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# **Telework in Japan: An overview from micro data of a Large Statistical Survey**

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## Telework in Japan: An Overview from Micro Data of a Large Statistical Survey \*

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### Abstract

Using micro data from the Employment Status Survey of 2022, this study provides an overview of the state of telework in Japan and the relationship between individual characteristics and teleworking. According to the results, first, the telework implementation rate among workers is less than 20%, and more than 90% of teleworkers work from home. Second, teleworking frequency among teleworkers averages 35%, and the share of telework in the total macroeconomic labor input is approximately 7%. Third, highly educated workers, workers in the information and telecommunications industry, workers in large companies, and workers in the Tokyo metropolitan area have higher rates of teleworking implementation and intensity. Fourth, males have telework implementation rates approximately 10 percentage points higher than females; however, the gender difference narrows to less than one percentage point after controlling for other individual characteristics. Fifth, teleworkers earn 30–40% higher wages after controlling for observable characteristics.

Keywords: telework, work from home, COVID-19

JEL Classification: I12, J22, J24, R41

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# Telework in Japan: An Overview from Micro Data of a Large Statistical Survey

## 1. Introduction

Telework has rapidly expanded worldwide since the COVID-19 pandemic. Because large-scale official statistics on teleworking are limited, studies have been conducted using original survey data on firms and workers (Barrero *et al.*, 2023 and Lee 2023, for surveys).<sup>1</sup> Trends in telework in Japan have been analyzed based on specially designed surveys of workers and firms (e.g., Kawaguchi and Motegi, 2021; Okubo *et al.* 2021; Kawaguchi *et al.* 2022; Morikawa, 2022, 2023a, b, 2024a, b). These studies generally made the following observations: telework increased significantly after the COVID-19 pandemic, full teleworking was rare, and most teleworkers were hybrid workers who used both the home and workplace; highly educated and high-wage workers in large companies in metropolitan areas were likely to engage in telework, and the use of telework mitigated the negative economic effects of the pandemic.

However, the survey data used in these studies are limited in terms of the sample size, and the extent to which they are representative of the economy remains debatable. In addition, it is difficult to analyze telework by subdividing detailed industries and occupational categories. However, the “Employment Status Survey” (ESS, Ministry of Internal Affairs and Communications) in 2022 introduced detailed questions on telework—whether and how often telework is implemented, and where telework is performed. This study uses micro data from a large-scale statistical survey to provide an overview of teleworking in Japan.

According to the results, first, the telework implementation rate is less than 20%, and more than 90% of teleworkers work from home (WFH). Second, teleworking frequency among teleworkers averages 35%, and the contribution of telework to the total macroeconomic labor input is approximately 7%. Third, highly educated workers, workers in the information and telecommunications industry, workers in large companies, and workers in the Tokyo metropolitan area have higher rates of telework implementation and intensity. Fourth, males have telework

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<sup>1</sup> In the United States, studies have defined telework based on questions about usual place of work or means of commuting in the American Community Survey, a statistical survey conducted by the Bureau of the Census (e.g., Pabilonia and Vernon, 2022, 2023).

implementation rates approximately 10 percentage points higher than females; however, the gender difference narrows to less than one percentage point after controlling for other individual characteristics. Fifth, teleworkers earn 30–40% higher wages after controlling for observable characteristics.

The remainder of this paper is organized as follows. Section 2 briefly explains the ESS, focusing on questions related to teleworking and the method of analysis. Section 3 reports the quantitative size of teleworking in the Japanese economy and the characteristics of teleworking workers. Finally, Section 4 summarizes the conclusions and discusses the limitations of this study.

## **2. Data and method of analysis**

This study uses micro data from the ESS for the year 2022. The ESS is a representative government statistical survey based on the Statistics Law, and its purpose is “to investigate the employment and unemployment status of the population and to obtain basic data on the employment structure nationwide and by region. The ESS began in 1956 and has been conducted every five years since 1982. The 2022 ESS was conducted in October 2022 and covered approximately 540,000 households and 1.08 million people.

Survey items included gender, age, education, employment status, place of employment, type of employment, number of annual working days, weekly working hours, annual earnings, and tenure. Many survey items were in a multiple-choice format. Regarding telework, the focus of this study, the survey asked whether, how often, and where telework was implemented.

Specifically, the ESS asked a question about “the status of telework implementation during the year for your job,” and respondents selected either “implemented” or “not implemented,” and if implemented, the frequency (as a percentage of the number of working days per year) was selected from “less than 20%,” “20% to less than 40%,” “40% to less than 60%,” “60% to 80%,” and “80% or more.” The survey was conducted on October 1, 2022; however, the telework implementation status covers the one-year period from October 2021.

Telework is defined as the use of ICT to work at a location away from an office (e.g., home or satellite office). The question regarding the location of telework implementation was “where did you telework?” with the options of “home,” “satellite office,” and “other.” In this study, we treated who selected “home” as WFH. The sample of this study was limited to working “graduates,”

excluding those in school. The sample size was approximately 470,000 individuals, of which 390,000 were employees. The sample was compiled and analyzed using the extraction rate (restoration multiplier) as a weight to ensure representativeness of the workforce in Japan.

First, we tabulated the rate of teleworking (and WFH), frequency of teleworking, and the number obtained by multiplying them to calculate the labor input share from teleworking for the economy as a whole. Because the frequency of teleworking was a multiple-choice question, we used the median value for each option (10%, 30%, 50%, 70%, and 90%). Note that since self-employed workers, family employees, and managers and executives of small companies often work and live in close proximity, the nature of telework may differ from the telework that has recently attracted attention. We also tabulated the data by limiting the sample to employees. Since being able to observe by industry and occupation subcategories is a major advantage of using the ESS, we also report the results broken down into smaller subcategories.

Next, we estimated the relationship between telework implementation and individual characteristics using a simple probit estimation in which telework implementation = 1, and the extraction rate was used as a weight. The individual characteristics, used as explanatory variables, were gender (female dummy), age group (15–24, 25–34, 35–44, 45–54, 55–64, 65–74, and 75 or older), educational background (elementary/junior high school, high school/old school, ..., university, graduate school (master's), graduate school (professional), graduate school (doctoral)), type of employment (full-time, part-time, temporary, contract, company director, self-employed, family worker, etc.), industry (agriculture, forestry, fisheries, mining, manufacturing, ..., services, etc.), occupation (managerial, professional or technical, ..., transportation, cleaning, packaging, etc.), and firm size (1, 2–4, 5–9, ..., 500–999, 1,000 or more, and government), and tenure (expressed in log).

The same explanatory variables were used to estimate the relationship with the individual characteristics of telework intensity (telework frequency with no teleworking was treated as zero). The teleworking frequency, used as the dependent variable is the median of the options, and a weighted least-squares (WLS) estimation using the restoration multiplier as the weight was employed.

Finally, we estimated the wage function with annual income (expressed in log) as the dependent variable. Since the annual income variable was not hourly wages, we controlled for hours worked per week (expressed in log). Gender, age, and education were used as individual characteristics, and teleworking was used as a dummy variable. Because this was a cross-sectional estimation,

the result was not a causal effect of teleworking on wages; however, our interest was in how high/low the wages of teleworkers were after controlling for other individual characteristics.

### 3. Results

#### 3.1. Implementation of telework

The teleworking rate for all workers was 19.5%, of whom 18.3% worked from home. When restricted to employees, the teleworking rates was 20.0%, of which 19.0% worked from home (see panel A of **Table 1**). More than 90% of teleworkers WFH. The average teleworking frequency for teleworkers was 35.0%, and the WFH frequency was 35.4% (33.9% and 34.3%, respectively, for employees only). In other words, for a 5-day work week, teleworking for fewer than two days was the average (see panel B of **Table 1**). Since only 3.4% of the respondents had a telework frequency of “80% or more,” only a small number of workers were full-teleworkers, and the majority were hybrid teleworkers.

The labor input share from teleworking (telework implementation rate multiplied by mean frequency) was equivalent to 6.8% of the total macroeconomic labor input, or 6.5% if calculated only for WFH (see panel C of **Table 1**). The teleworking rate was high for full-time employees and low for part-time workers. The figures weighted by the number of hours worked per week are shown in panel D of **Table 1**. In this case, the share of teleworking was 0.6–0.8 percentage points larger than when working hours were not considered, but it was still only approximately 7%.

According to Barrero *et al.* (2023), in the United States, 28% of market workdays for Americans aged 20–64 years were WFH in mid-2023, 12% of telecommuters engaged in full WFH, and nearly 29% engaged in hybrid WFH. Compared with these figures, teleworking and WFH are considerably less common in Japan. Barrero *et al.* (2023) interpreted that the WFH rate in the United States was higher than that in Europe and Asia because of more spacious housing, a higher share of industries, such as information and finance, more advanced management practices for evaluating worker performance, and the fact that Asia and some European countries have had fewer COVID-19 related deaths and hospitalizations. Cultural factors may also play a role. Zarate *et al.* (2024) found that a measure of cultural individualism could explain 1/3 of the differences in WFH rates across countries, with Asian countries with lower individualism scores

showing lower WFH rates.

### 3.2. Telework by individual characteristics

Tabulation results of the teleworking rate according to individual characteristics are shown in Appendix **Table A1**. **Table 2** presents the categories with high employee teleworking rates.<sup>2</sup> The rate of teleworking (or WFH) is very high among those with higher education, especially those with graduate education; more than half of them are engaged in teleworking. In contrast, less than 10% of workers with a high school education or lower implement teleworking. By employment type, about 1/4 of regular employees implement teleworking, and 15–20% of temporary and contract employees also implement teleworking. However, less than 5% of part-time workers are engaged in teleworking, showing considerable differences among non-standard employees according to employment type.

By industry, the “Information and communication industry” had an outstandingly high number of teleworkers, with approximately 80% of workers engaged in telework. “Academic research,” “professional/technical services,” and “finance and insurance,” had approximately 50% of teleworking rate. In contrast, the teleworking rate was less than 5% in the “healthcare and welfare,” “accommodation and food services,” and “agriculture, forestry, and fisheries” industries. This is unsurprising, as these industries are dominated by workers responsible for on-site operations. Note that the results are similar to those in the United States, where teleworking is higher among highly educated workers and in the information and financial industries (e.g., Barrero *et al.*, 2023).

At the three-digit industry classification, the industries with high teleworking rates were (1) telecommunications (84.6%), (2) software (84.4%), (3) internet-related services (83.0%), (4) financial instruments and commodity futures trading (77.8%), (5) management consulting and pure holding companies (77.2%), (6) tobacco manufacturing (76.5%), (7) advertising (73.6%), (8) information processing and provision services (69.7%), (9) advertising (67.9%), and (10) video and audio information production (66.9%). In general, the teleworking rate is high in the IT-related industry. The teleworking rate is generally low in the manufacturing industry; however,

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<sup>2</sup> Employees are a sample that excludes company executives, self-employed, and family workers from the working population.

some industries have the majority of workers engaged in teleworking, including computer and related equipment manufacturing (60.8%), communications machinery and related equipment manufacturing (57.6%), video and audio machinery and equipment manufacturing (57.2%), electronic equipment manufacturing (55.0%), and pharmaceutical manufacturing (51.6%).

Industries with low rates of teleworking included fresh fish retailers (1.3%), take-out food services (1.3%), barbering (1.9%), food retailers (2.1%), general clinics (2.1%), dental clinics (2.1%), hospitals (2.3%), various food retailers (2.8%), beauty shops (2.8%), soba and sushi restaurants (2.9%), etc., all of which provide face-to-face personalized services.

By occupation, the teleworking rate for “sales occupations” was the highest at 48.0%, followed by “professional/technical occupations (32.4%),” “clerical occupations (31.6%),” and “managerial occupations (30.0%).” The teleworking rate for “service occupations,” “agriculture, forestry, and fishery workers,” “transportation workers,” and “transportation, cleaning, and packaging workers” was less than 5%.

At the three-digit occupation classification, the occupations with high rates of teleworking were: (1) system consultants and designers (87.5%), (2) software creators (80.8%), (3) transportation equipment engineers (77.4%), (4) authors (75.7%), (5) researchers in the humanities and social sciences (75.2%), (6) other management, finance, and insurance professionals (74.8%), (7) aircraft pilots (71.7%), (8) other information processing and communications engineers (71.2%), (9) pharmaceutical sales (70.8%), and (10) reporters and editors (70.7%).

The occupations with low teleworking rates were housekeepers (0.0%), bartenders (0.0%), radiology technicians (0.1%), crane/winch operators (0.3%), block-laying/tiling workers (0.4%), dental hygienists (0.4%), nursing assistants (0.5%), hospitality and social workers (0.6%), fishermen (1.1%), and other health service occupations (1.2%). As is the case with the industry subcategories, many occupations require interpersonal contact and on-site work, which is essential because of the nature of the job.

Occupations in the same broad categories were often heterogeneous in subcategories. For example, among professional and technical occupations, researchers and technicians had a high rate of teleworking, whereas physicians and other medical occupations had a low rate. Among “teachers,” also classified as professional/technical occupations, the teleworking rate for university teachers was quite high at 67.1%, while the rates for elementary school teachers (9.4%) and junior high school teachers (10.0%) were very low.

There was a clear relationship by firm size: the larger the size (measured as the number of employees), the higher the teleworking implementation rate. The exception was a single-employee firm; however, this is because of the inclusion of self-employed workers. When limited to employees, there was a monotonous positive correlation between size and teleworking rates. For firms with 1,000 or more employees, the teleworking rate was 35.2%. The teleworking rate for government and municipal offices was approximately the same as that for firms with 100–299 employees.<sup>3</sup>

Tokyo has the highest percentage of teleworkers (41.6 %) by prefecture. Next in line are Kanagawa (31.4%), Chiba (24.9%), Saitama (22.6%), Osaka (20.7%), Aichi (18.8%), Hyogo (18.5%), and Kyoto (18.3%). The prefectures with the lowest teleworking rates were Akita (6.5%), Aomori (7.2%), Shimane (7.3%), Wakayama (7.8%), Kagoshima (7.7%), Yamagata (8.0%), and Oita (8.1%). The ESS is a household-level survey, and prefectures are defined by place of residence. Therefore, a significant number of teleworkers residing in the Kanagawa, Chiba, and Saitama prefectures are likely to commute to Tokyo.

We conducted a simple probit estimation using these individual characteristics as explanatory variables and the implementation of teleworking as the dependent variable. The results are shown in Appendix **Table A2**.<sup>4</sup> Restoration multipliers were used as weights, and the reference categories were males, 35–44 years old, high school graduates, full-time employees, manufacturing, clerical occupations, and firms with 100–299 employees. The population density of prefectures (in logarithms) and tenure (in logarithms) were used as explanatory variables. The estimation results (showing marginal effects) confirm the comparison results after controlling for other individual characteristics. The probability of teleworking was higher for those with higher education, those working in the information and communications industry, and those working in large firms. Note that the coefficient of population density was significantly positive, with a relationship of approximately two percentage points higher probability of teleworking when the population density of the prefecture doubles.

An interesting result was the coefficient of the female dummy variable. The estimated coefficient was significantly negative, indicating that females are less likely to telework than

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<sup>3</sup> However, the teleworking rates by detailed subcategory were 36.8% for national public service, 24.7% for prefectural agencies, and 13.5% for municipal agencies, indicating differences by size even among public offices.

<sup>4</sup> Dummies for industry and occupation are one-digit level. The same applies to the estimation of telework intensity described below.

males, but quantitatively, the difference was only approximately one percentage point or less. This is much smaller than the gender difference of approximately 10 percentage points observed in the simple comparison. When the estimates are limited to WFH, the difference between males and females is approximately 0.5% or less. This indicates that the differences in the composition of employment types, industries, and occupations played a significant role in the observed differences in WFH implementation rates between male and females.

### 3.3. Individual characteristics and telework intensity

The tabulation results of teleworking frequency by individual characteristics (gender, age group, education, employment status, industry, employment type, firm size, and prefecture) are reported in Appendix **Table A3**. **Table 3** shows the mean teleworking frequency for the category with the highest teleworking rate, focusing on employees. The figures in this table show the aggregate results for teleworkers and do not include those who do not telework. Although the differences in teleworking frequency (intensive margin) by individual characteristics were smaller than those by whether or not they are engaged in teleworking (extensive margin), the figures by industry were very high for the information and communications industry and by occupation for professional and technical occupations. The pattern by prefecture was similar to that of the teleworking rate, with Tokyo and three prefectures in the Tokyo metropolitan area (Kanagawa, Saitama, and Chiba) also showing high teleworking frequencies. However, the differences in frequency according to educational background, employment type, and firm size were relatively small.

By detailed (three-digit) industry, the following sectors showed high telework frequency: (1) internet-related services (67.3%), (2) tobacco manufacturing (59.5%), (3) other professional services (59.5%), (4) software (58.5%), (5) design (57.7%), (6) telecommunications (56.8%), (7) information processing and provision services (56.1%), (8) printing and related services (55.5%), (9) telecommunications-related services (52.5%), and (10) advertising (49.8%). In general, industries with higher rates of teleworking tend to have higher frequencies. When the relationship was plotted (see **Figure 1**), a positive correlation was observed (correlation coefficient: 0.49).

By detailed (three-digit) occupation, the following occupations showed high frequency of telework: (1) sculptors/painters/craftsmen (73.9%), (2) beverage/tobacco inspectors (70.0%), (3)

temporary caretakers of goods (70.0%), (4) writers (68.7%), (5) postal/telegraph outside clerks (67.9%), (6) dental technicians (62.8%), (7) software creators (59.3%), (8) system consultants/designers (58.7%), (9) designers (57.6%), (10) formwork carpenters (55.0%). However, these include occupations with very low teleworking rates (e.g., (2), (3), (5), (6), and (10) of the abovementioned occupations), and in some cases, the frequency of teleworking is high despite the small number of workers implementing teleworking. However, there are many occupations in which both the teleworking rate and frequency were high, and when the relationship was plotted (see **Figure 2**), a positive correlation was observed (correlation coefficient: 0.39).

The telework intensity, or labor input share from teleworking, by individual characteristics is shown in Appendix **Table A4**. **Table 4** shows teleworking intensity for categories with high teleworking rates. In this calculation, the teleworking frequency was treated as zero for non-teleworkers. As seen in subsection 3.1, the teleworking intensity for all workers was 6.8% (the WFH intensity was 6.5%). Individual characteristics with high telework intensity were postgraduate education (especially master's education), the information and communication industry, and Tokyo prefecture. The information and communication industry, professional and technical occupations, and Tokyo metropolitan area had high teleworking intensity from both the extensive and intensive margins. However, the difference in the extensive margin dominated the difference in teleworking intensity by education category.

The detailed industries with high telework intensity were: (1) internet-related services (55.9%), (2) software (49.4%), (3) telecommunications (48.0%), (4) tobacco manufacturing (45.5%), (5) information processing and provision services (39.1%), (6) management consulting and pure holding companies (38.4%), (7) design industry (37.4%), (8) other professional services (35.9%), (9) advertising industry (33.9%), and (10) advertising production (31.1%). IT-related service industries were prominent.

By detailed occupations, (1) authors (52.0%), (2) system consultants/designers (51.4%), (3) software creators (47.9%), (4) sculptors/painters/craftsmen (42.2%), (5) designers (38.8%), (6) other information processing/communications engineers (38.2%), (7) certified public accountants (36.5%), (8) other management/finance/insurance professionals (35.9%), (9) reporters/editors (32.6%), and (10) researchers in the humanities/social sciences (30.6%) were telework intensive.

Appendix **Table A5** shows the WLS estimation results, where individual characteristics are the explanatory variables and telework intensity is the dependent variable. The results confirm the

above tabulation results, even after controlling for other individual characteristics. The coefficient of population density was significantly positive, indicating that doubling the population density of the prefecture of residence is associated with a 1.1 percentage point higher telework intensity.

### 3.4. Wages of teleworkers

Finally, we report the results of a simple wage function estimation in which teleworking was used as an explanatory variable. The dependent variable was wages (log annual earnings from work) and the baseline explanatory variables were hours worked per week (log), gender, age group (in 10-year intervals), education, tenure (log), and population density (log). (1) Teleworker dummy and (2) telework frequency were additional explanatory variables. This WLS estimation was done by gender, with the sample restricted to employees.

**Table 5** shows the coefficients for teleworkers as percentages based on the estimation results. For both males and females, teleworkers are paid 30–40% higher wages after controlling for other individual characteristics. The results did not differ when the estimates were restricted to those engaged in WFH. When dummies for teleworking frequency were used, the differences in wage premiums by frequency were small, and no linear relationship was observed.

This result does not imply that teleworking increases wages, but rather that employees with higher wages are more likely to telework. Telework has amenity value in many ways, such as balancing work and personal life and reducing the burden of long commutes. Many studies have confirmed the existence of Willingness to Pay for teleworking (e.g., Mas and Pallais, 2017; He *et al.*, 2021; and Maestas *et al.*, 2023. Morikawa, 2020 for a survey). As previously reported, highly educated full-time employees and employees of larger firms tend to use teleworking services. Thus, when the amenity value of this work style is considered, labor market inequality by education, employment type, and firm size is greater than when comparing pecuniary wages alone.

## 4. Conclusion

This study uses micro data from the ESS in 2022 to present observations about the state of teleworking in Japan and its relationship with worker characteristics. While researchers have

relied on originally designed surveys to analyze teleworking during the COVID-19 pandemic, the contribution of this study is to clarify the accurate status of teleworking in Japan using micro data from a large-scale government statistical survey.

The main findings are summarized as follows: First, the teleworking implementation rate among workers is 19.5%, and more than 90% of teleworkers are those who WFM. Second, teleworking frequency among teleworkers averages 35.0%, and the share of teleworking in the total macroeconomic labor input is approximately 7%. Third, highly educated workers, workers in the information and telecommunications industry, workers in large firms, and workers in the Tokyo metropolitan area exhibit higher rates of teleworking implementation and intensity. These results hold even after controlling for other worker characteristics. Fourth, males have telework implementation rates approximately 10 percentage points higher than females, but the gender difference narrows to less than 1 percentage point after controlling for other worker characteristics. Fifth, teleworkers earn 30–40% higher wages after controlling for observable worker characteristics, but there is no monotonic relationship between telework frequency and wages.

This study has an obvious limitation in that the analysis is based on cross-sectional data at a single point in time: the year 2022.

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Table 1. Implementation, frequency, and labor input share of telework

	(1) All workers		(2) Employees	
	Telework	WFH	Telework	WFH
A. Implementation rate	19.5%	18.3%	20.0%	19.0%
B. Frequency	35.0%	35.4%	33.9%	34.3%
C. Contribution to labor input	6.8%	6.5%	6.8%	6.5%
D. Contribution: weighted by working hours	7.4%	7.2%	7.6%	7.4%

Note: The contribution to labor input is calculated as the teleworking implementation rate multiplied by teleworking frequency.

Table 2. Telework implementation rate of employees

	Telework	WFH
Education		
University	34.4%	33.1%
Postgraduate (Master's)	62.7%	60.8%
Postgraduate (Professional)	41.6%	40.0%
Postgraduate (Doctoral)	58.3%	53.7%
Industry		
Information & communications	80.5%	79.3%
Finance & insurance	47.6%	45.6%
Professional services	50.0%	48.5%
Occupation		
Managerial	38.5%	35.4%
Professional/technical	31.7%	30.4%
Clerical	32.1%	31.1%
Sales	50.0%	47.3%
Firm size		
1,000 employees or larger	35.0%	33.7%
Prefecture		
Tokyo	42.7%	41.5%
Kanagawa	31.8%	30.9%
All employees	20.0%	19.0%

Note: Categories with high implementation rate are extracted from appendix **Table A1**.

Table 3. Telework frequency of employees

	Telework	WFH
Education		
University	34.7%	35.1%
Postgraduate (Master's)	39.4%	39.8%
Postgraduate (Professional)	37.2%	36.5%
Postgraduate (Doctoral)	31.3%	31.9%
Industry		
Information & communications	56.1%	56.3%
Finance & insurance	27.7%	27.8%
Professional services	39.2%	39.4%
Occupation		
Managerial	19.7%	19.9%
Professional/technical	41.7%	42.5%
Clerical	33.6%	33.8%
Sales	28.9%	29.0%
Firm size		
1,000 employees or larger	37.3%	37.7%
Prefecture		
Tokyo	43.4%	43.8%
Kanagawa	42.1%	42.4%
All employees	33.9%	34.3%

Note: Categories with high implementation rate are extracted from appendix **Table A2**.

Table 4. Contribution to labor input of employees

	Telework	WFH
Education		
University	11.9%	11.6%
Postgraduate (Master's)	24.7%	24.2%
Postgraduate (Professional)	15.5%	14.6%
Postgraduate (Doctoral)	18.2%	17.1%
Industry		
Information & communications	45.1%	44.7%
Finance & insurance	13.2%	12.7%
Professional services	19.6%	19.1%
Occupation		
Managerial	7.6%	7.0%
Professional/technical	13.2%	12.9%
Clerical	10.8%	10.5%
Sales	14.4%	13.7%
Firm size		
1,000 employees or larger	13.0%	12.7%
Prefecture		
Tokyo	18.5%	18.2%
Kanagawa	13.4%	13.1%
All employees	6.8%	6.5%

Note: Categories with high implementation rate are extracted from appendix **Table A3**.

Table 5. Wages of teleworkers

	Male	Female
Telework		
Less than 20%	30.7%	28.5%
20%–40%	38.0%	35.0%
40%–60%	33.7%	36.5%
60%–80%	38.5%	35.0%
80% or more	37.1%	34.1%
WFH		
Less than 20%	31.4%	29.2%
20%–40%	38.7%	36.5%
40%–60%	34.3%	37.3%
60%–80%	39.8%	36.3%
80% or more	38.2%	34.6%

Note: The figures are calculated from wage function estimations.

Figure 1. Relationship between telework implementation rate and telework frequency by three-digit industries (all workers)

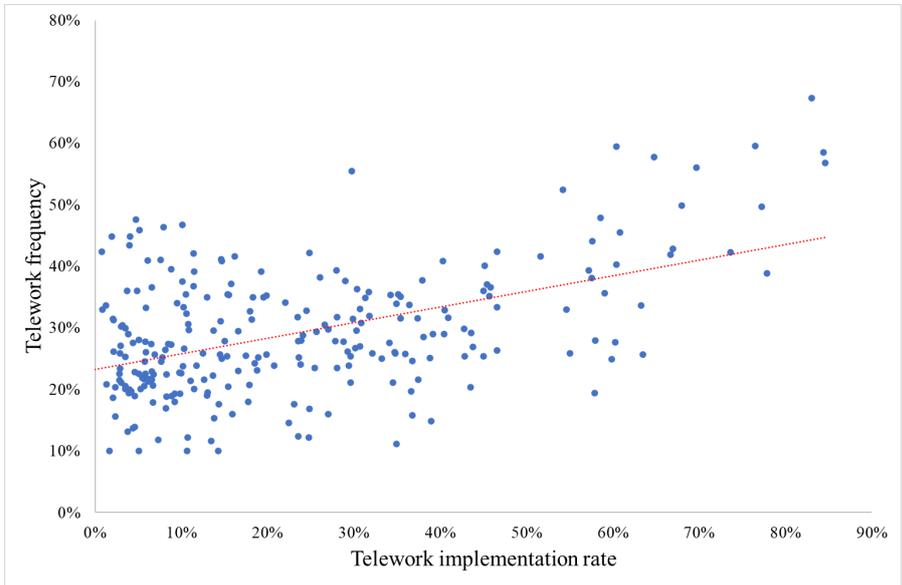


Figure 2. Relationship between telework implementation rate and telework frequency by three-digit occupations (all workers)

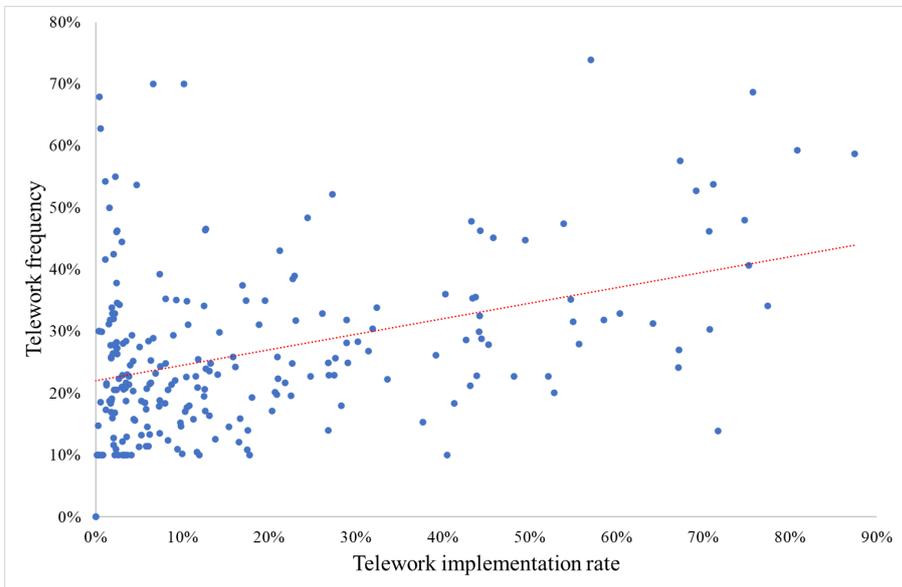


Table A1. Telework implementation rate by individual characteristics

		(1) All workers		(2) Employees	
		Telework	WFH	Telework	WFH
All		19.5%	18.3%	20.0%	19.0%
Gender	Male	23.7%	22.1%	25.3%	23.9%
	Female	14.5%	13.7%	14.2%	13.5%
Age	15–24	13.9%	12.8%	13.9%	12.7%
	25–34	25.5%	24.4%	25.4%	24.4%
	35–44	23.9%	22.9%	23.8%	22.9%
	45–54	21.0%	19.8%	21.2%	20.2%
	55–64	17.5%	16.2%	17.4%	16.2%
	65–74	8.0%	6.6%	6.7%	5.4%
	75–	7.3%	5.7%	6.8%	4.7%
Education	Elementary school or junior high school	4.3%	3.0%	3.9%	2.5%
	High school	8.8%	7.9%	8.8%	8.0%
	vocational school (less than 2 years)	9.4%	8.5%	9.4%	8.6%
	Vocational school (2-4 years)	14.6%	13.6%	14.0%	13.2%
	Vocational school (4 years or longer)	15.6%	14.7%	15.4%	14.7%
	Junior college	13.4%	12.5%	12.9%	12.1%
	Technical college	33.1%	30.6%	33.8%	31.7%
	University	33.7%	32.2%	34.4%	33.1%
	Postgraduate (master's)	61.7%	59.5%	62.7%	60.8%
	Postgraduate (professional)	45.8%	43.4%	41.6%	40.0%
Postgraduate (doctoral)	53.5%	49.2%	58.3%	53.7%	
Employment type	Company executive	23.0%	20.1%		
	Self-employed	14.7%	13.2%		
	Family worker	4.9%	4.4%		
	Standard employee	26.5%	25.3%	26.5%	25.3%
	Part-time worker	3.1%	2.6%	3.1%	2.6%
	Temporary worker	4.3%	3.5%	4.3%	3.5%
	Dispatched employee	17.7%	16.8%	17.7%	16.8%
	Contract employee	17.2%	15.6%	17.2%	15.6%
	Entrusted employee	20.4%	19.0%	20.4%	19.0%
	Other	11.2%	9.8%	11.2%	9.8%
Industry	Agriculture, forestry, fisheries	2.6%	2.1%	3.2%	2.7%
	Mining	13.7%	13.7%	13.8%	13.8%
	Construction	14.7%	13.1%	17.7%	16.1%
	Manufacturing	22.5%	21.6%	23.3%	22.5%
	Electricity, gas, water	42.2%	40.6%	42.6%	40.9%
	Information and communications	79.9%	78.4%	80.5%	79.3%
	Transportation	8.9%	8.1%	9.1%	8.3%
	Wholesale, retail	15.3%	14.2%	15.3%	14.4%
	Finance, insurance	47.7%	45.5%	47.6%	45.6%
	Real estate	23.0%	21.3%	27.2%	25.4%
	Professional/technical services	49.9%	47.5%	50.0%	48.5%
	Accommodations, restaurants	3.8%	3.0%	3.8%	3.1%
	Personal/entertainment services	9.0%	8.1%	8.7%	7.9%
	Education	19.3%	17.2%	18.1%	16.1%
	Healthcare, welfare	4.1%	3.3%	3.7%	3.0%
	Combined services	3.3%	2.4%	2.9%	2.3%
	Other services	16.9%	15.9%	17.2%	16.3%
Public services	22.0%	21.1%	22.1%	21.1%	
Occupation	Managerial	30.0%	26.6%	38.5%	35.4%
	Professional/technical	32.4%	30.9%	31.7%	30.4%
	Clerical	31.6%	30.6%	32.1%	31.1%
	Merchandise sales	9.2%	8.1%	7.9%	6.9%
	Sales	48.0%	45.2%	50.0%	47.3%
	Services	3.3%	2.6%	2.9%	2.2%
	Security	7.1%	6.2%	7.1%	6.3%
	Agriculture, forestry, fishery	2.1%	1.6%	2.2%	1.6%
	Manufacturing process	8.4%	7.6%	8.6%	7.9%
	Transport	2.5%	1.7%	2.4%	1.8%
	Machine operation	11.2%	10.1%	11.5%	10.5%
	Construction and mining	9.5%	8.1%	11.8%	10.3%
	Carrying, cleaning, packaging	2.1%	1.5%	1.9%	1.3%

		(1) All workers		(2) Employees	
		Telework	WFH	Telework	WFH
Firm size	1	19.1%	17.2%		
	2-4	9.7%	8.2%	8.7%	7.6%
	5-9	9.3%	8.2%	8.2%	7.4%
	10-19	9.9%	8.9%	8.8%	7.9%
	20-29	10.2%	9.2%	9.5%	8.6%
	30-49	11.8%	10.9%	11.1%	10.3%
	50-99	14.4%	13.2%	13.9%	12.9%
	100-299	17.9%	16.8%	17.6%	16.5%
	300-499	21.4%	20.3%	21.0%	20.0%
	500-999	24.3%	23.2%	24.1%	22.9%
	1000 or more	35.2%	33.9%	35.0%	33.7%
	Public sector	17.8%	16.6%	17.8%	16.6%
Prefecture	Hokkaido	12.6%	11.2%	12.4%	11.2%
	Aomori	7.2%	6.3%	7.4%	6.4%
	Iwate	8.2%	7.0%	8.5%	7.3%
	Miyagi	14.3%	13.3%	14.6%	13.7%
	Akita	6.5%	5.6%	6.4%	5.6%
	Yamagata	8.0%	6.7%	8.0%	6.8%
	Fukushima	8.5%	7.5%	9.1%	8.0%
	Ibaraki	13.8%	12.5%	14.5%	13.3%
	Tochigi	13.3%	12.3%	14.1%	13.1%
	Gunma	9.7%	8.8%	9.8%	8.9%
	Saitama	22.6%	21.5%	23.0%	22.0%
	Chiba	24.9%	23.7%	25.4%	24.2%
	Tokyo	41.6%	40.1%	42.7%	41.5%
	Kanagawa	31.4%	30.4%	31.8%	30.9%
	Niigata	8.9%	8.0%	8.9%	8.0%
	Toyama	10.7%	9.5%	10.8%	9.8%
	Ishikawa	13.4%	12.2%	13.5%	12.5%
	Fukui	11.7%	10.3%	12.2%	10.8%
	Yamanashi	10.6%	9.5%	10.5%	9.6%
	Nagano	10.8%	9.5%	11.4%	10.3%
	Gifu	10.8%	9.4%	10.8%	9.6%
	Sizuoka	11.6%	10.5%	11.8%	10.8%
	Aichi	18.8%	17.7%	19.5%	18.5%
	Mie	11.8%	10.9%	12.1%	11.3%
	Shiga	15.2%	14.0%	15.4%	14.4%
	Kyoto	18.3%	16.7%	18.5%	17.1%
	Osaka	20.7%	19.4%	21.2%	20.1%
	Hyogo	18.5%	17.5%	18.6%	17.8%
	Nara	16.4%	15.1%	16.2%	15.1%
	Wakayama	7.8%	6.9%	7.8%	7.0%
	Tottori	8.1%	6.7%	8.3%	7.0%
	Shimane	7.3%	6.1%	7.0%	6.0%
	Okayama	10.1%	8.8%	9.9%	8.8%
	Hiroshima	15.3%	14.0%	15.7%	14.5%
	Yamaguchi	9.4%	8.5%	9.4%	8.5%
Tokushima	8.5%	7.4%	8.9%	7.8%	
Kagawa	11.4%	10.2%	11.8%	10.6%	
Ehime	9.8%	8.6%	9.9%	8.8%	
Kochi	7.8%	6.9%	8.2%	7.2%	
Fukuoka	16.1%	15.0%	16.3%	15.2%	
Saga	9.2%	8.0%	9.4%	8.3%	
Nagasaki	10.1%	8.9%	10.5%	9.4%	
Kumamoto	11.3%	10.1%	11.7%	10.6%	
Oita	8.1%	7.3%	8.0%	7.4%	
Miyazaki	8.9%	7.8%	9.1%	8.0%	
Kagoshima	7.7%	6.6%	7.9%	6.8%	
Okinawa	14.7%	13.2%	14.8%	13.4%	

Table A2. Individual characteristics and probability to telework

	(1)		(2)		(3)		(4)	
	All worker Telework dF/dx	Robust SE	All worker WFH dF/dx	Robust SE	Employee Telework dF/dx	Robust SE	Employee WFH dF/dx	Robust SE
Female	-0.0096	0.0001 ***	-0.0033	0.0001 ***	-0.0113	0.0001 ***	-0.0053	0.0001 ***
15-24	-0.0606	0.0001 ***	-0.0561	0.0001 ***	-0.0513	0.0002 ***	-0.0498	0.0001 ***
25-34	-0.0246	0.0001 ***	-0.0224	0.0001 ***	-0.0196	0.0001 ***	-0.0188	0.0001 ***
45-54	-0.0072	0.0001 ***	-0.0078	0.0001 ***	-0.0048	0.0001 ***	-0.0060	0.0001 ***
55-64	-0.0187	0.0001 ***	-0.0191	0.0001 ***	-0.0159	0.0001 ***	-0.0177	0.0001 ***
65-74	-0.0439	0.0002 ***	-0.0464	0.0001 ***	-0.0323	0.0002 ***	-0.0406	0.0002 ***
75-	-0.0455	0.0003 ***	-0.0473	0.0002 ***	-0.0113	0.0006 ***	-0.0324	0.0004 ***
Elementary school or junior high school	-0.0072	0.0003 ***	-0.0233	0.0002 ***	-0.0091	0.0004 ***	-0.0285	0.0003 ***
vocational school (less than 2 years)	-0.0021	0.0002 ***	-0.0020	0.0002 ***	0.0006	0.0003 ***	0.0003	0.0002 ***
Vocational school (2-4 years)	0.0351	0.0002 ***	0.0327	0.0002 ***	0.0368	0.0002 ***	0.0354	0.0002 ***
Vocational school (4 years or longer)	0.0288	0.0010 ***	0.0296	0.0009 ***	0.0329	0.0010 ***	0.0352	0.0010 ***
Junior college	0.0413	0.0002 ***	0.0383	0.0002 ***	0.0438	0.0002 ***	0.0402	0.0002 ***
Technical college	0.1557	0.0007 ***	0.1345	0.0006 ***	0.1618	0.0007 ***	0.1421	0.0007 ***
University	0.0946	0.0001 ***	0.0864	0.0001 ***	0.0991	0.0002 ***	0.0904	0.0001 ***
Postgraduate (master's)	0.2605	0.0004 ***	0.2335	0.0004 ***	0.2733	0.0005 ***	0.2444	0.0004 ***
Postgraduate (professional)	0.2111	0.0020 ***	0.1866	0.0019 ***	0.2246	0.0023 ***	0.2060	0.0022 ***
Postgraduate (doctoral)	0.3635	0.0009 ***	0.3227	0.0009 ***	0.4132	0.0010 ***	0.3651	0.0010 ***
Part-time worker	-0.1039	0.0001 ***	-0.0926	0.0001 ***	-0.1013	0.0001 ***	-0.0904	0.0001 ***
Temporary worker	-0.0795	0.0002 ***	-0.0719	0.0001 ***	-0.0758	0.0002 ***	-0.0683	0.0001 ***
Dispatched employee	-0.0571	0.0002 ***	-0.0499	0.0002 ***	-0.0507	0.0002 ***	-0.0446	0.0002 ***
Contract employee	-0.0356	0.0002 ***	-0.0347	0.0001 ***	-0.0321	0.0002 ***	-0.0311	0.0002 ***
Entrusted employee	-0.0097	0.0003 ***	-0.0081	0.0003 ***	-0.0121	0.0003 ***	-0.0083	0.0003 ***
Other	-0.0180	0.0004 ***	-0.0170	0.0003 ***	-0.0175	0.0004 ***	-0.0144	0.0004 ***
Company executive	0.0083	0.0003 ***	0.0008	0.0002 ***				
Self-employed	0.0111	0.0004 ***	0.0117	0.0003 ***				
Family worker	-0.0222	0.0005 ***	-0.0142	0.0005 ***				
Agriculture, forestry, fisheries	-0.0385	0.0006 ***	-0.0357	0.0006 ***	-0.0240	0.0008 ***	-0.0258	0.0007 ***
Mining	-0.0238	0.0017 ***	-0.0096	0.0017 ***	-0.0303	0.0017 ***	-0.0165	0.0017 ***
Construction	-0.0245	0.0002 ***	-0.0252	0.0002 ***	-0.0194	0.0002 ***	-0.0213	0.0002 ***
Electricity, gas, water	0.0879	0.0007 ***	0.0742	0.0006 ***	0.0780	0.0007 ***	0.0649	0.0006 ***
Information and communications	0.3129	0.0004 ***	0.2751	0.0004 ***	0.3021	0.0005 ***	0.2659	0.0005 ***
Transportation	-0.0639	0.0002 ***	-0.0562	0.0001 ***	-0.0644	0.0002 ***	-0.0564	0.0001 ***
Wholesale, retail	-0.0399	0.0001 ***	-0.0363	0.0001 ***	-0.0433	0.0001 ***	-0.0390	0.0001 ***
Finance, insurance	0.0001	0.0002 ***	-0.0070	0.0002 ***	-0.0102	0.0002 ***	-0.0144	0.0002 ***
Real estate	-0.0144	0.0003 ***	-0.0129	0.0002 ***	-0.0053	0.0003 ***	-0.0075	0.0003 ***
Professional/technical services	0.1021	0.0003 ***	0.0827	0.0003 ***	0.0982	0.0003 ***	0.0832	0.0003 ***
Accommodations, restaurants	-0.0812	0.0002 ***	-0.0729	0.0001 ***	-0.0806	0.0002 ***	-0.0718	0.0002 ***
Personal/entertainment services	-0.0502	0.0002 ***	-0.0439	0.0002 ***	-0.0557	0.0002 ***	-0.0490	0.0002 ***
Education	-0.0647	0.0001 ***	-0.0620	0.0001 ***	-0.0752	0.0001 ***	-0.0693	0.0001 ***
Healthcare, welfare	-0.1277	0.0001 ***	-0.1137	0.0001 ***	-0.1336	0.0001 ***	-0.1190	0.0001 ***
Combined services	-0.1106	0.0001 ***	-0.0933	0.0001 ***	-0.1108	0.0001 ***	-0.0929	0.0001 ***
Other services	-0.0168	0.0002 ***	-0.0163	0.0002 ***	-0.0207	0.0002 ***	-0.0195	0.0002 ***
Public services	0.0009	0.0003 ***	-0.0034	0.0003 ***	-0.0112	0.0003 ***	-0.0127	0.0003 ***
Managerial	-0.0018	0.0003 ***	-0.0061	0.0003 ***	0.0096	0.0006 ***	0.0017	0.0005 ***
Professional/technical	-0.0124	0.0001 ***	-0.0121	0.0001 ***	-0.0097	0.0001 ***	-0.0089	0.0001 ***
Merchandise sales	-0.0822	0.0001 ***	-0.0735	0.0001 ***	-0.0899	0.0001 ***	-0.0795	0.0001 ***
Sales	0.0396	0.0002 ***	0.0263	0.0002 ***	0.0423	0.0002 ***	0.0284	0.0002 ***
Services	-0.0841	0.0002 ***	-0.0769	0.0001 ***	-0.0839	0.0002 ***	-0.0778	0.0001 ***
Security	-0.0967	0.0001 ***	-0.0831	0.0001 ***	-0.0966	0.0001 ***	-0.0827	0.0001 ***
Agriculture, forestry, fishery	-0.0987	0.0002 ***	-0.0843	0.0002 ***	-0.0958	0.0003 ***	-0.0820	0.0002 ***
Manufacturing process	-0.1099	0.0001 ***	-0.0954	0.0001 ***	-0.1119	0.0001 ***	-0.0967	0.0001 ***
Transport	-0.1075	0.0001 ***	-0.0932	0.0001 ***	-0.1078	0.0001 ***	-0.0930	0.0001 ***
Machine operation	-0.0926	0.0002 ***	-0.0789	0.0001 ***	-0.0920	0.0002 ***	-0.0779	0.0001 ***
Construction and mining	-0.0826	0.0001 ***	-0.0713	0.0001 ***	-0.0766	0.0002 ***	-0.0661	0.0001 ***
Carrying, cleaning, packaging	-0.1159	0.0001 ***	-0.1012	0.0001 ***	-0.1176	0.0001 ***	-0.1028	0.0001 ***
1	0.0000	0.0004 ***	-0.0014	0.0003 ***				
2-4	-0.0468	0.0002 ***	-0.0439	0.0002 ***	-0.0486	0.0002 ***	-0.0441	0.0002 ***
5-9	-0.0480	0.0002 ***	-0.0419	0.0002 ***	-0.0463	0.0002 ***	-0.0398	0.0002 ***
10-19	-0.0370	0.0002 ***	-0.0338	0.0002 ***	-0.0371	0.0002 ***	-0.0341	0.0002 ***
20-29	-0.0332	0.0002 ***	-0.0306	0.0002 ***	-0.0305	0.0002 ***	-0.0283	0.0002 ***
30-49	-0.0304	0.0002 ***	-0.0266	0.0002 ***	-0.0299	0.0002 ***	-0.0262	0.0002 ***
50-99	-0.0158	0.0002 ***	-0.0159	0.0002 ***	-0.0148	0.0002 ***	-0.0141	0.0002 ***
300-499	0.0158	0.0002 ***	0.0156	0.0002 ***	0.0143	0.0002 ***	0.0141	0.0002 ***
500-999	0.0380	0.0002 ***	0.0344	0.0002 ***	0.0370	0.0002 ***	0.0333	0.0002 ***
1000 or more	0.0989	0.0002 ***	0.0898	0.0002 ***	0.0952	0.0002 ***	0.0860	0.0002 ***
Public sector	-0.0324	0.0002 ***	-0.0259	0.0002 ***	-0.0266	0.0002 ***	-0.0215	0.0002 ***
In Tenure	0.0015	0.0000 ***	0.0016	0.0000 ***	0.0069	0.0000 ***	0.0060	0.0000 ***
In Population density	0.0276	0.0000 ***	0.0260	0.0000 ***	0.0290	0.0000 ***	0.0273	0.0000 ***
Nobs.	60,574,856		60,574,856		51,840,227		51,840,227	
Pseudo R <sup>2</sup>	0.3510		0.3667		0.3670		0.3829	

Notes: Marginal effects and robust standard errors are from probit estimations using the extraction

rate as weights. \*\*\*:  $p < 0.01$ , \*\*:  $p < 0.05$ . The reference categories were male, age 35–44, high school graduate, standard employee, manufacturing industry, clerical occupation, firm size 100–299.

Table A3. Telework frequency by individual characteristics

		(1) All workers		(2) Employees	
		Telework	WFH	Telework	WFH
All		35.0%	35.4%	33.9%	34.3%
Gender	Male	33.3%	33.7%	32.7%	33.0%
	Female	38.3%	38.7%	36.5%	36.8%
Age	15–24	33.8%	34.4%	32.9%	33.4%
	25–34	38.8%	39.1%	37.8%	38.1%
	35–54	36.3%	36.7%	35.0%	35.3%
	45–54	32.7%	33.2%	31.6%	32.0%
	55–64	31.5%	32.0%	30.9%	31.3%
	65–74	34.2%	34.6%	32.0%	31.7%
	75–	40.1%	39.1%	38.5%	35.0%
Education	Elementary school or junior high school	36.4%	34.6%	36.2%	33.2%
	High school	29.1%	29.2%	27.6%	27.6%
	vocational school (less than 2 years)	31.8%	32.3%	30.7%	31.0%
	Vocational school (2–4 years)	37.7%	38.2%	36.1%	36.5%
	Vocational school (4 years or longer)	53.3%	54.7%	53.3%	54.4%
	Junior college	33.4%	33.9%	31.9%	32.3%
	Technical college	33.3%	32.7%	32.4%	32.1%
	University	35.7%	36.1%	34.7%	35.1%
	Postgraduate (master's)	39.9%	40.4%	39.4%	39.8%
	Postgraduate (professional)	32.5%	32.3%	37.2%	36.5%
Postgraduate (doctoral)	33.3%	34.1%	31.3%	31.9%	
Employment type	Company executive	35.5%	36.2%		
	Self-employed	49.4%	51.0%		
	Family worker	45.7%	46.8%		
	Standard employee	33.1%	33.5%	33.1%	33.5%
	Part-time worker	34.7%	35.0%	34.7%	35.0%
	Temporary worker	44.5%	47.1%	44.5%	47.1%
	Dispatched employee	48.7%	48.5%	48.7%	48.5%
	Contract employee	39.1%	39.1%	39.1%	39.1%
	Entrusted employee	33.0%	33.4%	33.0%	33.4%
	Other	37.6%	39.0%	37.6%	39.0%
Industry	Agriculture, forestry, fisheries	28.7%	26.7%	24.1%	22.1%
	Mining	29.6%	29.6%	31.4%	31.4%
	Construction	25.1%	25.0%	24.7%	24.5%
	Manufacturing	31.2%	31.3%	31.3%	31.3%
	Electricity, gas, water	18.6%	18.8%	18.4%	18.5%
	Information and communications	56.6%	56.8%	56.1%	56.3%
	Transportation	22.0%	21.5%	22.0%	21.5%
	Wholesale, retail	30.9%	31.4%	29.9%	30.3%
	Finance, insurance	28.1%	28.2%	27.7%	27.8%
	Real estate	28.1%	28.2%	25.9%	25.7%
	Professional/technical services	42.4%	42.7%	39.2%	39.4%
	Accommodations, restaurants	24.1%	23.8%	23.2%	23.2%
	Personal/entertainment services	31.1%	31.4%	28.3%	29.1%
	Education	22.1%	22.6%	19.9%	20.3%
	Healthcare, welfare	20.1%	19.6%	19.1%	18.4%
	Combined services	16.3%	16.2%	16.5%	15.8%
Other services	35.8%	35.8%	35.1%	35.0%	
Public services	13.7%	13.6%	13.7%	13.6%	
Occupation	Managerial	28.7%	28.8%	19.7%	19.9%
	Professional/technical	43.1%	43.9%	41.7%	42.5%
	Clerical	34.5%	34.7%	33.6%	33.8%
	Merchandise sales	29.7%	30.4%	25.0%	25.5%
	Sales	29.2%	29.3%	28.9%	29.0%
	Services	22.9%	22.7%	19.4%	18.7%
	Security	14.9%	12.8%	15.0%	12.8%
	Agriculture, forestry, fishery	30.7%	28.3%	24.8%	22.1%
	Manufacturing process	26.0%	25.8%	24.8%	24.5%
	Transport	25.7%	23.0%	25.9%	23.0%
	Machine operation	20.3%	18.1%	19.8%	18.3%
	Construction and mining	19.3%	18.2%	18.8%	17.7%
	Carrying, cleaning, packaging	25.1%	21.6%	24.4%	20.0%

		(1) All workers		(2) Employees	
		Telework	WFH	Telework	WFH
Firm size	1	52.0%	53.3%		
	2-4	39.7%	40.9%	41.0%	42.3%
	5-9	34.5%	34.8%	36.5%	36.5%
	10-19	35.0%	35.2%	34.3%	34.5%
	20-29	31.3%	31.5%	32.4%	32.7%
	30-49	34.2%	34.7%	34.7%	35.1%
	50-99	34.0%	34.6%	34.4%	34.9%
	100-299	33.9%	34.2%	34.2%	34.4%
	300-499	32.6%	33.0%	32.9%	33.3%
	500-999	33.8%	34.2%	33.9%	34.3%
	1000 or more	37.2%	37.6%	37.3%	37.7%
	Public sector	14.7%	14.5%	14.7%	14.5%
Prefecture	Hokkaido	27.6%	27.6%	25.4%	25.2%
	Aomori	23.0%	22.4%	20.8%	20.3%
	Iwate	19.6%	19.0%	18.5%	18.0%
	Miyagi	27.5%	27.5%	25.7%	25.6%
	Akita	21.2%	21.0%	18.7%	18.0%
	Yamagata	22.4%	21.2%	20.0%	18.5%
	Fukushima	22.4%	22.1%	20.6%	20.2%
	Ibaraki	29.7%	29.4%	28.0%	27.6%
	Tochigi	27.5%	27.4%	26.0%	25.9%
	Gunma	24.1%	23.9%	22.7%	22.5%
	Saitama	38.9%	39.3%	37.8%	38.2%
	Chiba	39.2%	39.7%	38.3%	38.7%
	Tokyo	44.1%	44.5%	43.4%	43.8%
	Kanagawa	42.6%	42.9%	42.1%	42.4%
	Niigata	22.2%	22.2%	19.6%	19.5%
	Toyama	23.1%	23.0%	21.3%	21.3%
	Ishikawa	24.7%	24.4%	23.7%	23.6%
	Fukui	18.8%	18.4%	16.9%	16.6%
	Yamanashi	24.4%	24.9%	21.5%	21.8%
	Nagano	23.2%	23.3%	21.0%	20.8%
	Gifu	25.2%	24.6%	24.0%	22.8%
	Sizuoka	25.8%	25.8%	24.5%	24.3%
	Aichi	29.3%	29.3%	28.6%	28.4%
	Mie	22.7%	22.6%	20.8%	20.7%
	Shiga	25.4%	25.2%	24.1%	23.8%
	Kyoto	30.0%	30.4%	28.4%	28.8%
	Osaka	31.4%	31.3%	30.2%	30.1%
	Hyogo	27.9%	28.1%	26.9%	27.2%
	Nara	28.7%	29.0%	27.1%	27.2%
	Wakayama	24.0%	24.1%	22.1%	22.1%
	Tottori	19.9%	19.9%	17.7%	17.7%
	Shimane	24.1%	23.2%	21.3%	20.0%
	Okayama	24.2%	23.8%	21.6%	21.1%
Hiroshima	24.1%	23.8%	22.7%	22.4%	
Yamaguchi	22.1%	21.7%	20.0%	19.5%	
Tokushima	23.6%	23.0%	22.1%	21.1%	
Kagawa	22.7%	22.6%	20.3%	20.3%	
Ehime	23.0%	23.0%	19.5%	19.3%	
Kochi	21.1%	20.9%	17.9%	17.8%	
Fukuoka	27.1%	27.1%	25.4%	25.5%	
Saga	22.5%	22.1%	19.7%	19.3%	
Nagasaki	23.8%	23.6%	22.4%	22.0%	
Kumamoto	23.4%	23.4%	21.1%	21.1%	
Oita	21.6%	21.5%	19.7%	19.4%	
Miyazaki	24.5%	24.5%	22.9%	22.4%	
Kagoshima	23.2%	22.1%	20.0%	18.8%	
Okinawa	28.0%	28.3%	26.4%	26.8%	

Table A4. Contribution to labor input by individual characteristics

		(1) All workers		(2) Employees	
		Telework	WFH	Telework	WFH
All		6.8%	6.5%	6.8%	6.5%
Gender	Male	7.9%	7.5%	8.3%	7.9%
	Female	5.5%	5.3%	5.2%	5.0%
Age	15–24	4.7%	4.4%	4.6%	4.2%
	25–34	9.9%	9.6%	9.6%	9.3%
	35–54	8.7%	8.4%	8.3%	8.1%
	45–54	6.9%	6.6%	6.7%	6.5%
	55–64	5.5%	5.2%	5.4%	5.1%
	65–74	2.7%	2.3%	2.2%	1.7%
	75–	2.9%	2.2%	2.6%	1.6%
Education	Elementary school or junior high school	1.6%	1.0%	1.4%	0.8%
	High school	2.6%	2.3%	2.4%	2.2%
	vocational school (less than 2 years)	3.0%	2.7%	2.9%	2.7%
	Vocational school (2–4 years)	5.5%	5.2%	5.0%	4.8%
	Vocational school (4 years or longer)	8.3%	8.0%	8.2%	8.0%
	Junior college	4.5%	4.2%	4.1%	3.9%
	Technical college	11.0%	10.0%	11.0%	10.2%
	University	12.0%	11.6%	11.9%	11.6%
	Postgraduate (master's)	24.6%	24.0%	24.7%	24.2%
	Postgraduate (professional)	14.9%	14.0%	15.5%	14.6%
Postgraduate (doctoral)	17.8%	16.8%	18.2%	17.1%	
Employment type	Company executive	8.1%	7.3%		
	Self-employed	7.3%	6.7%		
	Family worker	2.2%	2.0%		
	Standard employee	8.8%	8.5%	8.8%	8.5%
	Part-time worker	1.1%	0.9%	1.1%	0.9%
	Temporary worker	1.9%	1.6%	1.9%	1.6%
	Dispatched employee	8.6%	8.1%	8.6%	8.1%
	Contract employee	6.7%	6.1%	6.7%	6.1%
	Entrusted employee	6.7%	6.4%	6.7%	6.4%
	Other	4.2%	3.8%	4.2%	3.8%
Industry	Agriculture, forestry, fisheries	0.7%	0.5%	0.8%	0.6%
	Mining	4.1%	4.1%	4.3%	4.3%
	Construction	3.7%	3.3%	4.4%	3.9%
	Manufacturing	7.0%	6.8%	7.3%	7.0%
	Electricity, gas, water	7.8%	7.6%	7.8%	7.6%
	Information and communications	45.2%	44.5%	45.1%	44.7%
	Transportation	2.0%	1.7%	2.0%	1.8%
	Wholesale, retail	4.7%	4.5%	4.6%	4.4%
	Finance, insurance	13.4%	12.8%	13.2%	12.7%
	Real estate	6.5%	6.0%	7.0%	6.5%
	Professional/technical services	21.1%	20.3%	19.6%	19.1%
	Accommodations, restaurants	0.9%	0.7%	0.9%	0.7%
	Personal/entertainment services	2.8%	2.5%	2.5%	2.3%
	Education	4.3%	3.9%	3.6%	3.3%
	Healthcare, welfare	0.8%	0.6%	0.7%	0.5%
	Combined services	0.5%	0.4%	0.5%	0.4%
	Other services	6.1%	5.7%	6.0%	5.7%
Public services	3.0%	2.9%	3.0%	2.9%	
Occupation	Managerial	8.6%	7.6%	7.6%	7.0%
	Professional/technical	14.0%	13.6%	13.2%	12.9%
	Clerical	10.9%	10.6%	10.8%	10.5%
	Merchandise sales	2.7%	2.5%	2.0%	1.8%
	Sales	14.0%	13.3%	14.4%	13.7%
	Services	0.8%	0.6%	0.6%	0.4%
	Security	1.1%	0.8%	1.1%	0.8%
	Agriculture, forestry, fishery	0.6%	0.5%	0.5%	0.4%
	Manufacturing process	2.2%	2.0%	2.1%	1.9%
	Transport	0.6%	0.4%	0.6%	0.4%
	Machine operation	2.3%	1.8%	2.3%	1.9%
	Construction and mining	1.8%	1.5%	2.2%	1.8%
	Carrying, cleaning, packaging	0.5%	0.3%	0.5%	0.3%

		(1) All workers		(2) Employees	
		Telework	WFH	Telework	WFH
Firm size	1	9.9%	9.2%		
	2–4	3.8%	3.4%	3.6%	3.2%
	5–9	3.2%	2.9%	3.0%	2.7%
	10–19	3.5%	3.1%	3.0%	2.7%
	20–29	3.2%	2.9%	3.1%	2.8%
	30–49	4.0%	3.8%	3.9%	3.6%
	50–99	4.9%	4.6%	4.8%	4.5%
	100–299	6.1%	5.8%	6.0%	5.7%
	300–499	7.0%	6.7%	6.9%	6.7%
	500–999	8.2%	7.9%	8.2%	7.9%
	1000 or more	13.1%	12.7%	13.0%	12.7%
	Public sector	2.6%	2.4%	2.6%	2.4%
Prefecture	Hokkaido	3.5%	3.1%	3.1%	2.8%
	Aomori	1.7%	1.4%	1.5%	1.3%
	Iwate	1.6%	1.3%	1.6%	1.3%
	Miyagi	3.9%	3.7%	3.8%	3.5%
	Akita	1.4%	1.2%	1.2%	1.0%
	Yamagata	1.8%	1.4%	1.6%	1.3%
	Fukushima	1.9%	1.7%	1.9%	1.6%
	Ibaraki	4.1%	3.7%	4.0%	3.7%
	Tochigi	3.7%	3.4%	3.7%	3.4%
	Gunma	2.3%	2.1%	2.2%	2.0%
	Saitama	8.8%	8.4%	8.7%	8.4%
	Chiba	9.7%	9.4%	9.7%	9.4%
	Tokyo	18.3%	17.8%	18.5%	18.2%
	Kanagawa	13.4%	13.0%	13.4%	13.1%
	Niigata	2.0%	1.8%	1.7%	1.6%
	Toyama	2.5%	2.2%	2.3%	2.1%
	Ishikawa	3.3%	3.0%	3.2%	2.9%
	Fukui	2.2%	1.9%	2.1%	1.8%
	Yamanashi	2.6%	2.4%	2.3%	2.1%
	Nagano	2.5%	2.2%	2.4%	2.1%
	Gifu	2.7%	2.3%	2.6%	2.2%
	Sizuoka	3.0%	2.7%	2.9%	2.6%
	Aichi	5.5%	5.2%	5.6%	5.2%
	Mie	2.7%	2.5%	2.5%	2.3%
	Shiga	3.9%	3.5%	3.7%	3.4%
	Kyoto	5.5%	5.1%	5.2%	4.9%
	Osaka	6.5%	6.1%	6.4%	6.0%
	Hyogo	5.2%	4.9%	5.0%	4.8%
	Nara	4.7%	4.4%	4.4%	4.1%
	Wakayama	1.9%	1.7%	1.7%	1.6%
	Tottori	1.6%	1.3%	1.5%	1.2%
	Shimane	1.8%	1.4%	1.5%	1.2%
	Okayama	2.4%	2.1%	2.2%	1.9%
Hiroshima	3.7%	3.3%	3.6%	3.2%	
Yamaguchi	2.1%	1.8%	1.9%	1.7%	
Tokushima	2.0%	1.7%	2.0%	1.6%	
Kagawa	2.6%	2.3%	2.4%	2.1%	
Ehime	2.3%	2.0%	1.9%	1.7%	
Kochi	1.7%	1.4%	1.5%	1.3%	
Fukuoka	4.4%	4.1%	4.2%	3.9%	
Saga	2.1%	1.8%	1.8%	1.6%	
Nagasaki	2.4%	2.1%	2.4%	2.1%	
Kumamoto	2.6%	2.4%	2.5%	2.2%	
Oita	1.7%	1.6%	1.6%	1.4%	
Miyazaki	2.2%	1.9%	2.1%	1.8%	
Kagoshima	1.8%	1.5%	1.6%	1.3%	
Okinawa	4.1%	3.7%	3.9%	3.6%	

Table A5. Individual characteristics and telework intensity

	(1)		(2)		(3)		(4)	
	All worker Telework		All worker WFH		Employee Telework		Employee WFH	
	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE
Female	0.9316	0.0057 ***	1.0329	0.0056 ***	0.6528	0.0060 ***	0.7365	0.0059 ***
15–24	-3.6230	0.0098 ***	-3.6651	0.0096 ***	-3.1137	0.0098 ***	-3.2093	0.0096 ***
25–34	-0.9135	0.0079 ***	-0.9484	0.0078 ***	-0.7690	0.0079 ***	-0.8260	0.0079 ***
45–54	-0.6966	0.0067 ***	-0.6780	0.0066 ***	-0.5180	0.0068 ***	-0.5195	0.0068 ***
55–64	-0.9720	0.0070 ***	-0.9796	0.0069 ***	-0.5537	0.0072 ***	-0.6121	0.0072 ***
65–74	-1.3980	0.0078 ***	-1.5005	0.0075 ***	-0.5295	0.0080 ***	-0.6888	0.0077 ***
75–	-1.6606	0.0121 ***	-1.8865	0.0113 ***	-0.1924	0.0160 ***	-0.7105	0.0139 ***
Elementary school or junior high school	0.7789	0.0062 ***	0.6208	0.0056 ***	0.9455	0.0069 ***	0.7596	0.0060 ***
vocational school (less than 2 years)	-0.3350	0.0073 ***	-0.3432	0.0071 ***	-0.1620	0.0078 ***	-0.1878	0.0076 ***
Vocational school (2–4 years)	0.5981	0.0075 ***	0.5424	0.0074 ***	0.6215	0.0077 ***	0.5522	0.0076 ***
Vocational school (4 years or longer)	1.7023	0.0398 ***	1.6613	0.0391 ***	1.8493	0.0403 ***	1.8265	0.0397 ***
Junior college	0.5895	0.0074 ***	0.5708	0.0072 ***	0.6648	0.0075 ***	0.6254	0.0073 ***
Technical college	3.3658	0.0262 ***	2.8723	0.0254 ***	3.3119	0.0274 ***	2.9173	0.0267 ***
University	3.4286	0.0059 ***	3.4411	0.0059 ***	3.4455	0.0062 ***	3.4660	0.0062 ***
Postgraduate (master's)	10.4621	0.0195 ***	10.6317	0.0196 ***	10.6853	0.0202 ***	10.8083	0.0203 ***
Postgraduate (professional)	5.3038	0.0970 ***	4.9273	0.0956 ***	8.2330	0.1102 ***	7.6848	0.1071 ***
Postgraduate (doctoral)	10.6348	0.0371 ***	10.3991	0.0379 ***	11.2510	0.0407 ***	10.9614	0.0416 ***
Part-time worker	-2.6804	0.0056 ***	-2.6759	0.0055 ***	-2.5543	0.0057 ***	-2.5309	0.0056 ***
Temporary worker	-2.0381	0.0088 ***	-1.9938	0.0086 ***	-1.9814	0.0089 ***	-1.9261	0.0087 ***
Dispatched employee	-1.1322	0.0186 ***	-1.2886	0.0182 ***	-0.7840	0.0186 ***	-0.9350	0.0182 ***
Contract employee	-0.6484	0.0116 ***	-0.9496	0.0113 ***	-0.6364	0.0117 ***	-0.9227	0.0113 ***
Entrusted employee	0.5382	0.0176 ***	0.4313	0.0173 ***	0.2449	0.0176 ***	0.1725	0.0173 ***
Other	0.4764	0.0172 ***	0.4952	0.0170 ***	0.3262	0.0174 ***	0.3658	0.0172 ***
Company executive	-0.0822	0.0124 ***	-0.2734	0.0122 ***				
Self-employed	0.2762	0.0144 ***	0.4178	0.0141 ***				
Family worker	-0.1583	0.0160 ***	-0.0442	0.0156 ***				
Agriculture, forestry, fisheries	-2.9224	0.0171 ***	-2.8893	0.0162 ***	-2.5012	0.0192 ***	-2.5553	0.0178 ***
Mining	-0.8338	0.0738 ***	-0.5293	0.0737 ***	-0.8401	0.0810 ***	-0.5791	0.0810 ***
Construction	-2.7860	0.0126 ***	-2.7737	0.0125 ***	-2.6644	0.0146 ***	-2.7150	0.0144 ***
Electricity, gas, water	-2.1194	0.0259 ***	-1.9904	0.0261 ***	-2.5902	0.0262 ***	-2.4880	0.0264 ***
Information and communications	29.6169	0.0236 ***	29.8165	0.0237 ***	29.2604	0.0249 ***	29.4604	0.0250 ***
Transportation	-5.9980	0.0106 ***	-6.0036	0.0104 ***	-6.2132	0.0112 ***	-6.2283	0.0111 ***
Wholesale, retail	-2.7422	0.0101 ***	-2.7357	0.0100 ***	-2.9463	0.0109 ***	-2.9524	0.0109 ***
Finance, insurance	-1.4732	0.0204 ***	-1.6259	0.0205 ***	-2.1062	0.0210 ***	-2.2252	0.0211 ***
Real estate	-3.9273	0.0168 ***	-3.9285	0.0167 ***	-4.0307	0.0194 ***	-4.1655	0.0192 ***
Professional/technical services	7.6546	0.0204 ***	7.5480	0.0205 ***	6.4257	0.0228 ***	6.4131	0.0229 ***
Accommodations, restaurants	-6.7529	0.0115 ***	-6.7956	0.0113 ***	-6.9395	0.0122 ***	-6.9959	0.0120 ***
Personal/entertainment services	-5.5362	0.0136 ***	-5.5648	0.0133 ***	-5.5687	0.0140 ***	-5.5649	0.0139 ***
Education	-7.5727	0.0139 ***	-7.6717	0.0138 ***	-8.3530	0.0140 ***	-8.4378	0.0140 ***
Healthcare, welfare	-9.0950	0.0107 ***	-9.0975	0.0106 ***	-9.2951	0.0112 ***	-9.3078	0.0112 ***
Combined services	-10.1563	0.0129 ***	-10.1429	0.0124 ***	-10.4691	0.0133 ***	-10.4434	0.0128 ***
Other services	-2.0523	0.0120 ***	-2.0884	0.0119 ***	-2.3293	0.0129 ***	-2.3813	0.0128 ***
Public services	-4.2742	0.0136 ***	-4.2341	0.0133 ***	-4.7830	0.0139 ***	-4.7338	0.0136 ***
Managerial	-1.4132	0.0182 ***	-1.6964	0.0178 ***	-2.1720	0.0278 ***	-2.3030	0.0278 ***
Professional/technical	0.6552	0.0106 ***	0.6570	0.0106 ***	0.6970	0.0109 ***	0.7277	0.0109 ***
Merchandise sales	-5.8714	0.0106 ***	-5.9384	0.0104 ***	-6.4405	0.0110 ***	-6.4740	0.0109 ***
Sales	0.3463	0.0148 ***	0.2003	0.0149 ***	0.4555	0.0156 ***	0.3141	0.0157 ***
Services	-2.1173	0.0081 ***	-2.0359	0.0080 ***	-1.7900	0.0082 ***	-1.7102	0.0080 ***
Security	-4.3009	0.0094 ***	-4.3591	0.0087 ***	-4.3899	0.0096 ***	-4.4362	0.0089 ***
Agriculture, forestry, fishery	-4.8994	0.0162 ***	-4.7960	0.0152 ***	-4.4264	0.0178 ***	-4.2975	0.0165 ***
Manufacturing process	-7.6138	0.0091 ***	-7.5873	0.0091 ***	-7.8400	0.0096 ***	-7.8272	0.0096 ***
Transport	-3.9321	0.0093 ***	-3.8766	0.0089 ***	-3.9743	0.0096 ***	-3.9123	0.0092 ***
Machine operation	-5.8663	0.0184 ***	-6.0458	0.0163 ***	-6.0070	0.0187 ***	-6.0912	0.0171 ***
Construction and mining	-5.9023	0.0121 ***	-5.9119	0.0118 ***	-5.4539	0.0139 ***	-5.4897	0.0135 ***
Carrying, cleaning, packaging	-5.9184	0.0073 ***	-5.8546	0.0071 ***	-5.8172	0.0073 ***	-5.7479	0.0071 ***
1	4.0410	0.0189 ***	3.7780	0.0187 ***				
2–4	-0.1965	0.0110 ***	-0.3167	0.0108 ***	-0.7489	0.0123 ***	-0.7610	0.0120 ***
5–9	-0.8567	0.0091 ***	-0.8659	0.0089 ***	-0.7640	0.0097 ***	-0.7633	0.0094 ***
10–19	-0.3954	0.0089 ***	-0.4569	0.0086 ***	-0.5575	0.0089 ***	-0.5694	0.0087 ***
20–29	-0.7381	0.0096 ***	-0.7241	0.0094 ***	-0.6093	0.0098 ***	-0.5823	0.0096 ***
30–49	-0.5540	0.0094 ***	-0.5268	0.0092 ***	-0.5481	0.0095 ***	-0.5272	0.0093 ***
50–99	-0.3177	0.0088 ***	-0.2918	0.0086 ***	-0.3100	0.0088 ***	-0.2726	0.0087 ***
300–499	0.1116	0.0106 ***	0.1629	0.0105 ***	0.0946	0.0107 ***	0.1468	0.0106 ***
500–999	1.0333	0.0104 ***	1.0627	0.0103 ***	1.0183	0.0105 ***	1.0515	0.0104 ***
1000 or more	4.6534	0.0082 ***	4.7108	0.0082 ***	4.6442	0.0083 ***	4.7027	0.0082 ***
Public sector	-2.4546	0.0096 ***	-2.4261	0.0093 ***	-2.1794	0.0094 ***	-2.1629	0.0091 ***
ln Tenure	-0.3127	0.0019 ***	-0.2910	0.0019 ***	-0.1129	0.0020 ***	-0.1017	0.0019 ***
ln Population density	1.5358	0.0016 ***	1.5451	0.0015 ***	1.5936	0.0016 ***	1.6065	0.0016 ***
Nobs.	60,608,406		59,921,491		51,811,170		51,287,547	
R <sup>2</sup>	0.3173		0.3258		0.3311		0.3400	

Notes: WLS estimations using extraction rate as weights. \*\*\*: p<0.01. The reference categories

were male, age 35–44, high school graduate, standard employee, manufacturing industry, clerical occupation, firm size 100–299. The telework intensity for those who do not implement teleworking is treated as zero.