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Uneven Normalization from the COVID-19 Crisis: Evidence from a Mask Survey in Japan

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Abstract

We aim to shed light on the society's normalization process after a pandemic by documenting the process of unmasking in the aftermath of the COVID-19 crisis in Japan. For that purpose, we conducted a weekly or biweekly survey of masking wearing behaviors from Summer 2022 to Spring 2024. Japanese citizens had worn masks at a high rate until mid-March 2023—three years after the onset of the pandemic—when the Prime Minister announced that mask-wearing would become up to individuals. After the announcement, Japanese citizens gradually unmasked themselves. However, the process of unmasking was uneven; some segments of the population unmasked themselves more gradually than others.

Keywords— COVID-19, Heterogeneity, Mask, Non-Pharmaceutical Interventions

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1 Introduction

The COVID-19 pandemic not only took away the lives of so many but also caused severe disruptions to the everyday lives of those who survived the pandemic. Just as countries differed in their policy in the initial phase of the pandemic, they also differed in how quickly to normalize society in the aftermath of the pandemic. Some have pointed out the phenomenon of "long social distancing," whereby some behavioral changes to reduce infection risk have persisted into the post-pandemic era (Barrero et al., 2023). These long-social-distancing behaviors can imprint positive effects on society, but can leave a scar. Thus, it is helpful to document and learn the process by which society normalized in the aftermath of the COVID-19 pandemic.

In this paper, we document the normalization process of a particular infection-prevention behavior that attracted much attention during the pandemic—mask-wearing. Mask-wearing is regarded as one of the most cost-effective ways to suppress the spread of COVID-19 infection. However, some have pointed out the adverse side effects of mask-wearing, ranging from impaired nonverbal communication to disruption in emotional perception. Throughout the COVID-19 crisis, we saw public policy debates regarding the extent to which the government require its citizens to wear masks in many countries.

In particular, we conducted weekly or biweekly surveys on mask-wearing behaviors from August 2022 to March 2024. This period includes two key policy events. First, on March 13, 2023, mask-wearing became up to the choice of each citizen, as declared by then Prime Minister Kishida about one month before the change. Second, on May 8, 2023, the official category of COVID-19 became Category V. Prior to that date, the disease was classified as Category II, which made it possible for the government to impose various restrictions on citizens to prevent infection. Under Category V, COVID-19 would be treated in the same way as the seasonal flu.

We analyze how these two events—a change in the mask-wearing guideline and the classification of COVID-19 into Category V—affected people's mask-wearing behaviors. We find that the mask-wearing rate began declining on March 13, 2023, continued to decline at a steady pace for the following six months until September 2023, and was stable thereafter until the end of our survey. While the change in the mask-wearing guideline triggered the decline in the mask-wearing rate, the classification of COVID-19 into Category V did not affect the pace of the decline in the mask-wearing ratio.

We then analyze heterogeneity in the mask-wearing ratio and the pace of unmaking. We find heterogeneity in the masking wearing ratio across various demographic and socio-economic groups, both before and after March 2023. For example, females and older people were more likely to wear masks than males and younger people, both before and after 2023. However, for many sub-groups, the difference in the masking ratio was similar before and after March 2023, suggesting that the pace of unmasking was similar across sub-groups. However, there were a few exceptions. Notably, we find that college graduates and those with high income were more likely to wear masks before March 2023 in a statistically significant way; however, they were less likely

to wear masks after March 2023, albeit not statistically significant in the case of college graduates. This pattern suggests that college graduates and higher income people more quickly unmasked themselves than non-college graduates and those with lower income.

We also find heterogeneity in the masking ratio and the pace of unmaking depending on factors a person takes into consideration when deciding whether to wear a mask. For example, those who cared about the government's view were more likely to wear masks before March 2023 but were less likely to wear masks after March 2023 than those who did not care about the government's view. Those who care about the experts' views were more likely to wear masks than those who did not, both before and after March 2023, likely because many infectious disease experts kept recommending masks to citizens even after March 2023.

Our work is related to the literature investigating people's masking behaviors during or in the aftermath of the COVID-19 crisis. Examples include Lee et al., 2024, Matschke and Rieger, 2022, Young et al., 2022, Hua et al., 2023, and Lu et al., 2022, among many others. Our paper is closely related to Li et al., 2023, Suzuki et al., 2024, Hirano et al., 2025, who study mask-wearing behaviours in Japan. These papers have examined how various factors—ranging from demographic and socio-economic characteristics to risk perception and political ideologies—affect mask-wearing behaviours. Our research is unique because we conducted our survey over a long period of time—from October 2022 to March 2024—and at high frequency—weekly or bi-weekly—which allows us to analyze the evolution of masking behaviors at a high resolution. Our analysis covers the periods before and after the change in the government guidance on mask-wearing, allowing us to observe the gradual process of unmasking, not just masking behaviors at a particular point in time.

Our work is also related to the literature highlighting heterogeneity in people's infection prevention measures across individuals. Examples include Bundorf et al., 2025, Swisher et al., 2022, Lee et al., 2022, Zhang et al., 2024, White et al., 2020, Handebo et al., 2021, Gotanda et al., 2021, Weill et al., 2020, Akesson et al., 2022, Galasso et al., 2020, Wise et al., 2020 among many others. These papers documented heterogeneity in various infection-prevention measures, ranging from handwashing and social distancing to vaccination. Our paper adds to this literature by providing novel evidence on heterogeneity in masking behaviors during the period in which society normalized itself in the aftermath of the COVID-19 crisis.

The rest of the paper is organized as follows. Section 2 describes our survey. Section 3 discusses the evolution of the mask-wearing rate at the aggregate level. Section 4 discusses the evolution of the mask-wearing rate for various groups. Section 5 concludes.

2 Method

2.1 Survey

We conducted our survey from the second week of August 2022 to the 4th week of March 2024, with help from Cross Marketing Inc., a marketing company based in Tokyo. We conducted the survey every week from August 2022 to April 2023 and every other week thereafter until the end of our survey.[1] The survey is a repeated cross-sectional survey, as opposed to a panel survey. The participants ranged from 20 to 79 years old. Considering the age group and gender ratios, the distributions of age and gender were matched to those in the Population Census. We collected 1,000 respondents in each survey. For convenience in presenting the results in a time-series manner, we reorganized the entire sample on a biweekly basis, excluding respondents from 28 waves conducted between August 2022 and April 2023. Eventually, we included 42,000 respondents from 42 waves during our survey period.

In each survey, we asked the respondents how often they wore a mask, scaled from 1 (always) to 5 (never). We also asked their opinions on whether they should wear masks, scaled from 1 (one should not take off a mask) to 5 (it is ok for people to take off a mask). We asked these questions under seven different situations: (i) on the street with few people around ("Street with few people"), (ii) on the street with many people around ("Street with many people"), (iii) in an indoor space where people work/study quietly ("Quiet indoor"), (iv) movie theater/theater/museum ("Movie theater, etc."), (v) in an indoor space where people chat ("Indoor chatting"), (vi) in a shopping mall or convenience store where people shop quietly ("Shopping area"), and (vii) public transportation ("Public transportation").

We also asked the reasons for their decision regarding whether to wear a mask: (i) COVID-19 infection situation in your area of residence ("Infection situation"), (ii) pressures on medical resources in your area of residence ("Hospital situation"), (iii) weather (temperature/humidity/sunlight/rain/etc.) ("Weather"), (iv) government's policy/views, (v) experts' views, (vi) how many people wear masks around you ("social conformity"), (vii) being able to hide part of your face ("hiding face"), (viii) uncomfortableness of wearing masks/concerns for negative impact of wearing masks ("uncomfortableness"), (ix) behavioral inertia ("Inertia"), and (x) health reasons independent of COVID-19 ("Other health reasons").

Finally, we asked our respondents about their basic demographic and socio-economic characteristics: age, gender, education, income, employment type (regular versus non-regular; full-time versus part-time), whether living with children or not, and whether living with the elderly or not.

Among 42,000 respondents, we excluded 10,340 respondents who did not provide information on household income. In addition, mask-wearing information is missing for 10,131 respondents in our main analysis because they did not visit at least one of the seven typical places where we

[1] We obtain the approval for our survey from the Ethics Review Board at the University of Tokyo (No. 22-424 and No. 23-418).

asked whether they wore a mask. Consequently, our final analytical sample consists of 21,529 respondents. Although a substantial number of respondents were dropped from the analysis, the attrition rate remained stable at around 50 percent until the end of 2023. Starting in January 2024, the attrition rate began to decline, reaching 42 percent in the fourth week of March 2024 as normalization progressed.

2.2 Regression Analysis

We analyze differential unmasking processes among subgroups of people in two ways. First, we plot the evolution of the mask-wearing ratio group-by-group. Second, we estimate two multivariate regression models based on two sub-samples—one before and one after the Prime Minister's announcement in March 2023, allowing for group-specific coefficients. By comparing the group-specific coefficients across these two subsamples, we can tell the differential unmasking process across sub-groups of people.

Specifically, for each subsample regression, we estimate parameters in the following equation:

$$y_{it} = \beta X_{it} + Pref_i + Wave_t + \epsilon_{it},$$

where y_{it} is a mask-wearing rate of respondent i in wave t, X_{it} is a vector of individual characteristics, $Pref_i$ is a prefecture fixed effect, $Wave_t$ is a wave fixed effect, and ϵ_{it} is an idiosyncratic error term. We estimate this equation using the ordinary least squares (OLS) method, and standard errors are clustered at the prefecture level.

3 Results

3.1 Descriptive Statistics

Descriptive statistics are shown in Table 1. The average masking rate in our study period is 66 percent, changing from 88 percent to 52 percent before and after liberalization in March 2023. The proportion of college graduates and regular employee are 48 and 46 percent, respectively. These proportions are higher than the national averages, suggesting that our survey respondents have a relatively high socio-economic background. Regarding the reasons for wearing masks, 46 percent of respondents answered that the "infection situation" affects their decision to wear masks. "Social conformity" was also an important determinant of masking; 29 percent of respondents chose it as a reason to wear a mask.

3.2 Evolution of masking behaviors

Figure 1a illustrates the evolution of the proportion of people not wearing a mask from our survey. The first and second vertical dashed lines indicate dates for two key policy changes discussed earlier: a change in the mask-wearing guideline on March 13, 2023, and the classification of COVID-19 into Category V on May 8, 2023.

According to the figure, the mask-wearing ratio was stable until March 13, 2023. Following the policy change, the mask-wearing rate started to decline. It kept declining at a steady pace until around September 2023, after which the rate stabilized. The classification of COVID-19 into Category V on May 8, 2023, did not affect the pace of the decline that began two months earlier.

The pattern described thus far applies to the evolution of the masking rate in specific situations, as shown in Figure 1b. According to the figure, unmasking ratios in all seven situations started to increase in March 2023, kept increasing at a steady pace until September 2023, and stabilized thereafter.

4 Heterogeneity

Thus far, we have described the process of unmasking at the aggregate level. We now turn to the analysis of how differently subgroups of people unmasked themselves.

4.1 Time-Series

Individual characteristics

According to panels 2a and 2b of Figure 2, older people and females wore masks at a higher rate than younger people and males before March 13, 2023. All groups began unmasking thereafter at a similar pace. At the new steady state, the difference in the masking rate remained similar across age groups as well as across genders. Thus, there is no heterogeneity in the unmasking process across these two attributes.

According to panels 2c and 2d, the mask-wearing rate was similar across college graduates and non-college graduates, as well as across those with low and high incomes, before March 13, 2023. The mask-wearing rate declined thereafter for all these groups of people. Interestingly, the mask-wearing rates for college graduates and those with high income declined by a larger amount than those for non-college graduates and those with low income. As a result, the mask-wearing rates are lower for college graduates and those with high income than for non-college graduates and those with low income in the new steady state.

According to panels 2e and 2f, there is no systematic variation in the unmasking process across different marital statuses as well as across different employment statuses, though the levels of the mask-wearing rates are different across these attributes. Finally, according to panels 2g and 2h,

there is no systematic variation in both the level of the masking rate and the unmasking process across those who lived with the elderly and those who did not, as well as across those who lived with children and those who did not.

Factors for mask-wearing decisions

According to panels 3a and 3b of Figure 3, those who consider local infection and hospital situations in their mask-wearing decision are more likely to wear masks throughout our survey, even after COVID-19 was classified to Category V. According to panel 3c, the mask-wearing rates are similar between those who consider weather in their mask-wearing decision and those who do not, until November 2023. From November 2023 to March 2024, the mask-wearing rate is higher for those who consider the weather than for those who do not, reflecting the benefit of masks in protecting faces from cold weather.

According to panel 3d, the mask-wearing rate is higher for those who consider the government's views on mask-wearing than for those who do not before March 2023. Not surprisingly, the relationship reversed after the change in the government's guidance on mask-wearing. In contrast, the mask-wearing rate for those who consider the experts' views on mask-wearing remained higher than that for those who do not, even after the change in the government guidance and the classification of COVID-19 into Category V. This result likely reflects the cautious views of prominent medical experts that persisted even after the official classification of the COVID-19 Pandemic to Category V.

According to panel 3f, the mask-wearing rate was higher for those who care about social conformity than for those who do not before March 2023. However, the mask-wearing rate for these two groups of people converged in the new steady state. Not surprisingly, the mask-wearing rate for those who want to hide their faces did not decline after the policy change as much as that for those who do not, as shown in panel 3g. The mask-wearing rate for those who care about the uncomfortableness associated with mask-wearing declined after the policy change by a larger amount than that for those who do not, as shown in panel 3h.

According to panel 3i, the mask-wearing rate for those who wore masks because they had been wearing masks remained higher than that for those who did not. According to panel 3j, the mask-wearing rate for those who had health reasons to wear masks was similar to that for those who did not until November 2023. From November 2023 to March 2024, the rate for those concerned with health reasons was higher than that for those who were not concerned, possibly reflecting the increase in cold and seasonal flu in the winter season.

4.2 Regression Analysis

Figure 4 illustrates the heterogeneous distribution of response scores between participant attributes. A coefficient near zero for each group suggests no significant difference in the mask-wearing ratio

between the group and the reference group. Negative (positive) values imply that the group wore masks more frequently than the reference group.

Individual characteristics

According to the top row of Figure 4, those in their 20s and 30s were less likely to wear masks than those in their 40s and 50s, both before and after March 2023. In contrast, masking behaviors are not statistically significantly different between those in their 60s and 70s and those in their 40s and 50s, both before and after March 2023, as shown in the second row. The coefficients for those in their 20s and 30s are similar for before and after March 2023. That is, the normalization process was similar for those in their 20s and 30s and those in their 40s and 50s, consistent with Figure 2a.

According to the third row of Figure 4, females were more likely to wear masks than males, both before and after March 2023. The coefficients are similar before and after March 2023, suggesting that the normalization process was similar across females and males. This result is consistent with Figure 2b. College graduates and those with high incomes were more likely to wear masks before March 2023 in a statistically significant way. However, they were less likely to wear masks after March 2023, albeit not statistically significant in the case of college graduates. This pattern suggests that college graduates and higher-income people more quickly unmasked themselves than non-college graduates and those with lower income, consistent with panels 2c and 2d of Figure 2.

Regular workers were less likely to wear masks than workers in the "Other" group, both before and after March 2023, albeit not statistically significantly. Part-time workers were more likely to wear masks than workers in the "Other" group, both before and after 2023, in a statistically significant way. For both regular and part-time workers, the coefficients are similar across before and after March 2023, suggesting that the normalization process was similar across different people with different employment situations. This result is consistent with panel 2e of Figure 2.

Married people were more likely to wear masks than unmarried people, both pre and post March 2023, albeit not statistically significantly for post March 2023. The coefficients are similar before and after March 2023, indicating a similar unmasking process across married and unmarried people. Those who lived with children did not differ significantly from those who did not in their masking behaviors, both before and after March 2023. Those who lived with the elderly were just as likely to wear masks as those who did not before March 2023, whereas they were more likely to wear masks after 2023. These patterns are consistent with panel 2e, 2g, and 2h of Figure 2.

Factors for mask-wearing decisions

Those who cared about infection or hospital situations were more likely to wear masks than those who did not, both before and after 2023. For both infection and hospital situations, the coefficients

are similar before and after March 2023, suggesting a similar normalization process across those who cared about infection/hospital situations and those who did not. This result is consistent with panels 3a and 3b of Figure 3.

Those who care about the weather were just as likely to wear masks as those who did not before March 2023. Those concerned with the weather were more likely to wear masks than the unconcerned after 2023 in a statistically significant way. This statistical difference reflects a surge in the mask-wearing ratio in the low-temperature season from December 2023 onwards, as shown by Figure 3a. The normalization process after March 2023 was similar across those who cared and did not care about the weather.

Unsurprisingly, those who cared about the government's view were more likely to wear masks before March 2023 but were less likely to wear masks after March 2023 than those who did not care about the government's view. Those who care about the experts' views were more likely to wear masks than those who did not, both before and after March 2023, likely because many infectious disease experts kept recommending masks to citizens even after March 2023. Interestingly, those who care about social conformity were more likely to wear masks than those who did not, both before and after March 2023. These patterns are consistent with panels 3d, 3e, and 3f of Figure 3.

Those who wanted to hide their faces from the public were more likely to wear masks than those who did not before March 2023. After March 2023, they became even more likely to wear masks relative to those who did not care about hiding faces, though their mask-wearing ratio declined in absolute terms. Those who cared about uncomfortableness were just as likely to wear masks as those who did not before March 2023. Unsurprisingly, they become less likely to wear masks after 2023. These results are consistent with panels 3g and 3h of Figure 3.

Those who wore masks for inertial reasons—wearing masks because they had been doing so for a while—were more likely to wear masks than those who did not, in both before and after 2023. However, they were even more likely to wear masks relative to those who did not after March 2023. This result is consistent with panel 3i of Figure 3. Finally, those who wore masks for health reasons other than COVID-19 were just as likely to wear masks as those who did not before March 2023. They were more likely to wear masks than those unconcerned with other health issues after March 2023. This difference reflects a gradual increase in the mask-wearing ratio since the winter of 2023, likely reflecting their concerns about seasonal flu, as shown in panel 3j of Figure 3. The normalization process right after March 2023 was similar across these two groups.

5 Conclusion

We have analyzed the normalization process of a particular infection-prevention behavior that attracted much attention during the COVID-19 pandemic—mask-wearing. Specifically, we conducted weekly or biweekly surveys on mask-wearing behaviors from August 2022 to March 2024. We found that the mask-wearing rate began declining on March 13, 2023, continued to decline at

a steady pace for the following six months until September 2023, and was stable thereafter until the end of our survey.

We then analyzed heterogeneity in the mask-wearing ratio and the pace of unmaking. We found heterogeneity in the masking wearing ratio across various demographic and socio-economic groups, both before and after March 2023. Notably, we found that college graduates and those with high income were more likely to wear masks before March 2023 in a statistically significant way; however, they were less likely to wear masks after March 2023, albeit not statistically significant in the case of college graduates. This pattern suggests that college graduates and higher-income people more quickly unmasked themselves than non-college graduates and those with lower income. We also found heterogeneity in the masking ratio and the pace of unmaking depending on factors a person takes into consideration when deciding whether to wear a mask.

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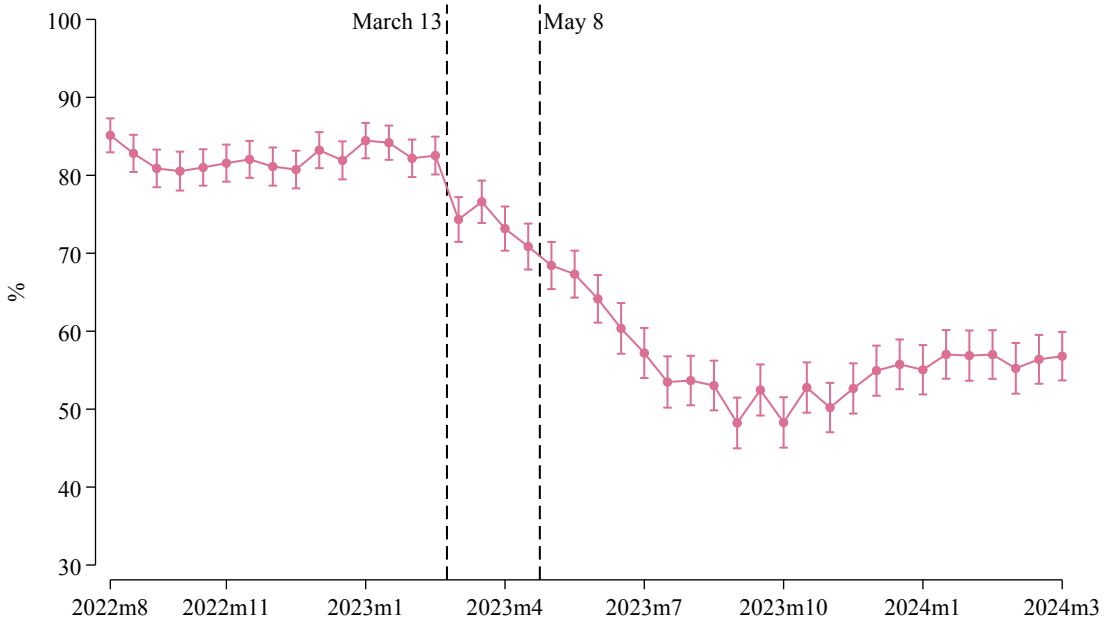
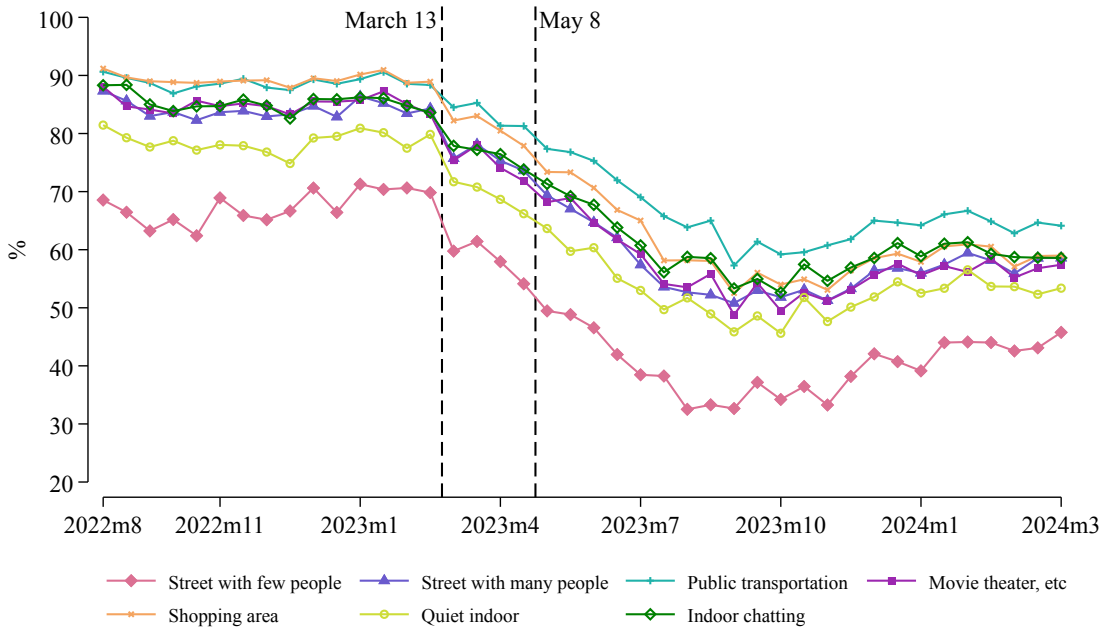
Table 1: Descriptive Statistics

	Total		Before Liberalization		After Liberalization	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Mask Wearing Rate						
Average rate	0.66	0.41	0.82	0.31	0.57***	0.42
Street with few people	0.53	0.50	0.68	0.47	0.44***	0.50
Street with many people	0.67	0.47	0.83	0.38	0.58***	0.49
Public transportation	0.73	0.44	0.87	0.33	0.65***	0.48
Movie theater, etc.	0.68	0.47	0.85	0.36	0.58***	0.49
Shopping area	0.70	0.46	0.87	0.34	0.60***	0.49
Quiet indoor	0.63	0.48	0.79	0.40	0.54***	0.50
Indoor chatting	0.69	0.46	0.85	0.36	0.61***	0.49
Basic Characteristics						
20s–30s	0.15	0.35	0.15	0.35	0.15	0.36
40s–50s	0.17	0.37	0.17	0.38	0.17	0.37
60s–70s	0.22	0.41	0.22	0.42	0.21	0.41
Female	0.46	0.50	0.46	0.50	0.46	0.50
College graduate	0.48	0.50	0.49	0.50	0.48	0.50
Income $>$ 5 million JPY	0.48	0.50	0.50	0.50	0.48	0.50
Regular employee	0.46	0.50	0.46	0.50	0.45	0.50
Part-time worker	0.22	0.41	0.22	0.41	0.22	0.41
Married	0.67	0.47	0.68	0.47	0.66***	0.47
Live with child(ren)	0.53	0.84	0.55	0.85	0.52**	0.84
Live with elderly	0.33	0.71	0.32	0.71	0.34	0.71
Reasons to Wear Mask						
Infection situation	0.46	0.50	0.50	0.50	0.44***	0.50
Hospital situation	0.23	0.42	0.26	0.44	0.21***	0.41
Weather	0.15	0.36	0.14	0.35	0.15	0.36
Government's views	0.15	0.36	0.19	0.39	0.13***	0.33
Experts' views	0.16	0.36	0.20	0.40	0.13***	0.34
Social conformity	0.29	0.45	0.31	0.46	0.28***	0.45
Hiding face	0.15	0.36	0.14	0.34	0.16***	0.36
Uncomfortableness	0.19	0.39	0.19	0.39	0.19	0.39
Inertia	0.26	0.44	0.25	0.44	0.26	0.44
Other health reasons	0.22	0.42	0.17	0.38	0.25***	0.43
Observations	21,529		7,695		13,834	

Note: Stars denote significance of differences in means between before and after liberalization: $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

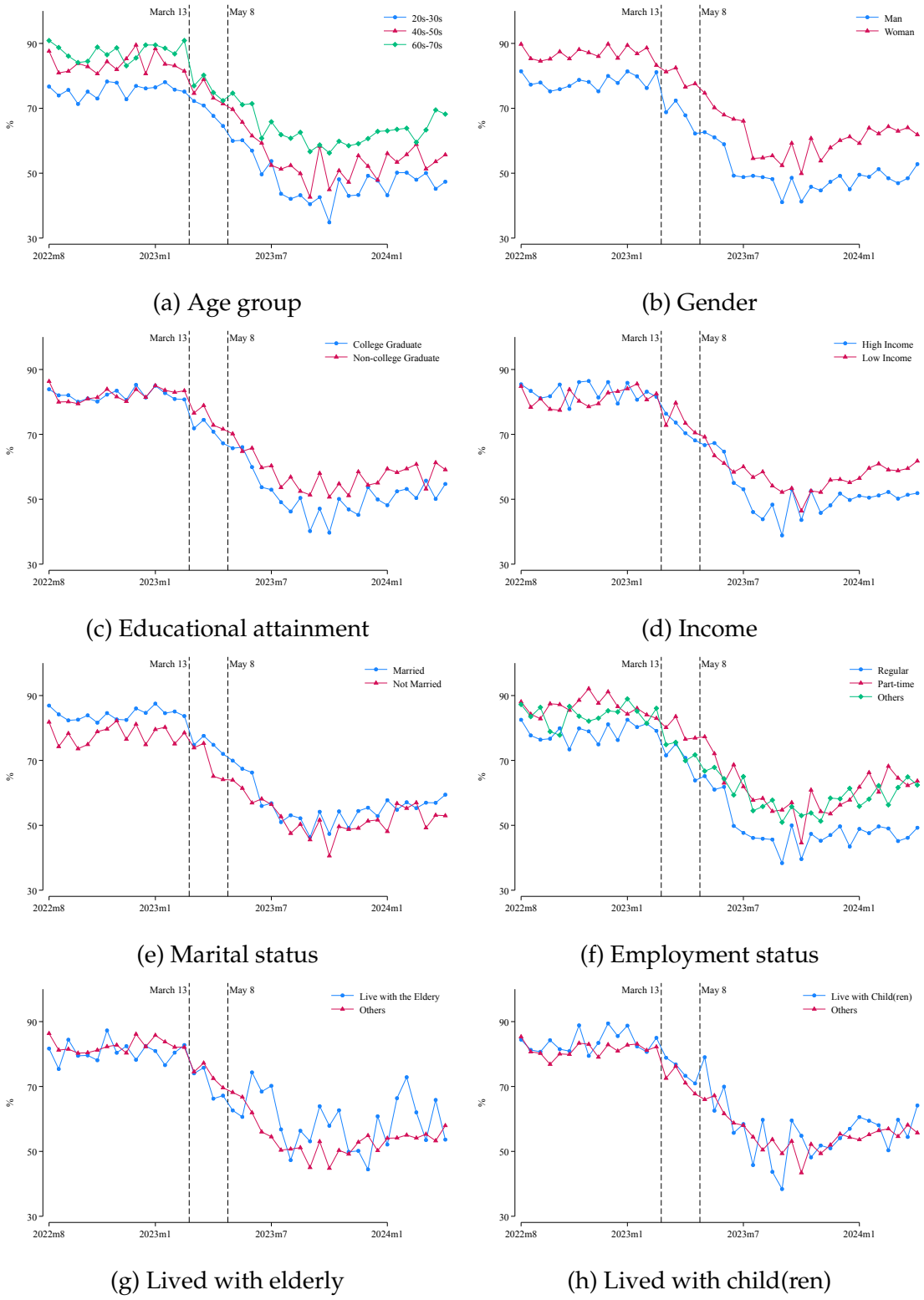


(a) Average



(b) Situation-by-situation

Figure 1: The Evolution of the Mask-Wearing Rate



(a) Age group

(b) Gender

(c) Educational attainment

(d) Income

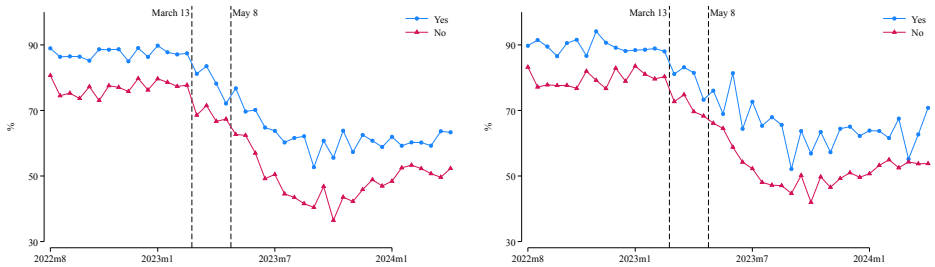
(e) Marital status

(f) Employment status

(g) Lived with elderly

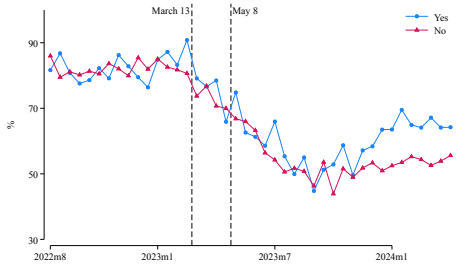
(h) Lived with child(ren)

Figure 2: The evolution of the mask-wearing rate across socio-economic Groups

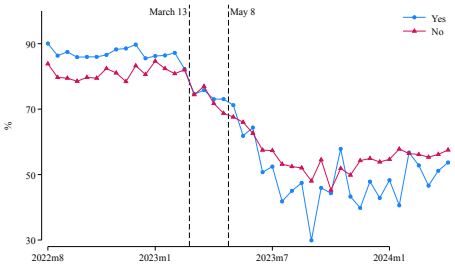


(a) Infection situation

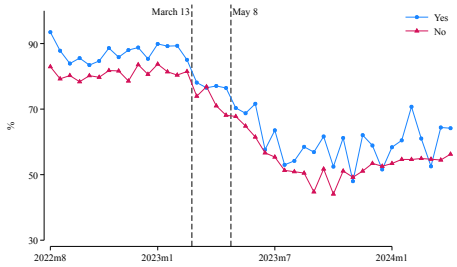
(b) Hospital situation



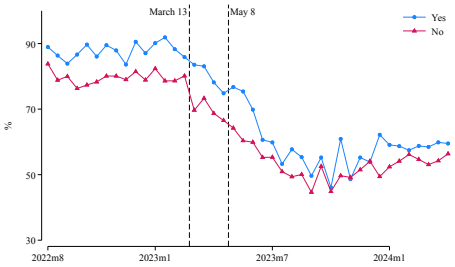
(c) Weather



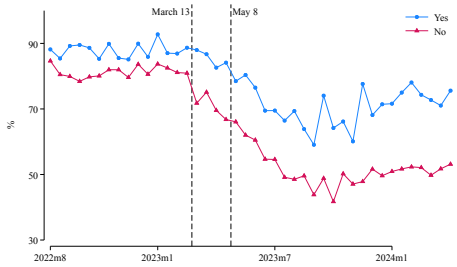
(d) Government's views



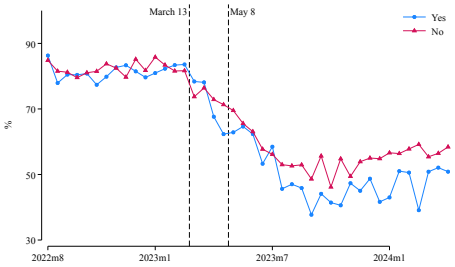
(e) Experts' views



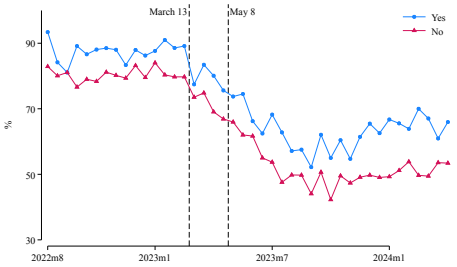
(f) Social conformity



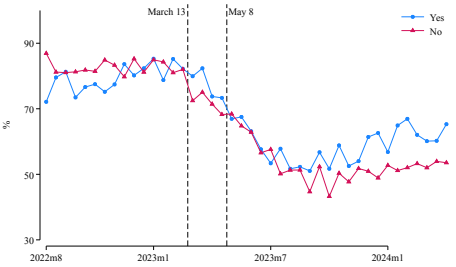
(g) Hiding face



(h) Uncomfortableness



(i) Inertia



(j) Other health reasons

Figure 3: Heterogeneity in mask-wearing rate across subgroups/decision factors

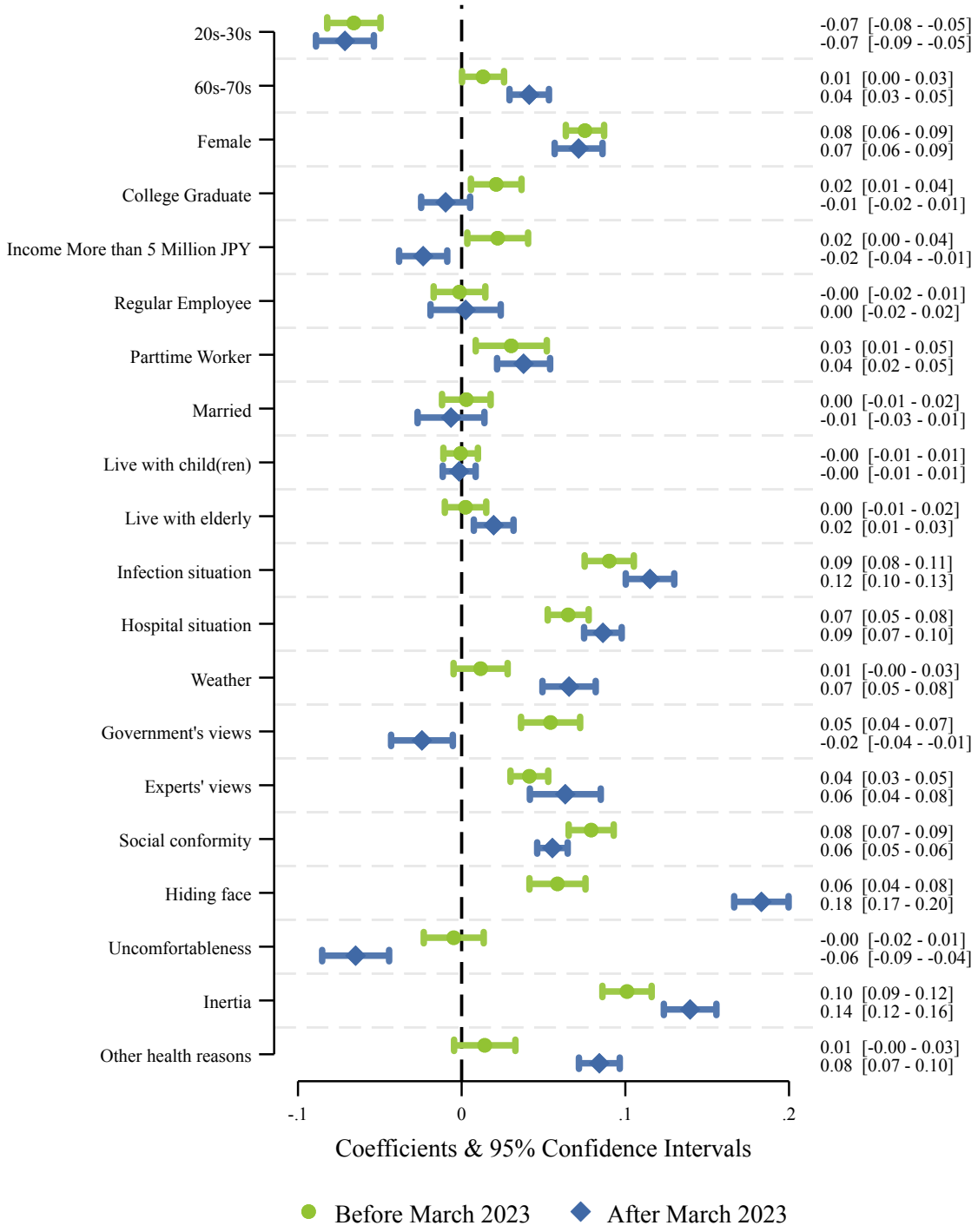


Figure 4: Heterogeneity in Mask-Wearing Rate Across Subgroups

Note: Regression results from OLS are reported in this figure. Coefficients and 95 percent confidence intervals are shown on the right-hand side.