



## 22-8 South Korea Should Prepare for Its Exposure to US-China Technology Tensions

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### INTRODUCTION

The Indo-Pacific Economic Framework for Prosperity (IPEF), launched by President Joseph R. Biden Jr. in May 2022, aims to deepen US economic engagement in the region. Thirteen countries have joined the US-led effort: Australia, Brunei, Fiji, India, Indonesia, Japan, Malaysia, New Zealand, the Philippines, Singapore, South Korea, Thailand, and Vietnam. Together, these founding members represent 40 percent of world GDP. The framework promises to coordinate new rules for digital transactions, establish strong labor and environmental standards, and accelerate efforts to combat climate change. The initiative also responds to perceived threats emerging from international trade and investment flows, especially threats resulting from supply shortages, overreliance on individual suppliers, and unwanted transfers of technology.

Given its economic weight in the region and the possibility that the IPEF may affect access to participating-country markets, South Korea has chosen a seat at the negotiating table. President Yoon Suk-yeol responded immediately to Biden's IPEF announcement, [noting](#), "This is a process of setting wide-ranging rules for economics and trade in the Indo-Pacific region, so obviously we have to take part in it."

The stated goal of the IPEF is to create standards that enhance and elevate regional trade and investment flows—but it is clearly aimed at reducing the role of China in global supply chains. Before its launch, US Commerce Secretary Gina Raimondo [stated](#) that the IPEF would shore up US supply chains and make US allies less vulnerable to Chinese economic coercion.

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Such a transition may not be easy to accomplish. Given the high degree of economic integration with China among IPEF partners, decoupling from China could be costly. Goodman and Arasasingham (2022) report that “some countries are concerned that policies under discussion for the ‘supply chain resilience’ pillar may include challenging requests to tighten policies on export controls and technology transfer, particularly toward China, or to relinquish the ability to maintain sovereign control over supply chains.”

As China is Korea’s largest trading partner, US policy discouraging Chinese participation in supply chains has immediate detrimental implications for Korean manufacturers. The United States is the second-most important destination for Korean exports. Given the values of these triangular trade flows, this Policy Brief assesses South Korea’s exposure to US demands to remove or reduce Chinese participation in the manufacture of exports destined for the US market.

We start from the premise that Korea has complied and will continue to comply with US export controls and that it has taken sufficient unilateral steps to contain unwanted technology transfer.<sup>1</sup> The Policy Brief therefore focuses on the entanglement of Chinese and Korean supply chains for unsanctioned goods and assesses how US demands to “build China out” could affect Korean manufacturers. It highlights Korean engagement in China-linked supply chains for computer, electronic, and optical equipment, a sector in which technology tensions between the United States and China are growing.

Several conclusions emerge from the analysis. The reliance of the proposed framework on certain standards will likely reduce Chinese participation in IPEF trade networks. Korea may benefit from this trend, but the IPEF could also increase production costs for Korean companies, especially in the electronics sector, a problem that would worsen if China retaliated against these companies. To reduce these risks, Korea might find it prudent to reduce its reliance on intermediate goods from China for products it produces for export to the United States. The Korean government should also seek to better understand its exposure to US-China trade tensions and diversify its trade relations. Korean firms should start preparing for supply chain disruptions, perhaps by making investments at home. Korea could also help other IPEF members reduce supply chain disruptions while addressing security concerns over China.

## **RISKS TO SOUTH KOREAN SUPPLY CHAINS FROM US-CHINA TECHNOLOGY TENSIONS**

The United States and Korea are deeply integrated economic partners. In 2021, the United States provided 12 percent of Korean imports, up from less than 9 percent in 2011–14, according to the Korean Customs Service. The United States

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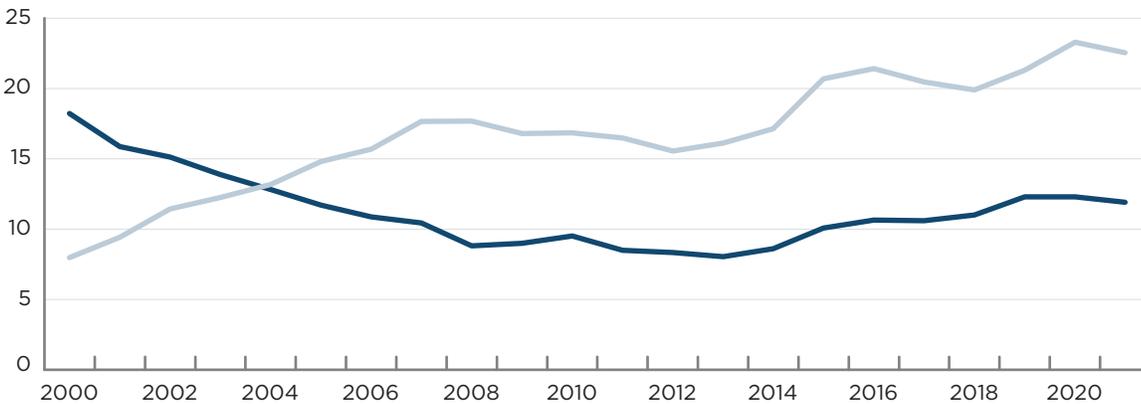
<sup>1</sup> Korea’s *Act on Prevention of Divulgence and Protection of Industrial Technology* was promulgated in 2006. It was enacted to make up for deficiencies in the Unfair Competition Prevention and Trade Secret Protection Act of 1998 and was most recently amended in 2019. It addresses national security and the national economic development imperatives by defining a list of “national core technologies” to be protected under the law. Over the course of the act’s existence, parts have been found unconstitutional because of the ambiguity of some definitions. The law faces criticism that the national core technology protection system is not sufficiently sophisticated.

purchased 15 percent of Korea’s exports in 2021, up from a low of 10 percent in 2011. US trade shares are now about 10 percentage points below China’s share of Korea’s imports and exports (figure 1).

**Figure 1**  
**Korean import and export shares from the United States and China, 2000-21**

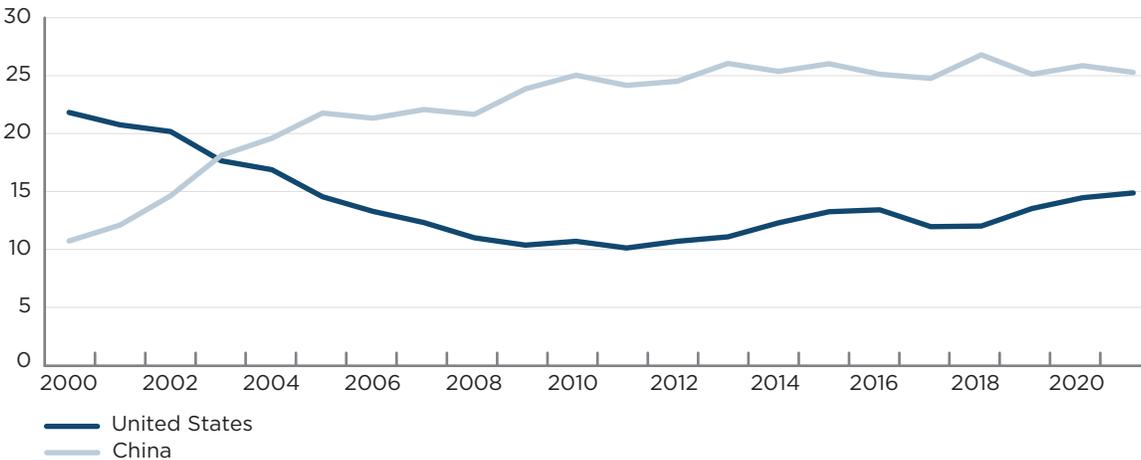
**a. Imports by source**

percent



**b. Exports by destination**

percent



— United States  
 — China

Source: Korean Customs Service.

The steady recovery of US shares of Korean imports and exports partly reflects the US-Korea Free Trade Agreement (KORUS), which went into force on March 15, 2012, and was renegotiated in 2018. This preferential trading agreement covers a wide range of bilateral economic interactions, including trade in goods and services, investment flows, and technical barriers to trade.

US efforts to reduce the presence of China in its supply chains could affect Korean trade flows in multiple ways. First, the United States’ evolving focus on supply chains could result in US bans of or taxes on Chinese content in third-party exports. Such an outcome is most likely in key technology sectors,

including electronic devices and integrated circuits. Chinese content in Korean exports to the United States stems from Korean purchases of Chinese intermediate goods for production at home as well as Chinese value added in Korean foreign affiliates operating in China and exporting back to their Korea-based parents. Defining “safe and secure” supplies to discourage Chinese participation in value chains would adversely affect Korean exports to the United States that contain Chinese-made inputs. This possibility is illustrated by the recently opened US investigation to determine whether imports of solar cells and modules from Cambodia, Malaysia, Thailand, and Vietnam are circumventing existing antidumping and countervailing tariffs on imports of solar cells and modules from China. Broader tariff coverage and stricter enforcement of anticircumvention rules could potentially affect Korean sourcing decisions.

Second, US-China trade tensions could affect Korean manufacturers through Korean content in Chinese exports to the United States. Korea is a major supplier of intermediate goods to Chinese manufacturers. Tariffs are levied on nominal values, not value added, so Korean content is taxed alongside Chinese content when a product enters the United States directly from the mainland. Tariffs or outright bans of imports from China would reverberate through Korean suppliers of Chinese manufacturers. These suppliers may be in the same industry as the banned or taxed product or in sectors that supply the sector or facilitate trade in the sector.

Third, US trade actions could affect production in Chinese-based affiliates of Korean multinational parents. US Customs does not differentiate between exports from Chinese domestic firms and exports originating in foreign-invested enterprises operating in China. Changes in US tariffs on imports from China can thus affect exports to the United States from Korean foreign affiliates operating in China. Because China Customs does not report export values separately for foreign-invested enterprises, it is difficult to assess the total value of exports from Korean multinationals’ Chinese affiliates to the United States. However, data from the United States and Korea can suggest the magnitude of such flows and identify the industries from which they originate.

## **CHINESE CONTENT IN KOREAN EXPORTS TO THE UNITED STATES**

In 2021, Korea’s exports to the United States reached \$95.9 billion. These exports incorporated value added from other countries that supply Korean manufacturers with parts and processing services.

Measuring how much foreign content makes its way into Korean exports is not a simple task. The propensity to import intermediate goods may differ substantially from the overall propensity to import for final consumption. To measure the foreign content of a country’s exports, researchers turn to the Trade in Value Added (TiVA) database of the Organization for Economic Cooperation and Development (OECD). TiVA estimates are based on intercountry input-output tables derived from national, regional, and international sources. Industries are classified using the International Standard Industrial Classification (ISIC) Revision 4.

The latest TiVA indicators were generated using the 2021 release of the OECD Inter-Country Input-Output (ICIO) tables, which extend to 2018. Estimates of Chinese content in Korean exports to the United States are thus based on supply

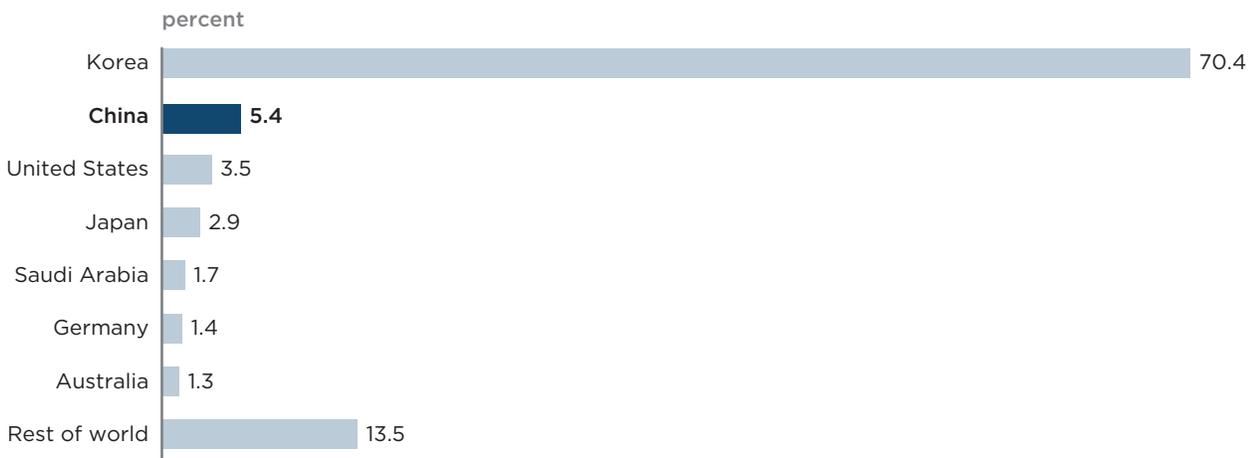
**US efforts to reduce the presence of China in its supply chains could affect Korean trade flows in multiple ways.**

relationships in place before the COVID-19 pandemic. Although somewhat dated, they reflect the most recently available information.

Because China is an outsourcing destination for Korean multinationals, one needs to know how Korean components sent to China for processing and then reexported to Korea are handled in the calculation of foreign value added. In the underlying data used to produce the 2021 TiVA estimates, the value of these Korean-made components is classified as Korean content if these components are reexported from China back to Korea before being made into products for the US market (Martins Guilhoto, Webb, and Yamano 2022).<sup>2</sup>

Figure 2 shows the origin of the value added from Korea in total US imports in 2018. The largest share (70.4 percent) came from Korea itself. The second-largest share (5.4 percent, or \$5.18 billion) originated in China.

**Figure 2**  
**Origin of value added in total US imports from Korea, 2018**



Source: OECD Trade in Value Added database, 2021.

The small share of value added from China in Korea's total direct exports to the United States suggests that US restrictions on such content may not be overly disruptive. But opportunities for alternative sourcing may not exist within the heavily fragmented sector producing computer, electronic, and optical equipment (ISIC 26). Figure 3 shows the share of value added in US imports of these products from Korea that originates in China. The largest share comes from Korea itself (72.9 percent); 7.0 percent of value added is from China. This Chinese content could hinder Korean exports to the United States if it is deemed a security risk, unfairly subsidized, or otherwise designated by the US government as unwelcome in its supply chains.

<sup>2</sup> When the processing is carried out abroad, exports from the processing country consist only of the processing fee. TiVA's handling of processing trade is derived from the ICIO tables, compiled according to the 2008 System of National Accounts and described in the document [here](#).

Figure 3

**Origin of value added in US imports of computer, electronic, and optical equipment from Korea, 2018**

Source: OECD Trade in Value Added database, 2021.

**KOREAN CONTENT IN CHINESE EXPORTS TO THE UNITED STATES**

China is the top destination for Korea's total exports. Because Korea is a major supplier of parts and components to Chinese manufacturers, reduction in Chinese exports of these products to the United States hurts Korean firms.

Figure 4 illustrates the origin of value added in total US imports from China. Korea supplies 2.3 percent of this value, the second-largest share after China itself. Given total US imports from China of \$504.9 billion in 2021, Korea supplied \$11.6 billion to the United States embodied in Chinese exports.<sup>3</sup> These indirect exports represent 12.1 percent of Korea's direct exports to the United States, a substantial sum.

Figure 4

**Origin of value added in total US imports from China, 2018**

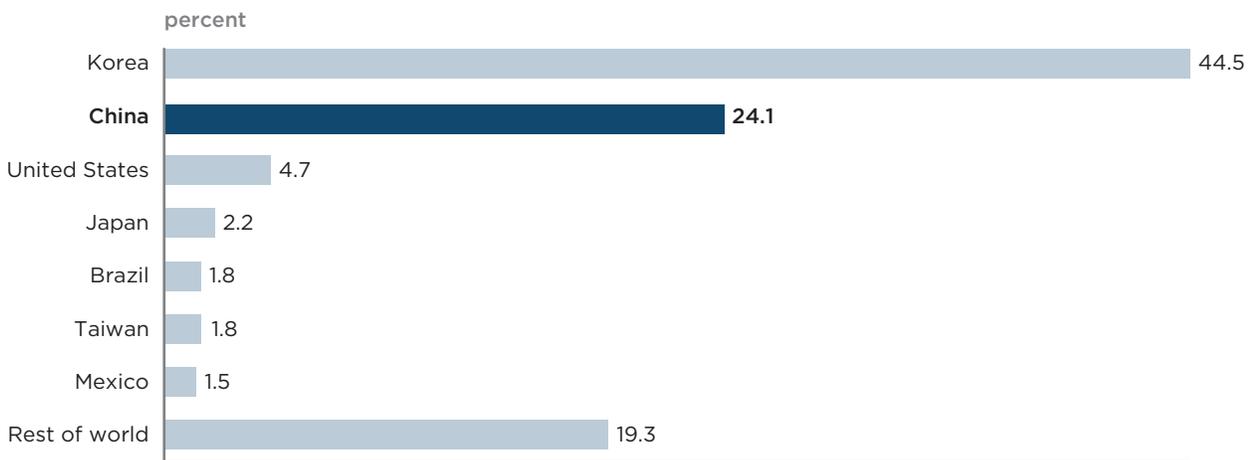
Source: OECD Trade in Value Added database, 2021.

<sup>3</sup> This calculation applies the 2018 TiVA share to bilateral exports in 2021. It is an approximation based on the most recent data available.

China is a particularly important export destination for the Korean electronics sector. It is the top destination for Korean exports of integrated circuits and liquid crystal displays (LCDs) and the second-most important destination for exports of cellphones.<sup>4</sup>

Information from the World Input-Output Database provides an estimate of Korea's reliance on sales to China in the computer, electronic, and optical products industry. In 2014, almost a quarter of the sector's output was exported to China. Some of this output ended up in sales to China's domestic market, but some of it was embedded in Chinese exports (figure 5).

**Figure 5**  
**Destinations for output of Korean-made computer, electronic, and optical equipment, 2014**



Note: The November 2016 version of the World Input-Output Database contains data for 2000-14. It is the latest release available at the time of publishing.

Source: World Input-Output Database, November 2016 release.

When combined with Chinese value added and inputs from other nations, a portion of Korean electronics sector output ends up as US imports from China. Drawing again from the TiVA database, as illustrated in figure 6, 5.8 percent of the value of US imports of computer, electronic, and optical equipment from China originates in Korea.

A diverse set of Korean industries supports this sector. Rearrangements in Korean supply chains because of US-China trade tensions could thus reverberate throughout large parts of the Korean economy. Hardest hit would be firms operating in the same broad sector, but retail and wholesale trade providers, electrical equipment manufacturers, and firms in the chemical sector would also suffer (figure 7).

<sup>4</sup> Destination shares for Korean exports are from the Comtrade database for 2020.

Figure 6

### Origin of value added of US imports of computer, electronic, and optical equipment from China, 2018



Source: OECD Trade in Value Added database, 2021.

Figure 7

### Korean industries supplying inputs to China's manufacturing of computer, electronic, and optical equipment industry, 2014



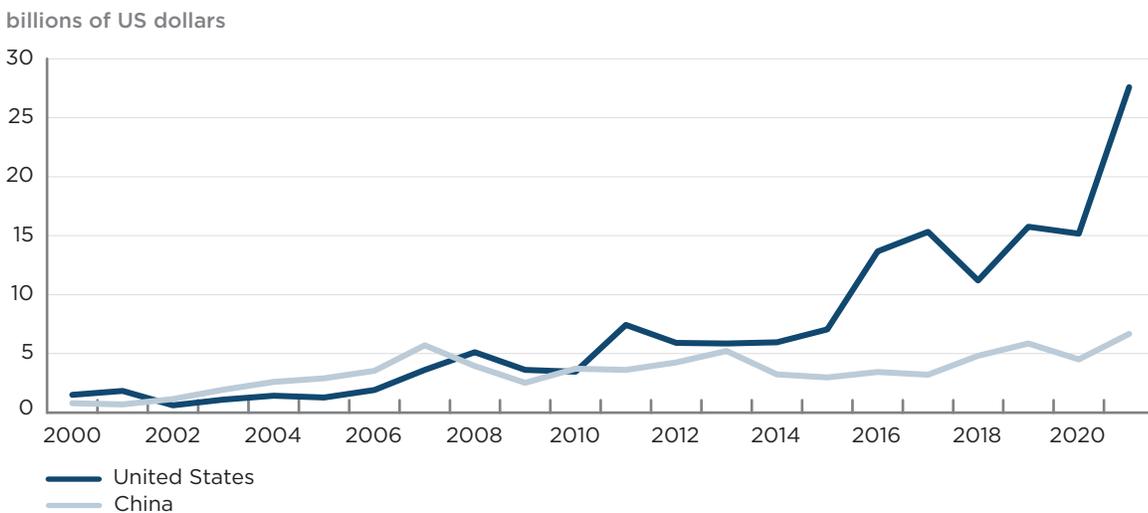
Source: World Input-Output Database, November 2016 release.

## EXPOSURE OF KOREAN FOREIGN AFFILIATES OPERATING IN CHINA

The assessment so far did not account for the full value created in the Chinese affiliates of Korean multinationals and exported directly from China to the United States. The methods used to create the TiVA estimates of the Korean value added in Chinese exports to the United States (discussed above) include the value of Korean inputs shipped to China for further processing and subsequently exported to the United States. A computer chip exported to China for use in production of a laptop shipped to the United States is thus included in the TiVA estimates of the Korean content of Chinese exports. These estimates do not include the value added in China-based affiliates of Korean multinationals, however. This output is Korean in the sense that it is produced and owned by a Korean company, but for TiVA purposes it is Chinese value added. Because of this method of accounting, the TiVA estimates understate the risk to Korean companies of US barriers to imports from China.

China Customs does not distinguish the value of exports from Korean-invested firms, but examination of the extent of Korean investment in China and the role these affiliates play in the supply chains serving the US market can provide an estimate of the likely magnitudes at risk. To enhance competitiveness, after China's accession to the World Trade Organization, in 2001, Korean multinationals began to offshore parts of the manufacturing process to China. However, Korean foreign direct investment (FDI) in China only recently exceeded \$5 billion (reaching \$6.67 billion in 2021); since 2015, it has been outweighed by Korean direct investment in the United States (figure 8). In 2021, Korean FDI in the United States totaled \$27.6 billion, more than four times the flow into China.

**Figure 8**  
**Outbound foreign direct investment by Korea in China and the United States, 2000–21**

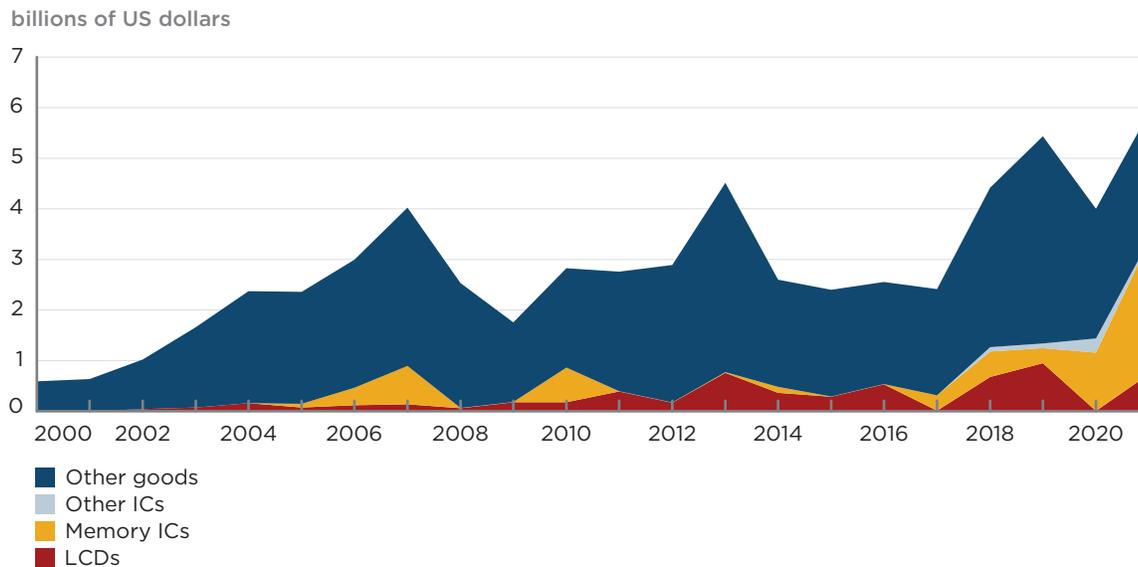


Source: Korea Eximbank.

The composition of Korean investment in China is quite different from its investment in the United States. In 2021, Korean direct investment in manufacturing represented almost 90 percent of its total direct investment in China but just 18 percent of total Korean direct investment in the United States. In recent years, Korean investment in China has focused on two subsectors of the electronics sector: integrated circuits (investment in which rose from 13 percent in 2018 to 36 percent in 2020 and 45 percent in 2021) and LCDs (which accounted for 12 percent of Korean investment in manufacturing in China in 2021). See figure 9.

New Korean-invested factories in China will supply both the Chinese market and other markets around the world. Some of what they produce will be exported to the United States. Data from the US Bureau of Economic Analysis indicate that Korean majority-owned affiliates operating in the United States rely primarily on their parent group for imports. This finding suggests that China-based affiliates of Korean parent firms may be exporting directly to their US-based affiliates.

Figure 9  
**Outbound foreign direct investment by Korea in Chinese manufacturing of integrated circuits (ICs) and liquid crystal displays (LCDs), 2000-21**



Source: Korea Eximbank.

Further evidence that China-based affiliates of Korean parent firms export directly to their affiliates outside Korea is provided by China Customs, which records “processing trade” flows separately from “ordinary trade” flows.<sup>5</sup> Processing imports are exempt from Chinese import duties, because they are intended for reexport. Chinese imports of both telephones and LCDs are designated predominantly as processing trade, an indication that these Korean exports are not intended for sale in the Chinese domestic market. Two-way trade in electronic integrated circuits is also heavily weighted toward processing trade, albeit to a lesser extent. In 2021, the processing share of China’s total imports from Korea was 39.8 percent and the processing share of China’s total exports to Korea was 30.5 percent (tables 1 and 2).

Do these components exported under a processing trade regime make their way back to Korea for further transformation, or are they embedded in Chinese-based export production? To answer this question, we first consider trade statistics for telephones. The value of processing imports of telephones from Korea (\$6.4 billion) is very close to the value of processing exports of telephones to Korea (\$6.8 billion) (tables 1 and 2). Although these bundles may not contain the same elements, the pattern suggests that Korean-made telephone components sent to China are largely exported back to Korea and intended for sale in Korea or for further processing in Korea. Chinese value added is captured by the TiVA methodology and added into the Chinese content of Korean exports if these products are not sold in the Korean domestic market (as seen in figures 2 and 3).

5 China Customs is the only source of information on the processing share of Korean trade with China. It consistently reports larger values for Korean exports to China than does the Korean Customs Service. Despite this discrepancy, Chinese Customs data provide a window into the purpose of Korean exports.

Table 1  
**Processing shares of selected Chinese imports from Korea, 2021**

Product	Harmonized System (HS) code	Processing imports from Korea (billions of US dollars)	Total imports from Korea (billions of US dollars)	Processing share of Chinese imports from Korea (percent)
Telephones	8517	5.9	6.4	92.2
Electronic integrated circuits	8542	43.7	88.3	49.5
Liquid crystal displays	9013	5.7	6.3	90.5
All imports		84.9	213.4	39.8

Source: China Customs.

Table 2  
**Processing shares of selected Chinese exports to Korea, 2021**

Product	Harmonized System (HS) code	Processing exports to Korea (billions of US dollars)	Total exports to Korea (billions of US dollars)	Processing share of Chinese exports to Korea (percent)
Telephones	8517	5.4	6.8	79.4
Electronic integrated circuits	8542	15.6	20.9	74.6
Liquid crystal displays	9013	0.6	1.0	60.0
All exports		45.4	148.8	30.5

Source: China Customs.

Bilateral trade statistics for integrated circuits and LCDs suggest a quite different supply chain configuration in these activities—one in which components made in Korea are sent to China for further processing and then exported to third markets. As 49.5 percent of the \$88.3 billion of integrated circuits imported to China from Korea are processing imports, as shown in table 1, one can conclude that \$43.7 billion of this value is intended for reexport from China. However, table 2 indicates that only \$20.9 billion of electronic integrated circuits are sent from China to Korea, of which only 74.6 percent are processing exports. Because China imported \$43.7 billion in integrated circuits from Korea for processing but sent only \$15.6 billion in processing exports back to Korea, at least \$28 billion of integrated circuits with Korean content must have been exported from China to other markets. These integrated circuits are used to create other products for

export from China, such as televisions and home appliances.<sup>6</sup> The data for LCDs suggest a similar supply chain configuration, in which the value of processing exports that are sent back to Korea is far below the value imported from Korea. Most of the imported Korean content thus seems to make its way to third markets embedded in exports from China.

TiVA captures the Korean content of Chinese exports, such as integrated circuits and LCDs imported from Korea for further processing in China before being exported to third markets. However, because much of this processing takes place inside the Chinese affiliates of Korean multinational companies, it does not capture the full value of flows from China that involve Korean interests. From a Korean firm's viewpoint, US barriers to Chinese technology exports affect the full value of its exports from China, not just the part made in Korea. The possibility of US tariffs on or bans of Chinese tech exports poses a risk for Korean multinational firms because such measures would disrupt significant trade flows between affiliates based in Korea, China, and the United States.

## FINDINGS AND POLICY IMPLICATIONS

Since the beginning of the COVID-19 pandemic, reducing vulnerabilities in supply chains has become an important goal for governments around the world. For the US government, the quest for supply chain resilience merges with its economic and national security concerns about overreliance on Chinese producers, especially in high-tech sectors. These concerns are increasingly shared by US allies and partners, some of whom were subjected to Chinese trade retaliation when they took foreign policy decisions that angered Beijing.

The proposed IPEF includes efforts to develop rules of the road for trade among its members and clear a pathway for "friend-shoring." The envisioned race to the top will exclude some countries from US supply chains. Differential tariff rates; export controls; inward and outward investment reviews; and exclusionary standards, including labor, environmental, and technical standards and transparency requirements are among the instruments that can be deployed to deflect the choices of IPEF producers and consumers away from Chinese supply partners.

As a founding member of the IPEF, Korea may gain from the resulting reorganization of supply chains. As the US government continues to encourage US firms to rely less heavily on China, many Indo-Pacific countries see opportunities to shift production to their countries. The imposition of high US tariffs on Chinese imports in 2018-19 did benefit Korea to some extent, with Korea's share of US manufacturing imports rising 0.9 percent and its share of US manufacturing imports subject to trade war tariffs rising 1.0 percent, according to Lovely, Xu, and Zhang (2021). Viewed from a wider angle, however, US-China trade tensions threaten to upend current supply relationship in ways that raise production costs for Korean companies and encourage supply chain duplication.

**The possibility of US tariffs on or bans of Chinese tech exports poses a risk for Korean multinational firms because such measures would disrupt significant trade flows between affiliates based in Korea, China, and the United States.**

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6 The Korean-made content of such products is included by TiVA methods in the Korean share of Chinese exports.

Korea may need to reduce its reliance on China for the intermediate goods used to build products for the US market. The Chinese content of total Korean exports is only about 5.4 percent. However, Chinese content in Korean exports of computer, electronic, and optical equipment is estimated at 7 percent of the total export value in the sector.

Korean firms could also be adversely affected by US taxes on and bans of exports from China. Korea provided only 2.3 percent of the value of China's exports to the United States in 2021, but Chinese exports to the United States are enormous, valued at \$504.9 billion. For manufactures of computer, electronic, and optical equipment, the Korean content of Chinese exports is substantially larger, at almost 6 percent of the value of sales to the United States. Because the United States avoided levying tariffs on many final goods from the sector, such as phones, computers, and laptops, during the US-China trade war of 2018-19, Korean firms supplying Chinese exporters or operating Chinese-based affiliates have not yet been directly affected by US trade restrictions on China. If such restrictions are put in place, the effect on Korean electronics firms could be disruptive and costly.

Sales to the Chinese market are important to the Korean electronics industry; reductions in Chinese activity would hurt the sector. There is also the possibility that China would retaliate if Korea joined an overt program of reorientation of supply chains. As Korean multinationals mediate much of the bilateral trade in the sector, it is not clear how China would hinder these flows. Loss of access to the domestic Chinese electronics market would nonetheless be a major blow to the sector. The multinational networks potentially most affected by US-China trade tensions would be those producing integrated circuits, LCDs, and cellphones, based both in Korea and in foreign affiliates operating in China. Loss of this market would also hurt other Korean industrial and service sectors.

The Korean government could take various actions to better understand and reduce risks stemming from ongoing US-China trade tensions.

**1** *Map and monitor engagement by Korean firms with Chinese high-technology manufacturing*

Working in conjunction with the private sector and building on existing coordination mechanisms, the government could map the routes along which Chinese production enters Korean supply chains. Key input-output relationships could be identified, and the value of these flows measured. Such information would provide a better assessment of Korean vulnerabilities and the benefits of diversifying supply relationships ahead of new tensions.

**2** *Encourage Korean firms to prepare for supply chain disruptions*

The government could encourage Korean firms to prepare for supply chain disruptions, including by making new investments at home and in countries that could serve as export platforms. Korea has already addressed the need for supply chain diversification through its Act on Supporting the Domestic Return of Overseas Companies, colloquially known as the U-Turn Company Support Law. The law allows state and local governments to offer tax incentives to returning companies, financial assistance, support to staffing, employment subsidies, help with liquidation, and other benefits.

**The Korean government could take various actions to better understand and reduce risks stemming from ongoing US-China trade tensions.**

Consideration could be given to providing further encouragement to firms that want to diversify manufacturing operations away from China. To remain competitive, for example, Korean firms may find it necessary to place certain manufacturing functions in countries with lower wages than in Korea. Encouraging them to do so may be in the national interest.

### 3 *Provide essential information to shape the IPEF's goal of making supply chains more resilient*

As a founding member of the IPEF, Korea can help shape its approach to building supply chain resilience. With detailed knowledge of where value is added in the region and the technology content of those activities, Korean negotiators could illuminate the costs and benefits of IPEF commitments. With this information, Korea could play an essential role in assisting IPEF members as they shape commitments to reduce supply disruptions while increasing security.

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