

Article



Evaluation of the Economic, Environmental, and Social Impacts of the COVID-19 Pandemic on the Japanese Tourism Industry

Yusuke Kitamura^{1,*}, Selim Karkour¹, Yuki Ichisugi² and Norihiro Itsubo¹

- ¹ Graduate School of Environmental and Information Studies, Tokyo City University, Yokohama 224-8551, Japan; g1893103@tcu.ac.jp (S.K.); itsubo-n@tcu.ac.jp (N.I.)
- ² Research Institute of Science for Safety and Sustainability, National Institute of Advanced Industrial Science and Technology, Tsukuba 305-8569, Japan; y0110.ichisugi@aist.go.jp
- * Correspondence: g1893104@tcu.ac.jp; Tel.: +81-45-910-2930

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Abstract: According to the United Nations Environment Program (UNEP) annual Emissions Gap Report 2019, further reductions in greenhouse gas (GHG) emissions are needed to reduce climate change impacts. In Japan, the 2030 Intended Nationally Determined Contribution (INDC) target is an emissions reduction of 26% compared to 2013. The World Health Organization (WHO) declared that the coronavirus (COVID-19) outbreak has led to 43,341,451 confirmed cases and 1,157,509 confirmed deaths globally and affected 218 countries (as of 27 October 2020). In Japan, as of the same date, 96,948 infectious cases and 1724 deaths related to the new coronavirus had been recorded. These numbers continue to increase. In Japan, in March 2020, the number of international tourist arrivals decreased by about 93% compared to last year at the same period. The World Tourism Organization (UNWTO) reported several significant scenarios for the tourism industry. COVID-19 is the greatest shock to international tourism since 1950 and represents an abrupt end to the 10-year period of sustained growth that followed the 2009 financial crisis. It was thought that it would be possible to analyze the economic, environmental, and social impacts of rapid social changes. Thus, this study estimates changes in Japan's tourist consumption, the carbon footprint (CFP), and employment due to the influence of the COVID-19 pandemic. The calculations in this study adopt a lifecycle approach using input-output tables. Based on these observations, this study uses four scenarios (SR 1, no recovery until December; SR 2, recovery from October; SR 3, recovery from July or September; and SR 0, same growth rate as 2018–2019) for Japan to calculate the CFP and employment change using input-output table analysis based on tourist consumption, which is a tourism metric. According to our results (2019 vs. SR 1 and 3), the consumption loss is between 20,540 billion yen (-65.1%) and 12,704 billion yen (-39.1%), the CFP reduction is between 89,488 kt-CO₂eq (-64.2%) and 54,030 kt-CO₂eq (-37.5%), and the employment loss is between 2,677,000 people (-64.2%) and 1,678,000 people (-37.5%). As of November 2020, the tourism industry continues to be affected by the COVID-19 pandemic. In the post-COVID-19 society, it will be necessary to maintain the GHG emissions reductions achieved in this short period and realize economic recovery. This recovery must also be sustainable for tourism stakeholders and society.

Keywords: life cycle assessment (LCA); carbon footprint (CFP); economic, environmental, and social analysis; sustainable tourism; coronavirus (COVID-19) pandemic

1. Introduction

The Paris Agreement was adopted in 2015 with the agreement of 195 countries of the United Nations (UN) [1]. The United Nations Environment Program (UNEP) annual Emissions Gap Report

2019 predicted that global emissions must be reduced by 7.6% each year in coming decades to meet the 1.5 °C Paris target [2]. In Japan, the 2030 Intended Nationally Determined Contribution (INDC) target is for an emissions reduction of 26% compared to 2013 [3]. Furthermore, Japan's Long-term Strategy under the Paris Agreement announced that it will aim to reduce emissions by 80% by 2050 [4]. On 26 October 2020, the Government of Japan declared that greenhouse gas (GHG) emissions in Japan will be cut to net-zero by 2050 [5].

The World Health Organization (WHO) declared the coronavirus (COVID-19) a pandemic on 11 March 2020. This pandemic is an unprecedented global challenge affecting all communities and economies [6]. According to the WHO, the COVID-19 outbreak has led to 43,341,451 confirmed cases and 1,157,509 confirmed deaths, affecting 218 countries (as of 27 October 2020) [7]. In Japan, as of the same date, 96,948 infectious cases and 1724 deaths related to the new coronavirus had been recorded [8]. These numbers continue to increase.

The Japanese government announced a state of emergency from 7 April to 31 May 2020. Under this declaration, people were restricted from going out and encouraged "stay home", and many stores were forced to close [9]. This basic coping policy required self-restraint to reduce unnecessary homecomings and travel across prefectures [10]. This had economic impacts on numerous domestic industries, including the tourism industry. Kuniya, T. (2020) estimated that the tourist peak in Japan is around early summer [11]. There is a concern that the longer the impact of the pandemic, the greater the effect on the economy.

According to the International Monetary Fund (IMF) [12], global growth is projected to be -3.0% in 2020, an outcome considerably worse than that during the 2009 global financial crisis. For Japan, real Gross Domestic Product (GDP) growth in 2020 is forecast to be -5.2%. The World Tourism Organization (UNWTO) stated that the worldwide outbreak of COVID-19 has had a major impact on the global economy, with tourism one of the worst affected of the major sectors. Against a backdrop of heightened uncertainty, up-to-date and reliable information is increasingly important, both for tourists and for the tourism sector [13]. In Japan, the number of international tourist arrivals decreased by about 93% (March 2020) [14]. According to the Japan Tourism Agency (JTA), inbound tourist consumption, according to national survey results for the January–March period of 2020 (first preliminary report), decreased 41.6% from the same period last year [15]. The overnight travel statistics survey showed a decrease of 49.6% (March 2020) compared with the same month last year. In particular, the total number of foreign guests fell 85.9% due to a decrease in inbound tourism [16]. In Japan, the tourism industry has been affected by the continued impact of COVID-19. It is clear that the tourism industry will continue to be affected, but the final magnitude of this impact remains unclear.

The report of the UNWTO [17], updated in May 2020, detailed (as of 20 April) all of the COVID-19-related travel restrictions for all global destinations introduced in response to the pandemic. Currently projected scenarios point to declines of 58% to 78% in international tourist arrivals for 2020, depending on the speed of the containment, the duration of travel restrictions, and the shutdown of international borders, although the outlook remains highly uncertain. These scenarios would put 100 to 120 million direct tourism jobs at risk.

Nicola et al. (2020) [18] showed that hospitality and tourism are most likely the hardest hit sectors. Mariolis et al. (2020) [19] predicted the impact of COVID-19 on GDP, total employment, and the trade balance in Greece. They found that the main effect was on the revenue of "hotel and restaurant services". Sun et al. (2020) [20] showed a significant decline in global aviation connections. Chang et al. (2020) [21] noted the importance of resuming tourism activities to maximize economic, social, and environmental contributions to turn future crises into sustainability opportunities.

Lenzen et al. (2018) [22] calculated the carbon footprint (CFP) of global tourism using an input–output life cycle assessment (LCA). CFP evaluation using this method has been applied in case studies in USA [23], New Zealand [24], UK [25], The Netherlands [26], Spain [27], China [28], and Japan [29]. Isaifan (2020) [30] showed that the outbreak of COVID-19 forced China to lockdown its industrial activities, and hence reduced its NO₂ and carbon emissions by 30% and 25%, respectively.

However, Cooper et al. (2020) [31] noted that the economic impact of COVID-19 cancellations clearly shows that reducing GHG emissions is not the only goal of sustainable tourism. Finally, Sun et al. (2020) [32] proposed a comprehensive Tourism Carbon Information System (TCIS) consisting of four important information components. They found that information on the tourism CFP is rarely available to policy makers, because relevant information is not directly edited and tracked in a country's greenhouse gas statistics.

Japan's tourism industry is expected to experience an employment-related effect as part of a large and wider economic effect [33]. It is hoped that the recovery of tourism will overcome these challenges, including economic, social, and environmental issues, leading to sustainable tourism in the future. It is clear that the post-COVID-19 society requires meaningful consideration. It is also important to have an understanding of the potential for positive impact on environmental issues in a short period of time, and to quantify the importance of the CFP as an approach to climate change.

It was thought that it would be possible to analyze the economic, environmental, and social impacts of rapid social changes. The calculations in this study adopt a lifecycle approach using input–output tables. This study thus estimates changes in Japan's tourist consumption, CFP, and employment due to the influence of the COVID-19 pandemic.

2. Materials and Methods

2.1. System Boundaries

As shown in Table 1, the system boundaries of this study follow the traditional approach adopted for tourism evaluation. The different stages are Preparation (Pre-tourism), Inbound Tourism, Domestic Tourism, Outbound Tourism, and After (Post-tourism). These stages cover consumption related to the movement and accommodation of tourists and the staff and participants of MICE events. However, these do not include the consumption of foreign tourists before or after travelling or items purchased by MICE organizers or energy consumption at the venues.

Table 1. Scope of the evaluation data. The items evaluated in this study are displayed as "O", and "N" indicates not applicable. "P" indicates preparing for travel, "W" indicates while traveling, and "A" indicates after travel. This target range is based on Kitamura et al. (2020) [29].

		Inbo	und To	urism	I	Domest Tourisn	ic 1	E T	Oomest Fourisn	ic n	C	utbour Fourisn	ıd 1	0	utbour Fourisn	nd n
					Overnight Stay			Day Trip			Domestic Transit			Destination		
	Life cycle stage	Р	W	А	Р	W	А	Р	W	А	Р	W	А	Р	W	A ³
Produ	Travel agencies, tour operators, and guide	Ν	0	Ν	Ν	0	Ν	Ν	0	Ν	Ν	0	Ν	Ν	Ν	Ν
icts :	Transport	Ν	0	Ν	Ν	0	Ν	Ν	0	Ν	Ν	0	Ν	Ν	Ν	Ν
an	Accommodation	N	0	N	Ν	0	Ν	N^2	0	Ν	Ν	0	Ν	Ν	Ν	Ν
d s	Food and beverage	Ν	0	Ν	0	0	Ν	0	0	Ν	0	0	Ν	Ν	Ν	Ν
er	Souvenirs	N	0	Ν	0	0	Ν	0	0	Ν	0	0	Ν	Ν	Ν	Ν
vices	Activities (including others ¹)	Ν	0	Ν	0	0	0	0	0	0	0	0	0	Ν	Ν	Ν

¹ This includes not only cultural services, recreation, and other entertainment services, but also other services. ² Day trips are not included for non-staying trips. ³ After is included in "transit" of domestic tourism.

The tourism statistics data, "Internal and national tourism consumption, by timing of purchase and products", provided by the JTA [34], distinguish between foreign visitors visiting Japan (referred to as inbound tourism in this study); domestic tourism, which also includes the travel within Japan of foreign visitors (e.g., flight connections); and the overseas travel of Japanese nationals and foreign residents (referred to in this study as outbound tourism). The items evaluated in this study are displayed as " \bigcirc " in Table 1, and those that are not included are displayed as "not applicable". These data were provided in JPY (1\$ = 117 JPY (2017 Ave.)) [35]. Table 2 shows the target years and scenarios of this study.

Type of Tourism	Scenario 1 (SR 1)	Scenario 2 (SR 2)	Scenario 3 (SR 3)	Scenario 0 (SR 0)
Inbound	August levels continue until December	August level continues until September, and from October it improves at the rate of July to August	From September, the improvement rate from July to August	2019–2020 will have the same growth rate as 2018–2019
Domestic (Overnight stay) Domestic (Day trip)	June levels continue until December	June level continues until September, and from October it improves at the rate of May to June	From July, the improvement rate from May to June	2019–2020 will have the same growth rate as 2018–2019
Outbound (Domestic transit)	August levels continue until December	August level continues until September, and from October it improves at the rate of July to August.	From September, the improvement rate from July to August	2019–2020 will have the same growth rate as 2018–2019
Outbound (Destination)	Ν	N	Ν	Ν

Table 2. Scenarios for each tourism ty	pe.
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2.2. Calculation Method of Economic Analysis

First, the calculation method used in the economic analysis is shown as follows:

$$\sum_{k=1}^{4} TEC_k = Ec_{it} + Ec_{dt(o)} + Ec_{dt(d)} + Ec_{ot}$$
(1)

Statistical data for Tourism Economic Consumption (*TEC*) [34] were applied from 2011 to 2017 based on the Tourism Satellite Account (TSA). These data include spending on different types of travel, defined as "k" (type of tourism), including economic consumption of inbound tourism (Ec_{it}), economic consumption of domestic tourism for overnight stays ($Ec_{dt(o)}$), economic consumption of domestic tourism for output stays ($Ec_{dt(o)}$), economic consumption of domestic tourism (Ec_{ot}).

Next, we derived estimates for 2018e (estimate)–2020e (estimate). Statistical data for this period are not available. Based on the consumption data of 2017, we applied the actual growth rate of the past five years (2013 to 2017) to each type of tourism. These rates were 127% for inbound tourism, 101.7% for domestic tourism (overnight stay), 102.6% for domestic tourism (day trip), and 100.2% for overseas tourism (domestic transit). Outbound tourism (rate of 97.7%) was not covered by this study.

Then, the amount of consumption per traveler was estimated. Finally, this was multiplied by the number of travelers per month to estimate the annual consumption for each year. The number of inbound and outbound tourists was provided by the Japan National Tourism Organization (JNTO) [36]. Domestic tourism (overnight stays and day trips) data was provided by JTA [37].

Evaluation scenarios of this study were divided into four types (Table 2). Scenario 1 (SR 1) maintains inbound and outbound (domestic transit) tourism at the August level until December, and domestic (overnight stay and day trip) tourism levels for June are maintained until December. In Scenario 2 (SR 2), inbound and outbound (domestic transit) tourism is maintained at the August level until September; from October, the level increases at the same rate as that of July until August. Domestic (overnight stay and day trip) tourism maintains the June level until September, and from October, it increases at the same rate as that of May until June. In Scenario 3 (SR 3), inbound and outbound (domestic transit) tourism increases from September at the same rate as that of July until August. Domestic (overnight stay and day trip) tourism increases from July at the same improvement rate as that of May until June. Finally, Scenario 0 (SR 0) assumes that 2019–2020 would have the same growth rate as that of 2018–2019. Evaluations were categorized according to these four scenarios.

For 2020, public statistics are available from January to August for inbound and outbound tourism, and from January to June for domestic (overnight stay and day trip) tourism. In addition, the per capita spending composition of tourists is the same as that of 2019 (based on the 2017 evaluation). Scenarios 1–3 do not include economic effects such as government strategic campaigns. In addition, Scenario 0 does not include the economic effects of Tokyo 2020.

2.3. Calculation Method of Environmental Analysis

Second, in this study, input–output analysis, based on the Japanese input–output table, was adopted for calculation in each year. The principles of this method are based on the works from W.W. Leontief [38] and are often used in the LCA research field, in which d is the direct environmental impact and the environmental impact per production value; $(I - A)^{-1}$ is the Leontief inverse matrix, which can be used to consider the direct and indirect economic ripple effects caused by the consumption of one type of good; *f* is the amount of activity. This method helps to evaluate the entire supply chain. This study calculated the CFP using the input–output LCA. The calculation formula is shown below:

$$\sum_{k=1}^{4} CFP_k = d_i (I - A)^{-1} f_i + DE_i$$
(2)

where d_i is the direct GHG emission intensity provided for each sector by the Inventory Database for Environmental Analysis version 2 (IDEAv.2), developed by the National Institute of Advanced Industrial Science and Technology (AIST) [39]. *A* is the direct input coefficient matrix: we used the 2011 waste input–output table (WIO) developed by Kondo et al. (2019) [40] to provide a broad overview. *I* is an identity matrix, $(I - A)^{-1}$ is the Leontief inverse matrix, and f_i is the activity level, obtained from the statistics of the JTA [34], as detailed previously. It would be more effective to use data focusing on the same year; however, the last waste input–output table available focuses only on 2011. *DE_i* is the direct emissions from fuel combustion included in the calculation to cover the full cradle-to-grave aspects of products and services; that is, using this equation, the calculation was extended from cradle-to-gate to cradle-to-grave. Based on the results of Kitamura et al. (2020) [29], who applied these calculations to tourism, we compiled a list of GHG emissions of tourism products and services (Appendix A, Table A1). In addition, the evaluation scenarios used in environmental analysis were the same as those used for the economic analysis.

2.4. Calculation Method of Social Analysis

Third, we calculated the number of employees. Ichisugi et al. [41] developed an employment factor to evaluate social aspects from the Japanese input–output table. This employment factor was also adopted in the social evaluation of this study, and can be expressed as:

$$\sum_{k=1}^{4} EMP_k = d_i (I - A)^{-1} f_i$$
(3)

where d_i is a direct factor and $(I - A)^{-1}$ is the Leontief inverse matrix. The direct factor per million yen was calculated by dividing the social evaluation data for each industrial sector by the value of domestic production. The employment factor was created by multiplying this by the Leontief inverse matrix. f_i is the amount of activity obtained from the estimates of each TEC. The number of employees (EMP) was calculated by multiplying this employment factor by the amount of consumption of each type of tourism. We used three categories of employment: paid officer, permanent employer, and temporary employer. Then, these were added together to provide the number of employees (Appendix A, Table A1). In addition, the evaluation scenarios used in environmental analysis were the same as those used for the economic analysis.

3. Results

3.1. Economic, Environmental, and Social Evaluation

We show the results of the estimation in Table 3. In 2019, the economy (consumption) valued at 30,514.5 billion yen, the environment (CFP) was 134,468.4 kt-CO₂eq, and the society (employment) was 3,955,200 people. In 2020, Scenarios 1 to 3, estimated consumption ranged from 9974.2 to 17,810.2 billion

yen, CFP from 44,980.5 to 80,438.8 kt-CO₂eq, and employment from 1,277,700 to 2,278,200 people. In Scenario 0, consumption was 32,034.7 billion yen, the CFP was 140,763.2 kt-CO2eq, and employment was 4,156,100 people.

Furthermore, Table 4 shows the reduction rate by comparing results of each scenario. In the comparison of Scenario 1 vs. 2019, i.e., the worst case, the consumption loss was 20,540 billion yen (-65.1%), the CFP reduction was 89,488 kt-CO2eq (-64.2%), and the employment loss was 2,677,000 people (-64.2%). In scenario 3 vs. 2019, i.e., the best case, the consumption loss was 12,704 billion yen (-39.1%), the CFP reduction was 54,030 kt-CO₂eq (-37.5%), and the employment loss was 1,678,000 people (-37.5%). The values for Scenario 2 were between these two extremes, and Scenario 0 resulted in more economic, environmental, and social growth.

	2 210		2020								
	2019	SR 1	SR 2	SR 3	SR 0						
Economic (B-JPY)	30,514.5	9974.2	12,033.1	17,810.2	32,034.7						
Environment (kt-CO2eq) Social (thousand people)	134,468.4 3955.2	44,980.5 1277.7	54,309.6 1540.5	80,438.8 2278.2	140,763.2 4156.1						

Table 3. Estimated results for each scenario.

The breakdown of the results from 2011 to 2020e is shown in Table A2 (consumption), Table A3 (carbon footprint (CFP)), and Table A4 (employment). "SR" refers to the scenario described in Table 2.

	2020 SR 1 vs. 2019 -20,540 -65.1% -89,488 -64.2% -2677 -64.2%		2020 SR 2	2 vs. 2019	2020 SR 3	3 vs. 2019	2020 SR 0 vs. 2019		
Economic (B-JPY)	-20,540 $-65.1%$ -89.488 $-64.2%$ $-64.2%$		-18,481	-18,481 -57.8%		-39.1%	1520	104.5%	
Environment (kt-CO ₂ eq)	PY) $-20,540$ - CO ₂ eq) $-89,488$ - people) -2677 -		-64.2% -80,159		-54,030	-37.5%	6295	104.2%	
Social (thousand people)	-2677	-64.2%	-2415	-58.3%	-1678	-37.5%	201	104.6%	
		"SR" refer	s to the scen	ario in Table	<u>- 2</u> .				

Figure 1a shows the results of categories. From these results, it can be confirmed that contributions to consumption and GHG are made by transportation, souvenirs, and shopping. In addition to transportation, souvenirs, and shopping, contributions to employment are also made by accommodation, food, and beverage. Figure 1b shows the results of the breakdowns. These results confirm that consumption is composed of accommodation, food and beverage, bullet train, confectionary, and international flights.



Figure 1. (a) Categories of significant contributions to the economy (consumption), environment (GHG), and society (employment). (b) Breakdown of significant contributions to the economy (consumption), environment (GHG), and society (employment).

Furthermore, GHG has a high impact due to the contribution of airplanes (international and domestic flight), gasoline cost, accommodation, and food and beverage. Employment includes accommodation and food and beverage, in addition to confectionery, food items, and bullet train contributions. This trend is almost the same for all years and scenarios (Figure 1a,b). Here, the breakdown of the top 5 contributions to the economy (consumption), environment (GHG), and society (employment) is shown clearly.

These results compare the CFP reduction and employer loss to the fall in the amount of consumption expenditure. From the perspective of the input–output table, CFP produces a large quantity of GHG emissions per production value. It is also shown that the number of employees is related to the value of production.

3.2. Economic Analysis

Figure 2 shows the results for tourist consumption from the economic evaluation. Figure 2a shows that the tourism economy grew from 2011 (detailed results are shown in Appendix A, Table A2), and Figure 2b shows equivalent monthly data. In SR 1, 2, and 3, the period from January until June shows the actual values of counted tourists. SR 1 was at the same level from June to December, SR 2 was at the level of June until September, followed by recovery from October, and SR 3 recovered from July. SR 0 is the same level as the past 10 years. Although the previous 10 years (2011–2019) experienced no major negatives, a large loss was confirmed for 2020. This is because tourism has experienced its worst situation of the past 10 years due to the influence of COVID-19.



(a)



(b)

Figure 2. Results of a focus on tourist consumption: (a) yearly trends, (b) monthly trends.

3.3. Environmental Analysis

Figure 3a shows the results for CFP from the environmental evaluation (detailed results are shown in Appendix A, Table A3) and indicates that tourism GHGs have increased annually since 2011. Figure 3b shows the equivalent monthly data. In SR 1, 2, and 3, the period from January until June was based on the actual values of counted tourists. SR 1 was at the same level from June to December, SR 2 was at the level of June until September, before recovering from October, and SR 3 recovered from July. SR 0 was at the same level as that of the previous 10 years. Again, the figure shows that there was no major reduction during the past 10 years (2011–2019), and that a large reduction was confirmed for 2020. This is because the CFP associated with tourism has improved compared to the past 10 years due to the influence of COVID-19.





(b)

Figure 3. Results of the focus on CFP: (a) yearly trends, (b) monthly trends.

3.4. Social Analysis

Figure 4a shows the results for employment from the social evaluation (detailed results are shown in Appendix A, Table A4) and indicates the growth in tourism employment since 2011. Figure 4b provides the equivalent monthly data. In SR 1, 2, and 3, the period from January until June was based on the actual values of counted tourists. SR 1 was at the same level from June to December, SR 2 was at the level of June until September, followed by a recovery from October, and SR 3 recovered from July. SR 0 was at the same level as that of the past 10 years. As for the previous evaluations, no major reduction was seen during the past 10 years (2011–2019), and a large decline can be confirmed for 2020.

This is because tourism employment experienced its worst situation of the past 10 years due to the influence of COVID-19.







(b)

Figure 4. Results of focus on employment, (a) yearly trends, (b) monthly trends.

4. Discussion

4.1. The current Economic Situation

COVID-19 has had a severe impact on the global tourism industry [42]. The UNWTO report [17], updated with current scenarios, projects a decline of between 58% and 78% in international tourist arrivals for 2020, depending on the speed of the containment, the duration of travel restrictions, and the shutdown of borders. Based on international tourism receipts for 2000–2019 and scenarios for 2020, export revenues associated with global tourism could decline by between USD 910 billion (-62%) and USD 1.2 trillion (-79%). Our study showed a consumption loss of between 12,704 billion yen (-39.1%) and 20,540 billion yen (-65.1%) in the case of Japan. The results of this study were included in the range of UNWTO's scenarios, albeit at the lower end of this range. This difference is related to the composition of Japan's tourism. According to The Japan Tourism White Paper (2017) [43], the value shares of tourism consumption in Japan are ranked as follows: domestic (overnight stay) (60.2%), domestic (day trips) (18.8%), inbound (16.5%), and outbound (domestic transit) (4.4%). Therefore, if the amount of inbound tourism decreases significantly, the economic impact will be small if supported by domestic travel. Following large losses, Japan's tourism industry is making a significant investment

to encourage the recovery. A total budget of 1679.4 billion yen was allocated for the "Go To Travel Campaign" [44], which has three main pillars. In addition to efforts to support food and beverage, events, and entertainment, a public–private integrated tourism demand campaign will be implemented. This will include promotion of the use of discount coupons that can be widely used for accommodation and day trip products, souvenir shops, restaurants, tourist facilities, transportation facilities, etc., around tourist destinations. The campaign will also include large-scale advertising to support the resumption of suspended airlines and to attract international tourists to Japan. Food and beverages are usually included in the restaurant industry. However, there are economic spillovers from food and beverage related to the tourism industry. From 22 July to 15 September, this campaign involved at least 16.89 million tourist nights and about 73.5 billion yen of support [45]. This support will continue until the end of January, thus potentially reducing the economic impact of the pandemic.

4.2. The Latest Situation of the Environmental Aspect

The results of this study indicate that the recovery of tourism demand and employment are the top priorities. In addition, however, it was also confirmed that GHG emissions were greatly reduced. The target of the Paris Agreement for Japan is to reduce its CFP by 26% by 2030 (compared to 2013) [4]. Lenzen et al. (2018) [22] calculated the carbon footprint of global tourism and found that tourism contributed about 8% of global GHG emissions. This highlights that the tourism industry has a significant responsibility to reduce its CFP. Furthermore, Kitamura et.al (2020) [29] estimated that tourism in Japan accounts for about 10.5% of the national CFP, accounting for approximately 136 million t- CO_2 per year, including outbound tourism. The contributions of each sector were found to be transport (56.3%), souvenirs (23.2%), accommodation (9.8%), food and beverage (7.5%), and activities (3.0%). In the current study, the CFP was estimated to be 134,468.4 kt-CO₂eq (2019), from 44,980.5 to 80,438.8 kt-CO2eq (2020, SR 1 to 3), 140,763.2 kt-CO2eq (2020, SR 0). CFP reductions were estimated to range from 89,488 kt-CO₂eq (-64.2%) to 54,030 kt-CO₂eq (-37.5%). The CFP of the tourism industry has been reduced beyond the goals of the Paris Agreement; thus, the tourism industry has made a large contribution to the overall reduction in the CFP. Despite this large reduction, however, the need for further reductions is well recognized due to the Japanese government's declaration to achieve net zero emissions by 2050. [5] In "Implications of COVID-19 for the Environment and Sustainability", published by the Institute for Global Environmental Strategies (IGES) [46], basic policy recommendations to promote a green recovery highlight the importance of Japan's emergency economic measures including environmental policies, such as meeting 100% of electricity demand from renewable energy sources (RE100). A recovery that prioritizes the economy is essential. However, the reductions in GHG emissions during this short pandemic period should not be reversed. As noted by Cooper et al. (2020) [31], the reduction in GHG emissions resulting from the death of the economy is not sustainable tourism. In business tourism (the MICE sector), international conferences have been held without the use of transportation for all participants [47]. Thus, in addition to transportation, souvenirs, accommodation, food and beverage, and activities at the destination also provide an opportunity for a major sustainability transformation towards decarbonization.

4.3. The Latest Situation of Social Aspect

The scenarios of the UNWTO report [17] show from 100 to 120 million direct tourism jobs are at risk globally. In addition, the International Labor Organization (ILO) reported the tourism sector accounted for 10.3% of global employment in 2019 [48]. The ILO notes that the pandemic could affect the work of 305 million people, many of whom are employed in the tourism sector. The Japanese Ministry of Internal Affairs and Communications (MIC) announced that the current level of employment is 59.46 million people and has been on a downward trend for five consecutive months. Furthermore, the number of unemployed is 2.06 million and has been on an increasing trend for seven consecutive months [49]. According to a report of the Japan Association of Travel Agents (JATA) [50], the tourism industry employs 2.31 million people, contributing 3.5% of total employment. This study estimated

employment losses of between 2,677,000 people (-64.2%) and 1,678,000 people (-37.5%). This result is comparable to the current number of unemployed. In addition, ANA Holdings Inc. released a full-year earnings forecast of -510 billion yen [51], and Japan airlines (JAL) also released its financial results [52]. For the largest airlines in Japan, such as ANA and JAL, management losses may affect the future employment of tourism industries. Thus, the future management situation of the tourism industry is unclear. However, growth in the number of travelers would also cause an increase in the number of overnight stays, indicating the potential for employment to recover.

4.4. Limitations and Future Investigations

Process-based LCA can reflect the effects of a reduction using physical quantities, such as resource usage, in evaluations. However, checking the supply chain is time-consuming and requires significant effort. Therefore, this study adopted input–output LCA based on consumption. However, individual products and services cannot be evaluated in detail. Environmental impact changes are dependent on monetary amounts, and it is difficult to reflect sustainability activities (resource efficiency, etc.) in the results. Process-based LCA is therefore required to allow examination of detailed changes. In addition, it is recommended to use monetary amounts and secondary data in the input–output LCA. Thus, we think it is necessary to evaluate the details with such a hybrid method. It should also be recognized that, because this evaluation was based on estimated scenarios based on the number of tourists, results are subject to a degree of uncertainty. Furthermore, world tourism information is constantly updated, and this should be carefully referred to in future estimations and evaluations.

5. Conclusions

In this study, the contributions of consumption, CFP, and employment of the Japanese tourism industry were shown for a 10-year period. Based on scenarios estimated using the number of tourists, we assessed the impact on consumption, CFP, and employment of the COVID-19 pandemic. In the worst case, consumption fell 20,540 billion yen (-65.1%), the CFP was reduced by 89,488 kt-CO₂eq (-64.2%), and employment fell by 2,677,000 people (-64.2%). Conversely, in the best case, the consumption loss was 12,704 billion yen (-39.1%), the CFP reduction was 54,030 kt-CO₂eq (-37.5%), and the employment loss was 1,678,000 people (-37.5%). These results reflect the deterioration in the economic and employment status of tourism to its worst situation in the past 10 years due to the influence of COVID-19. In contrast, the reduction in the tourism CFP represents a significant improvement. Overall, these results confirm the large influence of tourism and highlight the substantial opportunity for the industry due to its significant effects on the economy and employment. The CFP of tourism is largely focused on transportation. However, a transformation is necessary for the tourism industry to make a significant contribution to reducing global GHG emissions. Our hope is that the post-COVID-19 pandemic period is characterized by a sustainable recovery of the economy, societal health, and the environment. In this period, it will be necessary to maintain the reduced level of GHG emissions and to realize economic recovery. This recovery must also be sustainable for tourism stakeholders and society.

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Appendix A

Table A1. Sector row code table of the input–output table items by sector for carbon footprint (CFP) and number of employees. Created by the author based on Kitamura, Y. et al. (2020) [29] and Ichisugi, Y. et al. (2017) [41].

	т					
Product and Service		Social (Employment)		Environment (CFP)	Inp	out-Output Table Items
	(Paid Officer/JPY)	(Permanent Employer/JPY)	Temporary Employer/JPY)	(kg-CO2eq/JPY)	Low Code	Code Name
	1	Travel agencies, tour op	perators and tourist gui	ide services		
Travel agencies, tour operators, and tourist guide services	7.10×10^{-9}	1.25×10^{-7}	7.92×10^{-9}	6.88×10^{-4}	5789090	Travel and other transportation incidental services
		Pass	enger transport			
Airplane (domestic, local)	3.75×10^{-9}	7.61×10^{-8}	3.53×10^{-9}	1.01×10^{-2}	5751010	Air transport
Airplane (international flight)	3.75×10^{-9}	7.61×10^{-8}	3.53×10^{-9}	1.01×10^{-2}	5751010	Air transport
Bullet train	2.36×10^{-9}	5.67×10^{-8}	2.51×10^{-9}	1.64×10^{-3}	5711010	Railway transport
Railways (excluding bullet train)	2.36×10^{-9}	5.67×10^{-8}	2.51×10^{-9}	1.64×10^{-3}	5711010	Railway transport
Bus	6.31×10^{-9}	1.63×10^{-7}	5.34×10^{-9}	4.16×10^{-3}	5721010	Bus
Taxi	9.36×10^{-9}	2.08×10^{-7}	4.89×10^{-9}	4.93×10^{-3}	5721020	Taxi
Ships (inner service, local)	6.52×10^{-9}	8.17×10^{-8}	4.20×10^{-9}	1.23×10^{-2}	5742010	Marine and inland water
Ships (outbound)	3.71×10^{-9}	5.77×10^{8}	2.63×10^{-9}	2.57×10^{-3}	5741010	Ocean
Car rental fee	4.37×10^{-9}	5.25×10^{-8}	2.05×10^{-9}	7.86×10^{-4}	6612010	Car rental
Gasoline cost	2.69×10^{-9}	4.20×10^{-8}	1.76×10^{-9}	7.55×10^{-3}	2111010	Petrol
	-	-	-	2.10×10^{-2}	-	Petrol (direct)
Parking lot, toll road charge (except for highway charge), highway charge	6.92×10^{-9}	5.83×10^{-8}	2.76×10^{-9}	8.98×10^{-4}	5789010	Road
Highway charge	6.92×10^{-9}	5.83×10^{-8}	2.76×10^{-9}	8.98×10^{-4}	5789010	Road
		Accom	modation services			
Accommodation services	8.64×10^{-9}	1.30×10^{-7}	1.64×10^{-8}	2.33×10^{-3}	6711010	Accommodation
Vacation home ownership (imputed)	1.49×10^{-9}	1.35×10^{-8}	6.17×10^{-10}	2.37×10^{-4}	5531010	Vacation home ownership (imputed)
		Food	l and beverage			
Food and beverage serving services	9.81×10^{-9}	1.96×10^{-7}	2.41×10^{-8}	2.59×10^{-3}	6721010	Food and beverage
Agricultural products	5.46×10^{-9}	3.99×10^{-8}	1.99×10^{-8}	2.10×10^{-3}	116090	Other non-food cropping crops
Agricultural processed products	7.93×10^{-9}	1.07×10^{-7}	1.09×10^{-8}	3.12×10^{-3}	1116020	Agro-preserved food products (except bottles and cans)
Marine products	1.86×10^{-8}	1.28×10^{-7}	3.49×10^{-8}	6.07×10^{-3}	172001	Inland fishery and aquaculture
Fisheries processed products	8.85×10^{-9}	1.10×10^{-7}	$9.34 imes 10^{-9}$	$5.04 imes 10^{-3}$	1113090	Other seafood

		C(6				
		Social (Employment)	cient	Environmont (CEP)	Inp	out-Output Table Items
Product and Service	(Paid Officer/JPY)	(Permanent Employer/JPY)	Temporary Employer/JPY)	(kg-CO ₂ eq/JPY)	Low Code	Code Name
Confectionery	9.41×10^{-9}	1.22×10^{-7}	1.24×10^{-8}	3.66×10^{-3}	1115030	Confectionery
Other food items	1.27×10^{-8}	1.34×10^{-7}	1.71×10^{-8}	5.54×10^{-3}	1119090	Food items
Fiber products	1.04×10^{-8}	1.29×10^{-7}	5.58×10^{-9}	6.58×10^{-3}	1519090	Textile products
Shoes, bags	8.51×10^{-9}	1.16×10^{-7}	7.23×10^{-9}	3.05×10^{-3}	2229010	Footwear
Ceramics and glass products	1.23×10^{-8}	1.55×10^{-7}	9.54×10^{-9}	2.91×10^{-3}	2312020	Bags, bags and other leather products
Publication	8.92×10^{-9}	9.81×10^{-8}	5.41×10^{-9}	3.43×10^{-3}	5951030	Publication
Wood products and paper products	7.33×10^{-9}	9.46×10^{-8}	3.83×10^{-9}	5.62×10^{-3}	1649090	Other pulp, paper and paper products
Medical supplies and Cosmetics	5.31×10^{-9}	8.08×10^{-8}	4.08×10^{-9}	3.69×10^{-3}	2081020	Cosmetics
Film	$5.48 imes 10^{-9}$	8.29×10^{-8}	$2.94 imes 10^{-9}$	6.18×10^{-3}	2083010	Photosensitive material
Electrical equipment and related products	5.42×10^{-9}	9.09×10^{-8}	3.83×10^{-9}	3.61×10^{-3}	3321020	Consumer electrical appliances (except air conditioners)
Camera, glasses, watch	8.57×10^{-9}	1.19×10^{-7}	6.18×10^{-9}	3.26×10^{-3}	3919090	Other manufactured industrial products
Sports equipment \cdot CD \cdot stationery	8.57×10^{-9}	1.19×10^{-7}	6.18×10^{-9}	3.26×10^{-3}	3919090	Other manufactured industrial products
Other manufactured products	8.57×10^{-9}	1.19×10^{-7}	6.18×10^{-9}	3.26×10^{-3}	3919090	Other manufactured industrial products
	Activity (Cultural	services, Recreation and	l other entertainment	t services, and other servi	ces)	
A day spa warm-bathing facility beauty salon	8.31×10^{-9}	1.44×10^{-7}	1.63×10^{-8}	3.81×10^{-3}	6731040	Bathing
Museums, museums, zoos and gardens, aquariums	3.12×10^{-9}	1.23×10^{-7}	2.91×10^{-8}	2.30×10^{-3}	6312010	Social education (public)
Watching sports and Art appreciation	5.52×10^{-9}	7.73×10^{-8}	1.60×10^{-8}	1.01×10^{-3}	6741020	Office space (except movie theaters) and entertainment companies
Amusement parks and expositions	5.52×10^{-9}	$7.73 imes 10^{-8}$	$1.60 imes 10^{-8}$	1.01×10^{-3}	6741020	(except movie theaters) and entertainment companies
Sports Facilities	5.97×10^{-9}	1.29×10^{-7}	1.80×10^{-8}	1.34×10^{-3}	6741040	Sports facility offer work, park, amusement park
Ski lift fee	2.36×10^{-9}	5.67×10^{-8}	2.51×10^{-9}	1.64×10^{-3}	5711010	Railway
camp site	5.97×10^{-9}	1.29×10^{-7}	1.80×10^{-8}	1.34×10^{-3}	6741040	Sports facility offer work, park, amusement park

Table A1. Cont.

		Coeff	ficient		Т	out Output Table Items			
Product and Service		Social (Employment)		Environment (CFP)	input-Output fable items				
	(Paid Officer/JPY)	(Permanent Employer/JPY)	Temporary Employer/JPY)	(kg-CO2eq/JPY)	Low Code	Code Name			
Exhibition and convention participation fee	8.48×10^{-9}	8.87×10^{-8}	7.87×10^{-9}	6.27×10^{-4}	6699090	Other business services			
Tourist farm	4.05×10^{-9}	1.03×10^{-7}	2.04×10^{-8}	4.56×10^{-3}	131020	Agricultural services (except for veterinary services)			
Fishing boat	6.78×10^{-9}	1.27×10^{-7}	1.44×10^{-8}	1.45×10^{-3}	6741090	Other entertainment			
Guide fee	6.60×10^{-9}	$8.15 imes 10^{-8}$	1.37×10^{-8}	8.22×10^{-4}	6799090	Other personal services			
Rental charge	4.94×10^{-9}	5.63×10^{-8}	2.72×10^{-9}	7.80×10^{-4}	6611010	Goods rental business (excluding rental cars)			
Massage	6.28×10^{-9}	1.37×10^{-7}	9.55×10^{-9}	1.06×10^{-3}	6411050	Medical (other medical services)			
Photo shoot fee	1.39×10^{-8}	1.11×10^{-7}	1.61×10^{-8}	1.10×10^{-3}	6799010	Photography			
Mail and communication charges	1.58×10^{-9}	2.01×10^{-7}	4.28×10^{-9}	1.51×10^{-3}	5791010	Postal and letter mail			
Home delivery	8.47×10^{-9}	1.42×10^{-7}	9.28×10^{-9}	1.38×10^{-2}	5722010	Delivery			
Travel insurance · Credit card admission fee	3.87×10^{-9}	9.13×10^{-8}	2.27×10^{-9}	6.78×10^{-4}	5312010	Life insurance			
Passport application fee	2.34×10^{-9}	$7.28 imes10^{-8}$	3.04×10^{-9}	$8.16 imes10^{-4}$	6112010	Government (local)			
Visa application fee	2.34×10^{-9}	7.28×10^{-8}	3.04×10^{-9}	8.16×10^{-4}	6112010	Government (local)			
Hairdresser/Barber	8.45×10^{-9}	1.18×10^{-7}	1.16×10^{-8}	9.50×10^{-4}	6731030	Beauty industry			
Develop and print photos	6.60×10^{-9}	8.15×10^{-8}	1.37×10^{-8}	8.22×10^{-4}	6799090	Other personal services			
laundry service	6.77×10^{-9}	1.42×10^{-7}	1.28×10^{-8}	1.74×10^{-3}	6731010	Laundry service			
Other	6.60×10^{-9}	8.15×10^{-8}	1.37×10^{-8}	8.22×10^{-4}	6799090	Other personal services			

Table A1. Cont.

 Table A2. Results of tourist consumption breakdown (2011–2020).

	0011	2012	2013	2014	2015	2016	2017	0010	2010		2020		
Products	2011	2012	2013	2014	2015	2016	2017	2018	2019	SR1	SR2	SR3	SR0
Travel agencies, operators, and guides													
Travel agencies, tour operators, and tourist guide services	415.9	436.7	457.0	424.2	454.1	438.1	439.2	450.4	463.3	135.3	160.3	230.6	470.9
Transport													
Airplane (domestic, local)	1314.0	1304.5	1319.0	1348.1	1464.0	1395.1	1438.9	1469.6	1502.2	576.0	708.9	1085.9	1606.3
Airplane (international flight)	708.1	747.1	818.0	921.4	976.2	962.0	1052.0	1141.6	1255.1	180.9	182.8	185.0	1210.7
Bullet train	1743.1	1873.6	1952.0	1981.2	2364.6	2489.8	2352.6	2472.2	2614.0	910.1	1104.0	1646.8	2755.7
Railways (excluding bullet train)	753.9	711.8	771.0	662.2	751.6	766.8	729.2	743.8	758.7	299.5	366.4	553.3	799.9
Bus	525.0	460.8	471.0	373.9	395.3	434.3	439.6	448.6	457.8	181.5	221.7	333.7	481.2
Taxi	157.9	150.6	161.0	181.4	194.8	233.8	211.7	230.9	254.7	73.4	87.3	126.5	266.6
Ships (inner service, local)	104.5	107.2	101.0	100.5	110.8	110.5	114.0	117.6	121.6	45.2	55.5	84.7	130.1

Table A2. Cont.

											20	120	
Products	2011	2012	2013	2014	2015	2016	2017	2018	2019	SR1	SR2	SR3	SR0
Ships (outbound)	4.1	3.9	3.0	4.9	5.5	4.3	4.7	4.9	5.2	0.8	0.8	0.8	4.9
Car rental fee	260.3	274.1	322.0	259.9	302.8	361.8	344.9	362.2	382.7	132.6	161.5	243.1	406.5
Gasoline cost	1211.2	1189.2	1189.0	1096.7	1047.5	1013.2	1102.5	1125.3	1148.5	460.6	564.1	852.8	1212.7
Parking lot, toll road charge (except for highway charge)	378.0	260.4	260.0	314.7	279.8	279.8	291.4	297.2	303.1	118.8	145.2	218.8	318.8
Highway charge	660.7	754.8	798.0	738.5	844.6	891.5	967.5	987.1	1007.2	402.4	493.2	746.7	1065.1
Accommodation													
Accommodation services	3478.9	3681.1	3844.0	3619.8	4305.7	4544.7	4791.4	5147.0	5582.5	1717.2	2074.7	3091.2	5927.8
Vacation home ownership (imputed)	407.0	405.7	404.0	437.0	441.7	446.4	451.1	459.0	467.0	182.6	226.0	349.9	504.2
Food and beverage													
Food and beverage serving services	2422.3	2488.5	2724.0	2653.7	3142.8	3395.0	3514.2	3774.4	4091.7	1285.4	1545.8	2275.6	4304.8
Souvenirs													
Agricultural products	157.4	147.2	173.0	144.9	157.8	166.3	179.3	183.1	187.0	75.7	92.5	139.4	196.8
Agricultural processed products	104.7	96.2	96.0	99.8	94.1	99.6	103.0	105.1	107.2	43.1	52.8	80.0	113.4
Marine products	191.4	191.3	181.0	143.8	159.6	169.5	134.9	137.6	140.4	56.2	69.0	104.8	149.0
Fisheries processed products	171.8	163.8	172.0	145.0	149.8	147.3	152.7	155.8	158.9	63.6	78.1	118.6	168.6
Confectionery	1418.5	1418.2	1459.0	1367.4	1456.0	1489.9	1611.9	1677.9	1754.4	632.3	769.3	1153.2	1850.7
Other food items	1086.1	1093.1	1136.0	1011.7	1193.8	1211.1	1207.6	1272.4	1349.4	463.2	560.5	832.1	1418.3
Fiber products	1114.1	1059.6	1065.0	921.1	971.2	1076.1	981.9	1008.9	1038.7	383.6	467.7	703.9	1093.9
Shoes, bags	523.7	490.1	650.0	592.7	784.9	712.5	708.8	786.3	882.8	225.3	263.4	369.4	914.2
Ceramics and glass products	58.8	64.8	46.0	52.5	50.4	46.5	42.3	43.1	44.0	17.5	21.5	32.9	46.9
Publication	104.0	107.0	111.0	94.0	106.3	107.0	101.1	107.6	115.5	35.9	43.0	62.6	120.2
Wood products and paper products	44.9	42.0	33.0	28.5	34.9	32.0	41.5	42.4	43.3	17.5	21.4	32.3	45.6
Medical supplies and cosmetics	190.1	204.9	222.0	292.1	530.6	607.2	676.3	826.8	1017.4	158.8	170.1	200.1	1044.9
Film	12.2	14.6	11.0	5.9	8.3	8.5	7.1	7.2	7.3	2.7	3.3	5.0	7.7
Electrical equipment and related products	247.7	204.2	185.0	234.8	246.4	204.8	223.5	254.4	293.2	64.5	73.8	99.5	302.1
Camera glasses watch	196.7	178.0	205.0	196.6	244 7	198.4	229.3	253.5	283.6	71.9	84.2	118.3	293.8
Sports equipment · CD · stationery	101.3	100.6	100.0	92.0	157.2	204 7	237.5	242 5	247.7	99.1	121.1	181.9	259.9
Other manufactured products	146.1	141.2	142.0	157.5	176.2	202.5	199.2	221.3	248.6	67.9	80.0	113.7	259.0
Activities													
A day spa warm-bathing facility beauty salon	107.4	105.8	97.0	95.3	114.1	103.5	121.4	123.9	126.4	50.6	62.1	94.3	134.1
Museums, museums, zoos and gardens, aquariums	137.5	149.2	144.0	140.1	160.4	169.3	178.2	188.4	200.6	68.6	83.0	123.4	211.3
Watching sports and art appreciation	104.6	75.5	106.0	116.9	131.3	160.6	184.3	190.6	197.7	76.3	92.8	138.2	206.8
Amusement parks and expositions	311.5	322.3	341.0	349.5	396.5	407.3	430.6	451.4	475.8	170.5	206.7	307.7	500.1
Sports Facilities	121.1	124.9	163.0	129.5	136.1	137.3	132.3	135.3	138.4	56.6	68.9	103.0	144.5
Ski lift fee	38.2	51.8	43.0	43.2	41.9	30.6	39.9	40.7	41.5	16.6	20.4	31.0	44 1
Camp site	0.8	0.9	1.0	54	0.8	15	0.8	0.8	0.8	0.4	0.4	0.6	0.9
Exhibition and convention participation fee	27.2	23.2	22.0	25.9	20.2	30.9	31.2	31.8	32.5	13.2	16.1	24.2	34.2
Tourist farm	12.9	14.9	12.0	13.5	15.2	13.6	15.8	16.2	16.5	67	82	12.3	17.3
Fishing hoat	41.6	30.8	27.0	17.6	25.4	27.1	33.2	33.9	34.6	13.9	17.1	25.8	36.5
Guide fee	19.9	28.9	28.0	23.3	39.7	34.3	32.4	33.1	33.8	13.6	16.6	25.0	35.7
Rental charge	43.8	53.7	42.0	49.4	70.5	66.2	97.5	101.6	106.4	34.8	42.0	62.3	111 3
Massago	50.9	45.4	47.0	42.4	30.1	30.2	34.9	35.5	36.1	14.2	17.6	27.0	38.8
Photo shoot foo	25.2	4.5.4	24.0	41.4 25.3	18.7	17.8	14.7	15.0	15.3	14.4 6 1	75	27.0 11.4	16.0
Mail and communication charges	25.2	10.7	14.0	20.0	86	17.0	14.7	14.5	13.3	5.6	68	10.3	15.4
wan and communication charges	23.2	17.5	14.0	20.0	0.0	10.0	14.4	14.5	14.0	5.0	0.0	10.5	13.0

Table A2. Cont.

				2013 2014 2	2015	14 2015 2016 20	2017				2020		
Products	2011	2012	2013	2014	2015	2016	2017	2018	2019	SR1	SR2	SR3	SR0
Home delivery	111.7	106.3	111.0	108.2	108.4	93.6	96.2	97.9	99.6	37.8	46.4	70.8	105.9
Travel insurance · Credit card admission fee	54.6	56.3	52.0	37.0	39.8	63.9	60.9	61.5	62.1	17.0	19.9	27.9	61.9
Passport application fee	43.7	47.9	44.0	43.5	38.1	42.6	41.4	41.4	41.5	6.5	6.6	6.7	38.3
Visa application fee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hairdresser/Barber	261.2	232.9	254.0	208.7	214.0	238.9	229.1	233.5	238.0	92.5	113.2	171.3	251.3
Develop and print photos	106.6	90.6	95.0	70.6	62.5	55.1	48.9	49.8	50.7	19.1	23.3	35.1	53.1
Laundry service	56.3	58.4	53.0	45.7	59.5	50.9	53.5	54.5	55.5	21.5	26.4	40.0	58.7
Other	267.5	269.8	259.0	192.4	145.7	130.1	143.3	151.5	161.4	51.0	60.9	88.3	166.9
Total	22,383.8	22,492.7	23,560.0	22,500.9	25,481.3	26,371.8	27,117.4	28,660.1	30,514.5	9974.2	12,033.1	17,810.2	32,034.7
		//CD/	,	· · · .	11 O TT								

"SR" means scenario in Table 2. Unit: B-JPY.

Table A3. Results of CFP breakdown (2011–2020).

		0010	0010	0014	2015	2016	2017	0010	2010		2020		
Froducts	2011	2012	2013	2014	2015	2016	2017	2018	2019	SR1	SR2	SR3	SR0
Travel agencies, operators, and guides													
Travel agencies, tour operators, and tourist guide services	286.1	300.3	314.3	291.7	312.3	301.3	302.1	309.8	318.6	93.1	110.3	158.6	323.9
Transport													
Airplane (domestic, local)	13,244.4	13,149.2	13,295.0	13,588.3	14,756.7	14,062.1	14,503.2	14,812.7	15,141.4	5806.3	7145.9	10,945.5	16,190.6
Airplane (international flight)	7136.9	7530.3	8245.1	9287.6	9839.7	9696.5	10,604.1	11,507.2	12,650.6	1822.9	1842.3	1864.9	12,203.5
Bullet train	2866.9	3081.6	3210.5	3258.6	3889.0	4094.9	3869.3	4066.1	4299.3	1496.8	1815.8	2708.5	4532.3
Railways (excluding bullet train)	1239.9	1170.7	1268.1	1089.1	1236.2	1261.2	1199.3	1223.3	1247.8	492.5	602.6	910.1	1315.6
Bus	2185.7	1918.6	1960.9	1556.6	1645.7	1808.3	1830.3	1867.7	1906.0	755.4	923.0	1389.3	2003.3
Taxi	778.8	742.9	794.1	894.6	960.8	1153.2	1043.9	1138.9	1256.1	361.8	430.8	623.9	1315.0
Ships (inner service, local)	1286.2	1319.0	1242.8	1237.2	1363.7	1360.0	1402.2	1446.5	1496.7	556.2	683.0	1042.6	1600.7
Ships (outbound)	10.6	10.1	7.7	12.6	14.1	11.2	12.0	12.6	13.3	2.0	2.0	2.0	12.6
Car rental fee	204.5	215.4	253.0	204.2	237.9	284.2	271.0	284.6	300.7	104.2	126.9	191.0	319.4
Gasoline cost	34,611.7	33,981.5	33,976.4	31,339.1	29,933.6	28,953.7	31,505.5	32,155.9	32,820.4	13,162.8	16,120.9	24,368.1	34,654.8
Parking lot, toll road charge (except for highway charge)	339.3	233.8	233.4	282.5	251.2	251.2	261.6	266.8	272.1	106.6	130.3	196.4	286.2
Highway charge	593.2	677.7	716.5	663.1	758.3	800.5	868.6	886.3	904.3	361.3	442.8	670.4	956.3
Accommodation													
Accommodation services	8111.5	8583.1	8962.8	8440.1	10,039.4	10,596.6	11,171.9	12,001.0	13,016.5	4003.9	4837.4	7207.5	13,821.6
Vacation home ownership (imputed)	96.6	96.3	95.9	103.7	104.8	105.9	107.1	108.9	110.8	43.3	53.6	83.0	119.6

Table A3. Cont.

											2020		
Products	2011	2012	2013	2014	2015	2016	2017	2018	2019	SR1	SR2	SR3	SR0
Food and beverage													
Food and beverage serving services	6262.2	6433.3	7042.1	6860.5	8124.8	8776.7	9084.9	9757.6	10,577.9	3323.1	3996.1	5882.9	11,128.8
Souvenirs													
Agricultural products	330.1	308.7	362.8	303.9	330.9	348.7	375.9	384.0	392.2	158.7	194.1	292.3	412.8
Agricultural processed products	327.2	300.5	300.0	311.8	294.1	311.1	321.7	328.4	335.1	134.7	165.1	250.0	354.5
Marine products	1161.6	1160.7	1098.4	872.7	968.4	1028.8	818.8	835.2	852.0	341.0	418.7	636.1	904.2
Fisheries processed products	865.2	824.8	866.2	730.2	754.6	741.7	769.0	784.5	800.3	320.4	393.3	597.5	849.1
Confectionery	5198.0	5197.2	5346.6	5010.8	5335.7	5459.9	5907.1	6148.7	6429.3	2317.1	2819.3	4226.1	6782.0
Other food items	6017.8	6057.0	6294.5	5606.0	6614.7	6710.7	6691.3	7050.0	7477.0	2566.4	3105.4	4610.7	7858.8
Fiber products	7328.3	6969.6	7005.0	6058.4	6387.8	7078.1	6458.7	6635.8	6832.0	2523.0	3076.4	4629.8	7195.4
Shoes, bags	1595.7	1493.2	1980.4	1805.9	2391.4	2170.8	2159.5	2395.6	2689.5	686.4	802.6	1125.3	2785.4
Ceramics and glass products	171.2	188.7	134.0	152.9	146.8	135.4	123.2	125.6	128.0	50.9	62.7	95.7	136.6
Publication	356.4	366.8	380.4	322.2	364.1	366.6	346.4	368.6	395.7	123.1	147.3	214.7	411.7
Wood products and paper products	252.2	236.1	185.5	160.4	196.4	179.9	233.3	238.3	243.4	98.3	120.3	181.4	256.4
Medical supplies and Cosmetics	700.9	755.5	818.6	1077.1	1956.6	2238.7	2493.7	3048.5	3751.4	585.4	627.3	737.9	3852.7
Film	75.4	90.3	68.0	36.6	51.4	52.8	43.6	44.4	45.1	16.7	20.4	30.9	47.5
Electrical equipment and related products	893.8	737.0	667.6	847.2	889.2	739.0	806.4	918.0	1058.0	232.9	266.4	359.0	1090.1
Camera, glasses, watch	642.2	580.9	669.2	641.8	798.8	647.6	748.4	827.4	925.7	234.8	274.7	386.2	959.1
Sports equipment \cdot CD \cdot stationery	330.7	328.5	326.4	300.3	513.0	668.1	775.4	791.7	808.4	323.6	395.2	593.8	848.5
Other manufactured products	477.0	461.0	463.5	514.0	575.3	661.0	650.3	722.2	811.5	221.6	261.3	371.2	845.5
Activities													
A day spa warm-bathing facility beauty salon	408.9	402.7	369.2	362.7	434.1	393.7	462.1	471.5	481.0	192.7	236.4	359.1	510.2
Museums, museums, zoos and gardens, aquariums	315.7	342.7	330.7	321.7	368.4	388.7	409.3	432.7	460.7	157.5	190.7	283.3	485.2
Watching sports and art appreciation	105.5	76.2	106.9	118.0	132.5	162.0	186.0	192.3	199.4	77.0	93.6	139.5	208.7
Amusement parks and expositions	314.3	325.2	344.0	352.7	400.0	410.9	434.5	455.4	480.0	172.0	208.6	310.4	504.5
Sports facilities	161.9	166.8	217.8	173.1	181.9	183.5	176.8	180.8	184.9	75.6	92.1	137.6	193.1
Ski lift fee	62.9	85.2	70.7	71.1	68.9	50.3	65.6	67.0	68.3	27.4	33.6	51.0	72.5
Camp site	1.1	1.2	1.3	7.2	1.1	2.0	1.1	1.1	1.1	0.5	0.6	0.8	1.2
Exhibition and convention participation fee	17.0	14.6	13.8	16.2	12.7	19.4	19.5	20.0	20.4	8.3	10.1	15.2	21.4
Tourist farm	58.9	68.0	54.7	61.4	69.2	61.8	72.1	73.7	75.3	30.6	37.4	56.1	78.9
Fishing boat	60.4	44.7	39.2	25.5	36.8	39.3	48.1	49.1	50.2	20.2	24.8	37.4	52.9
Guide fee	16.3	23.8	23.0	19.1	32.6	28.2	26.7	27.2	27.8	11.2	13.7	20.7	29.4
Rental charge	34.2	41.9	32.8	38.6	55.0	51.6	76.0	79.2	83.0	27.1	32.8	48.6	86.8
Massage	53.8	48.0	49.6	43.7	31.8	31.9	36.8	37.5	38.2	15.0	18.5	28.6	41.0
Photo shoot fee	27.9	20.9	26.5	27.9	20.1	19.6	16.2	16.5	16.9	6.7	8.3	12.6	17.9
Mail and communication charges	38.0	26.1	21.1	30.1	12.9	23.7	21.5	21.8	22.2	8.4	10.3	15.6	23.5
Home delivery	1546.7	1471.9	1536.5	1498.2	1501.1	1296.2	1332.2	1355.2	1378.6	522.9	642.3	980.6	1466.5
Travel insurance · Credit card admission fee	37.0	38.2	35.3	25.1	27.0	43.3	41.3	41.7	42.1	11.5	13.5	18.9	42.0
Passport application fee	35.6	39.1	35.9	35.5	31.1	34.8	33.7	33.8	33.9	5.3	5.4	5.5	31.2

Products	0011	2012	2013	2014	2015	2016	2017	2018	2019	2020			
	2011									SR1	SR2	SR3	SR0
Visa application fee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hairdresser/barber	248.2	221.4	241.4	198.4	203.4	227.1	217.8	221.9	226.2	87.9	107.6	162.8	238.8
	87.6	74.5	78.1	58.0	51.4	45.3	40.2	40.9	41.7	15.7	19.2	28.8	43.7
Laundry service	97.8	101.5	92.1	79.4	103.5	88.5	93.0	94.7	96.5	37.4	45.9	69.5	102.1
Other	220.0	221.9	213.0	158.2	119.9	107.0	117.8	124.6	132.8	41.9	50.1	72.6	137.3
Total	10,9928.0	10,9356.5	11,2519.5	10,7583.6	11,5933.2	11,6765.3	12,1688.3	12,7531.6	13,4468.4	44,980.5	54,309.6	80,438.8	140,763.2

"SR" means scenario in Table 2. Unit: kt-CO₂eq.

Table A4. Results of employment breakdown (2011–2020).

				2014	2015	2016	2017			2020				
Products	2011	2012	2013					2018	2019	SR1	SR2	SR3	SR0	
Travel agencies, operators, and guides														
Travel agencies, tour operators, and tourist guide services	58.1	61.0	63.8	59.2	63.4	61.2	61.3	62.9	64.7	18.9	22.4	32.2	65.8	
Transport														
Airplane (domestic, local)	109.6	108.8	110.0	112.5	122.1	116.4	120.0	122.6	125.3	48.1	59.1	90.6	134.0	
Airplane (international flight)	59.1	62.3	68.2	76.9	81.4	80.3	87.8	95.2	104.7	15.1	15.2	15.4	101.0	
Bullet train	107.2	115.3	120.1	121.9	145.5	153.2	144.7	152.1	160.8	56.0	67.9	101.3	169.5	
Railways (excluding bullet train)	46.4	43.8	47.4	40.7	46.2	47.2	44.9	45.8	46.7	18.4	22.5	34.0	49.2	
Bus	91.5	80.4	82.1	65.2	68.9	75.7	76.7	78.2	79.8	31.6	38.7	58.2	83.9	
Taxi	35.0	33.4	35.7	40.2	43.2	51.9	47.0	51.2	56.5	16.3	19.4	28.1	59.1	
Ships (inner service, local)	9.7	9.9	9.3	9.3	10.2	10.2	10.5	10.9	11.2	4.2	5.1	7.8	12.0	
Ships (outbound)	0.3	0.3	0.2	0.3	0.4	0.3	0.3	0.3	0.3	0.0	0.1	0.1	0.3	
Car rental fee	15.3	16.2	19.0	15.3	17.9	21.3	20.3	21.4	22.6	7.8	9.5	14.3	24.0	
Gasoline cost	56.3	55.3	55.3	51.0	48.7	47.1	51.3	52.3	53.4	21.4	26.2	39.6	56.4	
Parking lot, toll road charge (except for highway charge)	25.7	17.7	17.7	21.4	19.0	19.0	19.8	20.2	20.6	8.1	9.9	14.9	21.7	
Highway charge	44.9	51.3	54.2	50.2	57.4	60.6	65.7	67.1	68.4	27.3	33.5	50.7	72.4	
Accommodation														
Accommodation services	539.6	570.9	596.2	561.4	667.8	704.9	743.1	798.3	865.8	266.3	321.8	479.4	919.4	
Vacation home ownership (imputed)	6.4	6.3	6.3	6.8	6.9	7.0	7.0	7.2	7.3	2.9	3.5	5.5	7.9	
Food and beverage														
Food and beverage serving services	556.8	572.1	626.2	610.0	722.5	780.4	807.8	867.6	940.6	295.5	355.3	523.1	989.6	
Souvenirs														
Agricultural products	10.3	9.6	11.3	9.5	10.3	10.8	11.7	11.9	12.2	4.9	6.0	9.1	12.8	
Agricultural processed products	13.1	12.1	12.1	12.5	11.8	12.5	12.9	13.2	13.5	5.4	6.6	10.0	14.2	

Table A4. Cont.

Declarate	0011	2012	2013	2014	2015	2016	2017	0010	0010	2020				
Products	2011							2018	2019	SR1	SR2	SR3	SR0	
Marine products	34.8	34.8	32.9	26.1	29.0	30.8	24.5	25.0	25.5	10.2	12.5	19.1	27.1	
Fisheries processed products	21.9	20.9	22.0	18.5	19.1	18.8	19.5	19.9	20.3	8.1	10.0	15.2	21.5	
Confectionery	204.1	204.0	209.9	196.7	209.5	214.3	231.9	241.4	252.4	91.0	110.7	165.9	266.2	
Other food items	178.1	179.3	186.3	165.9	195.8	198.7	198.1	208.7	221.3	76.0	91.9	136.5	232.6	
Fiber products	161.5	153.6	154.4	133.5	140.8	156.0	142.3	146.3	150.6	55.6	67.8	102.0	158.6	
Shoes, bags	68.9	64.5	85.6	78.0	103.3	93.8	93.3	103.5	116.2	29.7	34.7	48.6	120.3	
Ceramics and glass products	10.4	11.5	8.1	9.3	8.9	8.2	7.5	7.6	7.8	3.1	3.8	5.8	8.3	
Publication	11.7	12.0	12.5	10.6	11.9	12.0	11.4	12.1	13.0	4.0	4.8	7.0	13.5	
Wood products and paper products	4.7	4.4	3.5	3.0	3.7	3.4	4.4	4.5	4.6	1.9	2.3	3.4	4.8	
Medical supplies and cosmetics	17.1	18.5	20.0	26.3	47.8	54.7	61.0	74.5	91.7	14.3	15.3	18.0	94.2	
Film	1.1	1.3	1.0	0.5	0.8	0.8	0.6	0.7	0.7	0.2	0.3	0.5	0.7	
Electrical equipment and related products	24.8	20.5	18.5	23.5	24.7	20.5	22.4	25.5	29.4	6.5	7.4	10.0	30.3	
Camera, glasses, watch	26.3	23.8	27.4	26.3	32.7	26.5	30.6	33.9	37.9	9.6	11.2	15.8	39.3	
Sports equipment · CD · stationery	13.5	13.4	13.4	12.3	21.0	27.3	31.7	32.4	33.1	13.2	16.2	24.3	34.7	
Other manufactured products	19.5	18.9	19.0	21.0	23.5	27.1	26.6	29.6	33.2	9.1	10.7	15.2	34.6	
Activities														
A day spa warm-bathing facility beauty salon	18.1	17.8	16.3	16.1	19.2	17.4	20.5	20.9	21.3	8.5	10.5	15.9	22.6	
Museums, museums, zoos and gardens, aquariums	21.4	23.2	22.4	21.8	24.9	26.3	27.7	29.3	31.2	10.7	12.9	19.2	32.8	
Watching sports and art appreciation	10.3	7.5	10.5	11.6	13.0	15.9	18.2	18.8	19.5	7.5	9.2	13.7	20.5	
Amusement parks and expositions	30.8	31.9	33.7	34.6	39.2	40.3	42.6	44.6	47.0	16.9	20.4	30.4	49.4	
Sports Facilities	18.5	19.1	24.9	19.8	20.8	21.0	20.2	20.7	21.2	8.7	10.5	15.7	22.1	
Ski lift fee	2.4	3.2	2.6	2.7	2.6	1.9	2.5	2.5	2.6	1.0	1.3	1.9	2.7	
Camp site	0.1	0.1	0.2	0.8	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Exhibition and convention participation fee	2.9	2.4	2.3	2.7	2.1	3.2	3.3	3.3	3.4	1.4	1.7	2.5	3.6	
Tourist farm	1.6	1.9	1.5	1.7	1.9	1.7	2.0	2.1	2.1	0.9	1.0	1.6	2.2	
Fishing boat	6.2	4.6	4.0	2.6	3.8	4.0	4.9	5.0	5.1	2.1	2.5	3.8	5.4	
Guide fee	2.0	2.9	2.9	2.4	4.0	3.5	3.3	3.4	3.4	1.4	1.7	2.6	3.6	
Rental charge	2.8	3.4	2.7	3.2	4.5	4.2	6.2	6.5	6.8	2.2	2.7	4.0	7.1	
Massage	7.8	7.0	7.2	6.3	4.6	4.6	5.3	5.4	5.5	2.2	2.7	4.1	5.9	
Photo shoot fee	3.6	2.7	3.4	3.6	2.6	2.5	2.1	2.1	2.2	0.9	1.1	1.6	2.3	
Mail and communication charges	5.2	3.6	2.9	4.1	1.8	3.3	2.9	3.0	3.0	1.2	1.4	2.1	3.2	
Home delivery	17.8	17.0	17.7	17.3	17.3	15.0	15.4	15.6	15.9	6.0	7.4	11.3	16.9	
Travel insurance · Credit card admission fee	5.3	5.5	5.1	3.6	3.9	6.2	5.9	6.0	6.1	1.7	1.9	2.7	6.0	
Passport application fee	3.4	3.7	3.4	3.4	3.0	3.3	3.2	3.2	3.2	0.5	0.5	0.5	3.0	
Visa application fee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Hairdresser/Barber	36.1	32.2	35.1	28.8	29.6	33.0	31.6	32.2	32.9	12.8	15.6	23.6	34.7	
Develop and print photos	10.9	9.2	9.7	7.2	6.4	5.6	5.0	5.1	5.2	1.9	2.4	3.6	5.4	
Laundry service	9.1	9.4	8.6	7.4	9.6	8.2	8.6	8.8	9.0	3.5	4.3	6.5	9.5	
Other	27.2	27.5	26.4	19.6	14.8	13.2	14.6	15.4	16.4	5.2	6.2	9.0	17.0	
Total	2827.4	2843.7	2993.0	2837.2	3245.9	3387.5	3485.0	3698.0	3955.2	1277.7	1540.5	2278.2	4156.1	

"SR" means scenario in Table 2. Unit: thousand people.

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