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The role of prosociality and social capital in changes in subjective well-being during the COVID-19 pandemic*

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Abstract

This study examines the role of local social capital, individual personality, and their interaction on changes in subjective well-being (SWB) during the COVID-19 pandemic. Our estimations use tracking panel data based on a unique survey of approximately 25,000 people in Japan from 2019 to 2022. The results show that before the pandemic, individuals with high prosociality had higher SWB, whereas individuals with low and moderate levels of prosociality had no significant difference in SWB. Additionally, the relationship between individual prosociality and local social capital did not affect SWB. However, after the pandemic, the SWB of non-prosocial individuals changed heterogeneously depending on the level of local social capital. Non-prosocial individuals in areas with high social capital showed little change in SWB, whereas non-prosocial individuals in areas with low social capital showed significantly decreased SWB. These results may be caused by the possibility of free-riding on the reduced risk of infection due

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to the preventive actions of others in areas with high social capital.

JEL classifications: H00, I3, D64, I18, Z18

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Declaration of competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data and code availability statement

The raw survey data cannot be shared because they contain personal information. All other datasets are publicly available. Processed datasets and R-code to reproduce our results can be provided upon request.

1. Introduction

Like civic and environmental issues, pandemics are collective action problems in which individual and social interests conflict (Fang et al., 2022). To control pandemics, individual activities should be limited. However, the benefits of individual preventive action spill over into society such that individually optimal behavior does not coincide with socially optimal behavior (Farboodi et al., 2021). When considering these public goods dilemmas, social norms, altruism, and prosociality play essential roles (Fehr & Schmidt, 1999). Communities and individuals with high levels of compliance and prosociality can solve collective action problems because they willingly strive to improve their social welfare. However, the problem becomes more complex when many individuals are willing to free ride on this voluntary cooperation. Free riders enjoy greater benefits at lower costs, whereas collaborators receive only lower benefits at higher costs. Therefore, social welfare in the case of collective action problems must consider the relationship between community norms and individual prosociality. However, compared with many theoretical studies on this issue, existing studies provide little empirical evidence.

This study focuses on the recent COVID-19 pandemic and uses subjective well-being (SWB) to analyze social dilemmas and collective action problems. More specifically, we focus on the relationship between individual prosociality and community social capital. Previous studies have treated social capital as a comprehensive measure of norms and beliefs and have found that cities with higher social capital have higher levels of prevention (Barrios et al., 2021; Bartscher et al., 2021; Durante et al., 2021; Kuroda et al., 2022). Previous studies have revealed that individuals who are more prosocial are more likely to comply with policies and voluntary prevention (Campos-Mercade et al., 2021;

Müller & Rau, 2021). Furthermore, while disasters and pandemics can severely affect SWB (Brodeur et al., 2021), cities with high social capital and prosocial individuals are less likely to experience a decline in SWB (Laurence & Kim, 2021).

However, in cases of collective action dilemmas, the SWB of prosocial individuals is heavily affected by the norms of the community. Free riders can spoil individual efforts if cooperative norms are not solid, and SWB may decline. Alternatively, SWB may decrease due to frustration that others are not taking appropriate action (Hensel et al., 2022). Selfish individuals living in prosocial neighborhoods can improve their SWB by free-riding on the preventive behaviors of others.

This study addresses the above issues using SWB survey data for approximately 25,000 people from 2019 to 2022. By using data from the same monitors surveyed continuously before the start of the COVID-19 pandemic, we analyze changes in SWB before and after the pandemic. Because the survey includes a measure of personality that is a proxy for prosociality, we perform an estimation using the interaction term between that proxy and community social capital as measured by national election turnout, the number of volunteer firefighters, and so on. The results show that the relationship between individual prosociality and community social capital did not affect SWB before the pandemic. Furthermore, during the pandemic, non-prosocial individuals living in areas with low social capital had lower SWB, while those living in areas with high social capital had increased SWB. Additionally, the analysis of outdoor consumption behavior suggested that areas with low social capital may have decreased the frequency of outdoor activities during the pandemic. Therefore, in areas where the norm of cooperation is scarce, SWB is reduced by the failure of preventive actions, whereas in other areas, SWB is increased by free-riding on the preventive actions of others.

Our findings contribute to the literature on social cooperation, unity, and trust when disasters and collective action problems occur. Previous empirical studies suggest that mutual support and strong altruism can lead to informal care (Laurence & Kim, 2021), which may alleviate psychological distress (Aldrich & Meyer, 2015; Moore & Carpiano, 2020). However, evidence on the impact of crisis on community norms and social trust presents conflicting arguments (Wu et al., 2022). In communities where norms of mutual support and altruism are high, these norms may be reinforced when residents help each other overcome challenges (Rayamajhee & Bohara, 2021; Yamamura et al., 2015). Conversely, in areas where altruism and prosociality are low, selfish behavior may occur in times of crisis, and social norms may be undermined (Yamamura et al., 2015). Previous studies on COVID-19 suggest that social trust may have been particularly impaired among people with lower socioeconomic status, minorities, and people at greater risk of infection (Borkowska & Laurence, 2021; Lo Iacono et al., 2021; Wu et al., 2022). However, the mechanism still needs to be clarified, and unemployment, lower incomes, and a lack of informal care have been cited as potential possibilities. We present a possible novel channel for the impact of collective action problems on community norms by investigating the effects of the relationship between individual personality and community norms on SWB.

This study is also related to the social science literature on COVID-19. The empirical study of COVID-19 began in 2020 and has reached a new phase. While the first few years after the beginning of the pandemic focused on the impact of the policy on the level of infection and prevention, current interest has shifted to the optimal level of prevention policy. When considering optimal prevention levels and policy interventions, we must evaluate cost-effectiveness. However, the difficulty of monetary valuation due to many

externalities complicates evaluation. For example, financial losses and deaths from infectious disease are easily observed, but mental illness and resulting suicides are easily overlooked. Therefore, to evaluate social welfare and address effective policies, we should use comprehensive measures, such as subjective well-being and life satisfaction (Levinson, 2012). Studies examining the early stages of the pandemic revealed that infection decreased SWB with significant heterogeneity in the effects (Belot et al., 2021; Laurence & Kim, 2021; Sandner et al., 2023). However, given that infectious diseases are shocks that can last for several years and that behavioral fatigue is also an issue, analyzing changes in SWB over time is essential (Brodeur et al., 2021; Sibony, 2020). This study provides new insights into changes in social welfare over the years by using SWB data collected continuously since before the COVID-19 pandemic.

Compared with previous studies, this study has advantages and disadvantages. We have access to a sample of households first interviewed in December 2019, allowing us to control for prepandemic characteristics, an empirical challenge. Additionally, whereas most related studies have focused on the early stages of the pandemic, we use a four-year follow-up study to capture the medium-term impact of the pandemic. Additionally, the results of this study have external validity because Japan is not extreme in terms of time preference, risk preference, reciprocity, altruism, or trust (Falk et al., 2018). On the other hand, a limitation of this study is that we cannot attribute our findings to causal effects. Prosociality, social capital, and norms are essentially endogenous to society, culture, politics, and institutions. Since these factors cannot be observed perfectly and have interdependent and complex relationships, our empirical analysis must be correlational. However, because Japan is highly homogeneous in terms of culture, religion, race, and other characteristics that are difficult to quantify, the effects of confounding factors are

relatively small compared with those in Western countries (Central Intelligence Agency, 2024). Additionally, due to data availability, evidence of the mechanism is only suggestive. Therefore, the above limitations should be considered when interpreting the findings of this study.

The remainder of this paper proceeds as follows. Section 2 introduces the data used in the analysis. Section 3 presents the empirical strategy. Section 4 presents the main results and describes a series of robustness checks, and Section 5 concludes.

2. Data

We obtained survey data, including a wealth of personal characteristics on approximately 25,000 people throughout Japan, from the market research company Macromill, Inc. The survey targets the monitors of a home scanner dataset called the quick purchase report (QPR), provided by Macromill, Inc. The QPR data are intended to provide detailed marketing information by collecting nationally representative panel data on consumer purchasing behavior. The QPR monitors are picked at a specific rate from each region, reflecting the population estimates of the Statistics Bureau of the Ministry of Internal Affairs and Communications, so they are representative. If a monitor drops out, the sample size is ensured by adding individuals with similar characteristics. Personal characteristics include zip code, age, income, family structure, and personality and lifestyle questionnaires. Although the original purpose of collecting QPR data is marketing, it is also used in the economics literature because of its high representativeness and rich individual characteristics (e.g., Kuroda, 2022; Sato et al., 2024).

The QPR data contain a wealth of individual characteristics, but information on well-being is lacking. Therefore, we conduct an additional independent survey that target QPR

monitors to obtain records of their SWB and preexisting medical conditions. The surveys were conducted from early December 2019 through 2022, with four years of data available.[1] December 2019 was before the COVID-19 pandemic and is considered normal in our analysis. In 2020, the first case of COVID-19 was confirmed in Japan at the beginning of the year, and the infection was widespread in December. This was before the development of the vaccine, and the main preventive action was refraining from going out. In December 2021, the risk of infection decreased, but the fear of the virus persisted. The main preventive actions changed from refraining from going outside to vaccinating and limiting the number of people in a room. In December 2022, the pandemic was gradually ending, although there were still cases of infection. Although government-led infection control programs have weakened, voluntary infection prevention measures have remained.

There were approximately 25,000 respondents to the survey, excluding individuals who completed the survey incorrectly or did not answer the questionnaire. Approximately 14,000 individuals responded to all four surveys. Table 1 shows the descriptive statistics from the first- and third-year surveys. The primary outcome SWB was a discrete variable from the response to the following question: Currently, how happy do you feel? Score the degree of your happiness between 1 (very unhappy) and 10 (very happy). SWB is correlated with suicide rates at the regional and individual levels (Helliwell, 2006) and is plausibly strongly correlated with other observable variables (Konow & Earley, 2008).

[1] We were unable to obtain personal characteristics such as income and family structure in 2022, so we used 2021 indicators as a proxy. We confirmed changes in individual characteristics from 2019 to 2021 and confirmed that they did not change significantly over the year, so this should not seriously affect the results.

Therefore, SWB can be a valuable measure for analyzing social welfare during a pandemic.

	2019 (before the pandemic)				2021 (during the pandemic)			
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
Individual characteristics								
Subjective well-being	6.293	1.953	1	10	6.074	2.022	1	10
Prosociality	3.869	0.797	1	5	3.843	0.791	1	5
Age	46.060	14.695	15	75	46.369	14.361	15	75
Male	0.503	0.500	0	1	0.502	0.500	0	1
Children	0.566	0.496	0	1	0.561	0.496	0	1
Household Size	2.933	1.279	1	11	2.899	1.265	1	10
Chronic diseases	0.214	0.410	0	1	0.234	0.423	0	1
Household income	6.032	3.641	1	25	6.087	3.668	1	25
Regional characteristics								
Social capital	-1.043	0.595	-2.641	6.236	-1.046	0.592	-2.641	6.236
Population density	0.430	0.493	0.000	2.238	0.435	0.495	0.000	2.238
Average age	46.099	2.542	38.624	61.633	46.060	2.538	38.624	65.982
Ratio of elderly people	26.135	4.455	15.101	53.705	26.074	4.461	15.101	60.485
Ratio of foreigner	0.014	0.012	0.000	0.146	0.014	0.012	0.000	0.146
Average taxable income	3.291	0.584	2.120	9.799	3.297	0.585	2.088	9.799
Number of monitors	25,017				23,733			

Table 1. Sample summary statistics

Prosociality, age, gender, marital status, the presence of children, household size, the presence of chronic disease, household income, education level, occupation, family structure, and housing type were based on the QPR data. The prosociality measure is a five-level discrete variable that takes a value of five if the respondent agrees that "*sociability and cooperativeness are essential*" and one if the respondent disagrees. The prosociality measure changes slightly yearly for the same monitors, with an autocorrelation coefficient of approximately 0.5. Appendix Table A1 is a matrix of changes in prosociality from 2019 to 2021; it shows that few individuals experience

extreme increases or decreases in prosociality. We also use several other individual personality questions as placebo tests to check the robustness of the main results.

Chronic disease is a dummy variable that takes a value of one if diabetes, hyperlipidemia, or hypertension is present. Household income is a variable divided into nine groups: less than 2 million JPY, 2 to 4 million JPY, 4 to 6 million JPY, 6 to 8 million JPY, 8 to 10 million JPY, 10 to 12 million JPY, 12 to 15 million JPY, 15 to 20 million JPY, and more than 20 million JPY. In Table 1, annual household income is converted to the median value for each group (converted to 25 million JPY above 20 million JPY). Education is a five-level variable: middle school, high school, junior college, college, and master's degree or higher. Occupations include 12 categorical variables, such as public employees, clerical company employees, technical company employees, self-employed workers, and part-time workers. Family structure is a five-category variable: single, married couple, two-generation, three-generation, and other. There are six categorical variables for housing type: owned detached houses, rented detached houses, owned apartments, rented apartments, company and government housing, and others.

We use social capital measures as a proxy variable for community social norms. To measure social capital, the literature uses measures such as voting rates (Barrios et al., 2021), association densities (Giuliano & Wacziarg, 2020; Satyanath et al., 2017), and the number of civil offices and religious organizations (Rupasingha et al., 2006). Following related studies, we developed a social capital measure based on voter turnout in national elections, participation in volunteer fire companies, the number of community centers per capita, and assembly facilities per capita at the municipal level (Kuroda et al., 2022).

Voting is the most representative example of a privately costly activity with no direct reward that is socially beneficial. We obtained voter turnout rates for the 2012, 2014, and

2017 national elections from the Ministry of Internal Affairs and Communications (MIC) and used the average of these rates. Because participation in volunteer fire brigades contributes to the community but participation is voluntary and the rewards are small (the national average is approximately $300 per year), participation rates can capture the norm of willingness to contribute to the community. We obtained the participation rate of the fire brigade in 2021 from the Fire and Disaster Management Agency of the MIC. The number of community centers and meeting facilities per capita is a good measure of the strength of community bonds and the willingness to provide public goods. The 2008 Social Education Survey obtained the number of community centers and meeting facilities for each municipality. We use the first principal component of these four factors as the composite measure of social capital. Additionally, population density, average age, percentage of elderly individuals, percentage of foreigners, and taxable income at the municipal level are obtained from various government statistics and used as control variables.

Fig. 1 shows the distribution of SWB across the four survey years. The average SWB is approximately 6, with few reporting extraordinarily high or low SWB scores. Therefore, the results are not biased because SWB does not increase or decrease further. Appendix Table A2 also compares the differences in summary statistics between surviving and dropout monitors. The table shows that the dropout monitors have slightly higher SWB, confirming that those who experienced an unfortunate event, such as losing their jobs, are not more likely to drop out of the survey. Furthermore, students and younger people are more likely to drop out because of schooling, changing jobs, or moving, whereas people with stable lives, such as those with children and elderly individuals, are less likely to drop out. There is almost no significant difference in the regional characteristics. The

correlation coefficient between community social capital and prosociality is approximately 0.01, indicating that community norms are unrelated to individuals' personalities.

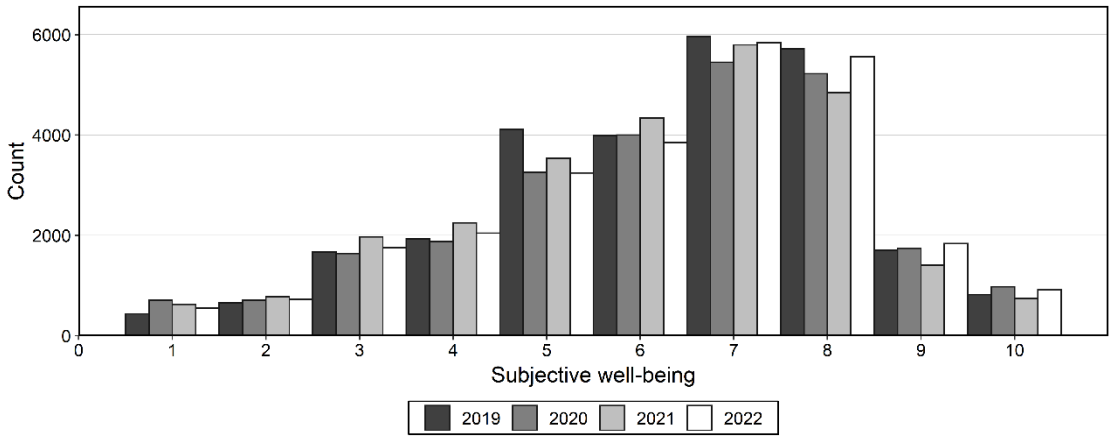

Fig. 1. Distribution of SWB from 2019-2022

Note: The horizontal axis represents each SWB level, and the vertical axis represents the number of individuals at each SWB level.

We developed a proxy measure of outgoing activity to examine the mechanisms of changes in SWB during the pandemic. QPR monitors scan and report the barcodes of all products purchased daily. Then, the product name and price and the location where the product was purchased (supermarket, convenience store, online, etc.) are given for each product. Following previous studies, we consider a monitor outgoing if he or she purchases more than one JPY in the store (Kuroda, 2023). Since the SWB survey was conducted in December, we use the number of days of outdoor consumption activity during November as a proxy variable for outdoor consumption activity. Notably, this measure does not fully capture outdoor activity and thus provides only suggestive

evidence.

3. Methodology

We apply the following specification to estimate the effect of the relationship between an individual's prosociality and local social capital on SWB:

$$SWB_{icp} = \alpha + \sum_{\substack{k=1 \\ k\neq 3}}^{5} \beta_k \mathbf{1}[PS_{icp} = k] + \sum_{\substack{k=1 \\ k\neq 3}}^{5} \gamma_k \mathbf{1}[PS_{icp} = k] \times SC_{cp} + SC_c + X_i + Y_c + Z_p + \varepsilon_{icp} \quad (1)$$

where SWB_{icp} is the subjective well-being of individual i living in city c within prefecture p. PS_{icp} is a five-level prosociality index, with the baseline of the third level (moderate level of prosociality). SC_{cp} is a dummy variable that takes a value of 1 if the social capital of the city of residence is above the median. Thus, β captures the impact of prosociality on SWB in low-social capital cities and γ captures this effect in high-social capital cities. X_i is a vector of individual characteristics, which includes age, age squared, gender, having children, health risk, household size, household income, education, occupation, household composition, and housing type. Y_c is a vector of regional characteristics and includes population density, average age, proportion of elderly individuals, proportion of foreigners, and average taxable income. Prefectural fixed effects Z_p also flexibly control for the effects of prefecture-level policies and the COVID-19 infection situation.

We estimate the equation using data from each year and analyze changes in impact during the pandemic by comparing the coefficients β and γ for each year. The problem with this specification is that it does not control for endogeneity caused by the unobserved characteristics of individuals. For example, the results could be biased by specific

characteristics associated initially with individuals with high or low SWB. Therefore, SWB in the baseline year of 2019 is included as an explanatory variable and is estimated using data collected after 2020. Therefore, the impact of the relationship between individual personality and local norms on SWB is identified after controlling for the original SWB.

4. Results

4.1. The effect of prosociality on SWB before and after the pandemic

Before the main analysis, we independently present the impact of individual prosociality and community social capital on SWB as a baseline. Table 2 shows the results estimated without cross terms, and columns (1) through (4) present the results when data from 2019 to 2022, respectively. First, column (1) shows that the higher the level of prosociality is, the higher the SWB, regardless of the pandemic. The impact of the control variables on SWB is consistent with the findings of previous studies and intuition, underscoring the validity of our SWB measures. Columns (2) through (4) capture the impact of the postpandemic outbreak. The impact of prosociality on SWB is the same as before the pandemic but with slightly greater heterogeneity due to prosociality. The coefficient of social capital is slightly larger but not statistically significant.

	Baseline				Controlling 2019 SWB		
	2019	2020	2021	2022	2020	2021	2022
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Social capital	0.024	0.039	0.033	0.044	0.058*	0.020	0.025
	(0.026)	(0.025)	(0.021)	(0.035)	(0.031)	(0.029)	(0.040)
SWB 2019					0.718***	0.647***	0.645***
					(0.008)	(0.007)	(0.009)
Prosociality							
Lowest	-0.374**	-0.525***	-0.289*	-0.684***	-0.277	-0.234	-0.430***
	(0.162)	(0.140)	(0.162)	(0.166)	(0.176)	(0.166)	(0.158)
Low	-0.074	-0.097	-0.036	-0.080	0.003	-0.031	-0.070
	(0.059)	(0.085)	(0.085)	(0.114)	(0.077)	(0.088)	(0.104)
High	0.418***	0.399***	0.407***	0.373***	0.126***	0.159***	0.124***
	(0.032)	(0.028)	(0.022)	(0.027)	(0.038)	(0.025)	(0.029)
Highest	0.568***	0.617***	0.653***	0.618***	0.200***	0.284***	0.290***
	(0.033)	(0.045)	(0.036)	(0.042)	(0.043)	(0.037)	(0.045)
Individual characteristics							
Age	-0.112***	-0.119***	-0.118***	-0.115***	-0.031***	-0.049***	-0.041***
	(0.006)	(0.007)	(0.005)	(0.009)	(0.009)	(0.009)	(0.010)
Age-squared	0.001***	0.001***	0.001***	0.001***	0.0004***	0.0005***	0.0005***
	(6.2×10^{-5})	(7.22×10^{-5})	(5.03×10^{-5})	(9.72×10^{-5})	(9.71×10^{-5})	(0.0001)	(0.0001)
Chronic diseases	-0.196***	-0.220***	-0.205***	-0.211***	-0.083***	-0.093**	-0.103***
	(0.032)	(0.031)	(0.033)	(0.034)	(0.029)	(0.038)	(0.030)
Household Size	0.038**	0.064***	0.050***	0.082***	0.014	0.001	0.038**
	(0.018)	(0.018)	(0.017)	(0.018)	(0.020)	(0.017)	(0.018)
Regional characteristics							
Population density	0.076	0.103*	-0.020	0.036	0.075	-0.045	0.023
	(0.047)	(0.052)	(0.037)	(0.046)	(0.051)	(0.032)	(0.064)
Average age	-0.010	-0.077**	-0.071**	-0.079**	-0.046	-0.066**	-0.092**
	(0.030)	(0.032)	(0.031)	(0.033)	(0.033)	(0.030)	(0.037)
Ratio of elderly people	0.012	0.043**	0.038*	0.042**	0.021	0.033*	0.049**
	(0.018)	(0.018)	(0.019)	(0.019)	(0.018)	(0.017)	(0.023)
Ratio of foreigner	0.748	-0.957	0.446	0.668	-1.15	-1.81	0.222
	(0.771)	(1.42)	(1.22)	(1.40)	(1.60)	(1.13)	(1.48)
Average taxable income	0.075**	0.046	0.051	0.047**	0.028	0.059**	0.063***
	(0.031)	(0.032)	(0.032)	(0.020)	(0.023)	(0.022)	(0.020)
Other individual characterist	YES	YES	YES	YES	YES	YES	YES
Prefecture fixed effect	YES	YES	YES	YES	YES	YES	YES
Observations	25,017	24,122	23,733	19,084	14,147	14,102	14,102
Adjusted R-squared	0.1382	0.1265	0.1218	0.1313	0.5179	0.4650	0.4690

Table 2. Changes in the impact of prosociality on SWB

Note: Standard errors appear in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Columns (5) through (7) present the results of estimating the impacts of various variables on SWB from 2020-2022, with prepandemic 2019 SWB as the control variable. According to the results, the importance of social capital has increased slightly since the pandemic started. Especially in December 2020, when infection was most severe before the vaccine was developed, high norms of regional cooperation significantly increased SWB. Additionally, even after controlling for prepandemic SWB, prosociality significantly affected SWB after the pandemic. This implies that the difference in SWB by prosociality increased after the pandemic, meaning that the prosocial group is happier and that the non-prosocial group is unhappier.

4.2. The effect of the relationship between prosociality and social capital on SWB

Table 3 reports the estimation results considering the cross terms of prosociality and social capital. Columns (1) through (4) present the estimated results without controlling for prepandemic SWB. Column (1), which shows the prepandemic results, indicates that more prosocial individuals had higher SWB. Less prosocial individuals tend to have lower SWB, although not statistically significantly, in cities with high social capital. Columns (2) and (3) capture changes in SWB in the first and second years of the pandemic, respectively. Similar to the results in Table 2, they show a gradual increase in differences in SWB due to prosociality. Notably, in 2021, the SWB of non-prosocial individuals declined in cities with low social capital, whereas the SWB of those in cities with high social capital increased significantly. The results suggest that even non-prosocial individuals in high-social capital cities may benefit from low infection risk by free-riding on the preventive behaviors of their surroundings. Additionally, individuals with high prosociality do not experience a decrease in SWB even if the community's social capital

is low. Column (4) shows the results for 2022, when the pandemic had moderated; the differences due to prosociality are greater. However, in contrast to columns (1) through (3), the SWB of individuals with moderate prosociality in cities with high social capital declines. Although unobserved heterogeneity is not controlled for and should be interpreted with caution, given the situation in 2022, behavioral fatigue due to excessive preventive behavior may be the cause (Brodeur et al., 2021; Sibony, 2020). Additionally, the consistently low SWB of non-prosocial individuals in cities with low social capital after the pandemic may be due to the failure to achieve a desirable level of prevention.

	Baseline				Controlling 2019 SWB			Using 2019 prosociality		
	2019	2020	2021	2022	2020	2021	2022	2020	2021	2022
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Prosociality										
Lowest	-0.206	-0.482	-0.581**	-0.761***	-0.186	-0.319	-0.463**	-0.286	-0.541**	-0.561**
	(0.235)	(0.297)	(0.217)	(0.241)	(0.226)	(0.209)	(0.228)	(0.226)	(0.245)	(0.248)
Low	-0.059	-0.114	0.048	0.094	-0.042	-0.030	0.037	0.008	0.034	0.045
	(0.086)	(0.098)	(0.106)	(0.137)	(0.103)	(0.073)	(0.141)	(0.102)	(0.121)	(0.149)
High	0.452***	0.429***	0.425***	0.432***	0.140***	0.136***	0.148***	0.120***	0.158**	0.210***
	(0.045)	(0.036)	(0.032)	(0.038)	(0.033)	(0.026)	(0.042)	(0.044)	(0.063)	(0.045)
Highest	0.574***	0.604***	0.669***	0.671***	0.200***	0.267***	0.308***	0.180***	0.191***	0.285***
	(0.053)	(0.071)	(0.044)	(0.049)	(0.050)	(0.053)	(0.071)	(0.048)	(0.068)	(0.053)
Prosociality × High SC										
Lowest	-0.323	-0.083	0.544**	0.151	-0.130	0.253	0.095	-0.034	0.556*	0.443
	(0.259)	(0.422)	(0.264)	(0.276)	(0.298)	(0.324)	(0.321)	(0.302)	(0.327)	(0.327)
Low	-0.030	0.039	-0.162	-0.335*	0.062	0.015	-0.208	-0.025	-0.098	-0.152
	(0.135)	(0.157)	(0.135)	(0.170)	(0.125)	(0.125)	(0.179)	(0.133)	(0.106)	(0.178)
High	-0.068	-0.058	-0.036	-0.118**	-0.012	0.047	-0.045	-0.085	-0.044	-0.131**
	(0.053)	(0.069)	(0.045)	(0.054)	(0.054)	(0.042)	(0.061)	(0.058)	(0.066)	(0.053)
Highest	-0.011	0.027	-0.031	-0.108	0.033	0.040	-0.051	-0.023	0.037	-0.134*
	(0.064)	(0.092)	(0.059)	(0.073)	(0.075)	(0.054)	(0.080)	(0.068)	(0.076)	(0.068)
Social capital	0.068	0.066	0.056	0.135**	0.034	-0.020	0.065	0.086**	0.037	0.120**
	(0.051)	(0.055)	(0.035)	(0.062)	(0.041)	(0.036)	(0.063)	(0.042)	(0.044)	(0.046)
SWB in 2019					0.699***	0.634***	0.643***	0.705***	0.638***	0.642***
					(0.008)	(0.007)	(0.009)	(0.008)	(0.006)	(0.008)
Individual characteristics	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Regional characteristics	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Prefecture FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	25,017	24,122	23,733	19,084	20,532	17,635	14,602	19,760	17,214	15,042
Adjusted R-squared	0.1382	0.1264	0.1219	0.1314	0.5031	0.4518	0.4661	0.5061	0.4498	0.4606

Table 3. Changes in the impact of the relationship between prosociality and social capital on SWB

Note: Standard errors appear in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

As in Table 2, columns (5) through (7) show the estimated results controlling for prepandemic SWB. The overall pattern is consistent with columns (2) through (4) and show that as the pandemic continues, the SWB of less prosocial individuals in cities with low social capital decreases. In contrast, the SWB of less prosocial individuals in high social capital cities is relatively high, although the statistical significance is low. Additionally, when controlling for prepandemic SWB, we find that effects such as behavioral fatigue are weakened.

In previous estimates, we estimated the impact of a given year's prosociality on SWB for that year. As Appendix Table A1 shows, prosociality does not vary substantially within individuals, but it increases or decreases to some extent. Therefore, there may be bias due to prosocial changes during the pandemic. Columns (8) through (10) therefore restrict the sample to monitors who have continued since 2019 and estimate them using prepandemic measures of prosociality. These results are consistent with the main results and with those of previous studies showing that SWB is less likely to decline in cities with high social capital because of better access to informal care (Laurence & Kim, 2021).

4.3. Robustness checks (placebo test)

In this section, we check the robustness of the main results using a measure different from prosociality. We have several concerns with our measure of prosociality. Because prosocial characteristics correlate with various other characteristics, our measure may become a proxy variable for other characteristics. It may also capture the characteristics

of individuals who always respond positively or negatively to personality questions. Therefore, we use other measures of personality instead of prosociality in the estimation.

Appendix Tables A3-5 present the estimation results when family bonding, active, and optimistic are used as personality measures, respectively. The personality that values family bonds was created based on a 5-level response to the item, "*It is very important to keep the family together*". The active personality was created based on the response to the item, "*I think I am someone who acts before thinking*". The active personality was created based on the response to the item, "*I am someone who does not mind so much if I cannot do what I expect*". The results were consistent with the intuition that the more family-oriented, active, and optimistic a person was, the higher his or her SWB. This result confirms the validity of our questionnaire's personality measures. It was also verified that the impact of these characteristics is unrelated to community social capital. Therefore, factors other than prosociality do not explain the main results.

4.4. Consideration of mechanism

To examine the mechanism by which the relationship between individual prosociality and community social capital affects SWB, we conduct an analysis using the monitors' outgoing behavior. This estimation uses a measure of outdoor consumption activity instead of SWB as the explained variable. The results are shown in Table 4, with the exact basic specifications shown in Table 2. Column (2) shows that in 2020, when the risk of infection was highest before the development of the vaccine, the difference in outdoor consumption activity by social capital was more significant. After 2021, the primary infection control strategy changed from social distancing to vaccination and limiting the number of people in the room. Therefore, it is plausible that there is no difference in

outdoor consumption activity depending on social capital.

	Baseline				Controlling 2019 purchases		
	2019	2020	2021	2022	2020	2021	2022
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Prosociality							
Lowest	1.019	-6.902***	3.996	3.524	-2.216*	-0.506	-1.623
	(2.708)	(2.118)	(3.366)	(2.387)	(1.132)	(1.816)	(1.708)
Low	-2.013	1.734	-0.949	-0.642	0.273	-1.617	-0.976
	(1.439)	(1.853)	(1.833)	(1.739)	(0.914)	(1.712)	(1.567)
High	0.126	-0.525	-0.039	0.961	-0.320	-0.109	0.729**
	(0.599)	(0.813)	(0.531)	(0.603)	(0.385)	(0.373)	(0.342)
Highest	1.486**	0.761	1.347	1.787*	-0.166	0.828	1.041
	(0.733)	(0.830)	(0.810)	(0.996)	(0.414)	(0.603)	(0.682)
Prosociality × High SC							
Lowest	0.389	8.062**	-4.554	-1.888	1.342	1.268	3.506
	(3.050)	(3.558)	(4.350)	(3.997)	(2.081)	(2.405)	(3.306)
Low	3.005*	-1.812	0.365	-0.265	-0.233	1.047	-0.236
	(1.660)	(2.692)	(2.143)	(2.266)	(1.362)	(1.891)	(2.182)
High	1.309	0.875	0.387	-0.628	0.738	1.430**	0.374
	(0.841)	(1.022)	(1.076)	(1.132)	(0.481)	(0.559)	(0.645)
Highest	0.883	0.662	-0.397	-0.972	0.436	0.360	-0.972
	(1.190)	(1.121)	(1.321)	(1.591)	(0.593)	(0.739)	(1.352)
Social capital	-1.004	-1.221	-1.148	-0.487	-0.935*	-1.492***	-1.343**
	(0.827)	(0.896)	(1.070)	(0.993)	(0.497)	(0.513)	(0.607)
Outdoor purchases in 2019					0.887***	0.837***	0.791***
					(0.004)	(0.006)	(0.008)
Individual characteristics	YES	YES	YES	YES	YES	YES	YES
Regional characteristics	YES	YES	YES	YES	YES	YES	YES
Prefecture FE	YES	YES	YES	YES	YES	YES	YES
Observations	25,013	24,113	23,727	19,077	20,523	17,631	14,596
Adjusted R-squared	0.1496	0.1310	0.1322	0.1068	0.7790	0.6971	0.6424

Table 4. Effects of the relationship between prosociality and social capital on outdoor consumption activity

Note: Standard errors appear in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Columns (5) through (7) also present estimates controlling for 2019 outdoor consumption activity. Although less statistically significant, the results show decreased

outdoor activity in 2020 in cities with lower social capital. This estimation requires caution in interpretation because it has solid assumptions and many limitations and is not highly statistically significant. However, the results provide suggestive evidence of the channels through which the relationship between social capital and prosociality affects SWB during the pandemic.

5. Conclusion

Using original survey data from Japan, this study examines the impact of individual personality and community norms on changes in SWB during the pandemic. The key findings of this study are as follows. First, the results are consistent with previous studies that showed that the more prosocial a person was, the higher his or her level of SWB. Second, the relationship between individual prosociality and community social capital had no significant effect on SWB before the pandemic. In contrast, after the pandemic, people with low prosociality were found to be significantly affected by community social capital. A suggestive evidence-based interpretation suggests that non-prosocial individuals may increase their SWB by free-riding in areas with high social capital.

Previous studies have pointed to the possibility of effectively solving collective action problems by relying on community social capital and norms (e.g., Bartscher et al., 2021; Durante et al., 2021). However, the most prosocial people continue to pay the costs. Therefore, the longer the problem persists, the unhappier a prosocial individual becomes, which may reduce his or her prosociality and normative behavior can be reduced. The reliance on norms may work for short-term shocks such as natural disasters. However, for problems such as infectious diseases and climate change, free-riding behavior can undermine people's prosociality, altruism, and social capital (Wu et al., 2022). Therefore,

policymakers must develop policies that emphasize mutual trust and social capital rather than simply overcoming post-emergency challenges and regulating disadvantageous activities. The accumulation of social capital and mutual trust can be a source of economic growth, and this accumulation may be substantial in the long term (Algan & Cahuc, 2013; Knack & Keefer, 1997).

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Appendix

Table A1. Changes in prosociality from 2019 to 2021

		Prosociality (2021)					
		Lowest	Low	Middle	High	Highest	Total
Prosociality (2019)	Lowest	59	28	64	36	18	205
	Low	22	90	202	148	18	480
	Middle	48	201	2,170	1,244	120	3,783
	High	36	138	1,554	6,439	1,062	9,229
	Highest	21	32	203	1,359	1,556	3,171
	Total	186	489	4,193	9,226	2,774	16,868

Note: Monitors answering both the 2019 and 2021 surveys are included in the sample.

Table A2. Comparison of surviving and dropout monitors

	Surviving monitors	Dropout monitors			
		2020		2021	
	Mean	Mean	t value	Mean	t value
Individual characteristics					
Subjective well-being	6.270	6.329	1.903	6.366	2.714
Prosociality	3.868	3.850	-1.284	3.884	1.029
Age	47.008	41.386	-20.640	44.767	-7.449
Male	0.496	0.532	4.646	0.506	1.188
Children	0.584	0.476	-13.737	0.535	-5.522
Household Size	2.929	3.005	3.518	2.895	-1.456
Chronic diseases	0.213	0.200	-2.033	0.210	-0.384
Household income	6.109	5.810	-4.471	5.780	-4.636
Regional characteristics					
Social capital	-1.041	-1.043	-0.258	-1.051	-0.924
Population density	0.430	0.433	0.354	0.428	-0.282
Average age	46.106	46.099	-0.191	46.066	-0.905
Ratio of elderly people	26.155	26.126	-0.420	26.032	-1.556
Ratio of foreigner	0.014	0.014	-0.584	0.014	0.950
Average taxable income	3.290	3.297	0.726	3.299	0.811
Number of monitors	17,101	5,220		3,720	

Table A3. Placebo test using other personality types (family unity)

	Baseline				Controlling 2019 SWB		
	2019	2020	2021	2022	2020	2021	2022
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Personality							
Lowest	-0.458***	-0.543***	-0.513***	-0.532**	-0.235	-0.258*	-0.107
	(0.124)	(0.137)	(0.150)	(0.209)	(0.154)	(0.133)	(0.181)
Low	-0.081	-0.043	-0.107	-0.020	0.019	-0.067	-0.032
	(0.116)	(0.089)	(0.077)	(0.085)	(0.101)	(0.060)	(0.088)
High	0.446***	0.516***	0.458***	0.439***	0.193***	0.169***	0.169***
	(0.050)	(0.041)	(0.040)	(0.037)	(0.033)	(0.036)	(0.038)
Highest	0.818***	0.974***	0.947***	0.936***	0.380***	0.419***	0.388***
	(0.042)	(0.042)	(0.053)	(0.047)	(0.042)	(0.044)	(0.042)
Personality × High SC							
Lowest	0.110	-0.227	-0.063	-0.174	-0.159	0.020	-0.084
	(0.173)	(0.198)	(0.255)	(0.299)	(0.185)	(0.220)	(0.216)
Low	-0.016	0.126	0.064	-0.056	0.153	0.005	-0.096
	(0.169)	(0.108)	(0.137)	(0.157)	(0.122)	(0.114)	(0.158)
High	0.041	0.012	0.025	-0.001	-0.009	0.065	0.014
	(0.062)	(0.048)	(0.052)	(0.057)	(0.041)	(0.042)	(0.054)
Highest	0.059	-0.048	-0.034	-0.108	-0.050	-0.040	-0.091
	(0.057)	(0.053)	(0.070)	(0.067)	(0.042)	(0.057)	(0.063)
Social capital	-0.022	0.042	0.028	0.076	0.045	-0.002	0.048
	(0.054)	(0.040)	(0.042)	(0.059)	(0.033)	(0.032)	(0.059)
SWB in 2019					0.690***	0.625***	0.637***
					(0.009)	(0.007)	(0.009)
Individual characteristics	YES	YES	YES	YES	YES	YES	YES
Regional characteristics	YES	YES	YES	YES	YES	YES	YES
Prefecture FE	YES	YES	YES	YES	YES	YES	YES
Observations	25,017	24,122	23,733	19,084	20,532	17,635	14,602
Adjusted R-squared	0.1537	0.1467	0.1409	0.1469	0.5060	0.4552	0.4674

Note: Standard errors appear in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The personality variable is based on responses to the item “It is essential to keep the family together” and is a five-level discrete variable that takes the value of 5 for agreement and 1 for disagreement.

Table A4. Placebo test using other personality types (activist)

	Baseline				Controlling 2019 SWB		
	2019	2020	2021	2022	2020	2021	2022
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Personality							
Lowest	-0.200***	-0.216***	-0.107*	-0.101	-0.102*	-0.006	0.006
	(0.058)	(0.068)	(0.057)	(0.075)	(0.053)	(0.070)	(0.070)
Low	0.144***	0.064*	0.099**	0.105**	0.006	0.021	0.025
	(0.045)	(0.034)	(0.038)	(0.046)	(0.032)	(0.034)	(0.036)
High	0.210***	0.294***	0.228***	0.251***	0.134***	0.059	0.075
	(0.041)	(0.039)	(0.070)	(0.080)	(0.046)	(0.055)	(0.065)
Highest	0.325***	0.316***	0.433***	0.402***	0.138	0.197	0.206*
	(0.090)	(0.101)	(0.112)	(0.088)	(0.095)	(0.124)	(0.113)
Personality × High SC							
Lowest	0.109	0.046	0.026	-0.030	0.024	0.018	-0.085
	(0.075)	(0.086)	(0.083)	(0.092)	(0.074)	(0.095)	(0.084)
Low	-0.039	0.045	0.014	0.015	0.043	-0.014	-0.018
	(0.051)	(0.048)	(0.055)	(0.058)	(0.040)	(0.043)	(0.036)
High	0.062	-0.085	0.041	0.058	-0.071	0.018	0.009
	(0.046)	(0.080)	(0.097)	(0.091)	(0.080)	(0.074)	(0.078)
Highest	0.090	0.037	0.124	-0.013	-0.042	-0.048	-0.127
	(0.135)	(0.140)	(0.178)	(0.167)	(0.123)	(0.199)	(0.190)
Social capital	0.008	0.034	0.014	0.035	0.032	0.016	0.045
	(0.034)	(0.038)	(0.033)	(0.037)	(0.035)	(0.025)	(0.038)
SWB in 2019					0.703***	0.640***	0.649***
					(0.008)	(0.007)	(0.008)
Individual characteristics	YES	YES	YES	YES	YES	YES	YES
Regional characteristics	YES	YES	YES	YES	YES	YES	YES
Prefecture FE	YES	YES	YES	YES	YES	YES	YES
Observations	25,017	24,122	23,733	19,084	20,532	17,635	14,602
Adjusted R-squared	0.1296	0.1180	0.1124	0.1218	0.5022	0.44961	0.4636

Note: Standard errors appear in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The personality variable is based on responses to the item “I think I am someone who acts before thinking” and is a five-level discrete variable that takes a value of 5 for agreement and 1 for disagreement.

Table A5. Placebo test using other personality types (easygoing)

	Baseline				Controlling 2019 SWB		
	2019	2020	2021	2022	2020	2021	2022
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Personality							
Lowest	-0.542***	-0.711***	-0.472***	-0.474***	-0.286***	-0.204***	-0.100
	(0.056)	(0.054)	(0.080)	(0.087)	(0.051)	(0.074)	(0.064)
Low	-0.150***	-0.068	-0.139***	-0.152***	-0.036	-0.095***	-0.048
	(0.052)	(0.042)	(0.048)	(0.053)	(0.040)	(0.033)	(0.046)
High	0.350***	0.413***	0.422***	0.414***	0.143***	0.167***	0.167***
	(0.050)	(0.037)	(0.042)	(0.058)	(0.036)	(0.040)	(0.050)
Highest	0.357***	0.684***	0.695***	0.630***	0.468***	0.323***	0.232**
	(0.099)	(0.117)	(0.092)	(0.079)	(0.070)	(0.098)	(0.088)
Personality × High SC							
Lowest	-0.061	0.143	-0.009	-0.015	0.028	-0.025	-0.125
	(0.084)	(0.103)	(0.105)	(0.097)	(0.087)	(0.096)	(0.078)
Low	0.045	-0.039	0.021	0.084	-0.013	-0.034	-0.014
	(0.076)	(0.058)	(0.065)	(0.058)	(0.048)	(0.058)	(0.054)
High	0.047	-0.004	0.072	0.076	0.0008	0.051	0.020
	(0.068)	(0.052)	(0.064)	(0.068)	(0.048)	(0.052)	(0.066)
Highest	0.168	0.128	0.041	0.067	-0.085	0.134	0.175
	(0.125)	(0.174)	(0.156)	(0.123)	(0.099)	(0.149)	(0.122)
Social capital	-0.004	0.026	0.013	0.011	0.034	0.011	0.032
	(0.043)	(0.034)	(0.033)	(0.048)	(0.030)	(0.032)	(0.049)
SWB in 2019					0.694***	0.630***	0.641***
					(0.008)	(0.007)	(0.009)
Individual characteristics	YES	YES	YES	YES	YES	YES	YES
Regional characteristics	YES	YES	YES	YES	YES	YES	YES
Prefecture FE	YES	YES	YES	YES	YES	YES	YES
Observations	25,017	24,122	23,733	19,084	20,532	17,635	14,602
Adjusted R-squared	0.1431	0.1347	0.1292	0.1370	0.5052	0.4542	0.4663

Note: Standard errors appear in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The personality variable is based on responses to the item, “I am someone who does not mind so much if I cannot do what I expect” and is a five-level discrete variable that takes a value of 5 for agreement and 1 for disagreement.