The positive and negative effects of the COVID-19 pandemic on subjective well-being and changes in social inequality: Evidence from prefectures in Japan

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ABSTRACT

This study aims to specify the effects of the COVID-19 pandemic on individual subjective well-being in Japan and to clarify the mechanism generating social inequality of subjective well-being during the crisis. Data were analyzed using fixed effects ordinary least squares (OLS) regression models from the *Online Panel Survey of Social Stratification and Psychology in 2020* (SSPW2020-Panel), which was conducted in four waves in June 2020, September 2020, December 2020, and March 2021. The results reveal that COVID-19 spread in a prefecture had differential effects on subjective well-being in prefectures with high infection rates: positive effects for socially advantaged individuals and negative effects for socially disadvantaged individuals. In conclusion, social inequality in Japan, in terms of subjective well-being, has been widened by the COVID-19 pandemic during 2020.

1. Introduction

To examine the effects of the COVID-19 pandemic on subjective well-being from a sociological perspective, this study focuses on changes in individual's subjective well-being during the COVID-19 pandemic and analyzes the differences in these changes across social classes. According to Bittmann (2021), the COVID-19 pandemic has negative effects on individual's subjective well-being. Moreover, Franke and Elliott (2021) found that changes in subjective well-being have been associated with the COVID-19 pandemic; therefore, studies need to evaluate not only the corresponding economic collapse, but also the crisis in metal health. However, some studies have pointed out that the COVID-19 pandemic might have had positive effects on individual subjective well-being (Recchi et al., 2020; Schmiedeberg & Thönnissen, 2021). This means that the effects of the COVID-19 pandemic are very complex and need to be explored carefully. Additionally, it is predicted that the complicated effects of the COVID-19 pandemic will influence social inequality in terms of individual subjective well-being.

First, previous studies have observed negative associations between the crises associated with the COVID-19 pandemic and subjective well-being (Anastasiou & Duquenne, 2021; Bittmann, 2021; Dymecka et al., 2021; Kimhi et al., 2020; Zacher & Rudolph, 2021). Such associations can be partly explained by the differences in personal character or belief (Casali et al., 2021; A.; Li, Wang, et al., 2021; Martínez-Martí et al., 2020; Pigaiani et al., 2020; Trzebiński et al., 2020; Vazquez et al., 2021). However, it should also be examined based on sociological factors such as social welfare regime, economic hardship, and restriction on daily activities (Paudel, 2021). For example, economic hardship and welfare losses caused by the COVID-19 pandemic might engender serious problems (decreased job prospects, withdrawal from savings, and reduced contacts with social networks) in individual lives (Codagnone et al., 2021; Paudel, 2021). Consequently, the COVID-19 pandemic decreases the individual's expectation of future economic prospects, which in turn negatively influences the individual's subjective well-being (De Simone et al., 2021). Therefore, changes in subjective well-being during the COVID-19 pandemic should be carefully and sociologically examined based on social survey data (Martínez et al., 2020).

Next, previous studies have pointed out that negative effects of the COVID-19 pandemic on hospitalization, economic conditions, subjective well-being, and mental health differ across social groups (Brogårdh et al., 2021; Engel de Abreu et al., 2021; Westrupp et al., 2021; Wiemers et al., 2020; Witteveen, 2020). Studies have confirmed that disparities in employment stability and subjective well-being among individuals of different employment statuses have been magnified during the COVID-19 pandemic (Bakkeli, 2021; Dias, 2021). The economic hardships caused by the COVID-19 pandemic have strengthened gender

inequality, as women are more likely to lose employment and income as well as exhibit lower job performance compared to men (King & Frederickson, 2021; Kristal & Yaish, 2020). Rieger and Wang (2021) clarified that less educated individuals were more likely to react extremely to social policies implemented by governments compared to higher educated individuals. Additionally, the COVID-19 pandemic could also negatively affect children's subjective well-being through differences in support from family members (Choi et al., 2021). As an exception, Hossain (2021) reported that males (i.e., socially advantaged individuals) were more likely to be negatively influenced in Ethiopia and India. On the whole, however, socially advantaged people are less likely to be negatively influenced by the pandemic, whereas socially disadvantaged people are more likely to be negatively influenced by the pandemic. In sum, the COVID-19 pandemic has potentially magnified pre-existing social inequalities in society (Hu, 2020; Wu et al., 2021). In addition to exacerbating pre-existing social inequalities, the COVID-19 pandemic has created new forms of social disparities (Qian & Fan, 2020). For example, a lack of marketable tech-related skills might contribute to widening social inequality (Canale et al., 2021).

Therefore, while social policies efficiently preventing the spread of COVID-19 should be enforced within a society, social policies addressing the social inequality widened by the Covid-19 pandemic must simultaneously be adopted as well. According to Kye and Hwang (2020), negative changes in social trust during the COVID-19 pandemic can be moderated by efficient social policies targeting the problems that arose during the pandemic.

Based on this, this article aims to explore the complicated effects of the COVID-19 pandemic on subjective well-being from a sociological perspective and specify how these effects affect social inequality by using online panel data collected from Japan in 2020. It will clarify the necessity of social policies to cope with the social inequalities widened by the COVID-19 pandemic. Compared with other countries, Japan had relatively low infection and mortality rates during the COVID-19 pandemic (Onozuka et al., 2021; Tashiro & Shaw, 2020). However, it did not mean that the COVID-19 pandemic did not severely affect Japan. The pandemic had imposed a serious burden on the medical system in Japan, which had led to the declaration of a state of emergency by the Japanese government four times during 2020–2021 that severely restricted the daily activities of residents in Japan (Karako et al., 2021). Additionally, Yoshikawa and Kawachi (2021) reported that the influences of the COVID-19 pandemic in Japan were distributed unevenly between regions and that the pattern was not unique to Japan when compared to the US and Europe.

2. Theory and hypotheses

To examine the micro processes explaining the relationship between the COVID-19 pandemic and social inequality of subjective well-being, I assume the following processes between economic recession, restrictions on daily activities, and subjective well-being. First, economic recession will negatively affect individuals' subjective well-being, as economic recession increases the threat of job loss and decreases income. According to the official statistics of the Japanese government (Cabinet Office, 2022; Statistics Bureau of Japan, 2022), GDP of Japan in the 2020 fiscal year declined 4.5% compared to the 2019 fiscal year, and the annual unemployment rate of Japan similarly increased from 2.4% in 2019 to 2.8% in 2020. Second, restrictions on daily activities will negatively affect individuals' subjective well-being, as restriction on daily activities threatens the various freedoms enjoyed by ordinary people. Lastly, economic recession, along with the restrictions on daily activities during the COVID-19 pandemic, will lead to the introduction of new digital technology into workshops that facilitates teleworking or remote working among employees. If the employees encounter difficulties associated with their new work environment, they may undergo a certain level of stress. Okubo, Inoue, and Sekijima (2021) pointed out that the COVID-19 pandemic in Japan had indeed promoted a shift to

telework, which led to workers experiencing both benefits and impediments. Niu et al. (2021) supports this claim by reporting that many workers did in fact experience some stress after shifting to telework. Thus, the COVID-19 pandemic might hurt their subjective well-being via changes in work environments. Overall, it is expected that the subjective well-being of individuals who feel economic threat due to unemployment or decreasing income and experience drastic changes in their work environments, is more likely to fall during the COVID-19 pandemic.

However, the effects of the COVID-19 pandemic might be different according to social class. Yoshikawa and Kawachi (2021) revealed that individuals living in economically weak prefectures of Japan were more likely to suffer COVID-19 incidence and mortality. Moreover, Hosoda (2021) also reported that workers of small and medium-sized companies were more likely to find difficulties in shifting to a new workstyle. In sum, socially advantaged individuals are more likely to be protected from the economic threat caused by the pandemic and adapt to new environments, whereas socially disadvantaged individuals are more likely to be exposed to the economic threat caused by the pandemic and are less likely to adapt to new environments. Thus, it is expected that differences will exist between social classes in coping with the problems caused by the COVID-19 pandemic.

Based on these inferences, the following hypotheses are derived:

Hypothesis 1. The individuals residing in prefectures with higher levels of COVID-19 infections are more likely to have lower subjective well-being compared to individuals residing in prefectures with lower levels of infections.

To measure the impact of the COVID-19 pandemic, this study focuses on the differences in infection rate between prefectures. It is known that there are differences in the effects of the COVID-19 pandemic between urban and rural areas (Brooks, Mueller, & Thiede, 2021). Such differences are partly derived from the difference in resources available to cope with the problems caused by the COVID-19 pandemic (Ferraz, Mariano, Manzine, & Moralles, 2021; Kim & Kim, 2021). Therefore, I believe that there are differences in the effects of the COVID-19 pandemic itself corresponding to differences in the infection rate. In addition, previous studies have clarified that restrictions on daily activities tend to adversely impact mental health and lower subjective well-being (Clair et al., 2021; Gonzalez-Bernal et al., 2021; Möhring et al., 2021; Rogowska et al., 2020; Stieger et al., 2021; Zheng et al., 2020) and, does not improve them (Brand et al., 2020). Therefore, individuals residing in prefectures with higher levels of COVID-19 infections are more likely to have lower subjective well-being. Based on Hypothesis 1, the following hypothesis is derived:

Hypothesis 2. Lower subjective well-being can be observed in prefectures with higher levels of COVID-19 infection, especially among individuals belonging to socially disadvantaged groups.

Hypothesis 2 states that the negative effects of the COVID-19 pandemic are not evenly distributed across different social groups. As there are differences in the degree of negative effects from the pandemic on subjective well-being between social classes, the disparities in subjective well-being between social classes could be widened during the COVID-19 pandemic. In other words, the problems related to the COVID-19 pandemic are not only epidemiological, but also sociological in nature.

3. Data and methods

3.1. Data

Data from the *Online Panel Survey of Social Stratification and Psychology in 2020* (SSPW2020-Panel) was used to examine the hypotheses developed in this study (SSP-Project, 2021). The composition rates of gender, cohort, and residential area in Japan were calculated using the Population Census in Japan; thereafter, the respondents of SSPW2020-Panel were sampled according to the calculated composition

rates from the online monitors registered in NEO MARKETING Inc. (https://neo-m.jp/), which is one of the social research agencies in Japan. The number of respondents of SSPW2020-Panel is 3,486, and their age ranges from 25 to 64 years old. Additionally, SSPW2020-Panel surveys were conducted four times for the same respondents as follows: June 2020 (Wave 1), September 2020 (Wave 2), December 2020 (Wave 3), and March 2021 (Wave 4). All respondents have lived in Japan during the survey period. Therefore, data from SSPW2020-Panel can be treated as a panel data conducted during the COVID-19 pandemic.

In this study, the COVID-19 infection rates for each prefecture during the survey period were used as a macro-level variable. The numbers of newly infected cases for each prefecture have been recorded by the Ministry of Health, Labour, and Welfare, and the data is available via its website publicly (MHLW, 2021). Based on this data, I calculated the number of newly infected cases of COVID-19 for each prefecture during each survey month per 100,000 capita and treated it as the COVID-19 infection rate for each prefecture. As the number of newly confirmed COVID-19 cases is usually announced on the next day, I used the number announced on the next day when I calculated number of infection cases in a day.

Fig. 1 shows changes in the COVID-19 infection rates in Japan from June 2020 to April 2021. It reveals that the infection rate in December 2020 (Wave 3) is the highest among Waves 1 to 4, followed by that in March 2021 (Wave 4) and September 2020 (Wave 2); the infection rate in June 2020 (Wave 1) is the lowest among the waves. This means that the COVID-19 pandemic in Japan had strengthened from Waves 1 to 3 and weakened from Wave 3 to Wave 4.

On the other hand, Fig. 2 depicts the differences in infection rate between prefectures by each survey month. Fig. 2 reveals that the distribution of the prefectural infection rate is exponential, thereby implying that there are large disparities in COVID-19 spread between prefectures. Moreover, Table 1 reveals that all correlation coefficients of the prefectural infection rate between survey waves are statistically significant and positive. In other words, prefectures with high rates of COVID-19 infection at Wave 1 were more likely to be highly infected at other survey waves. Therefore, the disparities in the effects of the COVID-19 pandemic between prefectures were found to be remarkably constant during the observed period.
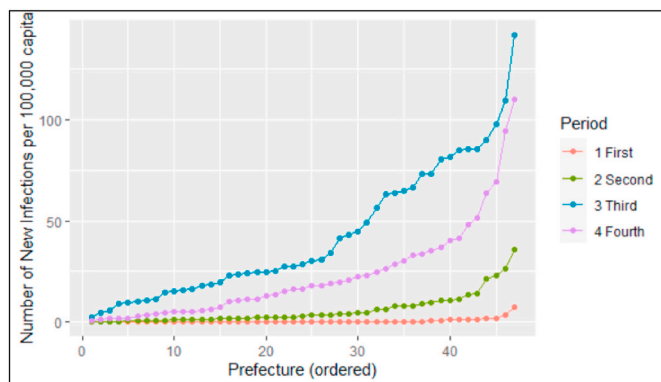
3.2. Variables

Dependent variables. As a dependent variable, life satisfaction was used in this study. Life satisfaction among the respondents of the
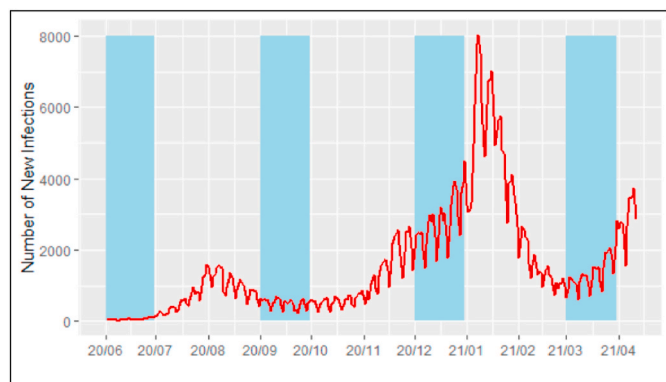
Source: Ministry of Health, Labour, and Welfare(MHLW, 2021).

Fig. 1. Number of new infections from June in 2020, to April in 2021
Source: Ministry of h
ealth, l
abour, and w
elfare
(MHLW, 2021).

Source: Ministry of Health, Labour, and Welfare (MHLW, 2021)

Fig. 2. Number of New Infections per 100, 000 capita, by Prefecture and Period.
Source: Ministry of Health, Labour, and Welfare (MHLW, 2021).

Table 1
Correlation coefficients of infection rate between survey waves.

	Wave 1	Wave 2	Wave 3	Wave 4
Wave 1				
Wave 2	0.652***			
Wave 3	0.633***	0.770***		
Wave 4	0.378**	0.678***	0.516***	

N = 47.
*p < 0.05, **p < 0.01, ***p < 0.001.

SSP2020-Panel was assessed using the following question: "How satisfied are you with the following aspects of your situation? a) Your life overall". This item was measured using a five-point scale, and the respondents were required to choose from the following alternatives: Satisfied (5), Somewhat satisfied (4), No opinion either way (3), Somewhat dissatisfied (2), and Dissatisfied (1). When I implemented the fixed effects OLS regression models, the dependent variable was transformed into a binary variable. Specifically, I recoded "1" when the respondent chose 4 or 5 for the variable of life satisfaction, and recoded "0" when the respondent chose less than 4.

Independent variables. As the independent variables at the macro level, I used the prefectural COVID-19 infection rate. I examined whether changes in life satisfaction during the COVID-19 pandemic were associated with the infection rates of prefectures where the respondents resided. Notably, I focused on the rates of newly infected cases and not on the number of newly infected cases in a prefecture. Obviously, the numbers of newly infected cases in large prefectures (in terms of population; i.e., Tokyo, Osaka, or Aichi) tend to be higher than those of small prefectures. To determine the effect of the infection rate itself, distinguished from effect of population size, I focused on the rate, rather than number, of newly infected cases. In addition to it, as the distribution of prefectural COVID-19 infection rate in Japan is skewed, prefectural infection rates were log-transformed when I implemented fixed effects OLS regression models.

As an independent variable at the micro level, I used decreasing income experienced during the COVID-19 pandemic. Changes in income among the respondents of the SSPW2020-Panel were assessed using the following question: "Did the monthly income of your household change compared to the same month in the last year? Please answer for each month." Respondents were required to choose from the following alternatives: Increased by more than 40%, Increased by 20–30%, Unchanged, Decreased by 20–30%, Decreased by more than 40%, and Lost income completely. In the analyses, I examined how changes in household income compared to the last year affect changes in subjective well-being (life satisfaction) during the COVID-19 pandemic.

In the analyses, I also examined the interaction effects of changes in prefectural infection rate with socio-economic factors: education, occupation, employment status, and household income. In order to specify the interaction effects of prefectural infection rate with socio-economic factors, I categorized respondents' educational level into university graduates and non-university graduates. Similarly, respondents' occupations were categorized into upper white collar, lower white collar, blue collar, and other occupation, and their employment status was categorized into regular employee, non-regular employee, self-employed, voluntary non-employee, and involuntary non-employee. Moreover, respondent's levels of household income were categorized into four categories using quartiles. Multi-variate analyses were performed using variables of university graduates, upper white collar. Regular employee, and the fourth quartile as a reference category.

3.3. Analytic strategy

Fixed effects OLS regression models were used to examine the effects of changes in prefectural infection rates on changes in subjective well-being during the COVID-19 pandemic. It is one of the models used to analyze panel data (Allison, 2009). In fixed effects OLS regression model, difference from the mean of dependent variable between survey waves for each respondent is predicted based on differences from the means of independent variables between survey waves for each respondent. Thereafter, the coefficients of independent variables (time-variant variables) are estimated, while controlling for the effects of time-invariant variables. Consequently, the effects of changes in independent variables on the changes in dependent variables can be examined.

The fixed effects OLS regression model can be expressed by the following equation:

$$y_{it} = \mu_t + \beta X_{it} + \gamma Z_i + \alpha_i + \varepsilon_{it}, \tag{1}$$

where i is a respondent, t is a time-point, y_{it} is the value of dependent variable of i at t, X_{it} is the vector of time-variant variables, Z_t is the vector of time-invariant variables, μ_t is the intercept for each time-point, β and γ are the vectors of coefficients, α_i is the error term for each respondent that only varies across individuals, and ε_{it} is the error term for each individual at each time-point. This equation can be transformed as follows:

$$y_{it} - \overline{y_i} = \mu_t + \beta(X_{it} - \overline{X_i}) + (\varepsilon_{it} - \overline{\varepsilon_i}) \tag{2}$$

where $\overline{y_i}$ is the mean of the dependent variable over time for the respondent i, $\overline{X_i}$ is the mean of the time-variant variables over time for the respondent i, and $\overline{\varepsilon_i}$ is the mean of the error term over time for the respondent i. As time-invariant terms (γZ_i and α_i) are disappeared from (2), this means that all effects of time-invariant terms are controlled. Additionally, as two-ways fixed effects OLS regression models were adopted in this study, the effect of μ_t is also controlled (Croissant & Millo, 2008).

By using fixed effects OLS regression models, I specifically examined the effects of prefectural infection rate on life satisfaction of living of each respondent. It needs to be noted that I employed individual and month (survey wave) fixed effects model. Moreover, the effects of restricting daily activities on changes in subjective well-being might be varied according to respondent's social class. To examine differences in the effects of restricting daily activities between social classes, therefore, I also examined interaction effects of prefectural infections rate with socio-economic variables (gender, educational level, employment status, occupation, and household income). Thereafter, to estimate coefficients of fixed effects OLS regression models, I used statistical software R (R Core Team, 2018) and plm (Croissant & Millo, 2008), which is one of the R packages. Moreover, I used lmtest in R packages to estimate cluster-robust standard errors at the individual level (Zeileis & Hothorn, 2002).

4. Results

4.1. Descriptive statistics

Table 2 shows descriptive statistics of dependent and independent variables used in my analyses. Table 2 clarifies that average life satisfaction of respondents in SSPW2020-Panel had slightly decreased from Wave 1 to Wave 3 and, after then, had slightly increased from Wave 3 to Wave 4. Even though changes in life satisfaction seem to correspond to changes in infection rate at the macro level, difference in average life satisfaction between Waves 1 to 4 are not statistically significant.

To explain such counterintuitive changes in subjective well-being during the COVID-19 pandemic, it is assumed that an attrition bias emerges on data from SSPW2021-Panel. Factually, it is observed that younger, non-highly educated, and lower income respondents in Wave 1 of SSPW2021-Panel, who tend to hold low subjective well-being, are more likely to drop out from Wave 3. To check possibility of attrition bias, I confirmed changes in composition rate of gender, cohort, and educational level (time-invariant variables) between survey waves of SSPWP2021-Panel. Table 3 shows composition rates of each wave of SSPW2021-Panel. However, while composition rates of young respondents, older respondents, women, and non-highly educated respondents were constantly decreasing from Wave 1 to Wave 4, those changes are very slight. As Paudel and Ryu (2018) pointed out, mortality selection might account for the differences in survival rates of a particular gender or socioeconomic category, which might confound these negative effects. However, the mortality rate of Japan in 2020 was lower compared to other years (Onozuka et al., 2021). Therefore, we cannot say with certainty that the socially disadvantaged individuals infected by COVID-19 died and, therefore, the negative effects of the COVID-19 pandemic were disappeared from the data. At the very least, these facts do not tell us that the effects of attrition bias are severe.

Even though attrition bias caused by respondents dropping out from panel might not influence trends in subjective well-being during the

Table 2
Descriptive statistics of variables in the analyses.

	N	Mean/ Rate	SD	Min	Max
Life Satisfaction (Wave 1)	3486	3.22	1.17	1	5
Life Satisfaction (Wave 2)	2845	3.19	1.16	1	5
Life Satisfaction (Wave 3)	2427	3.17	1.14	1	5
Life Satisfaction (Wave 4)	2427	3.19	1.16	1	5
Women	3486	0.49			
Age (25–29)	3486	0.10			
Age (30–39)	3486	0.24			
Age (40–49)	3486	0.30			
Age (50–59)	3486	0.25			
Age (60–65)	3486	0.12			
University Graduates	3471	0.59			
Regular Employee	3392	0.45			
Non Regular Employee	3392	0.23			
Self Employed	3392	0.10			
Involuntary Unemployed	3392	0.05			
Voluntary Unemployed	3392	0.17			
Upper White Collar Worker	3382	0.22			
Lower White Collar Worker	3382	0.34			
Blue Collar Worker	3382	0.21			
Equivalent Household Income	3486	369.38	279.46	0	3600
Decreasing Rate of Income (Wave 1)	3486	0.08	0.20	−0.4	1
Decreasing Rate of Income (Wave 2)	2845	0.07	0.20	−0.4	1
Decreasing Rate of Income (Wave 3)	2427	0.07	0.19	−0.4	1
Decreasing Rate of Income (Wave 4)	2427	0.07	0.20	−0.4	1

Table 3
Composition rates of each survey wave.

	Wave 1	Wave 2	Wave 3	Wave 4
Women	0.49	0.48	0.47	0.47
Age (25–29)	0.10	0.09	0.08	0.08
Age (30–39)	0.24	0.24	0.24	0.24
Age (40–49)	0.30	0.30	0.30	0.31
Age (50–59)	0.25	0.25	0.27	0.27
Age (60–65)	0.12	0.12	0.11	0.10
University Graduates	0.59	0.61	0.61	0.61

Covid-19 pandemic, the possibility should be considered carefully. To mitigate possible influences of attrition bias, instead of balanced data, I used unbalanced data which includes cases that did not respond all waves of SSPW2021-panel (Müller & Castiglioni, 2020). In other words, if a respondent responded more than two waves of SSPW2021-panel, I included the respondent into data applied to fixed effects OLS regression models. If trends in improving subjective well-being are still observed in SSPW2021-Panel even after using unbalanced data, it will mean that such trends need to be explained theoretically and reasonably.

4.2. Results of fixed effects OLS regression models predicting changes in subjective well-being

Table 4 shows the results of fixed effects OLS regression models predicting changes in life satisfaction. Model 1 of Table 4 refers to the baseline model examining effects of prefectural infection rates of COVID-19 on changes in residents' life satisfaction. Model 1 of Table 4 reveals that prefectural infection rates have no significant effect on changes in respondents' life satisfaction even during the COVID-19 pandemic ($\beta = -0.002$, ns). However, I need to consider a possibility that the effects of infection rates on changes in life satisfaction differ between respondent's social classes.

Model 3 of Table 4 considers the interaction effect of prefectural infection rate with respondent's educational level. It clarifies that the effects of prefectural infection rate are different between highly educated and non-highly educated individuals. In other words, highly educated respondents residing in highly infected prefectures are more likely to experience improved life satisfaction; meanwhile, lower educated respondents residing in highly infected prefectures are more likely to experience deterioration of life satisfaction. Model 4 of Table 4 considers the interaction effect of prefectural infection rate with respondents' employment status, and Model 5 of Table 4 considers the interaction effect of prefectural infection rate with respondent's occupation; moreover, Model 6 of Table 4 considers the interaction effect of prefectural infection rate with respondent's household income. Commonly, they clarify that socially advantaged respondents residing in highly infected prefectures are more likely to improve their life satisfaction, meanwhile socially disadvantaged respondents residing in highly infected prefectures are more likely to deteriorate their life satisfaction. Meanwhile, Model 2 of Table 4 reveals that the interaction effect of prefectural infection rate with respondent's gender is not significant.

I also implemented the full model, which includes all interaction terms (see Model 1 of Table A1 in Apendix A). I did not interpret these results in detail here, but these results revealed the robustness of the basic trend. In conclusion, the positive and negative effects of prefectural infection rate varied by social classes are canceled out by each other in Model 1 of Table 4.

4.2.1. Robustness tests

To test the robustness of the mechanism that prefectural infection rates affect respondent's subjective well-being, I examined the models controlling for decreasing household income. Here, decreasing household income is treated as a proxy index of stagnating economic activities during the COVID-19 pandemic. By controlling for effects of decreasing

Table 4
Fixed effects OLS regression models predicting changes in life satisfaction.

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Infection Rate(log)	0.002	(0.006)	−0.002	(0.008)	0.016*	(0.007)	0.020*	(0.009)	0.048***	(0.012)	0.076***	(0.010)
X Women			0.007	(0.011)								
X non University Graduates					−0.041***	(0.011)						
(Ref. Regular Employee)												
X Non Regular Employee							−0.050***	(0.014)				
X Self Employed							−0.022	(0.018)				
X Voluntary Unemployed							−0.017	(0.015)				
X Involuntary Unemployed							−0.083**	(0.026)				
(Ref. Upper White Collar)												
X Lower White Collar									−0.055***	(0.015)		
X Blue Collar									−0.084***	(0.017)		
X Other									−0.061***	(0.016)		
(Ref. Household Income 4thQ)												
X Household Income 1stQ											−0.131***	(0.015)
X Household Income 2ndQ											−0.098***	(0.015)
X Household Income 3rdQ											−0.087***	(0.015)
R2	0.000		0.000		0.002		0.003		0.005		0.014	
F(df)	0.083(1, 8387)		0.367(2, 8386)		9.348***(2, 8340)		5.513***(5, 8112)		10.005***(4, 8083)		30.656***(4, 8384)	
N (Individual)	2797		2797		2794		2780		2781		2797	
N (Observations)	11,185		11,185		11,136		10,897		10,868		11,185	

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.
Cluster-robust standard errors at the individual level in parentheses.

household income, the effects of stagnating economic activities and restricted daily activities during the COVID-19 pandemic could be distinguished from each other.

At first, I confirmed correlation coefficients with prefectural infection rate and respondents' decreasing rate of household income. Table A2 in APPENDIX A shows the correlation coefficients with prefectural infection rate and respondents' decreasing rate of household income for each survey wave. All correlation coefficients are not statistically significant. In other words, the negative effects of stagnating economic activities simultaneously emerged in Japan as a whole, regardless of prefectural infection rate.

Next, I examined the model by adding the decreasing rate of household income as a control variable to Model 2 of Table A1 in AP-PENDIX A. Model 2 of Table A1 reveals the results of the fixed effect OLS regression models predicting changes in life satisfaction after controlling for the effects of decreasing rate of household income. The results of the fixed effects OLS regression models predicting changes in life satisfaction clarify that the positive and negative effects of prefectural infection rate on respondent's life satisfaction remains even after controlling for effects of decreasing rate of household income. This means that the positive and negative effects of prefectural infection rate could not be explained by economic hardship caused by the COVID-19 pandemic.

Furthermore, the effects of the current intensity of the COVID-19 pandemic on subjective well-being might be prolonged in the foreseeable future. To confirm the extended effects of the COVID-19 pandemic, I also implemented the fixed effects OLS regression model with 30 days lagged values of virus infection rates (see Table B1 and B2 in Appendix B). The results of the analyses reveal that while the statistical significance of independent variables was unchanged mostly, the model fitting improved. This implies that the effects of the infection rate in a prefecture tend to reflect in individual subjective well-being after some time rather predictably and durably. Interestingly, after controlling for the interaction effects between prefectural infection rate and socio-economic statuses, the interaction effect between prefectural infection rate and gender had a statistically significant effect on changes in life satisfaction. In other words, women are more likely to improve their life satisfaction during the COVID-19 pandemic compared to men under similar conditions. This suggests the possibility that shifting to telework in Japan benefited women more than men.

4.3. Summary

The results of the analyses in this study reveal that the COVID-19 pandemic might have positive effects on subjective well-being of individuals. While this finding seems to be strange, it is however in congruence with some findings in previous studies. Recchi et al. (2020) reported that French people's subjective well-being tended to improve during the lockdown, and Gubler et al. (2021) pointed out that well-being does not decrease in the period with public life restrictions caused by the COVID-19 pandemic. Furthermore, Schmiedeberg and Thönnissen (2021) insisted that the positive effect of the COVID-19 pandemic could be found depending on the individual's personality. On the other hand, while Wang et al. (2021) reported that the COVID-19 anxiety had no significant effect on individuals in China, Y. Li (2021) clarified that the negative emotions of Chinese people were not affected by the COVID-19 pandemic. All of them commonly imply that the COVID-19 pandemic does not necessarily have negative effects on the subjective well-being of individuals.

In this study, however, the positive effects of the COVID-19 pandemic on subjective well-being could be found only in socially advantaged respondents. In socially disadvantaged respondents, rather, the negative effects of the COVID-19 pandemic on subjective well-being could be found. As mentioned in the Introduction section, these negative effects of the COVID-19 pandemic on subjective well-being largely corresponds to the main findings in previous studies. In this context, it needs to be considered how and why the differences in the effect of the

COVID-19 pandemic—in terms of subjective well-being—between socially advantaged and disadvantaged individuals are generated.

In this study, it is posited that the effects of the COVID-19 pandemic could be explained by two social factors: economic recession and restrictions on daily activities. However, the results of the analyses in this study show that economic hardship caused by the COVID-19 pandemic had negative effects on subjective well-being regardless of prefectural infection rate. This suggests that the negative effects of economic recession are not limited to the highly infected areas and, rather, spreads in the whole society. Further, the negative and positive effects of prefectural infection rate on subjective well-being could be found. This implies that the negative effects of the COVID-19 pandemic on socially disadvantaged individuals' subjective well-being might be explained by the restrictions on daily activities instead of economic hardship. Meanwhile, the reason the positive effects of the COVID-19 pandemic on socially advantaged individuals' subjective well-being could be found remains open for discussion and future research.

5. Discussion and conclusions

The results of the fixed effects OLS regression models predicting subjective well-being based on data from the SSPW2020-Panel reveals that the spread of COVID-19 in a prefecture influenced the subjective well-being of individuals residing in the prefecture. However, the effect of the spread of COVID-19' in the prefecture is different according to social class to which the individual belongs. For individuals belonging to a lower social class (not-highly educated, unstable employment, unskilled occupation, and low income), the COVID-19 pandemic has a negative effect on their subjective well-being. This finding partly supports Hypothesis 1 of this study. Meanwhile, such negative effects of the COVID-19 pandemic on subjective well-being could not be observed for individuals belonging to an upper social class (highly educated, stable employment, skilled occupation, and high income).

Furthermore, the results show that the negative effect of the spread of COVID-19 in a prefecture on individual well-being could not be explained by economic hardship arising from the COVID-19 pandemic. Even after controlling for decreasing household income, the negative effect of COVID-19 spread in a prefecture on the subjective well-being of socially disadvantaged individuals held statistical significance. Probably, as economic activities in a prefecture are closely connected with those in other prefectures, the influence of economic hardship caused by the spread of COVID-19 in the prefecture might spill over to other prefectures easily. Therefore, the negative effect of decreasing income was observed beyond prefectures. This suggests that the negative effect of the spread of COVID-19 in a prefecture on subjective well-being of socially disadvantaged individuals might be explained by the restrictions on daily activities that aims to prevent spread of COVID-19. Therefore, this finding partly supports Hypothesis 1 of this study. However, the negative effect of COVID-19's spread on individuals' subjective well-being could be observed only in socially disadvantaged people. In other words, Hypothesis 1 in this study was not supported for socially advantaged individuals. The effect of COVID-19 spread on subjective well-being varies according to social class.

Next, the reason that the spread of COVID-19 in a prefecture has positive effects on subjective well-being of socially advantaged individuals residing in highly infected prefectures needs to be explored. While the positive effects of the spread of COVID-19 were unexpected, few studies have pointed out the positive effects of the pandemic (Recchi et al., 2020; Schmiedeberg & Thönnissen, 2021). A case in point is the role of digital technologies, which has enabled socially advantaged individuals to smoothly telework. For example, Canale et al. (2021) confirmed the role of digital technologies in coping with difficulties caused by the COVID-19 pandemic.

When daily activities were restricted to prevent COVID-19 spread, many companies in Japan drastically introduced digital technologies into their work environments to facilitate telework among their

workforces. Consequently, individuals employed by the companies which have the capacity to introduce new digital technologies in their work environments could work more flexibly and realize work-family balance more easily, compared to the period before the COVID-19 pandemic. It is posited that the new work style might improve their subjective well-being. However, essential workers, lower white-collar workers (salesclerks etc.), or non-regular employees could not enjoy the benefits derived from the new work style (Hosoda, 2021). Therefore, the positive effects of COVID-19 spread via the new work style on subjective well-being were observed only in socially advantaged individuals.

However, the characteristics of Japanese society need to be considered. It is well known that the average working hours in Japan are longer than that in other developed countries and that it becomes difficult for Japanese people (especially, for Japanese women) to realize work-life balance (Yamaguchi, 2019). Additionally, the COVID-19 infection rate in Japan during 2020 was relatively low, compared to North America and Europe (World Health Organization, 2021). In other words, the positive effects of COVID-19 spread on subjective well-being might be easily found in Japan and, hence, should not be overestimated.

Finally, I sought to examine changes in social inequality in terms of subjective well-being during the COVID-19 pandemic. As mentioned previously, the subjective well-being of socially disadvantaged individuals had deteriorated during the COVID-19 pandemic. On the other hand, the subjective well-being of socially advantaged individuals had improved during the COVID-19 pandemic. Based on these findings, it is concluded that social inequality in terms of subjective well-being between social classes had been sharply widened by the COVID-19 pandemic. Moreover, this tendency could be especially found in prefectures with high COVID-19 infection rates. This means that the COVID-19 pandemic consists of a social mechanism exacerbating social inequality of subjective well-being.

This study hypothesized that the COVID-19 pandemic might widen social inequality of subjective well-being by lowering subjective well-being of socially disadvantaged individuals (Hypothesis 4). The results of the analyses support Hypothesis 2. The results also imply that the privileges of socially advantaged individuals tend to be protected and strengthened by the pandemic; however, these results have stronger implications compared to Hypothesis 2. In other words, the degree of widening social inequality observed in SSPW2020-Panel is larger than expected. The COVID-19 pandemic not only exacerbates pre-existing social inequalities but also creates new forms of disparities (Qian & Fan, 2020) derived from new digital technologies.

Moreover, as one of the reasons why such unexpected results were observed in Japan, I consider the changes in work style arising from new digital technologies. To cope with the difficulties caused by the COVID-19 pandemic, a sense of autonomy, competence, and relatedness is needed for individuals (Vermote et al., 2021). If such attributes are sufficiently realized through digital technologies, individuals will not have severe difficulties even during the pandemic. For socially advantaged individuals, new digital technologies are regarded as tools to bring a sense of autonomy, competence, and relatedness into daily life even during the COVID-19 pandemic. In this context, studies should not overlook the possibility that even if the COVID-19 pandemic ends, the social inequality widened by the introduction of new digital technologies in daily life will not disappear.

5.1. Limitations

This study has some limitations. First, changes in the social inequality of subjective well-being were examined only in Japan. East Asian countries including Japan have relatively low COVID-19 infection rates, compared to other countries, such as those in North America and Europe. Therefore, the implications derived from the case of Japan might not be generalizable to other countries unconditionally. The positive effects of the COVID-19 pandemic, especially, should not be overemphasized.

By employing a quasi-experimental method, I could only estimate the effects of infection rates at the prefecture level on individual subjective well-being. Given that the respondents were not selected from the population based on the random sampling method, I could not correctly estimate the degree of influence that the COVID-19 pandemic had over the whole society.

Third, it cannot be denied that there might be systematic bias between regions or over time for infection rates. Difference in infection rates between prefectures might occur due to differences in economic development, local government policies, and the quality of the healthcare system.

Fourth, to use causal inference correctly, it was to be desired that I estimated cluster-robust standard errors at the prefecture level (the level of treatment) instead of estimating robust-standard errors at the individual level. However, I could not estimate the cluster-robust standard errors at the prefecture level via the use of the *plm* package in R.

Lastly, the dataset does not include pre-pandemic data. Therefore, I could not compare the pandemic situation to the pre-pandemic situation. I could only compare prefectures with higher infection rates and lower infection rates in Japan. These limitations should be addressed in the future.

5.2. Conclusions

This study examined the effects of the COVID-19 pandemic on individual subjective well-being by using data from SSPW2020-Panel. It clarifies that the COVID-19 pandemic of Japan in 2020 had both positive and negative effects on subjective well-being. The COVID-19 pandemic had negative effects on the subjective well-being of socially disadvantaged individuals. If they resided in highly infected prefectures, their subjective well-being could deteriorate. On the other hand, for socially advantaged individuals, the COVID-19 pandemic had positive effects on subjective well-being. If they resided in highly infected prefectures, their subjective well-being could improve. Thus, the effects of the COVID-19 pandemic on subjective well-being were different based on social class.

When the positive and negative effects of the COVID-19 pandemic on subjective well-being are combined with each other, subjective social inequality observed in terms of individual subjective well-being will be sharply widened. Moreover, even if the COVID-19 pandemic is ended, it is expected that the social inequality widened by the COVID-19 pandemic will not disappear. For example, new digital technologies introduced during the COVID-19 pandemic, which might contribute to widening social inequality of subjective well-being, will not disappear even after the COVID-19 pandemic is ended. Therefore, we should investigate and examine changes in social inequality of subjective well-being during the COVID-19 pandemic more carefully. At the very least, it should not be regarded as instantaneous or temporal.

This study clarified that the COVID-19 pandemic affected individual subjective well-being negatively as well as positively. It is noted that only advantaged individuals could enjoy such positive effect and, therefore, social inequality of subjective well-being could be widened. In the previous studies, negative effects of the COVID-19 pandemic on subjective well-being inequality were mainly discussed and positive effects of the COVID-19 on subjective well-being were not provided enough attention. However, by focusing on positive effects of COVID-19 on socially advantaged individual's subjective well-being, it is clear that governments need to provide not only policies for infection control but also long-term support for socially disadvantaged individuals to adapt to social changes in workstyle caused by the COVID-19 pandemic. Without such support, increased social inequality due to changes in workstyle under the COVID-19 pandemic will remain in a society even after the ending of the pandemic. This finding is the most important contribution to the literature.

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Availability of data and material

The SSP Project (http://ssp.hus.osaka-u.ac.jp/) allowed me to use the SSPW2020-Panel.

Code availability

Contact the corresponding author.

Ethical statement

There are no conflicts of interest to declare.

Author statement

The author confirms sole responsibility for the following: study conception and design, analysis and interpretation of results, and manuscript preparation.

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APPENDIX

APPENDIX A

Table A1
Fixed Effects OLS Regression Models Predicting Changes in Life Satisfaction: Full Models

	Model 1			Model 2		
	Coeff.		SE	Coeff.		SE
Decreasing Rate of Income				−0.271	***	(0.032)
Infection Rate(log)	0.089	***	(0.014)	0.084	***	(0.014)
X Women	0.023		(0.012)	0.023		(0.012)
X Non University Graduates	−0.012		(0.012)	−0.011		(0.012)
(Ref. Regular Employee)						
X Non Regular Employee	−0.014		(0.017)	−0.013		(0.016)
X Self Employed	−0.008		(0.018)	−0.003		(0.018)
X Voluntary Unemployed	−0.009		(0.020)	−0.007		(0.020)
X Involuntary Unemployed	−0.058	*	(0.029)	−0.035		(0.028)
(Ref. Upper White Collar)						
X Lower White Collar	−0.030	*	(0.015)	−0.032	*	(0.015)
X Blue Collar	−0.038	*	(0.019)	−0.040	*	(0.019)
(Ref. Household Income 4thQ)						
X Household Income 1stQ	−0.122	***	(0.017)	−0.119	***	(0.017)
X Household Income 2ndQ	−0.091	***	(0.016)	−0.089	***	(0.016)
X Household Income 3rdQ	−0.082	***	(0.015)	−0.082	***	(0.015)
R2	0.018			0.030		
F(df)	12.386*** (12, 8000)			19.060*** (13, 7999)		
N (Individual)	2777			2777		
N (Observations)	10,789			10,789		

*p < 0.05, **p < 0.01, ***p < 0.001.
Cluster-robust standard errors at the individual level in parentheses.

Table A2
Correlation Coefficients with Infection Rate and Decreasing Rate of Income

	Decreasing Rate of Income
Infection Rate (Wave 1, N = 3486)	−0.006
Infection Rate (Wave 2, N = 2845)	−0.002
Infection Rate (Wave 3, N = 2427)	0.015
Infection Rate (Wave 4, N = 2427)	−0.005

*p < 0.05, **p < 0.01, ***p < 0.001.

APPENDIX B

Table B1

Fixed Effects OLS Regression Models Predicting Changes in Life Satisfaction with 30days lagged values of virus infection rates

	Model 1		Model 2		Model 3			Model 4			Model 5			Model 6		
	Coeff.	SE	Coeff.	SE	Coeff.		SE	Coeff.		SE	Coeff.		SE	Coeff.		SE
Infection Rate(log)	0.000	(0.007)	−0.008	(0.009)	0.018	*	(0.007)	0.020	*	(0.010)	0.054	***	(0.014)	0.089	***	(0.012)
X Women			0.017	(0.012)												
X non University Graduates					−0.051	***	(0.010)									
(Ref. Regular Employee)																
X Non Regular Employee								−0.052	**	(0.016)						
X Self Employed								−0.029		(0.021)						
X Voluntary Unemployed								−0.013		(0.018)						
X Involuntary Unemployed								−0.112	***	(0.029)						
(Ref. Upper White Collar)																
X Lower White Collar											−0.064	***	(0.017)			
X Blue Collar											−0.096	***	(0.020)			
X Other											−0.071	***	(0.018)			
(Ref. Household Income 4thQ)																
X Household Income 1stQ														−0.159	***	(0.017)
X Household Income 2ndQ														−0.116	***	(0.017)
X Household Income 3rdQ														−0.104	***	(0.017)
R2	0.000		0.000		0.003			0.004			0.006			0.018		
F(df)	0.088(1, 8387)		1.527(2, 8386)		12.113*** (2, 8340)			6.502*** (5, 8112)			11.177*** (4, 8083)			37.717*** (4, 8384)		
N (Individual)	2797		2797		2794			2780			2781			2797		
N (Observations)	11,185		11,185		11,136			10,897			10,868			11,185		

*p < 0.05, **p < 0.01, ***p < 0.001.
Cluster-robust standard errors at the individual level in parentheses.

Table B2

Fixed Effects OLS Regression Models Predicting Changes in Life Satisfaction with 30days lagged values of virus infection rates: Full Models

	Model 1			Model 2		
	Coeff.		SE	Coeff.		SE
Decreasing Rate of Income				−0.264	***	(0.032)
Infection Rate(log)	0.100	***	(0.016)	0.094	***	(0.016)
X Women	0.036	**	(0.014)	0.038	**	(0.014)
X Non University Graduates	−0.018		(0.014)	−0.017		(0.014)
(Ref. Regular Employee)						
X Non Regular Employee	−0.009		(0.018)	−0.008		(0.018)
X Self Employed	−0.012		(0.021)	−0.005		(0.020)
X Voluntary Unemployed	−0.006		(0.023)	−0.003		(0.023)
X Involuntary Unemployed	−0.081	*	(0.032)	−0.052		(0.031)
(Ref. Upper White Collar)						
X Lower White Collar	−0.040	*	(0.017)	−0.042	*	(0.017)
X Blue Collar	−0.042		(0.022)	−0.043	*	(0.021)
(Ref. Household Income 4thQ)						
X Household Income 1stQ	−0.151	***	(0.019)	−0.146	***	(0.019)
X Household Income 2ndQ	−0.108	***	(0.018)	−0.105	***	(0.018)
X Household Income 3rdQ	−0.097	***	(0.017)	−0.097	***	(0.017)
R2	0.023			0.034		
F(df)	15.684*** (12, 8000)			21.724*** (13, 7999)		
N (Individual)	2777			2777		
N (Observations)	10,789			10,789		

*p < 0.05, **p < 0.01, ***p < 0.001
Cluster-robust standard errors at the individual level in parentheses.

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