Social Capital and Preferences across Time: Trustlab Japan

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Abstract

This paper studies how experimental and survey measures of trust change over time for individuals and how these changes are correlated with changes in behavioral measures of trustworthiness, altruism, reciprocity, cooperation, and risk tolerance. In the Trustlab Japan project, panel data sets for different target populations that follow the same individuals with online experiments and surveys were collected by the Trustlab Platform in Japanese. This platform is internationally comparable and includes four incentivized tasks for the trust game, the public goods game, the dictator game, and a lottery choice. The data sets in the project are the only data which have both experimental and survey measures of trust for the same individuals for two or more points in time. This paper analyzes three panel data sets with at least 250 samples from this project. The survey measures of trust are less volatile over time than the experimental measures of trust and other behavioral measures. The change in the experimental measure of trust is positively correlated with each of the changes in social behavioral measures of trustworthiness, altruism, reciprocity, and cooperation with only a few exceptions of statistically insignificant correlations. The change in each of our two survey measures of trust is less positively correlated (both in terms of the smaller magnitude of correlation and of less frequent significance) with the changes in

these social behavioral measures. The change in the experimental and survey measure of trust is sometimes positively correlated with the change in risk tolerance. There is evidence that part of these changes was caused by COVID-19 for people living in larger sized metropolitan areas. These results are consistent with a class of models in which social capital affects preferences and preference shocks also affect social capital.

Keywords: dictator game, trust game, public goods game, lottery choice
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1 Introduction

Research questions of this paper is threefold. First, how do experimental and survey measures of trust change over time for individuals as COVID-19 and other shocks come to the economy? We view trust as one type of social capital. Social capital was defined by Putnam (1993) as "networks, norms, and trust" and we mainly focus on trust in this paper because trust has been most extensively studied in experimental economics among these. Second, how do experimental measures of trustworthiness, altruism (measured as giving in the dictator game), reciprocity, cooperation, and risk tolerance change as trust changes? In models in which individual social and risk preferences do not change over time and changes of behavioral measures are classical measurement errors, the change in trust will not be correlated with changes in risk tolerance and altruism. In models in which social capital such as beliefs about other people's kindness affects social preferences (e.g.,Rabin (1993) and Dufwenberg and Kirchsteiger (2004)), trust will be correlated with changes in altruism, reciprocity, cooperation, and trustworthiness. Third, how did COVID-19 affect changes in trust and behavioral measures for different groups of people?

A motivation for these research questions is the importance of the **community mechanism** that complements the **market mechanism** and the **power mechanisms** (a mechanism that can, for example, coerce people to pay taxes because of the power of the legal system)in an economic system during an era of crisis as Ogaki (2022) discusses. The community mechanism is defined by Ogaki (2022) as a mechanism for resource allocation by which at least one person proposes voluntary cooperation, and the proposal is not rejected. While this community mechanism can function alongside homo economicus in win-win situations, it can be further activated with social preferences for altruism and reciprocity and with social capital such as trust. An example is the Global Republic, which is an NPO in a broad

sense. was founded in April 2021 with the ideal of changing the world with the community. An example of a crisis: the number and population share of the elderly who cannot effectively use market mechanisms alone due to the natural decline of cognitive abilities and dementia caused by aging. Because Japan's aging is very rapid and its community mechanism can be stronger than many other countries' counterpart, it is important to study Japan.

This paper uses Trustlab Japan project's data sets. In the main Trustlab Project, a representative data set (in the sense of representativeness for sex, age, and income) for 1,000 or more individuals is collected in eight countries (France, Germany, Italy, Japan, Korea, Slovenia, UK, and US). Murtin et al. (2021) provided evidence that these measures help explain key political preferences, such as preferences for redistribution, trust in government, and attitudes towards migrants, in these eight countries.[1] Some authors of this paper are core members of the main Trustlab project in Japan. Our Trustlab Japan project extends the main projects of Trustlab in two dimensions. First, instead of the cross-sectional data in the main project, we collect panel data by following the same individuals to investigate the dynamics of these behavioral measures. Second, we use the Trustlab platform to conduct online studies with different target populations for the purpose of comparing results for different populations. We have collected four sets of panel data. The first is in line with the OECD's main project and in that a representative sample in the sense of representative in age, sex, and income was recruited from panel of registered participants for an internet research company in the first wave. This data set is called the OECD panel hereafter. The second set is called the Japan Social Capital Experimental Study (JSCES), and the subjects of the first wave were recruited by sending invitations to all the subjects of Japan Household Panel Survey (JHPS/KHPS), which is a panel survey for a representative sample collected by the Panel Data Research Center at Keio University. This is to check if results from the panel of the internet research company for the OECD data may result in significantly different results from the JHPS/KHPS sample. For example, motivations for registering the panel of internet research company which typically conducts marketing research may be different from those for participating in the academic research of the JHPS/KHPS. The third set is for students at Osaka University (OU) given that the standard subjects of economic experiments has been university students. [2] The fourth data set is for core participants of the

[1] Aassve et al. (2018) presented data and the peculiarities of Trustlab Italy, and Cetre et al. (2020) studied ethic in-group bias in trust games in a module on ethnic discrimination using Trustlab projects in the US and Germany.

[2] Hanaki et al. (2022) showed evidence that there is little significant difference between online and lab experimental results for their student population when the Trustlab Japan

Global Republic (GR), which is a nonprofit organization (broadly defined). See /citetOgaki2022 for an explanation that members of the GR can be seen as experts in the community mechanism. For each data set, invitations to the subsequent waves are sent to the participants of the first wave. We focus on the first three panel data sets with at least 250 samples in this paper.

This paper uses the three waves of the OECD, two waves of the JSCES, and two waves of OU panel data. The three waves of the OECD panel data set were as follows:

- Wave 1: January–February 2020 (before COVID-19 severely struck Japan) (N=2504)
- Wave 2: June–July 2020 (N=1467)
- Wave 3: September–October 2021 (N=1012)

We constructed three sub-panel data sets for Waves 1 and 2, Waves 1 and 3, and Waves 2 and 3. We use the polling company's ID, birth year, birth month, sex, father's education, and mother's education to construct sub-panel data for Wave 1 and Wave 2 (N=1026 for the experimental part).[3] We were not given the polling company's ID for Wave 3. So, we use, birth year, birth month, sex, father's education, and mother's education to construct sub-panel data set for Waves 1 and 3 (N=496) and sub-another panel data set for Waves 2 and 3 (N=395).

The two waves of the JSCES were as follows:

- Wave 1: September–November 2022 (N=893)
- Wave 2: October–November 2023 (N=511)

Because of some missing data, we remove some subjects to construct JSCES panel data (N=401).

The two waves of the OU were as follows:

- Wave 1: October 2022 (N=510)
- Wave 2: October 2023 (N=324)

platform is used.

[3]It is possible that a person who participated in Wave 1 give the invitation and the polling company's ID to another person to participate in Wave 2.

Because of some missing data, we remove some subjects to construct OU panel data (N=253).

To the best of our knowledge, the four sets of Trustlab Japan are the only panel data sets of individuals that contain both experimental measures of trust from trust game and survey measures of trust for the two or more points of time.[4] Both types of measures have been used in the literature.

2 Literature Review

Chuang and Schechter (2015) surveyed the literature and showed that many studies had shown that experimental measures of social and risk preferences and trust change over time for individuals. They also had their panel data from rural Paraguay of both game-based (some are incentivised, and others are hypothetical) and survey measures of social preferences and trust (which they call social preferences while we call social capital). They showed that survey measures are more stable than game-based measures of social preferences in their data, that shocks such as theft do not affect game-based measures of social preferences.

Hanaoka et al. (2018) used hypothetical game-based measures of risk preferences to show that men who experienced greater intensity of the 2011 Great East Japan Earthquake. These men became more risk tolerant a year after the Earthquake, were persistently more risk tolerant five years after the Earthquake and gambled more.

3 Data

In each of the three waves of the OECD, JSCES, and OU panel data sets, the online experiments with surveys are conducted using the platform for the Japanese version of the OECD's Trustlab project (see Murtin et al., 2018), which is programmed using oTree (Chen et al., 2016).

The platform contains four tasks with monetary incentives as well as a non-incentivized questionnaire. The four incentivized tasks are for the trust game, the public goods game, the dictator game, and a risky lottery choice, implemented in order before the non-incentivized questionnaire. The game tasks employ the strategy described below.

In the trust game, a participant is randomly paired with another participant. One is chosen randomly as the first mover, and another as the second

[4]Chuang and Schechter (2015) compared experimental and survey measures of risk, time, and social preferences but conducted trust game only once in their data set.

mover. Each participant receives an endowment of 1,000 JPY. The first mover then decides to send an amount $X \in [0, 1000]$ from their endowment, which will be tripled by the experimenter, to the second mover. The second mover then decides to send back an amount $Y \in [0, 1000 + 3X]$ to the first mover. Participants are then asked (a) how much, out of the initial 1,000 JPY endowment, would they send to their randomly chosen partner if they are chosen as the first mover, as well as (b) how much they would return, conditional on the each of the 11 amounts, $\in \{0, 100, 200, \ldots, 900, 1, 000\}$ JPY, sent by the first mover, to the first mover when chosen as the second mover. Participants were also asked how much they expect a randomly chosen second mover, when they as the first mover have sent 500 JPY, would send back (out of 2,500 JPY). This question, however, is not incentivized.

In the public goods game, a group of four participants is randomly created. Each has a 1,000 JPY endowment. Each participant then decides to invest $I^i \in [0, 1000]$ in a project. The amount not invested is retained by each of the participants. The amount invested by the four participants is then multiplied by 1.6, and the resulting sum divided and returned equally to each participant, regardless of the amount invested. Participants are asked (a) how much they would invest in the project without knowing how much others in the group have invested, and (b) how much they would invest in the project if the average investment of the others is $\{0, 100, 200, \ldots, 900, 1000\}$ JPY.

In the dictator game, each participant is randomly paired with another. Participants are then asked if they were chosen as the dictator, how much of a 1,000 JPY endowment they would give to a randomly paired participant. If chosen to be the recipient, they receive the amount given by the dictator. Finally, in the risky lottery choice, each participant is asked to choose from one of six lotteries: 1:(800, 800), 2:(700, 1000), 3:(600, 1200), 4:(500,1400), 5:(400, 1600), and 6:(100, 1900), where each lottery would pay one of the two amounts in parenthesis (both in JPY) with equal probability.

After the experiment, one of the four tasks is assigned randomly (conditional that the required number of participants can be assigned to form a group) to participants to compute their reward. Participants received, in addition to the participation fee of 500 JPY, the amount based on their own decisions as well as the decisions of others in their randomly formed group (or pair). The payment was in cash for the laboratory experiment and in the form of an Amazon Gift Card (e-mail version) for the online experiment. Participants were informed of the method of payment as well as the amount of the participation fee when registering for the experiment.

Table 1: Definitions of the Seven Experimental Measures

Trust (Tr–E)	Amount transferred as first mover in the trust game
Trustworthiness (Trw1)	Average amount transferred back as second mover in the trust game
Trustworthiness2 (Trw2)	Average share of available resource transferred back as second mover in the trust game
Altruism (Altm)	Amount given in the dictator game
Cooperation (Cprn)	Amount invested in the public goods game unconditional on the average investment of others
Reciprocity (Rcpy)	Average difference between the conditional amount invested in the public goods game and the average investment of others
Risk Tolerance (Rsts)	Choice in risky lottery (1=no risk and 5=the riskiest lottery)

4 Panel Data Analysis

4.1 Measures of Social Capital and Social and Risk Behaviors

Below, we report the results of the three tasks, namely, the dictator, trust, and public goods games, with monetary incentives. Based on the data gathered in these three games, we construct incentivized experimental measures of trust, altruism, risk tolerance, cooperation, reciprocity, trustworthiness, and trustworthiness2. See Table 1 for the definition of each measure.

In addition to the experimental measure of trust (denoted Tr–E), this paper uses two survey measures of trust:

1. Survey measure from the OECD question "On a scale from zero to ten, where zero is not at all and ten is completely, in general how much do you trust most people?": Tr–O

2. Survey measure from Rosenberg's question "Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people?": Tr–R

4.2 Stability of Measures of Social Capital and Social and Risk Behaviors

In this subsection, we investigate stability over time of experimental and survey measures. We first show that stability of our experimental and survey measures is consistent with those in the literature. Table 2 shows correlation coefficients for experimental and survey measures of trust in the OECD, JSCES, and OU data. Chuang and Schechter (2015) showed that correlation coefficients range from -0.38 to 0.68 from their survey of the experimental measures of risk preferences. When they excluded the studies with fewer than 100 observations, the range was from 0.13 to 0.55. From the survey of the literature for the stability of social preferences (they include trust in social preferences), they showed that correlation coefficients range from -0.15 to 0.69. When they excluded the studies with fewer than 100 observations, then only one study remained, with a range of 0.11 to 0.28. The correlation coefficients of our experimental measures of trust range from 0.251 to 0.351 and thus fall into these ranges from the literature. In the data set of Chuang and Schechter (2015), their survey measures of trust range from 0.064 to 0.525. Our survey measures of trust range from 0.530 to 0.669 in Table 2. Our survey measures are higher than theirs but their conclusion that experimental measures tend to be less stable than survey measures is supported our data.

Given that these measures are not very stable over time, Table 3 shows that the percentage of individuals in our OECD, JSCES, and OU panel data whose trust and other behavioral measures decreases, stayed the same, or increased for each pair of three waves. As shown in Table 3, for each measure, the measure of trust decreases between two waves for roughly 35% of the subjects, stayed unchanged for roughly 35% of the subjects, and increased for roughly 30% of the subjects. These results are similar for each of the three pairs of the OECD data. For other behavior measures, these numbers are about the same except that the Trw1 stayed the same for much lower percentage in each data set.

For the subjects whose trust and other measures change, are the changes large or small? To answer this question, for each measure we compute the average of the changes whose measure decreased (increased) and divide it by the average of the standard deviations of the levels of the measure in the JSCES and OU data in Table 4. These changes are large in each pairs of two waves in all three data sets.

Table 2: Correlation Coefficients of the Experimental Measure of Trust with Survey Measures

	Tr–O	Tr–R
OECD W1	0.0912***	0.1075***
	(0.0000)	(0.0000)
OECD W2	0.0853**	0.1331***
	(0.0014)	(0.0000)
OECD W3	0.1300***	0.0934**
	(0.0001)	(0.0032)
JSCES W1	0.0652	-0.0180
	(0.0767)	(0.6239)
JSCES W2	0.1357**	0.1050*
	(0.0022)	(0.0177)
OU W1	0.0687	0.0502
	(0.1211)	(0.2578)
OU W2	0.1810**	0.1124*
	(0.0011)	(0.0432)

Notes: Asterisks indicate that the coefficient is statistically significant at the ***0.1%, **1% and *5% levels.

4.3 Correlations of Measures of Social Capital and Behaviors

Tables 5–9 report correlation coefficients for experimental and survey measures of trust and other experimental measures of behaviorss in the OECD, JSCES, and OU data. In all pairts of two waves in the three data sets, the experimental measure of the change in trust is positively correlated with experimental measures of social behaviors such as trustworthiness, altruism (measured as giving in the dictator game), reciprocity, and cooperation. The survey measures of trust are less correlated with social behavioral measures than the experimental measure of trust.

Table 3: Correlation Coefficients of the Levels of Survey and Experimental Measures over Two Waves

	Tr–O	Tr–R	Tr–E	Trw1	Trw2	Altm	Cprn	Rcpy	Rsts
OECD W1-2	0.549**	0.657**	0.314**	0.325**	0.318**	0.336**	0.401**	0.252**	0.432**
OECD W2-3	0.613**	0.662**	0.356**	0.291**	0.263**	0.361**	0.427**	0.199**	0.400**
OECD W1-3	0.605**	0.675**	0.304**	0.293**	0.301**	0.265**	0.372**	0.118**	0.367**
JSCES W1-2	0.654**	0.635**	0.241**	0.151**	0.164**	0.348**	0.287**	0.199**	0.285**
OU W1-2	0.422**	0.547**	0.397**	0.552**	0.552**	0.439**	0.419**	0.533**	0.565**

Notes: Asterisks indicate that the coefficient is statistically significant at the **1% and *5% levels.

Table 3: Percentage of Individuals in Different Waves

	Tr–O	Tr–R	Tr–E	Trw1	Trw2	Altm	Cprn	Rcpy	Rsts
OECD Waves 1-2									
Decreased	36.37	34.99	32.10	41.92	44.11	27.02	33.60	31.29	29.21
Unchanged	27.48	31.41	39.03	15.13	8.89	45.27	37.07	36.03	42.96
Increased	36.14	33.60	28.87	42.96	47.00	27.71	29.33	32.68	27.83
N	866	866	866	866	866	866	866	866	866
OECD Waves 2-3									
Decreased	30.34	33.71	36.24	40.45	44.10	25.00	34.55	33.99	32.30
Unchanged	29.21	29.78	37.08	13.48	6.74	46.91	32.30	32.02	40.73
Increased	40.45	36.52	26.69	46.07	49.16	28.09	33.15	33.99	26.97
N	356	356	356	356	356	356	356	356	356
OECD Waves 1-3									
Decreased	31.72	31.38	35.86	41.72	45.52	26.55	35.86	31.72	33.10
Unchanged	30.00	36.55	38.97	13.45	7.59	42.41	33.10	30.00	39.66
Increased	38.28	32.07	25.17	44.83	46.90	31.03	31.03	38.28	27.24
N	290	290	290	290	290	290	290	290	290
JSCES Waves 1-2									
Decreased	32.17	34.91	34.16	41.90	43.64	28.18	27.68	33.42	26.93
Unchanged	35.91	30.67	33.67	16.46	15.71	47.63	36.41	25.44	31.42
Increased	31.92	34.41	32.17	41.65	40.65	24.19	35.91	41.15	41.65
N	401	401	401	401	401	401	401	401	401
OU Waves 1-2									
Decreased	42.29	38.74	42.69	50.59	50.99	39.53	48.62	42.69	24.90
Unchanged	32.02	25.69	30.04	22.92	22.53	46.25	25.69	28.85	39.53
Increased	25.69	35.57	27.27	26.48	26.48	14.23	25.69	28.46	35.57
N	253	253	253	253	253	253	253	253	253

Table 5: Average changes of Individuals in Different Waves

	Tr–O	Tr–R	Tr–E	Trw1	Trw2	Altm	Cprn	Rcpy	Rsts
OECD Waves 1-2									
Decreased	-0.93	-0.83	-1.29	-0.93	-0.88	-1.24	-1.12	-1.11	-1.16
Increased	0.93	0.80	1.32	0.85	0.78	1.41	1.23	1.08	1.20
OECD Waves 2-3									
Decreased	-0.90	-0.80	-1.13	-0.85	-0.81	-1.19	-1.21	-1.12	-1.15
Increased	0.92	0.84	1.22	0.85	0.78	1.31	1.00	1.02	1.21
OECD Waves 1-3									
Decreased	-0.89	-0.89	-1.28	-0.91	-0.86	-1.37	-1.15	-1.19	-1.27
Increased	0.93	0.80	1.26	0.87	0.79	1.37	1.15	1.05	1.15
JSCES Waves 1-2									
Decreased	-0.94	-0.91	-1.34	-1.04	-0.95	-1.30	-1.28	-1.16	-1.27
Increased	0.84	0.79	1.30	0.98	0.99	1.42	1.32	0.99	1.25
OU Waves 1-2									
Decreased	-1.11	-0.92	-1.20	-1.02	-1.01	-1.23	-1.06	-0.98	-0.88
Increased	1.07	0.94	0.93	0.63	0.64	1.42	0.88	0.67	1.16
GR Waves 1-2									
Decreased	-1.07	-0.98	-1.17	-1.07	-0.95	-1.63	-1.47	-1.08	-1.45
Increased	1.27	0.81	1.64	1.08	1.06	2.05	1.47	1.30	0.78

Table 6: Panel data correlation analysis of changes in OECD Waves 1-2

	Tr–O	Tr–R	Tr–E	Trw1	Trw2	Altm	Cprn	Rcpy	Rsts
Tr–O	1								
Tr–R	0.104*	1							
Tr–E	0.009	0.022	1						
Trw1	0.110**	0.130**	0.364**	1					
Trw2	0.097*	0.129**	0.403**	0.978**	1				
Altm	0.028	0.064	0.378**	0.251**	0.291**	1			
Cprn	0.100*	0.036	0.354**	0.253**	0.298**	0.342**	1		
Rcpy	0.135**	0.082*	0.139**	0.218**	0.235**	0.219**	0.363**	1	
Rsts	-0.009	-0.025	0.043	0.010	0.001	-0.007	-0.011	-0.004	1

Notes: Asterisks indicate that the coefficient is statistically significant at the **1% and *5% levels.

Table 7: Panel data correlation analysis of changes in OECD Waves 2-3

	Tr–O	Tr–R	Tr–E	Trw1	Trw2	Altm	Cprn	Rcpy	Rsts
Tr–O	1								
Tr–R	0.123*	1							
Tr–E	-0.052	-0.026	1						
Trw1	0.101	-0.048	0.241**	1					
Trw2	0.098	-0.031	0.261**	0.981**	1				
Altm	0.087	0.020	0.331**	0.309**	0.316**	1			
Cprn	0.097	0.002	0.210**	0.339**	0.361**	0.376**	1		
Rcpy	0.036	-0.004	0.126*	0.287**	0.289**	0.324**	0.332**	1	
Rsts	0.002	0.030	0.059	0.033	0.026	0.047	0.018	0.109*	1

Notes: Asterisks indicate that the coefficient is statistically significant at the **1% and *5% levels.

Table 8: Panel data correlation analysis of changes in OECD Waves 1-3

	Tr–O	Tr–R	Tr–E	Trw1	Trw2	Altm	Cprn	Rcpy	Rsts
Tr–O	1								
Tr–R	0.198**	1							
Tr–E	0.135*	0.040	1						
Trw1	0.117*	0.020	0.389**	1					
Trw2	0.122*	0.028	0.407**	0.981**	1				
Altm	0.234**	0.026	0.454**	0.381**	0.416**	1			
Cprn	0.056	0.075	0.331**	0.244**	0.256**	0.410**	1		
Rcpy	0.055	0.014	0.175**	0.313**	0.320**	0.263**	0.318**	1	
Rsts	-0.027	-0.026	0.125*	0.042	0.049	-0.074	-0.104	0.041	1

Notes: Asterisks indicate that the coefficient is statistically significant at the **1% and *5% levels.

Table 9: Panel data correlation analysis of changes in JSCES Waves 1-2

	Tr–O	Tr–R	Tr–E	Trw1	Trw2	Altm	Cprn	Rcpy	Rsts
Tr–O	1								
Tr–R	0.151**	1							
Tr–E	0.060	0.045	1						
Trw1	0.198**	0.094	0.290**	1					
Trw2	0.197**	0.107*	0.294**	0.990**	1				
Altm	0.170**	0.053	0.135**	0.242**	0.252**	1			
Cprn	0.046	-0.049	0.306**	0.183**	0.191**	0.128*	1		
Rcpy	0.074	0.019	0.260**	0.241**	0.243**	0.177**	0.415**	1	
Rsts	0.176**	0.017	0.017	0.174**	0.183**	0.038	-0.052	0.037	1

Notes: Asterisks indicate that the coefficient is statistically significant at the **1% and *5% levels.

Table 10: Panel data correlation analysis of changes in OU Waves 1-2

	Tr–O	Tr–R	Tr–E	Trw1	Trw2	Altm	Cprn	Rcpy	Rsts
Tr–O	1								
Tr–R	0.207**	1							
Tr–E	0.056	0.091	1						
Trw1	0.074	0.002	0.254**	1					
Trw2	0.069	-0.010	0.255**	0.995**	1				
Altm	-0.019	0.117	0.097	0.229**	0.233**	1			
Cprn	-0.044	0.093	0.201**	0.144*	0.149*	0.128*	1		
Rcpy	0.078	0.000	0.113	0.328**	0.328**	0.236**	0.386**	1	
Rsts	0.132*	0.066	-0.052	-0.009	-0.001	0.008	0.048	0.098	1

Notes: Asterisks indicate that the coefficient is statistically significant at the **1% and *5% levels.

4.4 Effects of COVID-19

In order to study whether or not COVID-19 caused some of these changes in trust and other behavioral measures, we uses four variables related COVID-19 in Tables 10–18 as an alternative COVID-19 explanatory variable in OLS regressions for the explained variable as each of the changes in trust and other behavioral measures between the first and second waves of the OECD data. These four COVID-19 variables are the number of infections in the prefecture (Num), the dummy variable of the prefectures for which the Declaration of a State of Emergency in response to the Novel Coronavirus Disease was declared on April 7, 2020 (E), and the dummy variables for the prefectures under special precautions (S), and the dummy variable for E or S. We also use dummy variables for the type of areas where the subject lives: Small metropolitan area, medium metropolitan area, and large metropolitan area with the base as towns and villages and their interaction terms with the COVID-19 variable. At least one of the COVID-19 variables or its interaction term is statistically significant for trust and other behavioral measures except for trustworthiness, giving empirical support that COVID-19 caused some of these changes.

Table 11: Change in Tr-E and COVID-19

	(1)	(2)	(3)
Small metropolitan (Small)	-69.26	-49.00	-49.00
Medium metropolitan (Medium)	-34.68	-18.15	-18.15
Large metropolitan (Large)	-32.20	246.6	246.6
Number of infections (Num)	0.105		
Emergency or specific (EorS)		37.69	
Emergency (E)			7.123
Specific (S)			79.86*
Num x Small	0.558		
Num x Medium	2.489		
Num x Large	0.176		
EorS x Small		-29.31	
EorS x Medium		22.13	
EorS x Large		-299.9*	
E x Small			-21.15
E x Medium			42.86
E x Large			-267.3*
S x Small			-14.67
S x Medium			55.34
S x Large			-349.7**

Notes: Asterisks indicate that the coefficient is statistically significant at the **1% and *5% levels.

Table 12: Change in Tr-O and COVID-19

	(1)	(2)	(3)
Small metropolitan (Small)	-0.488	-0.260	-0.260
Medium metropolitan (Medium)	0.029	0.129	0.129
Large metropolitan (Large)	-0.930**	0.539	0.539
Number of infections (Num)	-0.003		
Emergency or specific (EorS)		-0.015	
Emergency (E)			0.117
Specific (S)			0.849*
Num x Small	-0.817		
Num x Medium	-0.593		
Num x Large	-1.141		
EorS x Small		-0.817	
EorS x Medium		-0.593	
EorS x Large		-1.141	
E x Small			-0.586
E x Medium			-0.214
E x Large			-0.731
S x Small			-1.100
S x Medium			-1.678*
S x Large			-2.056

Notes: Asterisks indicate that the coefficient is statistically significant at the **1% and *5% levels.

Table 13: Change in Tr-R and COVID-19

	(1)	(2)	(3)
Small metropolitan (Small)	-0.297	-0.122	-0.122
Medium metropolitan (Medium)	-0.091	-0.173	-0.173
Large metropolitan (Large)	-0.657**	-0.250	-0.250
Number of infections (Num)	0.003		
Emergency or specific (EorS)		0.055	
Emergency (E)			0.107
Specific (S)			-0.019
Num x Small	0.008		
Num x Medium	-0.000		
Num x Large	0.022**		
EorS x Small		-0.134	
EorS x Medium		0.127	
EorS x Large		0.161	
E x Small			-0.118
E x Medium			-0.005
E x Large			0.211
S x Small			-0.246
S x Medium			0.789
S x Large			-0.171

Notes: Asterisks indicate that the coefficient is statistically significant at the **1% and *5% levels.

Table 14: Change in Altruism and COVID-19

	(1)	(2)	(3)
Small metropolitan (Small)	-26.21	-42.15	-42.15
Medium metropolitan (Medium)	-60.61	-28.66	-28.66
Large metropolitan (Large)	-20.99	89.64**	89.64**
Number of infections (Num)	1.535		
Emergency or specific (EorS)		15.13	
Emergency (E)			13.13
Specific (S)			17.88
Num x Small	-1.050		
Num x Medium	3.316*		
Num x Large	-1.305		
EorS x Small		5.947	
EorS x Medium		29.46	
EorS x Large		-132.6***	
E x Small			-0.888
E x Medium			35.70
E x Large			-120.5***
S x Small			25.58
S x Medium			-5.825
S x Large			-173.4*

Notes: Asterisks indicate that the coefficient is statistically significant at the **1% and *5% levels.

Table 15: Change in Risk Tolerance and COVID-19

	(1)	(2)	(3)
Small metropolitan (Small)	-0.501*	-0.454	-0.454
Medium metropolitan (Medium)	-0.247	-0.392	-0.392
Large metropolitan (Large)	-0.178	-1.978***	-1.978***
Number of infections (Num)	-0.009		
Emergency or specific (EorS)		-0.491*	
Emergency (E)			-0.503
Specific (S)			-0.474
Num x Small	0.023*		
Num x Medium	0.017		
Num x Large	0.007		
EorS x Small		0.487	
EorS x Medium		0.683*	
EorS x Large		2.142***	
E x Small			0.513
E x Medium			0.707
E x Large			2.189***
S x Small			0.435
S x Medium			0.579
S x Large			1.994***

Notes: Asterisks indicate that the coefficient is statistically significant at the **1% and *5% levels.

Table 16: Change in Cooperation and COVID-19

	(1)	(2)	(3)
Small metropolitan (Small)	-25.26	-58.07	-58.07
Medium metropolitan (Medium)	-57.34	-69.63	-69.63
Large metropolitan (Large)	-11.32	45.59	-45.59
Number of infections (Num)	0.030		
Emergency or specific (EorS)		-41.46	
Emergency (E)			-34.41
Specific (S)			-51.18
Num x Small	-1.242		
Num x Medium	2.829		
Num x Large	-1.171		
EorS x Small		36.90	
EorS x Medium		94.05	
EorS x Large		-67.90	
E x Small			26.37
E x Medium			72.04
E x Large			-73.55
S x Small			55.45
S x Medium			218.5*
S x Large			-63.41

Notes: Asterisks indicate that the coefficient is statistically significant at the **1% and *5% levels.

Table 17: Change in Reciprocity and COVID-19

	(1)	(2)	(3)
Small metropolitan (Small)	97.67	202.0	202.0
Medium metropolitan (Medium)	-71.11	-420.9	-420.9
Large metropolitan (Large)	108.9	-1717.3	-1717.3
Number of infections (Num)	32.54		
Emergency or specific (EorS)		737.1	
Emergency (E)			644.5
Specific (S)			864.9*
Num x Small	-2.673		
Num x Medium	-17.30		
Num x Large	-28.30		
EorS x Small		-280.6	
EorS x Medium		172.8	
EorS x Large		1256.1	
E x Small			128.5
E x Medium			197.0
E x Large			1097.4
S x Small			-1210.6
S x Medium			569.6
S x Large			2072.3

Notes: Asterisks indicate that the coefficient is statistically significant at the **1% and *5% levels.

Table 18: Change in Trustworthiness and COVID-19

	(1)	(2)	(3)
Small metropolitan (Small)	41.07	16.99	16.99
Medium metropolitan (Medium)	130.7**	121.1*	121.1*
Large metropolitan (Large)	115.8	8.773	8.773
Number of infections (Num)	3.821		
Emergency or specific (EorS)		41.52	
Emergency (E)			37.52
Specific (S)			47.04
Num x Small	-37.32		
Num x Medium	-42.67		
Num x Large	-25.07		
EorS x Small		-32.32	
EorS x Medium		-42.67	
EorS x Large		-25.07	
E x Small			48.56
E x Medium			-35.38
E x Large			-34.90
S x Small			13.47
S x Medium			-73.38
S x Large			21.32

Notes: Asterisks indicate that the coefficient is statistically significant at the **1% and *5% levels.

Table 19: Change in Trustworthiness2 and COVID-19

	(1)	(2)	(3)
Small metropolitan (Small)	0.0131	0.004	0.004
Medium metropolitan (Medium)	0.045*	0.042*	0.042*
Large metropolitan (Large)	0.038	0.012	0.012
Number of infections (Num)	0.001		
Emergency or specific (EorS)		0.016	
Emergency (E)			0.016
Specific (S)			0.016
Num x Small	-0.001		
Num x Medium	-0.001		
Num x Large	-0.002*		
EorS x Small		-0.001	
EorS x Medium		-0.014	
EorS x Large		-0.021	
E x Small			-0.018
E x Medium			-0.013
E x Large			-0.026
S x Small			0.011
S x Medium			-0.024
S x Large			-0.001

Notes: Asterisks indicate that the coefficient is statistically significant at the **1% and *5% levels.

5 Discussion

To summarize our empirical results, both the experimental measure of trust and the survey measures of trust change over time, but the survey measures are more stable than the experimental measure. This result is consistent with the results in the literature. The change of the experimental measure is positively correlated with the changes in experimental measures of altruism (measured as giving in the dictator game), reciprocity, cooperation, and trustworthiness in each of all four pairs of two waves in the OECD and JSCES panel data examined in this paper. It is also positively correlated with risk tolerance, and risk tolerance in the OECD Waves 1 – 2 at the 5 % significance level, but not in the other three pairs. As for the survey measures of trust, the change in Tr–O is positively correlated with the changes in altruism, trustworthiness, cooperation, and reciprocity in the OECD Waves 1 – 2, and with the changes in altruism, trustworthiness, the JSECES Waves 1 – 2, but is not correlated with any of these in the OECD Waves 1–3 and Waves 2 – 3. The change in Tr–O is positively correlated with risk tolerance only in the OECD Waves 2 – 3 and the JSCES Waves 1 –2. The change in Tr–R is positively correlated with the changes in altruism, trustworthiness, and reciprocity in the OECD Waves 1 – 2, and with the changes in altruism, trustworthiness, the JSECES Waves 1 –2, but is not correlated with an of these in the OECD Waves 1 – 3 and Waves 2 – 3. The change in Tr–O is positively correlated with risk tolerance only in the OECD Waves 2 – 3 and the JSCES Waves 1-2. There is evidence that some of these changes for some groups were caused by COVID-19.

For the purpose of interpreting these results, we assume that experimental and survey measures are subject to classical measurement errors that are independent across individuals, time, and measures. Under this assumption, we consider three classes of economic models to interpret our results. The first class is models of outcome-based social preferences without preference shocks, the second class is models of outcome-based social preferences with preference shocks to both social and risk preferences, and the third class is models of social preference that are affected by social capital.

For the first class of models, social preferences are assumed to be represented by the following form:

$$U_i(c_i, c_{-i}) \tag{1}$$

Here c_i is the payoff of the player i, and c_{-i} is the vector of the payoffs of all the players except for i. Examples include inequality aversion models of

Fehr and Schmidt (1999) and Bolton and Ockenfels (2000). For simplicity, we assume that expected utility is maximized even though it is possible to relax this assumption and think of extensions to rank-dependence, etc. For this class of models, social capital such as trust does not affect Altruism (measured by the amount given in the dictator game) and risk tolerance. On the other hand, social capital can affect social behavioral measures such as cooperation, reciprocity, and trustworthiness through probabilities attached to realizations of c_i and c_{-i}.

For the second class of models, social preferences are assumed to be represented by the following form:

$$U_i(c_i, c_{-i}, e_i) \tag{2}$$

where e_i: the vector of preference shocks the player i. Preference shocks are assumed to independently arise for social and risk preferences. When an individual becomes more risk tolerant because of a preference shock, the individual is expected to increase the experimental measure of trust which contains the purely investment aspect given the perceived distributions of the returns from the other player.

For the third class of models, the possibility that social capital of the decision maker and that of others affects the decision maker's social preferences is added to the second class of models:

$$U_i(c_i, c_{-i}, s_i, e_i) \tag{3}$$

where s_i: the vector of social capital of the player i. Models of Rabin (1993) and Dufwenberg and Kirchsteiger (2004) can be seen as examples of this class of models. In these models, beliefs of other players' intentions affect social preferences. Another example is Levine (1998) in which beliefs of other players' types affect social preferences. Trust affects altruism except for special cases in these models. Social capital can also affect behavioral measures of risk tolerance in this model e.g. by affecting loss aversion.

As noted in the Introduction, social capital includes trust, norms, and networks in Putnam (1993). Therefore, economic models of norms such as Akerlof and Kranton (2005) and Krupka and Weber (2013) are example of this class of models.

As an example of a theory to think about how social capital affects behavioral measures of social preferences and risk tolerance and how preference shocks affect social capital, the neuroscientific theory of Krueger and Meyer-Lindenberg (2019) can be used. Figure 2 of their paper explains the main part of their theory that we use. For trust measured by the trust game experiment, the anticipation of reward evaluated by the reward network (RWN) contrasted with the risk of treachery (evaluated by the salience network (SAN)) which is associated with vulnerability of trusting another person. To make a decision under the uncertainty faced by the RWN and SAN, two types of bounded rationality can be employed, where SAN acting as a switch engages either the central-executive network (CEN, externally directed cognition control for evaluating the subject's own risky economic payoff) or the default-mode network (DMM, internally directed cognition for evaluating the trustworthiness). Given the theory, if various stresses including thoughts of death caused by COVID-19 affect RWN, SAN, CEN, and DMN, then these stresses can cause trust and behavioral measures of altruism, risk tolerance, trustworthiness, cooperation, and reciprocity. According to Molins et al. (2023), psychological stress reduces loss aversion at the early stages of stress response while increases loss aversion and enhances the salience-network (SAN) at the later stages. According to Luo et al. (2019) thoughts of death decreased the SAN activity and also reduced the connectivity between the SAN and the DMN and other brain networks. These changes in brain networks can be interpreted as changes in social capital in the model.

With these in mind, for the groups that trust and behavioral measures were caused to change by COVID-19, various stresses from COVID-19 are likely to have affected trust and risk tolerance in many ways. For example, thoughts of death caused by COVID-19 reduced the connectivity between the SAN and the DMN, which can increase trust if the connectivity of RWN and the SAN remains the same. Another example is that various stresses related to COVID-19 can cause the reduction of loss aversion at the early stages of stress response while the increase in loss aversion in later stages resulting in trust to increase or decrease depending on the timing of stress and that of the study participation of the subject. It should be noted that COVID-19 may cause stresses to family members if a father with a tendency of domestic violence to work longer hours at home but also may cause family bonding to be strengthened if a gentle father spends more time with family members at home. Given that COVID-19 variables are not significant for many groups in Tables 9–17, and given that the low correlation coefficients indicating the low stability of the experimental measure of trust in our data is consistent in Table 2 is consistent with low correlation coefficients of trust

and other measures of social and risk preferences for various time periods that are not related to COVID-19 in low and high income countries in the literature, there seem many kinds of unobserved stresses and other causes that affect trust and behavioral measures of social and risk preferences.

Given our empirical results and these interpretations, we conclude that changes of trust are better measured by incentivized experimental measures than survey measures. The change in Tr–O and Tr–R are positively correlated in all four pairs of panel data, but the change in Tr–O does not have significant correlation with Tr–E in any pair. Tr–R is only correlated with Tr–E in the OECD Waves 1–2. On the other hand, the change in Tr–O and that in Tr–R are positively correlated with changes in some of the behavioral measures of social preferences in the OECD Waves 1–2 and the JSCES Waves 1–2. The change in Tr–O is positively correlated with that in risk tolerance in the OECD Waves 1–3 and the JSCES Waves 1–2 where the changes in Tr–E and Tr-R are not. Therefore, the survey measures of trust are likely to be measuring some aspects of trust that are not well measured the experimental measure of trust. For example, a type of a preference shock in the form of the change in the RWS may be better captured by Tr–O that does not mention the possible treachery than Tr–R or Tr–E.

6 Conclusion

The experimental measure of trust change over time and positively correlated with experimental measures of social behaviors such as trustworthiness, altruism (measured as giving in the dictator game), reciprocity, and cooperation. The survey measures of trust are less correlated with social behavioral measures than the experimental measure of trust. There is evidence that COVID-19 affected changes in trust and behavioral measures for people in larger metropolitan areas.

These empirical results are consistent with the third class of models we considered in the previous section in which social capital such as beliefs about other people's kindness affects social preferences (e.g., Rabin (1993) and Dufwenberg and Kirchsteiger (2004)). Our results are not consistent with the first class of models of exogenous social preferences without preference shocks because classical measurement errors cannot explain correlations of trust and other behavioral measures. Part of our results are also consistent with the second class of models with preference shocks in which social capital does not affect social preferences (e.g., a positive shock to risk tolerance affects the experimental measure of trust), but these models cannot explain why the change in trust is correlated with altruism. It may be possible

to develop deeper understanding by studying the third class of models with neuroscientific theories such as that of Krueger and Meyer-Lindenberg (2019).

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