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Social Costs of COVID-19 and the Nature of Behavioral Change

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Abstract

The coronavirus disease 2019 (COVID-19) pandemic has resulted in the need to implement certain measures, such as the declaration of a state of emergency in Japan, in order to prevent the spread of infection. This has led to widespread medical damage (death, severe illness, and sequelae) and economic damage (bankruptcy, business closures, and unemployment). People have also developed a fear of becoming infected with the disease. The economic losses have led to negative effects such as a rise in domestic violence, increased prevalence of depression, education stagnation resulting from school closures, and loneliness due to limited face-to-face interactions. In this study, we estimated the social costs of the COVID-19 pandemic and clarified the nature of people's behavioral changes. This research is important for evaluating the policies that have been implemented so far to combat infectious diseases. The study focused on the relation between behavioral changes and the recognition of social cost. It was hypothesized that behavioral change is more prevalent among people who do not recognize the social cost of measures implemented in response to the COVID-19 pandemic. Thus, we clarified the factors that determine the evaluation of policies, and those that determine the abovementioned societal changes in consciousness that serve as the basis for behavioral changes based on support or disapproval of the Swedish strategy.

Keywords: COVID-19 • Social cost • Pandemic • Well-being • Behavioral change • Swedish strategy

Introduction

The coronavirus disease 2019 (COVID-19) pandemic has not only caused widespread medical damage in terms of death, severe illness, and sequelae, but also economic damage, including bankruptcy, business closures, and unemployment resulting from measures such as the state of emergency declared in Japan aimed at preventing the spread of infection. In addition, there is a fear of becoming infected with the disease. The abovementioned economic losses have resulted in further consequences, including increased domestic violence due to the need to stay at home, increased prevalence of depression, education stagnation due to the closure of schools, and loneliness due to cessation of human interaction.

Accurately understanding the social costs of the COVID-19 pandemic and clarifying the nature of people's behavioral changes are important tasks for evidence-based evaluation of the policies that have been implemented so far to combat infectious diseases. These tasks are essential to considering appropriate responses to the threat of infectious diseases that are expected to continue in the future. This study focused on the relation between behavioral changes and the recognition of social cost. The hypothesis was that behavioral change is more prevalent among people who do not recognize the social cost of the measures implemented in response to the COVID-19 pandemic.

Many researchers have investigated the effects of the COVID-19 pandemic on society [1]. Empirically identified barriers to wearing masks, and found that individuals, who are younger, more educated, less sensitive to infection, and more introverted are more likely to refuse to wear masks [2]. Empirically showed that the risk of COVID-19 infection depends on social factors such as poverty as well as health and hygiene status, suggesting the need for reform of the social system in order to combat infectious diseases [3]. Empirically demonstrated the magnitude of the trade-off between preventing the spread of COVID-19 infection and the economy, showing that a mortality rate of 0.44% results in an economic loss of 28% [4]. Empirically analyzed how scientific knowledge influences behavioral change amid the COVID-19 pandemic, providing a comparative behavioral analysis of the various stresses and social problems caused by COVID-19 policies.

Our study closely aligns with questions posed by [5]. Tisdell empirically demonstrated the effectiveness of public policies in preventing the spread of COVID-19, with particular critical examination of the proposition that lockdowns are effective in preventing the spread of COVID-19. His paper poses questions regarding the extent to which individual freedom of choice should be restricted, and the conditions under which policies to prevent the spread of infection can be balanced while minimizing economic costs. To answer these questions, we need to examine how welfare is affected by COVID-19 and related policies that restrict individual freedom.

This study aimed to empirically clarify the state of behavioral changes in the general population for preventing the spread of COVID-19 in Japan and to analyze societal changes in consciousness that serve as the basis for behavioral changes and their impact on well-being. In addition, we clarified what factors determine the societal changes in consciousness that serve as the basis for behavioral changes based on support or disapproval of the Swedish strategy. In general, the Swedish strategy aims to protect people from becoming infected with COVID-19 while minimizing the social cost of preventive measures. Thus, preference for the Swedish strategy reflects the judgment of the balance between preventing COVID-19 and the social costs of the preventive measures. Our analysis clarifies the relation between the types of individuals who tend to support the Swedish strategy and how they judge the abovementioned balance.

The structure of this paper is as follows. Section 2 provides an overview of the data, and Section 3 clarifies the state of behavioral changes toward measures that have been put in place in order to prevent the spread of infection. Section 4 empirically analyzes the impact of behavioral changes and well-being. Section 5 examines the relationship between support for or disapproval of the Swedish strategy and attitudes toward infection prevention.

Materials and Methods

The data analyzed in this study were derived from a questionnaire survey entitled "Impact of the Spread of a New Type of Virus Infection on Society

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and the Economy" conducted September 8-9, 2020. The survey questions were prepared by referring to part of a report by the National Institute for Research Advancement (NIRA) Research Institute [6]. The survey was part of the "Research Project on COVID-19 Infections" at Doshisha University. Of the 13,502 questionnaires distributed, 2,274 were returned completed (16.8% response rate). After excluding responses that were considered to have been provided too quickly, a final 2,183 questionnaires were included in the analysis.

Results

Overview of the data

The demographic composition of the respondents by age group and the percentage by gender was found to be nearly equal to the actual demographic composition. That is, men were 49.3%, women were 50.7%, those aged less than 40 years were 29.4%, those aged between 40 and 60 years were 36.5%, and those aged over 60 years were 34.2%.

The data in Table 1 show distributions according to city size, final education, occupation, and personal income before taxes. Large cities were the areas of residence for nearly 40% of the respondents, and a university degree or higher were held by about 50% of the respondents. Retail, transportation and communication, and service industries accounted for 3.8%, 3.8%, and 21.7% of all occupation categories, respectively, and these industries continue to be severely affected by the COVID-19 pandemic. In addition, an annual personal income of less than 6 million yen before tax was reported by 85.1% of the respondents (Table 1).

Behavioral changes and changes in consciousness brought about by COVID-19

COVID-19 has affected various industries and people. The possible effects can be predicted using models. For example [7]. Performed simulation analysis using a model consisting of epidemiological and economic sectors to clarify the trade-offs between preventing the spread of infection and economic activities. However, we believe that empirical analysis of people's behavioral changes to prevent the spread of infection will enable us to more accurately predict policy effects and trade-off relationships. In this paper, we used the questionnaire survey described in subsection 3.1 to identify behavioral changes to prevent the spread of infection and clarified the relationship between behavioral changes and socioeconomic factors.

In the questionnaire survey, the respondents were asked about the impact of the spread of COVID-19 for eight items as follows. They were asked the same question for the eight items, "Since January 2020, how do you think the following has changed in daily life since the spread of the COVID-19?" The results are shown in Figure 1. The eight items were classified as behavioral changes or changes in consciousness. The behavioral changes included changes in working hours; housework, childcare, and nursing care hours; sleeping hours; leisure time; pre-tax household income, and the total workload. The changes in consciousness included changes in overall job satisfaction and overall life happiness.

Most respondents answered "no change" for all items. The items to which most of the respondents answered "decreased" were working hours, sleeping hours, pre-tax household income, total workload, overall job satisfaction, and overall life happiness. The items to which most of the respondents answered "increased" were housework, childcare, and nursing care hours and leisure time. The number of respondents who answered that sleeping hours decreased and those who answered that sleeping hours increased appeared to be roughly equal, but slightly more respondents answered that sleeping hours would increase (Figure 1).

To examine what attributes were affected by the spread of COVID-19, we conducted regression analysis on the affected items. The estimated equation is shown in equation.

$$Z\_i = \alpha + \beta X\_i + \varepsilon\_i \quad (1)$$

Here, subscript i is individual i, and Zi is the eight items of behavioral changes and changes in consciousness. Xi is the vector of socioeconomic attributes of individual i, consisting of income, age, gender, city size, marital status, education, employment status, number of children, and occupation. β is the vector of coefficients of explanatory variables, and ε is the error term. The eight items of behavioral changes and changes in consciousness are working hours; housework, childcare, and nursing care hours; sleeping hours; leisure time; household income (before tax), total workload, overall job satisfaction, and overall life happiness. The eight items were answered using the 5-point method but were treated as continuous variables in the estimation.

The estimation results are shown in Tables 2 and 3.

The variables that were found to be statistically significant were income, age, marital status, education, self-employed employment status, and finance and insurance occupations. Higher income tended to increase with increased total workload, sleeping hours, leisure time, and overall life happiness, suggesting a more favorable situation.

Age had an effect on housework, childcare, and nursing care hours; leisure time; and overall life happiness. The influence was not linear, but U-shaped or inverted U-shaped. The burden of housework, childcare, and nursing care hours was concentrated among married women with children,

Table 1. Distribution of respondents according to city size, education, occupation, and annual personal income before tax.

City size		Final education	%	Occupation	%	Individual annual income before taxation (10,000 yen)	%
Large city (population of one million or larger)	38.4	Junior high school graduates	1.88	Agriculture, forestry, and fisheries	0.6	0–200	45.4
Medium-sized city (population of less than one million)	15.8	High school graduate	27.71	Construction	4.1	201–600	39.7
Other city	38.9	Colleges, vocational	19.1	Manufacturing	11.1	601–1000	11.5
Town or village	6.8	Graduated from university	45.76	Wholesale business	2.6	>1000	3.4
Total	100	Graduate School	5.22	Retail	3.8	Total	100
		Total	99.68	Finance and insurance	2.5		
				Real estate	1.9		
				Transportation and Telecommunications	3.8		
				Electric gas	0.7		
				Service industry	21.7		
				Others	8.5		
				Unemployed	38.7		
				Total	100		

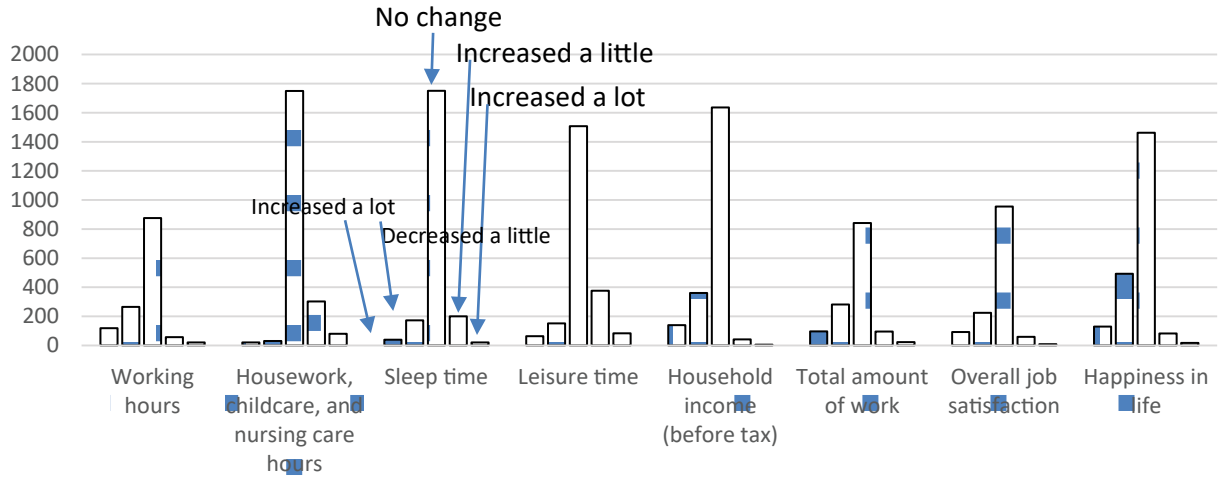

Figure 1. Effects of COVID-19 on daily life.

Table 2. Determinants of behavioral changes.

		Explanatory variable: 1=decreased considerably, 5=increased considerably.							
		Working hours	**Housework, childcare, and nursing care hours**	**Sleeping hours**	**Leisure time**	**Household income (before taxation)**	**Total workload**	**Overall job satisfaction**	**A sense of well-being in life**
Income	Income (10,000 yen)	0.0095	0.0006	0.0213	0.0318	0.0139	0.0228	0.0133	0.0241
		[0.87]	[0.08]	[2.62]***	[3.04]***	[1.48]	[2.09]**	[1.36]	
Age	Age	0.0296	0.1132	-0.032	-0.1237	-0.0209	0.0076	-0.0429	-0.119
		[0.57]	[3.22]***	[-0.83]	[-2.50]**	[-0.47]	[0.15]	[-0.93]	[-2.46]**
	Age square	-0.0034	-0.0078	0.0021	0.0085	0.0005	-0.0023	0.0017	0.0064
		[-1.04]	[-3.55]***	[0.86]	[2.76]***	[0.18]	[-0.71]	[0.60]	[2.12]**
Sex	Male (ref)	0	0	0	0	0	0	0	0
		[.]	[.]	[.]	[.]	[.]	[.]	[.]	[.]
	Female	-0.0112	0.1299	-0.0334	0.0107	-0.0038	-0.0557	-0.0498	-0.0008
		[-0.21]	[3.62]***	[-0.85]	[0.21]	[-0.08]	[-1.05]	[-1.06]	[-0.02]
City size	Large city	-0.0118	0.0534	-0.0083	0.0451	-0.0337	0.1051	0.0317	0.0554
		[-0.12]	[0.81]	[-0.11]	[0.48]	[-0.40]	[1.08]	[0.36]	[0.61]
	Medium-sized city	-0.0781	-0.0078	0.0016	0.101	-0.0258	0.0668	-0.002	0.065
		[-0.75]	[-0.11]	[0.02]	[1.01]	[-0.29]	[0.64]	[-0.02]	[0.67]
	Other city	-0.0614	0.009	0.0089	0.1068	-0.0272	0.0443	-0.0432	-0.0053
		[-0.63]	[0.14]	[0.12]	[1.15]	[-0.32]	[0.45]	[-0.50]	[-0.06]
	Town or village (ref)	0	0	0	0	0	0	0	0
		[.]	[.]	[.]	[.]	[.]	[.]	[.]	[.]
Marital status	Unmarried (ref)	0	0	0	0	0	0	0	0
		[.]	[.]	[.]	[.]	[.]	[.]	[.]	[.]
	Married	0.1765	0.1129	-0.0555	-0.1073	0.0911	0.1192	0.0443	0.1282
		[2.88]***	[2.72]***	[-1.22]	[-1.84]*	[1.74]*	[1.96]*	[0.81]	[2.25]**
	Divorce	0.1159	0.024	-0.0618	-0.03	0.0015	0.0776	-0.0266	0.1166
		[1.07]	[0.33]	[-0.77]	[-0.29]	[0.02]	[0.72]	[-0.28]	[1.16]
	Bereavement	0.2561	0.1968	0.1034	-0.2573	0.0944	0.243	0.2938	-0.1096
		[1.12]	[1.27]	[0.61]	[-1.18]	[0.48]	[1.07]	[1.45]	[-0.52]
Education	Junior high school graduate (ref)	0.2526	-0.1239	-0.1127	-0.247	0.3622	0.0139	-0.0061	0.1718
		[1.15]	[-0.83]	[-0.69]	[-1.18]	[1.93]*	[0.06]	[-0.03]	[0.84]
	High school graduates, vocational school graduates, junior college graduates	-0.075	-0.0747	0.0067	0.0698	-0.0784	-0.1096	-0.0746	-0.0708
		[-1.52]	[-2.23]**	[0.18]	[1.49]	[-1.86]*	[-2.23]**	[-1.70]*	[-1.55]
	Graduated from university and graduate school	0	0	0	0	0	0	0	0
		[.]	[.]	[.]	[.]	[.]	[.]	[.]	[.]
	Don't know	0.6148	-0.461	-0.1454	-0.2366	-0.1719	-0.1761	-0.2059	-0.301
		[1.36]	[-1.50]	[-0.43]	[-0.55]	[-0.44]	[-0.39]	[-0.51]	[-0.72]

Employment Status	Management and Executives	-0.2002	-0.0191	-0.0083	-0.0964	-0.0454	-0.188	-0.2325	0.0191
		[-1.64]	[-0.23]	[-0.09]	[-0.83]	[-0.44]	[-1.55]	[-2.14]**	[0.17]
	Full-time and regular (ref)	0	0	0	0	0	0	0	0
	.	[.]	[.]	[.]	[.]	[.]	[.]	[.]	[.]
	Contracts, temporary staffing. etc.	-0.0587	0.0497	-0.0022	0.0325	-0.0633	-0.0206	0.0032	-0.0635
		[-0.91]	[1.13]	[-0.04]	[0.53]	[-1.14]	[-0.32]	[0.06]	[-1.06]
	Self-employed	-0.1543	0.0568	-0.0523	0.1155	-0.309	-0.22	-0.1946	-0.1522
		[-1.78]*	[0.97]	[-0.81]	[1.40]	[-4.17]***	[-2.55]**	[-2.53]**	[-1.89]*
	Students	-0.0704	-0.1038	-0.0655	0.1161	0.0849	-0.0153	0.1616	0.1453
		[-0.42]	[-0.92]	[-0.53]	[0.73]	[0.60]	[-0.09]	[1.09]	[0.94]
N. of Children	N. of children	-0.0338	0.0581	-0.0122	-0.0416	-0.0329	-0.0211	0.0092	-0.027
		[-1.14]	[2.90]***	[-0.56]	[-1.48]	[-1.30]	[-0.72]	[0.35]	[-0.98]
Occupation	Agriculture, forestry and fisheries, and mining	-0.1765	-0.0095	-0.1576	-0.3015	0.4318	0.3397	0.0592	-0.1296
		[-0.74]	[-0.06]	[-0.89]	[-1.32]	[2.11]**	[1.42]	[0.28]	[-0.58]
	Construction	0.1003	0.0084	0.0758	-0.0577	0.1362	0.1792	0.0478	0.0293
		[0.99]	[0.12]	[1.01]	[-0.60]	[1.57]	[1.78]*	[0.53]	[0.31]
	Manufacturing (ref)	0	0	0	0	0	0	0	0
		[.]	[.]	[.]	[.]	[.]	[.]	[.]	[.]
	Wholesale business	-0.0518	0.1038	0.1214	0.1315	-0.079	-0.0598	-0.065	-0.0343
		[-0.43]	[1.27]	[1.35]	[1.14]	[-0.76]	[-0.50]	[-0.60]	[-0.30]
	Retail	0.0047	-0.0294	0.0463	-0.1802	-0.0977	0.0267	-0.0572	0.0113
		[0.05]	[-0.42]	[0.61]	[-1.84]*	[-1.11]	[0.26]	[-0.63]	[0.12]
	Finance and insurance	0.2705	0.1081	0.1619	-0.0158	0.3325	0.2147	0.1059	0.105
		[2.21]**	[1.30]	[1.79]*	[-0.14]	[3.18]***	[1.76]*	[0.97]	[0.92]
	Real estate	-0.0182	-0.1498	0.0807	0.054	0.2248	-0.0669	0.131	0.011
		[-0.13]	[-1.57]	[0.77]	[0.40]	[1.87]*	[-0.48]	[1.04]	[0.08]
	Transportation and telecommunications	0.1377	0.0161	0.0486	0.0211	-0.0495	0.0977	0.0193	0.0477
		[1.35]	[0.23]	[0.64]	[0.22]	[-0.57]	[0.97]	[0.21]	[0.50]
	Electricity, gas, water, and heat supply	0.164	-0.0274	0.1772	-0.1093	0.1407	0.3095	0.1521	0.297
		[0.79]	[-0.19]	[1.15]	[-0.55]	[0.79]	[1.50]	[0.82]	[1.54]
	Service industry	0.0995	0.0124	0.0454	-0.1124	0.0225	0.1493	-0.0054	0.0637
		[1.50]	[0.28]	[0.93]	[-1.78]*	[0.40]	[2.27]**	[-0.09]	[1.04]
	Others	0.1518	0.0357	0.0423	-0.1092	0.0864	0.1668	-0.021	-0.0033
		[1.77]*	[0.61]	[0.66]	[-1.33]	[1.18]	[1.95]*	[-0.27]	[-0.04]
	Constant	2.61	2.567	3.0274	3.4547	2.7782	2.6002	2.9196	3.0373
		[12.17]***	[17.67]***	[19.04]***	[16.90]***	[15.15]***	[12.18]***	[15.30]***	[15.23]***
	Adjusted R^2	0.0187	0.0519	-0.0012	0.018	0.0423	0.0333	0.0133	0.0214
	N	1200	1200	1200	1200	1200	1200	1200	1200

Note. *,**, and * are significant at 10%, 5%, and 1% levels, respectively. Numbers within [ ] are t-values.

but it peaked in the early 40s, with an inverted U-shape. On the other hand, leisure time decreased with age, but after the early 40s it began to increase, and the degree of impact was U-shaped and opposite to that of housework, childcare, and nursing care hours. Overall life happiness also decreased with age, but increased after the early 50s, with a U-shaped degree of influence.

Relative to unmarried respondents, married respondents were positively (+) or negatively (–) affected in terms of working hours (+), housework, childcare, and nursing care hours (+), leisure time (–), household income (before taxation) (+), total workload (+), and overall life happiness (+). Although there was damage in the form of increased working hours; increased housework, childcare, and nursing care hours; decreased leisure time; and increased total workload, there was an increase in pre-tax household income and overall life happiness. Married respondents were more affected compared with unmarried people because they have family relationships in addition to their social relationships. In terms of education, compared with those who have graduated from university and graduate school, those who have graduated from high school, vocational school, technical college, and junior college were affected by housework, childcare, and nursing care hours (–), household income (before taxes) (–), total workload (–), and overall job satisfaction (–).

In terms of employment status, compared with full-time regular employees and regular staff, those who were self-employed were affected by working hours (–), pre-tax household income (–), total workload (–), overall job satisfaction (–), total workload (–), overall job satisfaction (–), and overall life happiness (–). These negative impacts were significant, and as work decreased, overall job satisfaction and overall life happiness also decreased. Respondents who were self-employed found it difficult to work remotely because they needed to be in contact with other people. Therefore, they were likely to be more susceptible to such negative changes. Managers and executives were affected by overall job satisfaction (–). The number of children significantly increased housework, childcare, and nursing care hours. In terms of occupation, compared with the manufacturing industry, the finance and insurance industry was affected by working hours (+), sleeping hours (+), household income (before tax) (+), and total workload

Table 3. Impact of behavioral changes and changes in consciousness on well-being.

Explanatory variable (overall life happiness): 1=decreased considerably, and 5=increased considerably										
		Working hours	**Housework, childcare, and nursing care hours**	**Sleeping hours**	**Leisure time**	**Personal income**	**Household income**	**Total workload**	**Overall job satisfaction**	**A sense of well-being in life**
Behavioral change items	Reduced	-0.17382	0.223622	-0.28068	-0.54523	-0.45232	-0.50734	-0.168796	-0.74494	-1.01658039
		[-1.34]	[0.75]	[-1.78]*	[-3.55]***	[-3.99]***	[-4.68]***	[-1.29]	[-5.47]***	[-10.31]***
	No change (ref)									
	Increased	-0.23779	-0.24484	-0.00704	0.220315	0.649554	0.370176	-0.00316	0.7337928	1.27583049
		[-0.95]	[-1.98]**	[-0.05]	[1.96]**	[2.25]**	[1.22]	[-0.02]	[2.83]***	[6.16]***
Income	Income (10,000 yen)	0.000803	0.000795	0.000792	0.000745	0.000755	0.000736	0.0007708	0.0007472	0.00071026
		[3.38]***	[3.81]***	[3.79]***	[3.58]***	[3.63]***	[3.53]***	[3.25]***	[3.21]***	[3.54]***
Marital status	Unmarried (ref)									
	Married	1.036126	1.179877	1.157336	1.191526	1.132994	1.14728	1.0367952	1.0372247	1.10139252
		[7.41]***	[10.29]***	[10.22]***	[10.54]***	[10.07]***	[10.21]***	[7.43]***	[7.56]***	[10.14]***
	Divorce	-0.07962	-0.11223	-0.11734	-0.12356	-0.12623	-0.10734	-0.07715	-0.050171	-0.16592357
		[-0.29]	[-0.49]	[-0.52]	[-0.55]	[-0.56]	[-0.48]	[-0.28]	[-0.18]	[-0.76]
	Bereavement	-0.73736	0.413594	0.39902	0.42542	0.379786	0.401678	-0.724469	-0.846301	0.42910431
		[-1.26]	[1.32]	[1.27]	[1.36]	[1.22]	[1.29]	[-1.24]	[-1.47]	[1.42]
Sex	Male (ref)									
	Female	0.438112	0.662428	0.646712	0.643336	0.633972	0.634363	0.4320969	0.4663673	0.66298924
		[3.24]***	[6.22]***	[6.11]***	[6.09]***	[6.04]***	[6.04]***	[3.20]***	[3.51]***	[6.52]***
Age	Age	-0.55116	-0.38088	-0.40094	-0.38328	-0.38382	-0.39373	-0.550014	-0.540107	-0.34673301
		[-4.10]***	[-3.74]***	[-3.94]***	[-3.78]***	[-3.79]***	[-3.89]***	[-4.09]***	[-4.09]***	[-3.55]***
	Age square	0.039662	0.028182	0.029512	0.028205	0.02865	0.029035	0.0397352	0.0394478	0.02706629
		[4.77]***	[4.69]***	[4.93]***	[4.73]***	[4.81]***	[4.88]***	[4.77]***	[4.82]***	[4.71]***

Education	Junior high, High school, etc									
	University, Graduate school	0.302805	0.166393	0.15786	0.170954	0.164139	0.150979	0.2934957	0.2710636	0.13983823
		[2.38]**	[1.69]*	[1.60]	[1.74]*	[1.67]*	[1.54]	[2.30]**	[2.16]**	[1.48]
	Don't know	-3.03537	-2.96406	-2.91711	-2.88378	-3.12614	-2.83516	-3.038186	-2.93755898	-2.8057895
		[-2.59]***	[-2.95]***	[-2.91]***	[-2.89]***	[-3.13]***	[-2.84]***	[-2.60]***	[-2.56]**	[-2.92]***
Health	Healthy	0.807338	0.829522	0.815442	0.821809	0.817469	0.813745	0.8085588	0.7554132	0.74316905
		[14.86]***	[19.53]***	[18.98]***	[19.44]***	[19.34]***	[19.24]***	[14.86]***	[13.97]***	[17.99]***
Employment status	Management and executives	0.501537	0.517386	0.514925	0.531867	0.543037	0.539959	0.5107622	0.5758613	0.46721941
		[1.58]	[1.68]*	[1.67]*	[1.73]*	[1.77]*	[1.76]*	[1.60]	[1.84]*	[1.58]
	Full-time and regular (ref)									
	.									
	Contracts, temporary staffing etc.	-0.01912	-0.11598	-0.12272	-0.11594	-0.09215	-0.11156	-0.0235568	-0.03712566	-0.06610321
		[-0.12]	[-0.77]	[-0.81]	[-0.77]	[-0.61]	[-0.74]	[-0.15]	[-0.23]	[-0.45]
	Self-employed	0.164521	0.206008	0.202051	0.189353	0.304542	0.288369	0.1646476	0.2478887	0.29090398
		[0.75]	[0.97]	[0.95]	[0.90]	[1.44]	[1.36]	[0.75]	[1.15]	[1.43]
	Students		0.218454	0.196023	0.169767	0.170434	0.180183			0.28692733
			[0.48]	[0.43]	[0.38]	[0.38]	[0.40]			[0.66]
	Unemployed		0.163223	0.139798	0.172893	0.07049	0.073439			0.13966348
			[1.05]	[0.90]	[1.11]	[0.45]	[0.47]			[0.93]
	Others	0.831153	0.712439	0.738363	0.70094	0.687414	0.66693	0.823219	0.765137	0.62289047
		[2.02]**	[1.82]*	[1.88]*	[1.80]*	[1.76]*	[1.71]*	[2.00]**	[1.89]*	[1.65]*
City size	Large city	0.300864	0.370197	0.359568	0.339814	0.345154	0.357926	0.28312719	0.26393293	0.34096415
		[1.19]	[1.92]*	[1.86]*	[1.77]*	[1.80]*	[1.87]*	[1.11]	[1.06]	[1.84]*
	Medium-sized city	0.390648	0.226246	0.222675	0.192997	0.207517	0.23585	0.36563487	0.34586368	0.17958349
		[1.42]	[1.08]	[1.06]	[0.93]	[0.99]	[1.13]	[1.33]	[1.28]	[0.89]
	Other city	0.173675	0.157082	0.14808	0.123923	0.135113	0.155883	0.15872339	0.17179674	0.19080812
		[0.68]	[0.82]	[0.77]	[0.65]	[0.71]	[0.82]	[0.62]	[0.69]	[1.04]
	Town or village (ref)									
	Constant	4.009802	3.293694	3.436364	3.350357	3.468989	3.550803	4.01429367	4.23718686	3.65649061
		[6.91]***	[7.18]***	[7.47]***	[7.33]***	[7.58]***	[7.77]***	[6.89]***	[7.40]***	[8.27]***
	Adjusted R^2	0.285258	0.30371	0.303154	0.30902	0.310314	0.310863	0.28486587	0.30859085	0.3568396
	Sample size	1200	1944	1944	1944	1944	1944	1200	1200	1944

Note . *, **, and *** are significant at 10%, 5% and 1% levels, respectively. Numbers within [ ] are t-values.

(+). Although their household income increased, their total workload also increased.

Thus, those who experienced relatively large negative impacts were in their early 40s, married, either high school, vocational school, technical college, or junior college graduates, and self-employed. In contrast, those who experienced positive impacts had higher incomes, with happiness observed to increase among married respondents and also with age among respondents who were older.

Impact of COVID-19 on behavioral changes in terms of well-being

We analyzed the impact of COVID-19 on behavioral changes in terms of well-being. The estimated equation is shown in equation (2).

$$\text{Happiness}\ i = \alpha + \beta Z\_i + \gamma X\_i + \varepsilon\_i, \quad (2)$$

where subscript i is individual i, Happinessi is individual i's sense of well-being, Zi is the items of behavioral changes, Xi is the vector of socioeconomic attributes of individual i, β and γ are the coefficients of the explanatory variables, and ε is the error term. There are nine items of behavioral changes and changes in consciousness, as follows: working hours; housework, childcare, and nursing care hours; sleeping hours; leisure time; personal income; household income; total workload; overall job satisfaction; and overall life happiness. These items were answered using the 5-point method, and for the responses to behavioral changes and changes in consciousness, "increased significantly" and "increased somewhat" were combined into "increased," "no change" was unchanged, and "decreased significantly" and "decreased somewhat" were combined into "decreased" in the three response groups that were used as dummy variables. As shown in Tables 3 and 4.

When estimating equation (2), the nine items were estimated as explanatory variables one at a time, rather than at the same time. In the estimation, the income explanatory variable was used as a class value. For example, income between 1 million and 2 million yen was converted to a monetary value such as 1.5 million yen. This method was used when calculating the compensation variant, which is analyzed later in this paper.

The results presented in Table 3 were analyzed, focusing on statistically significant cases. As housework, childcare, and caregiving increased, and as sleeping hours decreased, the sense of well-being decreased. The cause might be increased burden and stress. As for leisure time and personal income, the sense of well-being decreased in the "decreased" group and increased in the "increased" group. This was also true for overall job satisfaction and overall life happiness. The results for household income were the same, but these results were not significant in the "increased" group. These findings were considered reasonable.

Support for or disapproval of the Swedish strategy and awareness of infection prevention

Definition of the Swedish strategy: According to, the Swedish strategy is a strategy to prevent the spread of infection by ensuring social distancing without lockdown [8]. It does not force cafes and restaurants to refrain from operating, but they are required to ensure social distancing on their premises. The Swedish measures are not necessarily aimed at achieving herd immunity, but rather at isolating older adults while maintaining social distancing to avoid collapse of the health care system. The Swedish strategy is based on the assumption that it will take time to achieve herd immunity, and that long-term sustainable countermeasures against infectious diseases can be taken without stopping economic activities [9].

The Swedish strategy is a way of thinking that prioritizes living a normal life as much as possible without requesting excessive self-restraint and taking only appropriate countermeasures against infection. Thus, it can be concluded that it has the potential to increase sense of well-being by reducing stress and improving quality of life. In the present study, we confirmed whether or not this hypothesis was actually true, and we clarified the factors that cause differences in attitudes toward preventing the spread of COVID-19 between those who support the Swedish strategy and those who do not. This clarification helps us to understand how individuals perceive COVID-19 differently and is expected to provide important information for considering measures to increase the effectiveness of infection control. First, we considered the ratio of support for and disapproval of the Swedish strategy, as shown in Figure 2. The ratio of those who did not support the Swedish strategy was 25.9%, including "do not support at all" and "do not support much," whereas the ratio of those who did support the Swedish strategy was 20.1%, including "support to some extent" and "support strongly" (Figure 2).

Who supports the Swedish strategy: In this subsection, we analyze the factors that determine how individuals judge the Swedish strategy. In general, the Swedish strategy aims to protect people from becoming infected with COVID-19 while minimizing the social cost of implemented preventive measures. Thus, preference for the Swedish strategy reflects the judgment of maintaining a balance between preventing COVID-19 and the social costs of the preventive measures. The results of regression analysis

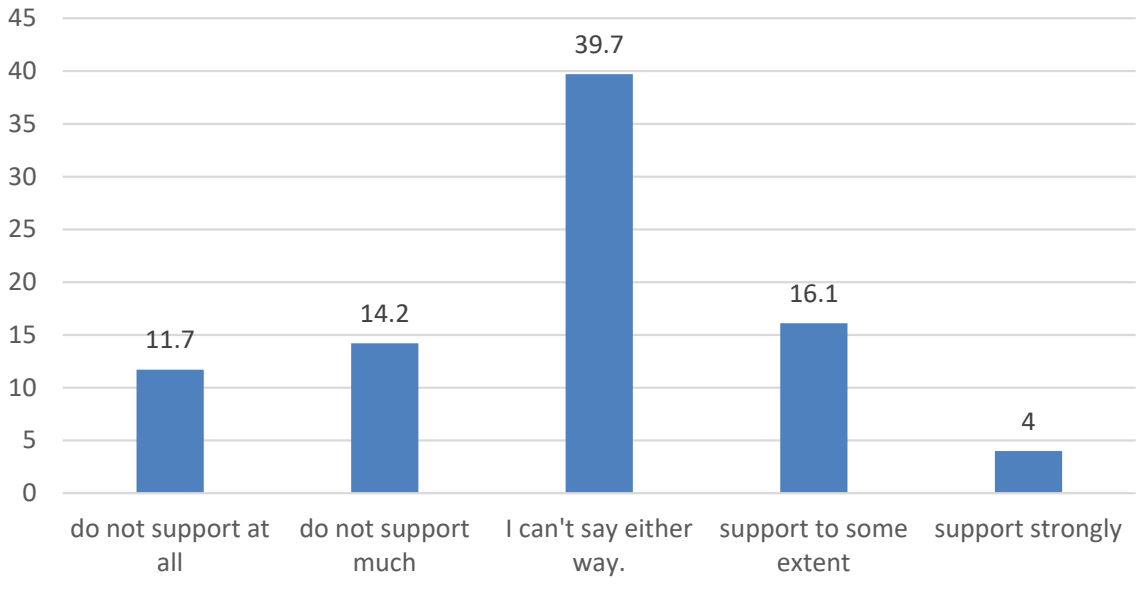

Figure 2. The ratio of support for and disapproval of the Swedish strategy.

Table 4. People who support the Swedish strategy in Japan.

	Model 1	Model 2	Model 3	Model 4	Model 5
(Constant)	3.825	3.842	3.774	3.708	3.835
	[15.392]***	[12.519]***	[12.498]***	[11.737]***	[13.256]***
Age	-0.007	-0.038	-0.037	-0.037	-0.041
	[-2.978]***	[-3.264]***	[-3.203]***	[-2.94]***	[-3.487]***
Age square		0.0001	0	0	0
		[2.627]***	[2.543]**	{2.382]**	[2.884]***
Male dummy variable				0.073	
				[1.279]	
Degree of risk aversion (ascending)		-0.002	-0.002	-0.002	-0.002
		[-1.81]*	[-1.805]*	[-1.551]	[-1.527]
Mask wearing from social pressure (ascending)	-0.114	-0.096	-0.092	-0.098	-0.09
	[-3.034]***	[-3.614]***	[-3.5]***	[-3.523]***	[-3.415]***
High educational career dummy variable	-0.125			-0.109	-0.07
	[-1.907]*			[-1.999]**	[-1.467]
Personal annual income				0	
				[1.246]	
Household annual income	0.094				
	[1.656]*				
Number of children	0.089	0.065	0.065	0.074	0.071
	[2.55]**	[2.242]**	[2.256]**	[2.417]**	[2.445]**
Degree of subjective happiness		0.017	0.016	0.027	0.021
		[1.484]	[1.426]	[2.124]**	[1.829]*
Health status		-0.038	-0.036	-0.046	-0.035
		[-1.582]	[-1.49]	[-1.801]*	[-1.436]
Changes in workload after COVID-19	-0.084				
	[-1.809]*				
Changes in subjective happiness after COVID-19	-0.121				
	[-2.58]***				
Hours of viewing TV		-0.035			
		[-1.235]			
Degree of reading newspapers and magazine	0.068	0.089	0.083		
	[2.211]**	[3.762]***	[3.589]***		
Degree of viewing SNS		-0.05	-0.062		
		[-1.69]*	[-2.255]**		
Note. *, **, and *** are significant at 10%, 5% and 1% levels, respectively. Numbers within [ ] are t-values.					

shown in Table 4. Clarify the relation between the types of individuals who tend to support the Swedish strategy and how they judge the balance.

We considered the level of risk aversion according to support for and disapproval of the Swedish strategy. The results of regression analysis suggest that people who are able to accept some degree of risk tend to support the Swedish strategy.

Mask wearing due to social pressure (ascending) was found to have a negative effect on approval of the Swedish strategy. This may reflect the fact that those who readily follow social opinion tend to support the regulative measures such as the states of emergency.

The number of children was found to have a positive effect on approval of the Swedish strategy. One of the interpretations of this result is that the measure of school closure most seriously harms the lives of those living in households with children.

We analyzed the effects of health status on how individuals judge the Swedish strategy. The results suggest that the hypothesis that people tend to support the Swedish strategy because they are confident about their health is not valid. Thus, health status is not an important factor in determining judgment.

Change in workload was found to have a negative effect on approval of the Swedish strategy. This indicates that the respondents whose workload decreased tended to support the Swedish strategy. Therefore, those whose jobs are negatively affected by the pandemic prefer to adopt the Swedish strategy.

Changes in subjective happiness after the onset of the COVID-19 pandemic were found to have a negative effect on approval of the Swedish strategy. This result is considered to be important because people with decreasing happiness approve the Swedish strategy and possibly think that the cause of decreasing happiness is due to the preventive measures implemented in Japan.

It is important to analyze the effect of information channel on judgment. Interestingly, the degree of reading newspapers and magazines had a positive effect on approval of the Swedish strategy, while the degree of viewing social network services (SNS) had a negative effect. TV viewing had no effect on judgment. We concluded that information about COVID-19 infection and prevention of the spread of infection greatly influenced judgment. The results suggest that information from newspapers and magazines transfers both positive and negative effects of prevention measures, and SNS increased people's fear from infection.

Discussion and Conclusion

Examination of what policies should be pursued in the event of a

pandemic is an extremely important issue in the world of the future. The disruptions and economic stagnation brought about by the COVID-19 pandemic have had a serious impact on people through various routes. The serious impact has not only been realized through the channel of fear of infection, but also through the channel of mental distress associated with isolation and economic deprivation, leading to an increase in suicides as well as deaths from infectious diseases. To achieve an optimal balance between the prevention of the spread of infection and economic losses, it is necessary to analyze people's behavioral change patterns, accurately understand the changes in social welfare and social costs associated with policies, and conduct evidence-based policy evaluation. In addition, in a pandemic, important policy choices need to be made, for example whether to adopt the Swedish strategy or stronger preventive measures such as lockdown strategies. In this study, we proceeded with our analysis with the aim of accumulating evidence for these important policy decisions.

The results of our analysis show that awareness of policy choices differs greatly depending on individual environments and family composition and attributes, suggesting the importance of formulating detailed policies. For example, our analysis suggests that school closure is not supported by families with children. In the future, it will be important to evaluate policies in the event of a pandemic from a variety of perspectives, accumulate more accurate evidence, and accumulate knowledge that will enable more precise policy decision-making.

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