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The COVID-19 Pandemic, Fiscal Policies, and the Korean Economy: A CGE Model Analysis

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Abstract

The COVID-19 pandemic led to severe economic disruptions worldwide, necessitating targeted fiscal interventions. This study assesses the impact of the pandemic and fiscal policies on the Korean economy using a multi-region, multi-sector computable general equilibrium (CGE) model and the Global Trade Analysis Project (GTAP) database (version 11A). The model, based on 2017 data projected to 2020, evaluates two policy scenarios: (1) the macroeconomic consequences of the pandemic and (2) the effectiveness of fiscal stimulus measures. The findings indicate that the pandemic resulted in a 1.47% contraction of Korea's GDP in 2020, deviating from its pre-pandemic annual growth of approximately 2%. Welfare losses reached US$57.38 billion, primarily driven by reduced consumer spending and rising unemployment. Supply chain disruptions and increased trade costs significantly impacted import and export volumes, contributing to a narrowed trade deficit of US$197.04 billion. Despite government stimulus measures, economic recovery remained constrained, with fiscal interventions leading to a net positive impact of US$104.68 billion relative to a no-policy scenario. These findings underscore the need for strategic fiscal policies to mitigate economic shocks, including targeted support for affected sectors, initiatives to stimulate private consumption, and measures to enhance Korea's international trade competitiveness. The study provides insights into the role of fiscal policy in crisis management and contributes to the broader discourse on economic resilience in the post-pandemic era.

Keywords: COVID-19; computable general equilibrium model; fiscal stimulus; economic welfare; Korea
JEL Classification: C68; C83; D31; O15

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1. Introduction

The COVID-19 pandemic has had a profound impact on Korean society, with both positive and negative repercussions across various sectors. Initially, the pandemic's sudden onset led to supply chain disruptions, declining consumer demand, and overall economic uncertainty, resulting in a contraction in economic activity. In response, the Korean government implemented aggressive measures to curb the spread of the virus, including large-scale testing, containment programs, and public health campaigns promoting hygiene and safety practices.

To address the economic challenges posed by the pandemic, the government adopted a six-pronged framework focused on supporting businesses and household incomes, stimulating economic recovery, addressing pressing concerns, and restoring daily life. Fiscal measures included financial assistance for affected industries, wage subsidies, and liquidity support for small and medium-sized enterprises (SMEs). The pandemic also accelerated digitalization, particularly in healthcare, pharmaceuticals, and digital services, while severely impacting the tourism and hospitality industries. Moreover, the global economic downturn had a significant adverse effect on Korea's export-driven economy. Nevertheless, the resilience of Korea's healthcare system and the government's swift response to mitigating the virus's spread inspired confidence. Widespread testing, contact tracing, and vaccination campaigns played a crucial role in facilitating economic reopening. The crisis also underscored the importance of a resilient, flexible, and adaptable global supply chain.

The COVID-19 pandemic notably affected Korea's export flows, with some sectors experiencing increased demand while others suffered from reduced consumer spending. To support exporters and domestic firms, the government introduced targeted fiscal measures. However, the tourism and services sectors were particularly hard hit, leading to substantial revenue losses and job cuts in hospitality. To mitigate the economic impact on these industries, the government provided financial aid and promotional support to encourage domestic travel.

Korea's economy, like many others, faced a severe contraction due to the pandemic, with GDP declining by 0.71% in 2020 (Table 1). This downturn reflected the economic toll of the crisis, particularly in export-reliant industries. However, Korea's rapid economic recovery in 2021, with a GDP rebound of 4.3%, highlights the role of effective fiscal policies and crisis management strategies. Examining this period provides valuable insights into the effectiveness of policy mitigation frameworks.

Table 1: Annual real GDP growth rates (%) for selected economies, 2017–2023

Region Code	Region	2017	2018	2019	2020	2021	2022	2023
KOR	Korea	3.16	2.91	2.24	-0.71	4.3	2.61	1.36
CHN	China	6.95	6.75	5.95	2.24	8.45	2.99	5.2
JPN	Japan	1.68	0.64	-0.4	-4.15	2.56	0.95	1.92
IND	India	6.8	6.45	3.87	-5.78	9.69	6.99	7.58
USA	United States	2.46	2.97	2.47	-2.21	5.8	1.94	2.54
EU27	European Union	2.84	2.07	1.81	-5.65	6.01	3.48	0.45

Region Code	Region	2017	2018	2019	2020	2021	2022	2023
GBR	United Kingdom	2.66	1.4	1.64	-10.36	8.67	4.35	0.1
RUS	Russian Federation	1.83	2.81	2.2	-2.65	5.61	-2.07	3.6
WLD	World	3.46	3.29	2.64	-2.93	6.26	3.09	2.72

Source: World Bank (2024a)

Our study provides a comprehensive assessment of the macroeconomic and microeconomic ramifications of the COVID-19 pandemic, as well as the effectiveness of the Korean government's fiscal intervention measures. Using the Global Trade Analysis Project (GTAP) model, an applied general equilibrium (AGE) model, we evaluate the dynamic economic effects of pandemics. This study serves as a regional case study, contributing to the academic discourse on assessing pandemic-related economic shocks and informing global economic recovery strategies.

Additionally, this study examines the effects of targeted fiscal policies, their distributional impacts, and the structural characteristics of the Korean economy. The findings offer crucial insights for policymakers in developing effective countermeasures against future pandemics, ensuring better preparedness and resilience in response to future public health crises.

The structure of this paper is as follows: Section 2 reviews relevant literature, followed by Section 3, which outlines the methodology. Section 4 presents the simulation results, while Section 5 concludes the study with key takeaways and policy implications.

2. Literature Review

The COVID-19 pandemic significantly impacted the Korean economy, leading to a notable decline in GDP. The Bank of Korea reported that GDP contracted by 3.2% in the second quarter of 2020, marking the first economic contraction since the 2008 financial crisis. This decline was primarily driven by a sharp drop in exports and domestic consumption (Bank of Korea, 2021). According to the International Monetary Fund (IMF, 2020), real GDP fell by 1% in 2020, contrasting sharply with the pre-pandemic growth rate of 2% (IMF, 2020). In response, the Korean government implemented fiscal stimulus packages totalling 310 trillion won (approximately $260 billion) to support businesses, employment, and consumption (Organisation for Economic Co-operation and Development [OECD], 2020). These initiatives effectively stabilized the economy and facilitated a relatively rapid recovery compared to other OECD countries. However, trade disruptions severely affected global supply chains and Korean trade.

The Korea Institute for International Economic Policy (KIEP, 2020) reported a 10.4% decline in exports in the first half of 2020, with the automotive and electronics sectors suffering the most (KIEP, 2020). However, trade rebounded toward the end of 2020 and into 2021, driven by increased global demand for semiconductors and IT products ((Korea Trade-Investment Promotion Agency [KOTRA], 2021). The automotive industry faced substantial setbacks due to supply chain disruptions, leading to a significant decline in overseas sales for Hyundai and Kia Motors (Hyundai Motor Company, 2020). Conversely, the semiconductor industry experienced

a surge in demand as remote working and digital services became prevalent, partially offsetting losses in other sectors (Samsung Electronics, 2020).

Computable General Equilibrium (CGE) Model Applications

Several studies have applied CGE models to assess the economic impact of the COVID-19 pandemic. Djiofack et al. (2020) analyzed the economic consequences of COVID-19 in sub-Saharan Africa, revealing a significant GDP contraction. The services and manufacturing sectors were hardest hit due to lockdowns and reduced external demand, whereas agriculture remained relatively stable despite labor shortages. The study highlights worsening poverty and inequality, disproportionately affecting low-income and informal workers. The authors recommend social protection programs, economic diversification, and investment in infrastructure and digital technologies to strengthen economic resilience.

Sun et al. (2024) assessed COVID-19's impact in 2022 across six major economies, finding that China and the EU suffered the most severe economic disruptions, whereas South Korea and Japan faced relatively milder effects. Arriola et al. (2022) used the OECD's METRO CGE model to examine the structural effects of COVID-19 on the global economy, concluding that reduced labor productivity was a primary driver of the 2020 output decline. Their study underscores the importance of understanding these structural changes to inform effective recovery policies.

Kim et al. (2023) developed a spatial CGE model to analyze the regional economic impact of COVID-19 in South Korea, revealing significant regional disparities and offering policy insights for recovery. Kabir et al. (2021) examined the gender-specific economic impacts of COVID-19 in Chad, focusing on labor force participation, employment, wages, and earnings using data from the 2020 High-Frequency Phone Survey. Their findings indicate that female-headed households, which comprise 23% of Chad's population, faced unique economic challenges.

Walmsley et al. (2023) applied a dynamic CGE model to evaluate the macroeconomic impacts of COVID-19 in the U.S., identifying key factors such as business closures, disease spread, and government interventions. Both studies provide valuable insights into the broad economic effects of the pandemic and guide policy responses and recovery strategies.

Labor Market and Employment Challenges

The Korean labor market faced significant challenges during the early stages of the pandemic. The unemployment rate surged to 4.2% in May 2020, the highest level in over a decade (Statistics Korea, 2020). Job losses were particularly severe in the service sector, impacting tourism, hospitality, and retail industries. To mitigate unemployment, the government introduced employment retention schemes and wage subsidies. The Emergency Employment Stabilization Program provided financial support to small business owners and precarious workers, helping curb unemployment and facilitating a faster labor market recovery compared to global averages (Ministry of Employment and Labor, 2021).

Sector-Specific Impacts: Tourism, Hospitality, and E-Commerce

The tourism and hospitality sectors were among the hardest hit. The Korea Tourism Organization reported a 76% decrease in foreign tourist arrivals in 2020 compared to 2019 due to strict travel restrictions (Korea

Tourism Organization, 2020). Conversely, the pandemic accelerated the digital transformation of the retail sector. The e-commerce industry experienced a sharp increase in online shopping, benefiting large retailers with strong digital platforms, such as Coupang (2020), while smaller brick-and-mortar stores struggled to compete (Statista, 2020).

Challenges in Fiscal Policy Implementation

Government fiscal measures during the COVID-19 pandemic faced several challenges. As seen with the U.S. Paycheck Protection Program, implementation delays, bureaucratic inefficiencies, and absorption constraints hindered aid distribution. Developing countries such as India and Nigeria struggled to reach informal workers, leaving many without adequate financial support. In some economies, loan programs were underutilized, as seen in the UK and South Africa, where businesses were reluctant to take on additional debt. Furthermore, inadequate healthcare investment weakened pandemic responses, particularly in Brazil and South Africa (Tax Policy Center 2024; Lacey, Massad, & Utz, 2022; Hill et al., 2023). The crisis also exacerbated social inequalities, disproportionately affecting low-income and minority populations worldwide.

Contribution of This Study

This study extends existing research by examining the macroeconomic and microeconomic impacts of COVID-19 and the effectiveness of Korea's fiscal responses across various sectors, including health and non-health industries. Previous studies primarily focused on aggregate or isolated sectoral effects, whereas this study adopts a sector-specific approach to analyze fiscal measures comprehensively.

Unlike previous studies, this research separately analyzes the health sector's role in economic resilience. Using a Computable General Equilibrium (CGE) model and the GTAP database version 11A, this study assesses the effectiveness of stimulus packages, tax relief, and other fiscal policies in mitigating economic disruptions. The findings provide critical insights for policymakers in designing future pandemic preparedness strategies.

In conclusion, the COVID-19 pandemic had far-reaching effects on the Korean economy, disrupting GDP growth, trade, employment, and various industries. While government interventions helped mitigate some adverse effects, the crisis accelerated structural shifts, particularly in digital transformation and e-commerce. Continuous economic review and adaptive policy formulation will be crucial for ensuring sustained recovery and long-term economic resilience in the post-pandemic era.

3. Method and Data

3.1. The Computable General Equilibrium Model

This study employs the standard GTAP model to assess the global economic impacts of the COVID-19 pandemic. The GTAP model is a global, multi-industry Computable General Equilibrium (CGE) model that captures the interactions between various economic agents, including producers, consumers, importers, exporters, investors, savers, and governments (Corong et al., 2017). A CGE model consists of a system of simultaneous equations that describe the constrained optimization behavior of these agents, reflecting their economic decisions within a given set of constraints.

Grounded in a general equilibrium framework, the CGE model quantifies changes in product and factor markets simultaneously, whereas a partial equilibrium model typically focuses on a single sector without accounting for broader economic linkages. The global nature of the CGE model allows for a comprehensive analysis of economic interdependencies across multiple regions through trade in goods and services. This interdependence is particularly important in the context of the COVID-19 pandemic, which disrupted supply chains and affected multiple sectors simultaneously.

The database underlying the GTAP model is structured as a Social Accounting Matrix (SAM), which integrates input-output (I-O) tables, national income and product account (NIPA) data, and bilateral trade data on traded goods and services. The SAM framework ensures that all economic activities are interconnected, allowing for a comprehensive analysis of policy shocks, market fluctuations, and trade dynamics. By incorporating trade flows, production structures, and income distribution, the model effectively captures the direct and indirect effects of external shocks, such as a global pandemic.

As illustrated in Figure 1, each regional economy in the GTAP model consists of four key economic agents: a representative regional household, the government, producers, and private households. The representative regional household collects all factor payments and tax revenues from firms, distributing income among private consumption, government expenditure, and savings. The model assumes that savings behavior follows a Cobb-Douglas savings utility function, ensuring that long-term economic welfare is maximized. Private households, constrained by their income levels, maximize their utility by consuming goods and services. The government, operating within the same general equilibrium framework, allocates its budget between domestically produced and imported goods and services based on a Cobb-Douglas aggregation function.

Firms in the model operate under the assumption of profit maximization, making production decisions based on input costs and prevailing market prices. They purchase factor inputs, including labor and capital, and supply their output to both domestic and international markets. The interactions between commodity and factor markets influence production decisions, trade balances, and economic growth trajectories. By simulating the impacts of the COVID-19 pandemic, the GTAP model provides valuable insights into the macroeconomic and microeconomic effects of the crisis, helping policymakers assess the effectiveness of fiscal interventions and trade policy adjustments. The model's ability to capture intersectoral linkages and cross-border economic relationships makes it an essential tool for evaluating pandemic-induced disruptions and recovery strategies.

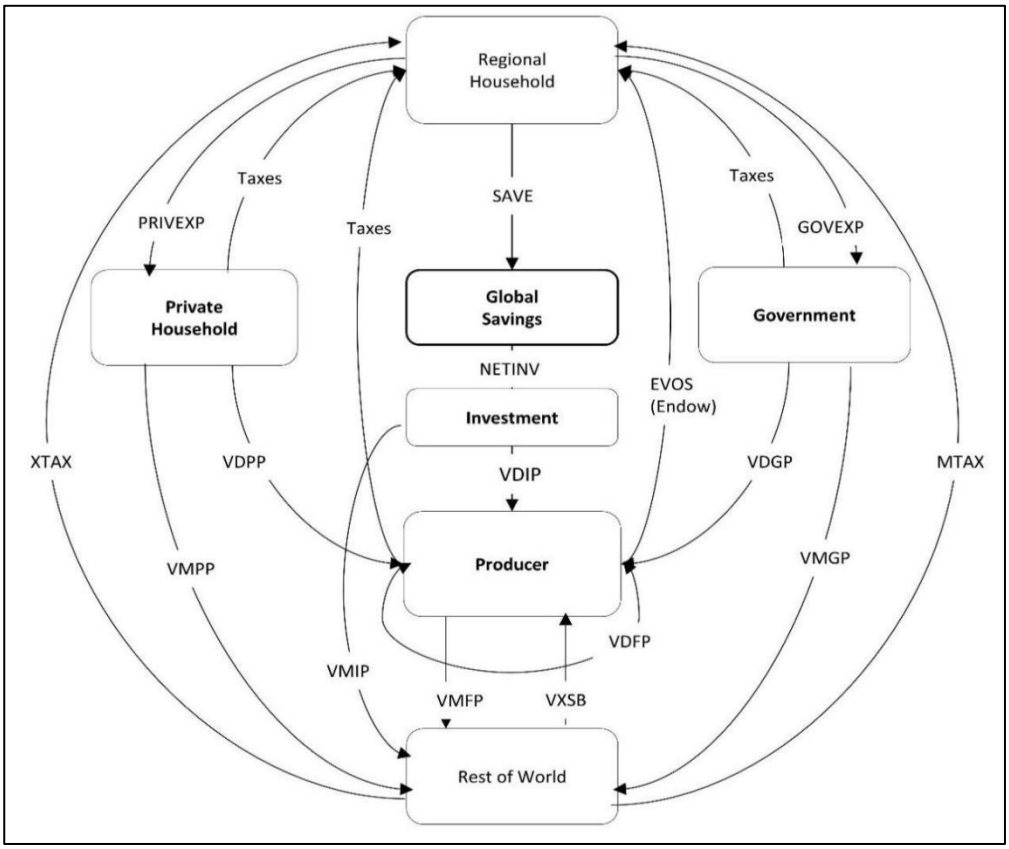

Figure 1: Structure of the GTAP model.

Source: Authors' drawing based on Corong et al. (2017)

Figure 1 applies the following abbreviations: PRIVEXP represents private expenditures, while GOVEXP denotes public expenditures. SAVE refers to net savings by region, and EVOS accounts for the after-tax value of endowment supply. NETINV captures net investment, while XTAX stands for export taxes. VDPP represents domestic purchases by households at purchasers' prices, whereas VDGP refers to domestic purchases by the government at purchasers' prices. MTAX denotes import tariffs, while VMPP represents import purchases by households at purchasers' prices. VMIP refers to import purchases by investment at purchasers' prices, and VMFP accounts for import purchases by firms at basic prices. VXSB represents non-margin exports at basic prices, while VDFP denotes domestic purchases by firms at purchasers' prices. Finally, VMGP refers to import purchases by the government at purchasers' prices.

To manufacture goods and services, firms utilize five factors of production: land, unskilled labor, skilled labor, capital, and natural resources. While capital, unskilled labor, and skilled labor are employed across all sectors, land is exclusively used in agricultural production, and natural resources are primarily utilized in forestry, fisheries, and mining sectors.

The model assumes perfect competition with constant returns to scale in production. In contrast, imperfect substitution exists between domestic and foreign goods and services, as well as between imports from different sources. This assumption follows the Armington (1969) approach, which explains two-way trade in identical product categories originating from different countries. Since tradeable and non-tradeable goods are considered distinct and imperfect substitutes by sector, changes in relative world market prices are only

partially transmitted to domestic markets. Consequently, the model accounts for a realistic degree of insulation in domestic commodity markets from global price fluctuations.

The GTAP model classifies the global economy into nine regions and 18 economic sectors, as summarized in Table 2. These classifications enable the model to assess how different regions and industries respond to economic shocks, particularly the disruptions caused by the COVID-19 pandemic. The regional classification includes major economies such as Korea (KOR), China (CHN), Japan (JPN), India (IND), the United States (USA), the European Union (EU27), the United Kingdom (UK), and Russia (RUS), as well as a "Rest of the World" (ROW) category. The sectoral classification encompasses a broad range of industries, including agriculture, natural resources, processed food, manufacturing, pharmaceuticals, technology, automobiles, construction, trade, transport, finance, and other services. This categorization facilitates a comprehensive analysis of sector-specific impacts and cross-sectoral economic linkages (Table 2).

Table 2: Regional and sectoral classification of the GTAP model

No.	Region	Description	No.	Sector	Description
1	KOR	Korea	1	Agr	Agriculture
2	CHN	China	2	Nat_Res	Natural Resources
3	JPN	Japan	3	ProcFood	Processed Food
4	IND	India	4	LightMnfc	Light Manufactures
5	USA	United States	5	Pharm	Pharmaceuticals
6	EU27	EU27	6	Comp_elec	Computer & Electronics
7	UK	United Kingdom	7	Auto	Automobile
8	RUS	Russia	8	RHeavyMnfc	Heavy Manufactures
9	ROW	Rest of the World	9	Utils	Utilities
			10	Construct	Construction
			11	Trade	Trade
			12	Hos_hotel	Hospitality & Hotel
			13	Trnspt	Transport
			14	Communic	Communication
			15	Financial	Insurance & Finance
			16	RealE	Real Estate
			17	Recreation	Recreational
			18	OthSrv	Other Services

Source: Authors' aggregation based on GTAP Database version 11A

The CGE model determines commodity and factor prices that equate demand and supply in all commodity and factor markets. Additionally, the model solves for world prices, ensuring that export and import demands are balanced across sectors in the global economy. The CGE model used in this study is inherently static, meaning it does not explicitly capture economic dynamics over time. However, by using the base scenario, which incorporates world output and trade flows in 2020, the model simulates how global production and trade patterns adjust following the COVID-19 pandemic and fiscal interventions by governments. The policy

scenarios then quantify the economic adjustments resulting from these interventions, providing valuable insights into the short-term economic impacts and the effectiveness of stimulus measures.

3.2. Data and Simulation Scenarios

3.2.1. Data

This study utilizes GTAP Database Version 11[1], which covers 160 regions and 65 sectors. For analytical purposes, the data were aggregated into 9 regions and 18 sectors, as summarized in Table 1 (authors' classification based on GTAP Database Version 11A). The analysis considers two scenarios: a baseline scenario, which assumes no impact from COVID-19, and policy scenarios, which incorporate the economic effects of the pandemic.

The study employs various macroeconomic variables, including real GDP (World Bank, 2024a), labor force (World Bank, 2024b), Population (World Bank, 2024c), and capital stock International Monetary Fund (IMF), 2021b), (see Table 2 for sectoral classification). The integration of these diverse datasets ensures a comprehensive and accurate representation of global economic conditions before and after the pandemic.

3.2.2. Baseline and Policy Scenarios

For the baseline scenario, changes in macroeconomic variables were applied to project the global economy from 2017 to 2020. The model closure was modified by swapping real GDP for total output productivity, allowing the simulation to account for productivity changes during the period. This approach provides a benchmark comparison against which the pandemic's economic impact can be measured.

To evaluate the effects of COVID-19 on the Korean economy, two policy scenarios (PS1 and PS2) were developed. These scenarios assess the economic disruptions caused by the pandemic and the effectiveness of fiscal intervention measures implemented by the Korean government to mitigate its impact. The simulation results provide insights into the extent to which government policies, such as stimulus packages and financial support programs, influenced economic recovery.

This study employs a static GTAP Computable General Equilibrium (CGE) model to analyze the pandemic's economic impact through three key transmission channels. First, it examines the adverse productivity shocks that affected labor supply, consumption, and investment. Second, it assesses the impact of increased trade costs, which disrupted cross-border supply chains and tourism. Third, the study explores the role of government interventions, focusing on budgetary measures and macroeconomic policy tools. By evaluating these interconnected factors, the research offers a comprehensive analysis of the pandemic's economic effects, providing valuable insights for future recovery strategies.

The labor supply quantity in region r is represented mathematically in Equation (1.1) and Equation (1.2), capturing the dynamic relationship between labor force participation, economic shocks, and sectoral labor demand.

$$qe_{(UnskLab,r)} = \sum_{a=1}^{ACTS} \left(ENDWMSHR_{(UnskLab,r)} * qfe_{(UnskLab,r)} \right) + endwslak_{(UnskLab,r)} \quad (1.1)$$

[1] The co-author of this manuscript contributed to the Korea datasets in the GTAP Database 11, including versions 5, 6, 7, 8, 9, and 10 (Ko, J.-H., 2023).

$$qe_{(SkLab,r)} = \sum_{a=1}^{ACTS}\left(ENDWMSHR_{(SkLab,r)} * qfe_{(SkLab,r)}\right) + endwslak_{(SkLab,r)} \quad (1.2)$$

where

$qe_{(UnskLab,r)}$ = supply of unskilled labor in region *r*

$qe_{(SkLab,a,r)}$ = supply of skilled labor in region *r*

$ENDWMSHR_{(UnskLab,r)}$ = share of unskilled labor used by activity *a* at supply prices

$ENDWMSHR_{(SkLab,a,r)}$ = share of skilled labor used by activity *a* at supply prices

$qfe_{(UnskLab,r)}$ = demand for unskilled labor by activity *a* in region *r*

$qfe_{(SkLab,a,r)}$ = demand for skilled labor by activity *a* in region *r*

$endwslackr_{(UnskLab,r)}$ = slack variable in unskilled labor market clearing condition

$endwslackr_{(SkLab,a,r)}$ = slack variable in skilled labor market clearing condition

ACTS = activities

Regarding tourism spending, we estimated the change between 2019 and 2020 and divided the difference by the total output value of each sector. This approach provides insights into the relative size and significance of each economic sector, facilitating the analysis of sectoral changes, including shifts in import-export flows. The difference between tourism consumption data from the UNWTO and the total sectoral output under the baseline scenario served as the shock input values for tourism spending in our model.

To incorporate these effects, we introduced a new model variable, qor(r), representing aggregate output in each region. Since qor(r) is endogenous by default, applying it as a policy shock required replacing it with an exogenous variable of the same dimension. For this purpose, we used afereg(r), a technological change variable, as our shock input. This approach implies that changes in the tourism industry were driven by factors outside the economic framework, rather than by policy interventions or industry-driven shifts.

The variable qor is a weighted composite of percentage changes in total output (qo). The mathematical formulation of this relationship is provided in Equation (2) and Equation (3), where qor(r) represents the aggregate output across all sectors in region r.

$$qor_{(r)} = \sum_{a=1}^{ACTS} QOSHR_{(a,r)} * qo_{(a,r)} \quad (2)$$

where

$qor_{(r)}$ = aggregate output across all sectors in region *r*

$qo_{(a,r)}$ = output of activity *a* in region *r*

$QOSHR_{(a,r)}$ = share of output of activity *a* in region *r*

$$QOSHR_{(a,r)} = \frac{MAKEBACT_{(a,r)}}{MAKEBACT\_TOT_{(r)}} \quad (3)$$

where

$MAKEBACT\_TOT_{(r)(a,r)}$ = the Sum of total output of activities at basic prices in region *r*

$MAKEBACT_{(a,r)(a,r)}$ = total output of activity *a* in region *r* valued at basic prices

Equation (4) ensures market-clearing conditions for total commodity supply, while Equation (5) guarantees market equilibrium for domestic sales. To quantify the impact of the COVID-19 pandemic on private household consumption, we obtained data on household consumption changes between 2019 and 2020 from the World Bank.

To integrate these changes into our model, we calculated the difference in household consumption values and divided it by the household consumption values derived from GDP by expenditure under Baseline Scenario 2. The resulting values were converted into percentage changes and subsequently used as shock values for private household spending in the simulation.

$$qc_{(c,r)} = \sum_{a=1}^{ACTS}\left(MAKEBCOMSHR_{(c,a,r)} + qca_{(c,a,r)}\right) \quad (4)$$

where

$qc_{(c,r)}$ = aggregate supply of commodity *c* in region *r*

$MAKEBCOMSHR_{(c,a,r)}$ = share of commodity *c* by activity *a* in region *r* valued at basic prices

$qca_{(c,a,r)}$ = supply of commodity c by activity *a* in region r

Equation (5) assures market clearing for domestic sales.

$$qds_{(c,r)} = \sum_{a=1}^{ACTS}\left(FDCSHR_{(c,a,r)} * qpd_{c,r}\right) + PDCSHR_{(c,a,r)} * qpd_{(c,r)} + GDCSHR_{(c,r)} * qgd_{(c,r)} + IDCSHR_{(c,r)} * qid_{(c,r)} \quad (5)$$

where

$qds_{(c,r)}$ = domestic sales of commodity *c* in region *r*

$FDCSHR_{(c,a,r)}$ = share of domestic product commodity *c* used by activity *a* in *r*

$qfd_{(c,a,r)}$ = demand for domestic commodity *c* by activity *a* in region *r*

$PDCSHR_{(c,a,r)}$ = share of domestic product of commodity *c* used by private households in *r*

$qpd_{(c,r)}$ = private household demand for domestic commodity c in region *r*

$GDCSHR_{(c,r)}$ = share of imports of commodity *c* used by government households in *r*

$qds_{(c,r)}$ = government demand for domestic commodity *c* in region *r*

$IDCSHR_{(c,r)}$ = share of domestic product of commodity *c* used by investment in r

$qid_{(c,r)}$ = investment demand for domestic commodity *c* in region *r*

For the expenditure shock, we assume that total private consumption, represented by the private expenditure utility variable (up), is shocked to different levels by swapping it with a technological shifter variable (avareg) in the value-added component of production. This linkage reflects the complex interactions between consumer spending and production dynamics. As with our other shocks, we maintain the private expenditure variable (up) as endogenous and apply the shock to avareg, based on pre-simulation results. This approach ensures that changes in private consumption influence production efficiency, capturing the indirect effects of pandemic-induced shifts in consumer behavior. The estimation of per capita utility from private spending in region r, as well as the utility derived from private expenditure, is presented in Equation (6).

$$UELASPRIV_{(r)} * up_{(r)} = yp_{(r)} - ppriv_{(r)} - pop_{(r)} \quad (6)$$

where

$UELASPRIV_{(r)}$ = elasticity of cost with respect to utility from private consumption

$up_{(r)}$ = per capita utility from private expenditure in region *r*

$yp_{(r)}$ = regional private consumption expenditure in region *r*

$ppriv_{(r)}$ = price index for private household consumption expenditure in region *r*

$pop_{(r)}$ = regional population

An identical approach was used to compute the shock values for investment. To determine the shock value for investment, we analyzed the investment component of GDP, comparing data from 2019 and 2020. The model assumes that investment slack (qcgdslack) remains fixed, ensuring that investment adjustments occur through other economic mechanisms. In this framework, $qinv_{(r)}$ represents the demand for investment or capital goods in region r, which can be interpreted as either gross investment or the expected rate of return. The mathematical representation of investment demand in region r is provided in Equation (7).

$$RORDELTA * rore_{(r)} + [1 - RORDELTA] * \left[\left(\frac{REGINV_{(r)}}{NETINV_{(r)}} \right) * qinv_{(r)} - \left(\frac{VDEP_{(r)}}{NETINV_{(r)}} \right) * kb_{(r)} \right] = RORDELTA * rorg + \left[1 - RORDELTA \right] * globalcgds + cgdslack_{(r)} \quad (7)$$

where

RORDELTA = binary coefficient to switch mechanism of allocating investment funds

$rore_{(r)}$ = expected net rate of return on capital stock in region *r*

$REGINV_{(r)}$ = regional gross investment in region *r*

$NETINV_{(r)}$ = regional net investment in region *r*

$qinv_{(r)}$ = demand for investment/capital goods in region *r*

$VDEP_{(r)}$ = value of capital depreciation in region *r*

$kb_{(r)}$ = beginning-of-period capital stock in region *r*

rorg = global net rate of return on capital stock

globalcgds = global supply of capital goods for net investment

$cgdslack_{(r)}$ = slack variable for $qinv_{(r)}$

We adopted the methodology used in previous studies, such as Narayanan and Villafuerte (2020), for assessing the global trade cost shock. Their study applied a -1% shock for a short containment period and a -2% shock for a prolonged containment period, uniformly across all regions. Similarly, Sone and Ko (2023) used a -2% shock value, while Maliszewska et al. (2020) applied a -25% shock to trade expenses. These approaches were influenced by prior research, such as Evans et al. (2015), who implemented a -10% shock value during the Ebola crisis.

Following this approach, we applied a uniform shock value across all regions to account for the increase in international trade costs. Empirical studies indicate that global trade costs rose by approximately 2% as goods and services crossed borders during the pandemic, affecting all countries (see Table 2).

The pandemic has had both direct and indirect ramifications on trade costs, significantly disrupting global supply chains due to lockdowns, travel restrictions, and the closure of manufacturing plants and ports. These disruptions resulted in delays, reduced production capacity, and higher transportation costs. Additionally, many countries imposed export restrictions on essential goods, particularly medical supplies, further affecting trade flows and increasing trade expenses. The trade cost shock is formally represented in Equation (8).

$$qxs_{(c,s,d)} = -ams_{(c,s,d)} + qms_{(c,r)} - ESUBM_{(c,r)} * [pmds_{(c,s,d)} - ams_{(c,s,d)} - pms_{(c,r)} \quad (8)$$

where

$ams_{(c,s,d)}$ = commodity *c* augmenting technical change from source region *s* to destination *d*

$qms_{(c,r)}$ = aggregate imports of commodity *c* in region *r*, basic price weights

$ESUBM_{(c,r)}$ = region-specific elasticity of substitution among imports commodity *c* in region r

$pmds_{(c,s,d)}$ = price of imported commodity *c* supplied by source region *s* to destination *d*

$pms_{(c,r)}$ = price of aggregate commodity imports bundle *c* in region *r*

Table 3: Macroeconomic projections from 2017 to 2020 (%)

Region	Real GDP	Population	Capital Stock	Labor
Korea	4.4702	0.9235	0.5784	0.8729
China	15.0994	1.0667	20.5035	-3.1951
Japan	-4.0502	-0.56	4.4807	0.8294
India	4.1274	3.1156	-2.5573	4.6753
USA	2.3927	1.9652	11.6254	0.2024
EU27	-1.984	0.331	10.6393	-0.9173
UK	-8.0622	1.5477	-3.636	0.6331
Russia	2.2789	-0.2932	-6.9751	-1.928
Rest of the World	-0.8621	4.5852	5.5775	1.2203

Source: Authors' calculation using data from the World Bank (2024a; 2024b; 2024c)

The evaluation of two policy outcomes in this study involved analyzing several economic variables, including labor supply, tourism spending, investment, household consumption, and global trade costs, alongside fiscal stimulus measures for health and non-health sectors, as shown in Table 3. The study also incorporated productivity factors to assess how changes in productivity impact economic performance.

Given the bureaucratic structure of governmental institutions, the limited workforce capacity due to COVID-19 social distancing measures, and the prevailing economic uncertainty, including constraints on the absorption of policy initiatives, we assumed that fiscal policy measures targeting non-health sectors were implemented at an average rate of 40%. This assumption reflects the delays and inefficiencies in policy

execution, which can hinder the effectiveness of government interventions in mitigating the economic impact of the pandemic.

Table 4: Shock values for policy variables

Region	COVID-19 Pandemic (PS1)					Fiscal Measures (PS2)	
	Labor Supply (%) V1	Tourism Expenditure (US$ million) V2	Household Consumption (US$ million) V3	Investment (US$ million) V4	Trade Costs (%) V5	Health Sector (US$ million) V6	Non-health Sector (US$ million) V7
Korea	-0.18	-13,932	-40,318	49,289	2	4,314	51,766
China	-3.35	-55,722	-16,882	266,561	2	21,306	689,460
Japan	-0.46	-37,813	-59,401	-15,241	2	89,837	692,496
India	-1.35	-18,248	-90,276	-306,819	2	4,840	75,808
USA	-4.38	-154,765	-211,383	3,783	2	483,800	3,019,500
EU27	-0.67	-252,146	-396,316	-127,153	2	57	486,949
UK	-0.73	-33,602	-225,112	-44,519	2	144,714	295,832
Russia	-1.09	-11,259	-104,761	-30,680	2	8,764	32,870
Rest of the World	-2.97	-117,691	-2,101,635	-306,819	2	1,034,277	6,738,368

Source: ILO (2024); UNWTO (2023); World Bank (2023); OECD (2020); IMF (2021a)

In Policy Scenario 1 (PS1), we introduced economic shocks, including reductions in labor supply, tourism spending, household consumption, and investment, alongside increased global trade costs (see Table 4). These adjustments simulate the economic implications of the pandemic, reflecting the challenges faced by various economic sectors due to travel restrictions, shifts in consumer behavior, and disruptions in international trade.

In Policy Scenario 2 (PS2), we implemented fiscal stimulus measures to mitigate the economic consequences of the pandemic. These interventions included above-the-line measures from the IMF database and liquidity injections aimed at supporting businesses, households, and industries affected by the crisis. The fiscal response encompassed government spending increases, tax adjustments, and financial support programs, all designed to stimulate economic recovery and cushion the impact of the downturn.

Overall, these policy scenarios provide insights into how the economy was influenced by the COVID-19 pandemic and offer policymakers a better understanding of the role of government interventions in mitigating economic downturns. The study underscores the importance of timely and targeted fiscal measures in supporting businesses, maintaining employment, and ensuring economic stability during crises.

$$ao_{(a,r)} = aosec_{(a)} + aoreg_{(a,r)} + aoall_{(a,r)} \quad (9)$$

where

$ao_{(a,r)}$ = output augmenting technical change by activity *a* in region *r*

$aosec_{(a)}$ = output augmenting technical change for activity *a*, worldwide

$aoreg_{(r)}$ = output augmenting technical change in region *r*

$aoall_{(a,r)}$ = output augmenting technical change in activity *a* of region *r*

Equation (9) accounts for the impact of government budgetary intervention on health and non-health sectors using $aoall_{(a,r)}$ – an output augmenting technical change in activity a of region r. See Equation (9).

4. Simulation Results

The COVID-19 pandemic had a profound impact on the Korean economy, leading to GDP contraction, rising unemployment, and declining exports. Many small businesses faced closures, while consumer behavior shifted significantly toward online shopping. Additionally, supply chain disruptions affected various industries, exacerbating economic instability. In response, policymakers and businesses implemented comprehensive measures to mitigate the crisis and support economic recovery. In this context, understanding both the macroeconomic and microeconomic implications of the pandemic is crucial for navigating post-pandemic recovery and enhancing resilience against future shocks.

From a macroeconomic perspective, the pandemic significantly affected Korean GDP in 2020. Labor shortages, declining exports, revenue losses in key industries, decreased household spending, reduced investment, and a sharp decline in tourism contributed to widespread economic instability. However, proactive fiscal measures, such as direct cash transfers to individuals, business loan guarantees, and increased healthcare funding, played a critical role in stabilizing the economy. These interventions supported businesses and households, mitigating the adverse effects on GDP, as illustrated in Tables 5(1) and 5(2).

Table 5(1): Macroeconomic impact of the COVID-19 pandemic and fiscal measures in Korea (%)

Region	COVID-19 Pandemic (PS1)					
	Labor Supply Shock (V1)	Investment Shock (V2)	Trade Cost Shock (V3)	Tourism Exp. Loss (V4)	Consumption Shock (V5)	Total Impact (V1+V2+ V3+V4+V5)
	Impact on Real GDP (%)					
Korea	0.01	-9.48	-0.75	-0.27	-3.21	-13.69
Rest of the World excl Korea	-1.35	-8.91	-0.64	-0.44	-6.52	-17.86
Global	-1.32	-8.93	-0.64	-0.43	-6.45	-17.78
	Impact on Welfare (US$ billion)					
Korea	3.42	-168.94	-15.53	-5.42	-76.97	-263.44
Rest of the World excl Korea	-1,146.82	-7,437.72	-529.23	-363.28	-5,454.10	-14,931.15
Global	-1,143.40	-7,606.67	-544.76	-368.69	-5,531.07	-15,194.60
	Impact on Trade Balance (US$ million)					
Korea	-15.34	-98.72	-9.94	-4.6	-68.43	-197.04
Rest of the World excl Korea	15.34	98.72	9.94	4.6	68.42	197.03
Global	0	0	0	0	-0.01	-0.01

Source: Authors' simulation

Note: The Rest of the World includes all regions in our data, excluding Korea

Table 5(2). Macroeconomic impact of the COVID-19 pandemic and fiscal measures in Korea (%)

Region	Fiscal Measures (PS2)			Net Impact (PS1 + PS2)
	Health Sector V6	Non-Health Sector V7	Impact of Fiscal Measures (V6+V7)	
	Impact on Real GDP (%)			
Korea	0	12.22	12.23	-1.47
Rest of the World excl Korea	0.04	14.29	14.32	-3.54
Global	0.04	14.25	14.28	-3.5
	Impact on Welfare (US$ billion)			
Korea	-0.18	206.24	206.06	129.1
Rest of the World excl Korea	30.54	11,822.98	11,853.51	6,399.41
Global	30.36	12,029.22	12,059.58	6,528.51
	Impact on Trade Balance (US$ million)			
Korea	0.45	91.9	92.36	-104.68
Rest of the World excl Korea	-0.45	-91.9	-92.36	104.68
Global	0	0	0	-0.01

Source: Authors' simulation

Note: The Rest of the World includes all regions in our data, excluding Korea

The COVID-19 pandemic had a significant impact on Korea's GDP in 2020, with a notable decline of approximately 13.69%, as shown in Tables 5(1) and 5(2). The combined effects of the pandemic and fiscal stimulus measures resulted in a 1.47% reduction in Korea's real GDP. In contrast, the simulated real GDP growth for the rest of the world, excluding Korea, was -3.54%, bringing global real GDP down to -3.5%. These simulated results align closely with actual real GDP figures for 2020, where Korea's real GDP decline was -0.71%, and the global economy contracted by -3.5%. The results fall within a ±2% margin of error, underscoring the model's reliability in capturing macroeconomic trends.

The strong correlation between our simulation results and actual GDP growth for both Korea and the global economy reflects the pandemic's widespread economic impact. The small margin of error further demonstrates the robustness of the applied model, reinforcing confidence in its accuracy and its ability to capture key macroeconomic trends driven by the pandemic and fiscal government interventions. The economic downturn was primarily caused by labor supply disruptions, rising trade costs, and a sharp decline in tourism expenditure, leading to income losses and job insecurity (Hong, 2023). However, government fiscal measures, such as increased healthcare spending and direct cash transfers, played a crucial role in stabilizing income, supporting businesses, and preventing a deeper economic collapse. While these challenges persisted, the government's proactive approach mitigated some of the economic hardships faced by private households and firms.

Trade Balance and Global Trade Disruptions

The trade balance measures the difference between a region's exports and imports over a given period, typically a year. It is a key economic indicator that reflects a country's integration into the global economy. A

trade surplus occurs when a country's export value exceeds its import value, while a trade deficit arises when imports surpass exports. Since the total global exports and imports are equal, the global trade balance is theoretically zero.

Simulation results indicate that the pandemic created a global imbalance in private consumption, where global demand for final goods and services exceeded global supply by US$0.01 billion. This imbalance reflects the widespread disruptions in trade flows, supply chains, and production capacity, which hindered global economic activity.

Impact on Economic Welfare

The pandemic's impact on economic welfare in Korea resulted in a decline of US$263.44 billion. Other countries, including Great Britain, China, and Japan, also experienced substantial declines in economic welfare, highlighting the widespread economic ramifications of the crisis. With government interventions, Korea recorded a net decrease of US$129.10 billion in economic welfare, suggesting that fiscal measures helped mitigate some negative effects but were insufficient to fully offset the economic downturn. The overall effectiveness of these interventions will be a key determinant of Korea's long-term recovery and economic resilience.

Interplay Between GDP and Economic Welfare

The pandemic had intertwined effects on Korea's GDP and economic welfare. The GDP contraction resulted from disruptions in trade, investment, and consumption, leading to reduced economic activity and lower production levels. Economic welfare, encompassing income levels, job availability, and quality of life, was influenced by workforce shifts, trade expenses, tourism spending, investment levels, and household consumption patterns. Government interventions played a critical role in supporting both GDP and economic welfare, stabilizing incomes, assisting businesses, and ensuring healthcare accessibility.

While initial pandemic-related challenges dampened economic welfare, increased labor supply and strategic government measures helped mitigate some negative impacts. However, 2020 still marked a period of economic hardship, with adverse effects on employment, income distribution, and overall well-being. Factors such as labor shortages, reduced tourism spending, declining investment, lower household consumption, and rising trade costs significantly influenced Korea's trade balance, affecting both exports and imports, as illustrated in Tables 6(1) and 6(2).

Table 6(1): Impact of COVID-19 pandemic, health and non-health fiscal measures on Korea's imports by sector (%)

Region	COVID-19 Pandemic (PS1)					
	Labor Supply Shock (V1)	Investment Shock (V4)	Trade Cost Shock (V5)	Tourism Exp. Loss (V2)	Consumption Shock (V3)	Total Impact (V1+V2+ V3+V4+V5)
Agr	0.26	5.3	-0.24	-0.23	-5.25	-0.17
Nat_Res	-0.8	11.52	1.17	-0.41	-5.83	5.65
ProcFood	0.57	0.71	-1.32	-0.09	-1.84	-1.97
LightMnfc	1.77	3.73	-2.3	-0.06	-1.46	1.69
Pharm	0.95	5.69	-1.62	0.56	0.59	6.18
Comp_elec	-0.81	1.57	-1.54	-0.46	-7	-8.24

Region	COVID-19 Pandemic (PS1)					
	Labor Supply Shock (V1)	Investment Shock (V4)	Trade Cost Shock (V5)	Tourism Exp. Loss (V2)	Consumption Shock (V3)	Total Impact (V1+V2+ V3+V4+V5)
Auto	1.22	2.09	-1.82	1.04	2.65	5.19
RHeavyMnfc	0.42	11.17	-1.91	-0.1	-2.92	6.66
Utils	0.32	9.51	-3.23	0.07	9.79	16.46
Construct	1.94	9.01	-0.62	0.71	8.2	19.23
Trade	-0.04	8.93	-1.11	-0.31	-6.75	0.72
Hos_hotel	0.22	-2.65	-2.19	-0.06	-1.61	-6.29
Trnspt	0.37	1.25	-1.41	-0.26	-4.28	-4.33
Communic	0.89	11.35	-1.66	0.56	3.02	14.16
Financial	0.71	4.79	-2.25	0.38	0.34	3.97
RealE	0.93	6.14	-2.45	0.24	-1	3.85
Recreation	0.35	-0.61	-2.47	0.22	-0.08	-2.59
OthSrv	0.54	9.78	-1.56	0.38	0.63	9.77

Source: Authors' simulations

Table 6(2): Impact of COVID-19 pandemic, health and non-health fiscal measures on Korea's imports by sector (%)

Region	Fiscal Measures (PS2)			Net Impact (PS1+PS2)
	Health Sector (V6)	Non-Health Sector (V7)	Impact of Fiscal Measures (V6+V7)	
Agr	-0.02	0.24	0.23	0.06
Nat_Res	0.01	0.98	0.99	6.64
ProcFood	-0.06	2.18	2.12	0.15
LightMnfc	-0.03	-5.55	-5.58	-3.9
Pharm	4.01	-1.49	2.52	8.7
Comp_elec	0.09	2.14	2.23	-6.01
Auto	0.1	-1.03	-0.93	4.26
RHeavyMnfc	-0.02	-4.79	-4.81	1.85
Utils	-0.41	-3.55	-3.96	12.5
Construct	-0.19	-9.03	-9.22	10.01
Trade	0.03	-5.05	-5.03	-4.3
Hos_hotel	-0.16	8.59	8.43	2.14
Trnspt	-0.09	3.35	3.26	-1.07
Communic	-0.09	-1.44	-1.53	12.63
Financial	-0.31	1.15	0.84	4.81
RealE	-0.03	2.53	2.51	6.36
Recreation	-0.26	5.23	4.97	2.38
OthSrv	-0.18	-1.08	-1.26	8.51

Source: Authors' simulations

However, the government's fiscal stimulus package, particularly when targeted at both health and non-health sectors, could have mitigated some of the negative economic impacts. Increased government spending may have supported specific industries, indirectly influencing trade volumes and economic stability. The net effect on Korea's trade balance in 2020 would have depended on the complex interplay between these factors. While reduced demand and increased trade costs may have constrained trade activity, the positive effects of fiscal stimulus could have partially offset these trends, ultimately shaping the country's overall trade balance.

Impact on Korea's Imports

The COVID-19 pandemic significantly affected Korea's import activity across multiple sectors in 2020, as illustrated in Tables 6(1) and 6(2). Imports of consumer goods declined as household spending contracted, with reduced demand for non-essential items such as electronics and apparel. Additionally, supply chain disruptions and a global manufacturing slowdown resulted in lower imports of intermediate goods, including raw materials, components, and machinery.

The uncertainty in investment and economic downturn further led to declining imports of capital goods, such as machinery, equipment, and technology. The automotive industry, a crucial sector in Korea, faced significant challenges, with decreased imports of automobiles and automotive parts due to disruptions in global supply chains. Even in industries where Korea is a leading exporter, such as electronics, imports were impacted by supply chain constraints and production slowdowns.

Moreover, imports of chemicals and pharmaceuticals were disrupted, with shifts in demand patterns due to the pandemic's effects on healthcare needs and pharmaceutical supply chains. Overall, the pandemic-induced decline in imports across multiple sectors was driven by reduced consumer demand, supply chain disruptions, and economic instability, highlighting the far-reaching implications of the global crisis on Korea's trade and economic structure.

Table 7(1): Impact of COVID-19 pandemic, health and non-health fiscal measures on Korea's exports by sector (%)

Region	COVID-19 Pandemic (PS1)					
	Labor Supply Shock (V1)	Investment Shock (V4)	Trade Cost Shock (V5)	Tourism Exp. Loss (V2)	Consumption Shock (V3)	Total Impact (V1+V2+ V3+V4+V5)
Agr	-1.64	-10.74	-5.79	-0.18	-3.68	-22.02
Nat_Res	-7.22	46.51	-6.22	0.53	25.95	59.55
ProcFood	-1.45	-18.54	-4.02	-0.66	-12.24	-36.91
LightMnfc	-3.42	-12.41	-4.14	-1.5	-21.42	-42.9
Pharm	-2.07	-14.04	-3.3	-3.85	-20.98	-44.24
Comp_elec	-2.98	-10.57	-2.02	-0.74	-11.34	-27.66
Auto	-1.39	-10.43	0.98	-1.53	-14.48	-26.86
RHeavyMnfc	-3.37	0.51	-4.38	-0.73	-10.78	-18.75

Region	COVID-19 Pandemic (PS1)					
	Labor Supply Shock (V1)	Investment Shock (V4)	Trade Cost Shock (V5)	Tourism Exp. Loss (V2)	Consumption Shock (V3)	Total Impact (V1+V2+ V3+V4+V5)
Utils	-4.72	-7.54	-7.56	-0.02	-10.39	-30.23
Construct	-0.98	-7.81	-1.32	-0.3	-25.64	-36.05
Trade	-2.35	-4.66	-2.34	-1.28	-13.27	-23.9
Hos_hotel	-3.39	-18.84	-2.83	-0.41	-10.46	-35.92
Trnspt	-0.96	1.72	-1.62	-0.8	-9.9	-11.57
Communic	-2.01	-3.74	-1.82	-1.67	-13.15	-22.4
Financial	-2.76	2.43	-1.4	-1.72	-14.56	-18
RealE	-3.65	4.43	-1.45	-1.22	-11	-12.89
Recreation	-3.62	-13.89	-3.19	-0.32	-6.43	-27.46
OthSrv	-1.8	-6	-1.11	-1.62	-11.77	-22.3
Aggregate Exports	-2.87	-6.42	-2.75	-0.92	-12.52	-25.46

Source: Authors' simulations

Table 7(2): Impact of COVID-19 pandemic, health and non-health fiscal measures on Korea's exports by sector (%)

Region	Fiscal Measures (PS2)			Net Impact (PS1+PS2)
	Health Sector (V6)	Non-Health Sector (V7)	Impact of Fiscal Measures (V6+V7)	
Agr	0.03	17.12	17.15	-4.87
Nat_Res	-0.03	-22.94	-22.97	36.58
ProcFood	0.21	27.36	27.56	-9.34
LightMnfc	0.21	35.72	35.93	-6.97
Pharm	-12.07	24.09	12.02	-32.22
Comp_elec	0.22	15.33	15.56	-12.1
Auto	0.08	17.14	17.23	-9.63
RHeavyMnfc	0.04	17.2	17.24	-1.52
Utils	0.2	42.25	42.45	12.22
Construct	0.27	23.28	23.55	-12.5
Trade	0.1	23.54	23.64	-0.26
Hos_hotel	0.21	44.03	44.24	8.32
Trnspt	0.07	7.44	7.5	-4.06
Communic	0.22	13.31	13.53	-8.86
Financial	0.49	14.35	14.84	-3.16
RealE	0.05	12.41	12.45	-0.44
Recreation	0.24	42.48	42.72	15.26

Region	Fiscal Measures (PS2)			Net Impact (PS1+PS2)
	Health Sector (V6)	Non-Health Sector (V7)	Impact of Fiscal Measures (V6+V7)	
OthSrv	0.35	13.11	13.46	-8.84
Aggregate Exports	0.1	18.45	18.54	-6.92

Source: Authors' simulations

Impact on Korea's Exports

The COVID-19 pandemic had a significant impact on Korea's exports in 2020, affecting multiple sectors. Labor supply disruptions and increased costs particularly affected industries such as agriculture and construction, limiting production capacity and international competitiveness. Global economic uncertainty led to declining investment and reduced demand for Korean exports in heavy manufacturing and real estate-related industries.

Higher trade costs due to supply chain disruptions negatively impacted export profitability, especially in sectors heavily reliant on global supply chains, such as electronics and automobiles. Additionally, the loss of tourism expenditure and reduced household consumption affected the export of consumer goods and services, exacerbating economic challenges. However, pharmaceutical exports may have helped offset some declines, as the pandemic increased global healthcare demand.

Overall, the pandemic-induced impact on exports varied across sectors, with the magnitude of the decline influenced by supply chain distortions and shifting consumer behavior, as illustrated in Tables 7(1) and 7(2).

Sectoral Output Decline in 2020

In 2020, several factors contributed to sectoral output declines in Korea. Labor supply shortages hindered productivity, reducing overall industrial output. Additionally, declines in tourism expenditures and household consumption had a direct negative impact on key sectors, including hospitality, retail, and services. These effects led to widespread reductions in sectoral output, as shown in Tables 8(1) and 8(2).

Table 8(1): Impact of COVID-19 pandemic, health and non-health fiscal measures on Korea's output by sector (%)

Region	COVID-19 Pandemic (PS1)					
	Labor Supply Shock (V1)	Investment Shock (V4)	Trade Cost Shock (V5)	Tourism Exp. Loss (V2)	Consumption Shock (V3)	Total Impact (V1+V2+ V3+V4+V5)
Agr	-0.22	0.21	0.32	-0.29	-3.5	-3.48
Nat_Res	-1.46	9.82	2.34	-0.18	1.66	12.18
ProcFood	-0.16	-5	-0.03	-0.36	-5.06	-10.61
LightMnfc	-1.18	3.11	0.03	-0.55	-7.3	-5.88
Pharm	-0.35	-0.28	0.93	-1.19	-7.28	-8.17
Comp_elec	-2.71	-8.3	-0.38	-0.64	-9.67	-21.7

Region	COVID-19 Pandemic (PS1)					
	Labor Supply Shock (V1)	Investment Shock (V4)	Trade Cost Shock (V5)	Tourism Exp. Loss (V2)	Consumption Shock (V3)	Total Impact (V1+V2+ V3+V4+V5)
Auto	-0.32	-4.36	1.21	-1.03	-8.42	-12.91
RHeavyMnfc	-1.24	6.2	-0.18	-0.4	-4.9	-0.52
Utils	-0.45	4.68	-0.33	-0.39	-5.08	-1.57
Construct	2.32	4.97	0.81	0.47	5.98	14.55
Trade	0.05	0.84	-0.1	-0.29	-3.42	-2.9
Hos_hotel	-0.08	-7.43	-0.39	-0.36	-4.99	-13.25
Trnspt	-0.51	4.01	-0.26	-0.46	-5.58	-2.79
Communic	0.73	2.74	0.19	-0.12	-0.93	2.61
Financial	-0.02	0.55	-0.11	-0.35	-4.02	-3.95
RealE	0.42	-0.34	-0.11	-0.21	-2.48	-2.72
Recreation	0.11	-6.99	-0.52	-0.32	-4.2	-11.92
OthSrv	0.35	-2.66	-0.05	-0.24	-2.68	-5.28
Aggregate output	-0.32	0.41	0.01	-0.33	-3.97	**-4.2**

Source: Authors' simulations

Moreover, increased trade costs negatively affected export-oriented sectors, such as manufacturing, by reducing international competitiveness and lowering demand, which in turn contributed to a decline in output levels. However, a slight increase in investment may have benefitted targeted industries, potentially stimulating production growth in those sectors.

The government's economic support plan, particularly those measures directed at both health and non-health sectors, likely mitigated some of these adverse impacts and helped bolster productivity across various industries. Increased investment in the healthcare sector could have led to higher output in healthcare-related industries, while investment in non-health sectors may have stimulated production and economic recovery in other areas.

Table 8(2): Impact of COVID-19 pandemic, health and non-health fiscal measures on Korea's output by sector (%)

Region	Fiscal Measures (PS2)			Net Impact (PS1+PS2)
	Health Sector (V6)	Non-Health Sector (V7)	Impact of Fiscal Measures (V6+V7)	
Agr	0.01	5.19	5.2	1.72
Nat_Res	0.01	-1.44	-1.43	10.75
ProcFood	0.03	10.53	10.56	-0.05
LightMnfc	0.05	9.96	10.01	4.13
Pharm	-3.73	6.53	2.8	-5.37
Comp_elec	0.2	13.67	13.87	-7.83

Region	Fiscal Measures (PS2)			Net Impact (PS1+PS2)
	Health Sector (V6)	Non-Health Sector (V7)	Impact of Fiscal Measures (V6+V7)	
Auto	0.01	9.54	9.55	-3.36
RHeavyMnfc	0.01	5.21	5.22	4.7
Utils	0.01	3.8	3.81	2.23
Construct	-0.06	-6.9	-6.96	7.59
Trade	-0.01	5.08	5.07	2.16
Hos_hotel	0.03	13.46	13.49	0.25
Trnspt	0	4.39	4.39	1.6
Communic	-0.01	0.56	0.55	3.16
Financial	0.02	5.46	5.48	1.53
RealE	-0.01	4.63	4.62	1.9
Recreation	-0.02	11.27	11.25	-0.67
OthSrv	0.01	6.27	6.28	1
Aggregate output	0.01	5.98	**5.99**	**1.79**

Source: Authors' simulations

In 2020, the overall impact on Korea's sectoral output was shaped by the complex interplay of these factors, as illustrated in Tables 8(1) and 8(2). While some industries experienced declining production due to reduced demand and increased trade costs, the positive effects of investment and government stimulus measures may have helped offset these trends, supporting output growth in certain sectors of the economy.

5. Concluding Remarks

In conclusion, the COVID-19 pandemic had a significant impact on the Korean economy, causing disruptions in GDP, economic welfare, trade balances, and other key economic indicators. However, proactive government interventions, particularly fiscal policies targeting both health and non-health sectors, played a crucial role in mitigating these adverse effects and laying the foundation for economic recovery. The government's swift response helped minimize economic damage, stabilize critical sectors, and, in some cases, facilitate a stronger-than-expected rebound, surpassing pre-pandemic levels in certain areas and offering hope for a robust and sustained recovery.

The economic consequences of the pandemic were severe, with welfare losses in Korea amounting to approximately US$103 billion. This substantial economic downturn was primarily driven by declining consumer spending and rising unemployment rates, which had ripple effects across multiple sectors, exacerbating financial instability. These welfare losses underscore the urgent need for resilient economic policies to mitigate the impact of future economic shocks and enhance long-term stability.

To further strengthen economic resilience and drive sustained growth, it is recommended that fiscal support measures continue to be implemented, particularly targeting small and medium-sized enterprises (SMEs) and critical infrastructure projects. Additionally, key policy strategies should focus on:

- Investing in healthcare infrastructure and preparedness to enhance future crisis response.
- Diversifying supply chains and promoting local production to reduce dependence on external disruptions.
- Accelerating digital transformation to boost productivity and competitiveness in the post-pandemic economy.
- Providing social safety nets for vulnerable populations to mitigate the socioeconomic effects of crises.

By implementing these strategic policy recommendations, Korea can fortify its economic foundation, enhance resilience, and emerge stronger in the aftermath of the pandemic. The government's proactive approach has demonstrated the critical role of targeted policy interventions in alleviating economic downturns, stabilizing markets, and fostering long-term sustainable growth. Moving forward, maintaining a flexible and adaptive policy framework will be essential in navigating future uncertainties and ensuring continued economic progress.

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