Domestic Politics and U.S.-China Trade Disputes over Renewable Energy

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Abstract

This paper draws on the two-level game approach to analyze the influence of domestic politics on U.S.-China trade disputes in alternative energy, especially in solar energy. It suggests that the difficulty Washington faces in getting China to address market access barriers in renewable energy needs to be viewed in light of both the coalitional dynamics in the U.S. resulting from the specific bilateral trade and investment relationship in this sector and Beijing's willingness to use industrial policy to foster economic competitiveness in nascent industries. Specifically, as China occupies the middle of the supply chain in the solar industry, both downstream users of low-cost Chinese imports and exporters of upstream products to China have voiced strong concerns about the U.S.' trade action. Such domestic opposition, coupled with the importance of industrial policy for defending the country's long-term interests in a "strategic emerging" sector such as alternative energy, substantially constrains Washington's ability to influence Chinese policies.

Introduction

CHINA'S RAPID EXPORT GROWTH IN RECENT YEARS HAS GENERATED HEIGHTENED TENSIONS IN ITS TRADE RELATIONS with the United States (U.S.), leading Washington to more frequently resort to the dispute settlement mechanism (DSM) of the World Trade Organization (WTO) to address its market access concerns. This paper examines Washington's efforts to address Beijing's compliance with its commitments to the Agreement on Trade-Related Invest Measures (TRIMs) in alternative energy, especially in solar energy. It will be suggested that the U.S. has exerted the most intense pressure on China to modify its trade practices in alternative energy in comparison to other

TRIMs-related sectors such as automobiles or semiconductors, and yet it has achieved the least success in eliciting positive Chinese responses in this sector.

This paper further draws on the two-level game approach to develop a framework for understanding the above pattern, suggesting that the degree to which the relevant actors in the U.S. are united in support of an aggressive market opening strategy *and* the resolve of the Chinese leadership in defending the alleged market access barriers play an important role in helping us understand the case outcome. Washington's effort to open the Chinese market is least likely to generate the desired outcome when domestic business groups in the U.S. are divided over the negotiation strategy and when the Chinese leadership has demonstrated intense resolve in defending the problematic policies.

Applying the above framework to U.S.-China trade disputes in solar energy, this paper suggests that the difficulty faced by the United States in pressuring China to modify its practices in this sector needs to be viewed in light of both the coalitional dynamics in the U.S. resulting from the unique nature of the bilateral trade and investment relationship in this sector *and* Beijing's willingness to use industrial policy to foster economic competitiveness in nascent industries. Specifically, as China occupies the middle of the supply chain in the solar industry, both downstream users who rely on low-cost Chinese imports and businesses that export upstream products to the Chinese market have voiced strong concerns about U.S. efforts to impose trade restrictions against China. Furthermore, growing Chinese investment in the U.S. solar industry has led American subsidiaries of Chinese solar companies to join the debate in opposition against the trade restrictions. Such domestic resistance, reinforced by the importance of industrial policy for defending the country's long-term interests in a "strategic emerging" sector such as alternative energy, has substantially constrained Washington's ability to influence Chinese policies.

Insights from the Two-Level Game Approach

This paper draws on the two-level game literature to analyze the influence of domestic politics on U.S.-China trade disputes in alternative energy, especially in solar energy. The two-level game literature emphasizes the importance of domestic politics for international bargaining strategies.[1] A country's market opening strategy will be more successful if the relevant domestic actors are united in support of such a strategy. Conversely, foreign threats of trade retaliation will be less credible and hence less effective if domestic interest groups in the target country are uniformly opposed to market liberalization or if strong pressure exists against policy changes in the target country.

In considering the intensity of pressure against the status quo in the specific target country that is the focus of this study, China, this paper adopts a rationalist, leader-oriented cost-benefit framework which emphasizes both the tangible and intangible economic and political interests

[1] For studies that employ this approach, see, for example, Evans et al. 1993; Odell 1993.

underlying the calculations of top elites that influence China's foreign economic policy. Rationalist approaches to international institutions posit that states seek to advance their key interests and promote beneficial cooperation through participation in international institutions. In the absence of anticipated gains, institutions will be either under-supplied or under-utilized.[2] While some variations of the rationalist model adopt the assumption that the state is a unitary actor, others point to the importance of analyzing the policy preferences of domestic actors such as policymakers, interest groups, and political institutions as well as the mechanisms through which they influence public policy in order to better understand how domestic actors may use international institutions to advance their own interests.[3]

As an approach that focuses on the domestic politics behind a country's international behavior, the leader cost-benefit framework utilized in this study stresses how, in spite of the proliferation of societal interests and the growing ability of societal actors to influence the decision-making process in an authoritarian regime such as China, top elites are nevertheless uniquely positioned to filter and shape the interests of societal actors in order to enhance legitimacy and ensure regime survival.[4] As top elites in China seek to sustain and maximize the power of the Party, maintain stability, and deliver the economic results necessary to preserve regime legitimacy,[5] it is reasonable to expect that top leaders will continue to use the instruments at their disposal to influence China's foreign economic relations in ways that serve the country's perceived core interests.

Table 1. Hypothesized Effect of Domestic Politics on the Effectiveness of Market Opening Pressure

		Chinese resolve in defending the alleged trade barriers	
		High	*Low*
Domestic Unity in the U.S.	*High*	Intermediate Outcomes	Most concessions
	low	Least concessions	Intermediate Outcomes

The above insights should lead us to expect Washington's efforts to open the Chinese market to be most effective in eliciting Chinese concessions when such pressure enjoys the support of key domestic groups *and* when the Chinese leadership has demonstrated the least resolve in defending the alleged trade barriers (upper right cell in Table 1). Conversely, U.S. market opening pressure should induce the least concessions when domestic actors are divided over the negotiation strategy *and* when Chinese leaders are intent on defending the alleged trade barriers (lower left

[2] Keohane 1988; Harsanyi 1969; Hasenclever, Mayer, and Rittberger 2000.
[3] Martin and Simmons 1998; Hudson and Vor 1995.
[4] On this point, see Blanchard and Ripsman 2008.
[5] For studies that emphasize such elite motivations, see, for example, Wang 2005; Sutter 2010.

cells). Cases combining a high level of domestic unity in the U.S. and a high level of Chinese leadership resolve (upper left cell) or a low level of domestic unity in the U.S. and a relative lack of Chinese interests in protecting the sector in question (lower right cell) should yield intermediate outcomes.

As the following analysis suggests, U.S.-China trade disputes over solar energy provide an example of a case where the Chinese were the most resistant to U.S. market opening pressure (lower left cell). The unique market structure in the solar industry created a major divide between solar panel producers on the one hand, and downstream users and exporters of upstream solar products to China as well as American subsidiaries of Chinese solar companies on the other, thus substantially reducing the credibility of the U.S. negotiation position. Domestic division in the U.S. was reinforced by the solar industry's status as a strategic emerging industry in China. As the Chinese government continued to come to the defense of the solar industry in spite of the market irrationalities generated by its previous support, it has demonstrated considerable resistance to drastic policy changes that would alter the status quo.

China's Rapid Ascent in the Global Solar Industry

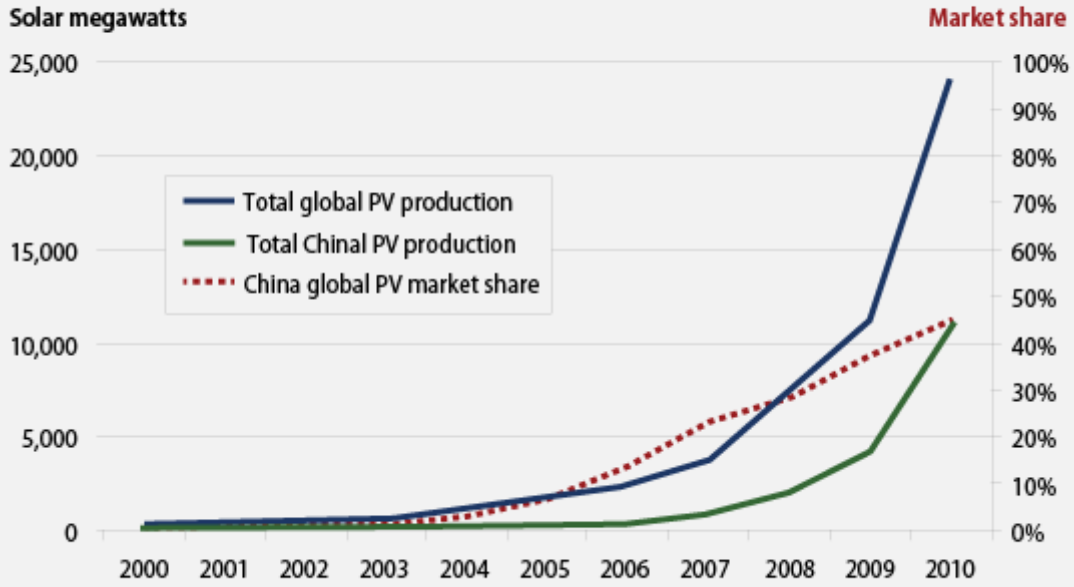
China's rapid ascent in the global solar industry provides the broad backdrop for understanding rising U.S.-China trade tensions in this sector. Chinese manufacturers entered the global solar equipment market in 2004 when demand for such products experienced a significant increase worldwide, in particular in Europe. The combination of a few factors contributed to the rapid expansion of China's solar production capacity that followed. At the lower end of the value chain, the country's low labor costs, massive supply chains as well as lax labor, safety, health, and environmental standards facilitated rapid industry growth. At the higher end, government support, including generous subsidies and other forms of support for high-technology research, development, and commercialization played an important role in propelling solar industry development.[6] In particular, the Chinese government targeted the solar panel manufacturing industry as part of its stimulus plan in the aftermath of the 2008 global financial crisis and provided considerable incentives for the industry in order to create job opportunities, ensure energy security, and preserve the environment and, as a result, private investment followed. Major Chinese solar companies such as Suntech, LDK Solar, and Yingli Solar all quickly entered the market and borrowed extensively. Growing global corporate and household demand for solar photovoltaic (PV) panels resulting from both environmental concerns and generous government subsidies in the European Union (E.U.) and the U.S. further fueled the growth in the production of renewable energy in China.

As a result of the confluence of market supply and demand conditions and the ability of Chinese enterprises to price products competitively, China had become the leading producer of solar cells in the world by 2007 and the largest producer of solar panels by 2008. Figure 1, which pre-

[6] Hart 2012.

sents China's rapid ascendance to dominance in the global solar PV market, shows that the country has been able to increase its share of the global market from just 15 percent in 2006 to almost half by 2010.[7] Its solar module manufacturing capacity further grew from less than 5 gigawatts (GW) in 2007 to a little less than 40 GW in 2011, more than double the total manufacturing capacity in the rest of the world.[8]

FIGURE 1
China's swift solar PV market dominance
Annual solar module production growth and China market share, 2000-2010



Source: Earth Policy Institute

However, it should be noted that the rapid expansion of China's solar manufacturing capacity quickly outpaced both domestic and global demand for solar module installations. Total global demand for solar module installations was only less than 5 GW in 2007, rising to about 30 GW by 2012, with the rest of the world accounting for most of this increase. China's solar module supply glut arising from the country's capacity increases driven by over-investment, thus directly threatened the viability of solar companies elsewhere in the world, leading several companies such as Q-cells and Solon in Germany and Solyndra and Evergreen Solar in the U.S. to declare bankruptcy.[9] China's swift ascendance to dominance in the global solar PV market and the competitive pressure it exerted on solar manufacturers in the U.S. thus set the stage for the U.S. trade challenges against China.

[7] Ibid.
[8] Parker 2012.
[9] Ibid.

Rising U.S.-China Tensions in Renewable Energy

China's emergence as a major player in the global clean energy industry has captured considerable external attention in recent years. The WTO dispute filed by the United States against China with regard to the country's special fund for wind power manufacturing (DS 419) provides an early indication of rising bilateral trade tensions in this sector. In December 2010, the United States requested WTO consultations with China on the grounds that certain Chinese measures providing grants, funds, or rewards to enterprises manufacturing wind power equipment were "contingent on the use of domestic over imported goods" and therefore violated Chinese commitments to the Agreement on Subsidies and Countervailing Measures ("SCM Agreement").[10] The WTO filing resulted from an investigation launched by the United States Trade Representative (USTR) under section 301 of the Trade Act of 1974 in response to a petition by the United Steelworkers (USW) against a slew of Chinese policies and practices affecting trade and investment in the clean energy technology sector, including subsidies. WTO consultations led China to quickly agree to take actions to revoke the legal measure that created the Special Fund Program in July 2011. [11]

However, China's relatively swift concessions in the wind power case by no means signaled the end of bilateral tensions in the green tech sector. In March 2012, following four months of investigations, the Commerce Department imposed countervailing duties on Chinese manufacturers of solar cells on the grounds that they had continued to receive subsidies from the Chinese government. Four months later, the United States moved to impose antidumping measures on Chinese solar panels in a separate investigation.[12] The imposition of tariffs by the United States on Chinese products in turn led Beijing to respond by launching its own investigations into six clean-energy products in five U.S. states which had allegedly received illegal support from the U.S. government, in addition to filing a WTO complaint against U.S. countervailing duties on a range of Chinese products, including solar panels.[13] The frequent use of threats as well as the actual imposition of trade restrictive measures in the green tech sector suggests that the United States has been far from successful in addressing China's alleged protectionist measures in this sector. In spite of its relative success in the wind power equipment case, Washington has had to resort to frequent threats of retaliatory trade actions in order to nudge Beijing to modify its practices. A comparison of China's record of compliance with its general obligations and commitments to the WTO's Agreement on Trade Related Investment Measures (TRIMs) in alternative energy with that in other TRIMs-related sectors such as automobiles and semiconductors further suggests that Beijing seems to have been more resistant to U.S. effort to influence its policy in the former than in the latter.[14]

[10] World Trade Organization, "DS 419: China – Measures Concerning Wind Power Equipment," http://www.wto.org/english/tratop_e/dispu_e/cases_e/ds419_e.htm. Accessed 12 April 2013.
[11] USTR 2011b.
[12] Politi and Lerner 2012.
[13] Mufson 2012.
[14] Blanchard 2013.

For example, in semiconductors, the U.S. launched its first WTO complaint (DS 309) against China regarding the preferential value-added tax (VAT) that Beijing provided to domestically produced or designed integrated circuits in 2004. Beijing quickly responded to Washington's complaint and settled the dispute during the consultation stage of the WTO dispute settlement process.[15] It also subsequently agreed to indefinitely postpone the implementation of its policy with regard to WLAN (Wireless Local Area Networks) Authentication and Privacy Infrastructure, or WAPI, in response to rising U.S. concerns about the extent to which these measures conformed to the WTO Agreement on Technical Barriers to Trade (TBT) and its national treatment requirement.[16] Overall, even though allegations of Chinese violations of its WTO commitments in semiconductors continued to exist,[17] both the number of WTO-inconsistent measures and the scope of alleged violations seem somewhat limited.

In the auto sector, China has similarly maintained a variety of protectionist measures, including high tariffs on auto imports, limited import licenses, strong localization requirements, and limits on the ability of foreign investors to hold majority stakes in joint ventures that favored the domestic auto industry over foreign manufactures, leading the U.S. to resort to WTO litigation and bilateral negotiation to try to get China to halt its problematic policies. The degree to which China responded to such pressure varied. While China eventually issued a decree to stop the implementation of relevant provisions concerning the importation of auto parts in the Automobile Industry Development Policy in the WTO auto parts case filed by the United States, Canada, the European Union, Japan, and others in 2006,[18] some of Beijing's other policies, such as the 2009 stimulus plan for the auto sector and its regulations regarding new energy vehicles, remained a considerable concern to the U.S. government and industry.

Overall, it seems reasonable to suggest that Beijing has been less responsive to U.S. pressure to alter its policies adversely affecting U.S. interests in alternative energy than in the auto and semiconductor industries. While the U.S. has exerted considerable pressure on China to end its alleged violations in renewable energy through both WTO litigation and other trade policy instruments, it continues to face an uphill battle in getting Beijing to address these concerns as a relatively large number of potentially TRIMs noncompliant policies with significant negative commercial implications for the United States remain.

Explaining the Difficulty of U.S. Pressure to Influence Chinese Policy

This section argues that the difficulty faced by the United States in attempting to bring about the desired policy changes in alternative energy can be explained by domestic dynamics in both countries. U.S. domestic divisions resulting from the underlying market structure and the Chinese

[15] Liang 2007.
[16] Cromer 2005; Lee and Oh 2006.
[17] USTR 2011a.
[18] USTR 2009; USCBC 2009.

leadership's strong desire to defend a strategic emerging industry such as renewable energy through industrial policy substantially reduced the likelihood that the United States will be able to successfully influence Chinese policy.[19] First, the market structure in renewable energy, especially in the solar industry, has given rise to coalitional dynamics in the U.S. that rendered the U.S. position less credible to the Chinese. Specifically, as Chinese manufacturers occupy the middle of the supply chain, opposition from both downstream customers of low-cost Chinese solar panels and exporters of upstream solar products has undercut the cohesion of the U.S. negotiation position. Coupled with opposition to trade restrictions by American subsidiaries of Chinese solar firms, such resistance substantially reduced the prospect that China will undertake substantial market liberalization. Second, renewable energy represents a pillar or strategic industry for Beijing whereby industrial policy is viewed as a key instrument for fostering the country's indigenous high-tech industries, promote exports, and enhance the prospect of long-term economic growth. The green tech sector's wide range of perceived benefits to the rest of the economy further enhanced the attractiveness of using industrial, trade, and technology policy to promote industrial development, thus weakening the Chinese leadership's incentives for concessions.

Market Structure and the Cohesiveness of the U.S. Position

The rapid growth of China's solar industry in the past decade has had a visible impact on the U.S. solar market by substantially increasing the attractiveness of solar energy among U.S. investors. The new investments that flowed into the solar sector in the U.S. resulted in an industry which was worth $6 billion by 2010.[20] However, it should be noted that growing trade and investment relationships between the two countries have substantially increased the dependence of some segments of the U.S. solar industry on Chinese products. Importantly, the solar value chain consists of multiple players, including both upstream players that engage in research and development, product manufacturing, and distribution as well as downstream players such as installers and companies that distribute products directly to consumers. Indeed, businesses that provide supporting equipment to solar panels such as steel structures and cables and services such as installation and maintenance comprise more than half of the solar value chain.[21] As Chinese solar products occupy the middle of the supply chain, businesses in the United States that provide the supporting equipment and services to the solar industry, in particular downstream installers who rely on low-cost solar cells and modules made in China have voiced strong concerns about the costs that increased solar panel prices would inflict on their services. In addition to the opposition from downstream installers, companies that sell solar manufacturing equipment and other upstream products have also expressed strong concerns about the tariffs due to the potential nega-

[19] For studies that emphasize the importance of the cohesion of domestic actors' position for a country's ability to successfully open foreign markets, see, for example, Odell 1993 and Evans et al. 1993.
[20] Koch 2011.
[21] Lu 2012.

tive impact that Chinese retaliation may exert on their own industries. Also joining the fray on the side of downstream installers and exporters of upstream products were American subsidiaries of Chinese solar companies who have gained increasing foothold in the U.S. market. Consequently there existed substantial divisions within the U.S. solar industry about the AD and CVD investigations over Chinese solar panels.

Importantly, U.S.-based solar manufacturers who directly compete with Chinese imports strongly supported efforts to impose trade restrictions against China. For example, solar module manufacturers such as SolarWorld Industries America, the largest manufacturer of crystalline silicon PV cells in the U.S., and Helios Solar Works alleged that the use of dumping and illegal subsidies by the Chinese government has resulted in the artificial suppression of solar panel export prices by a margin of at least 100 percent. As cheap Chinese exports played an important role in the 50 percent drop in solar panel prices in 2011 that eroded profit margins worldwide, import tariffs on Chinese products could potentially stall the price increase and increase profit margins for U.S. manufacturers, in addition to helping to create a more level playing field by allowing manufacturers from other world regions that do not provide subsidies, such as those in the European Union, to compete fairly in the U.S. market.[22] Other major U.S. producers of solar cells and panels, represented by the Coalition for American Solar Manufacturing (CASM), further attributed industry plight, including considerable cutbacks or downsizing as well as the bankruptcies of a number of American companies to the subsidies and other forms of support the Chinese government provided to the solar industry.[23]

At the opposite end of the debate were companies that design, market, and install solar panels. For example, solar-panel installers such as SunEdison, Q.Cells, and Standard Solar consistently opposed the investigation on the grounds that it would result in higher panel prices in the U.S., thus lowering rates of installation and threatening up to 60,000 jobs in the U.S. For example, Jigar Shah, founder of SunEdison stated that while the U.S. move "is a relatively positive outcome for the U.S. solar industry and its 100,000 employees, …tariffs large and small will hurt American jobs and prolong our world's reliance on fossil fuels." Similarly, the vice president of SunEdison stated that "by increasing the price of modules and therefore the price of solar energy, these tariffs will undermine the success of the U.S. solar industry and reduce the ability of solar energy to compete with electricity generated from fossil fuel."[24] The chief executive officer of Q.Cells further suggested that the issue was broader than panel prices and raised the challenge for the U.S. to "stay focused on providing reliable, predictable and sustainable energy solutions for utilities and other customers."[25] The Chinese retaliation thus threatened the interests of a significant segment of the U.S. solar industry which had benefitted from low-cost Chinese imports.[26]

[22] Hart and Gordon 2012.
[23] "U.S. Seeks Stiff Tariffs on Chinese Solar Panels," 2012.
[24] O'Tooley 2012.
[25] Carus 2012.
[26] Bradsher and Cardwell 2012.

Concerned that import tariffs would erode their profit margins, slow industry growth across the value chain, and further increase the difficulty for solar energy to compete with traditional fossil fuels, the solar-installation firms have coalesced around the Coalition for Affordable Solar Energy (CASE) to counter the claims made by solar panel manufacturers. The coalition argued that imposing high import tariffs on Chinese-made solar panels would eliminate thousands of jobs in that sector and threaten to drive the U.S. solar installation industry, which accounted for 52 percent of all U.S. solar industry jobs, out of existence.[27] In defending its claims, the CASE cited a research report prepared by the Brattle Group showing that a 50-100 percent tariff would lead to "net consumer losses" ranging from $621 million to $2.6 billion and job losses of up to 60,000 over the following three years. The likely Chinese retaliation would additionally cost 11,000 jobs within a year. Furthermore, imposing tariffs of either level would likely result in 25-30 percent increases in module prices, in addition to dampening end demand for PV systems from an estimated 4.9GW in the absence of tariffs to 3.16 to 3.35 GW.[28]

Still other companies that export solar manufacturing equipment and upstream products such as polysilicon to China sided with the installers in opposing the tariffs. These companies were concerned that trade restrictions may invite Chinese retaliation that could directly affect their exports to the Chinese market. For example, leading U.S. suppliers of polysilicon and other key solar materials such as Dow Corning Corporation and Hemlock Semiconductor Group issued a statement highlighting the impact that a potential trade war over solar module production could have on both nations' economies and on the global viability of the solar industry. According to the statement, the U.S. exported 5.6 billion in solar-related products in 2010, including approximately $400 million in net exports to China. The sharp drop in solar panel prices has not only generated significant benefits for consumers, have has also encouraged the development of large-scale photovoltaic projects that benefit both the economy and the environment. Resolving the dispute through an adversarial confrontation would therefore impede the ability of both countries to capitalize on the lower prices made possible by healthy competition between global manufacturers.[29] While far less vocal than the installers, opposition from these exporters further reinforced the arguments made by the installers, thus undermining the cohesiveness and hence credibility of the U.S. position vis-à-vis the Chinese.

Further complicating the story was China's growing investment in renewable energy in the United States. According to a World Resources Institute report, Chinese companies have made at least 124 investments in solar and wind industries in 33 countries between 2002 and 2011, especially in solar PV power plant and wind farm development. As the largest destination of these investments, the U.S. was the host of 24 solar projects and eight wind projects.[30] Favorable macroeconomic conditions, the government's policy and financial support, and industry conditions have been considered as key factors that push Chinese companies to invest abroad. China's leading so-

[27] Hart and Gordon 2012.
[28] Berkman, Cameron, and Chang 2012.
[29] "Striking Balance," 2011.
[30] Tan et al. 2013.

lar manufacturing companies such as Suntech, Trina Solar, and Yingli Solar, also its leading overseas investors. The growing presence of Chinese solar manufacturers in the U.S. market thus lent to additional dissenting voices in the solar trade dispute.

For example, Solar Energy Industries Association (SEIA), which included American subsidiaries of Chinese solar manufacturers and American companies that sell raw materials and factory equipment to Chinese makers of solar panels, weighed in on the side of the installers and exporters. One SEIA member company, Suntech Power, which was owned by China's industry giant Suntech, was thus strongly opposed to trade actions against China. As Suntech ships solar cells from China to the U.S. where the cells are bolted together in Arizona for final delivery, the company thus made strong public statements that the trade restrictions would "not only put thousands of jobs at risk," but would also "inhibit solar technology's ability to compete against traditional forms of electricity generation."[31] SEIA subsequently played a leading role in seeking a compromise solution to the solar trade dispute.

The substantial opposition to the trade action expressed by a wide range of actors in the U.S. thus undermined the credibility of the U.S. position. Indeed, following Beijing's decision to launch investigations into U.S. clean-energy projects, the chief executives of four major Chinese solar-power equipment producers reportedly stated at a news conference that they "had allies to fight Washington's allegations" as the Chinese industry is beneficial to the U.S. The Chinese manufacturers suggested that not only are U.S. companies major suppliers to the Chinese industry, American consumers also "benefit from the lower prices that result from the industry's concentration and competitiveness."[32] While the solar panel case took place outside of the WTO framework, the above discussion suggests that the Chinese did not lose sight of the dissention within the U.S. solar industry resulting from the linkages that China's inexpensive solar panel exports may have created with other parts of the U.S. solar industry. Knowledge of such fissures within American politics derived from media reports and other news outlets thus undercut Chinese leaders' willingness to align its policy with that preferred by the United States.

Renewable Energy as a Strategic Emerging Industry in China

Not only did divisions within the U.S. solar industry undercut the credibility of the U.S. position, the fact that renewable energy is considered to be one of the "strategic emerging industries" with significant implications for the country's long-term economic growth reinforced such domestic division and substantially reduced Beijing's willingness to make the desired policy concessions.
As in many other countries where public policy plays an indispensable role in shaping solar industry development, the Chinese government has proactively promoted the development of the solar industry. Chinese leaders saw renewable energy as a critical strategic opportunity not only because of the energy bottlenecks they faced at home, but also because the U.S. is lagging behind

[31] Bradsher 2011.
[32] Areddy and Ma 2012.

in renewable energy development. Central government support was seen as crucial for China to close the relatively narrow gap in this sector, claim its spot as the next global technology leader, and to realize the long-term goal of transitioning from a low-cost manufacturer to an economy led by higher-value-added technological innovation.[33] The continued reduction in the cost of solar-generated electricity in comparison with the rising costs of fossil fuel, the greater sustainability of solar energy, and solar energy' marginal impact on the environment further increased the attractiveness of solar energy for China's future economic growth and reinforced the need for government support. In view of the strategic importance of the solar industry, the Chinese government has adopted several key policy instruments to promote solar industry development, including technology transfer requirements, local content demands, the provisions of readily available credit at low interest rates, tax incentives, low rates for land and raw materials, guaranteed price mechanisms for solar projects, and rebates on tax and interest.[34]

The 2006 Renewable Energy Law (REL) and the 12th Five-Year Plan (FYP) set up the basic framework for renewable energy development in China. Passed in 2005, the REL established the State Council as the key agency responsible for managing renewable energy development, spelled out the key objective of in-country power generation, required grid enterprises to purchase renewable energy power generated within their grid and to provide grid connections, and provided the basic framework for tax incentives and financial subsidies.[35]

Under the REL, China established a feed-in-tariff, set conditions for participating in renewable energy projects, and identified priority geographic areas. Pursuant to the REL, the National Development and Reform Commission (NDRC) established the Renewable Energy Development fund in 2006 which offered grants and subsidies for PV projects and for research and development. [36] The 2009 revision to the REL further established a guarantee that all renewable energy-based electricity would be "subjected to purchases" by electricity utilities.[37]

The 12th five-year plan unveiled in 2011 further identified alternative energy as one of seven key "strategic emerging" industries that would offer the most optimum market environments for the country's indigenous innovation program. The plan also set the goal of expanding the share of non-fossil fuels in China's total energy consumption to 11.4 percent by 2015 and 15 percent by 2020.[38]

China's 12th Five-Year Plan for the Solar Photovoltaic Industry (i.e., the "Solar 12th FYP"), issued in February 2012, more specifically spelled out the goals of solar power industry development in the 2011-2015 period. In particular, the plan emphasized the need to promote industry development in order to "guarantee energy supply, establish a low-carbon society, promote economic restructuring, and foster strategic emerging industries."[39] To accomplish these objectives,

[33] USCC 2010; Hart 2011.
[34] USCBC 2006.
[35] ECJRC 2011; Su, Hui, and Tsen 2010.
[36] Solangi et al. 2011.
[37] Ibid.
[38] USCC 2010.
[39] "12th Five-Year Plan for the Solar Photovoltaic Industry," 2011.

the plan preserved considerable discretion for the Chinese government and allowed it to intervene extensively in the operations of individual solar companies through industrial plans and other policy directives.[40] It also called for substantial government subsidies to support a strategic emerging industry such as solar. The amount of money to be invested in the seven strategic industries over the five-year period reportedly amounted to more than $1.5 trillion.[41]

In addition, the solar 12th FYP set out the goal of further internationalizing the solar industry as part of China's "going abroad" strategy, emphasized the need to promote and support national champions, and provided the Chinese government with considerable authority over various aspects of solar industry development.[42]

The Golden Sun program, unveiled in 2009 to spearhead the construction of solar farms, provides a good illustration of the generous subsidies provided by the government to the solar industry. Under the program, the Chinese government would pay for half of solar-farm developers' costs based not so much on how much electricity a solar farm produces but on how much a developer spends on a solar farm. In December 2012, the government announced a second phase of the program aimed at installing a total of 2.835 GW of solar projects across the country.[43]

Overall, even though government support has resulted in considerable irrationalities,[44] the wide range of public policies initiated by the Chinese government, including loans, direct subsidies, tax rebates, land grants, and support for research and development made possible by the 2006 REL and the 12th Five-Year Plan constituted a significant driving force behind rapid industry expansion. Central government support, coupled with the solar industry's potentially important role in generating a high rate of return and hence in boosting the local economy, further led many local governments to follow suit by targeting the solar industry for support during the 12th five-year plan. Indeed, provincial officials across the country offered tax breaks and subsidies in a competitive drive to attract investment and develop solar manufacturing parks. For example, the city of Wuxi, home to the solar giant Suntech, has invested so heavily in solar farms that it quickly became a major center of solar manufacturing in China. Suntech, in particular, has undergone such rapid expansion in a short span of a few years that the company has not only gone public on the New York Stock Exchange in 2005, but has also surpassed Japan's Sharp Corp. to become the world's largest solar panel maker, spurring public offerings by other Chinese solar firms. The euphoria surrounding China's solar manufacturing boom in the early years of the industry's expansion generated a "herd effect," prompting local officials and big banks to continue to inject easy credit into the industry, fueling further industry expansion.[45]

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[40] "Summary of China's 12th Five-Year Plans Relating to the Solar Industry," 2012.
[41] Lim and Rabinovitch 2010.
[42] "Summary of China's 12th Five-Year Plans Relating to the Solar Industry," 2012.
[43] Feng 2012.
[44] For example, instead of encouraging developers to adopt the most efficient technology or to pick the most cost-effective sites, the easy credit available under the Golden Sun program has led to considerable inefficiency.
Some solar developers reportedly built solar farms, pocketed the subsidies, and then removed the solar panels and installed them elsewhere. Ball 2013.
[45] Ibid.

It should be acknowledged that even though government support played an important role in promoting the development of the solar sector, certain market dynamics inherent to the industry were indispensible to the rapid industry expansion. According to interviews with officials at the China PV Industry Alliance (CPIA), the fact that the industry was dominated by non-state enterprises meant that barriers to entry were relatively low. In addition, the heavy subsidies provided by the U.S. and the E.U. to the solar industry between 2005 and 2007 resulted in high profit margins that allowed the industry to attract a relatively large number of new entrants. In other words, government support alone would not have been able to successfully alter market outcomes in the absence of market forces conducive to rapid expansion.[46]

Rapid Expansion of the Chinese Solar Industry Leading to Overcapacity, Sluggish Domestic Demand, and Excessive Reliance on the Export Market

Regardless of the relative weight of the government versus that of market forces in shaping the course of solar industry development, the combination of such forces, fueled by the anticipation of future robust growth, has helped to provide a favorable environment for industry growth. Significant increases in China's solar supply capacities further coincided with rising global demand for solar energy. Between 2000 and 2010, total installed capacity increased from 1.5 GW to 39.5 GW globally, with Europe, the United States, and Japan accounting for 81, 7, and 7 percent of global demand for solar PV modules, respectively.[47]

As a result of both over-investment and rising global demands, China had taken over the United States as the most attractive country for renewable energy investment in 2010.[48] Its installed renewable energy capacity also exceeded that of the U.S. in the same year. The fact that the technology necessary for solar manufacturing was relatively mature and that Chinese enterprises were able to purchase equipment from major manufacturers have also contributed to China's rapid inroad into the global market.

However, the rapid expansion of China's solar industry has also resulted in considerable negative externalities such as overcapacity and excessive reliance on the overseas export market. In many ways the solar industry demonstrates the familiar pattern of government support leading to overcapacity, a pattern that similarly exhibits itself in other industries such as steel, aluminum, and coal.[49] As Louis Schwartz, president of China Strategies LLC, a China trade and investment consulting firm based in Pittsburgh, explained, "This is just the latest example of a long list of industries that have run through these peaks and valleys…. It starts with government incentives. In an incredibly short period, [the industry] develops enormous capacity, helped in large measure by the banking system, and the desire of towns, villages or provinces to foster a new industry for em-

[46] Author's interview with CPIA officials, August 2013.
[47] Stone 2011.
[48] Perkowski 2012.
[49] Song 2013.

ployment purposes. Once they get started, they have a hard time stopping."[50] Indeed, the country's major solar panel producers, including Yingli Solar, Trina Solar Ltd., and LDK Solar, all pushed for the expansion of production capacities in order to increase market shares. Suntech, for example, was able to increase its production capacity from 400 megawatts (MW) in 2007 to 1,800 MW in 2010, with the figure soaring to 2,400MW in 2012.[51]

Importantly, the dramatic expansion of the solar industry's production capacity quickly outpaced both global and domestic demand. In 2010, China's PV production capacity amounted to roughly half of global production capacity. However, the domestic installed capacity was only 400MW, which was only 2 percent of the total world installed capacity and less than 5 percent of the domestic solar cell production capacity. In 2011 the global installed PV capacity was about 20GW. However, the supply of China's solar cells in 2010 alone exceeded that figure.[52] Consequently, a significant gap existed between China's production and installation capacity.[53] In particular, the significant price differentials between solar-generated electricity and conventional electricity and the lack of sufficient power grids significantly constrained the development of the domestic market.

As a result of overcapacity and sluggish domestic demand, low-cost Chinese PV products quickly found their way onto the international market and created considerable competitive pressure on international companies, leading many companies such as Solyndra, EvergreenSolar, and SpectraWatt to declare bankruptcy. The skyrocketing global panel production resulting from the entry of Chinese firms additionally caused prices to plunge in the global market. Between 2009 and 2011, as Chinese production of solar panels quadrupled, panel prices dropped by 40 percent, which in turn led to a sharp decline in Chinese exports. According to the CPIA, in 2012 orders for Chinese PV equipment dropped by 80 percent compared to the previous year.[54] Furthermore, in light of the lower panel prices, European governments scaled back their solar subsidies on the ground that they would no longer need to give away so much money. These subsidy cuts eroded investors' interests in building solar farms, further undercutting solar-panel makers' profit margins.

The plummeting global demand further led to a spate of bankruptcies by Chinese firms and contributed to the solar industry's considerable financial problems. The number of Chinese PV enterprises also decreased by more than half, from 262 in 2011 to 112 in 2012. By 2012 up to 90 percent of Chinese poly-silicon makers had halted production and 80 percent of Chinese solar panel producers were either shut down or had to sharply reduce output.[55] According to Yuanta, a Taiwanese financial firm, China's 10 largest solar-panel companies had a cumulative debt of $27.7 billion as of 2012. Their average debt ratio, or the share of debt in total assets, reached an alarming level of 75.8 percent. Global overcapacity and the fierce price war even led Suntech, once one of China's four largest solar module makers, to declare bankruptcy after defaulting on a $541 mil-

[50] Ibid.
[51] "Suntech's Fall Rings Alarm Bell for China's Solar Industry," 2013.
[52] Wang 2011.
[53] Ibid.
[54] Ball 2013.
[55] "Suntech's Fall Rings Alarm Bell for China's Solar Industry," 2013.

lion bond payment in 2013.[56] Soon after Suntech declared bankruptcy, the Bank of China reported that 21 percent of its solar loans were "nonperforming" or near default and that it had set aside only enough money to cover 11 percent of the bad loans. However, even as more than half of the PV enterprises have exited the market, China's PV generation capacity still reached 45 GW, or 700 percent of the 2009 level.[57]

Chinese Government Response to the Solar Dispute

The competitive threat that China's solar manufacturing posed to the U.S. industry thus led the U.S. to impose both countervailing and antidumping duties on Chinese solar panels in 2012. It should be noted though that the Chinese government response to the foreign challenge was characterized by continued support in an effort to bolster the industry and enhance its long-term sustainability, even though past government support to the solar industry has generated considerable negative externalities and contributed to the industry's domestic plight. Instead of abandoning an industry exhibiting the paradoxes of government support, Beijing has adopted a number of measures in order to help the companies stay afloat.

Domestically, the Chinese government resorted to policies that would help to bolster the solar power market. For example, it set a major goal of expanding the solar energy market in order to boost domestic demand for solar-generated electricity. As a result of this initiative, the newly installed capacity of energy generated by solar panels in China surged from 0.45 GW in 2010 to 4.5 GW in 2011. The government also set the target of creating a 10 GW domestic market in 2012.[58] In addition, efforts were undertaken to alleviate bureaucratic red tape in an effort to encourage growth. The State Grid announced a so-called "Welcome, Support, and Service" initiative that involved not issuing any charges for eligible distributed PV projects in order to reduce system costs.

At a State Council executive meeting in December 2012, the government identified excessive reliance on overseas markets and lack of sufficient domestic demand as key hurdles to future industry development and came up with five policies designed to further promote the development of the solar industry, including accelerating the adjustment of industry structure and technological development; consolidating order in the industry; actively promoting the development of the domestic market for the application of solar and PV products; improving supporting policies and market mechanism; and scaling back government intervention and prohibiting local protectionism. Specifically, the policy encouraged mergers and acquisitions, provided for preferential tax treatment, increased the level of subsidies for the industry, and proposed the use of distributed PV generation based on capacity in order to expand the domestic market.[59]

[56] Ibid.
[57] "Zhongguo Guangfu Chanye, Haineng Yinglai Chuntian Ma?" 2013.
[58] Michelsen 2012.
[59] "PV Industry "Five Major Policies' to be Implemented," 2013.

It is important to note that while the policies emphasized the need to encourage market mechanisms, they also preserved a key role for the government in shaping industry development. According to Shijiang Wang of the CPIA Secretariat, given the relatively high cost of solar-generated electricity, the PV industry is still at an infant industry that needs considerable government support and promotion. The high production costs also need to be addressed through multiple mechanisms, including government subsidy, the long-term support of banking institutions and insurance companies, and the industry's internal development. CIPA General Secretary Bohua Wang further suggested that the development of the PV industry depends on both "market expansion" and "cost reduction," a process that involves both the filtering out of uncompetitive enterprises on the basis of market competition *and* the creation of compensation mechanisms that defray the high cost of PV production and increase the affordability of PV products on the domestic market.[60] In other words, while the government realized the need to enhance the competitiveness of the solar industry through consolidation, the closure of small panel producers, and the reduction of subsidies and loans, government support remained important in promoting the development of the domestic market and the reduction of the risk of the industry as a whole.

A series of government policies adopted in the aftermath of the trade disputes between China and the European Union in 2013 further underscore the importance of continued government involvement in shaping the dynamics of industry development. In order to boost domestic demand for solar-generated electricity, the government encouraged grid companies to build solar-friendly networks and give priority access to solar-generated power. It also emphasized the need for lenders to help solar manufacturers raise capital and encouraged mergers and acquisitions among solar companies.[61] The Ministry of Industry and Information Technology (MIIT) played a leading role in promoting the application of solar energy in rural areas. Efforts were also undertaken to increase domestic demand for solar energy through initiatives such as the creation of a distributed PV power generation system and the establishment of model jurisdictions such as the National Renewable Energy Model City, Green Energy Model Country, and Solar Energy Model Village.[62]

The continuation of the government's central role in solar industry development thus reduced the room for concessions when China's practices were challenged by its key trading partners. As the government sought to protect an industry with the potential of generating considerable revenue and given the extent of existing government involvement, it was perhaps not surprising that China made few concessions in response to U.S. market opening pressure.

To be sure, renewable energy is similar to other sectors such as automobiles or semiconductors in which the U.S. has substantial concerns with China's TRIMs non-compliant policies in that these industries are pillar industries for which industrial policy is considered as a key instrument for fostering competitiveness. However, it seems reasonable to suggest that the benefits of defending the problematic practices may outweigh the potential reputational and economic costs

[60] "Zhongguo Guangfu Chanye, Haineng Yinglai Chuntian Ma?" 2013.
[61] "China to Boost Its Solar Industry," 2013.
[62] "Overcapacity in China's PV Industry; MIIT Lead in Expanding Domestic Demand," 2013.

of foreign retaliation against non-compliance in alternative energy than in other sectors. As China attempts to shift away from coal-based energy production, development of a viable green technology industry could help to address the country's severe environmental degradation, reduce its dependence on foreign energy, create new export opportunities, and propel the country's movement along the value-added chain.[63] In comparison, China's growing technological capabilities in industries with a relatively longer history of development such as semiconductors and the perceived narrower range of benefits of the chip sector for the rest of the economy may have moderated the need for China to act aggressively in this sector. Consequently, even though failure to alter the alleged protectionist policies may invite foreign retaliation and deter foreign investment, such costs seem to pale in comparison with the potential benefits that could be derived from developing a vibrant green tech sector capable of competing in the international market. The need to foster domestic production capacities and technology competency in the renewable energy industry which is critical to overall economic growth and national security thus undermined incentives in favor of change. The dominant role of the National Development and Reform Commission (NDRC) in energy and environmental policymaking and the greater responsiveness of firms to provincial, rather than to the central government[64] further enhanced the ability of the central government to influence policy direction in a way that is consistent with the country's long-term economic interests.

Conclusion

The above analysis underscores the importance of domestic politics for understanding why solar products have repeatedly emerged as a major point of contention in U.S. trade relations with China. Despite the widely recognized importance of renewable energy for the sustainable growth of the U.S. economy and the intense pressure it exerted on Beijing, Washington has nevertheless managed to secure few concessions from the Chinese. Domestic opposition from downstream users of solar panels, exporters of upstream solar products to China, as well as American subsidiaries of Chinese solar companies, combined with Beijing's strong defense of a strategic emerging industry, has reduced the degree to which Beijing can effectively address Washington's policy concerns.

The role of the Chinese government in fostering the development of the solar industry described in this paper raises important questions about the relative role of the government versus that of the market in the development of a strategic industry in an emerging economy such as China. Beijing's support for the solar industry illustrates how government intervention in strategic industries may well generate market distortions leading to major trade frictions. How to effectively balance the role of the government and the market to prevent market irrationalities from

[63] Yue 2011; Blanchard 2013.
[64] Louche et al. 2007.

spilling over to China's foreign trade relations could therefore present a major challenge to the Chinese government.

In addition, the above analysis highlights the challenge China faces in balancing its internal and external demand. The solar industry has demonstrated a high degree of reliance on export markets and foreign technology during the course of its development, a pattern that is consistent with the export-oriented growth strategy that underlies China's phenomenal economic growth in the past three decades. However, as excessive reliance on overseas markets could generate heightened tensions in China's foreign trade relations, as the U.S.-China trade disputes illustrate, it may be important for the Chinese government to cultivate its domestic market and to search for effective policy tools that would ensure the sustainable development of strategic emerging industries. Such a shift would also be consistent with China's attempt to re-orient itself toward a model of economic development based on domestic consumption in the aftermath of the 2008 global financial crisis.

Finally, the industry dynamics described in this paper have substantial implications for understanding the trade disputes that flared up between China and the E.U. over PV products in 2013. Just as in the U.S.-China solar disputes, global overcapacity resulting from the rapid expansion of the Chinese PV industry generated heightened tensions in E.U.-China trade relations. If the argument about the influence of domestic politics on U.S.-China trade relations described in this paper is valid, then we should expect the fragmentation of the solar industry in the E.U. resulting not only from the global integration of solar manufacturing but also the divergent policy preferences among E.U. member states[65], along with the Chinese government's continued support for the solar industry, to preclude an easy compromise solution to the dispute.[66] ■

[65] For example, Germany and Britain have expressed concerns that the E.U.-China trade spat over solar PV could jeopardize ties with E.U.'s second largest trading partner. "EU, China near deal to defuse solar PV spat," 2013.
[66] For discussions of E.U. industries' ongoing concerns with China's solar policies in spite of the settlement. agreement reached in July 2013, see, for example, Neidlein and Meza 2013.

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