Economic and Environmental Consequences of the COVID-19 Pandemic through Foreign Tourists Demand in Japan.

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Abstract

Foreign tourists demand was one trillion (JPY) in 2012 in Japan and thus it has considerably contributed to the Japanese economy. The government estimated that the foreign tourists demand will increase by a factor of 15 from 2012 to 2030. However, the COVID-19 pandemic has contributed to rapidly shrinking the inbound demand since December 2019. On the other hand, it is true that the slowdown of economic activity due to the COVID-19 pandemic reduced CO2 emissions in 2020 and it contributed to climate change mitigation. To the best of our knowledge, the economic loss and the environmental benefits in a country are still poorly understood. In doing it, we propose an environmentally-extended, semi-closed input-output model that incorporates endogenous final consumptions of a nation as well as exogenous final consumptions of the foreign tourists. Based on the analysis framework, we found that the COVID-19 pandemic led to the economic loss of 1260 billion yen and the emission reduction of 16,517 kt-CO2 in 2020 in Japan. Tourism and restaurant business activities had the biggest direct economic loss, whereas they indirectly contributed to considerably reducing CO2 through reducing electricity demand. This study suggests a counter-measure against COVID-19 pandemic. The government should not only give financial support to higher priority industries (i.e., heavily-damaged industries) identified in this study but require them submit a report on how their production activity environmentally improves through the financial support.

1. Introduction

Since 2012, Japan has been adopting policies to attract foreign visitors to Japan, such as visa easing and expansion of shipping routes. These policies doubled both the number of foreign visitors to Japan and the amount of travel spending from 2012 to 2015.

JTA (Japan Tourism Agency) expected that Japan inbound revenues would continue to grow further in 2020 and 2030 (Figure 1) (Japan Tourism Agency, 2016). However, owing to the COVID-19 pandemic, the number of inbound visitors to Japan in 2020 plummeted to 4,115,900 (-87.1% from the previous year) (Japan National Tourism Organization, 2021). Meanwhile, the pandemic helped Japan meet the strict emission reduction targets set in the Paris Agreement and according to preliminary figures from the Ministry of the Environment, CO_2 emissions in 2020 were 5.1% lower than in 2019. It is the largest decrease in CO_2 emissions witnessed since 2013 (Ministry of the Environment, 2021).

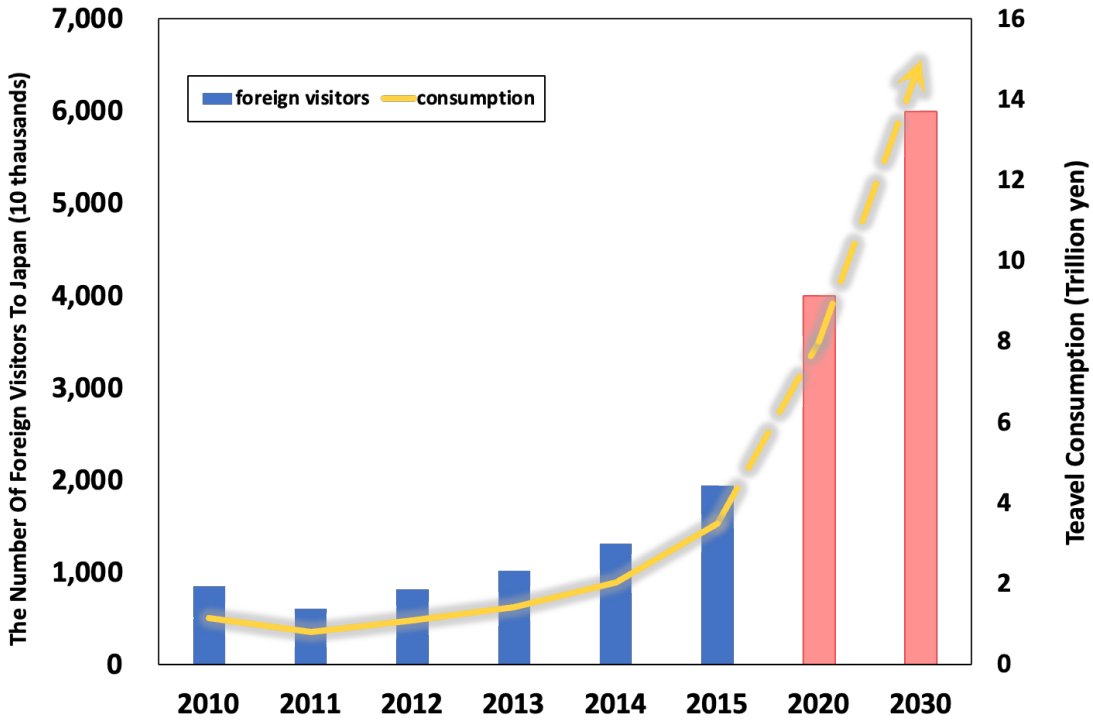


Figure 1. The number of foreign visitors to Japan and the amount of their travel consumption between 2010 and 2015, and predicted value of 2020 and 2030. Made by authors with reference to JTA, 2016.

One of the key challenges for the inbound industry post-pandemic is to revive the inbound market while maintaining the environmental benefits gained. This study quantifies the direct and indirect economic losses incurred and CO_2 reductions brought to the Japanese economy by the decline in the number of inbound visitors to Japan using an Input-Output analysis. As related studies, Miyauchi and

Abe (2021) and Kitamura et al. (2020) used an input-output analysis to determine the impact of COVID-19 in Japan as a whole through the tourism industry include Miyauchi and Abe (2021) and Kitamura et al. (2020).

Specifically, Miyauchi and Abe (2021) quantified the direct and indirect impact of the decline in final demand for the tourism industry from April to June 2020 in four prefectures —Hokkaido, Kanagawa, Kyoto, and Kagawa— selected according to the characteristics of their tourism resources. Kitamura et al. (2020) estimated the economic (monetary), environmental (carbon footprint), and social (employment) impacts of the epidemic on the Japanese tourism industry for the year 2020 under three scenarios. The estimates were divided into three scenarios, based on the different levels of the coronavirus epidemic in 2020.

While the studies mentioned above are useful in that they can provide decision-making materials in considering a rapid response to the pandemic, the data used for these estimates are limited due to the lack of initial public data that were initially made publicly available. In addition, the estimates assumed that the inbound pandemic to be a major factor post-COVID-19. Furthermore, these studies do not consider the environmental aspects of the inbound industry and discuss policies to maintain this industry post pandemic.

Based on these facts, this study focuses on inbound tourism. Specifically, we estimate the economic losses and environmental benefits for Japan throughout the year using the latest data. In addition to direct and indirect effects, income spillover effects are also evaluated to quantify the impact of the COVID-19 in a broader sense, to estimate the economic losses and environmental benefits to the Japanese economy.

2. Method

To clarify the economic and environmental impact of the COVID-19 pandemic, we defined two scenarios, a With-COVID Scenario and a Non-COVID Scenario. "With-COVID Scenario" is created for the year 2020 in the reality of the COVID-19 pandemic. On the contrary, "Non-COVID Scenario" is created for the year 2020 in the absence of the pandemic. In the With-COVID Scenario, we defined the result multiplying the number of foreign numbers to Japan (JNTO, 2021 by travel consumption per person in 2019 (Japan Tourism Agency,2020) as their total consumption. In the Non-COVID Scenario, there is no data about foreign visitors. Thus, we estimated the number of foreign visitors in the fictional 2020 Non-COVID Scenario, by using the exponential smoothing method, where, by inserting the number of foreign visitors from 2003 to 2019 into regression equation, we estimated the foreign visitors of 2020.

By multiplying the estimated number by travel consumption per head in 2019, the total travel consumption in the Non-COVID Scenario was calculated. Travel consumption is a direct effect brought in by foreign visitors. We identified the consumption as $\mathbf{f}$ in the following calculations. Then, we calculated indirect effect by using Input-output analysis. We used input-output table of 2015

(Ministry of Internal Affairs and Communications,2019). The formula is as follows.

$$\mathbf{L} = \left[\mathbf{I} - \left(\mathbf{I} - \widehat{\mathbf{M}}\right)\mathbf{A}\right]^{-1} \quad (1)$$

L stands for Non-Competitive Imported Leontief inverse. **I** is an identity matrix. $\widehat{\mathbf{M}}$ stands for diagonal import coefficient matrix. A is an input coefficient matrix. Then we estimated direct-indirect production spillovers to industry ($\mathbf{q_1}$) associated with final consumption of foreign visitors (**f**), The following equation is derived:

$$\mathbf{q_1} = \mathbf{Lf} \quad (2)$$

Furthermore, this study calculates income spillover effects from direct and indirect economic benefits derived from the inbound market according to the Ministry of Land, Infrastructure, Transport and Tourism (2015). The income spillover effect（$\mathbf{q_2}$）is calculated using equation (3) below.

$$\mathbf{q_2} = \mathbf{Lcvq_1} \quad (3)$$

c stands for household-consumption-rate column vector. **v** stands for labor -income-coefficient row vector. We estimated direct, indirect, and income spillover effect on Japanese economy due to the consumption by foreign visitors, in each With-COVID Scenario and Non-COVID Scenario. To calculate the sum of economic activity, the amount of CO_2 emissions as the result of that activity also needs to be incorporated.

By multiplying these sector-specific emission coefficients by the direct production spillover, indirect production spillover, and income spillover effects on the economic side, we estimated the CO_2 emissions ($\mathbf{g_1}$and $\mathbf{g_2}$) associated with consumption by foreign visitors to Japan (see Equations (4) and (5)).

$$\mathbf{g_1} = \hat{\mathbf{e}}\mathbf{Lf} \quad (4)$$

$$\mathbf{g_2} = \hat{\mathbf{e}}\mathbf{q_2} \quad (5)$$

$\hat{\mathbf{e}}$ stands for diagonal emission coefficient matrix.

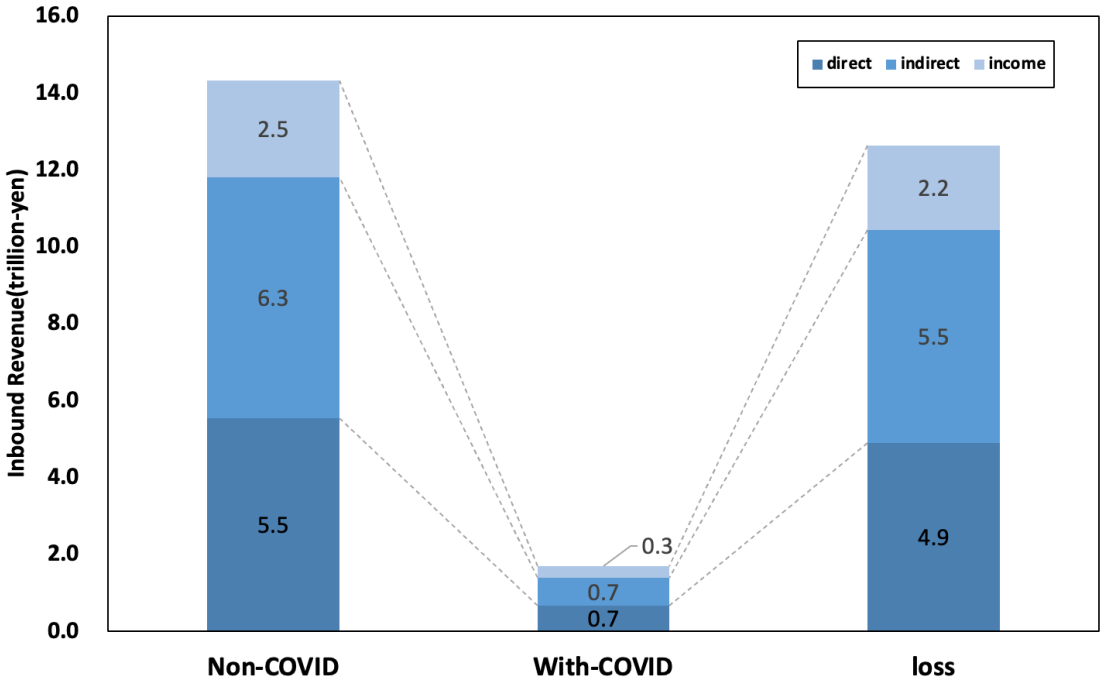
Finally, in both scenarios, the data has been available, which is direct, indirect, and income spillover effect of economic side and direct, indirect, income spillover effect of environmental side. By subtracting inbound benefits of the Non-COVID Scenario from that of the With-COVID Scenario, we calculated economic loss due to COVID-19. In the same way for CO_2 emissions, the environmental benefit was assessed. By comparing the data, we estimated the amount of economic loss and environmental benefit resulting from the COVID-19 epidemic.

3. Data

For the quantification of economic losses, the number of foreign visitors to Japan from 2003 to 2020 were obtained from JNTO, and the 2019 Survey of Foreign Visitor Spending Trends from the Japan Tourism Agency were used to estimate the direct effects. To ascertain the indirect effects, we got Input-output table of 2015 from the Ministry of Internal Affairs and Communications. To estimate the income spillover effects, the disposable income rate and consumption propensity of the average working household from the household survey report of the Ministry of Internal Affairs and Communications were also used to calculate the consumption propensity column vector (Ministry of Internatinal Affairs and Communications, 2021). For quantification of CO_2 emissions, we used Embodied energy and emission intensity data for Japan using input–output tables (3EID) (Nansai,K. et al. 2022).

4. Result and Discussion

Figure 2 presents the direct and indirect inbound revenues for each scenario and the economic losses estimated from the difference between them. Inbound earnings under the With-COVID Scenario were approximately 1,700 billion yen, whereas inbound earnings under the Non-COVID Scenario were 1,400 billion yen, and the economic loss estimated from the difference between the two scenarios was 1,260 billion yen. This result means that 88% of the inbound revenue expected for 2020 has been lost. In addition, the loss is larger for the amount of consumption that would have occurred domestically (indirect impact) than for the amount that would have been spent in Japan by visitors (direct impact). The decrease in the number of visitors to Japan due to the COVID-19 pandemic has caused significant



direct and indirect losses to the Japanese economy.

Figure.2 Direct and indirect inbound revenue for each scenario and Estimated economic loss

Figure 3 shows the top 10 sectors of the economy that accounted for the highest percentage of economic losses. The top five sectors are accommodation (1,500 billion yen), food services (1,200 billion yen), wholesale (503 billion yen), cosmetics and toothpaste (452 billion yen), and rail passenger transportation (406 billion yen). The largest direct losses are in the sectors of accommodation, food services, cosmetics and toothpaste, and railroad passenger transportation. The largest indirect and income spillover losses are in the sectors of wholesale, retail (328 billion yen), residential rental (imputed rent) (278 billion yen), other services to businesses (266 billion yen), business power generation (251 billion yen), and oil, crude oil, and natural gas (243 billion yen). Sectors with large losses from indirect effects were closely related to accommodation, food services, and rail passenger transportation, which had incurred large losses from direct effects. The large losses in the cosmetics and toothpaste sector were mainly due to a sharp decline in the number of Chinese visitors to Japan, who have high per capita consumption of cosmetics.

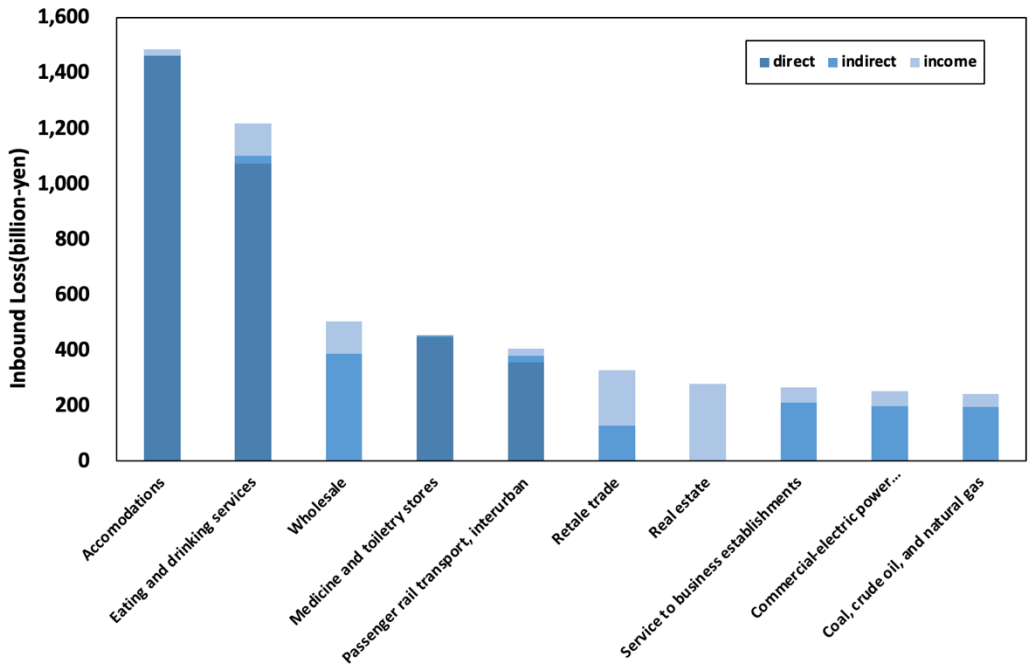


Figure 3. Top 10 sectors with losses by industry

Figure 4 presents the top 10 countries in terms of losses incurred owing to them, estimated by the nationality of foreign visitors to Japan. The top five countries are China (5,371 billion-yen), Taiwan

(1,352 billion-yen), South Korea (1,128 billion-yen), Hong Kong (858 billion-yen), and the United States (789 billion-yen). The decline in the number of Chinese visitors to Japan is a significantly large cause of loss. In addition, Taiwan, South Korea, Hong Kong, and the U.S are also with particularly large numbers of visitors to Japan. It clearly indicates that Japan's inbound market is dependent on neighboring Asian countries and the U.S.

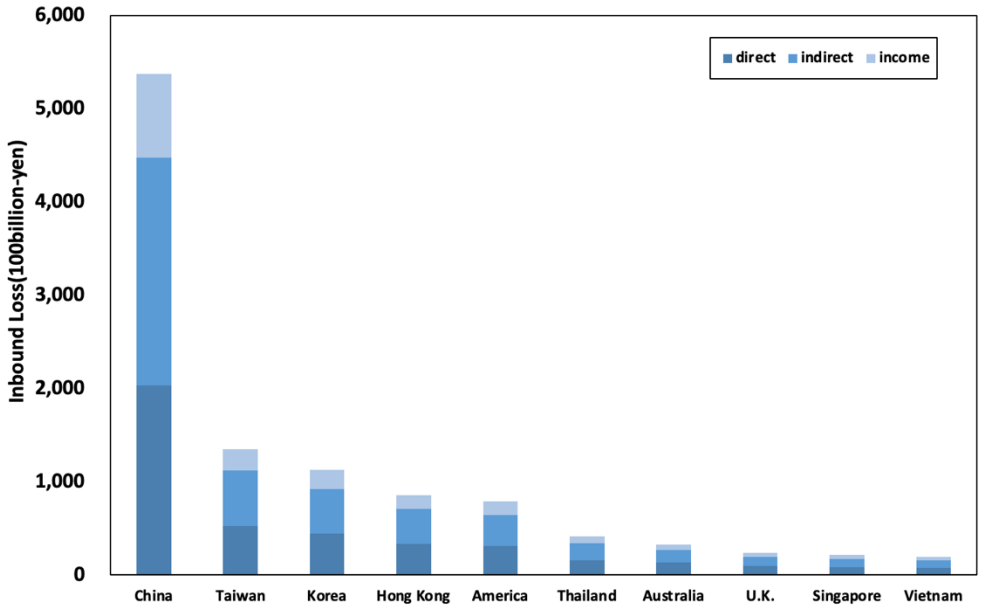
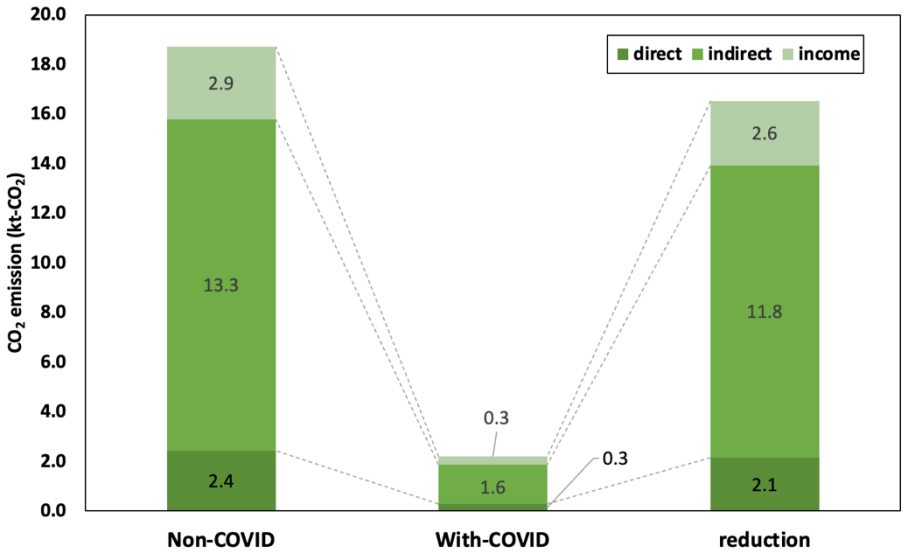


Figure 4. Top 10 countries by nationality

Figure 5 presents the direct and indirect CO_2 emissions for each scenario and the environmental benefits estimated from them.In the With-COVID Scenario, it is estimated that 2,199 kt-CO_2 of CO_2



was emitted, while in the Non-COVID Scenario, it was 18,716 kt-CO_2 emissions from inbound market. Nearly 71% of the CO_2 emissions from inbound are indirect emissions.

Figure 5. Direct and indirect CO_2 emissions for each scenario and estimated environmental CO_2 reduction

Figure 6 presents the top 10 industries, estimated by industry, for the environmental benefits shown in Figure 5. The top five industries were commercial-electric power generation (6,295 kt-CO_2), private-electric power generation (1,157 kt-CO_2), accommodations (1,027 kt-CO_2), waste disposal (631 kt-CO_2), and Private transport (passenger car) (500 kt-CO_2). Indirect demand reduction related to power generation was the largest (45%); 56% of this electricity demand was supplied to the accommodation and food services industry. This situation was due to the closure of accommodation and food service establishments owing to the pandemic.

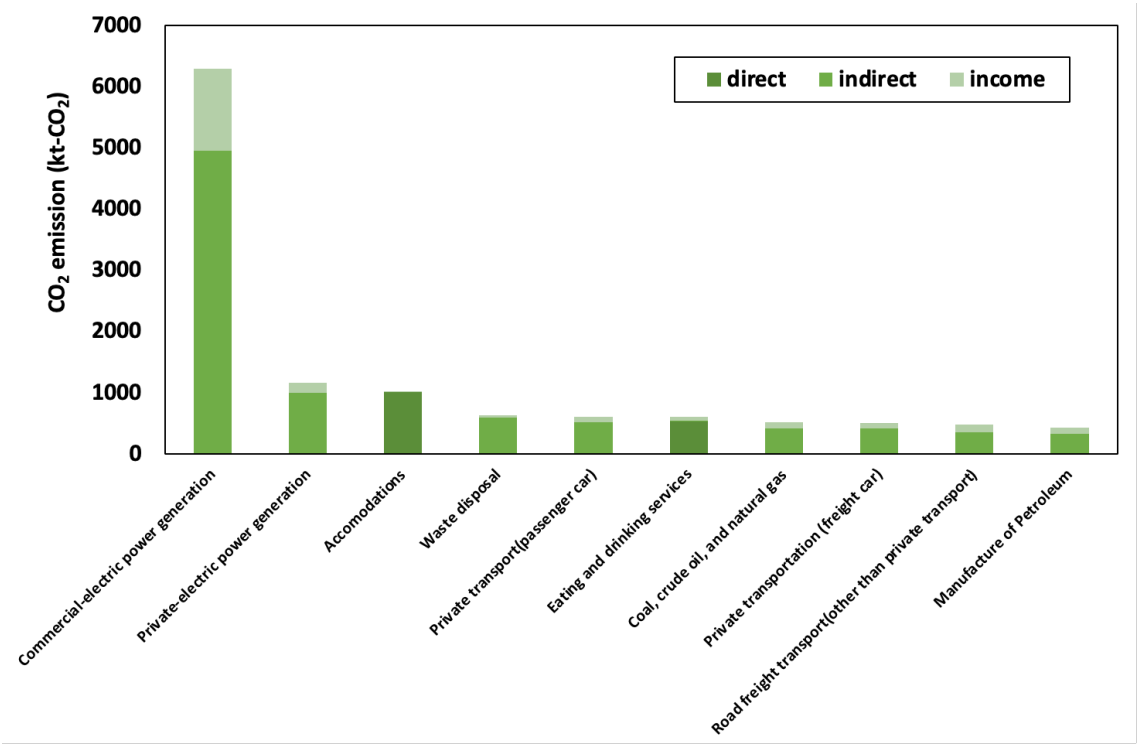


Figure 6. Top 10 Sectors with CO_2 Reduction by Industry

Figure 7 presents the top 10 countries in terms of environmental benefits estimated by the nationality of foreign visitors to Japan as revealed in Figure 6. The top five countries are China (6,022 billion-yen), Taiwan (1,536 billion-yen), South Korea (1,269 billion-yen), Hong Kong (973 billion-yen), and the United States (924 billion-yen).

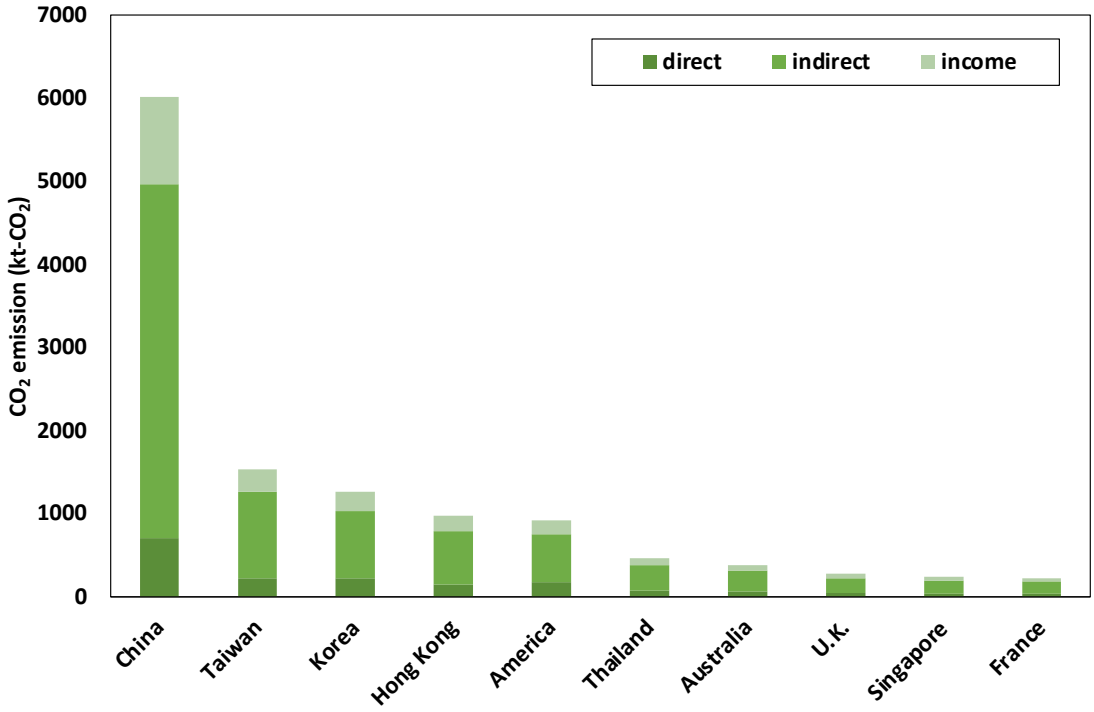


Figure 7. Top 10 categories of CO_2 reduction by nationality

5. Conclusion

This study estimated the economic losses and environmental benefits that the COVID-19 pandemic caused directly and indirectly to Japan through the inbound market, using an Input-Output analysis. The results indicate an economic loss of 12,600 billion yen and an environmental benefit of 16,517 kt-CO_2. The largest direct losses were witnessed in the accommodation, food and beverage services, cosmetics and toothpaste, and rail passenger transportation sectors. The largest indirect losses were witnessed in the wholesale, retail, other services to business, commercial power generation, petroleum and crude oil, and natural gas sectors. Income spillover losses were significant in the residential rental sector.

On the environmental side, the largest reduction in CO_2 emissions was attributed to reduced electricity demand, of which about 56% was due to the closure of lodging and food services. The COVID-19 epidemic wave is in a stagnant phase as of June 2022. However, the risk of another pandemic due to the birth of a mutant strain cannot be completely ruled out. Economic activity may continue to decline and then resume with each successive wave. During periods of stagnant economic activity following the spread of the infection, government support measures for businesses must be as precise as possible to sustain each industry in accordance with the impact of the pandemic.

In addition, the lodging and food service sectors are the most likely to be affected by the closure and shortened operating hours requirements. If policies can be put in place to incentivize companies in these

sectors to improve their business conditions to reduce their environmental impact, they can contribute to the realization of a decarbonized society. In the inbound market, which has a large economic impact, the precise allocation of support funds to each industry in accordance with the direct and indirect losses identified by the estimates of this study is necessary to ensure that each company is supported until the post pandemic.

Specifically, support should be provided not only to the lodging and food services, which received support from the "GO TO Campaign" and other sources, but also to the cosmetics and toothpaste, rail passenger transport, wholesale, retail, other services to businesses, business power generation, oil and crude oil, and natural gas industries that have suffered significant direct and indirect losses, depending on the scale of the losses incurred.

Furthermore, CO_2 emissions, which were reduced by COVID-19, will increase again when inbound traffic resumes. The accommodation and food and beverage service sectors, which are major contributors to inbound CO_2 emissions, are the industries most affected by COVID-19 and are in particular in need of government support. If governments could build a system that provides additional support to companies that improve their business conditions or invest in equipment to reduce their environmental impact during periods when they are closed or operate at shorter hours as a measure to prevent infection, it could also bring us closer to a decarbonized society

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