Public Investment on Health and Voter Responses: Evidence from the Mass Vaccination during COVID-19*

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Abstract

This study examines the effect of COVID-19 vaccination on political support by leveraging Japan's age-based vaccination rollout, which prioritized people aged 65 and older. Using a fuzzy regression discontinuity design, we found that vaccination increased favorable opinions of vaccination progress and infection control measures by 28.9% and 15.4%, respectively. These favorable opinions extended to positive perceptions of other infection control measures, ultimately fostering trust in the government. In addition, the effect of vaccination was heterogeneous: it was more pronounced among individuals with chronic diseases, women, those of lower socioeconomic status, and those with higher levels of interpersonal trust. In contrast, low trusters became more dissatisfied with how the Tokyo Olympics and Paralympics in 2021 were managed, without showing an increase in positive opinions of the government.

Keywords: Mass vaccination; Political support; Interpersonal trust
JEL classification :D72, H51, I18

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1 Introduction

Public investment in health has been rising sharply in many developed countries, with increasing health expenditures over the past several decades. However, the effect of these investments on political support remains unexplored—specifically, how voters in democratic societies value the rising public investment in health and whether incumbents can enhance their electoral prospects by increasing health investments. Previous studies have shown that incumbents in OECD countries increased public health expenditures in election years to enhance their win margins (Potrafke, 2010; Herwartz & Theilen, 2014). Several political science theories propose that incumbents can enhance their win margin in the next election by targeting public services to specific groups (Lindbeck & Weibull, 1993; Dixit & Londregan, 1996; Dahlberg & Johansson, 2002)[1], but the empirical evidence on the relationship between public service provision and political support for incumbents remains unclear (Levitt & Snyder Jr, 1997; Adiguzel, Cansunar and Corekcioglu, 2023).[2] Furthermore, to the best of our knowledge, no study has explored the electoral consequences of health investment—a major and rising budgetary component in all aging societies.

This study examines whether and how the provision of healthcare services increases favorable opinions of the government in the context of COVID-19 vaccination, exploiting an age-based vaccination rollout in Japan. The Japanese government, similar to other countries, prioritized older adults for vaccination[3] due to their higher risk of developing severe COVID-19 (CDC, 2022). Specifically, individuals born before April 1, 1957, who had reached or would reach 65 years of age during fiscal year 2021, were eligible to receive vaccination two to three months earlier than younger age groups. To use this age-based priority rule as an exogenous source of identification, we conducted a fuzzy regression discontinuity (RD) analysis. Data were collected from 14,198 elderly individuals near the cutoff age of 65 years in August 2021,

[1] Classical theories propose that incumbents can enhance their win margins in the next election by targeting swing voters (Lindbeck & Weibull, 1993; Dixit & Londregan, 1996; Dahlberg & Johansson, 2002), while another theory argues that incumbents can enhance their win margins by targeting voters who already show stong support (Cox & McCubbins, 1986). Recent theories and evidence from behavioral economics suggest that incumbents target individuals with high levels of reciprocity (Hahn, 2009; Finan & Schechter, 2012; Cruz, 2019).

[2] Some studies show that incumbents' electoral performances improve when they provide public services to specific groups(Akbulut-Yuksel, Okoye and Turan, 2024; Kaba, 2022), but others find no measurable effects on electoral performance (Imai, King and Velasco Rivera, 2020).

[3] Although many countries prioritized vaccines for high-risk populations such as older adults, priority rules were not strictly enforced. For example, the U.S. categorized people into three priority groups for vaccination based on age (i.e., 75+ years, 65–74 years, 16–64 years). However, there was significant regional variation in the actual implementation of this policy(Dooling, 2021; Painter et al., 2021), indicating the low enforcement of priority rules. As the U.S. promptly secured sufficient vaccines from the international society, adherence to early priority rules became unnecessary.

a period when the gap in vaccination rates between those aged 65 and older and those under 65 was most pronounced.

The results are fourfold. First, our RD analysis revealed that the vaccination rate increased by 32.6 percentage points at the age-65 threshold. This sharp rise in the vaccination rate increased favorable opinions of vaccination progress and infection control measures in the municipality by 28.9% and 15.4%, respectively. Second, vaccination influenced voters' opinion not only on vaccination-related issues but also on a broader range of COVID-19 policies. Vaccination led to more favorable opinions on emergency financial assistance for low-income households during the pandemic and also increased the number of voters who believed "infection control measures in Japan are based on scientific evidence." These results suggest that providing one public service can spill over into the evaluation of other public policies and overall trust in government authorities.

Third, the effects of vaccination were heterogeneous. For example, people with chronic diseases were more likely to develop favorable opinions of the municipal government, possibly because they were at greater risk of severe COVID-19. In addition, individuals with lower socioeconomic status (SES), measured by education and household income, had more favorable opinions of the municipal government following vaccination. Women also responded positively, while men showed no significant change. Finally, we found that people with a high level of interpersonal trust had increased favorable opinions about the municipal government, whereas other dimensions of trust, such as institutional trust and trust in scientists, were not associated with the magnitude of the vaccination effect.

Finally, looking at the heterogeneous effects of interpersonal trust in greater depth, we found that low trusters might downgrade their overall assessment of the central government's infection control measures. When vaccinated, low trusters became more vocal in their dissatisfaction with the government, particularly regarding the Tokyo Olympics and Paralympics—held without spectators in 2021—-which they believed should have allowed spectators given the widespread availability of vaccines.

This study contributes to the literature on the relationship between public service provision and political support. While previous studies focused on low-income populations (Manacorda, Miguel and Vigorito, 2011; De La O, 2013; Pop-Eleches & Pop-Eleches, 2012; Linos, 2013; Labonne, 2013; De Janvry, Finan and Sadoulet, 2012)[4] and had limited sta-

[4] Manacorda, Miguel and Vigorito (2011) and De La O (2013) examine the impact of cash transfers to the poor on political support for the government in Uruguay and Mexico, respectively. Pop-Eleches & Pop-Eleches (2012) analyze the political implications of distributing coupons to low-income individualsfor purchasing computers in Romania.

tistical power to explore the mechanisms, our study contributes to the literature by not only examining alternative political support mechanisms with rich individual data but also focusing on a public service that affects the entire population—COVID-19 vaccination. In fact, COVID-19 vaccines were administered to the entire population regardless of their socioeconomic background. This widespread provision enables us to explore how people with different health statuses, personalities, and SES update their beliefs about the government after receiving one public service.

2 Background

As in many countries, the COVID-19 vaccine was considered particularly effective in reducing severity risks of COVID-19 in Japan. Amid public expectations for vaccines, the Japanese government prioritized the distribution of the vaccine in its fight against COVID-19 in early 2021. However, the vaccine diffused more slowly in Japan than in other developed countries because of the slow regulatory approval (Matsui, Inoue and Yamamoto, 2021; Kosaka et al., 2021). The first mRNA vaccine by Pfizer-BioNTech was approved on February 14, 2021, and vaccines by Moderna and AstraZeneca were approved on May 21, 2021. After approval, the Japanese government rushed to purchase vaccines from pharmaceutical companies and launched a mass vaccination program in April 2021.

The Japanese government prioritized older adults for vaccination (Matsui, Inoue and Yamamoto, 2021). Specifically, individuals born before April 1, 1957, who had reached or would reach the age of 65 during fiscal year 2021, were vaccinated before younger people.[5] On May 13, Prime Minister Yoshihide Suga pledged to vaccinate all older citizens aged 65 and older (36 million individuals) by the end of July 2021. Figure 1a shows the typical vaccination schedule in Sumida ward, Tokyo. In this ward, vaccine tickets were distributed starting in April 2021, and mass vaccination for older adults in nursing homes began in the third week of April. The vaccination of all non-institutionalized older adults started on May 10, while vaccinations for younger individuals began in the last week of June. Thus, the timing of the start of mass vaccinations for older adults was approximately two months earlier than for younger individuals.

Figure 1b plots the second-dose vaccination rate among individuals aged 65 and older, compared to those under 65, using publicly available official government data. Among older adults, the vaccination rate increased from 0.1% on June 1 to 79% on July 31. For younger

[5] Fiscal year starts in April and ends in March in Japan.

individuals, the vaccination rate on July 31 was only 7.4%.

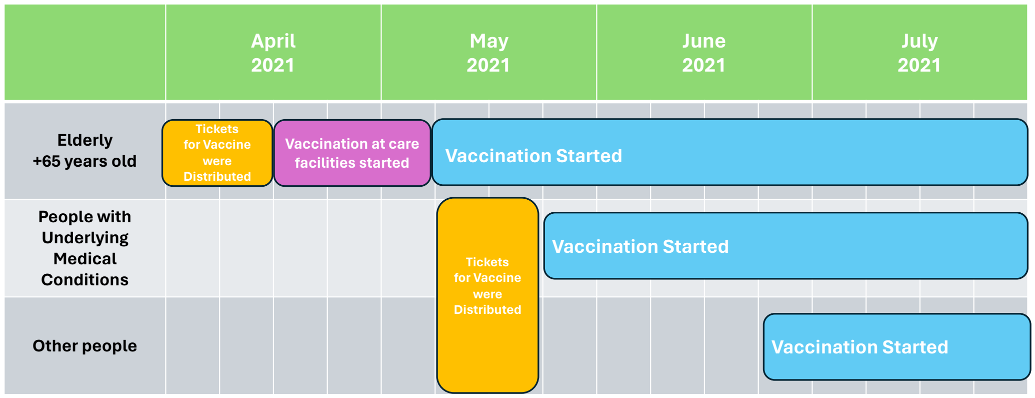
Figure 1b also shows the number of infected individuals per 100 thousand (represented by dots). While vaccinations for older adults increased since early June, COVID-19 cases increased in August due to the nationwide spread of the Delta variant. To control the outbreak, the Tokyo government declared a state of emergency—the Japanese version of lockdown[6]—on July 12. Twenty-one other prefectures followed suit. These restrictions were lifted on September 30, as the outbreak was quickly brought under control.

At the time, many people in Japan regarded the government's response to the pandemic as one of the most important policy issues. A pre-election poll conducted by the Yomiuri Shimbun, the newspaper with the largest circulation in Japan, revealed that 70% of the population chose the government's response to the pandemic as the key issue in the upcoming general election in October 2021 (Yomiuri Shimbun, 2021).

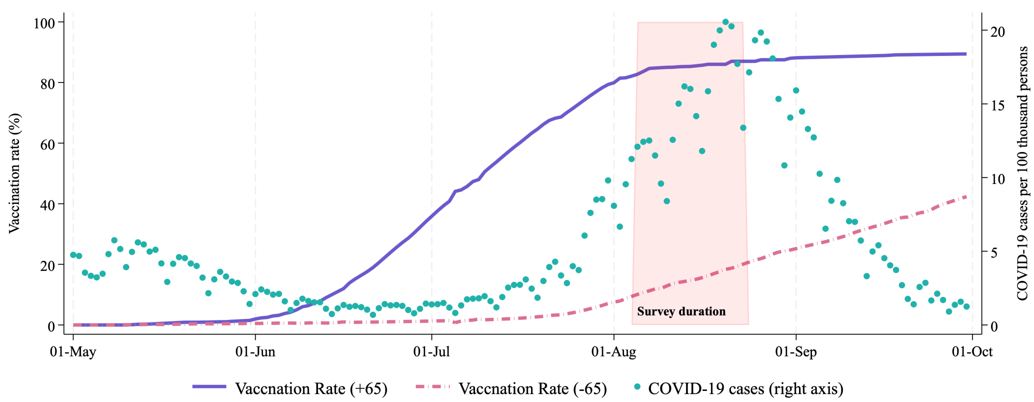
[6]Unlike lockdowns in other countries, regulations under the state of emergency were not legally binding. Instead of mandatory restrictions on behavior, the government requested people to refrain from going out, limit gatherings, and shorten restaurant operation hours. For details on Japan's state of emergency, see Watanabe & Yabu (2021) and Takaku et al. (2022)

Figure 1: Schedule of the Mass Vaccination and Diffusion of the Vaccine

(a) Typical Schedule of Mass Vaccination



(b) Diffusion of the Vaccine and Epidemics of COVID-19



Notes: In figure 1b, the shaded area represents the period when our online survey was held. Vertical lines represent the period from July 12, 2021, to September 30, 2021, when the state of emergency was declared in large cities, including Tokyo. The number of newly confirmed cases is per 100 thousand persons.
Sources: Source for figure 1a is from https://www.city.sumida.lg.jp/kuhou/backnum/210325corona/kuhou01.html, accessed on June 13, 2024.

3 Data

3.1 Online Survey

We conducted an online survey in collaboration with Cross Marketing Inc., one of the largest survey companies in Japan. The company employed random sampling from approximately 4.79 million individuals across the nation who had preregistered as potential survey participants. We conducted our survey from August 5 to 23, 2021, a period when the difference in vaccination rates between people aged 65 and older and those under 65 was most pronounced, as shown in Figure 1b[7]. In addition, the Tokyo Olympics and Paralympics, held without spectators, took place from July 23 to August 8, just before we started our survey.

To implement a RD analysis, we targeted individuals near the age threshold for prioritized vaccination. Specifically, we recruited those born between April 1954 and March 1960, which corresponds to individuals aged 62 to 67 at the end of fiscal year 2021 (March 2022). We collected 14,198 responses, ensuring the gender ratio in the survey matched that of the census. Table A1 summarizes the descriptive statistics. The number of respondents below and above 65 years were 8,208 and 5,990, respectively.

3.2 Main Variables

3.2.1 Variable of Interest

We asked the survey participants how many times and when they had been vaccinated. For our analysis, we used whether a respondent had completed two doses of the COVID-19 vaccine as the variable of interest (vaccination status) because two doses are necessary to generate antibodies (CDC, 2022). In our data, the vaccination rate for people under 65 was 50.3%, compared to 85.9% for those aged 65 and older, resulting in a 35.6% difference in vaccination rates between the two groups, as shown in Table A1.

3.2.2 Outcomes

- **General opinions on vaccination progress and infection control measures**
  We gauged respondents' evaluation on vaccination progress and infection control measures implemented by the central and municipal government. Respondents were asked whether they agreed (support) or disagreed (not support) with statements such as "Vaccinations are progressing well in your municipality" and "Your municipality has adequate measures to prevent COVID-19 infection." Similar questions were posed regarding vaccination progress nationwide and effectiveness of infection control measures implemented by the central government. Respondents answered on a 5-point Likert scale, ranging from 1 for "disagree (not support)" to 5 for "agree (support)."

[7] The vaccination rate was 83% among the elderly and 11% among others on August 5 when we started the survey.

- **Opinions on specific infection control measures beyond vaccination**

  In addition to general opinions on vaccination progress and overall infection control, we asked respondents about their opinions on specific measures such as school closure, emergency financial assistance for low-income households, and request for closing restaurants and bars.[8] We also asked respondents whether they agreed or disagreed with the statements "The government is not hiding accurate information about COVID-19" and "The government's COVID-19 measures are based on sufficient scientific evidence." Finally, we asked respondents whether they believed the Tokyo Olympics and Paralympics should have been held with spectators.[9] Respondents answered these questions on a 5-point Likert scale.

- **Infection rate**

  We asked respondents whether they had ever contracted COVID-19. As of August 2021, the infection rate remained low at 0.5%, as shown in Table A1.

- **Daily behaviors, risk perception, and future prospects**

  In addition to respondents' political support for municipalities and the central government, we examined other outcomes, including two scores on daily behaviors, as well as individual scores on risk perception and future prospect. Specifically, we calculated the total score based on seven items assessing risk perception toward COVID-19[10], 19 items measuring infection preventive behaviors, and 20 items assessing risky behaviors over the past month. In addition, an index of respondents' future outlook was also created based on their agreement or disagreement with 10 forward-looking statements, such as "The pandemic will be contained by next summer."[11] For the empirical analysis, these four scores were standardized by the mean and standard deviation. Table A2 provides the descriptive statistics for each item before total scores were calculated.

[8] Similar to other countries, the Japanese government implemented school closures and requested restaurants and bars to close in April 2020. Detailed explanations of these policies can be found in Takaku & Yokoyama (2021) and Takaku et al. (2022). Emergency financial assistance for low-income households was provided from May to July 2020, as described in Kubota, Onishi and Toyama (2021).

[9] The Tokyo Olympics and Paralympics were originally scheduled for August 2020 but were postponed by one year due to the pandemic. The events were ultimately held without spectators in August 2021.

[10] The seven items include "COVID-19 is very scary," "It makes me uncomfortable when I think about COVID-19," "I am afraid of losing lives to COVID-19," "I feel anxious about being infected with COVID-19," "I feel anxious about my family getting infected with COVID-19," "I'm worried that I will infect my family and others with the coronavirus," and "I feel anxious about creating a cluster." Respondents answered each item on a 5-point scale of approval or disapproval.

[11] Specifically, we asked respondents, "What do you think are the chances that the next 11 items will have been accomplished by this time next year?" with responses ranging from 0% to 100%.

3.2.3 Pre-determined Characteristics

To obtain information on health status, we asked respondents whether they had any of the following chronic conditions: hypertension, diabetes, bronchitis/pneumonia, angina, myocardial infarction, stroke (cerebral infarction or cerebral hemorrhage), chronic obstructive pulmonary disease, cancer, or chronic pain. Descriptive statistics for each condition are presented in Table A3. As shown in Table A1, 42% of survey respondents had at least one chronic condition. The most common conditions were hypertension (34.2%) and diabetes (11.5%).

In addition to basic predetermined characteristics, such as gender and education, we identified whether respondents lived in epidemic areas, which included the following highly populated prefectures: Tokyo, Kanagawa, Saitama, Chiba, Aichi, Kyoto, Osaka, and Fukuoka. We also collected information on respondents' working status at the time of the survey. A binary variable was created to indicate whether household income exceeded the median (5 million JPY = 34,395 USD).

Finally, as subjective evaluation of vaccine efficacy significantly influences the decision to get vaccinated, our survey included a question on the perceived efficacy of COVID-19 vaccine: "Much research has been done on the effectiveness of the new coronavirus vaccine. If 100 people received two doses of Pfizer or Moderna, how many of them do you think will be protected from the risk of severe COVID-19 infection?" Scientific evidence (Polack et al., 2020) suggested that the answer was 95% for the vaccines available during the study period. Respondents were asked to choose an answer between 0% and 100%.

4 Empirical Strategy

4.1 Identification

We identified the political impact of COVID-19 vaccination by using the age-based priority rule. We used the year and month of birth to determine if the respondent was prioritized for vaccination. For example, individuals born in March 1957 were prioritized for vaccination, whereas those born in April 1957, whose birthdays were one month later, were not.

One threat to identification is related to the social security system in Japan, which also uses age 65 as a threshold for eligibility. For example, eligibility for public pensions and long-term care insurance changes when people turn 65 years old. If the age threshold used in our study coincided with the age-based eligibility rules in such policies, it would have been difficult to separate the effects of the age-based priority rule in mass vaccination from these other factors. However, this threat has minimum impact on our research design because the age-65 threshold for prioritized vaccination represents whether a person will *turn 65 within fiscal year 2021*, but eligibility in other policies changes at the birthday—*when a person turns 65*. These events do not necessarily occur in the same month. Likewise, some companies set the mandatory retirement age at 65 years, but the timing of retirement is typically at the end of the fiscal year; thus, the timing of mass vaccination for prioritized individuals aged 65 and older in our analysis is earlier than that of mandatory retirement.

4.2 Estimation

The structural equation in our analysis is expressed as follows:

$$Y_i = \alpha_0 + \beta_0 Vaccine_i + f_{0l}(m_i)\mathbb{1}\{m_i < 0\} + f_{0r}(m_i)\mathbb{1}\{m_i \geq 0\} + X_i'\gamma_0 + \varepsilon_i, \qquad (1)$$

where Y_i is the outcome variable for political opinions or other responses of respondent i. $Vaccine_i$ represents a dummy variable that equals 1 if respondent i was vaccinated twice. m_i represents age in months and is standardized to zero at the age-65 threshold. Respondent i was prioritized if $m_i \geq 0$. We used m_i as the running variable in the estimation. Functions $f_{0l}(\cdot)$ and $f_{0r}(\cdot)$ signify the polynomial function of running variable m_i on the left- and right-hand sides of the threshold, respectively. X_i is a vector of predetermined covariates, such as education and morbidity—all covariates used in this analysis are listed in Table A1. Finally, because our estimation strategy relies on a fuzzy RD design, the vaccination status is instrumented by the eligibility rule. The parameter of interest β_0 denotes the local average treatment effect of COVID-19 vaccination on political opinion and other outcomes.

Concerning the actual implementation and presentation of this framework, in addition to reporting the results of the conventional local linear regression, we reported the results of the robust bias-corrected inference (Calonico, Cattaneo and Titiunik, 2014a). In both estimations, we used a local linear function because higher-order functions can lead to erratic behavior of the estimator at the threshold (Gelman & Imbens, 2019).

5 Main Results

5.1 Regression Discontinuity Plot

Figure 2a plots the vaccination rate by standardized age in months using the optimal data-driven method for RD plots (Calonico, Cattaneo and Titiunik, 2015). Among those who were not prioritized, approximately 80% completed one dose, but only half completed two doses. However, the vaccination rates for one and two doses jumped to approximately 90% and 80% at the threshold, respectively, suggesting that the vaccination status of respondents was strictly divided by their age.

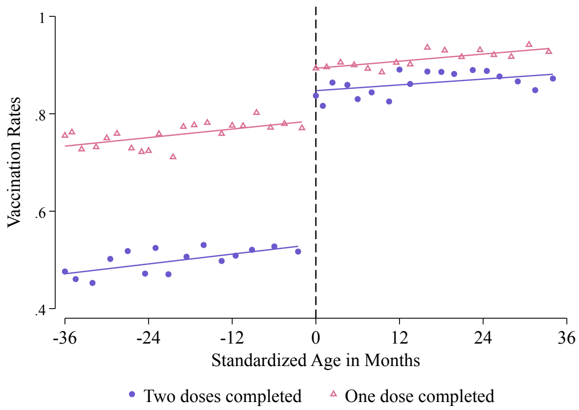
Figures 2b and 2c show similar plots for our main outcome variables. In Figure 2b, positive opinions on the vaccination progress in the municipality appear to increase at the threshold age (in months). Positive opinions regarding the infection control measures implemented by the municipality may also increase slightly at the threshold age. However, we found no discernible changes in opinions about the progress of vaccination nationwide or the infectious disease control measures implemented by the central government in Figure 2c.

Next, we present an RD data plot of opinions on infection control measures other than vaccination in Figure 3. For all six items, the right-hand side of the threshold age consistently scored higher than the left-hand side, indicating that vaccination influenced the evaluation of several other policies besides vaccination.

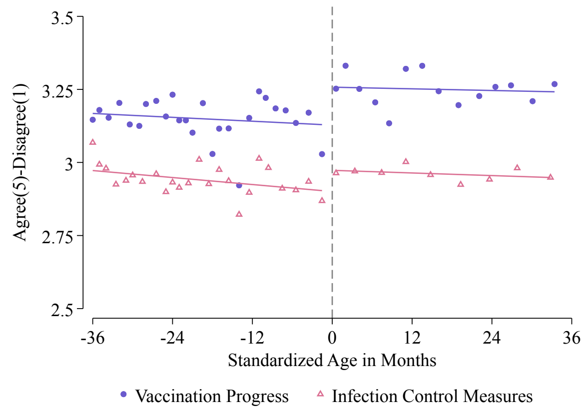
In Appendix B, we show the RD plots for other outcome variables, including the daily preventive behavior index and the score of risk perception toward COVID-19, and found that the trend around the threshold age was smooth, as shown in Figure B1. In addition, we did not observe any jumps in the infection rate at the threshold, as shown in Figure B1.

Figure 2: Regression Discontinuity Plots for Main Variables

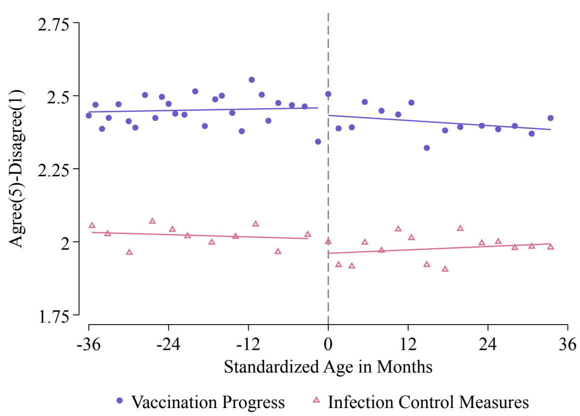
(a) Vaccination Rate



(b) Opinions on Municipal Government



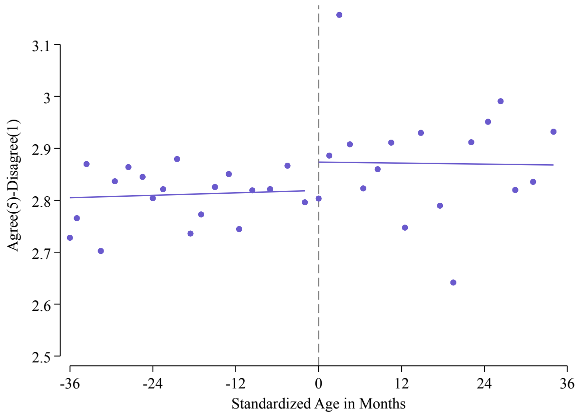
(c) Opinions on Central Government



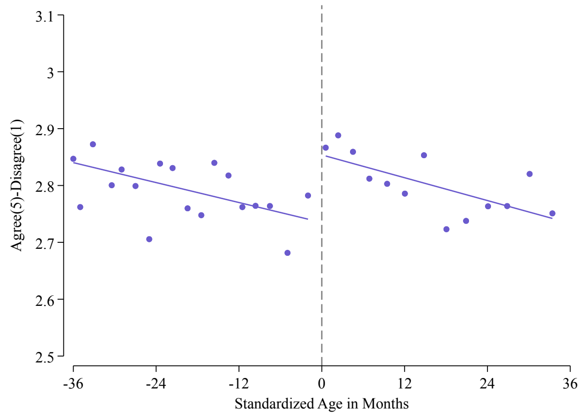
Notes: The horizontal axis represents the age in months standardized to zero at the age-65 threshold. RD plots with linear fitted lines are based on the optimal data-driven method proposed by Calonico, Cattaneo and Titiunik (2015).

Figure 3: Opinions on Infection Control Issues Other than Vaccination

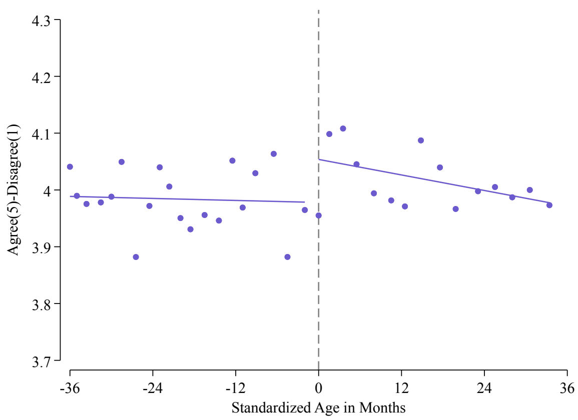
(a) School closures are effective in containing COVID-19.



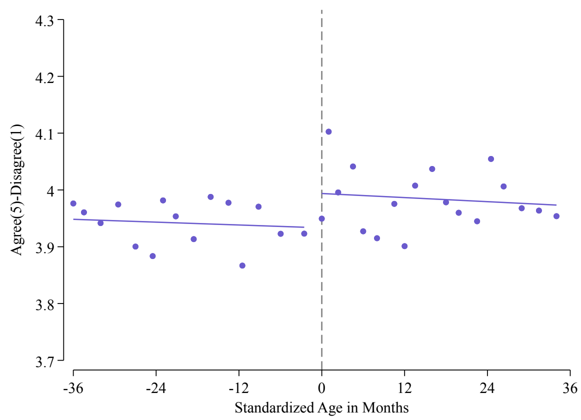
(b) Closing restaurants and bars is effective in containing COVID-19.



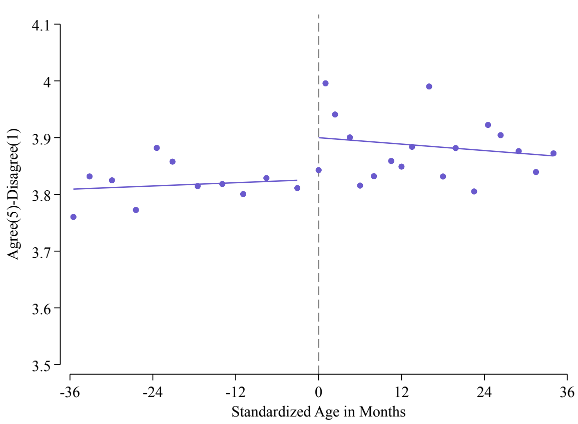
(c) Emergency financial assistance for low-income households is adequate.



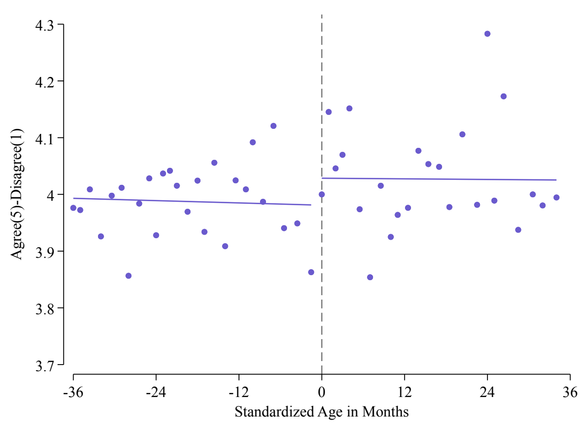
(d) The government is not hiding accurate information about COVID-19.



(e) Infection control measures in Japan are based on scientific evidence.



(f) The Tokyo Olympics and Paralympics should have been held with spectators.



Notes: The horizontal axis represents age in months standardized to zero at the age-65 threshold. RD plots with linear fitted lines are based on the optimal data-driven method proposed by Calonico, Cattaneo and Titiunik (2015).

5.2 Continuity of Covariates and First Stage Results

Before examining the regression results, we checked the continuity of the basic characteristics of the respondents around the threshold by implementing an RD analysis on these characteristics. The RD estimates and confidence intervals are graphically represented in Figure 4a. These estimates and confidence intervals are based on the bias-corrected coefficients with robust standard errors, as proposed by Calonico, Cattaneo and Titiunik (2014a). The results show that observables such as education, gender, household income levels, employment status, living areas/prefectures, and perceived vaccine efficacy are sufficiently continuous at the threshold, indicating that the basic characteristics of respondents are distributed smoothly around the threshold age.

In Figure 4b, we summarize the first-stage results using a gray marker for the full sample result and other markers for subsample results. The full sample result reveals that the prioritization increases the percentage of respondents who completed the two doses by 32.6 percentage points ([95% CI: 0.254-0.398]). Compared with the mean before the cutoff age (54%), this impact amounts to a 60% increase in the vaccination rate.

It is important to note that our estimation strategy does not allow us to separate the effect of the first dose from that of the second dose. This is because, as shown in Figure 2a, the prioritization (instrumental variable) increased both the probability of receiving the first dose and that of the second dose. Therefore, the instrumental variable strategy in Equation (1) estimates the mixed effects of the first and second rounds of COVID-19 vaccination.

Examining the results for the subsamples, men were slightly more responsive to prioritization than women. In addition, the effect of prioritization in non-endemic areas (0.423 [95%CI: 0.317-0.529]) was 17 percentage points greater than that in endemic areas (0.253 [95%CI: 0.157-0.350]). As vaccination spread more promptly in endemic areas, such as Tokyo, than in non-endemic areas, the marginal increase in the vaccination rate through prioritized vaccination was greater in non-epidemic areas than in epidemic areas.

5.3 Reduced Form and 2SLS Results

We present the second-stage results in Table 1. The RD estimates for the reduced-form analysis are shown in Columns (1) and (2), while those for the two-stage least squares (2SLS) effects are shown in Columns (3) and (4). The columns marked "Robust" report the bias-corrected coefficients with robust standard errors proposed by Calonico, Cattaneo and Titiunik (2014a), which yield less biased estimates than the results from the conventional methods shown in Columns (1) and (3).

As the main outcome variables related to voters' evaluation of the quality of municipal government, we first present the results for description (a) "Vaccinations are progressing well in your municipality" and description (b) "The infection control measures implemented by your municipality are successful" in the top rows of Table 1. In the reduced-form regression for description (a), we found that prioritization increased favorable opinions about vaccination progress in a municipality by 0.289 points, as shown in Column (2). In addition, vaccination increased favorable opinions on vaccination progress in a municipality by 0.875 points, as shown in Column (4). These estimates correspond to 9.2% and 28.9% of the means of the outcome variables, respectively. Regarding description (b), prioritization and vaccination increased favorable opinions on municipal governments' infection control measures by 0.135 and 0.435 points, respectively. These estimates correspond to 4.7% and 15.4% of the means of the outcome variables, respectively. In summary, vaccination increased favorable opinions of the municipality's vaccination progress infection control measures by 28.9% and 15.4%, respectively.

Conversely, vaccination did not change the evaluation of the central government in both the vaccination progress in description (c) and infection control measures as a whole in description (d). This may be because voters could easily recognize the efforts of the municipal government to provide vaccines, whereas the efforts of the central government might not be as visible to voters. During mass vaccination, the municipality was responsible for administering the vaccination program, including securing medical personnel, preparing vaccination sites, and distributing vaccination cards, while the central government was only responsible for securing the vaccines from the international community. Thus, voters might attribute their vaccination to the efforts of the municipal government rather than those of the central government.

Although vaccination did not change the overall evaluation of infection control measures implemented by the central government, it might affect the evaluation of specific infection control measures beyond the vaccination policy. In description (g) "Emergency financial assistance for low-income households is adequate," vaccination increased favorable opinions by 0.507 points, as shown in Column (4). While it was not statistically significant in the robust inference in Column (4), vaccination might also increase the favorable opinion regarding closing restaurants and bars in description (f).

In addition, vaccination might enhance general trust in the government. For example, it increased the number of voters who believed "infection control measures in Japan are based on scientific evidence" by 0.38 points. Although not statistically significant in the robust inference in Column (4), the vaccination effect on agreement with description (h) ("the government is not hiding accurate information about COVID-19") was also positive. These results indicate that public service provision is directly related not only to the evaluation of these services but also to a broader assessment of the quality of government services in general, which could ultimately enhance trust in the government.

While people changed their beliefs about infection control measures positively, one exception was the evaluation of how the Tokyo Olympics and Paralympics were held—specifically, the Tokyo Olympics and Paralympics in July–August 2021 were held without spectators. Due to vaccination, voters were more likely to agree with the statement that "The Tokyo Olympics and Paralympics should have been held with spectators." The vaccination effect on this outcome was 0.862 points and statistically significant, representing a 21.5% increase from the mean of the outcome variable. This negative evaluation of the Tokyo Olympics and Paralympics without spectators might explain why we found no statistically significant effects of the central government's infection control measures as a whole: although voters updated their evaluations of some infection control measures positively, these positive updates were offset by the negative update in the evaluation of the Tokyo Olympics and Paralympics without spectators.

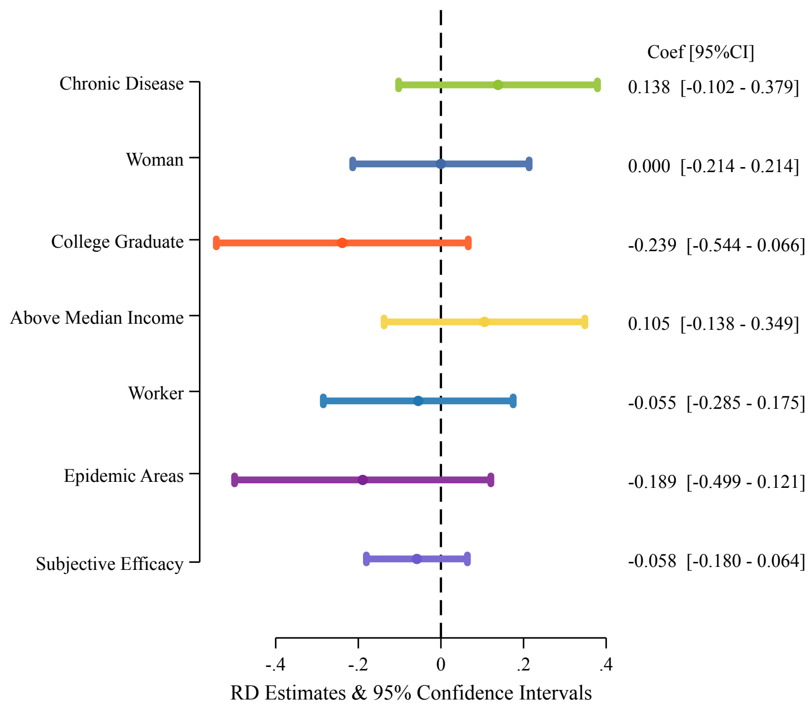
Regarding other outcomes, we found no statistically significant decrease in the infection rate of COVID-19. This was because the infection rate at the time of the survey was very low (0.5%), making it difficult to identify the preventive effects of the vaccine. In addition, we found no statistically significant changes in daily preventive behaviors such as mask wearing, tendency to engage in risky behaviors, risk perception toward COVID-19, and subjective future outlook for economies. These results are counterintuitive because many studies have shown a close association between vaccination intention, risk perception toward COVID-19, and compliance with daily preventive behaviors (Abel, Byker and Carpenter, 2021; Bundorf et al., 2023; Caserotti et al., 2021). However, this survey period coincided with the epidemic period of the Delta variant. During this period, many seriously ill patients could not be hospitalized due to the paralyzed medical system in Japan. Therefore, people could not relax vigilance despite vaccination.[12] The results for each item, comprising four total scores are shown in Table E1. Among the 57 outcome variables (seven items for risk perception, 19 items for preventive behavior, 20 items for risky behavior, and 11 items for

[12] Agrawal, Sood and Whaley (2022) empirically evaluate the ex-ante moral hazard effects of COVID-19 vaccines by exploiting the discontinuity in vaccination rates at age 65 in the US. Similar to our study, they also found no evidence of a decrease in risk-mitigating behavior.

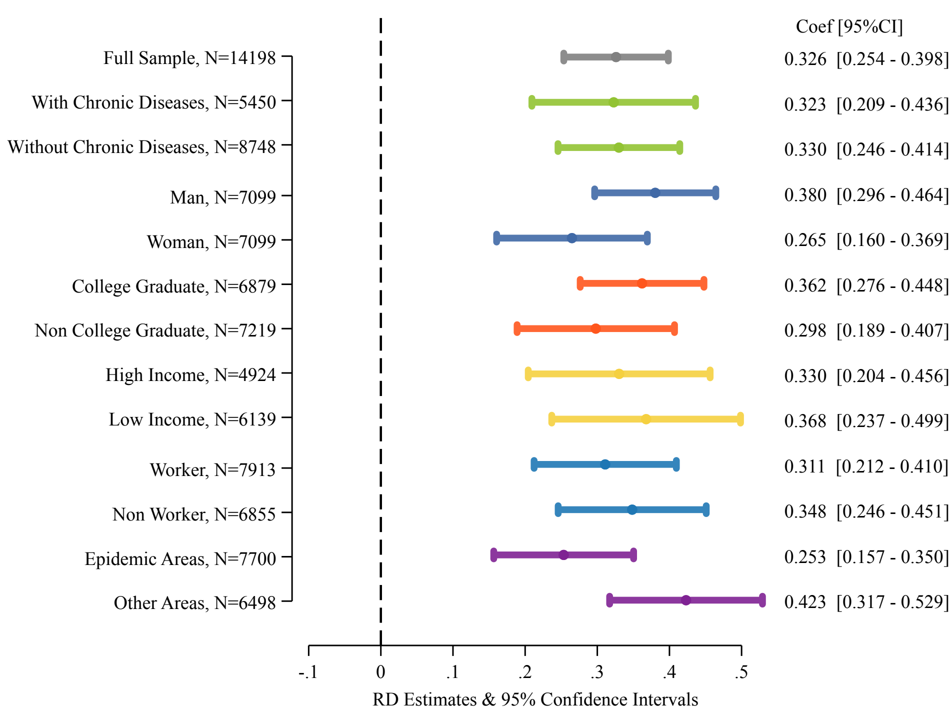
future prospects), we found that only one RD estimate was statistically significant at the 95% confidence interval; however, this statistically significant result could be influenced by multiple testing problems.

Figure 4: Continuity Test and First-Stage Results

(a) Continuity of Predetermined Characteristics



(b) First-Stage Results



Notes: The band around point estimate represents 95% confidence intervals. The RD estimates are based on bias-corrected estimates and their 95% confidence intervals are derived from robust standard errors proposed by Calonico, Cattaneo and Titiunik (2014b).

6 Mechanisms and Heterogeneous Effects

Next, we explored the factors that drove the impact of COVID-19 vaccination on political support for the municipal government. Previous studies have proposed two hypotheses explaining why people update their beliefs regarding the quality of the incumbent. One is the "rational but poor informed voters" hypothesis (Rogoff, 1990; Manacorda, Miguel and Vigorito, 2011). According to this theory, voters positively update their belief in the incumbent when they benefit from public services because they do not have sufficient information about the incumbent's quality, and they infer the government's quality based solely on the fact that they receive benefits. The other hypothesis is based on behavioral economic insights: voters are more or less reciprocal; thus, they generally feel grateful to the incumbent when they benefit from public services (Hahn, 2009; Finan & Schechter, 2012). Though there is no ultimate way to determine which hypothesis supports our main findings, a detailed subsample analysis could help to discuss potential mechanisms.

In the following subsection, we first explored the heterogeneous effects of basic characteristics such as gender and education. Next, we explored the heterogeneous effects of trust levels to understand how personality traits such as reciprocity and interpersonal trust were associated with voters' belief updates.

6.1 Basic Characteristics and Political Support

The subsample results on opinions about vaccination progress are shown in Figure 5a and those on the infection control measures are shown in Figure 5b. Figures E1a and E1b in the Online Appendix present the same subsample analysis for the central government outcomes.

- **Health Status**

  First, we examined the impact by health risk. It is widely known that individuals with underlying medical conditions are more likely to become critically ill from COVID-19. Therefore, those with chronic diseases could feel more grateful for the vaccines compared to those without such conditions. The empirical results were consistent with this prediction. In Figure 5a, the effect size on vaccination progress was greater among those with chronic diseases (1.237 [95%CI 0.422-2.052]) than among those without (0.624 [95%CI -0.017-1.266]).

- **Gender**

  The vaccination effects also varied by gender. The vaccination effect on opinions on vaccination progress in the municipality was greater among women than men in Figure 5a. In addition, while there appeared to be no gender difference in opinions on infection control measures by the municipal government in Figure 5b, we found significant gender differences in opinions on vaccination progress across the country in Figure E1a and on infection control measures implemented by the central government in E1b.

The observed gender difference could be attributed to three reasons. First, women may respond more positively to vaccination than men because they might be more reciprocal, as indicated in a review article on gender differences in preferences by Croson & Gneezy (2009).[13] Second, women may be more willing than men to engage in government-encouraged preventive behaviors during the pandemic, as evidenced by the literature on the gender gap in preventive behaviors(Galasso et al., 2020). Third, women might respond more positively to vaccination than men because of the higher risk from greater exposure to face-to-face environments in the workplace.

- **Socioeconomic Status**

  We also found a substantial difference in the political impact of COVID-19 vaccination by SES. Figure 5a shows that non-college graduates increased their favorable opinion of vaccination progress in their municipality by 1.311 points (95%CI 0.503-2.118), while college graduates did not change their opinion (0.426 [95%CI -0.190-1.042]. We found similar results between high- and low-income individuals.

  In Figure 5b, we found that low-SES individuals responded more positively than their high-SES counterparts in opinions on infection control measures by the municipality. In addition, we found similar heterogeneous effects regarding opinions on vaccination progress across the country in Figure E1.

  These heterogeneous responses by SES were consistent with the "rational but poor informed voters" hypothesis(Rogoff, 1990). The vaccination status of a single person provides little information on overall vaccination progress and the adequacy of infection control measures. However, if people have limited knowledge about policy outcomes in advance, they may update their beliefs about the government based on personal experiences, such as receive the vaccine. As individuals with low SES tend to have less accurate political information than those with high SES (Angelucci & Prat, 2021), this hypothesis may plausibly explain the SES differences in our results.

[13] According to Croson & Gneezy (2009), after reviewing 18 articles on gender differences in reciprocity, seven studies found women to be more reciprocal than men, while only one study reached the opposite conclusion.

Another explanation for SES differences is that the subjective health benefits of vaccination may be greater among low-SES individuals because they tend to have worse health conditions compared to high SES individuals (Cutler, Lleras-Muney and Vogl, 2011). However, this interpretation may not be supported by our data. In Figures C2a and C2b, we compared the prevalence of chronic conditions by education and found that chronic diseases were slightly more prevalent among non-college graduates than among colleges graduate, but the difference was only 2.0 percentage points for men ($p = 0.06$) and 3.7 percentage points for women ($p < 0.001$), suggesting that the prevalence of chronic diseases was similar by education.

Finally, the marginal utility gain from a unit of public service is generally greater for poor low-SES individuals than for rich high-SES individuals, as predicted by the standard concavity assumption of utility function. However, in the case of COVID-19 vaccination, this interpretation might not be appropriate because vaccine hesitancy was more prevalent among low-SES individuals compared to high-SES individuals (Dhanani & Franz, 2022). Consistent with this, Figures C2a and C2b show that the perceived efficacy of the vaccine was higher among college graduates than among non-college graduates, suggesting that college graduates valued vaccines more.

In summary, we observed more positive responses to vaccination among low-SES individuals compared to high-SES individuals, even though the prevalence of chronic conditions was almost the same between SES groups and the subjective evaluation of vaccine efficacy was lower among low-SES individuals. Therefore, although not completely conclusive, the observed SES differences in the vaccination effect may be explained by the classical "rational but poor informed voters" hypothesis (Rogoff, 1990; Manacorda, Miguel and Vigorito, 2011).

- **Employment Status and Regional Epidemics**

  Non-workers were slightly more responsive than workers in both opinions on vaccination progress and infection control measures. This is likely because a higher proportion of women and non-college graduates were among non-workers than workers. In addition, we explored the heterogeneous effects by regional epidemic conditions at the time of the survey. Although health risks were higher in epidemic areas, we found no notable differences in the subsample analysis by local epidemics.

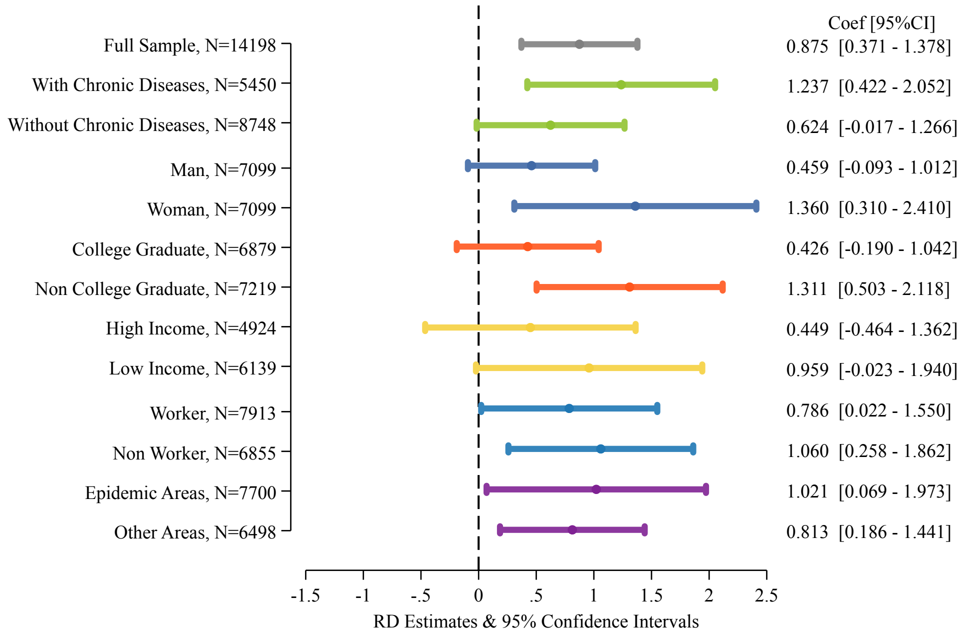
Table 1: RD Estimates for the Vaccination Effects

	Reduced-form		2SLS		Mean	N
	Conventional	Robust	Conventional	Robust		
Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
General opinions on vaccination policy and infection control measures						
(a)Vaccinations are progressing well in your municipality.						
	0.252***	0.289***	0.736***	0.875***	3.192	14,198
	(0.090)	(0.101)	(0.216)	(0.257)		
(b)Infection control measures implemented by your municipality have been successful.						
	0.120**	0.135**	0.380**	0.435**	2.949	14,198
	(0.056)	(0.066)	(0.178)	(0.213)		
(c)Vaccinations are progressing well across the country.						
	0.083	0.106	0.175	0.235	2.433	14,198
	(0.084)	(0.100)	(0.226)	(0.273)		
(d)Infection control measures implemented by the central government have been successful.						
	-0.091	-0.101	-0.339	-0.386	2.003	14,198
	(0.065)	(0.078)	(0.236)	(0.282)		
Opinions on specific infection control measures						
(e)School closures are effective in containing COVID-19.						
	0.136	0.147	0.403	0.417	2.836	14,198
	(0.096)	(0.115)	(0.285)	(0.339)		
(f)Closing restaurants and bars is effective in containing COVID-19.						
	0.102	0.078	0.434*	0.411	2.796	14,198
	(0.088)	(0.104)	(0.225)	(0.266)		
(g)Emergency financial assistance for low-income households is adequate.						
	0.143**	0.151*	0.444**	0.507**	3.998	14,198
	(0.069)	(0.083)	(0.202)	(0.242)		
(h)Government is not hiding accurate information about COVID-19.						
	0.112*	0.125	0.330*	0.363	3.960	14,198
	(0.065)	(0.078)	(0.195)	(0.231)		
(i)Infection control measures in Japan are based on scientific evidence.						
	0.117*	0.127*	0.363*	0.380*	3.846	14,198
	(0.060)	(0.073)	(0.191)	(0.227)		
(j)The Tokyo Olympics and Paralympics should have been held with spectators.						
	0.265***	0.296***	0.717***	0.862***	4.004	14,198
	(0.093)	(0.109)	(0.232)	(0.277)		
Infection, daily behavior, risk perception, and future prospects						
(k)Infection Rate						
	0.003	0.004	0.008	0.011	0.005	14,198
	(0.002)	(0.003)	(0.009)	(0.010)		
(l)Preventive behavior index						
	-0.011	-0.004	-0.082	-0.112	0.00	14,198
	(0.057)	(0.069)	(0.201)	(0.241)		
(m)Risky behavior index						
	0.016	0.025	0.037	0.039	0.00	14,198
	(0.071)	(0.087)	(0.213)	(0.257)		
(n)Risk perception index						
	0.047	0.067	0.111	0.143	0.00	14,198
	(0.075)	(0.090)	(0.212)	(0.252)		
(o)Future prospects index						
	-0.051	-0.058	-0.129	-0.184	0.00	14,198
	(0.073)	(0.090)	(0.212)	(0.254)		

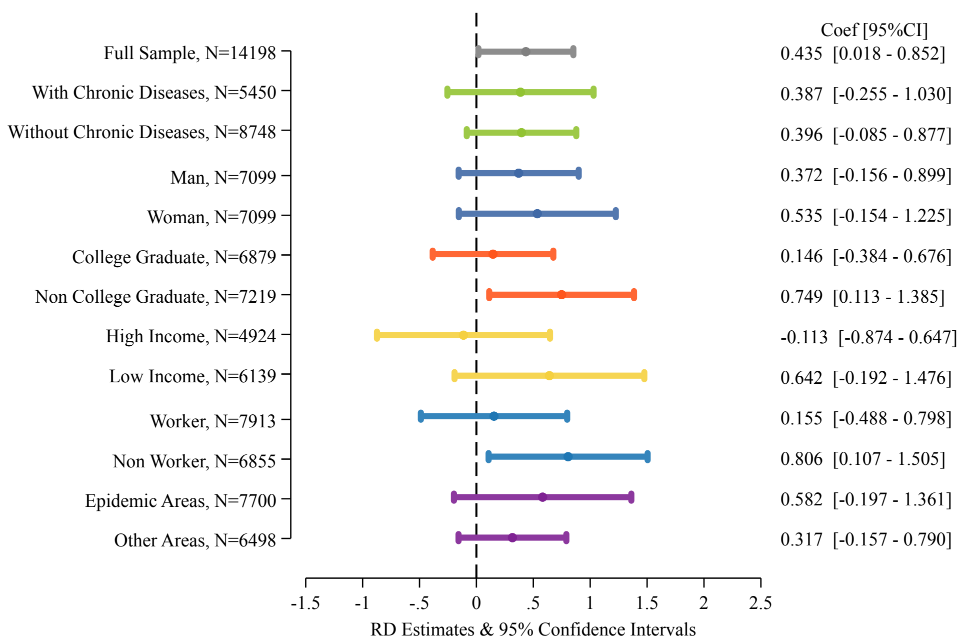
Notes: This table presents RD estimates from reduced-form and 2SLS regressions. "Conventional" represents standard RD estimates with local linear regressions. In the columns marked "Robust," bias-corrected estimates and robust standard errors proposed by Calonico, Cattaneo and Titiunik (2014b) are reported. A triangle kernel function is applied. All dependent variables from (l) to (o) are standardized. *** p<0.01, ** p<0.05, * p<0.10.

Figure 5: Subsample Results (2SLS)

(a) Vaccinations are progressing well in your municipality



(b) Infection control measures implemented by your municipality have been successful



Notes: The band around point estimate represents 95% confidence intervals. The RD estimates are based on bias-corrected estimates and their 95% confidence intervals are derived from robust standard errors proposed by Calonico, Cattaneo and Titiunik (2014b).

6.2 Trust and Political Support

Taking advantage of our rich individual-level survey data, we next examined the heterogeneous effects by trust level. This additional research agenda is as relevant as the subsample results shown previously because the potential significance of trust in political support has been largely disregarded, with only a few exceptions (Rothstein, Samanni and Teorell, 2012; Svallfors, 2013; Daniele & Geys, 2015)[14].

Regarding COVID-19 vaccination, we consider alternative hypotheses about the relevance of trust in vaccination effects. In our survey, we asked questions related to three types of trust: interpersonal trust, institutional trust, and trust in science. First, if "trust" indicates interpersonal trust, interpersonal trust and reciprocity are closely related concepts(Ostrom & Walker, 2003; Altmann, Dohmen and Wibral, 2008; Song, 2008)[15]. In this case, high-trust individuals may respond more positively to COVID-19 vaccination than those with low trust. This is because high-trust individuals may feel more gratitude for the public services they receive.

Second, if "trust" indicates institutional trust or trust in science, high-trust individuals respond more positively to COVID-19 vaccination than low-trust individuals. Previous studies consistently find that vaccine confidence is related to trust in science and scientists (Sturgis, Brunton-Smith and Jackson, 2021; Murphy et al., 2021) as well as institutional trust (Steinert et al., 2022; Lazarus et al., 2022).

In our data, we measured interpersonal trust using a questionnaire developed by Siegrist & Bearth (2021). Institutional trust and trust in science were based on a questionnaire from the World Value Survey (Inglehart, 2004). See Online Appendix C for further details.

Figures 6a and 6b report the results of favorable opinions on local vaccine progress and infection control measures implemented by the municipality, respectively. The RD estimate of the vaccination effect on favorable opinion on local vaccine progress was 1.222(95%CI 0.540-1.915) and statistically significant for high trusters; however, it turned out to be statistically insignificant (0.565 [95%CI -0.205-1.335]) for low trusters in Figure 6a. The qualitative

[14] Rothstein, Samanni and Teorell (2012) and Svallfors (2013) argued that public support for social welfare policies is affected by citizens' trust in the institutional fairness and effectiveness of the procedures that regulate production. In addition, using data from the European Social Survey, Daniele & Geys (2015) empirically demonstrate a strong positive association between interpersonal trust and welfare state support. Many country-level studies examine the association between trust and welfare state size (Bergh & Bjørnskov, 2011; Beugelsdijk, De Groot and Van Schaik, 2004; Ponzetto & Troiano, 2018).

[15] Trust can be broadly defined as "the expectation that arises within a community of regular, honest, and cooperative behavior, based on commonly shared norms, on the part of other members of the community" (Fukuyama, 1996), which reduces conflict between agents. "Trustworthiness" is related to the reciprocity of a person.

results were consistent for the infection control measures in Figure 6b: the effect among high trusters was positive and statistically significant (0.669 [95%CI 0.158-1.179]), but that among low trusters was not. We found a similar heterogeneity on the opinions regarding vaccination progress across the country,.

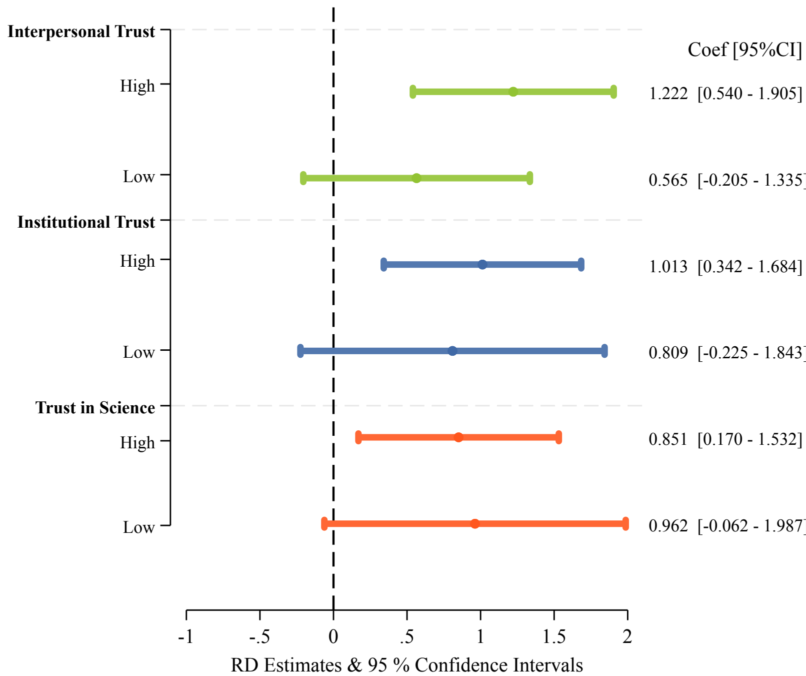
Next, we found no difference in the vaccination effect based on the level of institutional trust and trust in science in both Figures 6a and 6b. In Figure 6a, for example, the RD estimate of the vaccination effect was 0.851 for those with high trust in science and 0.962 for those with low trust in science. These point estimates were very close, suggesting that those with high trust in science—those who might be confident in vaccine efficacy—responded similarly to those who were skeptical about the scientific evidence.

As we found clear heterogeneity based on the level of interpersonal trust, we explored the heterogeneous effect on other outcomes in Figure 7. In this analysis, we found that the point estimates for eight items were consistently positive among high trusters, while they were not statistically significant due to the smaller sample size. In particular, the vaccination effect on the item that "Vaccinations are progressing well across the country" was 0.680 (95%CI -0.172–1.532) among high trusters, weakly indicating they updated their belief on vaccination progress across the country positively when they got vaccinated.

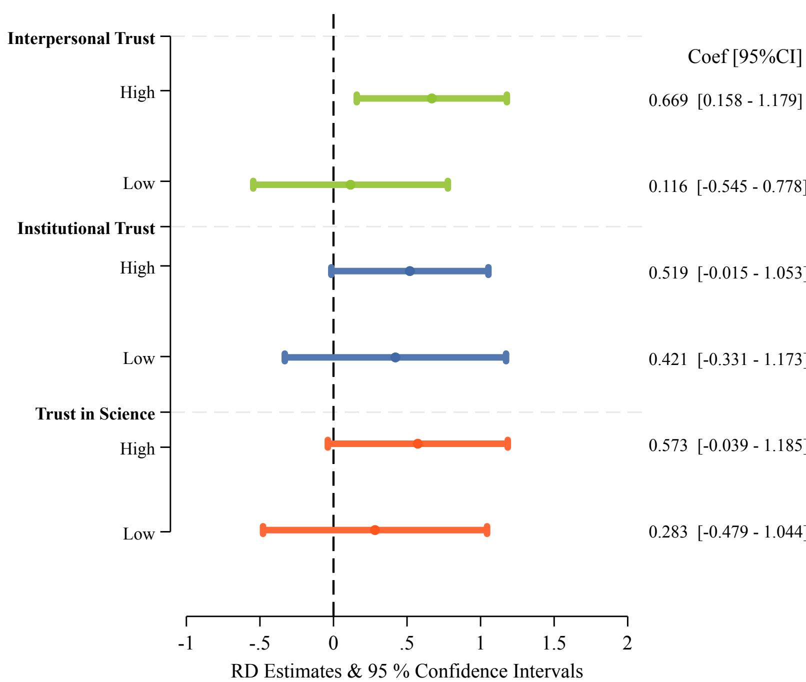
However, the point estimate for the item that "infection control measures implemented by the central government have been successful" was negative (-0.829) and the upper bound for the 95% confidence interval was close to zero ([95%CI -1.730 - 0.072]) among low trusters, indicating that low trusters negatively updated their evaluation of the central government when they got vaccinated. This result was a bit counterintuitive but was consistent with the results on other items because low trusters began to strongly agree with the statement that "The Tokyo Olympics and Paralympics should have been held with spectators" (1.232 [95%CI 0.253–2.212]). In other words, those with low trust began to express skepticism about the government's policy, arguing that as they were vaccinated, the Tokyo Olympics and Paralympics should have allowed spectators; there was no need to hold them without an audience. Possibly, this negative update outweighed the potential positive update on other policies, causing low trusters to downgrade the overall assessment of the central government's infection control measures.

Figure 6: Trust and Political Support (2SLS)

(a) Vaccinations are progressing well in your municipality

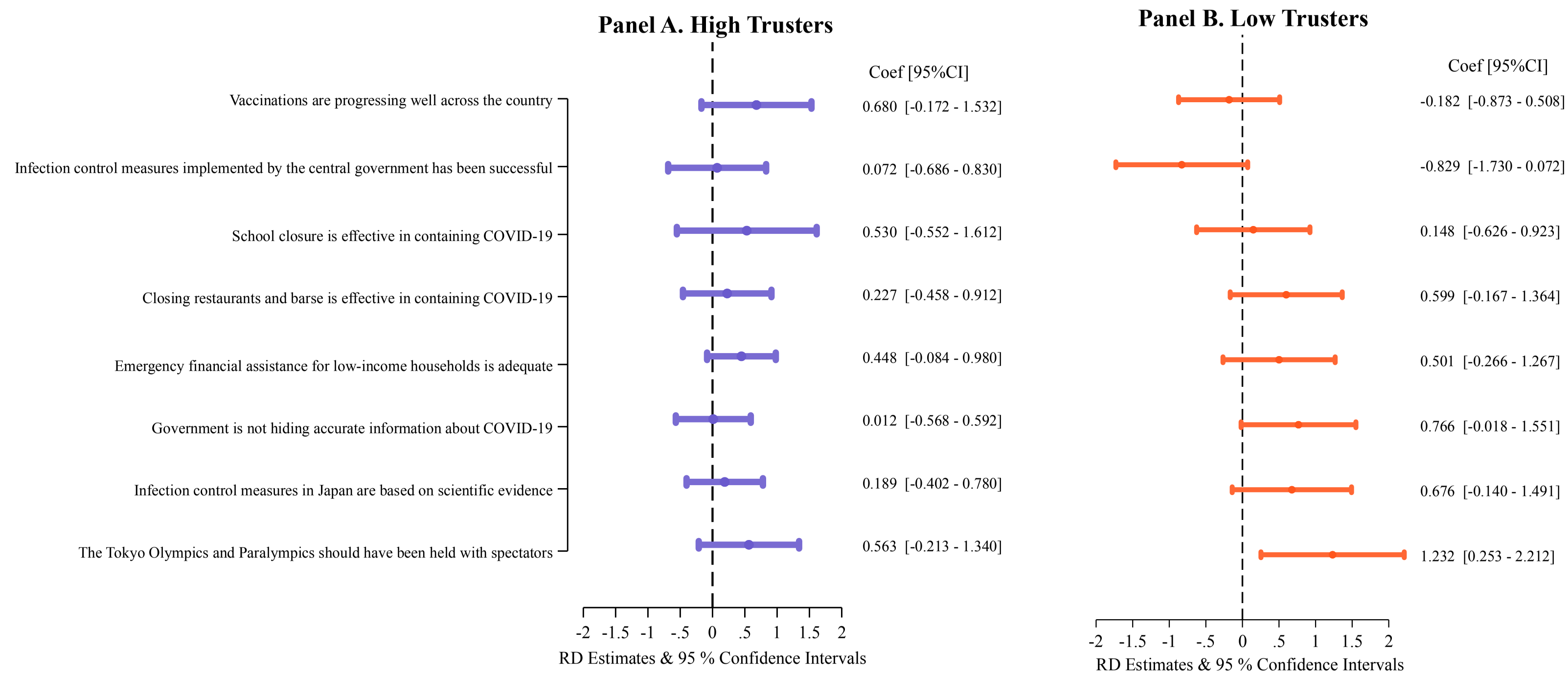


(b) Infection control measures implemented by your municipality have been successful



Notes: The band around the point estimate represents 95% confidence intervals. The RD estimates are based on bias-corrected estimates and their 95% confidence intervals are derived from robust standard errors proposed by Calonico, Cattaneo and Titiunik (2014b).

Figure 7: Interpersonal Trust and Political Support (2SLS)



Notes: The band around point estimate represents 95% confidence intervals. The RD estimates are based on bias-corrected estimates and their 95% confidence intervals are derived from robust standard errors proposed by Calonico, Cattaneo and Titiunik (2014b).

6.3 Perceived Vaccine Efficacy and Political Support

As we argue that voters respond positively when they receive public services with greater personal value in the subsample analysis by health status, we directly explore the heterogeneous effects of perceived vaccine efficacy in the Online Appendix D. We found that respondents changed their opinions on the municipal government more positively when they believed the vaccine would save more people; however, the difference in vaccination effects by perceived vaccine efficacy was neither substantial nor clear.

This is probably because perceived vaccine efficacy may reflect the subjective public benefit of vaccination rather than the private benefit indicated by individual health status. Those in poor health may personally benefit from vaccination, while those in good health may not, even if they believe the vaccine will save many people. If voters only change their evaluations positively when they receive private benefits, it is natural that we find clear differences only in vaccination effects by health status, but not in those by perceived vaccine efficacy.

6.4 Heterogeneous Effects on Other Outcomes

The subsample results for the other six outcomes on infection control measures are summarized in Figure E2 to E7. In summary, we did not find particularly large heterogeneity by basic characteristics on the two items—our full sample results were statistically significant for these outcomes—that "emergency financial assistance for low-income households is adequate" and "the Tokyo Olympics and Paralympics should have been held with spectators."

7 Conclusion

Political theories postulate that incumbents can increase their support by targeting public services to a specific subset of the population. However, empirical evidence on the relationship between political support for incumbents and public service provision remains unclear. To shed new light on the impact of public service provision on the political support of the entire population, we examined one of the largest health investment programs in history—the mass COVID-19 vaccination. The COVID-19 vaccine was particularly exceptional as it was distributed to the vast majority of the population large numbers, encompassing individuals from various backgrounds, including the poor and the rich, women and men, college graduates and non-graduates. Anyone who wanted the vaccine received it at no out-of-pocket cost during the pandemic. In addition, the strict age-based priority rule in Japan provides a valuable opportunity to identify the causal effects of vaccination on political support.

Our RD estimates yield two main insights into the political impact of large-scale health investment programs. First, COVID-19 vaccination increases favorable opinions regarding vaccination progress in municipalities and infection control measures of municipal governments. Specifically, the 2SLS estimates indicate that COVID-19 vaccination increases favorable opinions on vaccination progress in municipalities and infection control measures of municipal governments by 28.9%and 15.4%, respectively. Second, the increase in favorable opinions on these issues spills over into evaluations of other policies and government transparency, suggesting that public service provision—if the quality of the service is sufficiently high, as in the case of the COVID-19 vaccine—may foster greater trust in the government in the long run.

After presenting the vaccination effect in a nationally representative population around the age of 65, we further explored the heterogeneous responses using rich individual-level survey data to facilitate understanding of the main result. The pattern of heterogeneous responses based on respondent characteristics (i.e., health status and gender) is consistent with several political theories. First, the subsample results based on chronic condition and gender indicate that reciprocal motives (Hahn, 2009; Finan & Schechter, 2012) may explain the heterogeneity of the vaccination effect, because individuals with chronic illnesses are more likely to express gratitude for earlier vaccinations than others. Furthermore, phycological and experimental studies indicate that women are more reciprocal than men (Croson & Gneezy, 2009). These factors may explain why those with chronic diseases and women respond more positively than their counterparts. Subsample results based on interpersonal trust also indicate that individuals with high interpersonal trust—who may also be highly reciprocal—change their opinions on the government more positively than others.

Second, subsample results based on SES are consistent with the "rational but poorly informed voter" hypothesis Rogoff (1990). According to this hypothesis, rational but poorly informed voters may update their knowledge of incumbents more significantly when they benefit from public services, as they use these policies to infer politicians' redistributive preferences and competence. As low-SES individuals generally possess less political knowledge than those with higher SES (Angelucci & Prat, 2021), it is natural that low-SES individuals significantly increased positive opinions on vaccination progress and infection control measures when they got vaccinated, while high-SES individuals did not change their opinions.

Finally, examining the heterogeneous effects by interpersonal trust more extensively, we found that low trusters may downgrade their overall assessment of the central government's infection control measures. In particular, low trusters began to criticize the government for not allowing spectators at the Tokyo Olympics and Paralympics when vaccines were widely available. This negative update among low trusters contrasts with the positive updates on vaccination progress and overall infection control measures among high trusters.

In the concluding remarks, we discuss the external validity of our analysis. As the COVID-19 vaccine was distributed to the entire population for free, its political impact may be akin to that of basic public services consumed individually, such as public education and general health care. Therefore, it is possible that women, individuals with low SES, and those with high interpersonal trust would increase their political support when modern welfare states implemented similar policies in the early and mid-20th century. In particular, the heterogeneous effects of interpersonal trust—often referred to as a typical indicator of social capital—may explain why countries with high interpersonal trust have successfully expanded these policies and achieved high economic performances.

In countries with high interpersonal trust, an honest and appropriate political response from voters linked to effective public service provision, generates a virtuous circle between politicians and voters, leading to favorable economic and institutional outcomes in the long run. Conversely, politicians have less incentive to expand services in countries with low interpersonal trust because voters may not respond to the provision of quality services. In our data, high trusters increased their support for vaccination progress and other infection control measures, while low trusters expressed complaints about the Tokyo Olympics and Paralympics without spectators upon vaccination, failing to increase favorable opinions on the government. If the majority of a country's population consists of low trusters, expanding basic public services to everyone becomes a significant challenge. In this regard, our study on mass COVID-19 vaccination may supplement historical macro-level evidence revealing an association between interpersonal trust— a general measure of social capital—and government quality (Putnam, Leonardi and Nanetti, 1994; Keele, 2007; Knack, 2000; Nannicini et al., 2013), welfare state size (Bergh & Bjørnskov, 2011, 2014), public investment in education (Ponzetto & Troiano, 2018), and long-run economic growth (Algan & Cahuc, 2010; Zak & Knack, 2001).

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Online Appendix

A Descriptive Statistics

Table A1: **Descriptive Statistics**

	All respondents		Prioritized (Age 65–67)		Not Prioritized (Age 62–64)	
	Mean	SD	Mean	SD	Mean	SD
Vaccination rate (two doses completed) (%)	65.7	0.47	85.9	0.34	50.3	0.50
General opinions on vaccination policy and infection control measures (5: Agree - 1: Disagree)						
Vaccinations are progressing well in your municipality.	3.19	1.09	3.15	1.11	3.25	1.06
Infection control measures implemented by your municipality have been successful.	2.95	0.90	2.94	0.91	2.96	0.90
Vaccinations are progressing well across the country.	2.43	1.06	2.45	1.07	2.41	1.04
Infection control measures implemented by the central government have been successful.	2.00	1.06	2.02	1.06	1.98	1.04
Opinions on specific infection control measures (5: Agree - 1: Disagree)						
School closures are effective in containing COVID-19.	2.84	1.26	2.81	1.25	2.87	1.27
Closing restaurants and bars is effective in containing COVID-19.	2.80	1.16	2.79	1.16	2.80	1.15
Emergency financial assistance for low-income households is adequate.	4.00	0.97	3.98	0.98	4.02	0.96
Government is not hiding accurate information about COVID-19.	3.96	1.03	3.94	1.04	3.98	1.02
Infection control measures in Japan are based on scientific evidence.	3.85	1.02	3.82	1.03	3.88	1.01
The Tokyo Olympics and Paralympics should have been held with spectators.	4.00	1.17	3.99	1.18	4.03	1.16
Infection, daily behavior, risk perception, and future prospects						
Infection Rate	0.005	0.073	0.006	0.077	0.004	0.068
Preventive behavior index	0.00	1.00	-0.01	1.01	0.02	0.99
Risky behavior index	0.00	1.00	0.01	1.04	-0.01	0.94
Risk Perception index	0.00	1.00	0.01	1.00	-0.01	1.00
Future prospects index	0.00	1.00	-0.02	1.00	0.03	1.00
Predetermined Covariates						
Chronic disease	0.42	0.49	0.41	0.49	0.43	0.50
Woman	0.50	0.50	0.50	0.50	0.50	0.50
College graduate	0.49	0.50	0.49	0.50	0.49	0.50
High income	0.59	0.49	0.61	0.49	0.56	0.50
Worker	0.55	0.50	0.62	0.49	0.46	0.50
Epidemic area	0.54	0.50	0.54	0.50	0.54	0.50
Trust (1: High - 0: Low)						
Interpersonal trust	0.56	0.50	0.55	0.50	0.57	0.50
Institutional trust	0.54	0.50	0.54	0.50	0.55	0.50
Trust in science	0.45	0.50	0.45	0.50	0.46	0.50
Observation	14,198		8,208		5,990	

Notes: All four indicators for behavior and perception are standardized to a mean of zero and a standard deviation of one.

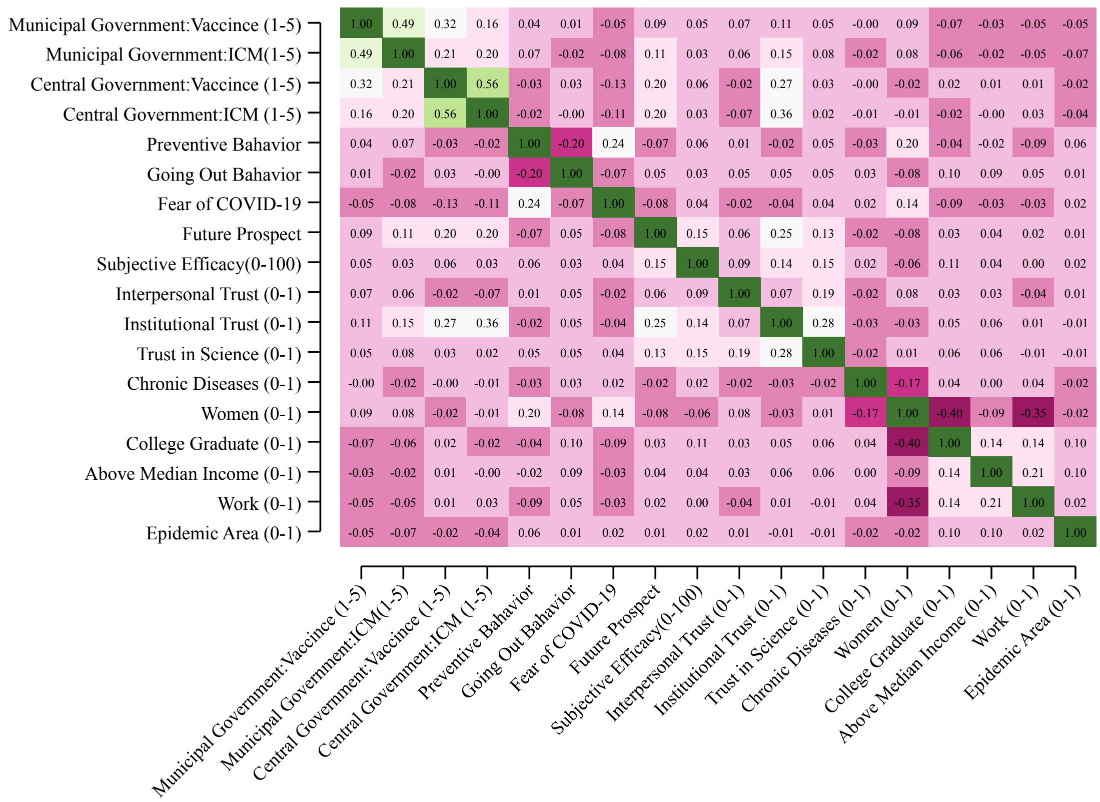
Table A2: Details on Outcome Variables Except Political Opinions

	Mean	SD	Min	Max
Risk Perception toward COVID-19 : 1(Do not agree at all)- 5(Completely Agree)				
COVID-19 is very scary	3.82	1.04	1	5
It makes me uncomfortable when I think about COVID-19	3.51	1.09	1	5
I am afraid of losing lives to COVID-19	3.45	1.13	1	5
I feel anxious about being infected with COVID-19	3.51	1.06	1	5
I feel anxious about my family getting infected with COVID-19	3.62	1.05	1	5
I'm worried that I will infect my family and others with the coronavirus	3.33	1.11	1	5
I feel anxious about creating a cluster	2.90	1.16	1	5
Preventive Behaviors : 1 (Always)-–4 (Never)				
I disinfect hands and fingers with rubbing alcohol	1.35	0.59	1	4
I wash hands for 15 seconds or more using soap and hand soap	1.53	0.75	1	4
I gargle when I get home	1.95	1.06	1	4
I comply with cough etiquette	1.51	0.88	1	4
I avoid touching eyes, nose and mouth with unwashed hands	1.84	0.91	1	4
I disinfect items that are frequently touched by humans, such as doorknobs	2.58	1.02	1	4
I open windows to ventilate the room	1.71	0.81	1	4
I wear a mask when there are people around	1.10	0.41	1	4
I refrain from traveling	1.27	0.67	1	4
I refrain from unnecessary and nonurgent outings and business trips	1.43	0.68	1	4
I avoid talking or speaking at close range (within 1 meter)	1.62	0.75	1	4
I maintain social distance	1.59	0.72	1	4
I avoid meeting people who are at high risk of infection	1.44	0.79	1	4
I avoid going to crowded places	1.38	0.63	1	4
I eat a nutritionally balanced diet	1.61	0.75	1	4
I try to maintain a regular routine	1.51	0.71	1	4
I eat breakfast	1.28	0.71	1	4
I refrain from dining at in-store restaurants	1.59	0.78	1	4
I avoid exposure to cigarette smoke (passive smoking)	1.66	1.08	1	4
Risky Behaviors: 1 (Never), 2 (Once), 3 (Sometimes), 4 (Once or more in a week)				
I visited a friend's house	1.12	0.41	1	4
I visited a relative's house	1.40	0.69	1	4
I invited friends and relatives to my house	1.23	0.54	1	4
I went to restaurants (other than bars) with my friends and colleagues.	1.19	0.52	1	4
I went to a Japanese pub or bar with my friends and colleagues	1.08	0.34	1	4
I went to restaurants (other than bars) by myself	1.24	0.63	1	4
I went to a Japanese pub or bar by myself	1.05	0.29	1	4
I went to a nightclub	1.02	0.20	1	4
I went to karaoke with multiple people	1.02	0.20	1	4
I went to a live house	1.02	0.20	1	4
I participated in group sports	1.13	0.50	1	4
I went to watch sports	1.05	0.28	1	4
I went to a sports gym	1.19	0.67	1	4
I went for outdoor exercise or a walk	2.05	1.22	1	4
I went to pachinko / pachislot.	1.10	0.44	1	4
I went to a club or girl's bar with entertainment	1.02	0.20	1	4
I went to a sex shop	1.02	0.21	1	4
I got on a crowded train	1.31	0.77	1	4
I went to a museum or cinema	1.12	0.41	1	4
I went to buy something other than groceries or daily necessities	2.45	1.18	1	4
Future Prospects: 1 (0%)–11 (100%)				
Vaccines will be available to all applicants in the country	8.29	2.58	1	11
Medical shortages will be eliminated	6.20	2.64	1	11
People will be able to live without masks	4.32	2.78	1	11
Restaurants will be able to reopen for business	5.83	2.69	1	11
Large-scale events will resume as usual	5.69	2.70	1	11
Domestic travel will be free	6.02	2.75	1	11
People will be able to travel freely abroad	4.92	2.72	1	11
Economic activity will increase and the economy will improve	5.31	2.62	1	11
Highly effective treatments for COVID-19 will become available	5.90	2.63	1	11
No more deaths from COVID-19 in Japan	4.50	2.88	1	11
No more people infected with COVID-19 in Japan	3.69	2.77	1	11

Table A3: Descriptive Statistics on Chronic Diseases

Chronic diseases	Fraction (%)	SD
Hypertension	34.2	0.47
Diabetes	11.5	0.32
Asthma	2.8	0.16
Bronchiectasis, Pneumonia	0.8	0.09
Atopic dermatitis	2.0	0.14
Otitis media	0.5	0.07
Angina pectoris	2.0	0.14
Myocardial infarction	1.4	0.12
Cerebral hemorrhage	1.5	0.12
Chronic obstructive pulmonary disease (COPD)	0.5	0.07
Cancer	2.5	0.16
Chronic pain lasting more than 3 months	4.4	0.20
Depression	1.6	0.12
Mental disorders other than depression	1.0	0.10

Figure A1: Correlation Matrix

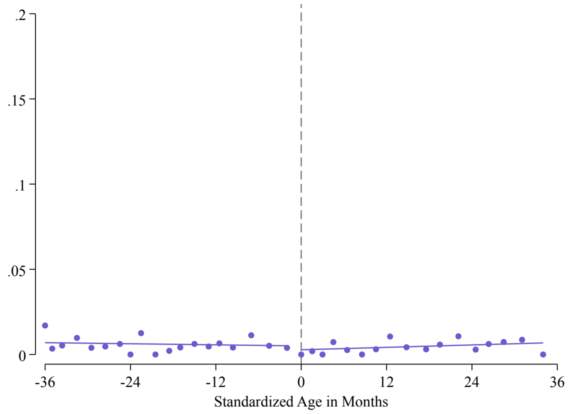


Notes: The band around each estimate represents the 95% confidence interval. The variable used as the criterion for sample separation is excluded from the control covariates. The term "High Income" ("Low Income") refers to individuals with incomes above (below) the median income of the analyzed sample.

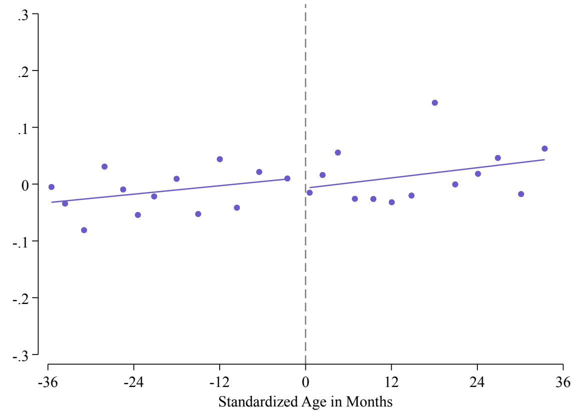
B RD Plot on Other Outcomes

Figure B1: Regression Discontinuity Plots on Other Outcomes

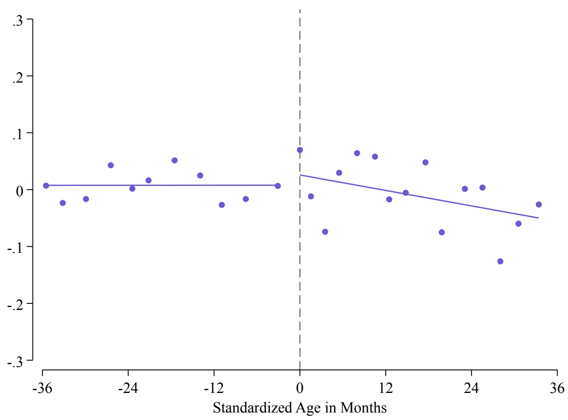
(a) Infection Rate



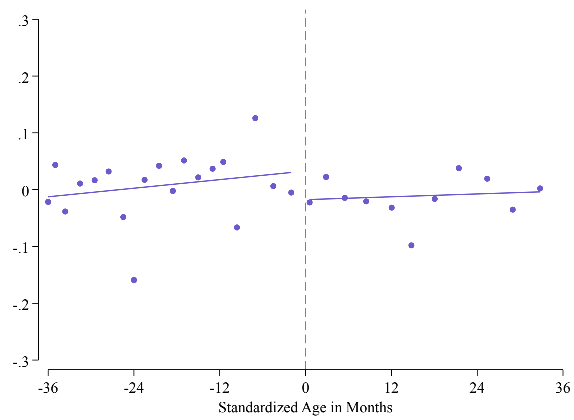
(b) Preventive Behavior Index



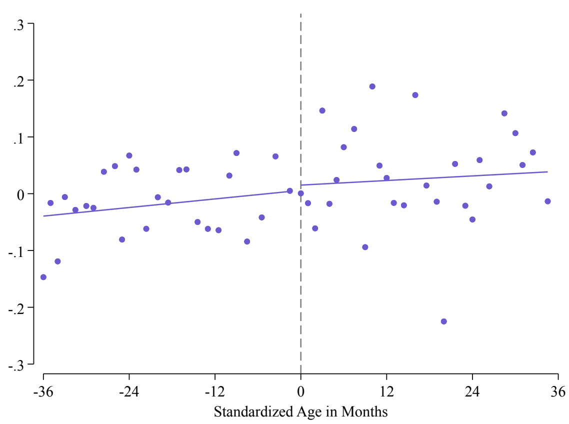
(c) Risky Behavior Index



(d) Risk Perception Index



(e) Future Prospects Index



Notes: The horizontal axis represents age in months standardized to zero at the age-65 threshold. The RD plots with linear fitted lines are based on the optimal data-driven method proposed by Calonico, Cattaneo and Titiunik (2015).

C Measurement and Distribution of Trust Scores

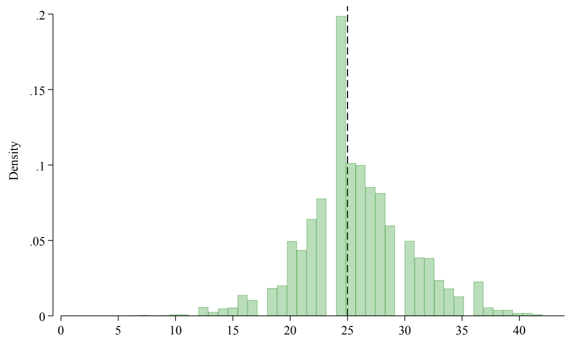
We examine three aspects of trust: interpersonal trust, institutional trust, and trust in science. First, we used a scale on interpersonal trust proposed by Siegrist & Bearth (2021), which integrates various items from other studies (Glaeser et al., 2000). Six items were used to measure respondents' interpersonal trust: 1) "If given the chance, most people in your city would try to take advantage of you"; 2) "Most people in your city are too busy looking out for themselves to be helpful"; 3) "You can't trust strangers anymore"; 4) "When dealing with strangers, one is better off using caution before trusting them"; 5) "Most people in your city are honest"; 6) "Most people in your city tell a lie when they can benefit from doing so." Respondents rated their agreement with each statement on a scale from 1 (completely agree) to 7 (do not agree at all). The total score of these items serves an index of interpersonal trust.[16] The total score ranged from 6 to 42, with higher values indicating higher levels of interpersonal trust.

Second, we measured the degree of institutional trust and trust in scientists using questions from the World Values Survey (Inglehart, 2004). Specifically, the participants were asked to rate their trust in the legal system, parliament, police, and scientists on an 11-point scale. Institutional trust was assessed using the total score of the first three items, while trust in scientists was measured using the last item. The distributions of three trust scores are shown in Table C1.

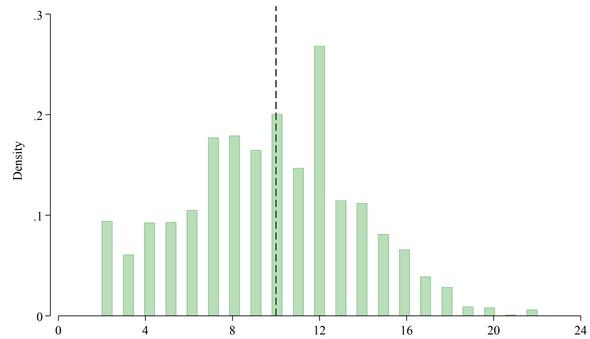
[16]To align the direction of the scale, w fifth item was reverse-coded, as lower values for this item indicated higher interpersonal trust.

Figure C1: Trust Scores

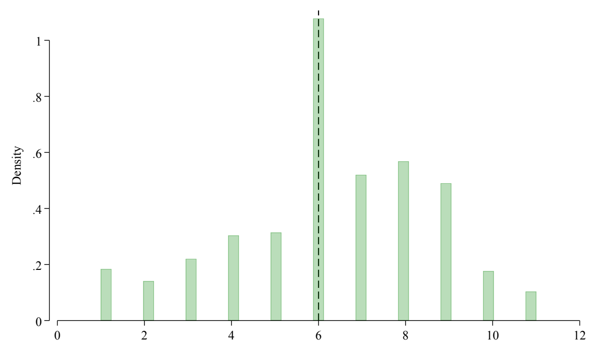
(a) Interpersonal Trust Score



(b) Institutional Trust Score



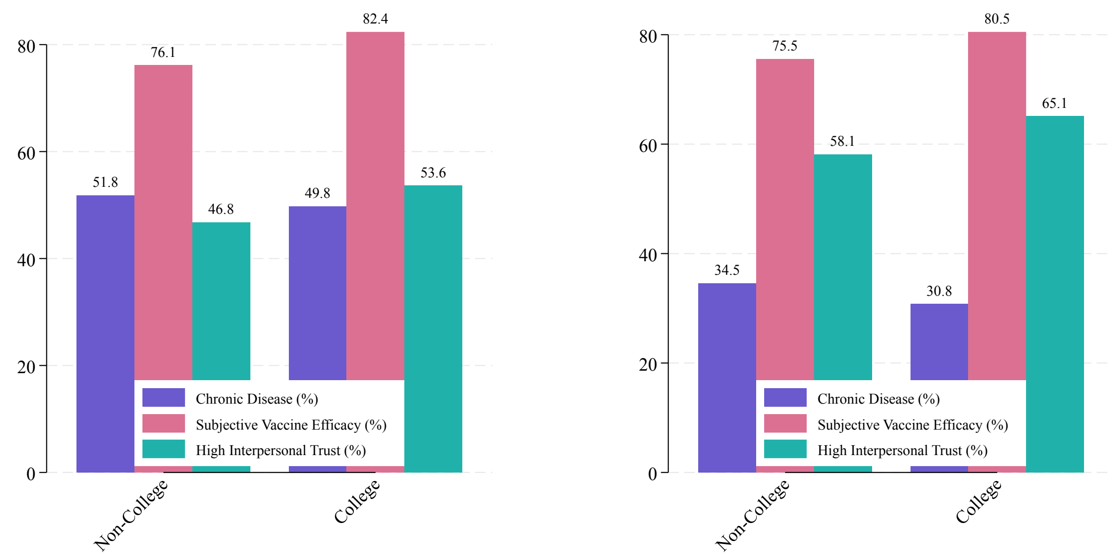
(c) Trust in Science Score



Notes: Dashed line represents the median.

Figure C2: Differences in Key Characteristics based on Education

(a) Men (b) Women



Notes: "Chronic disease" and "High interpersonal trust" represent the proportion of male and female respondents with chronic diseases and interpersonal trust scores above the median. For the subjective efficacy of the vaccine, which ranges from 0 % to 100 %, we report the mean value for each subsample.

D Perceived Vaccine Efficacy and Political Support

In the main text, we argued that voters may evaluate their government positively because they benefited from a specific policy—the early distribution of the COVID vaccine. The next question in this appendix is whether the subjective value of the public service that they received matters. To answer this question, we explored the relevance of perceived vaccine efficacy. Figure D1a shows the distribution of perceived vaccine efficacy among respondents, with a mean and median of 78% and 90%, respectively. Figure D1a also suggests that some respondents are skeptical about the vaccine efficacy. In our study, we divided the sample based on the median value (90%).

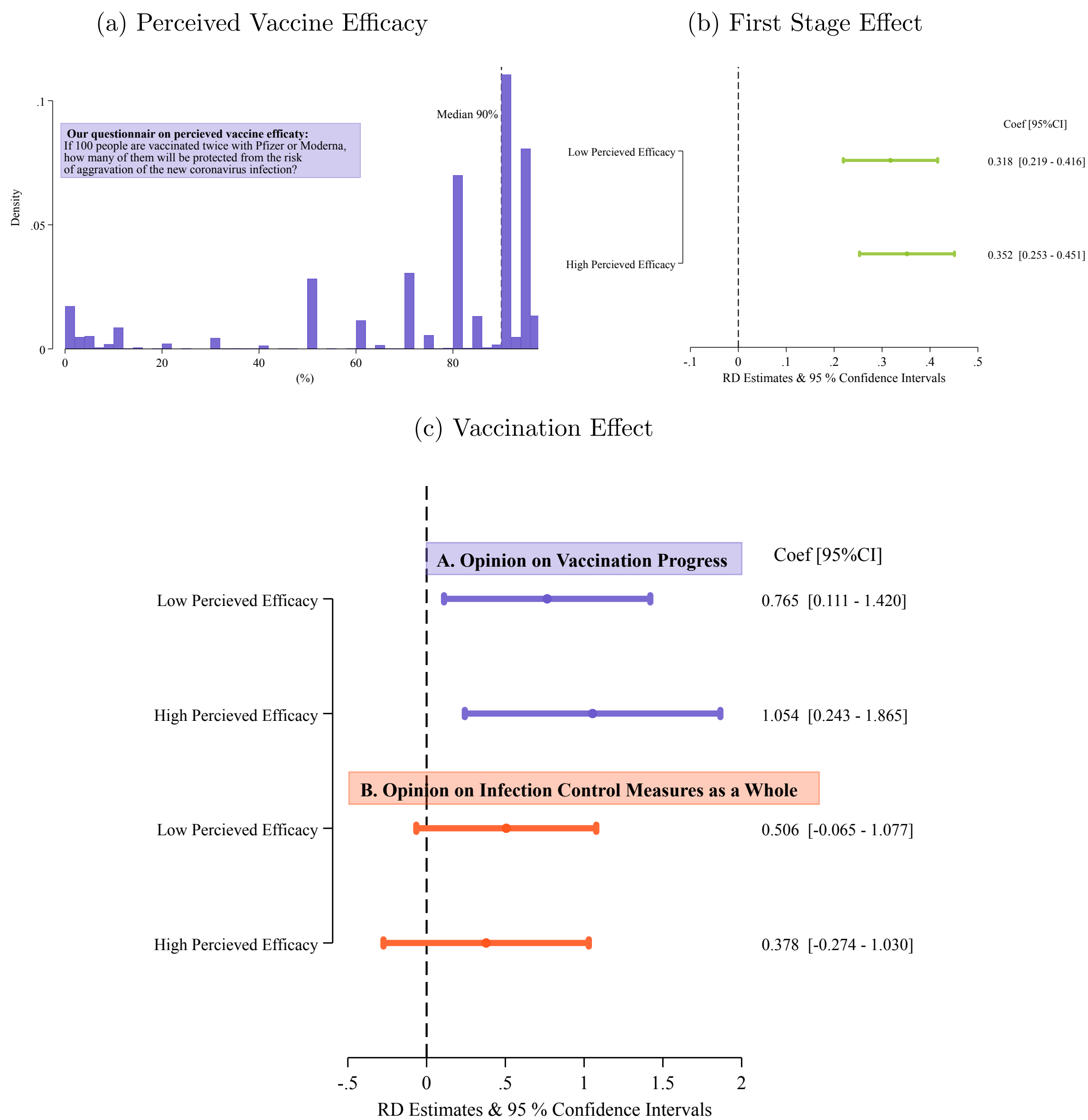
First-stage estimates for the effects of prioritization are shown in Figure D1b. Among respondents with low perceived efficacy, prioritization increased the vaccination rate by 31.8 percentage points (95%CI 0.219–0.416). This effect among those with low perceived efficacy was nearly identical with that among those with high perceived efficacy, suggesting that people got vaccinated regardless of their perceived vaccine efficacy. While counterintuitive, this may be explained by the fact that vaccine was free during the survey period, encouraging vaccination even among those who doubted its efficacy .

The 2SLS estimates for the vaccination effect are shown in Figure D1c. The top and bottom rows of the figure show the results of the respondents' evaluation of vaccination progress in the municipality and the results of the infection control measures implemented by the municipality, respectively. This figure indicates that those with high perceived efficacy exhibited higher vaccination effect (1.054) than those with low perceived efficacy (0.764); however, the difference was not significant compared to the results based on interpersonal trust in Figures 6a and 6b. In addition, we found that the effects of the evaluation of infection control measures as a whole were not statistically significant in either group.

If voters update their beliefs about the incumbent more positively when they perceive greater benefits from public services, we should expect that perceived vaccine efficacy would significantly impact vaccination effects. However, our results do not support this prediction, suggesting that beneficiary voters evaluate their incumbent positively, mostly regardless of the subjective value of public services.

This is probably because perceived vaccine efficacy may reflect the subjective public benefit of vaccination rather than the private benefit indicated by individual health status. Those in poor health may personally benefit from vaccination, while those in good health may not, even if they believe the vaccine will save many other people. If voters only change their evaluations positively when they receive private benefits, it is natural that we find clear differences only in vaccination effects by health status, but not in those by perceived vaccine efficacy.

Figure D1: Perceived Vaccine Efficacy and Political Support



Notes: The band around the point estimate represents the 95% confidence interval. The RD estimates are based on bias-corrected estimates and their 95% confidence intervals are derived from robust standard errors proposed by Calonico, Cattaneo and Titiunik (2014b). In Figures D1b and D1c, the sample is divided by the quartiles based on the question regarding vaccine confidence. A higher order of the quartiles indicates higher confidence in COVID-19 vaccines.

E Additional Regression Results

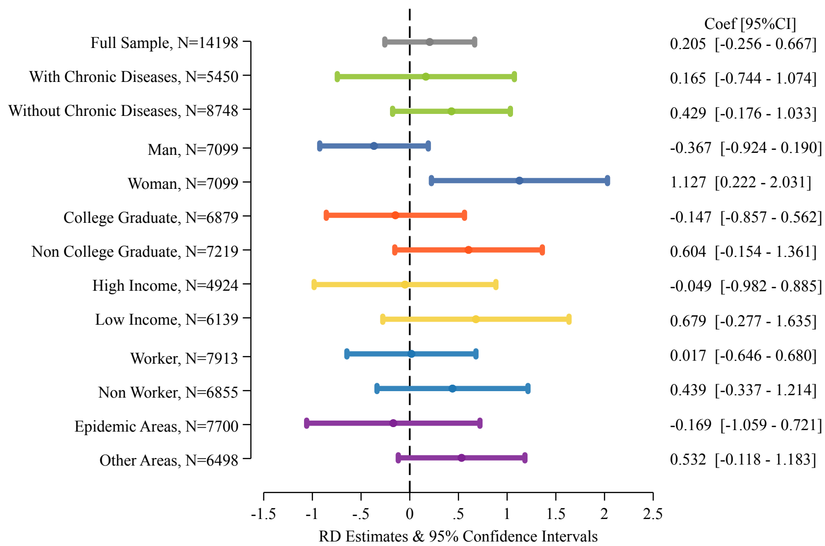
Table E1: Vaccination Effect on Risk Perceptions, Daily Behaviors, and Future Prospects

	Coef.	Robust SE
Perception toward COVID-19 : 1 (Do not agree at all)—5 (Completely Agree)		
COVID-19 is very scary	0.421*	(0.252)
It makes me uncomfortable when I think about COVID-19	0.566**	(0.267)
I am afraid of losing lives to COVID-19	0.103	(0.281)
I feel anxious about being infected with COVID-19	-0.032	(0.265)
I feel anxious about my family getting infected with COVID-19	0.047	(0.257)
I'm worried that I will infect my family and others with the coronavirus	-0.213	(0.263)
I feel anxious about creating a cluster	-0.106	(0.307)
Daily Preventive Behavior : 1 (Always)–4 (Never)		
I disinfect hands and fingers with rubbing alcohol	0.183	(0.142)
I wash hands for 15 seconds or more using soap and hand soap	0.143	(0.176)
I gargle when I get home	-0.083	(0.267)
I comply with cough etiquette	-0.045	(0.207)
I avoid touching eyes, nose and mouth with unwashed hands	0.118	(0.216)
I disinfect items that are frequently touched by humans, such as doorknobs	-0.198	(0.238)
I open windows to ventilate the room	0.213	(0.191)
I wear a mask where there are people around	0.056	(0.081)
I refrain from traveling	0.177	(0.137)
I refrain from unnecessary and nonurgent outings and business trips	-0.067	(0.165)
I avoid talking or speaking at close range (within 1 meter)	-0.021	(0.175)
I maintain social distance	-0.057	(0.174)
I avoid meeting people who are at high risk of infection	0.09	(0.174)
I avoid going to crowded places	0.009	(0.149)
I eat a nutritionally balanced diet	-0.042	(0.178)
I try to maintain a regular routine	-0.08	(0.164)
I eat breakfast	0.058	(0.176)
I refrain from dining at in-store restaurants	0.136	(0.179)
I avoid exposure to cigarette smoke (passive smoking)	0.199	(0.248)
Risky Behaviors: 1 (Never), 2 (Once), 3 (Sometimes), 4 (Once or more in a week)		
I visited a friend's house	-0.01	(0.105)
I visited a relative's house	-0.15	(0.186)
I invited friends and relatives to my house	0.13	(0.136)
I went to restaurants (other than bars) with my friends and colleagues.	0.08	(0.122)
I went to a Japanese pub or bar with my friends and colleagues	0.03	(0.068)
I went to restaurants (other than bars) by myself	-0.10	(0.141)
I went to a Japanese pub or bar by myself	-0.01	(0.069)
I went to a nightclub	0.01	(0.047)
I went to karaoke with multiple people	-0.01	(0.048)
I went to a live house	0.02	(0.050)
I participated in group sports	0.05	(0.125)
I went to watch sports	-0.03	(0.061)
I went to a sports gym	0.18	(0.162)
I went for outdoor exercise or a walk	-0.18	(0.304)
I went to pachinko / pachislot.	0.13	(0.108)
I went to a club or girl's bar with entertainment	-0.02	(0.051)
I went to a sex shop	-0.04	(0.052)
I got on a crowded train	-0.09	(0.185)
I went to a museum or cinema	0.00	(0.096)
I went to buy something other than groceries or daily necessities	0.17	(0.309)
Future Prospects: 1(0%)-11(100%)		
Vaccines will be available to all applicants in the country	-0.837	(0.663)
Medical shortages will be eliminated	-0.806	(0.672)
People will be able to live without masks	0.606	(0.704)
Restaurants will be able to reopen for business	-0.613	(0.673)
Large-scale events will resume as usual	-0.95	(0.696)
Domestic travel will be free	-0.823	(0.709)
People will be able to travel freely abroad	-0.721	(0.684)
Economic activity will increase and the economy will improve	-0.315	(0.618)
Highly effective treatments for COVID-19 will become available	-0.232	(0.667)
No more deaths from COVID-19 in Japan	-0.342	(0.741)
No more people infected with COVID-19 in Japan	0.797	(0.693)

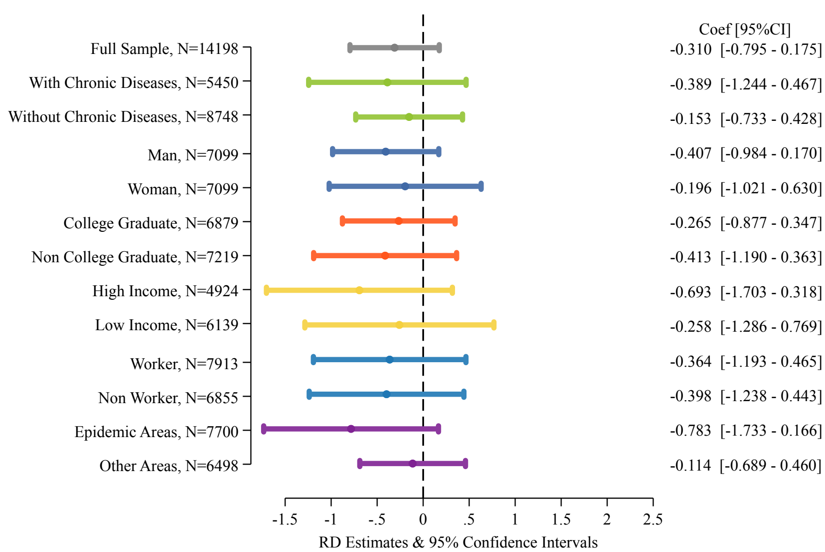
Notes: The bias-corrected estimate of the effect of vaccination and the robust standard error proposed by Calonico, Cattaneo and Titiunik (2014b) are reported. *** p<0.01, ** p<0.05, * p<0.10.

Figure E1: Subsample Results (2SLS)

(a) Vaccinations are progressing well across the country

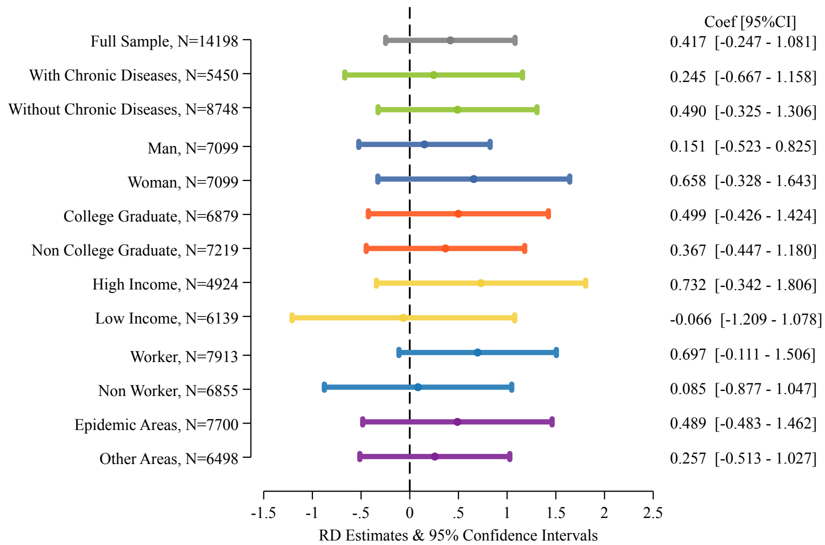


(b) Infection control measures implemented by the central government have been successful



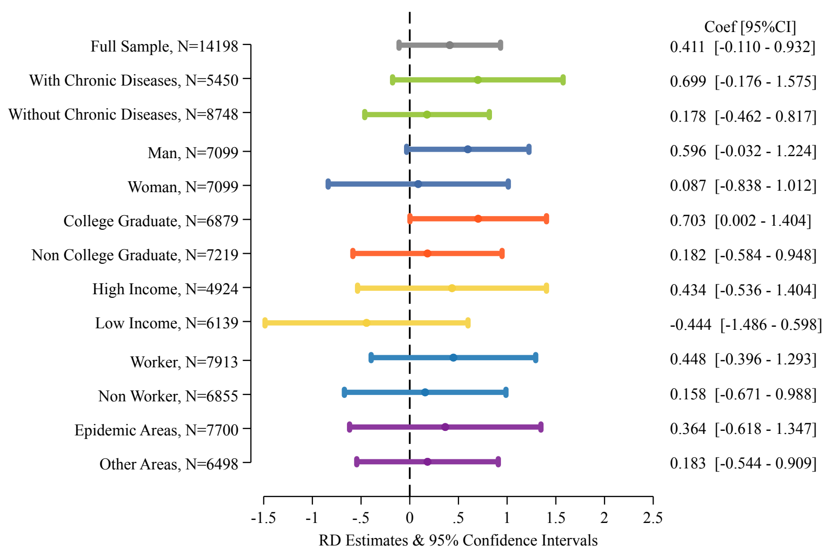
Notes: The band around each estimate represents the 95% confidence interval. The variable used as a criterion for sample separation is excluded from the control covariates. The term "High Income" ("Low Income") refers to individuals with incomes above (below) the median income of the analyzed sample.

Figure E2: School closures are effective in containing COVID-19



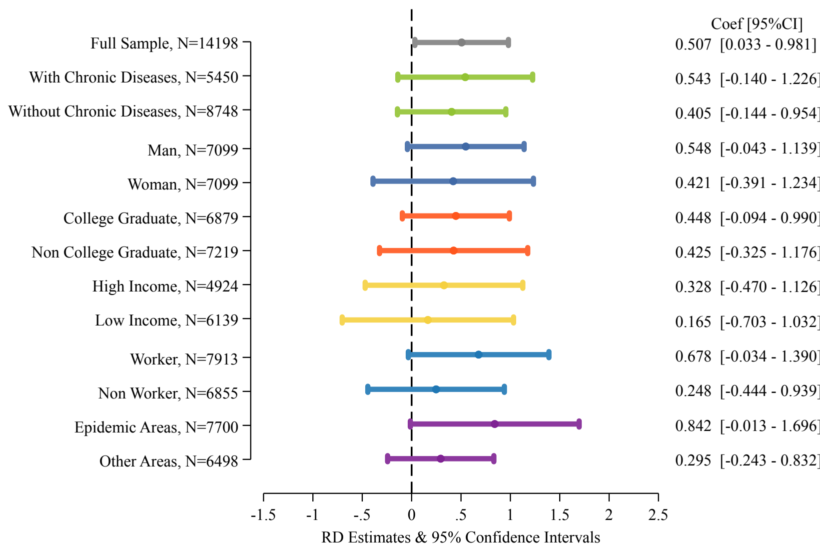
Notes: The band around the point estimate represents the 95% confidence interval. The RD estimates are based on bias-corrected estimates and their 95% confidence intervals are derived from robust standard errors proposed by Calonico, Cattaneo and Titiunik (2014b).

Figure E3: Closing restaurants and bars is effective in containing COVID-19



Notes: The band around the point estimate represents the 95% confidence interval. The RD estimates are based on bias-corrected estimates and their 95% confidence intervals are derived from robust standard errors proposed by Calonico, Cattaneo and Titiunik (2014b).

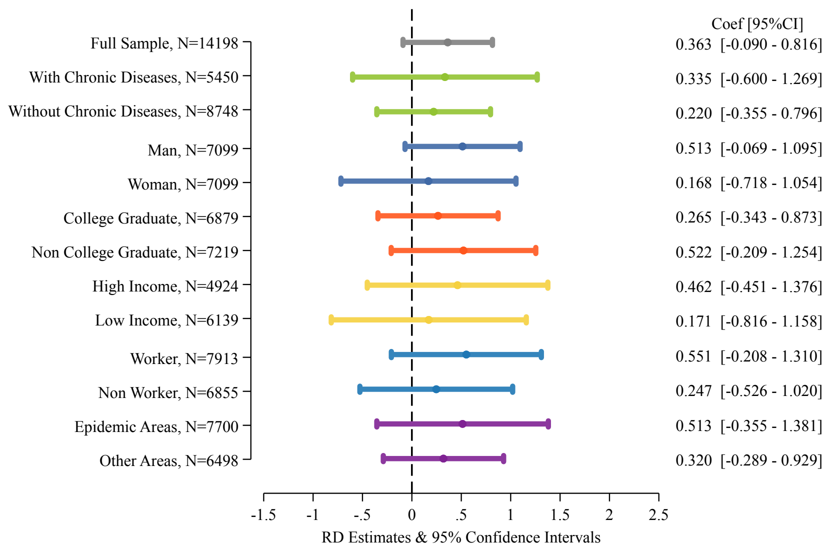
Figure E4: Emergency financial assistance for low-income households is adequate



Notes: The band around the point estimate represents the 95% confidence interval. The RD estimates are based on bias-corrected estimates and their 95% confidence intervals are derived from robust standard errors proposed by Calonico, Cattaneo and Titiunik (2014b).

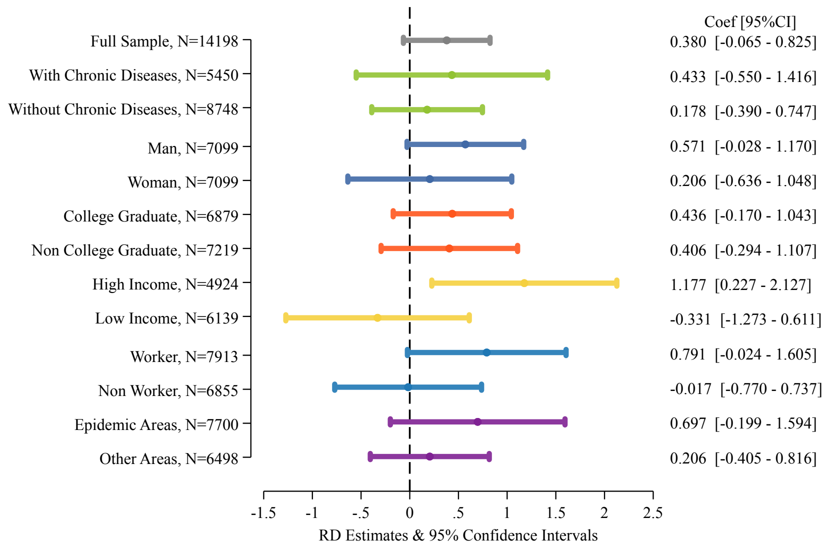
Figure E5: Government is not hiding accurate information about COVID-19

(a) Heterogeneous Effects by Basic Characteristics



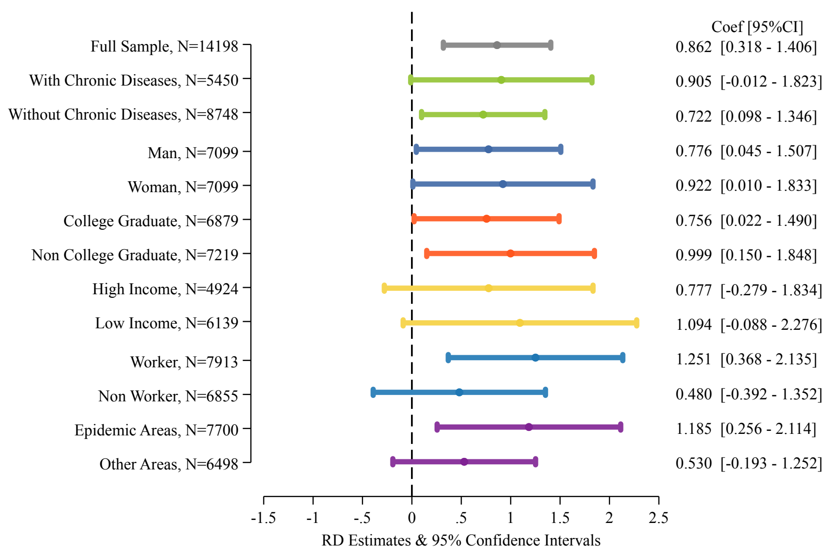
Notes: The band around the point estimate represents the 95% confidence interval. The RD estimates are based on bias-corrected estimates and their 95% confidence intervals are derived from robust standard errors proposed by Calonico, Cattaneo and Titiunik (2014b).

Figure E6: Infection control measures in Japan are based on scientific evidence



Notes: The band around the point estimate represents the 95% confidence interval. The RD estimates are based on bias-corrected estimates and their 95% confidence intervals are derived from robust standard errors proposed by Calonico, Cattaneo and Titiunik (2014b).

Figure E7: The Tokyo Olympics and Paralympics should have been held with spectators



Notes: The band around the point estimate represents the 95% confidence interval. The RD estimates are based on bias-corrected estimates and their 95% confidence intervals are derived from robust standard errors proposed by Calonico, Cattaneo and Titiunik (2014b).