

# Supply Chain Resilience and the Innovation Challenge

**Yasuyuki Todo**, is a professor in the Graduate School of Economics and Faculty of Political Science and Economics at Waseda University



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## Summary:

Supply chain resilience is at the heart of economic security in the face of pandemic disruptions and the threat China poses to national security for both the United States and Japan. Both Tokyo and Washington have pursued “onshoring,” or the boosting of domestic production capabilities and supply chains, to offset dependence upon vulnerable supply chains overseas. Yet, dependence upon Chinese goods remains high, particularly for Japan.

Onshoring alone is insufficient to reduce dependence upon Chinese supply chains, and “friendshoring,” or the relocating of manufacturing and supply chains to friendly allies and partners in emerging markets must be part of the policy conversation on economic security. Often referred to as a “China plus one” strategy, expanding supply chains amongst countries with minimal security concerns will reduce risks and dependence upon China. Looking beyond manufacturing, Japan and the United States should also embrace international research collaboration on technology, or “knowledge friendshoring.”

Economic security requires balancing national security concerns and economic growth. Reducing risks likely necessitates expanding domestic production alongside efforts to diversify supply chains abroad, both in traditional sectors and the knowledge economy.

## Policy recommendations:

- Economic security requires balancing national security needs and economic growth across a wide variety of governments, private sector actors, and stakeholders. Securing supply chains will require Tokyo and Washington to look both at home and abroad.
- Japan and the United States should leverage multilateral frameworks (for example, the G7, IPEF, and SCRI) to invest in friendshoring to diversify supply chains and offset dependence upon China.
- “Knowledge friendshoring” can enhance international research collaboration and accelerate the development of technologies crucial for maintaining a competitive edge.

In recent years, the United States and its allies, including Japan and several European countries, have implemented policies aimed at derisking the supply chains of critical products from China due to national security concerns, particularly semiconductors. These policies involve incentivizing domestic production (onshoring) and imposing restrictions on international trade, technology transfers, and investments with China.

## Effects of decoupling policies

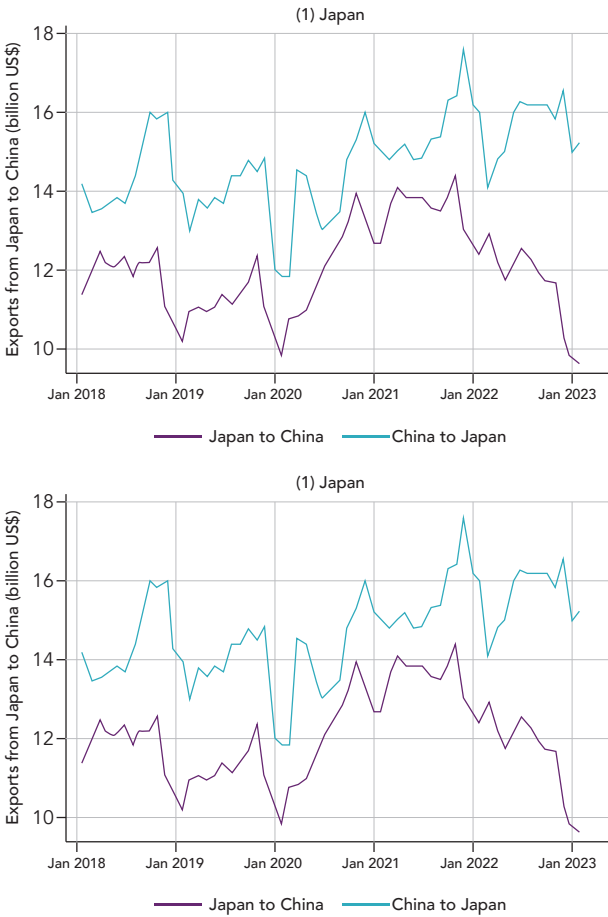
In Japan, the government has implemented various strategies to enhance supply chain resilience. Firstly, in 2019 and 2020, the government strengthened export controls and imposed restrictions on foreign direct investment (FDI) in high-tech sectors. Secondly, since 2019, Japan provided subsidies to Japanese companies (beyond just semiconductor firms) for onshoring investments within the domestic market, as well as for diversifying production facilities in ASEAN countries.<sup>60</sup> Thirdly, the 2022 Economic Security Promotion Act enables producers of critical products, such as semiconductors and batteries, to receive subsidies and preferential loans by sharing procurement plans and inventory information with the government.<sup>61</sup> Fourthly, substantial subsidies, amounting to 620 billion yen, were recently granted to attract Taiwan's leading semiconductor firm, TSMC, to Kumamoto and to facilitate the expansion of plants for Kioxia and Western Digital in Mie, and Micron Memory Japan in Hiroshima.<sup>62</sup> Lastly, a subsidy of 70 billion yen was provided to Rapidus, a newly established semiconductor firm, to establish a production plant in Hokkaido and advance the development and production of next-generation semiconductors.<sup>63</sup>

In response to these economic security policies, China has also tightened controls on exports and technology transfers of sensitive products since 2020.<sup>64</sup> Additionally, the Chinese government has offered significant subsidies to its high-tech sectors, with 40 billion RMB (\$6 billion US dollars) in 2015 and 100 billion RMB (15 billion US dollars) in 2020, as reported by METI.<sup>65</sup> These measures were implemented even prior to the US-China decoupling period.

Despite of these decoupling policies, overall trade volumes between Japan and China and between the United States and China, have not experienced significant declines, particularly when compared to the pre-COVID-19 period (Figure 1). An exception is the decline in monthly exports from Japan to China, which

decreased from a peak of 14 billion dollars in October 2021 to 10 billion dollars in February 2023. However, it is important to note that this sharp decline may be temporary or influenced by exchange rate fluctuations. Trade data from Japan’s Ministry of Finance reveals that exports from Japan to China in March 2023 amounted to 1.55 trillion yen, a figure comparable to 1.68 trillion yen in March 2022 and 1.63 trillion yen in March 2021.

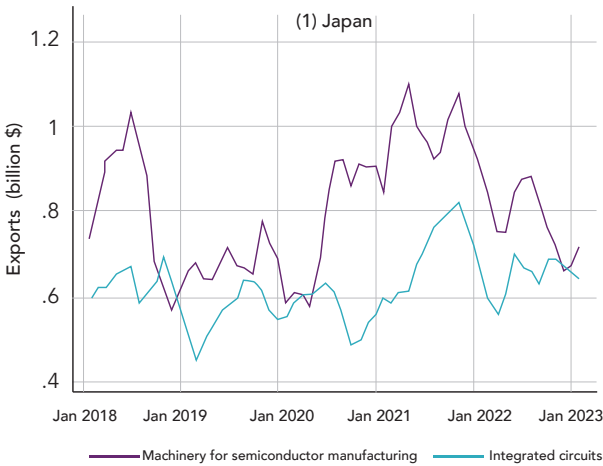
**Figure 1: Trade of Japan and the United States with China**

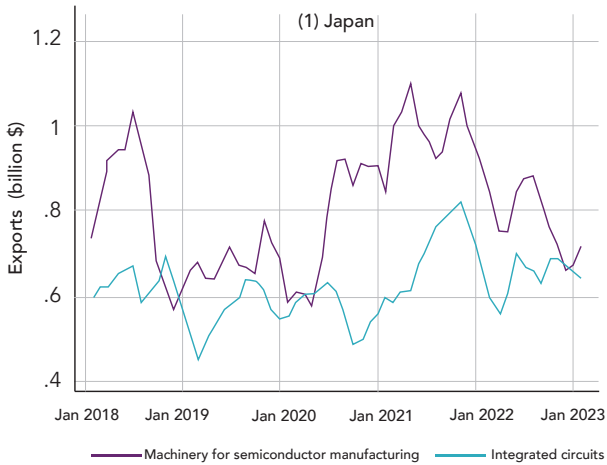


Source: UN Comtrade. Note: 3-month moving averages are shown.

Trade of semiconductor-related products have been affected more than overall trade. Figure 2 illustrates a significant decline in exports of machinery for semiconductor manufacturing and integrated circuits from the United States to China since early 2021. Similarly, Japan semiconductor manufacturing machinery exports fell, while exports of integrated circuits have remained stable. This stability may be attributed to the fact that Japan’s integrated circuits are predominantly of standard quality, making them less subject to heavy restrictions compared to state-of-the-art versions.

**Figure 2: Exports of Semiconductor-related Products from Japan and the United States to China**





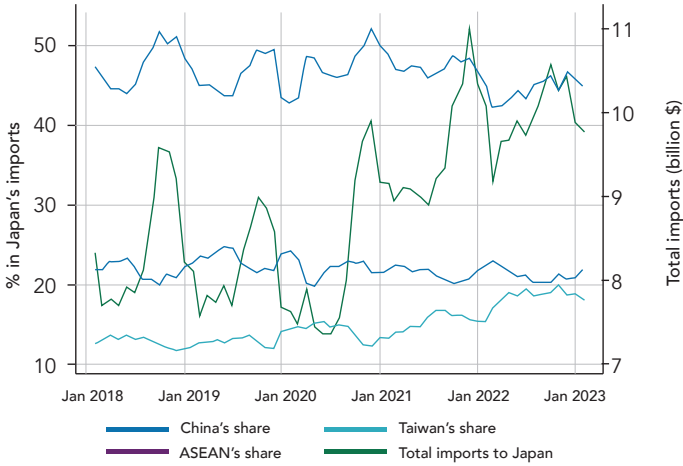
Source: UN Comtrade. Notes: 3-month moving averages of exports of HS codes 8486 and 8542 are shown.

These figures demonstrate the successful implementation of export restrictions on sensitive products to China for national security reasons while overall trade with China remains steady. Both Japan and the United States have effectively balanced their national security concerns with their economic interests, achieving a state of partial decoupling that avoids complete separation, which would be detrimental to both objectives.

## Heavy Reliance on China in Supply Chains

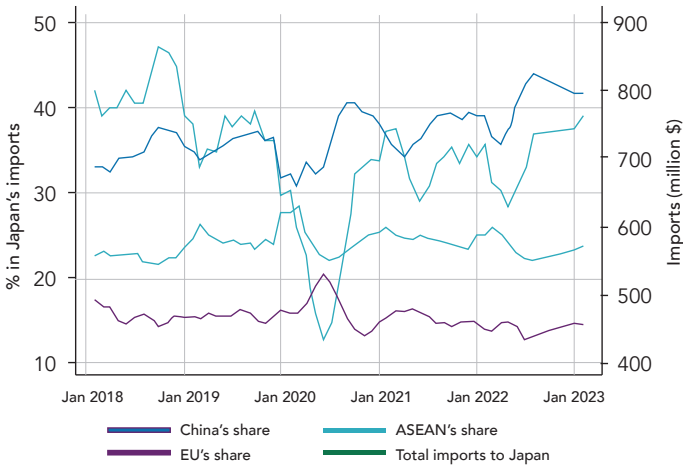
However, a significant challenge persists in trade with China, namely the heavy dependence on China as a supplier of materials and parts. This issue is particularly critical for Japan, where China accounts for 45 percent of imports of electrical machinery and electronic devices, as well as 42 percent of automobile parts imports (Figures 3-4). Moreover, the share of China in auto parts imports is not decreasing over time. Rather, it is exhibiting an increasing trend (Figure 4).

**Figure 3: Japan's imports of electrical machinery and electronic devices**



Source: UN Comtrade. Notes: 3-month moving averages of imports of HS code 85 are shown.

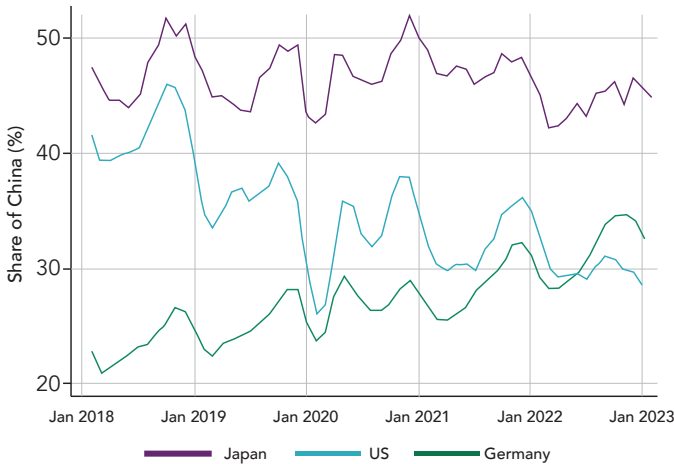
**Figure 4: Japan's imports of automobile parts**



Source: UN Comtrade. Notes: 3-month moving averages of exports of HS codes 8705, 8706, 8707, 8708, 870990, and 8714 are shown.

By contrast, the United States has made substantial strides in reducing its reliance on China for imports of electrical machinery and electronic devices since the onset of the US-China trade conflict in 2018 (Figure 5). While the share of China in imports was similar for both countries in 2018, it currently differs by 15 percentage points. Figure 5 also demonstrates that the reliance of Germany on China has significantly and consistently increased since 2018 and currently surpasses the level of the United States.

**Figure 5: Share of China in imports of electrical machinery and electronic devices for selected countries**



*Source: UN Comtrade. Notes: 3-month moving averages of the share of China in imports of HS code 85 are shown.*

The heavy dependence of Japan's supply chains on China entails significant economic risks. Should imports from China diminish due to national security concerns, including during a possible Chinese invasion of Taiwan, the resultant economic losses would extend beyond the mere value of those imports. Disruptions in the inflow of materials and parts would precipitate declines in the production levels of downstream companies, thereby amplifying the adverse effects throughout the entire supply chain.

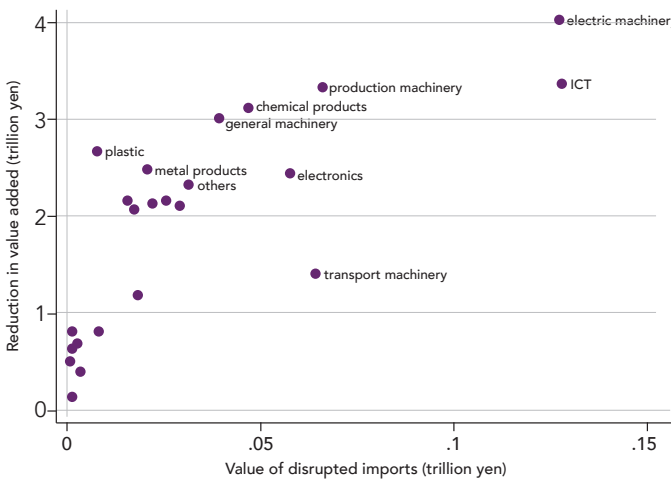
Together with Hiroyasu Inoue of the University of Hyogo, I conducted a simulation to assess the impact of import disruptions from China on Japan's



production. This analysis utilized data encompassing over one million firms and more than four million supply-chain relationships.<sup>66</sup> The findings revealed that if 80 percent of imports from China were disrupted for a two-month period, Japan's value-added production would decrease by roughly 13 trillion yen, despite the disrupted imports amounting to approximately 1.4 trillion yen. This decrease represents approximately 15 percent of value-added production over the same two-month period. In essence, the reduction in value-added production would be nearly ten times greater than the value of the disrupted imports.

Furthermore, our simulation examined the repercussions of import disruptions across specific sectors, as depicted in Figure 4. It becomes evident that the impact of import disruptions on the electrical and information and communication equipment industries is particularly substantial. However, even in sectors such as machinery, metal products, chemicals, and plastics, where the value of disrupted imports is relatively small, the disruptions would still engender notable declines in production. This is primarily due to the utilization of imported materials and parts in the upstream segments of Japan's domestic supply chains. Consequently, when upstream materials and parts become unavailable, a larger number of downstream companies are adversely affected, leading to a more pronounced overall economic loss.

**Figure 6: Effect of disruption of imports from China to each industry in Japan on Japan's value added production**



Source: Inoue and Todo (2022). Note: This figure shows simulation results assuming disruption of imports from China to each sector shown by each dot by 80 percent for two months.

## Limitations of onshoring

To address the adverse effects of import disruptions from China arising from national security concerns, it is imperative to strategically reduce heavy dependence on China.

One viable approach is the promotion and attraction of domestic manufacturing facilities, commonly known as onshoring. Presently, countries such as the United States, Japan, and European nations are implementing policies to incentivize onshoring, which is essential for enhancing the resilience of supply chains. Furthermore, onshoring holds the potential to invigorate and rejuvenate the domestic economy. For instance, substantial subsidies have been allocated to attract TSMC's plant to Japan, leading to the formation of industrial clusters in proximity to the facility, comprising semiconductor user firms, material suppliers, parts manufacturers, and machinery producers. If these clusters foster technological advancements through knowledge sharing within the region, the subsidies will yield significant economic benefits.

Nonetheless, it is crucial for both the government and private sector to acknowledge the limitations of onshoring. Firms expand their operations overseas primarily to achieve production efficiency,<sup>67</sup> and therefore, an excessive emphasis on onshoring could undermine the efficiency and international competitiveness of domestic firms. Notably, Japan has witnessed a rapid increase in imports of electrical and electronic products (Figure 3), making it impractical to substantially replace these imports with domestic production.

Furthermore, industrial policies that provide subsidies to specific industries do not guarantee success. Even in the case of China, often cited as a successful example of industrial policy, productivity improvements resulting from such policies were observed only when competition within the industry was maintained.<sup>68</sup> Therefore, for the current industrial policies of the United States, Japan, and European countries to succeed, it is crucial to implement them while fostering competition instead of resorting to protectionism.

Moreover, there are inherent risks associated with disruptions in domestic supply chains. Japan and the United States, in particular, are susceptible to natural disasters that can significantly disrupt domestic supply chains. For example, predictions indicate that severe disasters, such as the Nankai Trough earthquake,

the Tokyo metropolitan earthquake, and the eruption of Mount Fuji, could cause substantial damage to Japan's industrial clusters in the near future. Consequently, an excessive concentration of production facilities domestically poses significant risks that must be duly considered.

## Risk mitigation through friendshoring

Therefore, to reduce dependence on China and mitigate the negative impacts of import disruptions, it is crucial, in addition to facilitate onshoring, to expand supply chains among countries with minimal security concerns. This strategy, known as friendshoring, involves diversifying production plants and procuring materials and parts from diverse sources in friendly countries. By doing so, even if supply chains are disrupted due to national security issues, it would be relatively easy to find alternative sources and mitigate the impact.

The importance of diversification in supply chain resilience is supported by various studies. For instance, a study examined the propagation of the economic impact of Hurricane Sandy through supply chains.<sup>69</sup> It found that firms connected to overseas firms in addition to firms in the affected region experienced smaller reductions in post-disaster sales than those connected to only directly affected firms. Similarly, another study analyzed firm-level data from ASEAN countries and India during the COVID-19 pandemic and discovered that firms with major suppliers in multiple countries exhibited greater resilience compared to those reliant on a single country.<sup>70</sup>

Recognizing the benefits of diversification, the private sector has taken measures to enhance supply chain resilience. Following the Great East Japan earthquake, which caused significant disruptions, Japan's automotive industry standardized parts and diversified its suppliers. This enabled the industry to minimize the impact of subsequent events such as the Kumamoto earthquake and the COVID-19 pandemic.<sup>71</sup> Currently, Japanese firms are actively pursuing not only onshoring but also diversification of production plants. According to a survey conducted by the Nikkei Newspaper in November 2022, 50 percent of Japan's top 100 manufacturing companies indicated a reduction in reliance on China, with Japan (86 percent), Thailand (76 percent), and Vietnam (72 percent) being mentioned as alternative destinations.<sup>72</sup>

Diversifying supply chains incurs costs for the private sector, such as information costs associated with finding suitable partners abroad.<sup>73</sup> However, the rising risks of dependence on China have made a China Plus One strategy, which involves maintaining production plants and procurement sources in at least one country other than China, cost-effective.

Figures 3 and 4 indicate that the share of imports of electrical and electronic products and automobile parts from ASEAN countries—strong candidates for the China Plus One strategy—to Japan has remained stagnant, suggesting room for expansion. However, diversification targets should not be limited to emerging economies, such as ASEAN countries for Japan, Latin America for the United States, and East Europe for Western Europe. Given the promotion of onshoring in Japan, the United States, and Europe, as well as the declining share of wages in total production costs due to robotics and ICT, strengthening supply chains among these advanced regions has become an important strategy. Moreover, less developed countries in South Asia, notably India, and Sub-Saharan Africa should also be targeted as linkages with the Global South have become crucial to both economic interests and national security.

To facilitate the diversification of supply chain partners through friendshoring, policies are necessary to address the externality caused by information spillovers. Even when firms obtain information on overseas partners on their own costs, it may spill over to other firms, reducing incentives to information collection in the market economy. Therefore, governments should provide public support for sharing information about foreign markets and facilitating business matching between domestic and foreign companies through export and investment promotion agencies, such as the Japan External Trade Organization (JETRO), which has proven to be effective.<sup>74</sup>

Furthermore, to accurately identify suitable countries for friendshoring, it is recommended to leverage existing multilateral frameworks such as the Group of Seven (G7), the Indo-Pacific Economic Framework (IPEF), and the Supply Chain Resilience Initiative (SCRI) involving Australia, India, and Japan. These frameworks can facilitate information sharing and business matching among countries. Notably, the previous G7 Summit held in Hiroshima, Japan marked a historic moment as supply chain resilience was discussed for the first time in the summits. Moreover, the participation of many non-G7 countries from the Global

South, such as India, Indonesia, and Brazil, in the previous G7 Summit strengthened their economic and political ties with the G7 that may be helpful to expand friendshoring. It is crucial to effectively utilize such multilateral frameworks to further promote friendshoring. Specifically, the G7 countries should foster win-win scenarios with the Global South by offering trade opportunities, as well as financial and technical support for innovation and infrastructure development within these frameworks.

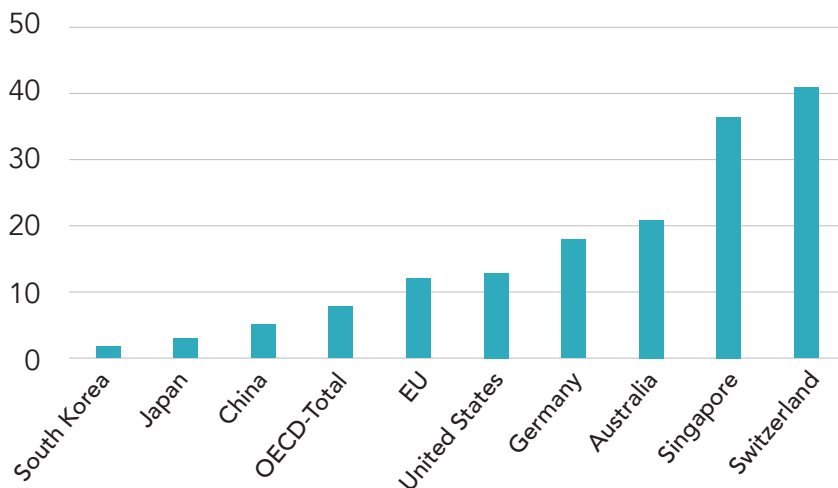
## Benefits of Knowledge Friendshoring

In order to enhance the robustness and resilience of supply chains, it is critical to elevate the level of technology. When the supply of a specific input, which is difficult to substitute, faces disruption, firms downstream can mitigate the negative impact by innovating their technology. This enables them to produce the input internally or explore alternative production methods that do not rely on the input. Toyota's development of new magnets for electric motors, reducing their dependence on rare earth minerals due to export restrictions from China, serves as an example of such innovative efforts.<sup>75</sup> Although Japan still heavily relies on China for rare earth minerals, these endeavors are essential for long-term supply chain resilience.

To effectively promote innovation, international research collaboration has proven to be highly valuable as cutting-edge innovation requires diverse knowledge.<sup>76</sup> An empirical study found that firms engaged in international research collaboration experience a 27 percent increase in the number of citations per patent, indicating higher-quality innovation.<sup>77</sup> In comparison, domestic collaboration yielded a 5.5 percent increase. These findings underscore the significance of international linkages for acquiring new knowledge and fostering innovation.

However, the level of international research collaboration among Japanese firms has been relatively low. In 2017, the share of international co-invention in total international patent applications by Japanese agents was only 3 percent, significantly lower than the 12-13 percent observed for the United States and the European Union (Figure 7).

**Figure 7: Share of International Co-invention (percent of Total PCT Patent Applications)**



*Source: OECD Science, Technology, and Innovation Scoreboard.*

Therefore, it is recommended to promote international research collaboration among friendly countries, which can be termed “knowledge friendshoring.” Policies are required to address the externalities associated with knowledge spillovers, as in the case of product friendshoring. Specifically, public support for information provision and partnership matching can effectively encourage knowledge friendshoring. Existing multilateral frameworks such as the G7, IPEF, and SCRI can also be utilized to provide such support.

The current landscape aligns with this suggestion. The previous G7 summit held in Japan recognized the importance of research collaboration among G7 countries. The Japanese government, apart from attracting TSMC’s production plant to Kumamoto, also facilitated the establishment of its research and development center in Tsukuba, promoting joint research with Japanese firms and universities.<sup>78</sup> Furthermore, the Japanese government established the Leading-edge Semiconductor Technology Center (LSTC) to foster the development of next-generation semiconductors through research collaborations between Japan and the United States.<sup>79</sup> Samsung Electronics from South Korea has also taken advantage of Japanese government subsidies to establish a semiconductor develop-

ment center in Yokohama and engage in joint research with Japanese material and machinery manufacturers.<sup>80</sup> These initiatives for knowledge friendshoring should be further strengthened, encompassing a wide range of industries rather than focusing solely on the semiconductor sector.

## Balancing national security and economic interests

It is critical for Japan, the United States, and European countries to reduce reliance on China in supply chains and promoting their friendshoring of products and knowledge to mitigate the risks associated with China's national security threats. However, the benefits of maintaining economic relations with China must be acknowledged, both for economic and political purposes. Maintaining a certain level of economic ties can also actually contribute to conflict prevention.<sup>81</sup> As such, while it is necessary to diversify supply chain partners for industries heavily dependent on China and minimize trade with China in products and technologies with significant security concerns, it is not advisable to drastically sever economic relations with China.

In practice, while both Japan and the United States have experienced a decline in exports of security-sensitive products, such as machinery for semiconductor manufacturing and integrated circuits, to China (Figure 2), overall trade has remained relatively stable or experienced only minor decreases (Figure 1). Such balance between national security concerns and economic interests should be maintained by careful policy making.

The views expressed are the author's alone, and do not represent the views of the U.S. Government or the Wilson Center.

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