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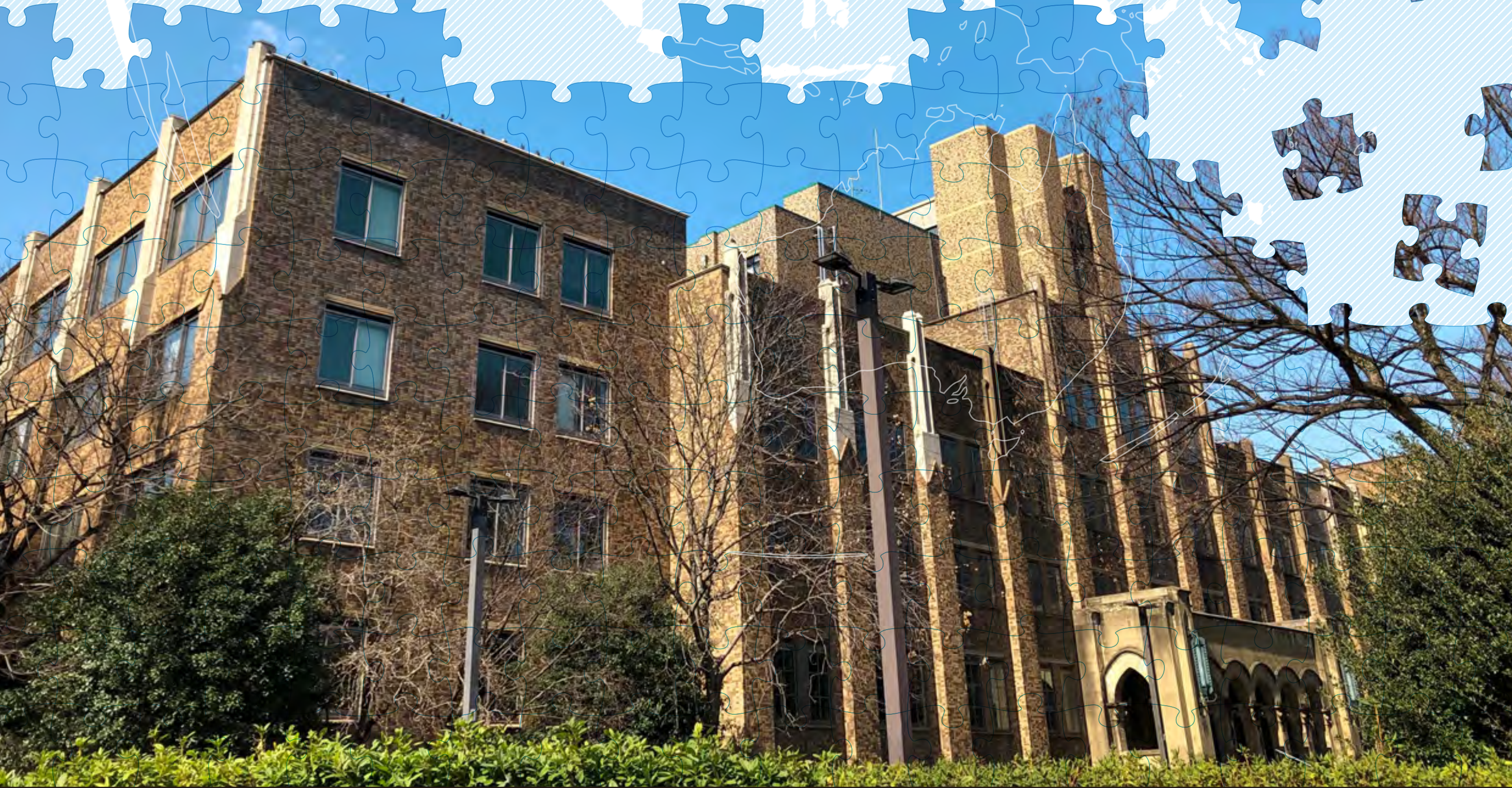
Rising socioeconomic inequality in telework eligibility: Evidence from before and after the COVID-19 outbreak in Japan



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Rising socioeconomic inequality in telework eligibility:

Evidence from before and after the COVID-19 outbreak in Japan

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Abstract

Recent scholarship has focused on identifying which workers gained the option of telework during the new coronavirus disease (COVID-19) pandemic. However, little is known about how the spread of telework eligibility during this period is related to workers' socioeconomic backgrounds. This study examines changes in socioeconomic inequality in workers' telework eligibility by analyzing Japanese panel survey data from January 2020 to January 2022. The results show that workers with a higher social class, income, and level of education had a greater increase in telework eligibility than their counterparts. While the expansion of socioeconomic gradients in telework eligibility was partly attributable to differences in workers' tasks being suitable for telework, it was not fully accounted for by task differences. We argue that request-based telework introduction during the COVID-19 period in Japan may have resulted in increasing socioeconomic inequalities in telework eligibility across workers.

Keywords

Inequality, flexibility, class, education, income.

JEL classification

J21 Labor Force and Employment, Size, and Structure, J32 Nonwave Labor Costs and Benefits; Retirement Plans; Private Pensions, M52 Compensation and Compensation Methods and Their Effects.

Introduction

Access to telework is dependent on workers' socioeconomic attributes. Access to telework enhances workers' psychological well-being (Giménez-Nadal et al., 2019; Vega et al., 2015; Wheatley, 2012), work-family balance (Tremblay, 2002), productivity (Bloom et al., 2015; Glenn Dutcher, 2012), and likelihood of staying at the job (Caillier, 2013; Gajendran & Harrison, 2007). Accessibility for telework is ensured by eligibility, which refers to the option given to workers to work from home or other locations outside their office regardless of whether they exercise the option. Similar to other flexible work arrangements, workers' telework eligibility is (Amis et al., 2020; Cook et al., 2021; Gerstel & Clawson, 2015) not only determined by the task characteristics of their jobs but also affected by the balance between employers' and workers' power (Bailey & Kurland, 2002; Kelly & Kalev, 2006; Sostero et al., 2020), resulting in socioeconomic differentials in telework eligibility. Studies have found that workers in advantageous socioeconomic positions with greater bargaining power may be more likely to have access to telework in their organization (Felstead et al., 2002b; Golden, 2008; Peters et al., 2004; Peters & van der Lippe, 2007; Swanberg et al., 2005; Vilhelmson & Thulin, 2016).

A recent unprecedented external shock, namely, the new coronavirus disease (COVID-19) outbreak, may have increased the socioeconomic inequalities in telework eligibility. Many studies have shown that workers in lower socioeconomic positions, such as lower occupational class, education, or income, are less likely to work remotely (Adams-Prassl et al., 2022; Cetrulo et al., 2022; Eurofound, 2020b; Garrote Sanchez et al., 2021; Okubo, 2022; Ono & Mori, 2021), which also leads to greater risks of reduced earnings or job loss (Adams-Prassl et al., 2020; Bonacini et al., 2020; Garrote Sanchez et al., 2021; Lekfuangfu et al., 2020; Mongey et al., 2021; Robinson et al., 2020; Shibata, 2021); this relationship suggests that the pandemic has exacerbated labor market inequality in working conditions. Regarding telework eligibility, we can also anticipate that individuals in higher socioeconomic positions experienced a more pronounced increase in their eligibility for telework, as a long-term right or welfare rather than a temporary option, in comparison to their counterparts in lower positions. However, few studies have investigated how socioeconomic inequality in telework eligibility evolved during the COVID-19 outbreak.

In this study, we examine whether inequality in telework eligibility based on workers' socioeconomic attributes increased before and after the COVID-19 outbreak in Japan. Studies have suggested that socioeconomic inequality in telework eligibility can be heightened in countries where telework implementation is left to the discretion of employers rather than being mandatorily guaranteed as a workers' right by the government (van den Broek & Keating, 2011). Japan serves as an interesting case because while the government has incentivized employers to adopt telework as a means of work style reform or infection control, there have been no mandates for telework implementation either before or during the pandemic. While the coverage of employed workers under telework policies has sharply increased in Japan since the COVID-19 outbreak (Mugiyama & Komatsu, 2023), the prevalence remains relatively lower than that in other countries (Ono & Mori, 2021). This indicates that accessibility to telework remains a scarce asset for workers in Japan. We investigate this expansion of telework eligibility during the COVID-19 outbreak in Japan through the lens of socioeconomic inequality.

To achieve this aim, we utilize a panel survey conducted before the COVID-19 outbreak in Japan, namely, the Japanese Panel Survey of Employment Dynamics (JPSED), from January 2020 to January 2022, combined with the Occupational Information Network of Japan (JONET), which collects various occupational characteristics of Japan. Workers' socioeconomic attributes are measured by their occupational class, earned income, and level of education. In addition to investigating the trends in workers' telework eligibility based on their socioeconomic attributes, we analyze the trends controlling workers' task characteristics that are suitable for telework. Numerous studies conducted during the pandemic have evaluated the telework suitability of jobs based on their task characteristics (Adams-Prassl et al., 2022; Alipour et al., 2021; Boeri et al., 2020; Cetrulo et al., 2022; del Rio-Chanona et al., 2020; Dingel & Neiman, 2020; Garrote Sanchez et al., 2021; Gottlieb et al., 2021; Mongey et al., 2021; Sostero et al., 2020) and shown that tasks with higher levels of telework potential are generally performed by socioeconomically advantaged workers (Adams-Prassl et al., 2020, 2022; Cetrulo et al., 2022). Introducing workers' task characteristics enables us to assess the extent to which the differential pace of spreading telework eligibility among socioeconomic groups can be attributed to the differences in workers' task contents.

We contribute to the literature by providing evidence on how the socioeconomic inequality of telework eligibility has changed over time. Although studies have investigated socioeconomic differentials in telework eligibility before the COVID-19 outbreak (Felstead et al., 2002a, 2002b; Golden, 2008; Peters et al., 2004; Peters & van der Lippe, 2007) or the changes in actual telework use throughout the COVID-19 outbreak (Bick et al., 2021; Okubo, 2022; Shin & Takenoshita, 2022), we analyze the changes in workers' eligibility for telework, using Japan as the study case. We argue that the inequality in telework accessibility, as a measure of workers' better working conditions, has expanded in a country where employers' introduction of telework policies was request-based rather than mandatory throughout the pandemic.

Theoretical background

Telework eligibility and workers' socioeconomic attributes

Access to telework is associated with workers' socioeconomic attributes, such as occupational class, education, and income. Three measures of socioeconomic attributes, namely, class, education, and income, are interrelated but distinct concepts used to capture workers' labor market position; these attributes have been used as proxies for socioeconomic positions in many fields (Kraus et al., 2012; Marks, 2011; Oakes & Rossi, 2003). In terms of telework, studies have shown that professional or managerial workers, highly educated workers, or high-income workers are more likely to be entitled to and engaged in telework (Bailey & Kurland, 2002; Eurofound, 2020a; Felstead et al., 2002b; Golden, 2008; Kawaguchi & Motegi, 2021; Milasi et al., 2021; Sostero et al., 2020); this relationship was also observed during the COVID-19 pandemic (Adams-Prassl et al., 2022; Cetrulo et al., 2022; Eurofound, 2020b; Garrote Sanchez et al., 2021; Okubo, 2022; Ono & Mori, 2021). The differences in accessibility to telework based on workers' socioeconomic attributes are argued to reflect the differences in their status or power against their employers (Bailey & Kurland, 2002; Sostero et al., 2020).

Among the three indicators, occupational class measures positions in the division of labor and is linked to applicability to telework. While there are various measurements of occupational class (Connelly et al., 2016), the Erikson-Goldthorpe-Portocarero (EGP) class schema (Erikson et al., 1979) is a widely used measure of occupational class classification in sociological research (Barone et al., 2022) that has been validated in recent studies (Smallenbroek et al., 2022). The EGP class schema categorizes occupations in terms of their employment relationship[1]; a service relationship, which is represented by managerial and professional occupations in salariat classes, encompasses the difficulty of monitoring workers' performance and their high asset specificity, resulting in long-term contracts with their employers (Goldthorpe, 2007). In contrast, manual and lower-grade nonmanual occupations are characterized by labor contracts that entail shorter-term contract relations with employers because of the ease of monitoring the workers and their low asset specificity (Goldthorpe, 2007). By combining the level of asset specificity and monitoring difficulty, occupations are classified into a maximum of eight classes (Erikson & Goldthorpe, 1992), in addition to three self-employed classes. The difficulty of monitoring performance and asset specificity is linked to the likelihood of the application of telework to workers. Employers generally hesitate to implement telework in their workplace because it changes the existing organizational practices by reducing the visibility of workers' performance (Bailey & Kurland, 2002; Felstead et al., 2003; Peters & van der Lippe, 2007). Since the performance of manual and lower-grade nonmanual employees with lower asset specificity becomes difficult when allowing them to work remotely, employers will not allow them to telework. In contrast, the introduction of telework to professional and managerial employees does not largely change organizational practices because their performance is difficult to monitor regardless of whether their work is carried out remotely. Moreover, the long-term contracts between these parties also induce employers to allow the use of telework to elicit employees' commitment to organizational goals.

Higher education and income are also related to the availability of telework. Studies have indicated that highly educated and higher-income workers are more likely to have access to telework even when controlling for their occupation (Felstead et al., 2002b; Golden, 2008; McNamara et al., 2012; Peters et al., 2004). As human capital theories and signaling theories suggest, workers' levels of education and earned income are correlated with their skill levels, which enable them to produce more output (Becker, 1964; Spence, 1973). Employers tend to allow telework for workers whom they regard as valuable to their organization or strongly trusted (Beham et al., 2015; Felstead et al., 2003; Kelly & Kalev, 2006). Both the value of employees as seen by their employers and the level of trust in employees by employers depend on employees' skills, as well as the signals associated with their higher earnings and educational qualifications.

Worker segregation across organizations is also linked to telework eligibility. The organizational literature suggests that employers' responses to work-family policies are contingent on their internal logics (Powell & DiMaggio, 1991). Employers may attempt to gain positive social recognition or avoid being labeled as family-unfriendly employers by introducing telework policies that are oriented to work-family balance as a measure to increase their organizational legitimacy (Baum & Oliver, 1992; Kelly & Dobbin, 1999). Employers of companies that pay higher wages to their employers tend to have more work-family supportive policies (Osterman, 1995). Because the concentration of higher-skilled workers is concentrated in organizations that pay higher earnings (Tomaskovic-Devey et al., 2020), workers with higher socioeconomic attributes may be more likely to engage in telework policies via their employers.

Task content of jobs and potential for telework

Even before the COVID-19 outbreak, studies argued that certain types of jobs are more suited to be carried out by telework. Jobs with a greater control of work pace and ways in which to work or a broader range of tasks allow workers to separate jobs into segments that can be done remotely (Bailey & Kurland, 2002; Baruch & Nicholson, 1997). Studies have shown that a greater control over one's job is positively associated with telework accessibility (Felstead et al., 2002b; Peters & van der Lippe, 2007). Moreover, jobs with little demand for physical interactions are also expected to be easily performed remotely (Bailey & Kurland, 2002; Baruch

& Nicholson, 1997). Kawaguchi and Motegi (2021) showed that those who are engaged in cognitive tasks, which require fewer physical interactions with others, tend to engage in remote work (Kawaguchi & Motegi, 2021). Furthermore, independent tasks that are not affected by others' work or do not affect others' work are suitable for remote work (Peters & van der Lippe, 2007). Beham and colleagues also revealed that managers are less likely to allow subordinates access to telework when they are engaged in interdependent tasks net of their occupation (Beham et al., 2015).

Studies have shown that during the COVID-19 pandemic, the potential to engage in telework was highly dependent on workers' task characteristics. Dingel and Neiman (2020) constructed binary indicators for each occupation if it is possible to engage in telework by using 15 measures released in the O*NET database in the United States; they estimated that a maximum of 37% of workers can perform their tasks at home. Their index of telework potential encompasses multiple aspects of task content, such as physical work conditions (performing general physical activities; walking or running; handling or moving objects; controlling machines and processes; operating vehicles and equipment; repairing and maintaining mechanical equipment; repairing and maintaining electrical equipment; inspecting equipment, structures or materials), external work conditions (working outdoors; wearing protective equipment; exposure to burns or bites; exposure to disease or infection), social interactions (performing or working directly with the public; dealing with violent people), and the use of communication technology (using email) (Sostero et al., 2020). Subsequent studies have validated that less physical or external work, fewer social interactions, and a greater use of communication technology are associated with higher telework implementations (Adams-Prassl et al., 2022; Ishii et al., 2021; Okubo, 2022). Other studies have measured workers' potential for telework by utilizing individual-level task characteristics (Alipour et al., 2021; Brussevich et al., 2022; Gottlieb et al., 2021; Hatayama et al., 2020).

Workers belonging to higher social classes, possessing higher levels of education, and earning higher incomes are more likely to be engaged in tasks that are conducive to telework. This observation aligns with job polarization arguments (Fernández-Macías & Hurley, 2017; Goos et al., 2009), which indicate a correlation between higher skills and engagement in nonroutine cognitive tasks that are suitable for telework. Numerous studies have demonstrated that during the COVID-19 pandemic, socioeconomically advantaged workers were more likely to be engaged in tasks amenable to telework, such as smaller manual tasks, fewer interactions with others, and the more frequent use of communication technology (Adams-Prassl et al., 2022; Boeri et al., 2020; Brussevich et al., 2022; Cetrulo et al., 2022; del Rio-Chanona et al., 2020; Garrote Sanchez et al., 2021; Gottlieb et al., 2021; Hatayama et al., 2020; Mongey et al., 2021; Sostero et al., 2020). These studies have suggested that the changes in socioeconomic differentials in telework eligibility during the COVID-19 periods may be, at least partially, explained by differences in workers' task characteristics.

The Japanese context of telework and the COVID-19 outbreak

The introduction of telework was significantly accelerated following the COVID-19 outbreak in Japan. In 2017, before the outbreak, the Japanese government established goals to accelerate telework adoption by providing financial support to implement telework, particularly for small and medium-sized employees, aiming to enhance workers' work-life balance and productivity. Telework was also promoted in 2018 guidelines released by the Ministry of Health, Labour, and Welfare. In April 2020, after the inception of the COVID-19 outbreak, the Japanese government declared a state of emergency and requested that employers reduce their employees' office attendance rate by 70% to prevent infection, which resulted in a greater expansion of telework implementation. Subsequently, the government declared a state of emergency three times during 2021 in reaction to the increasing confirmed cases of COVID-19, and telework was strongly encouraged. A survey reported that the percentage of regular employees who were engaged in telework increased from 13.2% in March 2020 to 27.9% in April 2020; thereafter, the percentage has remained at approximately 20% (Persol Research Institute, 2022). Furthermore, many companies have introduced telework as a system rather than as a temporary solution for infection control, as shown by the proportion of employees covered by telework policies increasing from 5% in January 2020 to 16% in 2021 (Mugiyama & Komatsu, 2023). The introduction of telework was significantly accelerated following the COVID-19 outbreak in Japan,

Telework has been promoted as a request-based policy to employers rather than as a legal obligation in Japan. Telework was promoted through campaigns and subsidies to employers before the COVID-19 outbreak. After the outbreak began, the government strongly requested the implementation of telework but still did not impose mandatory policies. During the pandemic, media criticized that employers arbitrarily allowed their employees to engage in telework; for example, some employers allowed telework for permanent employees but not for temporary employees (Asahi Shimbun, 2020). These trends are consistent with the expectation that employers allow telework for employees with more power if the decision to allow telework is dependent on the discretion of the employer rather than mandatory demands (van den Broek & Keating, 2011); the outcome is also found in other countries, such as Britain and the United States (Felstead et al., 2003; Kelly & Kalev, 2006). Additionally, in Japan, it has been confirmed that telework is more likely to be implemented when a company labor union exists, suggesting that workers' bargaining power is linked to telework authorization (Genda, 2022).

Studies have shown that workers' telework practices during the COVID-19 pandemic were differentiated by their socioeconomic status. Managerial and professional workers were more likely to be engaged in remote work than manual workers (Takami, 2022). Moreover, highly educated or high-income workers tended to carry out telework net of their occupational characteristics (Ishii et al., 2021; Okubo, 2022; Takami, 2022). Some studies have shown that workers with a higher socioeconomic status (SES) became more likely to be engaged in telework in the period between the start and end of the COVID-19 outbreak (Araki, 2023; Motegi, 2022). While there are limited studies on the changes that have been made in regard to telework eligibility, Mugiyama & Komatsu (2023) revealed that workers in larger-size firms and those employed in permanent contracts have become more likely to be entitled to telework in their workplace since the outbreak. These studies suggest that higher-class, educated, and high-income workers became more likely to be entitled to telework during the COVID-19 outbreak.

Workers' task characteristics are also associated with their availability to engage in telework in Japan. Various task characteristics, such as the frequent use of communication technology, fewer physical/external work conditions, less social interaction, nonroutine tasks and cognitive tasks, are associated with telework implementation and eligibility (Ishii et al., 2021; Kawaguchi & Motegi, 2021; Mugiyama & Komatsu, 2023; Okubo, 2022). Moreover, these task characteristics are also correlated with workers' socioeconomic attributes (Ishii et al., 2021; Mugiyama & Komatsu, 2023). These findings suggest that the change in the socioeconomic differentials in telework eligibility may be explained by their differential task contents.

Methods

Data

The data we use are drawn from the 2020, 2021 and 2022 Japanese Panel Study of Employment Dynamics (JPSED). The JPSED is a panel survey collected by the Recruit Works Institute. In January of each year, the survey collects the responses of participants aged 15 and above from the registered internet panel of Intage Co. The sample is allocated by gender, age group, employment status, educational background, and regional area to represent the estimated population composition of the Labor Force Survey. The respondents are asked to report their employment situations as of December, i.e., one month prior to the time of the survey. Detailed information on the JPSED can be found at https://www.works-i.com/surveys/panel_surveys/panel.html. The JPSED collects information on whether respondents are eligible for telework, which enables us to compare changes in socioeconomic inequality in telework eligibility during the COVID-19 pandemic. We use sampling weights provided by the Recruit Works Institute, which allows us to adjust the sample ex post to represent the estimated population composition of the Labor Force Survey at each period.

We admit that the respondents may not be representative of the population since the survey collects respondents from an opt-in web survey; however, the data are collected with the aim of representing the population composition based on gender, age group, employment status, educational background, and regional area. While the fixed-effects model employed in our analysis also allows us to control for unobserved time-invariant individual traits, the time-variant unobserved factors may still affect participation in the sample.

The analytical sample consists of 25–64-year-old employees who work 20 or more hours per week. Self-employed individuals, family workers, and unemployed individuals are removed from the sample.[2] After this exclusion, 38,692 respondents with 81,933 person-year observations remained. We then drop observations that have missing variables in each survey. Moreover, we select those who have reported a valid response in at least two periods to examine the within-individual changes. Finally, the resultant sample comprises 24,013 respondents with 62,226 person-year observations.

Variables

The dependent variable, *telework eligibility*, is constructed from the answers to the question, "As of December last year, had a telework system been introduced in your workplace? If so, were you covered by the system?" Respondents choose one of the four options: "It had been introduced as a system and applied to me," "It was introduced as a system, but not applied to me," "It has not been introduced as a system," or "I don't know." We code the first item as eligible (=1) and the others as not eligible (=0). We use this measure to represent whether respondents are eligible to engage in telework.[3]

We measure three socioeconomic attributes, namely, occupational class, earned income, and level of education, at each survey period.[4] *Occupational class* is measured using the EGP class scheme (Erikson & Goldthorpe, 1992). We use the following five categories: I (higher professionals/managers), II (lower professionals/managers), IIIa (higher routine nonmanual), IIIb (lower routine nonmanual), and V+VI+VII (manual worker).[5] Class IV (small employers/self-employed) is not included because our sample consists of employed workers. *Earned income* is measured as quintiles, with reference to respondent's earnings last year; we construct the quintiles based on January 2020 data. The same quintile break is applied to the January 2021 and 2022 data. *Level of education* is measured by the last educational institution the respondents graduated from, which is classified as junior high, high school, junior college and vocational school (junior college hereafter), university, or graduate school.[6]

Occupational-level task measures are constructed from the Occupational Information Network of Japan (JONET). JONET is a recently developed database operated by the Japan Institute of Labour Policy and Training; the database is designed to be comparable to the US O*NET, which is a comprehensive database that focuses on occupational-level tasks, skills, work contexts or other characteristics (Kamakura et al., 2020).[7] We construct occupational task measures by matching JONET occupational measures to each occupational category collected in the JPSED. After matching the JONET occupational measures to the JPSED analytical sample, we derive three occupational task measures relating to telework with reference to Sostero and colleagues' (2020) operationalization, which disaggregates Dingel and Neiman's (2020) composite index. The first is *physical and external work conditions*, which measures the extent of manual work activities and exposure to hazardous environments, which are factors negatively associated with telework.[8] The second is *social interaction*, which captures interaction with the public, which is also expected to be negatively related to telework. The third is the *use of communication technology*, which is measured by the indicator of the frequent use of email during work. The detailed measurements are shown in Table 1. Each JONET occupational measure is first standardized to have a mean of zero and a standard deviation of one and then averaged to the corresponding composite index.

Additionally, individual-level task measures are constructed from the JPSED questionnaires. The JPSED collects information on the extent to which respondents conduct nonroutine/routine tasks, cognitive/manual tasks, and independent/interdependent tasks with scales ranging from 0 to 100 in 5 increments. We regard these scales as indicating nonroutine tasks relative to routine tasks, cognitive tasks relative to manual tasks, and independent tasks relative to independent tasks. The JPSED also asks the extent of the variety of one's tasks, one's influence on others, and decision latitudes in one's work, which are also used to gauge workers' tasks. The detailed definitions of these measures are presented in Table 1. All the abovementioned task measures are introduced to regression models by standardization to have a mean of zero and a standard deviation of one for comparisons.

We control for age, age squared and weekly working hours as the basic time-variant individual characteristics. In addition, prefecture of residence (47 categories), industrial sector (17 categories), and firm size measured by the number of employees (13 categories) are also controlled because studies have reported that the expansion of telework and its use in Japan varies by region (Persol Research Institute, 2022; Takami, 2022), industry sector (Takami, 2022), and company size (Motegi, 2022; Mugiyama & Komatsu, 2023; Ono & Mori, 2021; Takami, 2022).[9] The descriptive statistics of the variables are shown in Table S1 in the Supplementary Data.

Statistical model

We employ linear regression models predicting individual i's telework eligibility at time t with time-invariant individual and period fixed effects (i.e., fixed-effects linear probability models).[10] The estimated model is as follows:

$$Y_{it} = \alpha + \beta D_t + \gamma_1 X_{it} + \gamma_2 X_{it} \times D_t + \delta_1 Z_{it} + \delta_2 Z_{it} \times D_t + u_i + \varepsilon_{it}$$

where Y_{it} refers to dummy variables indicating whether respondents have access to telework, X_{it} refers to dummy variables indicating socioeconomic measures (class, income, or education), D_t refers to dummy variables indicating survey periods (i.e., January 2021 or 2022) relative to

January 2020, Z_{it} refers to time-variant dummy variables, and u_i refers to individual fixed effects; ε_{it} represents the residuals. The parameter γ_2 gauges the absolute percentage change in telework eligibility by socioeconomic attributes with reference to January 2020, which is shown in the main results. We also investigate whether the parameters γ_2 remain significant after controlling for task measures and the interactions with the survey periods. All control variables, which are represented by Z_{it}, are also interacted with survey period dummy variables to capture the differential trends in increasing telework eligibility. Statistical tests are carried out using individual-clustered robust standard errors.

Results

Descriptive trends in increasing telework eligibility

Telework eligibility substantially increased following the COVID-19 outbreak. Figure 1 shows the percentage of workers eligible for telework, which rose from 5.0% in January 2020 to 17.5% in the subsequent year and even further to 19.5% in January 2022. This indicates that nearly four times as many workers now have access to telework compared to in the pre-COVID-19 period.

However, the eligibility for telework increased disproportionately, resulting in an expanding gap based on socioeconomic attributes. Figure 2 illustrates the trends in the proportion of telework eligibility by workers' class, income, and education. Prior to the COVID-19 outbreak, higher-class workers had greater access to telework (as shown in the left panel); in January 2020, 10% of higher professional/managerial workers (Class I) had access to telework, compared to only 2% of manual workers (Class V+VI+VII). The class gradient in telework eligibility widened following the outbreak; the proportion of higher professional/managerial workers eligible for telework increased to 35% in 2021 and 39% in 2022, while only 4% of manual workers had access. Moreover, telework eligibility increased more among higher-income workers than among lower-income workers (as shown in the middle panel). The proportion of higher-income workers (5th quintile) with access to telework increased from 13% in 2020 to 37% in 2021 and 41% in 2022, while the increase among lower-income workers (1st quintile) was only marginal. Last, there was an increase in the educational gradients in telework eligibility (as shown in the right panel). Highly educated workers experienced a greater increase in telework eligibility in 2021 and 2022 than the least educated workers. These findings indicate that the inequality in telework eligibility based on workers' socioeconomic attributes intensified following the outbreak and has persisted thereafter.

Task characteristics, telework eligibility, and socioeconomic status

The eligibility for telework is related to the nature of workers' tasks. Table 2 shows the results of linear probability models on the relationship between telework eligibility and task measures across different survey years. The results indicate that in all periods, the use of communication technology, engagement in nonroutine and cognitive tasks, influence on others, and decision latitude are all positively associated with a higher likelihood of telework eligibility. Furthermore, following the COVID-19 outbreak, the strength of these associations has increased, which suggests that the increase in telework eligibility has been disproportionately influenced by the specific content of workers' tasks.

Workers with higher socioeconomic attributes are more inclined to be engaged in tasks that are better suited for telework, particularly tasks that have become more strongly associated with telework eligibility following the outbreak. Table 3 presents the average values of each task by class, income, and education. Tasks involving the use of communication technology, nonroutine tasks, cognitive tasks, and those influencing others are largely undertaken by higher-class, higher-income, and higher-educated workers. The disproportionate engagement of workers with higher socioeconomic attributes in these tasks may account for the widening gaps in telework eligibility, as these individuals are more likely to have adapted to telework due to their increased exposure to tasks that are more compatible with the telework approach.

Increasing socioeconomic inequality in telework eligibility

Figure 3 presents the changes in telework eligibility for each socioeconomic measure, estimated using fixed-effects linear probability models. The values on the vertical axis represent the within-individual percentage point change in the proportion of telework eligibility compared to January 2020, just prior to the COVID-19 outbreak. Telework eligibility experienced a greater increase among higher-class workers (see the upper-left panel). Between January 2020 and 2021, higher professional/managerial workers experienced an 8 percentage point increase in telework eligibility compared to that of higher routine nonmanual workers, while manual workers lagged behind by 13 percentage points. By 2022, the gap had widened to 16 percentage points, further emphasizing the disparities between occupational classes. When controlling for task measures and interactions with periods in Model 2, the class gaps decrease (see the upper-middle panel). This indicates that higher-class workers tend to become eligible for telework due to their engagement in tasks suitable for telework, as opposed to their lower-class counterparts. However, even after accounting for task differences, a significant class gap remains. In 2021, higher professional/managerial workers had a 7-percentage-point higher level of telework eligibility compared to that of higher routine nonmanual workers, while manual workers lagged behind by 6 percentage points; this lag corresponds to an 8-percentage-point lag in 2022.

Moreover, there have been significant increases in the gaps in telework eligibility between income quintiles. The highest-income workers (5th quintile) experienced a greater increase in telework eligibility compared to middle-income workers (3rd quintile), whereas the lowest-income workers fell behind (see the middle-left panel). Controlling for task measures in Model 2 reduces the gaps between income quintiles, but the significant increases persist (see the middle panel). The highest-income workers saw an increase in telework eligibility of 6 percentage points more than that of middle-income workers, whereas the lowest-income workers lagged behind by 5 percentage points.

Educational gradients also showed significant increases. The higher the workers' educational background is, the greater their increase in telework eligibility is (see the bottom-left panel). University graduates experienced a 4-percentage-point increase in telework eligibility following the COVID-19 outbreak compared to junior college graduates. Moreover, graduate-school graduates saw a 15-percentage-point increase relative to junior college graduates. In contrast, the increase among junior high and high school graduates lagged behind that among junior college graduates by 5 percentage points. Workers' task differences partly explain the differential increase in telework eligibility across educational backgrounds, as indicated by the smaller increase in the educational gap after controlling for task measures (see the bottom-middle panel). However, workers who graduated from university or graduate schools still show a greater increase in telework eligibility.

The observed increases in gaps based on three socioeconomic indicators cannot be solely attributed to a single indicator. The findings from Model 3, which incorporates class, income, and education into the model alongside task measures and other control variables, indicate that each socioeconomic attribute independently contributed to the rise in telework eligibility following the COVID-19 outbreak (see the right-side panels). The increased gaps between nonroutine manual workers and manual workers, as well as those between middle-income workers and both the highest-income and lowest-income workers, persist significantly. Additionally, workers with university or graduate school degrees still experienced a significant increase in telework eligibility. These results suggest that the widening gap in telework eligibility is intertwined with the multiple socioeconomic backgrounds of workers, namely, their class, income, and education.

Conclusion

The recent outbreak of COVID-19 has brought about an increased level of attention to the unequal distribution of telework availability across socioeconomic attributes. However, there is little evidence on how the inequality of telework eligibility, i.e., the option to work from home, changed in the period between the beginning and end of the COVID-19 outbreak. Utilizing panel survey data that has collected information in Japan since January 2020, i.e., just before the outbreak, we examined the extent to which the gap in telework eligibility based on workers' occupational class, earned income and level of education has changed over time while accounting for differences in their engaged tasks.

The results show that socioeconomic gradients in telework eligibility increased following the COVID-19 outbreak. Telework eligibility sharply increased among higher-class, higher-income, and higher-educated workers between January 2020 and 2021, which increased the gap between their lower counterparts. The expanded gap in telework eligibility was still present in January 2022. Furthermore, the increased socioeconomic gaps in telework eligibility cannot be fully attributed to the workers' task differences. Professional and managerial workers, higher-income workers, or higher-educated workers perform tasks using communication technology, nonroutine tasks, and cognitive tasks; thus, they tend to be entitled to telework. While part of the increased socioeconomic gaps can be explained by differential task engagement, the significant differences in the uneven increase in telework eligibility remained after controlling for task measures. In sum, these results suggest that task-unrelated factors have contributed to the overall rising inequality in telework eligibility.

The factors relating to workers' bargaining power associated with their socioeconomic status, such as class, income, or education, may have contributed to the gain in access to telework during the examined period. Workers in higher socioeconomic positions have greater autonomy over their tasks (Bailey & Kurland, 2002; Felstead et al., 2002b; Peters & van der Lippe, 2007) or are trusted by their employers (Felstead et al., 2003; Kelly & Kalev, 2006), which allows them to secure telework eligibility in their workplaces. Moreover, they may tend to be employed by companies where employers have higher economic feasibilities or stronger incentives for implementing telework (Baum & Oliver, 1992; Kelly & Dobbin, 1999; Osterman, 1995). The results suggest that who is eligible for telework is also determined by factors other than task characteristics, even in the unprecedented worldwide COVID-19 pandemic.

The observed increase in socioeconomic inequality in telework eligibility during the examined period may have been caused by Japan's request-based policies regarding telework. Before the COVID-19 outbreak, studies pointed out that employers were able to choose who was eligible for telework or other flexible work arrangements (Felstead et al., 2003; Kelly & Kalev, 2006); this arrangement was more likely to be observed in countries where telework is not positioned as a workers' right (van den Broek & Keating, 2011). Japan's telework policies during the COVID-19 period were not mandatory but rather request-based, which may have allowed employers to selectively establish telework eligibility according to workers' socioeconomic attributes regardless of their task characteristics. While this is partly in line with studies suggesting that telework implementation in Japan is dictated by cultural factors rather than economic constraints (Ono, 2022), we argue that the greater the degree to which telework eligibility can be determined at the discretion of the employers is, the greater the socioeconomic disparities in eligibility will become.

There are several limitations to this study. First, we measure telework eligibility based on the respondent's subjective evaluation, which does not necessarily correspond to an objective eligibility for telework. If respondents' socioeconomic attributes are positively correlated with their knowledge of whether telework is applied to themselves, the socioeconomic gap may be overestimated. Second, unobserved task differences that were not included in this study may explain the remaining association between socioeconomic attributes and increasing telework eligibility. For example, the use of advanced communication technology other than email will also allow workers to work remotely more easily. Third, it is not clear whether the observed increase in socioeconomic gaps in telework eligibility is a temporary or persistent phenomenon because of the limited observation periods utilized between January 2020 and 2022.

Despite the several abovementioned limitations, this paper provides evidence that socioeconomic inequality in telework eligibility among workers expanded after the COVID-19 outbreak by comparing the telework situation before and after the COVID-19 outbreak in Japan. Future studies are required to examine whether the increase in inequality in regard to telework eligibility varies across time and place with different institutional characteristics, which would also be helpful to better understanding the impact of the COVID-19 outbreak on labor market stratification.

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Figures and Tables

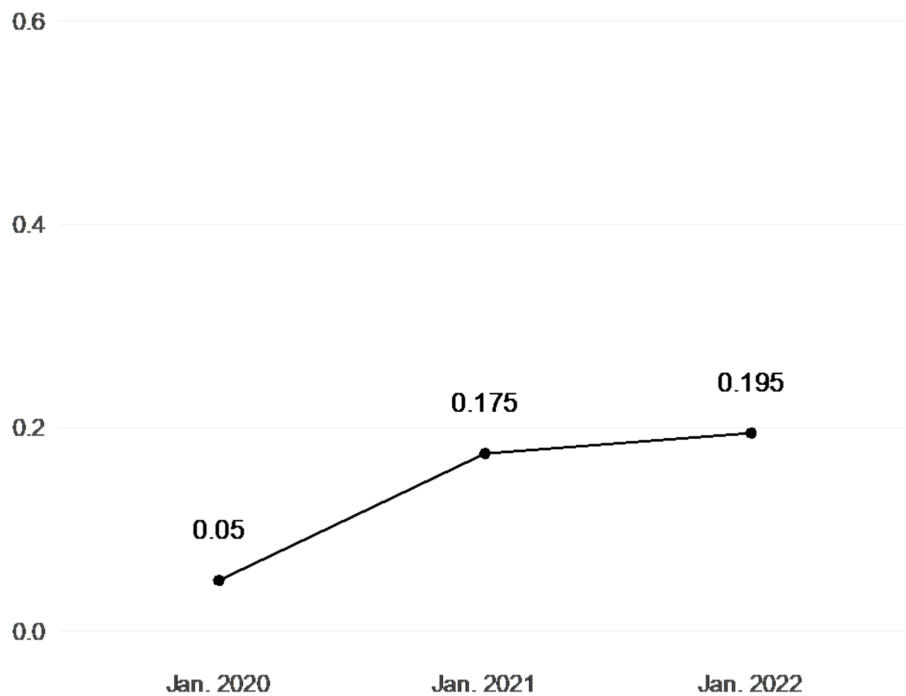

Figure 1. Telework eligibility between January 2020 and 2022.
Note. The sample consists of 25–64-year-old employees who worked 20+ hours per week in January 2020–2022. Observations are weighted by the sampling weight.

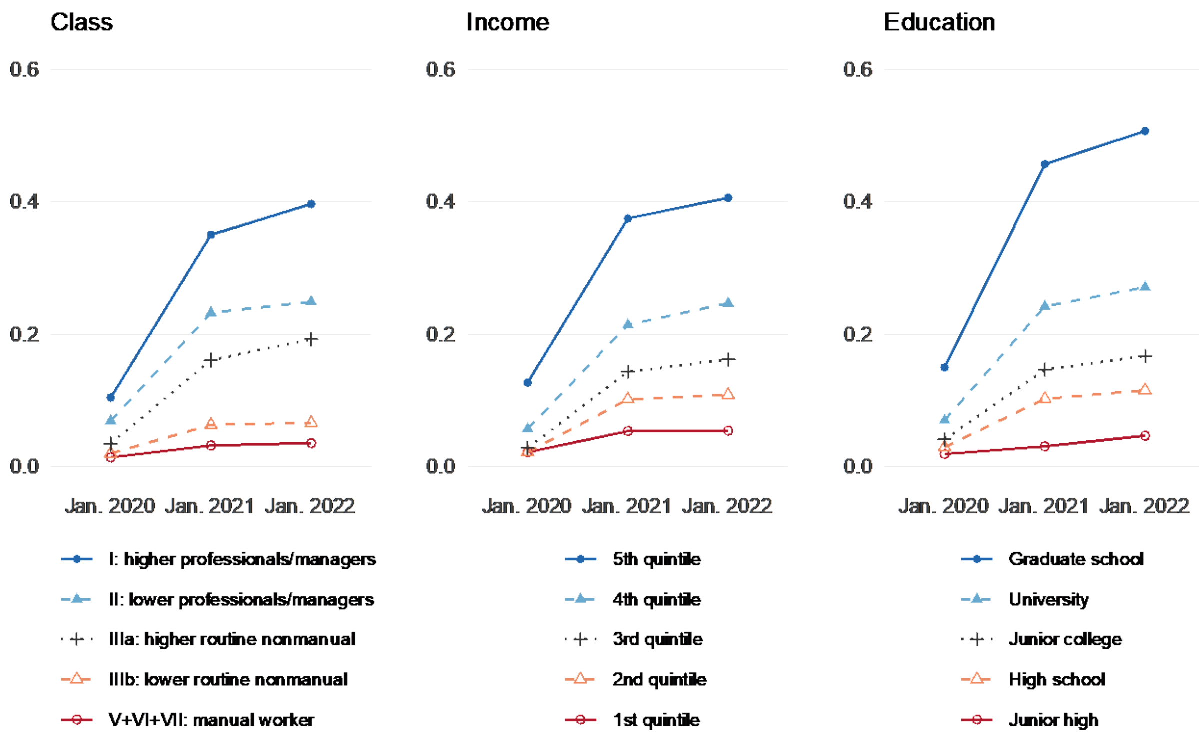

Figure 2. Telework eligibility by workers' socioeconomic attributes between January 2020 and 2022.
Note. The sample consists of 25–64-year-old employees who worked 20+ hours per week in January 2020–2022. Observations are weighted by the sampling weight.

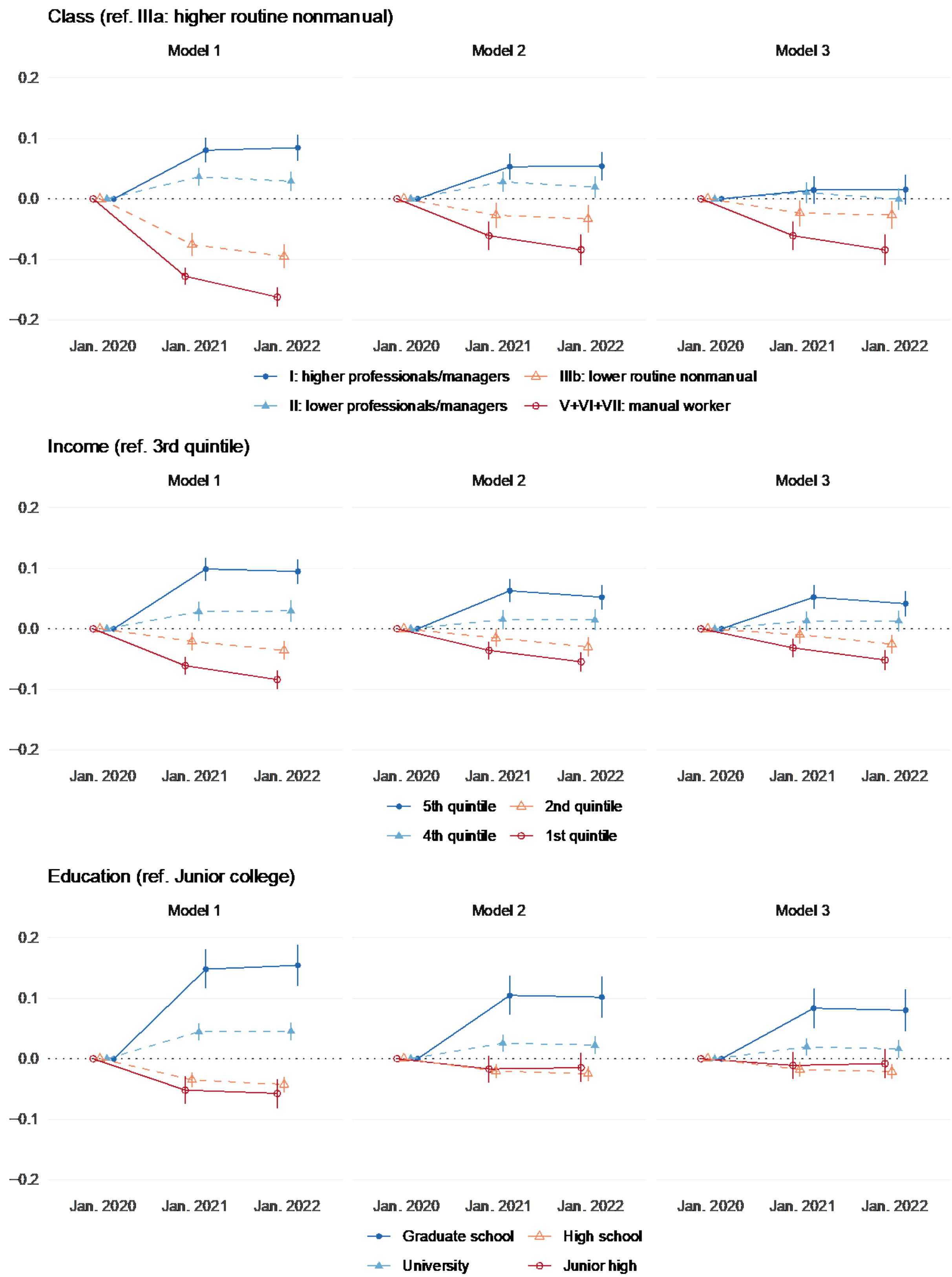

Figure 3. Estimates of the changes in the effect of workers' socioeconomic attributes on their telework eligibility.

Note. Coefficients of the interaction between each socioeconomic measure and survey period and 95% confidence intervals obtained from fixed-effects linear probability models are shown. The confidence intervals were calculated from cluster-robust standard errors. All models control for age, age squared, weekly working hours, industry, prefecture, company size and the interactions with survey periods, individual fixed effects, and period fixed effects. Model 1 introduces each socioeconomic measure separately. Model 2 controls for task measures and the interaction with year dummies in addition to Model 1. Model 3 includes three socioeconomic measures, task measures and the interactions with year dummies to Model 2. The sample consists of 25–64-year-old employees who worked 20+ hours per week in January 2020–2022. Observations are weighted by the sampling weight.

Table 1. Details in occupational and individual task measures.

Task measures	Definitions
Occupational task measures (measured by JONET)	
Physical/external work conditions	The following JONET indicators are added together: - Performing general physical activities - Walking or running - Handling or moving objects - Controlling machines and processes - Operating vehicles and equipment - Repairing and maintaining mechanical equipment - Repairing and maintaining electrical equipment - Inspecting equipment, structures, or materials - Working outdoors - Wearing protective equipment - Exposure to burns or bites - Exposure to disease or infection
Social interaction	The following JONET indicators are added together: - Performing or working directly with the public - Dealing with violent people
Use of communication technology	The following JONET indicator is used: - Using email
Individual task measures (measured by JPSED questionnaire)	
Nonroutine tasks	Item in which respondents indicate the degree to which their tasks are routine ("Do the same thing repeatedly") or nonroutine ("Do the different thing each time") on a scale of 0 to 100. The higher the value is, the more their tasks are regarded as routine ones.
Cognitive tasks	Item in which respondents indicate the degree to which their tasks are manual ("Move your body") or cognitive ("Use your head") on a scale of 0 to 100. The higher the value is, the more their tasks are regarded as cognitive ones.
Independent tasks	Item in which respondents indicate the degree to which their tasks are interdependent ("Do with others") or independent ("Do individually") on a scale of 0 to 100. The higher the value is, the more their tasks are regarded as independent ones.
Variety of tasks	The extent to which respondents indicate "Doing various tasks rather than monotonous tasks" on a five-point scale ranging from "applicable" (4) to "not applicable" (0).
Influence on others	The extent to which respondents indicate "Being engaged in jobs that influence others both inside and outside the workplace" on a five-point scale ranging from "applicable" (4) to "not applicable" (0).
Decision latitude	The extent to which respondents indicate "Being able to decide how to do my job" on a five-point scale ranging from "applicable" (4) to "not applicable" (0).

Table 2. Linear probability models of the relationship between telework eligibility and task content by year.

	Jan. 2020	Jan. 2021	Jan. 2022
Physical/external work conditions	-.003	-.006	-.003
	(.002)	(.003)	(.004)
Social interaction	.001	.001	-.011***
	(.002)	(.003)	(.003)
Use of communication technology	.010***	.048***	.055***
	(.002)	(.003)	(.003)
Nonroutine tasks	.011***	.032***	.034***
	(.002)	(.003)	(.003)
Cognitive tasks	.008***	.047***	.057***
	(.002)	(.003)	(.003)
Independent tasks	-.004*	.000	-.000
	(.001)	(.002)	(.002)
Variety of tasks	.003*	.003	.003
	(.002)	(.003)	(.003)
Influence on others	.006***	.014***	.010***
	(.002)	(.003)	(.003)
Decision latitude	.010***	.018***	.024***
	(.001)	(.002)	(.003)
N	21050	21628	19548
R^2	.080	.246	.290

Note. * p<0.05, ** p<0.01, *** p<0.001 (two-tailed tests). Robust standard errors in parentheses. Age, age-squared, weekly working hours, industry, prefecture, and company sizes are controlled. All task measures were standardized to have a mean of 0 and standard deviation of 1.

Table 3. Means in task measures by class, income, and education.

	Class				
	V+VI+VII: manual worker	IIIb: lower routine nonmanual	IIIa: higher routine nonmanual	II: lower professionals /managers	I: higher professionals /managers
Physical/external work conditions	1.107	0.120	-0.829	0.028	-0.447
Social interaction	-0.022	0.665	-0.405	0.198	-0.111
Use of communication technology	-0.948	-0.712	0.330	0.224	0.832
Nonroutine tasks	-0.273	-0.194	-0.291	0.240	0.486
Cognitive tasks	-0.866	-0.656	0.376	0.227	0.603
Independent tasks	-0.001	-0.279	0.227	-0.069	-0.057
Variety of tasks	-0.288	-0.050	-0.135	0.185	0.293
Influencing others	-0.252	-0.323	-0.180	0.206	0.425
Decision latitude	-0.300	-0.263	-0.064	0.155	0.380
N	13805	5417	14744	18797	9462
	Income				
	1st	2nd	3rd	4th	5th
Physical/external work conditions	-0.055	-0.060	0.117	0.108	-0.127
Social interaction	-0.051	-0.072	0.054	0.039	0.025
Use of communication technology	-0.403	-0.160	-0.054	0.164	0.483
Nonroutine tasks	-0.293	-0.221	-0.022	0.160	0.396
Cognitive tasks	-0.359	-0.127	-0.064	0.121	0.459
Independent tasks	-0.033	0.072	0.041	-0.001	-0.086
Variety of tasks	-0.178	-0.132	-0.029	0.088	0.266
Influencing others	-0.373	-0.171	-0.012	0.161	0.417
Decision latitude	-0.296	-0.123	0.003	0.111	0.321
N	12456	12094	13669	12240	11768
	Education				
	Junior high	High school	Junior college	University	Graduate school
Physical/external work conditions	0.496	0.135	0.007	-0.190	0.003
Social interaction	0.031	-0.039	0.066	0.000	-0.135
Use of communication technology	-0.581	-0.189	-0.131	0.287	0.575
Nonroutine tasks	-0.131	-0.133	-0.023	0.101	0.520
Cognitive tasks	-0.631	-0.229	-0.028	0.249	0.513
Independent tasks	0.009	0.059	0.006	-0.056	-0.098
Variety of tasks	-0.126	-0.114	-0.006	0.090	0.341
Influencing others	-0.207	-0.127	-0.048	0.145	0.365
Decision latitude	-0.058	-0.059	-0.007	0.047	0.194
N	1512	20975	17542	19469	2728

Notes. All task measures are standardized to have a mean of 0 and a standard deviation of 1. All differences by socioeconomic attributes in means of all task measures were statistically significant ($p < .001$, F test).

Supplementary data

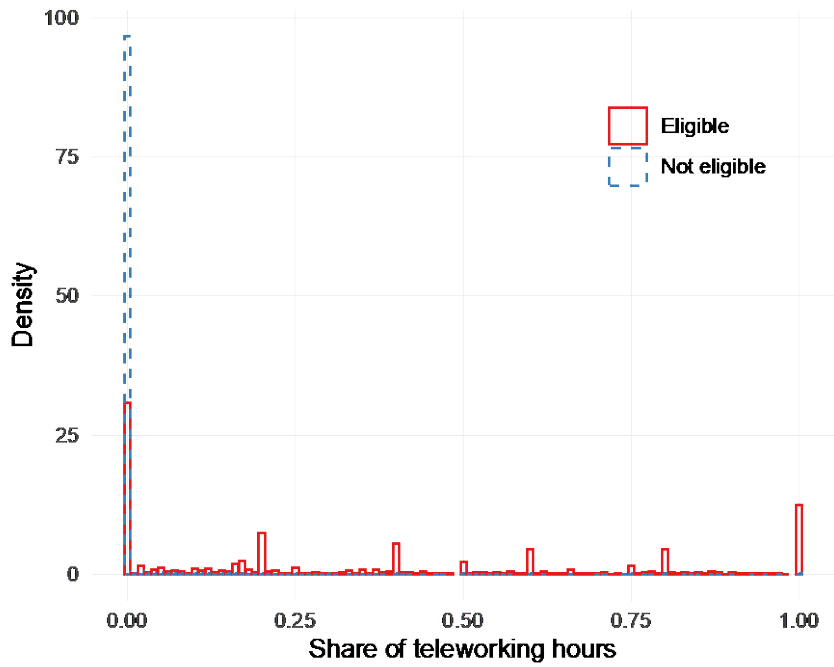

Figure S1. Distribution of the share of teleworking hours within hours worked last month by telework eligibility.
Note. The sample consists of 25–64-year-old employees who worked 20+ hours per week in January 2020–2022. Observations are weighted by the sampling weight.

Table S1. Summary statistics.

	Mean	SD
Telework eligibility	0.139	
Survey period		
Jan. 2020	0.335	
Jan. 2021	0.348	
Jan. 2022	0.317	
Class		
V+VI+VII: manual worker	0.222	
IIIb: lower routine nonmanual	0.087	
IIIa: higher routine nonmanual	0.237	
II: lower professionals/managers	0.302	
I: higher professionals/managers	0.152	
Income		
1st quintile	0.200	
2nd quintile	0.194	
3rd quintile	0.220	
4th quintile	0.197	
5th quintile	0.189	
Education		
Junior high	0.024	
High school	0.337	
Junior college	0.282	
University	0.313	
Graduate school	0.044	
Physical conditions of work	0.000	0.744
Social interaction of work	0.000	0.851
Use of communication technology	0.000	1.000
Nonroutine tasks (0–100)	41.673	28.692
Cognitive tasks (0–100)	61.642	30.075
Independent tasks (0–100)	57.268	29.242
Variety of tasks (0–4)	2.144	1.122
Influencing others (0–4)	2.027	1.163
Decision latitude (0–4)	2.248	1.119
Age (25–64)	45.141	10.154
Weekly working hour (20–140)	41.729	9.642
Industry		
Primary	0.004	
Construction	0.058	
Manufacturing	0.208	

Electricity, gas, heat supply and water	0.014
Information and communications	0.072
Transport and postal activities	0.083
Wholesale and retail trade	0.106
Finance and insurance	0.044
Real estate and goods rental and leasing	0.023
Scientific research, professional and technical services	0.022
Accommodations, eating and drinking services	0.030
Living-related and personal services and amusement services	0.013
Education, learning support	0.038
Medical, health care and welfare	0.114
Other services	0.054
Industries unable to classify	0.050
Government, except elsewhere classified	0.068
Company size	
1–4 employees	0.044
5–9 employees	0.065
10–19 employees	0.071
20–29 employees	0.048
30–49 employees	0.069
50–99 employees	0.099
100–299 employees	0.143
300–499 employees	0.064
500–999 employees	0.068
1000–1999 employees	0.060
2000–4999 employees	0.056
5000+ employees	0.137
Public sector	0.076
N	62,226

Note. Summary statistics on prefecture of residence are not shown.

Notes

[1] In addition to the employment relationship, the class can be further divided into self-employed and employed individuals based on whether they sell their own labor to employers (Goldthorpe,

2007). Since our focus is on the telework eligibility among employed individuals, we specifically concentrate on class differentiation within them.

[2] The increase in Japan's unemployment rate during the COVID-19 pandemic was relatively small; the unemployment rate rose from 2.4% in January 2020 to 3.0% in January 2021 and has since remained at similar levels (Statistics Bureau of Japan, 2023). Therefore, we believe that sample selection into employed workers does not significantly affect the results.

[3] Telework eligibility is positively correlated with workers' actual telework use, as shown in Figure S1 in the Supplementary Data. While 98% of those who are not eligible for telework did not engage in telework at all, 70% of workers who are eligible for telework did engage in telework to some extent. Moreover, the hours spent varied; 15% of workers who are eligible to telework were fully teleworking, while 30% were not teleworking at all.

[4] The measurement of socioeconomic characteristics at each period may produce biased estimates of the effects of these characteristics on the increase in telework availability. For example, those with access to telework were less likely to reduce their income during the COVID-19 pandemic; thus, we may have overestimated the effect of income on the change in telework availability. To reduce this possibility, we also measured the workers' class, income, and education as of the first period (i.e., January 2020) and found that there were no substantial differences found in the results after using the time-invariant measures (available on request).

[5] We constructed EGP categories based on this occupation using the following procedures. The JPSED asks respondents about their occupation using precoded 224 items. We assigned a 4-digit ISCO-08 code to each of the occupations interviewed and converted each code into an ISCO-88 code (Ganzeboom & Treiman, 2019a). We then assigned EGP categories by referencing the ISCO-88 code, whether the respondent was self-employed, and the number of subordinates

(Ganzeboom & Treiman, 2019b). We constructed the number of subordinates from managerial position and firm size following the procedures outlined in Kanomata et al. (2008). We used the *iscogen* command (Jann, 2020) to transform ISCO-08 codes into ISCO-88 codes and to construct EGP categories.

[6] In International Standard Classification of Education 2011 (UNESCO Institute for Statistics, 2012), junior high corresponds to 2 (lower-secondary education), high school corresponds to 3 (upper-secondary education), junior college and vocational school correspond to 5 (short-cycle tertiary education), university corresponds to 6 (bachelor's degree or equivalent), and graduate school corresponds to either 7 or 8 (master's degree, doctoral degree or equivalent).

[7] We used version 3.01 of the JONET (The Japan Institute for Labour Policy and Training, 2022).

[8] Sostero et al. (2020) separated physical work content, which is related to manual tasks, and physical/external work conditions, which are exposed to the outside or hazardous environment. Because the correlation coefficient between physical work content and physical/external work conditions was fairly high (0.85), we combined these two occupational tasks into one category.

[9] Studies regarding the employers' adoption of work-family policies have also shown that regions, industries and company sizes are also significantly associated with policy introductions (Ingram & Simons, 1995; Kelly & Dobbin, 1999; Milliken et al., 1998).

[10] We used the *reghdfe* command (Correia, 2017) to estimate the fixed-effects models.