

Increasing supply chain risks and Implications for Korea

Wonseok CHOI Associate Research Fellow, Economic Security Team, Dept. of International Trade, Investment and Economic Security (wschoi@kiep.go.kr)

Hyoungmin HAN Research Fellow, India and South Asia Team, Center for Area Studies (hmhan@kiep.go.kr)

I. Introduction

Geopolitical factors such as the recent US-China conflict and the Russia-Ukraine war are changing the existing efficiency-oriented supply chain through tariff adjustments or trade sanctions against related countries. Specifically, the U.S.-China conflict began with retaliatory tariffs on bilateral trade and increased investment scrutiny, and the U.S. has recently been gradually implementing policies to restrict Chinese raw materials and intermediate goods for key products such as semiconductors and batteries. This conflict between the U.S. and China is leading to discussions about restructuring supply chains, particularly in the high-tech manufacturing industry.

Moreover, the U.S.-China conflict and the Russia-Ukraine war have highlighted problems with the concentration of supply chains in certain countries, and these geopolitical conflicts and external effects such as the COVID pandemic are undermining the stability of supply chains. A look at the supply chain stability index released by KPMG shows that supply chain stress levels have risen significantly since 2020 and have yet to return to their previous levels. In addition to the United States and China, major countries linked to global supply chains such as the EU, Japan, and Korea are proposing specific support policies for maintaining the supply chain of key items and strengthening international cooperation with production-linked countries. In this

* This is a brief summarization of Choi et al. 2022. "Emergence of Economic Security Issues and External Cooperation Strategy." Chapter 2 (pp.32~78). KIEP Policy Analyses, no. 22-28. Korea Institute for International Economic Policy. (in Korean)

context, this study aims to examine the changes in the proportions and roles among the connected countries in the supply and demand aspects of the United States, China, and

Japan, which are major trading partners of Korea, and to derive policy implications by looking at their policy responses.

Figure 1. Supply Chain Stability Index



Source: KPMG, Supply Chain Stability Index. <https://advisory.kpmg.us/insights/supply-chain-stability-index.htm>.

II. Responding to Changes in Supply Chain Structure and Related Policies in Major Countries

1. United States

Most of US production is consumed domestically, and about 90% of production is Most of US production is consumed domestically, and about 10% of production is consumed abroad through trade. The U.S. trade method has a higher trade method using global supply chains (GVC-linked production) than traditional trade methods that are assembled and

delivered overseas as final goods, and the proportion of GVC-linked production increased from 5.4% in 2007 to 6.7% in 2021. This means that the consumers of US products are expanding more actively through the global supply chain.

Looking at the changes in overseas demand countries for US production, Canada is the traditional demand country for US production, accounting for 12.9% of overseas demand for US production in 2010. However, in 2021, Canada's demand for U.S. production increased, but the share fell to 9.5% due to increased demand from China to the U.S. China accounted for the largest share of U.S. overseas demand as of 2021, accounting for 13.5%.

Table 1. Trends in Foreign Demand and Supply of U.S. Production

		2010		2021	
		Country	Share	Country	Share
DEMAND	1	CAN	12.9	PRC	13.5
	2	PRC	6.7	CAN	9.5
	3	MEX	6.2	MEX	6.5
	4	DEU	4.8	JPN	5.6
	5	JPN	4.6	DEU	5.0
SUPPLY	1	CAN	14.5	CAN	14.9
	2	MEX	7.5	PRC	11.6
	3	PRC	7.3	MEX	6.4
	4	DEU	4.9	GBR	6.2
	5	JPN	4.8	DEU	5.4

Note: Country names are based on ISO 3166-1 Alpha-3 code.

Source: Choi et al. (2022), Table 2-1(p.38), Table 2-2(p.40).

Looking at the countries in the supply chain that contribute to U.S. output, Canada accounts for the largest share. Canada's share of the total foreign value-added contributing to US production rose slightly from 14.5% in 2010 to 14.9% in 2021. Meanwhile, China's share of US output also increased significantly, growing from 7.3% in 2010 to 11.6% in 2021. Trade barriers between the two countries have risen since the U.S.-China trade dispute, but China's added value contributes to U.S. production through various countries, and this trend is maintained through 2021.

From the above results, it can be seen that China is still an important country in the U.S. supply chain, and is of great importance until 2021. In particular, given that the size difference between Mexico and the United Kingdom, which are the third largest in terms of value-added supply for U.S. production, it is

difficult to reduce the dependence on China in terms of production and consumption of U.S. goods in a short period of time. Therefore, the U.S. is focusing on policies to reduce dependence on China in key areas such as semiconductors and secondary batteries, rather than decoupling from China in all supply chains.

First, the “Semiconductor Science Act” includes support to promote semiconductors in the United States, strengthen supply chains, and expand future high-tech research and innovation capabilities. Among other things, to strengthen the semiconductor supply chain, the U.S. government will provide \$52.7 billion in semiconductor technology development, manufacturing, and workforce training, and provide tax credits for investments in high-tech semiconductor equipment in the U.S. However, companies that have benefited from the U.S. government will prohibit the expans-

ion of semiconductor manufacturing facilities from countries of concern including China over the next 10 years.

The U.S. “Inflation Reduction Act”, which took effect in August 2022, is a \$740 billion bill on responding to climate change, improving welfare in the health sector, and reforming corporate taxation. A large portion of the budget is earmarked for energy security and climate change-related budgets, allowing companies investing in production facilities in clean industries such as solar panels, wind, and batteries to receive partial tax credits. As a result, the U.S. is expected to strengthen domestic and regional supply chains and expand overseas investment in energy industries. In addition, the bill is expected to affect the supply chain of various energy industries, as finished vehicles that use minerals or parts

sourced from “foreign entities of concern” are excluded from the tax credit.

2. China

In China, the share of domestic demand for production rose significantly from 71.8% in 2007 to 83.6% in 2021, and trade accounts for a larger share of production than in the United States, as about 16.4% of production is consumed abroad through trade in 2021. In addition, the gap between the proportion of intermediate goods exports through traditional trade methods and GVC-linked production in China's trade method narrowed from 4.1%p in 2007 to 0.6%p in 2021. This shows that the share of exports in the form of intermediate goods has been steadily increasing compared to that of final goods exports.

Table 2. Trends in Foreign Demand and Supply of PRC Production

		2010		2021	
		Country	Share	Country	Share
DEMAND	1	USA	18.1	USA	19.2
	2	JPN	7.5	JPN	5.9
	3	DEU	4.2	DEU	5.1
	4	RUS	3.2	KOR	3.6
	5	GBR	2.9	IND	2.8
SUPPLY	1	JPN	9.0	USA	10.4
	2	USA	7.2	JPN	6.1
	3	AUS	6.8	AUS	5.7
	4	KOR	5.5	KOR	5.5
	5	DEU	4.2	RUS	4.5

Note: Country names are based on ISO 3166-1 Alpha-3 code.

Source: Choi et al. (2022) Table 2-3(p.48), Table 2-4(p.50).

Looking at the changes in overseas demand countries for Chinese production, the United States is the most important overseas demand country for Chinese production. The U.S. share of China's overseas demand rose slightly from 18.1% in 2010 to 19.2% in 2021. Even at a time when the U.S.-China trade dispute is intensifying, the share of U.S. demand for Chinese production has not changed much. In addition, Japan, Germany, the United Kingdom (6th, in 2021) and Russia (7th, in 2021) are the main consumers of Chinese production.

On the supply side Japan, the United States, Australia, and Korea are among the major foreign countries contributing to China's production. The U.S. share of the total foreign value-added contributing to China's production increased significantly from 7.2% in 2010 to 10.4% in 2021. In addition, Russia and Brazil are emerging as important suppliers of intermediate goods needed for Chinese production. Russia's share of the total foreign value-added required for Chinese production grew from 3.6% in 2010 to 4.5% in 2021, and Brazil's share grew from 3.4%(8th) to 4.2%(6th) over the same period. Considering the industrial structure of these countries, it is estimated that they are used in China's production, focusing on minerals and raw materials. Meanwhile, Japan's share of the total overseas value-added contributing to China's production decreased from 9.0% to 6.1%, and Korea remains at 5.5% during the same period.

Looking at the above results, it can be seen that China's share in the supply chain with the

United States is still high. Therefore, China is also pursuing supply chain cooperation by establishing a regular dialogue for exchanging information on the implementation of export control with the United States rather than a sharp break with the United States.

On the other hand, China is implementing strategies aimed at strengthening domestic supply chains and supply chain links with neighboring countries to cope with U.S. supply chain sanctions against China. In particular, China's "Dual Circulation" strategy consists of a domestic and international cycle of strengthening China's internal capabilities through the independence of key technologies and the development of industrial structures, including the stable supply of raw materials, food, the integration of internal and external trade norms and standards, and the promotion of exports.

The Chinese government supported the semiconductor manufacturing industry through the \$20 billion "China National Integrated Circuit Industry Investment Fund" in 2014, and announced \$29 billion in support to foster semiconductor ecology in 2019. In addition, the Chinese government is strengthening fiscal support for semiconductor companies, such as corporate income tax and import tariff reduction. In particular, import tariffs on semiconductor production equipment and materials that cannot be produced in China are exempted.

In December 2020, the Chinese government classified rare earths as strategic resources

through the “Export Control Law” and strengthened the management of the rare earth external supply chain. Later, in January 2021, through the draft rare earth management ordinance, the Chinese government's authority over the rare earth management system (investment prior government permission, distribution management authority, stockpiling, and legal punishment) was legislated.

3. Japan

About 85% of the added value produced by Japan is consumed by domestic demand, and about 15% is shipped for overseas demand. Japanese products shipped for overseas demand take the form of intermediate goods rather than final goods, and the share of intermediate goods in particular has increased since the spread of COVID-19. The share of traditi-

onal trade in Japanese products fell slightly from 6.7% in 2007 to 6.1% in 2021, but the share of GVC production expanded from 8.2% to 8.9% during the same period. In particular, the difference between the two proportions expands from 1.5% in 2019 to 2.8% in 2021, meaning that the form of Japanese products consumed abroad will change mainly to the form of intermediate goods.

China and the United States are the main overseas markets for Japanese production. China's share of Japan's total overseas demand increased from 15.9% in 2010 to 24% in 2021, and the U.S. share increased from 15.3% to 20.9% over the same period. In addition, the share of demand for Japanese products in Germany and Korea also increased, with Germany's share from 2.6% in 2010 to 5.7% in 2021, and Korea's share from 4.2% to 4.4%

Table 3. Trends in Foreign Demand and Supply of Japanese Production

		2010		2021	
		Economy	Share	Economy	Share
DEMAND	1	PRC	15.9	PRC	24.0
	2	USA	15.3	USA	20.9
	3	KOR	4.2	DEU	5.7
	4	TWN	3.1	KOR	4.4
	5	DEU	2.6	TWN	3.5
SUPPLY	1	PRC	9.6	USA	15.2
	2	USA	9.1	PRC	12.4
	3	AUS	8.7	AUS	7.5
	4	RUS	4.3	KOR	3.3
	5	IDN	4.2	RUS	2.9

Note: Country names are based on ISO 3166-1 Alpha-3 code.

Source: Choi et al. (2022) Table 2-7(p.60), Table 2-8(p.62)

The main countries contributing to Japanese production are China and the United States. China's share of foreign added value contributing to Japanese production expanded from 9.6% in 2010 to 12.4% in 2021, while that of the U.S. rose from 9.1% to 15.2% over the same period. Following the recent U.S.-China trade dispute and the spread of COVID-19, Japanese production has become more linked to the U.S. than to China.

It can be seen that the importance of China and the United States in Japan's supply chain is gradually increasing. In particular, mitigating the supply chain shock caused by the U.S.-China conflict is very important for Japan, as the U.S. and China's share of added value in Japanese production increased from 18.7% in 2010 to 27.6% in 2021. Accordingly, Japan's supply chain restructuring policy consists of subsidies for reshoring and domestic investment companies and cost support for diversification of supply lines, and focuses on semiconductor and battery supply chains in terms of industry.

Japan subsidized part of the cost of relocating production facilities when relocating production bases concentrated in China to Japan, allocating a budget of 220 billion yen. In addition, the Japanese government will support some of the costs such as investment in production facilities, implementation of demonstration projects, and market research if a company with production facilities in China wishes to relocate production facilities to nearby ASEAN countries.

Japan implements support policies for semiconductors and batteries among various industries and items. The Japanese government's specific direction of support for semiconductor items focuses on attracting high-tech semiconductor plants to Japan. The semiconductor strategy identifies the weakness of the Japanese semiconductor industry as a lack of global semiconductor foundries in Japan, and is actively implementing support for attracting overseas foundry using semiconductor materials and manufacturing capabilities in Japan and revitalizing domestic semiconductor production facilities. The latest move by the Japanese government regarding the supply chain is the "Economic Security Promotion Act" passed in May 2022. Under the bill, private operators dealing with certain critical goods are obliged to submit plans to the ministers to whom the industry belongs to secure stable supply, and the ministers in the industry are authorized to investigate the supply chain for operators.

III. Implication

Looking at global supply chain changes and responses in major countries, Korea's strategies are: 1. Stabilizing supply chain through cooperation with the United States and China 2. Strengthening supply chain connectivity with emerging countries 3. Building supply chain solidarity through multilateral or bilateral cooperation.

First of all, like major countries, the role of the U.S. and China in the Korean supply chain

is very large, and the role of Korea in the U.S. and Chinese production networks has expanded slightly amid the U.S.-China conflict. The supply chains of China and the United States are linked to various countries, and Korean products are produced by combining the value-added of the United States and China. Therefore, it can be said that dichotomous cooperation between the U.S. and China in the Korean supply chain is practically difficult amid the U.S.-China conflict, and it can be said that it is difficult for the U.S. and China to cut off the supply chain with Korea.

However, the participation of manufacturing-based countries such as India in the supply chains of the U.S. and China is gradually progressing, and the U.S. and China are investing to secure their own supply chains for semiconductors, Korea's main export items. Therefore, in order to maintain and improve Korea's comparative advantage in the supply chain to the United States and China, mid- to long-term investment in high value-added items (semiconductor technology, next-generation displays, etc.) that can lead the market is necessary.

India and Mexico are expanding their roles amid recent changes in the global supply chain. These countries are continuously improving their investment environment to promote manufacturing at the national level, increasing

their production base capabilities, and have high market value considering the population of their home countries and neighboring countries. Therefore, Korea may consider strengthening supply chain connectivity with these emerging economies, which have recently expanded their role in the global supply chain, in order to disperse some of the supply chains that are skewed between the U.S. and China. In particular, since these countries have poorer production and trade infrastructure than advanced countries, infrastructure support using public funds should be accompanied to expand actual supply chain cooperation.

Meanwhile, as mentioned earlier, the global supply chain has recently been affected and changed by various factors such as natural disasters and conflicts between countries. In particular, Korea supplies intermediate goods to various countries, including the United States and China, which are global supply chain hubs, and needs to maintain a stable global supply chain due to the high proportion of trade in the economy. Therefore, Korea needs to actively participate in bilateral supply chain discussions with multilateral councils such as the Indo-Pacific Economic Framework (IPEF) and major countries to find a direction for joint response to the global supply chain crisis and reorganization. **KIEP**