



BASC NEWS

Berkeley APEC Study Center

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DIRECTOR'S NOTE

Dear Colleague,

Thank you for your continued interest in the Berkeley APEC Study Center (BASC). Through your readership, we are excited to continue being part of an interdisciplinary conversation regarding the dynamics of the increasingly critical Asia-Pacific region.

The articles in this newsletter reflect the work that BASC has been doing on these fronts over the last year. To begin, we are pleased to present two adapted versions of published articles by *Global Asia* that are a part of our “Middle Power Strategies for High-Tech Industries Project.” In the first, I join BASC Deputy Director Andrew Reddie in examining the new reality of economic statecraft in the 21st Century and illustrating that economic statecraft is very much alive. In the second, Assistant Director Margaret Kenney discusses intellectual property as national security by studying the case of artificial intelligence in the Indo-Pacific.

We are also excited to present a series of research analyses that examine the range of strategic, economic, technological, and energy concerns that BASC has been addressing. Zeroing in on technological, domestic political, and systemic factors, Associate Director Yuhan Zhang sheds light on U.S.-China climate non-cooperation. The abbreviated version of his study was published by *East Asia Forum* and *Global Policy*. Assistant Director Ishana Ratan offers commentary on Chinese manufacturing and forward linkages in the Malaysian solar industry. Our undergraduate Research Assistant, James Freeman, assesses the economic statecraft of the United States and China in the solar industry and the implications for the liberal international order.

We hope this newsletter will help enhance your understanding of the Asia-Pacific region. BASC is especially grateful for the generous support from the Institute of East Asian Studies, the Social Science Matrix, the Center for Chinese Studies, and the Center for Korean Studies for our cooperative projects. We are also deeply grateful for the UC National Laboratory Fees Research Program's sustained support in our collaboration with the UC Institute on Global Conflict and Cooperation and the Taipei Cultural and Economic Office in San Francisco. Finally, we are also deeply grateful for the sustained support of the Korea Foundation, Institute of the National Interest at Chung-Ang University, the Center for Global Partnership of the Japan Foundation, the Ron and Stacey Gutfleish Foundation, the Notre Dame Pietas Foundation, and our ever-expanding group of former BASC alums.

Through our supporters, collaborators, and colleagues like you, BASC has the privilege of advancing the discussion on a range of critical economic and security issues in increasingly unprecedented times. We look forward to continuing our dialogue for years to come.

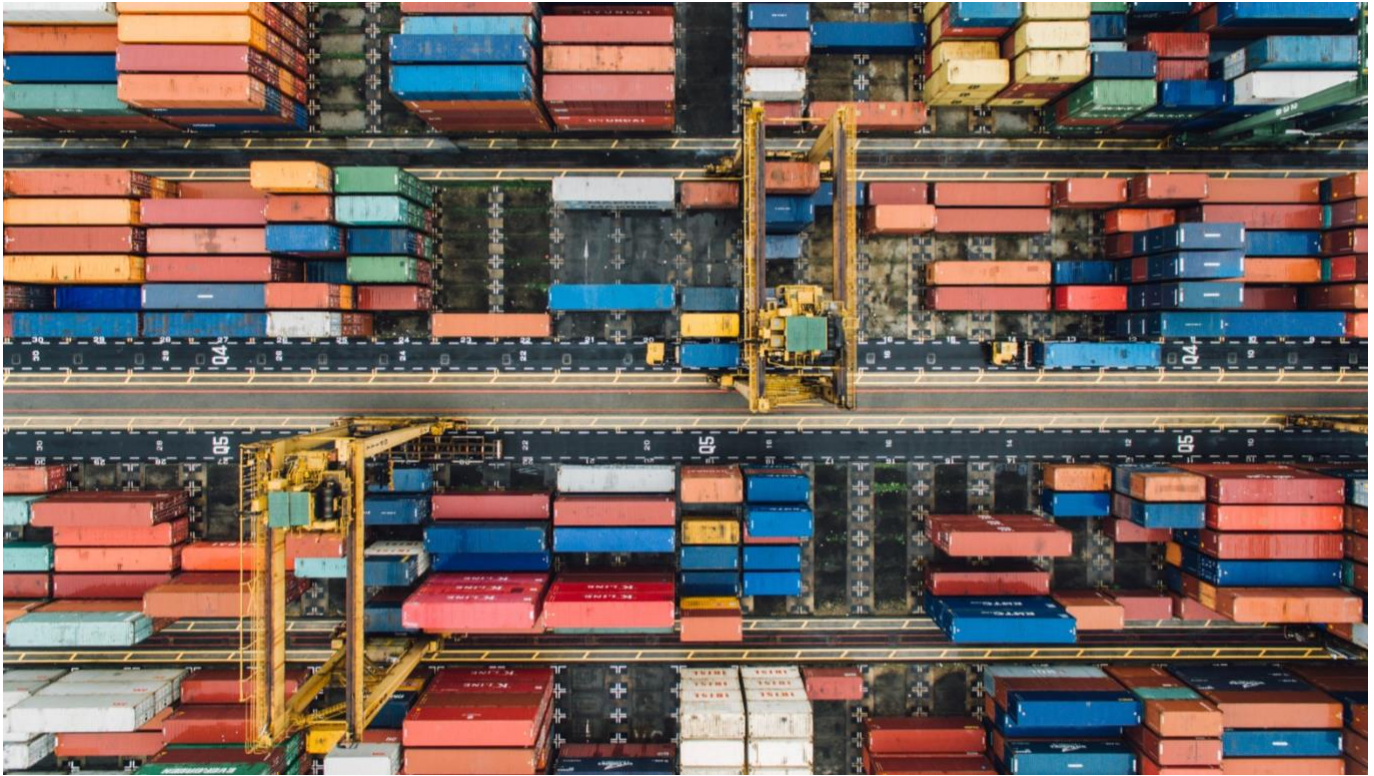
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The New Reality of Economic Statecraft

By Vinod K. Aggarwal and Andrew W. Reddie



Graphics Credit: CHUTERSNAP on Unsplash

The August 2022 Taiwan crisis appears to be a classic clash between near peer adversaries. To pressure Taiwan after U.S. Speaker of the House Nancy Pelosi's visit, China launched a series of military exercises from Aug. 4-10, which included deployment of an aircraft carrier, a nuclear submarine, bombers and missile launches. These exercises took place in waters surrounding Taiwan and appear to represent preparation for an eventual invasion of Taiwan. The G7 criticized China's actions, but China appears to be undeterred. Despite direct U.S. criticism, Washington did little to respond to Chinese actions.

What do Beijing's actions portend for what we have dubbed "new economic statecraft" – state intervention to influence trade, investment and industrial policy, rather than the traditional focus on economic statecraft that emphasizes policies related to economic sanctions?¹ Has new economic statecraft already become passé in the face of hardcore military tensions?

In short, no. We argue that although understanding the domestic and international politics leading to an increasingly tense military context is essential, economic statecraft is increasingly relevant – both for China and Taiwan as well as for the global economy more broadly.

The clash between China and Taiwan has far reaching consequences for the pursuit of economic statecraft. Here, we focus on the potential disruption of global supply chains, continued trade conflict and accelerating efforts to regulate cross-border flows of investment in the context of a renewed emphasis on industrial policy, primarily in the context of U.S.-China relations. From our perspective, the view that the shift from the Trump administration to the Biden administration would herald a return to a globalized world after a protectionist interlude has proven false. Rather, we see much greater continuity in American policy as it pertains to economic statecraft and the likely continued fragmentation of the global economy.

Threat to global supply chains

Although the most immediate concerns in the aftermath of the recent Taiwan crisis have dissipated, analysts argue that tensions between Taipei and Beijing have been escalating more generally, and that the recent crisis is a manifestation of growing conflict, which will likely result in a significant disruption to global supply chains in the future.

Taiwan is a crucial link in global technology supply chains. Indeed, the Taiwan Semiconductor Manufacturing Co. (TSMC) accounts for 90 percent of the world's cutting-edge chip capacity, while downstream electronic contract manufacturers such as Foxconn produce components and assemble products for some of the world's biggest companies. Specifically, Interos's global relationship-mapping platform reveals that hundreds of thousands of U.S., European and East Asian firms rely on Taiwanese suppliers for parts including semiconductors, software, chemicals and other electronic equipment.²

Second, the Taiwan Strait represents a chokepoint for global shipping – particularly when the Luzon Strait is impacted by bad weather.³ Best estimates suggest that nearly 50 percent of global container ships transited through the strait this year.⁴ If the Taiwan crisis translates into a hot war, global supply chains will undoubtedly be disrupted,

Unsurprisingly, a great deal of commentary has focused on the effect of a potential conflict on the global supply chain for semiconductors, and the central role of TSMC – particularly for advanced processors with 5-nanometer and 7-nanometer transistors. Drawing insights from a wargame scenario, global consulting firm IHS concluded that “any significant disruption to semiconductors production or transportation logistics to key markets would create significant shockwaves to various industries, such as electronics and auto manufacturing.”⁵ With the global semiconductor industry “already facing significant backlogs in its new orders pipeline,” these production shortages are expected to continue in the foreseeable future.⁶

And while many countries have been promoting their own domestic chip industries while TSMC itself has expanded its operations beyond Taiwan, this is unlikely to lead to an immediate resolution of industry concentration and reliance on Taiwan.

Continuing trade tensions

Beyond the prospects of a proximate Taiwan crisis, broader trade disputes between Washington and Beijing have continued.

First, the Phase One trade accord is failing to live up to its promise – with the Covid-19 pandemic coupled with looming economic challenges in China contributing to the agreement failing to deliver on its promise.⁷

Moreover, tensions appear to once again be escalating. Over the past 12 months, multiple Chinese companies including Huawei have been blacklisted by U.S. regulators over national security concerns. Washington also continues to make clear its concern surrounding intellectual property theft. The U.S. and Japan also pledged to work closely in areas “such as 5G, A.I., quantum computing, and semiconductor supply chains.”⁸

In response, China passed the Anti-Foreign Sanctions Law to counter U.S. trade sanctions in June 2021. According to the law, “individuals or entities involved in making or implementing discriminatory measures against Chinese citizens or entities could be put on an anti-sanctions list... their assets within China may be seized, detained, or frozen.”⁹

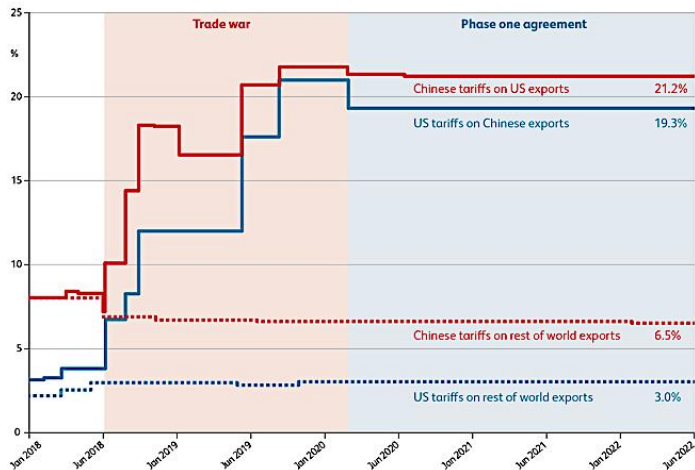
During the first half of 2022, the office of U.S. Trade Representative Katherine Tai doubled down on competition with China in its 2022 Trade Policy Agenda and 2021 Annual Report. Tai emphasized that the U.S. “must recognize that China ... has uniquely distorted global trade through its economic policies and practices, causing harm to U.S. production, investment, and even consumption” and that there is an “urgent need for reform.”¹⁰ So far, more than 110

Chinese firms have been added to the list since the start of the Biden administration.¹¹

The Biden administration has also maintained Trump-era tariffs on Chinese goods – and when the U.S. government opened the window for comments on the tariffs in May 2022, it received “hundreds of requests for them to remain.” It is widely expected that the Biden administration will “allow Trump-era tariffs on hundreds of billions of dollars of Chinese merchandise imports to continue while it continues its review.”¹²

China also maintains much higher tariffs (21.2 percent) on U.S. goods than on the rest of the world (6.5 percent).¹³

FIGURE 1 COMPARISON OF US AND CHINESE TRADE TARIFFS, 2018-2022
Source: Peterson Institute for International Economics, updated June 2022



Alongside the challenges posed by the continuing trade disputes and rounds of sanctions, the U.S. and China have diverging perspectives concerning the direction of institutions to govern global trade. *The China-led Regional Comprehensive Economic Partnership (RCEP) came into effect on Jan. 1, 2022, with the most recent data showing that China’s trade with member countries expanded 6.9 percent year-on-year to 2.86 trillion yuan (approximately \$449 billion).*¹⁴ RCEP allows China to leverage its trade potential further to secure greater market access in the region – coupled with its broader Belt and Road Initiative. RCEP also reinforces economic interdependence between China and other participating countries, further pushing the region into China’s political orbit.¹⁵ Ironically, China also

requested to join the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), a regional trade agreement with higher standards than the RCEP and a successor to the Trans-Pacific Partnership from which the U.S. withdrew in the early days of the Trump administration.¹⁶

In response to China's actions on trade agreements, on May 23, President Biden launched the Indo-Pacific Economic Framework for Prosperity (IPEF) with a dozen initial partners. On the economic front, the Biden administration aims to deepen economic engagement with its Indo-Pacific partners on a wide range of issues such as digital trade, cross-border data management, supply chain resilience, decarbonization and anti-corruption.¹⁷ Geopolitically, the IPEF is a response by the U.S. to efforts by Beijing to bolster a China-led regional economic order.

While analysts have rightfully focused on the high-politics nature of a possible Taiwan conflict, we are likely to see continued tension on trade issues and strategic maneuvering in this arena.

National security regulation of investment and industrial policy

In the U.S., there remains an increasing concern surrounding Chinese investment, particularly in sensitive sectors tied to national security.¹⁸ Investment regulation and industrial policy now increasingly go hand in hand. In Biden’s first year in office, Washington implemented an industrial strategy to revitalize U.S. manufacturing, create more domestic jobs and strengthen American supply chains. As these efforts mature, they will almost certainly have downstream consequences for global supply chains, and for Chinese companies, in particular.

Under the Trump administration, the long-standing administrative process to review investments known as the Committee on Foreign Investment in the United States (CFIUS) was enhanced with Congressional passage of the Foreign Investment Risk Review Modernization Act (FIRRMA) in 2018. This new legislation calls for the review of even minority stakes

in U.S. companies. The definition of “critical technologies” will also continue to be refined on a rolling basis by the Department of Commerce.¹⁹

The U.S. Senate has also passed the CHIPS and Science Act with the goal of reducing U.S. reliance on overseas supply chains. It also aims to boost the nation’s science and technology research base and address China’s anti-competitive trade practices amid broader concerns surrounding intellectual property theft.²⁰

The direct link between industrial policy and investment regulation is explicit in the CHIPS Act. It prohibits funded recipients from “expanding semiconductor manufacturing in China and other countries defined by U.S. law as posing a national security threat to the United States.”²¹ In addition, companies doing business in China over the next 10 years will not be able to produce highly advanced chips that are smaller than 28-nm.²²

Troublingly for Beijing, similar moves appear to be headed to Europe. For example, the European Union is investing more to boost chip production and mitigate losses from supply chain disruptions.²³

Unsurprisingly considering these developments, China is already taking steps to insulate its economy from external vulnerabilities. Technological and material self-sufficiency are primary goals of China’s 14th Five-year Plan (2021-2025).²⁴ It appears the Taiwan crisis might further strengthen China’s

determination to reduce its dependence on foreign suppliers – though China’s domestic semiconductor industry lags behind the industry standard.

Conclusion

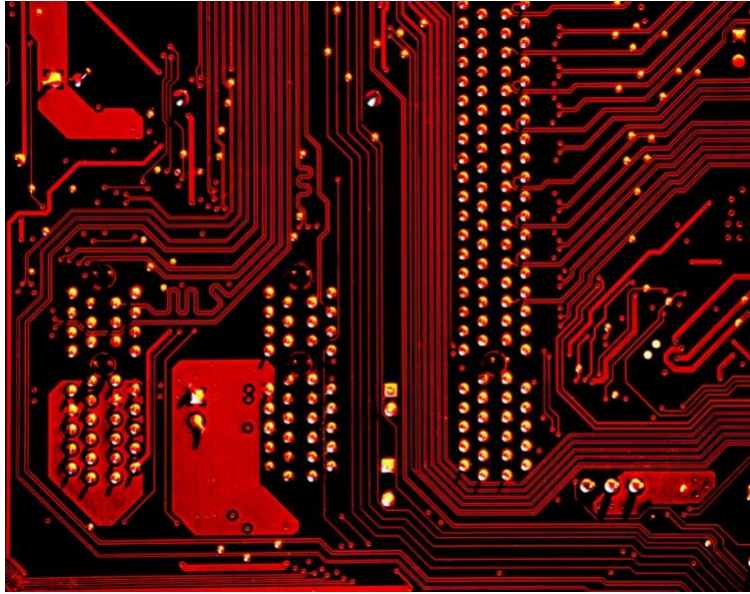
So, what should we make of these developments? Current events are notoriously difficult for academics to deal with in terms of broaching theoretical trends. However, supply chain concerns made salient by the Taiwan crisis, the trade war that continues unabated, and efforts to limit foreign direct investment and bolster national economies via industrial policy does appear, in our view, to serve as an indication that how states engage their economic levers of power in the service of national security appears to be changing – both qualitatively and by degree.

This is a critical area of competition that is not likely to abate anytime soon. Understanding how different states make “strategic bets” on R&D projects as well as the types of tools they use to bolster national industries is needed now more than ever. We might also consider how institutions developed over the past 70 years to enable global trade and development might have to be re-tooled to cope with the contemporary reality that we find ourselves in. Despite wishful thinking about a return to peaceful economic globalization, new economic statecraft looks like it is here to stay.

This article was originally published by *Global Asia* in December 2022, which can be found [here](#).

Intellectual Property as National Security: The Case of AI in the Indo-Pacific

By Margaret Kenney



Graphics Credit: Michael Dzedzic on Unsplash

During the Second World War, the U.S. government filed 2,100 separate patent applications for the Manhattan Project, in what seemed to contradict the project’s principle of secrecy. The government pursued this strategy in the hopes of achieving international control over nuclear weapons technology. In effect, “arriving at sound international relationships will be much less likely to be complicated by reason of private interest” if the U.S. government established control first.²⁵ This is an example of a government using the patent system for national security purposes, rather than traditional economic protection. Artificial intelligence (AI) technology calls this phenomenon to the fore once again. As the U.S. and China attempt to expand their influence in the Indo-Pacific region, intellectual property protection (IPP) is once again being used as a political tool to bolster state security.

Artificial Intelligence and IPP

AI is defined as “machines that respond to stimulation consistent with traditional responses from humans.”²⁶

It is posited to have future effects on global value chains, digital platforms and trade negotiations. The private sector has allocated extensive resources to AI development, with \$40 billion invested in AI start-ups alone. While artificial intelligence has been a field of research for years, the technology became extremely popular around 2010 because of three developments: Big Data, machine learning and computing power. The majority of AI research is taking place in the private sector.

AI has broad military applications. Vladimir Putin, in his announcement of Russia’s commitment to AI development, said that “whoever becomes the leader in this field will rule the world.”²⁷

The U.S. and China have also indicated their engagement in developing and applying AI technologies in warfare to protect national security. Some military applications of AI include surveillance, lethal autonomous weapon systems (LAWS), cybersecurity and autonomous vehicles. These technologies can process large quantities of

information and make algorithmic decisions, adding enormous capacity to human capabilities. Because most AI research is occurring in the private sector, the U.S. National Security Strategy indicated “a need to establish strategic partnerships to align private sector R&D resources to priority national security applications.”²⁸ Specific attention is being paid to increasing the cybersecurity of American corporations who are developing AI to prevent their technologies from being stolen or pirated. In the case of AI, the numerous security benefits could allow a state’s military to have a relative advantage over an adversary, keep human beings out of conflict situations, and analyze intelligence and information more effectively. These implications are contingent on the maintenance of solid public-private partnerships so the state can gain from AI innovation.

The Trade-Related Aspects of Intellectual Property Rights (TRIPS) created an international enforcement mechanism to resolve IPP disputes, requiring each member state to arbitrate IP cases under their domestic judicial system. Since these groundbreaking developments in harmonizing intellectual property regulations, new technology has created additional hurdles for international cooperation. IPP have traditionally been centered on the importance of the lone inventor’s right to garner profits from their innovation. However, these debates have presumed the humanity of the inventor, which cannot be guaranteed in the case of AI. In the U.S., *Feist Publications vs. Rural Telephone Service Company, Inc* (1991) has been used to justify why copyright right law does not apply to non-human creators. The case states that “copyright law only protects ‘the fruits of intellectual labor’ that ‘are founded in the creative powers of the mind.’”²⁹

While IPP is traditionally viewed an economic issue, the rise of dual-use technologies that require strong private-public partnerships raises questions about the policy’s effect on national security as well.

The Indo-Pacific

In 2004, Chinese Prime Minister Wen Jiabao said: “the future world competition will be for intellectual property rights.”³⁰ This was incredibly prescient, as distinct intellectual property rights have had significant economic and security implications, particularly in artificial intelligence. The most powerful actors in AI domestic patent filings are currently located in the Indo-Pacific region, including the U.S., China, South Korea and Japan. By protecting the intellectual property of their national corporations, each country attempts to gain the lead in AI technology within the private sector. In doing so, these private sector developments have the potential to be used for military applications in the future, depending on the extent of public-private partnership.

U.S. President Donald Trump issued an executive order in 2019, stating that “continued American leadership in AI is of paramount importance to maintaining the economic and national security of the U.S.”³¹ This executive order also addressed the international intellectual property environment by stating that the U.S. must work on “protecting our technological advantage in AI and protecting our critical AI technologies from acquisition by strategic competitors and adversarial nations.” In October 2020, the U.S. Patent and Trademark Office (USPTO) released a report on domestic public views of AI and IP. The consensus was that existing U.S. IP laws are sufficiently robust and flexible to address AI-related issues. However, commenters also stressed the need to revisit these issues and consider new IP rights in the future as AI continues to evolve, including when artificial general intelligence is achieved. Despite the stated emphasis on AI IPP, U.S. AI IPP has been weakened by several court cases. First, in *Google vs Oracle* (2021) the U.S. Supreme Court decided that reimplementing computer code to innovate was fair use.³² This decision has mixed effects – it increases a company’s ability to innovate, but it does not guarantee that creators have copyright over their written code. Second, in 2022, the USPTO stated unequivocally that without a human author you cannot

submit a piece for copyright, meaning works produced by AI do not qualify.³³ This decision was upheld in the Eastern District of Virginia in *Thaler v. Hirshfield*.

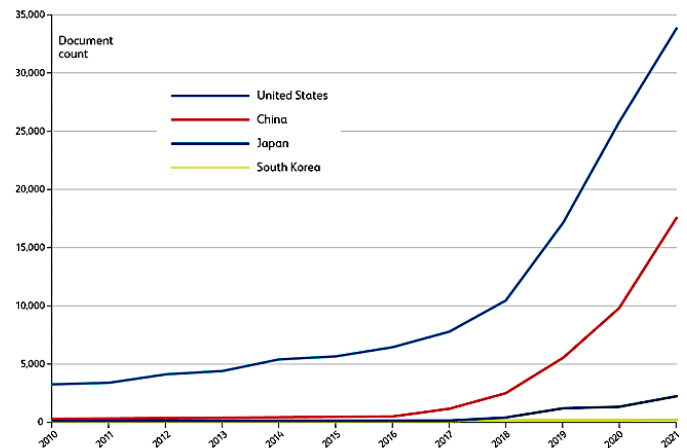
Both South Korea and Japan maintain similar policies to the U.S. regarding AI human creation and patent protection. In South Korea, the Patent Act defines an invention as “a highly advanced creation of a technical idea utilizing the laws of nature.”³⁴ Therefore, to be patent eligible, AI inventions must also satisfy this requirement.³⁵ “Korean patent laws and related precedents only recognize a natural person as an inventor, so companies, corporations and devices cannot be marked as inventors,” the Korean Intellectual Property Office (KIPO) said in a statement on June 3, 2021.³⁶ Similarly, Japan maintains that work made by AI without a human is not considered protected by either the Copyright Act or the Patent Act. Japan did amend its Copyright Act on Jan. 1, 2019, removing copyright barriers for AI. More recently, Japan has increased its focus on protecting patents in AI and the Internet of Things (IoT) as the number of patents filed in these areas has burgeoned. Japan’s focus on improving the AI intellectual property environment also reflects its concern for competing with China. However, these improvements have not extended to providing IPP to AI-created content.

China has been working to further develop its domestic IPP, with particularly extensive changes to legislation in 2019 and 2020. On Feb. 1, 2020, the Chinese government revised its Patent Examination Guidelines, focusing particularly on emerging technologies such as AI and Big Data and providing more specific guidelines on how to get patent protection for AI-related inventions in China. China issued a plan in September 2021 to strengthen the buildup and protection of IPP, by accelerating legislation in Big Data, artificial intelligence (AI), algorithms and genetic technology. China will also formulate and revise laws and regulations on the protection of business secrets, improve the legal system for regulating the abuse of IPR, and improve legislation covering monopoly practices and unfair

competition related to IPR.³⁷ These changes have been borne out in Chinese case law, with two major decisions further cementing China’s unique attention to protecting the intellectual property of AI. First, in *Shenzhen Tencent Computer System Co., Ltd. v. Shanghai Yingmou Technology Co., Ltd.* (2019), the municipal court “held that an article that was created by an artificial intelligence program benefitted from copyright protection.”³⁸ Similarly, the Beijing Intellectual Property Court (2017), again decided in favor of AI innovators, holding that pictures of the earth’s surface taken by a human-programmed camera were subject to copyright law even though the human did not take the pictures.³⁹ The significant protections offered to AI programmers will encourage innovation within China.

Figure 1 illustrates this trend, with the U.S. and China engaging in aggressive patent filing over the past 10 years.⁴⁰ The U.S. far outpaces competitors with a large increase in patent filings after Trump’s executive order in 2019. At the same time, China’s AI patent filings have increased at an almost exponential rate. Taken together, powerful states have signaled publicly the importance of AI for their military capabilities and have chosen to protect private sector AI technologies through an increase in IPP at the domestic level.

FIGURE 1 ANNUAL PATENT FILINGS IN AI RESEARCH AND PRODUCTION BY COUNTRY, 2010-2021
Source: Online patent database www.lens.org



What’s next?

First, as AI innovators and corporations decide where to conduct their work, the distinct policies may motivate forum shopping, or relocation to gain access

to the most favorable policies. This could result in extreme distortions in foreign direct investment and multinational corporations' activities over time, especially as case law cements these standards. Companies may make decisions about where to conduct their activities by considering where their property will be best protected, among other factors. China will thus have a significant advantage in attracting private corporations and inventors. Private relocation will offer increased opportunities for public-private partnership, especially in China as the central government has significant leverage over companies operating domestically. The accumulation of AI technology in specific jurisdictions will have significant impacts on the extent to which the state is able to gain access to dual-use technologies. Furthermore, once companies have relocated, there will be significant sunk costs and path dependency. Technology firms also tend to concentrate in certain zones (for example, Silicon Valley). China's creation of an AI industrial park in Beijing could attract companies that wish to engage in this concentrated community of around 400 businesses.⁴¹

Governments can respond to the pressure of forum shopping via competition or cooperation. Cooperation in AI IPP standards will be difficult for two primary reasons. First, IPP has traditionally been in the domain of the World Trade Organization. The WTO has suffered from a lack of successful negotiations in recent years. It has also experienced strife such as the Trump administration's criticism of the WTO appellate body and refusal to approve WTO appellate judge reappointments. The Joe Biden administration has continued these policies. With the WTO unable to find agreement and enforce its policies, it is unlikely that the IPP of emerging technologies will be at the top of the organization's agenda. Next, because of AI's potential military use, states will undoubtedly bargain more fiercely over international regulations.

Therefore, competition seems more likely than cooperation in multilateral AI IPP.

This article was originally published by *Global Asia* in December 2022, which can be found [here](#).



Read the December 2022 special issue of *Business and Politics* and submit your papers for publications at: <https://www.cambridge.org/core/journals/business-and-politics>

U.S.-China Climate Non-Cooperation on Attaining the 1.5-Degree Goal

By Yuhan Zhang



Graphics Credit: East Asia Forum

The daunting challenges posed by global warming are real. Several hundred years ago, pre-industrial carbon dioxide (CO₂) concentrations in the atmosphere were around 280 parts per million (ppm).⁴² However, due to anthropogenic activities, CO₂ is accumulating to more than 420 ppm today.⁴³ The accumulation of CO₂ influences the climate, changes the chemistry of the oceans and causes them to rise, and leads to water shortages and droughts, among other extreme events.

The alarm bells of the climate crisis have been ringing for years. There is an increasing consensus among climate scientists that it is indispensable to hold the increase in the global average temperature within 1.5 degrees Celsius above pre-industrial levels. But as the world's largest greenhouse gas emitters, the United States and China have not cooperated to commit themselves to sufficiently meeting this climate goal.

China's climate policy is consistent with a global warming of 3 degrees Celsius, and the U.S. nationally determined contribution is consistent with a 2 degrees

Celsius temperature target.⁴⁴ Yet at the 27th Conference of the Parties to the UN Framework Convention on Climate Change, both countries pointed fingers at each other for not acting fast enough.

Bilateral Non-Cooperation

From the political-economy lens, this article argues that, owing to technological, domestic political, and systemic factors, great power cooperation to attain the 1.5 degrees Celsius target is dead.⁴⁵

Firstly, while necessary, existing clean technologies are not a panacea and have not been sufficient to tackle global climate problems. There is an increasing consensus among policymakers, entrepreneurs, climate scientists, and social activists that existing clean technologies are incapable of preventing climate problems from adversely affecting humanity as a whole and limiting global warming to 1.5 degrees Celsius. For instance, clean tech investors like Bill Gates pessimistically note that the 'miracles' of solar and wind technologies will not save us from climate

change — technological breakthroughs are needed.⁴⁶ Naomi Klein in her book also argues that current technologies are not mature enough and cost-effective, which have failed to help change course.⁴⁷

Here I consider two widely applicable renewables to flesh out the most significant limits of clean technologies:

- **Solar Energy Technology:** In the foreseeable future, neither the U.S. nor China could cover all available land areas or commercial/residential building roof areas with solar facilities to supply electricity with zero emissions. Additionally, photovoltaic systems, which convert solar energy to direct electricity, are already in use, but they operate at low efficiency and are only economical in sun-rich off-grid areas. Some leading solar energy companies in both the U.S. and China have been conducting research and development on solar flywheel storage for several years, yet this technology is still premature. Although flywheel storage has higher values for specific power, specific energy, power and energy density, efficiency, and self-discharge rate, it has low values for lifespan, scale, maintenance, and capital costs, according to scientific studies.⁴⁸
- **Wind Energy Technology:** wind power has become economically viable for areas experiencing adequate average wind speeds. Wind turbines have been installed on the land in some locations in both the U.S. and China. Scaling up, however, will require more than the expected improvements in wind turbine technology. As an irregular power source with wind unpredictability, wind power's storage and electricity production have been and will continue to be challenges for engineers to deal with. European countries have the world's most wind power penetration. But the highest rate (Denmark) is only slightly more than 50 percent. Wind electric generation as a share of total power generation accounts for only 8 percent and 6 percent in the U.S. and China, respectively.

It is far from the goal of limiting global heating to 1.5 degrees Celsius, and to hit that goal, wind power needs to grow 20 percent per annum by 2030.⁴⁹

Policymakers in the United States and China understand this challenge. But, as rational players, they have little incentive to substantially reduce emissions and stabilize the level of carbon dioxide in the atmosphere.

Additionally, domestic political factors also impede bilateral cooperation.⁵⁰ In the U.S., domestic industry lobby always steps on pressure on policy outcomes. Powerful companies that stand to be adversely affected by mitigation policies — particularly large energy corporations in the oil, gas, and coal industries — have continued to exercise substantial clout and effectively work against any binding commitment to reduce GHG emissions substantially.

Beijing also faces domestic political obstacles. Sustaining the Kuznetsian economic development is the primary goal for China, whose rapid growth has relied heavily on burning fossil fuels. Since the late 1990s, coal consumption in China has increased approximately threefold.⁵¹ Path dependence casts a long shadow and has expansionary effects over time on the country's climate policies.⁵² Despite investing enormously in renewable development, it refuses to reduce the use of fossil fuels and takes insufficient actions to achieve the 1.5-degree Celsius goal.

Furthermore, great power rivalry also prohibits bilateral cooperation. For example, a focus on national security has led the U.S. government to tighten its export control policy for fear that high-tech products might reach military end users. Since 2018, the United States has waged a trade war against China,⁵³ and tariffs on Chinese clean tech products remain during the Biden administration. Washington has also passed legislation known as the Foreign Investment Risk Review Modernisation Act to expand the oversight

procedures of the existing Committee on Foreign Investment in the United States.⁵⁴

China, too, has imposed various strict regulations that obstruct cleantech cooperation with the United States. For example, in October 2020, the country introduced the Export Control Law of the People's Republic of China, providing it with justifications to restrict foreign commercial transactions based on national security.⁵⁵ In December 2020, China issued the Measures on National Security Review of Foreign Investment, strengthening government oversight and the ability to restrict or deny foreign investment.⁵⁶ Some advanced clean technologies are on the list of technologies prohibited or restricted for export or investment.

Consequently, the non-cooperative strategy is the dominant strategy for both the United States and China.

Prospects and Implications

In the foreseeable future, it remains unlikely that the United States and China will take climate actions to achieve the 1.5-degree Celsius goal for three reasons.

First, from a more dynamic perspective, technologies may evolve over time. But the ‘incremental’ success we have witnessed is far from enough to drive policymakers to cooperate. It may take a long time — perhaps decades — to achieve ‘transformative’ technologies.

Second, domestic political barriers are likely to persist. Some interest groups in the United States may not firmly oppose stringent climate actions. But many will impede substantial policies that threaten their survival or harm their balance sheets. With President Xi Jinping securing his third term as China’s paramount leader,⁵⁷ it is expected that Chinese climate policies will be consistent: Beijing will continue to prioritize economic growth and depend heavily on traditional energy-intensive industries.

Third, great power competition will likely intensify. Although the United States and China may cooperate in certain fields — for instance, when Tesla operates plants in China or when U.S. firms purchase Chinese solar panels — neither will sacrifice their national interests to substantially reduce emissions to limit global warming to 1.5 degrees Celsius in the foreseeable future.

In the United States, former president Donald Trump has already announced a White House bid for 2024.⁵⁸ If he becomes president again, Washington will probably quit multilateral climate agreements and escalate conflicts with China. In response to such U.S. policies, Chinese policymakers, predominated by *realpolitik*, are unlikely to compromise.⁵⁹

The fact that the United States and China are the world’s largest economies and emitters make it galling to the international community when they refuse to take on serious commitments to substantially reduce emissions and control global warming.

Years of failure to cooperate is a tragedy for the entire humankind. They blocked the world from getting on a carbon emissions reduction pathway capable of preventing severe climate change. Until breakthroughs in clean technologies, the insulation of climate cooperation from domestic politics, and the de-escalation of great power strategic competition, cooperation in substantial emissions reduction — and with it, the 1.5-degree Celsius goal — is not feasible.

Conclusion

The U.S. and China are responsible for nearly 40 percent of global GHG emissions, and they will likely contribute to alarming increases in CO₂ in the future. Unfortunately, both countries have blamed each other for not doing fast and enough in GHG emissions reduction. Some contend that realizing the catastrophic consequences of climate change might drive both countries to cooperate in effective climate

actions to curb emissions and global temperature. Yet, recognizing potential climate risks and associated economic costs does not necessarily mean the U.S. or China commits themselves to sufficient GHG mitigation to attain the 1.5-degree goal.

As shown in this article, over the last decade, technological, domestic political, and systemic factors in both the U.S. and China have driven policymakers to choose non-cooperation as their dominant strategy. As a result, neither has committed to sufficiently reducing emissions that curb global warming to 1.5 degrees Celsius. In the foreseeable future, such a situation is unlikely to change, which will negatively affect international politics and humankind's fate.

Many of the conclusions are derived from political-economy theories and qualitative analysis. Future research could focus on statistical analysis to prove the causal relations between the independent and dependent variables identified in this article. Another avenue of research can be developing formal models to analyze the non-cooperative climate game (non-cooperation) between the United States and China.

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Spillover and Scale Up or Stall? Chinese manufacturing and forward linkages in the Malaysian solar industry

By Ishana Ratan



Graphics Credit: Anders J on Unsplash

Solar Manufacturing and Local Installation

In 2009, Chinese industrial policy and overproduction led to a massive increase in the quantity of solar panels available on the global market, deeply undercutting comparatively high-cost producers in the United States.⁶⁰ The price of solar precipitously declined, and global solar installation soared. However, these Chinese firms priced out higher-cost U.S. and European Union (EU) competitors. In 2011, the U.S. and EU imposed retaliatory tariffs on solar photovoltaic cells and modules imported from China, rather than competing with China on cost.⁶¹ To avoid these tariffs, China first moved production first to Taiwan, but lawyers caught up in 2014 and added tariffs to Taiwanese imports. When these 2014 tariffs from SolarWorld Americas

doubled the tariff on solar panels to the U.S.A., Chinese firms chose to yet again offshore solar cell and module manufacturing facilities to nearby Southeast Asian countries, and export onwards to the United States as a tariff circumvention strategy.⁶² In 2015, China shifted solar module assembly to Malaysia, Thailand, and Vietnam, building out Malaysian factories in under six months. Did this shock of foreign manufacturing investment increase downstream firm and household productivity for local solar installation?

The remainder of this article proceeds as follows. I first lay out political economy expectations regarding the effects of foreign manufacturing on downstream industries. Local firms interested in solar installation that are located near new manufacturers can connect

with upstream suppliers and should be able to build solar projects at a lower cost as a result. After describing the processes by which FDI can lead to these local linkages, I evaluate the case of Chinese solar manufacturing in Malaysia, drawing on government documents, news reports, and policy briefs from local academic experts. I conclude with a summary of my findings, namely that solar manufacturing does not seem to significantly impact local solar installation and provide some policy suggestions regarding how to exploit FDI more effectively for local renewable energy industry development.

FDI and Local Linkages?

Foreign direct investment (FDI) in manufacturing can create positive spillovers in downstream segments of the supply chain by reducing cost of inputs, transaction costs of procurement for domestic firms, and employing local labor. First, if manufactured panels are available for sale on the local market, rather than simply exported abroad for tariff jumping purposes, Chinese production relocation should directly reduce the total cost of solar panels for local firms and households. Second, as highly productive firms, foreign investors can transfer skills and technology gained through expertise abroad to local markets.⁶³ They can even provide locals with information about global suppliers for additional components like inverters, even if Chinese panels themselves are not being consumed in Malaysia. Finally, foreign companies can employ local labor in the production process, in this case Malaysians in solar manufacturing.⁶⁴ Theoretically, this access to capital, expertise, and local employment will increase domestic expertise regarding solar, and lead to more growth in the local market.

On the other hand, middle income countries have historically struggled to grow domestic industries beyond export-oriented and low value-added manufacturing, falling into the middle-income trap.⁶⁵ In these cases, foreign investment is directed towards providing goods for the export market, operating in

enclaves that yield little spillover for the local economy. Malaysian solar presents a unique case of investment and spillover that echoes these potential constraints on the positive benefits of FDI. In solar, all foreign manufacturing facilities are located in Special Economic Zones (SEZs). SEZs were originally intended to serve as vehicles for development, to both entice foreign firms and mediate technology transfer to locals.⁶⁶ However, in practice, work finds mixed evidence for their efficacy in achieving positive developmental outcomes.⁶⁷ While manufacturing investment may facilitate downstream solar installation via lower costs to locals and higher foreign expertise, the fact that facilities are located in SEZs may pose an impediment to spillovers.

The Malaysian solar industry case presents a rich opportunity to investigate the benefits and challenges for spillover from upstream to downstream segments of the supply chain. Chinese manufacturing has two key advantages that may increase the likelihood of local spillover, rather than an “enclave effect.” First, solar panels are a relatively simple product, and Chinese firms produce the cheapest, most basic version of solar technology - polycrystalline silicon photovoltaic panels. This technology has a low “gap” between FDI and host country capabilities, because it is relatively compatible with Malaysian firms’ existing business activities in low-complexity electronic equipment.⁶⁸ As the gap is low, Chinese FDI presents a “likely case” to observe forward linkages to the local economy. Second, Chinese firms strategically chose production relocation to exploit regional cultural variation that reduces transaction costs. Chinese Jinko Solar and JA Solar both set up shop in Penang, the Chinese speaking part of Malaysia. Given that local labor is more likely to speak the MNCs’ native language, and share cultural ties, the transaction costs of doing business and sharing knowledge with local firms are lower.⁶⁹ For these reasons, solar provides a “best case” scenario of forward linkages.

Case study: Chinese Solar Manufacturing in Malaysia

Did Chinese manufacturing benefit solar installation areas closer to production facilities, with lower-cost panels, access to expert knowledge, and solar industry employment? In this section, I first provide background on the Malaysian solar industry, and then evaluate the case of Chinese solar manufacturing and local installation in Malaysia with qualitative evidence. Prior to the relocation of Chinese manufacturing, Malaysia already had adopted policies supportive of domestic solar installation. In 2011, Malaysia adopted a Feed in Tariff (FiT) subsidy for small (up to 5 Megawatt) solar, restricted to domestic firms and households.⁷⁰ This provided a flat subsidy per unit (Megawatt) of energy sold, which ensures firms make a profit on energy sold back to the grid. In 2016 this policy was substituted with Net Metering, which allows for self-consumption of solar energy, again restricted to small domestic firms and households. In 2019, the government swapped these locals-only policies for an auction system with competitive bidding for larger projects and allowed foreign investment. Theoretically, firms and households closest to Chinese manufacturers should experience the highest reduction in costs – and increase in solar installation – after the 2015 production relocation.

Chinese firms specifically offshored manufacturing capacity to Malaysia following European quota impositions in December 2013 and a sharp increase in U.S. tariffs in 2014 from 26.71 to 78.42 percent on solar cells and 27.64 percent to 49.79 for modules.⁷¹ JA Solar, JinkoSolar, and LONGi all shifted production facilities to Malaysia in 2015, with JA and JinkoSolar located in Penang, and LONGi in Sarawak. These three facilities accounted for over a third of total Malaysian solar exports in facility capacity (i.e. number of production lines) at the time of construction - though in output, they likely even accounted for a greater share of production. The two facilities located in Penang are the focus of this study, as Sarawak operates on a unique grid system with different

governance over renewable energy subsidies and solar installation.

Despite the opportunity afforded by solar manufacturing in its relative technological simplicity, and the advantageous location of Chinese production facilities in terms of local language compatibility, there is little evidence to suggest that Chinese manufacturers created significant positive benefits for local solar installation. First, Chinese solar manufacturers did not visibly contribute to local supply chains for solar installation, except in the largest of projects. Systematic searches of local newspapers identified few instances of Chinese solar modules used in a local solar project. JA Solar publicized the fact that it supplied modules to Malaysia’s “largest single-axis tracking PV project,” a massive 116 MW solar farm in eastern Malaysia in 2022, as well as the first floating solar project and the first installation with bifacial modules and sun-tracking technology in 2020.⁷² However, JA Solar’s collaboration appears limited to only the largest projects in Malaysia, and there is no evidence to confirm that Jinko Solar supplied modules for *any local Malaysian solar projects*. Beyond the “first” innovative large-scale projects, all of which were constructed many years after 2015 solar manufacturing relocation, Chinese manufacturers have not supplied the domestic market.

However, even with limitations in supplying solar panels to locals, solar manufacturers do appear committed to utilizing local labor. CEO of Jinko Solar, Kanping Chen, remarked that “Malaysia offers us talent pool of highly educated workers and engineers, relatively advanced industry infrastructure, a receptive business investment climate, cost competitive environment. In return, we bring our latest technology and manufacturing excellence know-how and expertise, our experienced management team helping to cultivate local talents, and our capital as well.”⁷³ Indeed, Jinko Solar promised to create 4000 jobs at the manufacturing facility.⁷⁴ That said, these employment benefits appear insufficient to generate significant public awareness about the benefits of solar

installation. Other authors find that Malaysian public awareness of solar energy and its benefits is overall very low, despite hosting manufacturing facilities.⁷⁵ This is compounded by the fact that households enjoy subsidized electricity from fossil fuel generation. While there are some targeted employment benefits to high-skilled workers, it is unclear if manufacturing relocation truly increased widespread awareness of solar energy among the local population.

Indeed, the primary proponents of solar energy in Malaysia seem to be local firms themselves, adopting solar to power energy intensive industrial operations rather than an FDI-driven pattern of solar energy adoption.⁷⁶ For example, local leading solar developer SOLAR+ lists that its primary clients are local firms with a high level of energy consumption, including IOI Acidchem and Ma Sing Plastics manufacturing facilities, and an IKEA shopping mall.⁷⁷ Solar helps power these industrial and commercial businesses at a low cost. These large, industrial, electricity consumers have driven Malaysia's solar energy installation – but this domestic demand does not appear to have benefitted from Chinese production destined for U.S. and European markets.

Spatial analysis of solar investment among Malaysian firms and households, which exploits available government data on the Feed-in-Tariff subsidy and auction contract recipients, confirms that areas closest to Chinese manufacturers did not, in fact, experience a significant increase in solar installation after manufacturing relocation. Evidence echoes the enclave hypothesis at best, where some Malaysian workers may be employed at solar assembly facilities, but panels are produced for export and Chinese firms only do business with the local market on the largest of projects.

Conclusion

Did areas most proximate to Chinese manufacturing in Malaysia install more solar relative to areas far away? On balance, I find scant evidence for meaningful local linkages, beyond a small number of manufacturing-

workers and a handful of large local projects where Chinese manufacturers have supplied modules. This engages with IPE debates about the relative benefits of foreign investment, particularly how manufacturing does, or in this case does not, lead to local industry scale up. On balance, solar panel manufacturing follows more an enclave-style model of investment and export, where foreign firms exploit local labor and expertise but do not contribute significantly to local infrastructure and development.

While the case of Malaysia may be unique in that China specifically relocated production to evade tariffs on exports to the United States, these insights travel to other green technologies that are often destined for North American and European Markets, like electric vehicles. Particularly in green technologies where the technology gap between FDI and host countries is higher, these enclave-style effects are likely to persist even in the absence of tariff jumping incentives. Broadly, where FDI invests to produce for export markets, production alone may be insufficient to reap benefits for local firms. In Malaysia, the real determinant of local solar installation seems to be demand from the business community rather than some FDI-led pattern of spillovers. Centering the role of local firms, rather than foreign investors, may be most effective to sustain energy transition.



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Sino-U.S. Solar Economic Statecraft and its Implications for the Liberal International Order

By James Freeman



Graphics Credit: Council on Foreign Relations

Introduction

Over the past few years, great power competition between the United States and China has intensified.⁷⁸ Although economic statecraft is not an optimal strategy that often escalates interstate conflict, both countries are increasingly using it. I define economic statecraft as using industrial policies, export controls, and investment restrictions in order to achieve national security goals.⁷⁹

In the solar industry, we have witnessed the increased usage of economic statecraft by both the United States and China which I argue negatively impacts the Liberal International Order (LIO). Section 2 will analyze China's economic statecraft in the solar industry. Section 3 will examine American economic statecraft as a response to Chinese solar strategies. Section 4 will analyze how these specific instances of

economic statecraft are negatively impacting the LIO. Finally, Section 5 will provide a brief conclusion.

Chinese Solar Economic Statecraft

Chinese economic statecraft in the solar industry focuses on capturing as large a portion of the global market share as possible, and then maintaining the geo-economic advantage. The Chinese government implemented solar policies much earlier and more comprehensively than the United States through utilizing subsidy programs, tax credits, and preferential lending in particular to boost domestic firms.

Since 2011, China has been using feed-in tariffs for its solar industry where domestic solar producers were given guaranteed increased 10 percent profit margins for their efforts by the government. There are large amounts of government solar projects with lucrative contracts that also typically offered 10 percent profit

margins.⁸⁰ In addition, tax credits are offered by the Chinese government to incentivize local industry as well as tempt foreign companies.⁸¹ Moreover, although creating overcapacity issues,⁸² the China Development Bank and other Chinese financial institutions have provided massive capital to Chinese solar industries in the wake of the 2008 crisis that solar industries in other nations simply could not rival.⁸³ The solar sector is a reoccurring part of China's 5-year plans. The current 14th Five-Year Plan sets a target of 18 percent of electricity generation from wind and solar by 2025.⁸⁴

These government efforts are paying off. As of 2021, China dominates the global market share of polysilicon, ingots, wafers, cells and modules manufacturing, the main components of solar production, exceeding 80 percent share in all 5 sectors. It also accounts for a significant portion of the Chinese economy and trade. In 2021, China's solar exports of \$30 billion made up 7 percent of China's surplus trade over the prior 5 years. It is expected that the world will continue to be dependent on China for solar in the foreseeable future.⁸⁵

United States Economic Statecraft

American economic statecraft in the solar industry can be viewed as a reactive response to China's industrial policies and dominance of the solar industry, which has severely depleted American capacity in the sector. The United States has lost 80 percent of the global market share of solar in the past decade and 89 percent of current domestic solar shipments are imported from Chinese companies.⁸⁶

Under the Obama administration, in 2012 the U.S. attempted to hamper China's growth in the solar sector by implementing discriminatory trade tariffs against China's solar industry on an anti-dumping basis. The United States argued that the Chinese government was subsidizing their domestic solar industry which was unfairly disadvantaging American solar producers.⁸⁷ In 2018, the United States adopted uniform tariffs against any solar products made abroad on the basis

that Chinese manufacturers moved their operations to other countries in Southeast Asia to dodge the discriminatory tariffs.⁸⁸

In recent years, the Biden administration began to utilize more economic statecraft to boost the domestic solar sector. The policy instruments the United States has used include tax incentives, public financing initiatives, tariffs, and R&D funding. This push for solar is part of a wider initiative around countering Chinese industrial dominance in important sectors such as solar.

The Inflation Reduction Act (IRA) enhanced incentive structures and policies relating to renewable energy.⁸⁹ For instance, the IRA has a \$27 billion Greenhouse Gas Reduction Fund with the purpose of starting green banks around the country. Depending on the goals and initiatives of those banks, as they are given discretion in what local initiatives they fund, portions of that \$29 billion will go towards the solar industry.

In June of 2022, Biden also issued an executive order to utilize the Defense Production Act which increases domestic production of solar panels, federal procurement of solar panels, and places 24-month waiver on solar imports from Southeast Asia that were affected by the tariffs so as to ensure supply.⁹⁰

Overall, U.S. economic statecraft has increased in both intensity and scope since the new Biden administration due to China's rise and the politicization of climate change in the United States. This is in contrast to the early 2010s in which American policy was mainly focused on tariffs and research subsidies. The goal is to capture a larger market share of the sector and compete with China which is considered a perceived threat by both Democrats and Republicans.

Implications for LIO

The LIO is a global order with three distinct characteristics that are weakened by the usage of protectionist economic statecraft. First, it prescribes values of economic liberalism and liberal democracies. Second, it is maintained by a number of

international institutions that uphold and enforce those values. Third, it is a unipolar power structure with the U.S. as the hegemon.⁹¹ All three of these facets are undermined by the usage of economic statecraft in the solar industry by China and the United States.

The economic statecraft policies that the United States and China have been implementing with respect to solar are policies that run against these tenets of free trade and economic liberalism. These nations are trying to artificially change the situation so that their domestic industries have an advantage in the solar industry rather than allowing the market to make the determination.

The American trade tariffs in the solar industry are a concrete example of how the international institutions are being undermined, in particular the World Trade Organization (WTO), which by extension undercuts the LIO. The WTO is an institution designed to promote free trade by putting regulations in place that are supposed to limit trade barriers like tariffs. The 2018 tariffs implemented by the United States were essentially a protectionist policy for the American solar industry. The adoption of these tariffs raises questions about the efficacy of the WTO and whether its principles will still be upheld, considering its purpose is to prevent such barriers to trade. This is especially true after the WTO 2021 ruling on these tariffs, which found them to be compliant with WTO agreements. This was the first time a challenged safeguard was found to be conforming to the General Agreements on Tariffs and Trade 1994 (GATT). The issue was compounded by the confusing arguments made by the WTO that seemed to be legally unsound and left it unclear how nations should proceed in future similar situations.⁹² At the very least, the ruling leaves nation-states confused as to when safeguards are legally applicable within WTO guidelines. The ruling also seems to indicate that the WTO is willing to tolerate American interpretations of WTO regulations more so than other nations.⁹³ The 2021 WTO ruling sets a precedent that the values of the LIO are only to be protected when they align with American interests. If the enforcement mechanism of an institution like the

WTO is not reliable, then it also makes the structure of the LIO, in which institutions are a vital part of, seemingly flawed.

With both China and the United States increasing their usage of protectionist economic statecraft, the unipolar nature of the LIO is challenged, undermining the entire order. The unipolar dynamic typically means that the United States is powerful enough on its own basis to not need to resort to protectionist economic statecraft; however in this instance China has made itself enough of a power in the world that its primacy in the solar sector necessitates such a response from the United States. This dynamic indicates the gradual shifting of the global power structure from a unipolar to a bipolar one.⁹⁴ China's ability to use economic statecraft and achieve such a strong position in the global solar market, challenges American authority and the authority of the LIO indicating that the current world order is not hegemonic. Instead, it suggests that China itself possesses enough economic and political strength to partially participate in the LIO and its values while escaping significant punishment.

It should be noted that China has historically benefitted from the rules of the WTO as the WTO encouraged economic liberalism that helped facilitate China's large exports. The WTO discouraged barriers to trade which allowed China to capitalize on its advantages in production capacity and cost. China has achieved its economic strength largely in part due to LIO principles such as hyper globalization, which allowed it to develop so rapidly and facilitated China's rise to become the world's largest goods exporter in 2009.⁹⁵ If the WTO and its rules were to disappear those advantages in trade would be negated. This is what makes the situation for China difficult because the WTO is clearly favoring the U.S. contrary to its own rules, but at the same time it still generates a net positive for China's economy. In fact, it appears China does not want to fundamentally challenge the LIO and is very receptive to the concept of multilateralism.⁹⁶ The issue for China is that it has never complied with the political components of the WTO, and its continued denial of those aspects is also a significant

undermining factor for the LIO.⁹⁷ China's grievances with the LIO are more centered on the hegemony possessed by the United States and LIO institutions, and the imposition of Western ideals such as democracy, free press, and human rights.⁹⁸ The reality of the LIO being dominated by the U.S. and international institutions heavily favored towards the West is not beneficial if sometimes detrimental to China and its interests, so it would be logical for China to counter it.

America is heavily incentivized to maintain all aspects of the LIO for numerous reasons. First, it is a structure that has it as the unipolar power with international institutions aligned with its beliefs, and that provides distinct advantages, such as power in establishing precedents. It is also an order that was constructed around American values and beliefs, so its erosion is also a reflection on global sentiment of these beliefs as well as the United States.⁹⁹ What is more puzzling is why the United States is now choosing to violate the LIO, with its usage of economic statecraft. The logical conclusion we can make is that the United States is no longer aligned with all of the aspects of the LIO as it once was. The political components of democracy and free speech are clearly still important to the United States as it has not violated them, but the values of economic liberalism no longer fit with the United States as it has decided to forgo those in favor of strength in the solar sector.

From these understandings of America and China we can understand that the LIO is unlikely to disappear completely as some of its components and facets are vital for the current positions of both actors and will

be necessary for the future as well. This means they will likely endeavor to at least retain the economic liberalism aspect of the LIO as much as possible, so as to ensure their continued growth.

Conclusion

The solar industry will be critical in the near future as it is one of the solutions to the existential threat of climate change. Having a strong solar industry would be a boon to any nation's economy in the future, thus we are seeing the U.S. and China competing to achieve primacy in the sector by using economic statecraft. The increased usage of this economic statecraft, however, is detrimental to the continued existence and relevance of the LIO as it challenges some of the LIO's core values. Great power economic statecraft in the solar industry has undermined the institutions that enforce those values. It is unlikely the liberal international order will vanish in the foreseeable future, but there is no reason for us to become sanguine about its prospects.

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