with the Chinese military is a more direct threat to our security.

Mr. PERRY. So if you were going to make a recommendation based on what you know or believe the Chinese to be pursuing, which seems to me, at least based on the last paragraph of your statement, regarding their military involvement, what should America be doing right now?

Mr. CHENG. We do still have one of the foremost aerospace industries out there, but we seem to be lacking in direction. Much along the same lines as we have talked about here about defending our

own high-tech crown jewels, are we intent upon being able to win any competition, including armed competition——

Mr. PERRY. Is this the business of NASA or DOD or both?

Mr. CHENG. We need to coordinate both of them. NASA is a civilian agency. It is dedicated much more toward science, but it should recognize that it plays a role in terms of diplomacy. NASA has the best brand of any part of the U.S. Government, and yet it doesn't play that role.

Mr. PERRY. Thanks, Mr. Chairman.

Mr. YOHO. Thank you for those questions.

We will next go to Mrs. Ann Wagner from Missouri.

Mrs. WAGNER. Thank you, Mr. Chairman. And I thank you for holding this hearing and shining a light on China's technological advancements across sectors—frankly, a challenge that poses a threat to the rules of global trade.

I hardly agree with Dr. Atkinson that to defend free trade and American jobs we should not advocate U.S. protectionism but actively respond to Chinese protectionism. There is no question that China's theft of American intellectual property, their state control of major industries, and WTO accession have cost the American people.

So I am going to jump right into it. The last administration created a pathway to sanction foreign companies that steal American intellectual property through cyber activities in Executive Order 13694, but it appears that only Russian actors were ever sanctioned.

Dr. Atkinson, or others, do you recommend that the Trump administration sanction Chinese companies that repeatedly steal American IP?

Mr. ATKINSON. I do. I think the only way that this is ever going to turn around is for the Chinese Government to realize that there will be actions in reaction to what they are doing. And those actions have to impose some level of pain, if you will.

Mrs. WAGNER. You said real pain, yes?

Mr. ATKINSON. Real pain, and not just pretend like we are going to do it at the next G20 meeting.

Mrs. WAGNER. Right.

Mr. ATKINSON. So we have to identify those pain points, if you will, and where we can apply them. But we have to do it in a way that is respectful. We have to do it in a way that is strategic and focused on real goals and things that we want to see the Chinese accomplish within a particular period of time.

Mrs. WAGNER. Dr. Scott, you have put together a compelling statement on jobs. China's market interference and anticompetitive subsidies hurt the U.S. economy. While I am not convinced that currency manipulation and the trade deficit are the key drivers of U.S. job loss, I am curious to hear your thoughts on the U.S.-China Bilateral Investment Treaty and where you think it should go under the Trump administration.

Mr. SCOTT. Thank you very much, Congresswoman.

I am very concerned about the Bilateral Investment Treaty. As I have documented in my testimony and elsewhere, my research has indicated that bilateral investment tends to lead to a loss of jobs, particularly with a country like with China, both in terms of

when Chinese firms come here to take over U.S. firms, as we have been discussing, but also when U.S. firms go to China and outsource their production to that country.

So I think that a passage or adoption of a bilateral investment treaty is not in our national interest at this point, especially with a country like China that is such an egregious violator of the norms of fair trade behavior.

Thank you.

Mrs. WAGNER. Absolutely.

Dr. Atkinson, last year, Congress created a private right of action for victims of trade secret theft in U.S. courts. And 1 year later, have companies doing business in China begun taking advantage, do you know, of this cause of action?

Mr. ATKINSON. I would have to consult with my colleague Stephen Ezell, who follows that issue for us more carefully. My sense is they have not, and I think one of the principle reasons for that is retaliation.

American companies are incredibly hesitant to raise any complaints because they know from real experience there will be retaliation and pain and consequences within that, which is why I think, again, it has to be the U.S. Government that leads this. The Chinese know how to divide and conquer among our firms and within particular industries, picking one firm off against another. The U.S. Government has to have essentially a policy that we will defend U.S. economic interests regardless.

Mrs. WAGNER. What about the Department of Justice? Should they be directing additional resources toward prosecuting trade secret theft, perhaps?

Mr. ATKINSON. One of the big problems that we have is that, if you look, for example, within the FBI at the commercial counterintelligence arm that we have, it is vastly underfunded. The folks who are doing that are very, very talented and hardworking agents, both in terms of counterintelligence and going after this. But that is an afterthought at the FBI right now. There are bigger fish that the FBI is focusing on, and they have really let that slide.

There is a very good book, by the way, that two FBI counterintelligence agents wrote—and I will send that link to you—wonderful book about how the Chinese are going after our secrets and how limited their ability is to go after them just because of the resources.

Mrs. WAGNER. I wish I had more time, but it appears that I have run out, Mr. Chairman, so I shall yield back.

Mr. YOHO. Thank you, ma'am.

If you guys are up to it, if you guys want to ask an additional question or two, it would be okay—are you guys okay with that?

Go ahead, Ann.

Mrs. WAGNER. Mr. Atkinson, are there additional efforts you would recommend to the new administration—I am sorry, Dr. Atkinson. Forgive me—to the new administration to safeguard U.S. intellectual property? How can we better safeguard from our Chinese cyber attacks?

Mr. ATKINSON. Well, a couple things.

I mean, one is, clearly, we need better defensive measures. One of the challenges has been the U.S. Government itself has weak-

ened our own commercial cybersecurity by not giving out information on zero-day exploits, for example, because they want to then use those weaknesses for their own purposes. We can have a good discussion about that, but it is clear that one of the results of that is to weaken our cybersecurity and allow the Chinese to be inside our systems. So that is a very important debate to have.

A second area would be, again, I think we have to go back to results-oriented trade, if you will. Reagan did that in the eighties with Japan; it was results-oriented. We need to pick four or five key things—cyber theft and cyber attacks should be on the top of that list—and say, we need to see a reduction of that within X amount of months or else there will be consequences.

Mrs. WAGNER. Mr. Cheng, would you care to comment, please?

Mr. CHENG. Two other key points.

One is it is essential to recognize a Chinese cyber activity is not random. We are playing Whac-A-Mole. Oh, my gosh—or kiddie soccer. Oh, my gosh, something happens over here, and everybody rushes over there, and it is the OPM hack, or it is UnitedHealth, or it is some company.

To recognize that there is a Chinese strategy behind their cyber activities means that we can stop addressing individual items, which are important but, at the end of the day, are tactical. If we can counter the Chinese strategy, whether through better investment in counterintelligence, perhaps by also improving the level of overall computing security in this country, then, in that case, that would go a far distance.

Representative Perry asked about quantum computing. One of the great problems we have is this idea that, "Well, but quantum computing will make the NSA's job almost impossible." And there is a great deal of truth to that. But the answer is not to, therefore, stand in front of quantum computing and scream, "Don't go there." It may be that, at the end of the day, we are all better off, American companies and the American Government, if we simply embrace quantum computing and think about other ways to then counter that issue rather than denying our own companies and government the benefits from that.

Mrs. WAGNER. Very good testimony. I appreciate that.

Let me shift gears here, and I will just toss this out to whomever thinks that they are most schooled on this. The saga over rare earth minerals and Mountain Pass mine in California has been right out of a movie script. The Wall Street Journal reported this week that coal-mining magnate Tom Clarke may purchase the mine.

To anyone who knows best, do you think that Mountain Pass could play a role in rebuilding a U.S. supply chain for rare earth minerals?

Yes, Mr. Cheng.

Mr. CHENG. Rare earths, one, aren't rare. They happen to be heavily localized in China, but India, Canada, the United States, and Australia all produce rare earths. Part of the issue is that rare earths are, however, incredibly environmentally damaging in terms of the refining process to get at it.

So the interesting problem here is not can a domestic source be found. It is how important is it that we have a domestic source rel-

ative to EPA standards, EPA requirements. If we want to be dependent on the largest supplier, which is China——

Mrs. WAGNER. Right.

Mr. CHENG [continuing]. That is one thing. If we want not to be totally dependent upon it, then we also need to recognize that there may need to be regulatory relief with regards to environmental——

Mrs. WAGNER. Well, you may have answered my followup question, which is: What can the U.S. do to compete with China's dominance in the rare earths production?

Dr. Atkinson?

Mr. ATKINSON. So there are a couple things, I think.

Certainly, the Chinese have used their monopoly on rare earth production to force U.S. companies to localize production. If you want to get that, we are not going to export that material to you, you have to come here to get it. Again, that violates the WTO. We should have brought a case against that.

Mrs. WAGNER. Right.

Mr. ATKINSON. In terms of domestic production, I agree with Mr. Cheng. We just have to decide that is a national priority. And, unfortunately, we haven't done that. We have chosen to believe that the Chinese will give us those materials.

Then the third thing we have to do, because we have seen this from experience, is when a company tries to then get in the market, the Chinese then dump to bring down prices so that they can't get in the market. We have to be ready to go with a dumping case and dumping and pressure so that they can't use that to keep new entrants from getting into the marketplace.

Mrs. WAGNER. Thank you for your testimony.

Yes, Dr. Scott.

Mr. SCOTT. Just one final point. As an economist——

Mrs. WAGNER. Could you hit your mike, please?

Mr. SCOTT. Yes. Speaking as an economist, these are clearly industries that are huge externalities because it is such a polluting industry. There may have to be public subsidies for the cost, and we may also have to regulate the industry, not export the product, and, as Dr. Atkinson says, respond when we are challenged by actions in China if they dump the product.

Mrs. WAGNER. Great. Thank you.

I think this is very good testimony, Mr. Chairman, and testimony that certainly can be taken on board by this administration. So I thank you very much, and I appreciate the indulgence, sir.

Mr. YOHO. Yes, ma'am.

And I was going to follow up with that question. Mr. Perry, do you have another question?

Mr. PERRY. I do. Thank you for your indulgence, Mr. Chairman.

Mr. Cheng, thinking about the Chinese, their incursions on the Moon, so to speak, satellite, you know, around-the-Moon mapping and communications on the back side of the Moon, what is the purpose of being on the other side of the Moon and mapping the other side of the Moon and endeavoring, I think, to go to the other side of the Moon in the next couple years? What would be the civilian purposes, and what are the military implications?

Mr. CHENG. Well, the civilian purposes is probably to make contact with the Transformers base over there.

That was intended as humor.

No, almost certainly one of the most important aspects is prestige, to demonstrate, again, that China can be innovative, that China can do things that no other country has done.

From a security perspective, however, it is the communications link with the far side of the Moon. Because of the way the Moon orbits around the Earth, the far side of the Moon never faces Earth. So communicating with the far side requires one of two options, either creating a lunar satellite, a satellite that orbits the Moon itself—no one has done that yet—or putting a satellite at certain key points in deep space that will allow you to communicate, which is what China has already announced it is going to do.

It will deploy a communications satellite to Lagrange point 2. No other country has done that. Countries have put scientific exploration satellites there, but no one has put a communications or application satellite there. Once there, China will have opened the door to deploy other satellites there.

That is beyond the geosynchronous belt. It will complicate our ability to do space situational awareness. It will allow the Chinese to create essentially an on-orbit reserve of communication satellites, so, in the event of conflict, it will have, essentially, already in place additional systems to take up the slack.

It could, in theory, bring those satellites back in, whether to populate geosynchronous to replace casualties in time of war or, alternatively, even as a potential form of anti-satellite capability. Because, of course, the satellites in geosynchronous are very predictable, so you could, in fact, come in from outside orbit and come in, whereas right now we are focused on going out to geosynchronous.

Mr. PERRY. Do we have any plans whatsoever that are similar to the Chinese in this regard to station, to map, to communicate on the back side? Do we have any of these plans whatsoever?

Mr. CHENG. Not to the best of my knowledge. The closest is the deployment of the James Webb Space Telescope, which will also go to Lagrange point 2. But that, of course, is a dedicated scientific satellite which intends to base a supplement to Hubble. So, no, there is nothing like this, as far as in the public record, for either DOD or NASA.

Mr. PERRY. In my mind, in the way that you present it as well, it seems like they have, if they complete this task, an extraordinary military capability from a communications standpoint and from, if you think about a GPS satellite and how much the military depends—nobody reads a map in the military anymore, right? It is all GPS-based. Not saying it will always be, but right now that is the primary means of location.

I mean, it presents, I think, a significant hazard. The door is wide open for them, if they chose to, to take military action on our communications and location array that is in geosynchronous orbit without any—there is almost nothing we can do.

Mr. CHENG. Yes, sir. The Chinese, they publish an enormous amount of material, and they are very open in saying, the next war, one of the things we will try to do—we, the PLA—is establish space dominance. This is clearly a step in that direction.

Mr. PERRY. Is it something that we should be concerned about? I don't know when the next national military strategy or national

security strategy comes out. Do we not care? Do we not take them seriously? Do we not see this as a problem? Or is this out of the realm of your expertise?

Mr. CHENG. There is no evidence that we have taken this on board in the most recent national military strategy, national security space strategy, or national space strategy, sir.

Mr. PERRY. Okay. Thanks, Mr. Cheng.

Thank you, Mr. Chairman.

Mr. YOHO. Again, I appreciate you all, your patience staying here.

I want to just touch base. There is no separation, from what I have studied—and I think you have alluded to this—between the Chinese Government, the Chinese military, and/or Chinese businesses. They are kind of one entity.

The idea of national pride, going to the Moon, if China wants to do that, we can understand that in this country because we did that. We can remember how this Nation rallied behind that. I truly believe that was for national pride. It was a leap of faith and a giant step for mankind that the whole world benefited from.

But what I am seeing here with the Chinese program, I am not seeing that. It is like I talked about before; if you look at a past activity, we can predict future actions. I wanted to touch on the rare earth comments that Mrs. Wagner talked about. As of late 2016, China produced more than 85 percent of the global rare earth mineral supply, which is used in the production of everything from smartphones to advanced weapons. I have heard reports that there are almost 2 tons of rare earth metals in some of our fighter jets.

China's control of the market, however, enabled them in 2010 to restrict rare earth exports by 40 percent and cut off supplies to Japan over territorial disputes. We remember that, the Japanese Coast Guard ramming the Chinese ship. China just backed up, says, "Not a problem," and cut off their rare earth, crippling their market.

So we have seen the story over and over again. And then their leader—and I remember this because I saw a documentary on it. It was from 1992. It was the Chinese leader, Deng Xiaoping. He said that the Middle East has oil, America and Japan are in technology. We can't compete with them, but we can compete with them on rare earth metals, and we are going to corner the market. And they have done that.

I think we are at a point in this country—and this is something we have talked about on this committee—to develop a rare earth national security policy for the United States. I know they are difficult to mine and there are EPA things that we have to look at as far as regulations and make sure it is done right. But we would be foolish if the American Government didn't come together and say, we are going to procure and secure the rare earth metals needed from us instead of having to depend on any other country, I don't care who it is.

One of the things I saw when I first came up here is we were arguing the farm bill, and one of the sentiments of some of the people up here was, why do we need a farm bill? Why don't we import our food? I am thinking, good God, we tried that on oil. Do we really want to go down here again? So to be dependent on another

country for rare earth metals when we need them in everything, I think, is foolish, and I think we need to have that policy.

The other thing is, as General Perry brought out about the intentions of China in space, I think that is very telling, again, by their past history. All we have to do in current days is see what they are doing in the South China Sea. They are going to do what is best for China.

And then we know the IP Commission estimates that possibly up to $600 billion of intellectual property has been stolen—$600 billion. And, again, it points to future activity.

So I guess a question I want to ask you, are there existing nation-to-nation or U.N. treaty and/or agreements that are satisfactory to prevent China's aggressive pursuit of space in something other than civilian purposes for exploration versus military? Are there sufficient treaties or agreements between nations, or is there something that needs to be written up on that?

Go ahead, Mr. Cheng.

Mr. CHENG. There is only a handful of international treaties governing space.

Mr. YOHO. Right.

Mr. CHENG. China and the United States and quite a few other countries are party to almost all of them. The U.S. is not a party to the Moon Treaty, but that is actually not specifically relevant here.

The U.S. has resisted most efforts at creating a space arms control treaty because of the very real—two very large real problems. One, it is almost impossible to define what a space weapon is. The Chinese version of a treaty that they have forwarded actually would allow all of the anti-satellite activities that they have conducted and would ban any American militarization of space. Yes, it is a lovely treaty——

Mr. YOHO. A great plan.

Mr. CHENG. Exactly. And it goes directly to the other piece, sir, which is that the Chinese are excellent practitioners of legal warfare. You sign a bad treaty; it is not just like a bad contract, although we have seen examples of bad contracts here today. What happens is China will basically—and there will be an American community, both from the legal, academic——

Mr. YOHO. Right.

Mr. CHENG [continuing]. And arms control communities, who will basically say, if we signed it away, it doesn't matter that China has it and we don't.

Mr. YOHO. I agree with you.

Anybody else? Any comments?

All right. Gentlemen, I appreciate your time. And what you see is a rare earth policy and a policy to secure our semiconductor industry are paramount. I think we need to rally this Nation. Through leadership is the only way that we are going to go back and do the things we used to do, of exploring space and going on to that next frontier. It would be a poor choice for us not to pursue that, and it is something we need to do. That comes from the top down and for America to put a focus out there.

I want to thank you for you time, for your commitment to come here, for your patience while we voted.

And, with that, this meeting is adjourned, and we look forward to having your statements submitted.

[Whereupon, at 4:34 p.m., the subcommittee was adjourned.]

# APPENDIX

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## Material Submitted for the Record

**SUBCOMMITTEE HEARING NOTICE**
**COMMITTEE ON FOREIGN AFFAIRS**
U.S. HOUSE OF REPRESENTATIVES
WASHINGTON, DC 20515-6128

**Subcommittee on Asia and the Pacific**
**Ted Yoho (R-FL), Chairman**

April 26, 2017

**TO: MEMBERS OF THE COMMITTEE ON FOREIGN AFFAIRS**

You are respectfully requested to attend an OPEN hearing of the Committee on Foreign Affairs, to be held by the Subcommittee on Asia and the Pacific in Room 2172 of the Rayburn House Office Building (and available live on the Committee website at http://www.ForeignAffairs.house.gov):

**DATE:** Wednesday, April 26, 2017

**TIME:** 2:30 p.m.

**SUBJECT:** China's Technological Rise: Challenges to U.S. Innovation and Security

**WITNESSES:** Mr. Dean Cheng
Senior Research Fellow
Asian Studies Center
The Heritage Foundation

Robert D. Atkinson, Ph.D.
President
Information Technology and Innovation Foundation

Robert E. Scott, Ph.D.
Senior Economist
Director of Trade and Manufacturing Policy Research
Economic Policy Institute

**By Direction of the Chairman**

*The Committee on Foreign Affairs seeks to make its facilities accessible to persons with disabilities. If you are in need of special accommodations, please call 202/225-5021 at least four business days in advance of the event, whenever practicable. Questions with regard to special accommodations in general (including availability of Committee materials in alternative formats and assistive listening devices) may be directed to the Committee.*

# COMMITTEE ON FOREIGN AFFAIRS

MINUTES OF SUBCOMMITTEE ON *Asia and the Pacific* HEARING

**Day** *Wednesday* **Date** *April 26, 2017* **Room** *RHOB 2172*

**Starting Time** *2:33 p.m.* **Ending Time** *4:32 p.m.*

**Recesses** *1* (*3:06 pm* to *3:45pm*) (____ to ____) (____ to ____) (____ to ____) (____ to ____) (____ to ____)

**Presiding Member(s)**

*Chairman Ted Yoho*

*Check all of the following that apply:*

**Open Session** ☑
**Executive (closed) Session** ☐
**Televised** ☐

**Electronically Recorded (taped)** ☐
**Stenographic Record** ☐

**TITLE OF HEARING:**

***"China's Technological Rise: Challenges to U.S. Innovation and Security"***

**SUBCOMMITTEE MEMBERS PRESENT:**

***Rep. Ted Yoho, Rep. Dana Rohrabacher, Rep. Scott Perry, Rep. Steve Chabot, Rep. Ann Wagner Rep. Brad Sherman***

**NON-SUBCOMMITTEE MEMBERS PRESENT:** *(Mark with an * if they are not members of full committee.)*

*N/A*

**HEARING WITNESSES: Same as meeting notice attached? Yes** ☑ **No** ☐
*(If "no", please list below and include title, agency, department, or organization.)*

**STATEMENTS FOR THE RECORD:** *(List any statements submitted for the record.)*

***Rep. Gerald Connolly, statement for the record***
***Rep. Ted Yoho, questions for the record***

**TIME SCHEDULED TO RECONVENE** _____
**or**
**TIME ADJOURNED** _____

John J. Young
**Subcommittee Staff Associate**

**Statement for the Record**
Congressman Gerald Connolly
AP Subcommittee Hearing: "China's Technological Rise: Challenges to U.S. Innovation and Security"
April 26, 2017

China has pursued policies in the technology industry that pose a serious threat to U.S. economic and national security interests. Beijing's state-directed cyberattacks, noncompetitive practices, and policies that limit market access for U.S. companies directly harm U.S. interests in the Asia-Pacific.

The United States had an opportunity to set the rules for economic engagement in the Asia-Pacific, where we already maintain longstanding commitments, with the Trans-Pacific Partnership. The trade agreement encompassed 12 countries that account for 40 percent of global GDP and 20 percent of global trade. A high-quality TPP deal would have deepened U.S. alliances, strengthened ties to emerging partners, and established labor, environmental, human rights, and intellectual property standards. Conversely, our withdrawal from TPP has created a vacuum, and given an unbelievable gift to the Chinese. They are still drinking champagne in Beijing.

Abandoning TPP is one of the most profound retreats since the U.S. Senate's failure to ratify the Treaty of Versailles after World War I. It is no coincidence that right after we walked away from TPP, the Chinese have moved ahead with their own alternative trade agreement, the Regional Comprehensive Economic Partnership, which meets none of the standards that the U.S. fought so hard to include in TPP.

Earlier this month, President Trump hosted a summit with Chinese President Xi Jinping. The two leaders apparently agreed to 100 days of negotiations in order to address trade tensions, but exactly what that plan looks like and which concessions China will make remain to be seen. Early commitments from China to offer the U.S. better market access for financial sector investments and U.S. beef exports are relatively easy to make. China had already been willing to allow majority foreign ownership in securities and insurance companies during the Obama Administration and the beef ban has been in place since a bovine infection scare in 2003. The real test will come amidst negotiations about China's unfair and illegal trade practices regarding its technological industries at home and abroad.

China has limited foreign competition in its domestic market and propped up private enterprises with Chinese state funding and intelligence. For example, in order to bolster China's semiconductor industry, the Chinese government launched a $150 billion public-private fund to subsidize investment, acquisitions, and the purchase of new technology from 2015 to 2025. Such biased policies flood global markets with cheap supply, undercut foreign competition, and create an environment where it is impossible for U.S. companies to compete. I recently wrote a letter to the Chinese Ambassador expressing concerns over steps the Chinese government is taking to restrict U.S. cloud service providers from providing services in China. Currently China has two draft notices that would essentially require the transfer of all cloud ownership and operations to a Chinese partner.

In cyberspace, China has been even more aggressive. Chinese state-backed hackers have stolen intellectual property and trade secrets from technology companies so that China can reduce its reliance on foreign technology suppliers and spur its own technological innovation. This theft of trade secrets, along with counterfeit goods and pirated software, costs the U.S. economy between $225 and $600 billion annually, and China is the largest source of such illegal activity.

Our concerns extend far beyond just the economic impacts of Beijing's tech policies. Semiconductors are ever-present in today's tech products from smart phones to satellites and advanced military systems. China produces more than 85 percent of the global supply of rare earth minerals, which are essential components in many of these same technologies. China's subversion of the semiconductor market and near dominance of rare earth production create significant concerns about supply chain control that threaten U.S. national security interests. China has also used its cyber capabilities to hack into U.S. military networks to steal information about U.S. weapons programs, including the F-35 fighter aircraft, and penetrate critical U.S. infrastructure.

During the 100 days of trade negotiations with China, the Trump Administration should push back on China's unlawful support of private enterprises and cyberattacks on the U.S. military and private sector companies. At the same time, China has an essential role to play in addressing many global and regional challenges, not the least of which is de-escalating tensions on the Korean Peninsula. It is imperative that any dialogue with the Chinese Government account for these competing interests. I look forward to hearing from our witnesses regarding the best way to carefully manage our relationship with China to assert U.S. economic and national security interests that are threatened by Beijing's unfair trade practices.

**Questions for the Record**
Chairman Ted Yoho
AP Subcommittee Hearing: "China's Technological Rise: Challenges to U.S. Innovation and Security"
April 26, 2017

1.) Mr. Cheng, the U.S. and China announced a cybersecurity agreement in 2015 that you referred to at the time as "a broad statement of generalities." A private sector report last year found a drop in China-based hacking, which the Obama Administration attributed to the agreement. How do you assess the impact of the U.S.-China cybersecurity agreement on Chinese cyber operations? Do you believe that the U.S. and China share a "common understanding" of cybersecurity and norms in cyberspace?

**Mr. Cheng:** It is not clear how much, or even whether, Chinese cyber espionage for economic purposes has decreased. This is in part because it was not clear what metrics were used to assess the level of such activity prior to the agreement. That is, at this point, has there been an ***absolute drop*** in Chinese cyber activity, or only a drop in the ***observed*** Chinese cyber activity. While it is possible that there has been a reduction in Chinese cyber espionage (especially that aimed at American commercial entities), it is also possible that there has been a reduction in Chinese cyber information gathering by ***known Chinese government entities***, while overall levels of cyber espionage may not have changed at all! (For example, if the Chinese government contracted with civilian hackers or employed non-governmental "patriotic hacker" groups, substituting them for cyber units from the PLA.)

This goes to the bigger question of whether there is a "common understanding" of cybersecurity and cyber norms. Chinese activity in cyber space, including the continued efforts to censor what the Chinese population can access, as well as ongoing efforts to extend Chinese sovereignty throughout cyber-space, would suggest that no such "common understanding" has been reached.

2.) The State Department describes "cyber diplomacy" as "encompass[ing] the full range of U.S. interests in cyberspace…including security, freedom, governance, human rights, and economic growth." What role should the State Department or other U.S. Government agencies play – if any – in addressing China's authoritarian approach to Internet governance, including its advocacy of "cyber sovereignty" as a global regulatory norm?

**Mr. Cheng:** The United States has been, and should remain, the foremost champion of a free and open Internet, where not only governments but civil society organizations can participate in both the free flow of information and the administration of the Internet itself. Therefore, the United States government, whether through the State Department or other parts of the bureaucracy, should resist efforts to place the administration of the Internet under government-only authorities such as the UN International Telecommunications Union (ITU). Instead, the US Government should make clear that it will firmly support the role of entities such as ICANN, the International Corporation for the Assignment of Names and Numbers, in administering the Internet. ICANN's multi-stakeholder approach, whereby both government and non-government entities have essential roles in helping set the rules of Internet operation, must be defended, if the free flow of information, a hallmark of today's Internet, is to be preserved.

**Mr. Atkinson:** China considers "cyber sovereignty" an inalienable right in that each country should respect how other countries decide to manage the Internet.[i] China's view and management of the Internet is very different to the United States, Japan, and other countries. China tightly censors the Internet through the "Great Firewall of China" maintains strict controls of what information is accessed from outside the country.

When it comes to values-based issues, each country should be able to pursue its own policies. For example, some countries block objectionable content like hate speech. Nations have these rights, but they should exercise them without impeding on how the Internet and information flows in other countries. It is when China crosses this line is when the U.S. government needs to be vigilant and prepared to push back—both bilaterally and in coordination with likeminded countries—in resisting China's efforts to enforce its values and rules of the Internet in other countries.

Equally important, countries should work together on technical issues that underpin the connectivity, administration, and security of the global internet. The U.S. government needs to do more on this front as China is ramping up efforts to enforce its view of the Internet as part of a new international framework or set of global norms. In recent years, China has begun pushing for a new model for government the Internet based on strict rules and order. President Xi made China's major push for global internet leadership in 2015 when he outlined that the world needed to "create a fine cyberspace order following relevant laws."[ii] In November 2016, President Xi called for "more fair and equitable" governance of the global internet at the China-run Wuzhen World Internet Conference, where China often tries to get government and private sector officials from other countries to sign onto China's approach to managing the Internet as a way to influence their own approach. China has said that it thinks the internet is dominated by the United States, leading it to back a proposal to transfer control over some of the internet's core architecture to a U.N agency, the International Telecommunication Union.[iii]

3.) The Chinese government recently released an updated draft of its new Cybersecurity Law, which would require technology firms to undergo a cybersecurity assessment before transferring their data abroad. Could this be considered just another way for the Chinese government to require data localization? How could a law like this affect U.S. technology firms and continue to support policies in Beijing that undermine the high-tech industry in the United States?

**Mr. Cheng:** The Chinese government has made clear that it is intent upon controlling information within the PRC. This is reflected in the development of the "Great Firewall of China," the armies of censors maintained by not only the PRC government but also Chinese Internet Service Providers (ISPs), and the willingness to shut down large portions of the Internet within China (e.g., in Xinjiang).

It should therefore not be surprising that Chinese cybersecurity laws will be fashioned (and as important, interpreted and enforced) to ensure that the Chinese government can monitor information within the PRC. This will include compelling foreign companies to not only warehouse data in China, but to provide means of accessing even secure data (e.g., requiring back doors which the Chinese government can access).

**Mr. Atkinson:** China's has introduced a number of new laws and regulations that will greatly expand local data residency requirements—known as data localization—and other measures that make it harder to transfer data outside of China or to use foreign technology products, all of which discriminate against

foreign technology companies. Despite pushback from the United States and other countries, China's Cybersecurity Law, initially adopted in late 2016 and due to come into effect on June 1, maintains many of these measures. As ITIF outlined in a submission to the Chinese government, China's recent draft measure on personal and other personal data would greatly expand the scope of data localization as well as measures that inhibit the seamless collection, use, and transfer of data.[iv] These efforts have already made it harder for foreign firms to sell their products in China, raised the risk of disclosing valuable intellectual property, and also forced them to set up or use duplicative computing facilities and be constrained in how they use data.

The United States needs to more aggressively push back against China's use of cyber and data-related policies to discriminate against U.S. firms. Like every country, China has legitimate grounds to address cybersecurity and privacy issues. However, mandating data localization does not make data more secure or private. Moreover, the Chinese government has consistently used these concerns as a pretext to introduce intrusive and discriminatory policies that target foreign technology companies. For example, the day after President Xi made his comments last November, the *People's Daily*, warned in an editorial that China must break monopolies over core technologies and standards and remain untethered to other countries' technology supply chains.[v]

By limiting access to best-in-class technology products and services, China is undermining its own firms and economy's ability to compete and innovate in today's global digital economy. U.S. technology companies have considerable experience and technology that could help China develop a dynamic and competitive data-intensive and innovative economy. These discriminatory laws limit the ability (and their willingness) of U.S. and other foreign technology companies to operate in China. China's rapidly changing regulatory environment has further raised a number of serious concerns about the role that foreign technology firms will be allowed to play in China in the years ahead.

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[i] Eva Dou, China's Xi Jinping Opens Tech Conference With Call for 'Cyber Sovereignty', *WSJ*, November 16, 2017, https://www.wsj.com/articles/chinas-xi-jinping-opens-tech-conference-with-call-for-cyber-sovereignty-1479273347

[ii] Gerry Shih, China seeks global support for cyber sovereignty framework, *AP*, March 2, 2017, https://apnews.com/ede57c2d442b437492f2aaccbee27f44/china-seeks-global-support-cyber-sovereignty-framework

[iii] Gerry Shih, China doubles down on internet control after tough new law, *AP*, November 17, 2016, https://apnews.com/d3c6545801d040d69cc4021f49a83926/china-doubles-down-stance-internet-control

[iv] Robert Atkinson and Nigel Cory, Comments to Chinese State Internet Information Office on Handling Data (Information Technology and Innovation Foundation, May, 2017), https://itif.org/publications/2017/05/11/comments-chinese-state-internet-information-office-handling-data

[v] Gerry Shih, China doubles down on internet control after tough new law, *AP*, November 17, 2016, https://apnews.com/d3c6545801d040d69cc4021f49a83926/china-doubles-down-stance-internet-control

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