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The Impact of COVID-19 and Korea's New Southern Policy on Its Global Value Chain

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Abstract

Purpose – The Korean government has been promoting the New Southern Policy (NSP) prior to the onset of the COVID-19 pandemic, which damage global value chain (GVC). The purpose of this paper is to emphasize that the NSP should be developed to provide tangible support in corporate GVC adjustment, away from diplomatic activities in order to offset GVC losses due to COVID-19 and expand export capabilities.

Design/methodology – Two research methodologies are combined for this paper: A computational general equilibrium (CGE) model is used to estimate the impacts of the COVID-19 pandemic and NSP on Korea's exports, and the decomposition methodology (Wang, Wei and Zhu, 2013) to evaluate the stability of GVC. The conventional CGE model was modified to obtain an estimate for decomposition. The research methodology adopted in this study was attempted for the first time, and it can be widely used in future GVC research.

Findings – Results found the effects of COVID-19 reduced Korea's total exports by 27% and GVC by more than 30%. In particular, VA in Korea's exports to the NSP region was found to have a huge impact in heavy industries and textiles, and its exports to Vietnam seemed to suffer the largest loss in GVC among ASEAN countries. If the NSP is implemented properly, it appears that it could offset much of the negative impacts of COVID-19, implying the importance of the effectiveness of the NSP.

Originality/value – Many papers have assessed the NSP descriptively, and the GVC has been a topic for many publications. However, the impact of COVID-19 on Korea's GVC with the NSP countries has not been quantitatively studied. This paper emphasizes that the NSP should be pursued based on the results of quantitative analysis. In addition, the research methodology of this paper can be used for other GVC research with relevant modifications.

Keywords: COVID-19 Pandemic, Global Value Chain (GVC), GVC Adjustment, New Southern Policy (NSP), Vertical Specialization Trade

JEL Classifications: F13, F14, F17

1. Introduction

As the US-China trade conflict intensified, Korea's heavy dependence on China in terms of its exports and production networks needed to be diversified and adjusted. As a result, the Korean government decided to promote the New Northern Policy (NNP) and New Southern Policy (NSP) in 2018. The NSP seeks to expand and deepen economic relations with ASEAN countries and India. To this end, the Korean government established a new special committee for the New Southern Policy. ASEAN countries and India can be good partners for Korea in

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adjusting its global value chain (GVC), which is the international division of production tasks for the reduction of production costs and the creation of high value added (VA), based on improved efficiency and market access for intermediate goods and final assembly.[1]

The NSP faces the unexpected environmental change with the outbreak of COVID-19 this year. Korea, which followed China as the country with the most serious COVID-19 crisis early this year, had immediate success in overcoming the COVID-19 pandemic. However, Korea is currently facing a second crisis of COVID-19 that started in mid-August 2020. As a result, the Bank of Korea (2020) lowered economic growth forecasts to -1.3% for this year. In order to prevent further deterioration in economic growth, Korea should reorganize its GVC to be more resilient as quickly as possible and establish an export system that can adapt appropriately to changes in the trade environment. In this respect, the NSP has great implications for companies and the national economy.

Many countries blocked entry as a preventative measure after the declaration of the pandemic by the World Health Organization (WHO) on March 11, 2020. People's movements were restricted, and production facilities were shut down, including the NSP region. As a result, demand and supply were damaged on a global scale. Many research institutes are projecting that COVID-19 will push the reorganization of GVC (Foreign Policy, 2020; McKinsey Global Institute, 2020; OECD, 2020b; UNCTAD, 2020; World Bank, 2020; WTO, 2020a), in addition to severe economic depression globally.

GVC is a concept related to a company's production activities, so it is very difficult to analyze macroeconomically. This is due to the difficulty in establishing a data system at the national level containing the information on the change in the procurement method of individual companies' parts and intermediate goods (WTO, 2017).[2] This is why the number of papers on the quantitative analysis of GVC is relatively low, while there is a lot of descriptive literature on GVC. In addition to data, the analysis of the COVID-19 crisis on Korea's GVC requires a set of complex simulation tasks. The effect of COVID-19 on GVC should be estimated first, and these results should be decomposed to several VA indices. The same methodology will be applied for Korea's NSP in order to evaluate the impact on its GVC with NSP countries.

Although the Korean government is promoting the NNP and the NSP, the NNP has not made the expected progress. The NSP, which sets ASEAN and India as targets for cooperation, has had positive results. Korean companies consider ASEAN countries, which are geographically close and active in economic cooperation, as an alternative production base for China (KITA, 2020). Indeed, trade and investment with ASEAN have increased in recent years seen in Kwak Sung-Il (2020), and a series of KIEP reports such as Lee Jae-Ho (2019). India is also an NSP target area, and many Korean companies are operating production facilities there.

It has long been pointed out that Korea may be the biggest victim of the US-China conflict. This is because Korea's trade dependence on the two countries is approximately 40%, and Korea is one of the countries with the highest trade dependence in the world. The NSP was designed to escape from this trap. The outbreak of the COVID-19 pandemic has created poor external conditions for Korea's GVC. The purpose of this paper is to emphasize that the NSP should be developed to provide tangible support in corporate GVC adjustment to offset GVC

[1] One-third of world production is made by Multinational Corporations (MNCs), and cross-border transactions by MNCs account for half of world trade (OECD, 2018). In addition, 70% of international trade is trade of raw materials and intermediates required for production, implying GVC trade (OECD, 2020a).

[2] Although it is deeply related to the actual business, it is difficult to systematically construct the related data, so the vast GVC literature uses descriptive research methods.

losses resulting from COVID-19. This paper attempts to estimate the impact of the COVID-19 pandemic and Korea's NSP on its GVC with the NSP region.

2. Literature Review

Following the COVID-19 pandemic declaration, countries blocked entry, ordered containment and self-isolation, and the world economy came to a halt. Since then, economic activity has partially recovered, but many countries still do not allow cross-border movement. Research on the effects of the NSP under COVID-19 is currently lacking, although the literature on the effects of COVID-19 on GVC is rich. The relationship between COVID-19 and GVC is first reviewed and then summarized on the NSP and Korea's GVC with the NSP countries.

2.1. GVC after the Covid-19 Outbreak

In the current situation, there is a limit to grasping the true impact of the pandemic. It is predicted that the world before COVID-19 will be markedly different from the world after COVID-19. Foreign Policy (2020) reported the views of world-renowned scholars such as Richard N. Haass, chairman of the Council for Foreign Relations (CFR), regarding the question "How the Economy Will Look After the Coronavirus Pandemic?" All respondents expect massive economic losses due to the shut-down and blockade. Professor John Ikenberry of Princeton University suggested strengthening competition between countries, the strategic decoupling of the US and China, and the negative impacts of globalization in addition to the economic damage. Dr. Gita Gopinath of the IMF warned that the international movement of people could be brought back to the situation in the 1970s, and this will have a huge impact on GVC. Many countries may pursue domestic economic activity due to supply chain vulnerability, and supply chains may be localized rather than global outsourcing. Chairman Haass of the CFR predicted that many countries would pursue selective self-sufficiency, and Robin Niblett, director of Chatham House, also raised questions about maintaining long-distance supply chains.

After the global financial crisis in 2008, GVC weakened, and structural changes appeared in the weakening of the manufacturing GVC, the strengthening of the service GVC, the reduced importance of labor costs in GVC, and the increase of GVC participation in the knowledge-intensive sector (WTO, 2018). Also, the localization of GVC was remarkable. The WTO (2020a) is concerned about rising trade costs due to the pandemic, implying severe damage to GVC. Trade costs may reduce after the coronavirus is overcome, but some may persist due to changes in the policy environment or market dynamics. In particular, the WTO expects that the cost of travel and air transport will not decrease for a considerable period. COVID-19 ravaged production and demand globally through its global supply chains (Baldwin and Tomiura, 2020). In the early phase of the pandemic, the supply of major parts, mainly in the automobile and electronics industries, was delayed or restricted, resulting in turmoil in the global supply chain (Haren and Simchi-levi, 2020).

Researchers have a variety of opinions on the impact and response of COVID-19 on GVC. According to Urata (2020), automobile production in Japan declined by 10% in February compared to last year due to supply disruptions from China, and by 45% in April because of the expansion of the virus in Japan. The OECD (2020b) is proposing reshoring to home countries or configuring various intermediate suppliers to make GVC more resilient to external shocks. These proposed options are also supported by the studies by Inoue and Todo

(2017) and Zhu, Ito and Tomiura (2016) that studied the GVC of companies in affected areas of the 2011 earthquake in East Japan. Bonadio et al. (2020) pointed out that the nationalization of GVC may worsen economic performance in a pandemic situation, and Baldwin and Freeman (2020) refers to the situation in which global production activities were suspended, as governments took measures.

GVC enables an optimal production configuration, lowering the unit cost of products, and splitting production tasks over several countries; that is, production is fragmented, depending on the international competitiveness of each production task (OECD, 2013). In addition, the improvement in the competitiveness of certain production tasks can attract multinational corporations (MNCs), so GVC plays a pivotal role in economic development and poverty eradication in developing countries (World Bank, 2019).

2.2. Korea's New Southern Policy and COVID-19

The government of Korea adopted the "New Southern Policy" for increasing the country's focus on ASEAN and Southern Asian countries such as India. In order to cope with the reorganization of the global economic order caused by US-China tension while reducing excessive dependence on China, the Moon Jae-in administration recognized that it became necessary to diversify trade and foreign investment. Korea is now oriented to have better diplomatic relations in coping with the challenges that threaten national security.

Korea's NNP, which consists of 16 key tasks such as the development of the Arctic logistics route, may have a great potential economic effect, but many political variables pose risks. In addition, due to delays in improving relations with North Korea, it may take time to commercialize. On the other hand, the NSP is currently forming a close trade-investment relationship and is a region of interest for Korean companies due to the spread of global protectionism and conflicts between the US and China. Moreover, the Korean government has upgraded the organization and staff at the Korean Embassies in the region. President Moon has also visited most ASEAN countries to support ASEAN-Korea cooperation.

Research on economic cooperation is also more frequent in the NSP than in the NNP. Although Jeong Jae-Won (2020) examined the economic effects of the NNP, its feasibility is low. But many studies are found for the NSP. Lee Keun, Szapiro and Mao (2018) researched ways to use ODA to expand the GVC with the NSP regions. Shim Jae-Hee (2019) analyzed the Trade Complementarity Between Korea and NSP Countries, suggesting closer economic cooperation as a way to minimize the damage of the US-China conflict. Cho Choong-Jae et al. (2018) discusses measures to stimulate Korea-India economic cooperation to realize the NSP. Na Seung-Kwon, Lee Sung-Hee and Kim Eun-Mee (2018) analyzed Japanese and Chinese foreign policies in the ASEAN region from the perspective of soft power and suggested implications for the NSP. Lee Jae-Ho (2019) has examined Korea's investment in the ASEAN region since the announcement of the NSP, and Han Hyoung-Min et al. (2019) analyzed foreign direct investment (FDI) by country, trying to provide policy implications for Korea's NSP.

Comparing the progress of economic cooperation so far, the NSP is more dominant than the NNP (Kim Jong-Bub, 2019), although the former has made larger improvements. Many Korean companies exited China and have reestablished their production bases in other ASEAN countries, including Vietnam and India. As of the end of 2018, Korea's cumulative investment in ASEAN amounted to US$ 61.9 billion, and the number of Korean companies in the region reached 14,680. In 2018, the year after the NSP was announced, investment in ASEAN nations was made by 1,291 Korean companies, and the investment amount was $6.13 billion, with growth ratios of 14.1% and 16.7%, respectively. As investments in ASEAN increased, Korean financial institutions increased local businesses. According to Kim Jeong-

Han and Seo Byeong-Ho (2018), domestic banks are relatively active in opening their offices in ASEAN nations. At the end of 2017, the number of overseas branches of domestic financial companies was 431, of which 157 were operating in the ASEAN region.

2.3. Quantitative Studies on Korea's GVC with NSP Countries

Research on the GVC with NSP countries has been actively conducted in Korea in recent years. Most studies were conducted prior to the COVID-19 outbreak, so most do not reflect any COVID-19 effects. In addition, many studies focused on GVC analysis with ASEAN nations, and it is difficult to find papers that quantitatively examined GVC with India. The GVC analysis method in Wang, Wei and Zhu (2013, abbreviated as WWZ) has been used in many studies, and the multi-regional input-output (ADB-MRIO) framework developed by the ASEAN Development Bank (ADB) has been widely used as a database. Taking the results of the five studies mentioned, the ASEAN-Korea GVC is still weak. Although there are differences depending on the study, it can be seen that Korea has formed one of the strongest GVCs with Vietnam among the 10 ASEAN member countries.

Table 1. Summary of Studies on Korea's GVC with NSP Countries

Researcher	Methodology and data base	Major findings
KIEP(2019)	WWZ(2013), ADB-MRIO database	Korea's deep GVC with some of NSP countries, especially Vietnam and Singapore
KIEP(2018)	WWZ(2013), ADB-MRIO database	Only Vietnam among ASEAN countries has a deep GVC with Korea.
Yoo Jeong-Ho and Lee Jun-Yeop (2019)	WWZ(2013), OECD-ICIO database	The foreign VA share of intermediate goods is relatively high in ASEAN countries.
KOTRA(2019)	WWZ(2013), EoRA-MRIO	Korea has high GVC structure with Malaysia, Thailand and Indonesia.

The Korea Institute for International Economic Policy (KIEP) published two volumes of GVC research with NSP regions. KIEP (2018) suggested that only Vietnam among the ASEAN countries has a deep GVC with Korea. Laos and Cambodia have a deep GVC structure with China, while the Philippines and India have a strong GVC structure with the US. Japan is known to have developed a high GVC with Indonesia. KIEP (2019) showed that the ASEAN region showed a significant increase in domestic VA exports, and it was analyzed that Korea's GVC participation was higher with ASEAN than other regions, such as RCEP and NAFTA. In particular, the use of GVC in the NSP region is steadily improving, and the regional value chain participation is increasing. This has led to the expansion of regional production divisions.

Yoo Jeong-Ho and Lee Jun-Yeop (2019) found that ASEAN countries are relatively located in downstream industries, importing capital goods, and exporting consumer goods. From the viewpoint of VA trade, the foreign VA of intermediate goods is relatively high in ASEAN countries. In addition, the degree of GVC participation by ASEAN countries varies considerably, and the proportion of vertical specialization in Singapore, Vietnam, and Malaysia is high. KOTRA (2019) found that the GVC participation of the NSP countries was centered on the forward GVC and that Korea's regional value chain with NSP countries was deepened over time. It was found that Korea's participation is high in forward GVC with Malaysia and Thailand, and backward GVC with Indonesia.

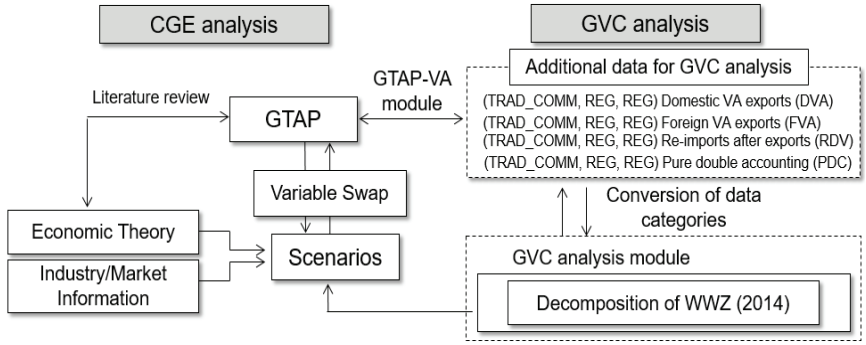
3. Methodology and Simulation Scenarios

The CGE model is widely used to analyze the impacts of a specific policy. The impacts of COVID-19 and the NSP on international trade can also be analyzed with the CGE model. In order to analyze the impacts of these issues on GVC, a GVC decomposition methodology is required, and the CGE model must also be modified to produce data suitable for GVC analysis. Here, the research methodology is briefly presented first, and the GVC analysis methodology is then presented. This is followed by the modification of the conventional CGE model.

3.1. Methodology

Research methods can be roughly divided into two parts. First, the impacts of COVID-19 and the NSP on trade is estimated, and then the resulting estimates are analyzed using the GVC decomposition method. The whole research methodology is presented in Fig. 1. By combining the CGE model and the GVC methodology, the impacts of the COVID-19 and the NSP on GVC are estimated. The data derived includes domestic VA exports (DVA), foreign VA exports (FVA), re-import after exports of intermediate goods (RDV), and double accounting (PDC). The effects on GVC are examined. Korea's exports are shown in Section 3.2. Although the CGE model and GVC methodology are built with many equations, this paper has presented the main ideas briefly so that readers can grasp the methodology.

Fig. 1. Structure of Research Methodology



GVC analysis cannot be performed with gross trade data, which can be seen in export and import statistics. This is because gross trade data differs from value added (VA). Korea's exports in 2019 were $542.4 billion, but a part of it was Korea's VA, and the remaining VA is provided to foreign suppliers. Therefore, a method of extracting VA from trade statistics is needed.

Intermediate inputs in production can be provided domestically or imported. A value chain can be formed when imported intermediates are used. The importance of GVC is evident, but the method of measuring GVC is extremely limited due to the difficulty of obtaining data. In view of these difficulties, Hummels, Ishii and Yi (2001) devised the concept of vertical specialization (VS). It is the value of imported intermediate goods included in producing exports, and country j's VS ratio in total exports can be calculated as follows:

$$\frac{VS_j}{X_j} = \frac{\sum_i VS_{ji}}{\sum_i X_{ji}} = \frac{\sum_i (VS_{ji}/X_{ji}) \cdot X_{ji}}{\sum_i X_{ji}} = \sum_i \left[\left(\frac{X_{ji}}{X_j} \right) \cdot \left(\frac{VS_{ji}}{X_{ji}} \right) \right] \quad (1)$$

$$\frac{VS_j}{X_j} = uA^M X / X_j = u[I - A^D]^{-1} X / X_j \quad (2)$$

where u : 1×n vector of ones, A^M: n×n imported coefficients, X : n×1 vector of exports, X_j : country *j*'s total exports, I : n×n identity matrix, A^D : n×n domestic coefficients, n : number of sectors.

The VS ratio can be calculated either by using a weighted average of VS shares across sectors (eq. 1) or with a matrix of imported coefficients (domestic coefficients) (eq. 2). This is useful for analyzing the GVC of a country. Johnson and Noguera (2012), Wang, Wei and Zhu (2013), Koopman, Wang and Wei (2014) and others have devised methods to extend the VS of Hummels to a multi-country framework. Their research develops an accounting framework that can calculate DVA, FVA, RDV, and PDC in the context of production fragmentation across several countries, thereby enabling international comparison of GVC. For this, major matrix calculations are done as follows:

Gross exports can be divided into intermediate and final goods' exports.

$$X^s = A^{ss} X^s + Y^{ss} + A^{sr} X^r + Y^{sr} \quad (3)$$

where X^s : gross export vector of Country s, Y^{sr}: final demand vector that gives demand in Country r for final goods produced in s, A^{sr} : IO coefficient matrix, giving intermediate use in r of goods produced in s.

Gross output is absorbed according to the following networks.

$$X^r = [(1 - A^G)^{-1}]^{rr} Y^{rr} + [(1 - A^G)^{-1}]^{rr} Y^{rs} + [(1 - A^G)^{-1}]^{rs} Y^{ss} + [(1 - A^G)^{-1}]^{rs} Y^{sr} \quad (4)$$

whereX^r : gross output vector of Country s, A^G: n×n Global IO coefficients , Y^{sr} : demand vector of Country r, sourced from Country s.

Finally, the VA included in exports is decomposed as follows;

$$A^{sr} X^r = A^{sr} L^{rr} Y^{rr} + A^{sr} L^{rr} Y^{rs} + A^{sr} L^{rs} Y^{ss} + A^{sr} L^{rs} Y^{sr} \quad (5)$$

whereA^{sr} : Input-Output coefficient, when Country s export to Country r, L^{r*}: Leontief vector of Country r, when Country * export,

Equation (5) presents the decomposition as VA = DVA + FVA + RDV + PDC.

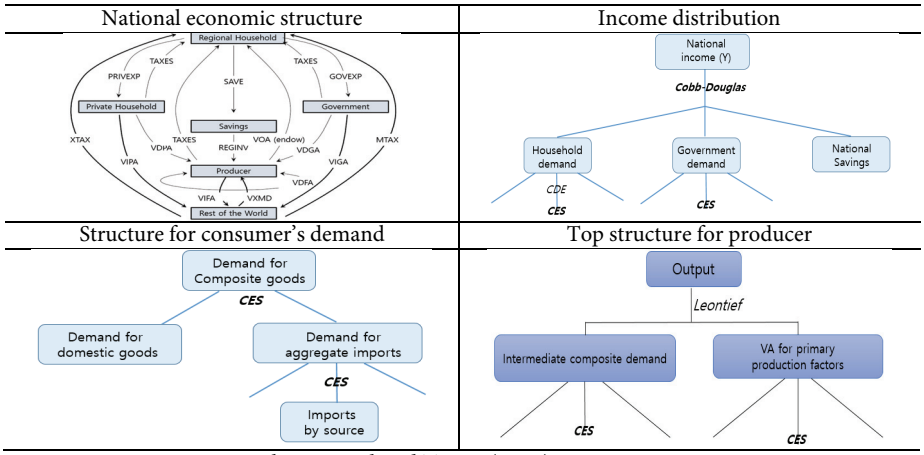
This paper estimates the effects of COVID-19 and the NSP using the GTAP CGE model. The GTAP model was developed by a research team led by Professor Tom Hertel of Purdue University and spread internationally. It is the most widely used CGE model worldwide, as it provides a CGE model and related database.[3] The GTAP model is a global economic model and defines the behavioral equations of major economic actors (consumers, companies, governments) as the method used in economics (Leontief, Cobb-Douglas: CD, Constant Elasticity of Substitution: CES). A country's income is distributed as consumption, government expenditure, and savings in the CD method, and demand for goods and services is determined by the CES specification. In the case of production, the Leontief (fixed coefficient) structure is adopted for the highest tier of decision making, and the CES is applied to the demand for production factors or intermediate inputs (Fig. 2). The GTAP model is

[3] Regarding the value of GTAP database, refer to McDonald and Thierfelder (2004), Rutherford (2005) and Aguiar et al. (2019).

described in detail in Hertel and Tsigas (1997).

For CGE users, the GTAP database is very useful. This is because, in addition to data on trade, consumption, government spending, and taxes, the Social Accounting Matrix (SAM) required for CGE is assembled and systemized in a single system. The database, which may take several years in assembling, is systematically compiled by the GTAP Center and is designed to be convenient for users (Hertel and Tsigas, 1997). Users of the CGE model other than GTAP also use this database (Aguiar et al., 2019; Rutherford, 2005). Version 10 of the GTAP database was used, which includes 141 countries and 65 industries.

Fig. 2. Structure of the GTAP CGE Model



Source: Various sources such as Hertel and Tsigas (1997).

For this study, the regions and industries of the GTAP database mentioned earlier are aggregated, as shown in Table 3. Korea, individual ASEAN countries, India, China, and the US were classified as individual countries, the 28 EU member states were classified as the EU, and the remaining countries were classified as rest of the world (ROW). Since there are as many as 16 countries/regions, CGE simulation is facilitated only when the number of industries is reduced as much as possible. The economy of a region is divided into 10 industries, which is commonly disaggregated.

Table 2. Aggregation Scheme for Country/Region and Sector

	Country/Region (16)	**Sector (10)**
Classification	Korea, individual members of ASEAN countries, India, China, USA, EU, ROW	Agriculture, Textile-apparel, chemicals, high-tech industries, steel, machinery, automobiles, heavy industry, light industry

In the WWZ (2013) method of analyzing GVC, trade statistics have one blind spot. That is, the use of goods imported by a country is unknown. For example, when a billion dollars worth of auto parts are imported, it is not known how much would be used to manufacture exports in most cases. GTAP uses the Armington (1969) specification to determine the amount of imports for the simplification of the model, and these imports are distributed among consumption (household and government) and intermediate goods (company) using

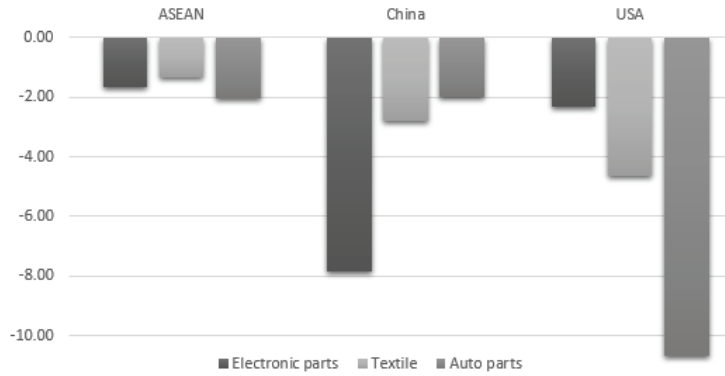
the CES function. Therefore, the GTAP model itself cannot generate the necessary country-specific import data for manufacturing exports that is required in analyzing the impact on GVC.

Peter, Andrew and Lennox (2011) provide a useful module in extending the data of the GTAP using proportional assumption (Jonson and Noguera, 2012; Lejour, Rojas-Romagosa and Veenendaal, 2014).[4] Following Lejour, Rojas-Romagosa and Veenendaal (2014), this paper borrows the module of GTAP-VA based on the proportional assumption in calculating necessary data for GVC analysis from the simulation of the GTAP model,[5] decomposing VA for the GVC analysis following WWZ (2013). Detailed information can be found in Peter, Andrew and Lennox (2011), Antimiani and Fusacchia (2018).

3.2. Evaluation of Korea's Exports with GVC Decomposition

The difference-in-differences (DID) analysis results of Korean exports of its major intermediate goods (electrical-electronic parts, textiles, auto parts), as shown in Figure 3, found that exports of electrical-electronic parts to China and auto parts to the US decreased by 7.8% and 10.7%, respectively, comparing levels before and after the COVID-19 outbreak. However, the export reduction of intermediate goods to ASEAN nations was relatively small compared to those of the US and China.

Fig. 3. DID Results on Korea's Major Exporting Intermediate Goods (%)



Note: Korea's monthly export data used.
Source: Korea Trade Statistics Promotion Institute.

In order to consider the background for this finding, it is necessary to decompose Korea's GVC for the NSP region. For this, the GVC decomposition methodology of WWZ (2013) was applied to the data of the 2017 ADB-MRIO, which includes India and six ASEAN countries. The VA included in the total exports is decomposed into DVA, FVA, RDV, and PDC, as presented in Fig. 1.

[4] Early versions of the GTAP model in 1990s were built on extended version of data using proportional assumption, which assumes imported goods to be distributed in equal ratios across sectors.

[5] Alternative option to derive the additional data is to calculate bilateral trade ratios of intermediate and final goods by classifying intermediate and final goods based on the UN BEC codes, as Walmsley, Hertel and Hummels (2014) and Aguiar et al. (2016). Yet, this still has a limitation, since it needs an assumption for the ratios, which is similar with proportional assumption.

For Korea's GVC by country, the DVA ratio varies greatly from country to country. The DVA for ASEAN nations (average) was lower than for China, the US, and India. However, the FVA of Korea's exports to ASEAN nations was 18.8% higher than that of other regions that ranged from 7.3% to 12.9%. That is, the input ratio of imported parts is high for Korea's exports of intermediate goods to ASEAN nations. Linking this to the regional trade performance shown in Figure 3 suggests that despite the novel coronavirus outbreak in the first half of this year, Korea had little difficulty in procuring foreign intermediate goods necessary for the production of intermediate goods for export to ASEAN countries.

Table 3. GVC Decomposition of Korea's Exports to Major Countries

	DVA	FVA	RDV	PDC
ASEAN	66.4%	18.8%	0.51%	14.6%
Indonesia	86.5%	9.01%	1.22%	4.67%
Malaysia	61.0%	20.8%	0.19%	22.2%
Philippines	79.0%	12.3%	0.22%	8.09%
Singapore	43.4%	23.7%	0.21%	31.6%
Thailand	67.6%	17.9%	0.19%	10.5%
Viet Nam	61.0%	29.6%	0.19%	18.3%
India	77.5%	12.9%	0.77%	8.86%
China	75.6%	8.99%	**7.71%**	7.84%
US	84.7%	7.30%	**3.85%**	4.16%

Source: Author's estimation based on ADB-MRIO.

RDV accounts for the VA included in re-imported intermediate goods, which were exported after processing in a third country. The higher the RVC ratio, the longer the length of GVC. In this regard, RVC can be interpreted as an indicator of how long GVC is spread bilaterally. According to Table 2, the ratio of RDV in exports to ASEAN and India was significantly lower than that of China and the US. This means that although Korea is developing GVC with NSP countries, it remains at a shallow level that includes simple processing. This can be seen as consistent with the survey results from the existing literature, such as KIEP (2018), Yoo Jeong-Ho and Lee Jun-Yeop (2019). This implies that if production contracts due to COVID-19, Korea's GVC risk may be relatively small regarding the trade with ASEAN nations and India. In other words, the GVC decomposition suggests that the damage caused by COVID-19 can be directly seen in trade with China and the US in terms of Korea's GVC, while it is relatively easy to manage the risk in trade with ASEAN nations and India. In this context, the reason why the COVID-19 shock to Korea's exports of intermediate goods to ASEAN nations, shown in Table 2, was relatively lower than that of China, and the US can be understood in this context.

3.3. Scenario

As discussed in the previous section, the impact of COVID-19 on GVC varies by region. It is expected that companies will adjust GVC to manage the risk caused by COVID-19. The adjustment of the GVC is highly likely to take place by focusing on the NSP region currently being promoted by the government of Korea. Therefore, the scenarios of this study not only measures the damage of COVID-19 but also consider the effects of the NSP as a post-COVID-19 strategy.

In the case of the NSP, there is heavy criticism that there is only a policy, and a concrete plan of action has not been implemented yet. The three communities (people, win-win prosperity, and peace) proposed by the Presidential Committee on New Southern Policy and the 16 detailed strategies are similar to the grand development plan by ASEAN, and the NSP lacks in specific measures to induce the interest of ASEAN countries (Choi Young-Jong, 2019).

As of the end of August 2020, the number of COVID-19 confirmed cases worldwide has exceeded 25 million, and the death toll is approaching 85,000 (WHO COVID-19 Dashboard). The number of new confirmed cases was about 285 thousand per day, and it is difficult to predict the end of the COVID-19 pandemic. In April of this year, the IMF (2020) predicted that the global economy would decrease 2.1% due to COVID-19 risk, and then increased its predicted decrease to 4.9% in a subsequent report two months later. As in the worst-case scenario presented in the IMF report, global economic growth could decrease by 10% or more.

Since COVID-19 loss is difficult to predict, this paper considers three scenarios. Table 4 presents the 3 scenarios with variables for demand (*y* : income) and supply (*ams* : logistics efficiency, *afe* : reduction in labor productivity),[6] referring to the forecast in ADB (2020), PwC (2020), and ILO (2020).[7] In addition, the Korean government's NSP strategy is included in these scenarios. From an economic perspective, Korea's NSP objective will be to adjust GVC for risk management. ASEAN nations are active in strengthening economic cooperation with Korea.[8] The adjustment of GVC will lead to a continued increase in Korea's investment in the ASEAN region. Scenario 1 (S1) assumes a relatively low damage outcome, while scenario 3 (S3) sets the worst-case scenario. Currently, S2, which is between S1 and S3, is predicted as having a likelihood of occurring.

Overseas investment and overseas M&A disruptions are serious due to the coronavirus risk. However, if NSP can solve these problems, it can be of great help in extending GVC. In general, investment occurs in countries with low risk, and in the GTAP model, the slack variable for investment (*cgdslack*) is swapped with the rate of return (*rore*) to analyze the investment effect of risk reduction (Malcolm, 1998). In this study, it is assumed that the GVC risk caused by the COVID-19 outbreak could be reduced through GVC adjustment with the NSP countries, and this is included in the scenarios.[9]

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[6] Considering the negative effects of COVID-19 on the supply side, exogeneous variables of productivity (*afe*) and trade efficiency (*ams*) were adopted to be shocked. In the CGE model used for this paper, these variables could be relevant for the lockdowns and cross-border restrictions on the movement of natural persons, which result in the losses in productivity and trade efficiency. In addition to these, income reduction was reflected with the variable of income (*y*).

[7] In estimating the unprecedented impact of COVID-19 on GVC, it was very difficult for authors to predict the impact of COVID-19 on the global economy. Accordingly, they prepared 3 simulation scenarios and related shocks based on the economic outlooks by international economic institutions in the middle of 2020 when this paper was written. It may appear somewhat arbitrary, but they chose scenarios and shocks with the best judgment.

[8] ASEAN is promoting high value-added industries through investment attraction and technology transfer from Korea (ASEAN briefing, 2014).

[9] The variable *rore* representing future capital investment returns is the sum of risk and *rorg*, which is the global average return on investment. In the GTAP model, when RORDELTA is 1, it can be expressed as *rore(r) = rorg(r) + cgdslack(r).* At this time, *cgdslack* is an investment risk.

Table 4. Summary of Simulation Scenarios

			S1	S2	S3
Damage of COVID-19	Supply	Productivity (*afe*)	-3%	-5%	-10%
		Trade efficiency (*ams*)	-5%	-10%	-15%
	Demand	Income (*y*)	-5%	-10%	-15%
New Southern Policy	Investment	Risk reduction (*rore*)	-10%	-15%	-20%
	Spillover	Labor productivity (*afeall*)	10%	15%	20%

Next, Korea's continued investment in the ASEAN region could create a spillover effect. Deng, Falvey and Blake (2008) explain that FDI causes a spillover effect, which in turn contributes to productivity growth. In particular, permitting the priority transfer of essential personnel to ASEAN countries, which the Korean government is pursuing after the COVID-19 outbreak, will also have a positive effect on Korean companies' investment into the ASEAN region. Cross-border movement of essential personnel has become an important issue in enhancing the productivity of investment in host countries (Javorcik, 2004; Liu et al., 2000; Meyer and Sinani, 2009). In this study, this effect is reflected in the scenarios through the productivity variable (*afeall*).

4. Simulation Results and Interpretation

Many estimates are produced by calculating the effects of COVID-19 and the NSP on Korea's GVC over several steps using the modified GTAP model and VA decomposition method. However, in this paper, only the core content is presented, focusing on the VA decomposition due to the limitation of pages.

4.1. Impact of COVID-19

The possible impact of COVID-19 on Korea's total exports is presented in Table 5. Korea's total exports are expected to decrease from 9.4% to 27.2%. The estimates in this study are close to the projections of the WTO (2020b) that global trade could decrease by 12.9%-31.9% this year. For reference, the total export volume of Korea in the first half of this year was $246.4 billion, which is down by 11.3% from the same period last year. The impact by country/region shows a similar result as in Fig. 3. The decline in Korea's exports to China and the US is expected to be larger than the decline in total exports, while the shock on exports to ASEAN nations, India, and the EU is expected to be relatively low.

Table 5. Impact of COVID-19 on Korea's Total Export by Country/Region (Unit: %)

	Total Export		
	S1	**S2**	**S3**
ASEAN	-8.8	-16.7	-25.5
India	-7.8	-14.3	-22.1
China	-11.5	-21.5	-33.0
USA	-15.5	-29.3	-44.8
EU	-6.8	-12.8	-19.6
Total	-9.4	-17.8	-27.2

The impact on export VAs was decomposed into DVA, FVA, and PDC. In the case of domestically procured VA (DVA), depending on the scenario, it decreases by 8.9%-25.7%, and looking at the shocks by country/region, exports to the US have the largest shock, followed by 33.9% in Vietnam, and 31.7% in China.

It was noted that Hummels and his colleagues developed VS as an indicator to analyze the impact on GVC. In Table 6, VS is calculated as the sum of FVA and PDC. It can be seen that the imported VA (FVA) of Korea's exports to the world can decrease by up to 29.3% (Scenario 3), and the double-counted VA (PDC) can decrease by up to 37.6%. Also, FVA and PDC are expected to decline significantly in exports to the US. As the trade environment deteriorates due to COVID-19, the results suggest that the GVC of producing goods for exports to the US could be the most exposed to risk. The biggest GVC damage could happen to Vietnam, excluding the US and China. This outlook is in line with Vietnam's economic performance after COVID-19.[10]

Table 6. Decomposition of COVID-19 Impacts on VA (Unit: %)

	DVA			FVA			PDC		
	S1	**S2**	**S3**	**S1**	**S2**	**S3**	**S1**	**S2**	**S3**
ASEAN	-8.4	-16.0	-24.4	-9.2	-17.6	-26.9	-12.0	-23.3	-35.3
- Cambodia	-6.8	-12.8	-19.6	-6.7	-13.0	-19.7	-9.8	-18.4	-28.2
- Indonesia	-8.1	-14.7	-22.8	-9.1	-17.1	-26.2	-9.9	-19.0	-28.9
- Laos	-0.6	-0.6	-1.3	-0.0	-0.8	-0.8	-2.4	-4.8	-7.1
- Malaysia	-6.5	-12.3	-18.8	-7.6	-14.6	-22.2	-9.8	-19.9	-29.7
- Philippines	-4.5	-8.8	-13.2	-5.0	-9.9	-14.8	-7.4	-15.6	-23.0
- Singapore	-7.5	-14.7	-22.2	-9.1	-17.8	-26.9	-11.3	-22.9	-34.2
- Thailand	-7.6	-14.6	-22.2	-8.8	-16.9	-25.7	-11.4	-22.0	-33.3
- Vietnam	-11.7	-22.2	-33.9	-12.2	-22.9	-35.1	-15.8	-29.7	-45.5
India	-7.2	-13.0	-20.2	-8.6	-15.8	-24.5	-10.3	-19.9	-30.1
China	-11.1	-20.7	-31.7	-11.9	-22.4	-34.3	-15.0	-28.5	-43.5
USA	-14.9	-28.4	-43.3	-16.4	-30.9	-47.3	-19.7	-36.8	-56.5
EU	-6.7	-12.7	-19.5	-6.8	-13.0	-19.8	-9.5	-18.9	-28.4
Total	-8.9	-16.8	-25.7	-10.1	-19.2	-29.3	-12.8	-24.8	-37.6

This can be interpreted as showing the vulnerability of Korean exports. The production bases of Korean companies established in China and Vietnam use many intermediate goods made in third countries, and a large portion of the products produced are exported to the US. If any of the interlocking GVC systems is disturbed, the operation of the entire production system may experience significant slow-downs, as shown in Table 6.

The VA impact on the NSP countries in Table 6 is decomposed by industry in Table 7. First, looking at the impact on the DVA indicator, the industries that are expected to have the greatest impact across all scenarios are in the order of heavy industry, textile, pharmaceuticals,

[10] According to Bloomberg (2020), Vietnam has successfully quarantined COVID-19, but economic growth has deteriorated significantly due to a decline in demand in major export markets such as the US. Samsung Electronics (Vietnam), which produces 20% of Vietnam's total exports, also lowered its export target this year from $45.5 billion in 2019 to $32 billion.

and chemicals. In the case of FVA, the greatest impacts are expected to occur in the order of heavy industry, textile, pharmaceuticals, and light industry. In the case of the PDC indicator, the shocks are expected to be largest in the order of heavy industry, textile, light industry, and pharmaceuticals. From this table, it can be seen that if the COVID-19 risk prolongs in the future, Korea's heavy industry and textile will have a significant impact on exports to the NSP countries, and the procurement of intermediate goods (FVA, PDC) required for production is the most vulnerable. Based on this, it can be said that the NSP authority should hurry to seek effective supply chain support measures for these industries.

Table 7. Impacts of COVID-19 on Korea's Exports to NSP Region by Sector (Unit: %)

	DVA			FVA			PDC		
	S1	**S2**	**S3**	**S1**	**S2**	**S3**	**S1**	**S2**	**S3**
Agriculture	-12.2	-23.7	-35.9	-11.8	-23.0	-34.8	-13.7	-26.9	-40.5
Heavy Industry	-19.3	-32.8	-52.0	-17.9	-30.9	-48.8	-23.1	-42.3	-65.4
Textile-Apparel	-14.3	-27.0	-41.3	-14.6	-27.2	-41.8	-18.6	-34.2	-52.8
Light industry	-11.1	-21.0	-32.1	-11.3	-21.2	-32.4	-14.4	-27.1	-41.5
Chemical	-11.7	-22.5	-34.2	-10.5	-20.2	-30.7	-12.6	-24.2	-36.8
Pharmaceutical	-13.8	-26.0	-39.8	-12.0	-22.8	-34.9	-14.1	-27.2	-41.3
Metal	-8.0	-14.7	-22.8	-9.1	-16.7	-25.8	-11.7	-22.0	-33.8
High-tech	-7.4	-14.3	-21.6	-7.7	-15.0	-22.7	-11.5	-22.6	-34.0
Machinery	-2.6	-3.9	-6.5	-4.2	-6.8	-11.0	-7.6	-14.3	-21.9
Transport	-1.7	-2.8	-4.5	-3.2	-5.7	-9.0	-6.2	-12.4	-18.7

4.2. VA Decomposition Including NSP Effects

The expansion effect of the NSP on Korea's export VA is not separately reported due to space restrictions, and the effects of COVID-19 and the NSP are presented in Table 8 for easy comparison. The minimum and maximum values of VA effects are separated by commas in [,]. Focusing on DVA, in the case of ASEAN as a whole, DVA in Korea's exports could decrease by 8.4% to 24.4% due to the effects of COVID-19. On the other hand, the negative impacts can be partially offset by the NSP. Depending on the investment promotion policy, the recovery can be 2.8%~7.1%, and the productivity improvement policy based on the spillover effect is expected to offset 4.6%~10.1%. In addition, when both policies are used simultaneously, the export DVA recovery effect ranges from 7.4% to 17.3%. The countries with the highest growth in DVA through the NSP are Thailand and Singapore, which are expected to increase up to 26.3% and 25.3%, respectively.

Table 8. Impacts of COVID-19 and NSP on Domestic Value Added (DVA) (Unit: %)

	Damage of COVID-19	**Recovery effects of the NSP**		
		Investment	**Spillover**	**Total NSP**
ASEAN	[-8.4, -24.4]	[2.8, 7.1]	[4.6, 10.1]	[7.4, 17.3]
- Cambodia	[-6.8, -19.6]	[1.7, 3.4]	[0.2, -0.9]	[1.8, 2.4]
- Indonesia	[-8.1, -22.8]	[2.9, 7.0]	[2.2, 4.0]	[5.1, 11.0]

Table 8. (Continued) (Unit: %)

	Damage of COVID-19	Recovery effects of the NSP		
		Investment	Spillover	Total NSP
- Laos	[-0.6, -1.3]	[3.8, 10.1]	[2.7, 7.7]	[6.5, 17.8]
- Malaysia	[-6.5, -18.8]	[2.9, 6.7]	[4.2, 8.8]	[7.0, 15.5]
- Philippines	[-4.5, -13.2]	[3.3, 8.3]	[4.5, 9.7]	[7.8, 18.0]
- Singapore	[-7.5, -22.2]	[3.5, 10.4]	[6.1, 14.9]	[9.6, 25.3]
- Thailand	[-7.6, -22.2]	[4.7, 12.9]	[5.6, 13.5]	[10.3, 26.3]
- Vietnam	[-11.7, -33.9]	[1.4, 3.2]	[5.2, 11.3]	[6.6, 14.5]
India	[-7.2, -20.2]	[2.2, 5.7]	[3.1, 6.1]	[5.3, 11.7]

Note: number means [min, max] effects under each scenario.

The effects of COVID-19 and the NSP on Korea's VS (FVA+PDC), which is the GVC index, are summarized in Table 9. The effects of spillover are bigger than those of investment. This is clear for India. In the case of ASEAN as a whole, VS exports could decrease from 9.3% to 26.9% due to COVID-19. However, depending on the NSP scenarios, negative effects are expected to recover by 7.8%-14.3%, although net effects remain negative. By country, exports to Singapore can recover by up to 17.0%. The COVID-19 impact on Korea's exports to India is expected to be at a level similar to that of ASEAN as a whole, and export VA is expected to recover by 15% if the NSP is realized under scenario 3.

Table 9. Impacts of COVID-19 and NSP on Vertical Specialization (VS) (Unit: %)

	Damage of COVID-19	Recovery effects of the NSP		
		Investment	Spillover	Total NSP
ASEAN	[-9.3, -26.9]	[2.7, 7.1]	[5.2, 7.2]	[7.8, 14.3]
- Cambodia	[-6.8, -19.8]	[1.8, 4]	[-0.9, -3.1]	[0.9, 0.9]
- Indonesia	[-9.1, -26.3]	[2.6, 6.4]	[0.4, -0.3]	[3.0, 6.1]
- Laos	[0.0, 0.8]	[4.3, 11.8]	[-0.5, -1.2]	[3.8, 10.6]
- Malaysia	[-7.6, -22.3]	[2.6, 6.4]	[2.2, 4]	[4.8, 10.4]
- Philippines	[-5.0, -14.9]	[3.1, 8.3]	[2.1, 3.4]	[5.2, 11.8]
- Singapore	[-9.1, -27]	[3.8, 11.3]	[3.1, 5.7]	[6.9, 17.0]
- Thailand	[-8.8, -25.7]	[4.3, 11.9]	[1.9, 3]	[6.2, 14.9]
- Vietnam	[-12.2, -35.2]	[1.4, 3.4]	[4.3, 8.9]	[5.7, 12.4]
India	[-8.6, -24.5]	[0.8, 2.9]	[5.2, 12.2]	[6.0, 15.0]

Note: number means [min, max] effects depending on the scenarios; VS effects are calculated as summation of FVA and PDC.

The effects of COVID-19 and the NSP on RDV[11], which is an international VA network indicator, are reported in Table 10. In the case of ASEAN nations as a whole, it is analyzed that the RDV index in exports to ASEAN nations could decrease by 10.7%-29.9% due to COVID-19. This table suggests that the promotion of the NSP will be able to fully recover from the negative effects of the virus. Korea's exports to Indonesia, Malaysia, and the

[11] RDV is drawn from the *FVA_rfl* in GTAP-VA model, which is defined as the VA embedded as re-imported intermediates that reflect back to source after processing in the third country.

Philippines showed high recovery rates, showing a difference from the GVC indicator VS in Table 10. Similar results are found for Korea's exports to India.

Table 10. Impacts of COVID-19 and NSP on RDV Index (Unit: %)

	Damage of COVID-19	Recovery effects of NSP		
		Investment	Spillover	Total NSP
ASEAN	[-10.7, -29.9]	[3.4, 12.3]	[11.1, 20.6]	[14.5, 33.0]
- Cambodia	[-11.7, -33.1]	[-1.4, -3.4]	[4.1, 8.3]	[2.8, 4.8]
- Indonesia	[-8.2, -24.6]	[4.1, 16.4]	[9.8, 22.5]	[13.9, 38.9]
- Laos	[0.0, -16.7]	[0.0, 0.0]	[16.7, 33.3]	[16.7, 33.3]
- Malaysia	[-7.7, -22.5]	[4.6, 14.2]	[7.7, 17.9]	[12.3, 32.1]
- Philippines	[-5.1, -17.3]	[3.2, 10.3]	[7.7, 17.3]	[10.9, 27.6]
- Singapore	[-13.8, -38.0]	[3.2, 9.5]	[4.0, 7.3]	[7.3, 16.8]
- Thailand	[-9.2, -26.7]	[3.6, 10.8]	[3.2, 6.0]	[6.8, 16.7]
- Vietnam	[-18.7, -47.2]	[0.7, 2.5]	[5.7, 12.3]	[6.4, 14.7]
India	[-9.1, -24.5]	[0.3, 0.8]	[9.9, 23.5]	[10.2, 24.2]

Note: number means [min, max] effects depending on the scenarios.

5. Conclusion and Policy Implications

The post-COVID-19 trade environment can be characterized by intensifying conflict between the US and China, incapacitating the multilateral trade system led by the WTO, 'Nation First,' restructuring GVC, digital transformation, and others. The COVID-19 crisis served to disrupt the WTO-led multilateral system, and countries recognized the importance of active trade policies. Considering the current increase in protectionism and bilateralism, countries should prepare strategies to respond. Relations between the US and China have been deteriorating since the enactment of the Hong Kong Security Act following the dispute over COVID-19 liability, and the US is recommending its own companies to withdraw from China.

According to the results of this paper, COVID-19 was found to reduce Korea's total exports by 27% and GVC by more than 30%. Korea's exports have a GVC structure that is vulnerable to COVID-19, and considering the conflict between the US and China, Korea's exports are bound to suffer a big blow. If decoupling between the US and China, which accounts for approximately 40% of Korea's total exports, becomes a reality, Korea's exports and its GVC will be severely affected, as discussed in Chapter 4 of this paper.

However, if the NSP develops to the point where it works in terms of investment and spillover, it appears that it could offset much of the negative impacts of COVID-19. In this respect, the NSP has important policy implications. This chapter attempts to suggest several measures for the NSP.

The government should support companies' supply chain adjustment with visible incentives. The NSP is a representative foreign trade policy of Korea, and is operated in a format supported by relevant ministries such as the Ministry of Foreign Affairs and the Ministry of Trade, Industry, and Energy, and led by the NSP Special Committee under the Blue House. Until now, the major programs of the NSP have been focusing on diplomatic activities such as summit meetings. The level of Korea's international cooperation has not improved compared to 10 years ago. In addition, the level of GVC with the NSP countries has

not changed much, except that Korean companies have invested heavily in Vietnam in recent years.

The US, EU, and Japan are announcing massive support to companies that exit from China. Japan is supporting 70% of the cost of factory relocation for reshoring. The Korean government should establish and support companies that are in a similar situation. The KITA (2020) argues that the ASEAN region should be focused as a stable production base to replace China. Korean companies are seeking to establish production bases in third countries, rather than returning production to Korea due to the nation's labor costs and regulations. While ASEAN countries are also offering support measures to attract companies in relocation, the government of Korea should provide tangible support for companies moving to the NSP region even if they are not reshoring to Korea.

As cross-border human movement is prohibited due to the coronavirus, companies are experiencing great difficulties in investing in the NSP region and local marketing. Therefore, the government should address these problems in terms of trade policy. The government should be active in expanding special entry procedures for entrepreneurs, facilitating trade and investment, and revising the FTA and reforming regulations. Regional cooperation organizations, such as ASEAN+6, the Regional Comprehensive Economic Partnership Agreement (RCEP), and the Asia-Pacific Economic Cooperation (APEC), can be good channels to discuss the introduction of a "Special Passport for Business Persons" system. As Tables 8-10 suggest, the spillover effects from allowing international movement of people were slightly higher than the investment effect. As the COVID-19 situation can be extended indefinitely, the effect of the special passport system can be significant.

COVID-19 makes overseas M&A difficult, which involves long bargaining and many negotiations. The Korea Trade-Investment Promotion Agency (KOTRA), which has offices in 127 cities around the world, should expand its role in supporting corporate M&A activities. Domestic companies must acquire chemical materials and electronic materials companies with high technical capabilities to develop core intermediary procurement capabilities. This will contribute to stabilizing GVC with the NSP region and help cope with Japanese export regulations.

Due to the coronavirus risk, where overseas business trips are difficult, exporting companies have no choice but to rely on "non-face-to-face" marketing. Moreover, marketing in ASEAN and Indian markets is not easy. It is difficult to enter overseas markets without digital competency and online marketing. Recently, in the ASEAN region and India, online platform transactions such as e-commerce and social media are increasing rapidly. It is necessary for the government to step up and build platforms to advance into the NSP region. Right now, the trade authorities, including KOTRA, should support companies to improve the accessibility of Korean companies to platforms such as Lazada and Shopee, which are widely used in the ASEAN market.

Finally, the limitations of this paper should be mentioned. First of all, if the COVID-19 becomes much worse than it is today, there is a possibility that the methodology of this study may not properly reflect these changes. In this case, a new analytical methodology may be required. Next, setting up a scenario is always controversial. The authors would like to clarify that this is a scenario that they have adopted with substantial consideration. Although simulation estimates differ depending on the scenarios, the research results of this paper clearly show the importance of the effectiveness of the NSP. The modified GTAP CGE model and VA decomposition methodology consist of systems of many equations and matrix operations. The authors are regretful about the brief presentation of the main ideas in this paper due to space limitations. However, relevant content can be provided upon the request of the reader.

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