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# Online productivity and types of assignments in a Japanese workplace

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## Abstract

With the advance of the COVID-19 pandemic, many companies in the world have embraced telework. Despite the large volume of related studies, only few of them have addressed telework in relation to types of assignments and employment. In this context, we pose an open question of how productivity in an online environment depends on formats of work, remuneration systems and socioeconomic factors in comparison to a face-to-face environment. We collect the data of 500 Japanese employees through the stratified questionnaire survey, empirically examining and characterizing the perceived telework productivity for carrying out simple and creative tasks in individual and group formats as compared with face-to-face productivity. The three main findings are obtained. First, online productivity tends to be noticeably low for group format as compared to individual format, especially when carrying out creative tasks. Second, we find that managerial affiliation and sleeping hours tend to translate into, respectively, low group productivity and low individual productivity for both simple and creative tasks. Third, our study demonstrates that online productivity is unconditionally exacerbated under a seniority-based system as compared to a performance-based system. Overall, our findings reveal the difficulties faced by employees when performing group tasks remotely, pointing at the importance of professional incentives for increasing collective productivity of telework. The caveats we identified can thereby help companies to improve their transition from a face-to-face to an online environment.

**Key Words:** Human resource management; Employee attitudes; Organizational culture; Institutions

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## Nomenclature

CGP Creative group productivity

CIP Creative individual productivity

ICT Information and Communications Technology

OECD Organisation for Economic Co-operation and Development

R&D Research and development

SGP Simple group productivity

SIP Simple individual productivity

SME Small and medium-sized enterprises

WFH Work from home

# 1 Introduction

Against the background of the ongoing COVID-19 pandemic, our everyday lifestyles as well as working conditions have undergone noticeable changes. Initially, the transition from a face-to-face to an online environment has been dictated by a need of social distancing and was mostly perceived as a temporary concession. However, as entire sectors of economy have started to embrace teleworking in the long run, management, employees as well as environmental advocates and other stakeholders have realized the benefits associated with this format. The most obvious ones include colossal spared cost of transportation and office rent, better opportunities to spend time with family as well as enhanced autonomy and flexibility regarding a workplace routine. At the same time, switching to telework entails fundamental modifications of corporate practices.

Whereas for the relatively more digitalized sectors it has only been natural to widen the scope of remote activities, for other sectors (especially certain services and manufacturing) such transition is problematic if not impossible (Dingel and Neiman, 2020, Etheridge et al., 2020). Other associated problems include (i) lack of proper employee monitoring (Greer and Payne, 2014), (ii) inability to draw lines between assigned duties and private life when working from home (Golden et al., 2006), (iii) unrealized collaboration possibilities, and (iv) security concerns over data transmission (Ruth and Chaudhry, 2008). All in all, under the normal circumstances, management remains skeptical regarding the potential of telework-associated benefits to outweigh accompanying costs. Taking into account the variety of challenges as well as opportunities that telework-transition entails for companies (Allen et al., 2015), our paper analyzes employees' perception of telework as compared to a face-to-face working format.

Meta-analysis by Harker Martin and MacDonnell (2012) who covered 19 scholarly articles yields an overall support to the assumption about the positive organizational outcomes (such as productivity, retention, commitment, and performance) that telework embodies. Golden (2006), Mahler (2012) and Caillier (2013) report that on top of, and, partially, as a result of the increased job satisfaction, limited teleworking hours are associated with higher labor productivity. Those who are allowed to telework also display higher levels of organizational commitment (Golden et al., 2006, Caillier, 2013), while

28 those unable to telework have lower motivation and productivity (Mahler, 2012). The positive effect  
29 of the transition is magnified for those who used to spend long hours commuting to their workplaces  
30 (Lister and Harnish, 2019).<sup>1</sup> Management plays a key role in the extent and quality of telework  
31 adoption. Zhou et al. (2008), who analyze the impact of organizational changes on the perceived  
32 employee creativity in Korea, find out that better creative outcomes depend on corporate willingness to  
33 provide support and training for employees. Oldham and Cummings (1996), Harrington and Ruppel  
34 (1999), Zhang et al. (2011) and Solís (2017) argue that supportive supervision enhances telework  
35 productivity, while the opposite holds true for the controlling management style.

36 Despite longer working hours associated with carrying out job-related tasks remotely, 76 % of  
37 the U.K. employees report improved work effectiveness, which is mostly attributed to the absence of  
38 office distractions (Baruch, 2000). Under proper ICT-maintenance, telework does not hinder inter-  
39 employee communication, provided that evaluation criteria and performance benchmarks are clearly  
40 defined (Bailey and Kurland, 2002, Illegems and Verbeke, 2004, Bosua et al., 2013). The above  
41 findings hold true in various institutional settings, for example in Japan (Maruyama et al., 2009,  
42 Kazekami, 2020, Okubo et al., 2021). Importantly, however, under the situation of the COVID-19  
43 pandemic, certain employees have been conducting their work in a solely online environment over a  
44 long period of time. While the introduction of telework could be viewed as beneficial for their work-  
45 life balance during the initial stage, the situation is likely to have deteriorated subsequently due to the  
46 following factors.

47 First, proximity to a family as a result of working from home could have degraded from the  
48 primary productivity boost to routine, leading to the blurring of demarcation lines between job re-  
49 sponsibilities and domestic chores (Baruch, 2000, Golden et al., 2006). Second, whereas occasional  
50 teleworking can ease the burden of formal office communication, an entirely online environment with  
51 unclear time horizons may lead to a psychological isolation, deepening of trust-related issues between  
52 employees and management as well as among employees, and, finally, to a perceived loss of loyalty  
53 towards a company (Gajendran and Harrison, 2007, Pyöriä, 2011, Galanti et al., 2021). As for Japan,

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<sup>1</sup>There is also a well-documented evidence of environmental benefits associated with the transition from an office to an online working environment (Shabanpour et al., 2018).

54 face-to-face interaction plays a crucial role in the local corporate context (Amano et al., 2021) that  
55 allocates plenty of time to socializing practices ranging from morning aerobics to after-work drink-  
56 ing parties. By providing “social therapy,” these measures serve as a psychological counterweight  
57 to the highly-accountable and controlling shop-floor environment. Workers habitually placed into  
58 such contrasting conditions may easily experience boredom and insufficient motivation upon finding  
59 themselves in an isolated casual atmosphere over a long period of time. In a nutshell, local corpo-  
60 rate culture is one of the reasons why Japan has been the most reluctant OECD-member to introduce  
61 telework (Okubo, 2020, Morikawa, 2022).

62 In this paper, we inquire about the main factors affecting productivity and job satisfaction in  
63 an online environment as compared to a face-to-face environment. While the existing scholarship  
64 pays attention to this problem in general, few studies distinguish between types of assignments as  
65 well as work formats. To this end, we test the following hypotheses by analyzing the results of a  
66 stratified survey consisting of 500 employees: (1) perceived telework productivity tends to be higher  
67 for *individual* as compared to *collective* tasks, (2) perceived telework productivity tends to be higher  
68 for *simple* as compared to *creative* tasks, (3) managers and recipients of “seniority-merit” wages have  
69 higher likelihood than, respectively, ordinary employees and recipients of “performance-based” wages  
70 to experience dissatisfaction and lower productivity resulting from the transition to telework. First,  
71 we investigate performance and work-satisfaction heterogeneity across four domains encapsulated  
72 by “individual-collective” and “simple-creative” dimensions. After identifying dimension-specific  
73 strengths and weaknesses, we perform the statistical analysis to estimate the factors associated with  
74 these subjective evaluations. We conclude with the implications of the obtained results for corporate  
75 stakeholders.

## 76 **2 Working environment and productivity**

77 Most of the existing literature concentrates on the individual dimension of creativity, with the  
78 group work receiving far less attention. Group context is often considered as a hindrance to re-  
79 sourcefulness because of its tendency to swing between the poles of either being either a harbinger

80 of conflicts or a social coercive mechanism. Goncalo and Staw (2006) and Hoegl and Parboteeah  
81 (2007) claim that group cohesion and conformity run against creative pursuits due to their tendency  
82 to stipulate routinization and to impede divergent thinking. In this context, Nemeth et al. (2004) and  
83 Zhou et al. (2008) observe a positive correlation between minor in-group dissent and creativity, pro-  
84 vided the existence of institutional support from management and fellow employees. On the other  
85 hand, Baer (1998) points out the benefits of group solidarity, arguing that rather than being divergent,  
86 creative skills require task-specific proficiency that is best attained through collective efforts. Fur-  
87 thermore, Paulus et al. (2001) mention synergies arising from collective collaborations that include  
88 mutual moral support and inspiration. According to these authors, a group as a whole exceeds the  
89 sum of its encompassing individuals.

90 The latter observation holds true for the Japanese corporate environment, as argued by Nonaka  
91 and Konno (1998) who re-introduced the concept “*ba*” (originating from the Japanese philosopher  
92 Nishida Kitarō) to describe an empowering environment that transcends individual boundaries. In  
93 more concrete terms, a Japanese company is known for its capacity to utilize *tacit* knowledge. As  
94 opposed to the explicit, i.e. pre-existing type of information, tacit dimension draws its source from  
95 inter-subjective intuitions and alliances. Differently from a stylized Western company where informa-  
96 tion has an objective value that overarches firm-specific configurations, Japanese firm is viewed as an  
97 organism, whereby ideas do not exist separately from their mediums. Here, employees can be viewed  
98 as nodes of an expanding network. Having been nurtured in this way, some corporate strategies are not  
99 expressible as a codified system of knowledge ready to be applied in any environment. On contrary,  
100 being unique to a specific habitat, they develop through in-house reproduction.

101 “Collective” dimension of Japan’s corporations is encapsulated by well-established R&D depart-  
102 ments, low employment turnover rates, on-the-job training and job-rotation systems (Kleinknecht  
103 et al., 2014). As a result of the telework introduction, however, the strong inter-subjective element  
104 embodied in these institutions has been substantially weakened. Morikawa (2022) estimates that in  
105 Japan, work from home (WFH) is associated with 30-40% productivity decrease compared to an  
106 office format. Among the main reasons are the lack of prior technological training coupled with in-  
107 sufficient ICT implementation (Okubo, 2020, Umishio et al., 2022). Khalifa and Davison (2000),

108 Overmyer (2011) and Allen et al. (2015) acknowledge that communication quality and knowledge  
109 transfer are among the main challenges for a successful telework transition. Since, by definition,  
110 communication and knowledge sharing are at the heart of collective tasks, we assume the following:

111 **Hypothesis 1** *The perceived telework productivity is higher for individual tasks than for collective*  
112 *tasks.*

113 The existing evidence on productivity differences between office and online environments for sim-  
114 ple and creative tasks appears to be rather contradictory. Based on the laboratory experiment, Dutcher  
115 (2012) finds that while face-to-face environment is beneficial for routine tasks, telework is associated  
116 with higher creative productivity.<sup>2</sup> Using the sample of 156 Spanish companies, Martínez-Sánchez  
117 et al. (2007) establish that companies with larger proportions of teleworkers are more innovative.  
118 Umishio et al. (2022), who conducted their empirical study in Japan, also find the evidence that an  
119 online environment is suitable for carrying out creative tasks.

120 On the other hand, Vega et al. (2015) argue that while online environment is supportive to an  
121 overall creativity enhancement, this is not the case for the self-rated creative performance.<sup>3</sup> The results  
122 of Mercier et al. (2021) also run against the “telework-creativity” assumption, revealing that higher  
123 creativity during the lockdown period has been an attribute of a face-to-face — not an online working  
124 environment. Pointing at the importance of spontaneous office communication for the generation of  
125 new ideas, Bosua et al. (2013) conclude that hybrid forms of employment appear to be optimal in  
126 terms of achieving the balance between job satisfaction and creative skills’ development. One of the  
127 pioneering studies on telecommuting conducted by DuBrin (1991) concludes that telework is better  
128 geared for structured and repetitive than for creative tasks.

129 **Hypothesis 2** *The perceived telework productivity is higher for simple than for creative tasks.*

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<sup>2</sup>The author implemented experimental design not least because of the fact that, until recently, employees were en-  
dogenously assigned to telecommute based on their credibility and superior performance. In contrast, the COVID-19  
pandemic has prompted non-discriminatory telework transition, enabling researchers to capture differences in productiv-  
ity as compared to office format.

<sup>3</sup>We choose to focus on self-rated performance which, while being frequently used in literature, is sometimes consid-  
ered to be inflated (Allen et al., 2015).



130 The ease with which telework can be introduced depends on a degree of industrial digitalization.  
131 On one end of the spectrum, those involved in factory operations and many service sector employees  
132 cannot conduct their duties remotely by definition (Dingel and Neiman, 2020, Okubo, 2020). On the  
133 other end, employees that extensively deploy ICT capabilities can easily adapt to an online environ-  
134 ment. On top of these predictable industrial responses to an introduction of telework, variation exists  
135 between different employee groups inside an organization. In Japan, these discrepancies are primar-  
136 ily related to employment status and remuneration system. Since only 13.6% of our respondents are  
137 non-regular employees<sup>4</sup>, we choose to concentrate on salary arrangements.

138 Traditional seniority-merit wage system called “*nenkō jōretsu*,” where salary is a function of age,  
139 characterizes privileged regular employees. While this system is being gradually substituted for the  
140 performance-based pay called “*seika shugi*,” many large companies still adhere to it as means of  
141 retaining and rewarding committed employees in the long run. Following evidence exists regarding  
142 the perception of telework depending on age. According to Maruyama et al. (2009) who focus on  
143 Japan, the most positive feedback comes from the cohort of “55+,” which can be explained by its  
144 members’ (i) higher status in organizations, (ii) higher perceived stress when working from office due  
145 to longer commuting hours and (iii) higher willingness to spend time with family members. Having  
146 already reached the maturity age for reaping full benefits of the seniority-merit wage system, many of  
147 these employees view telework as a prelude to retirement.

148 These remuneration systems partially reflect the commonly-known dichotomy between *pay-for-*  
149 *performance* and *fixed-salary* types of compensation (Lazear, 2000, Eriksson and Villeval, 2008).  
150 There are, however, notable differences. First, for Japan, seniority-merit system (fixed-salary ana-  
151 logue) comes with employment security, while also entailing long-term incentives embedded in wage  
152 hikes. Second, whereas fixed salary is normally characterized by lower monitoring costs (Lazear,  
153 2000), *nenkō jōretsu* requires close communication between management and employees. All in  
154 all, while seniority-merit wages are the most prestigious in Japan, for the U.S. and Europe it is  
155 performance-based payment that provides stronger financial incentives for more ambitious employees

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<sup>4</sup>According to Kikuchi et al. (2021) whose study is based on the Japanese sample, non-regular employees have experienced far more serious deprivations (such as income loss and job loss) than regular employees.

156 (Cadsby et al., 2017). Another dimension of intra-corporate heterogeneity is related to the differences  
157 between management and employees. According to the available scholarship, communication issues  
158 in an online format are further exacerbated for managers who experience difficulties in monitoring  
159 their subordinates remotely (Illegems and Verbeke, 2004, Mahler, 2012). Due to the lack of special-  
160 ized training in online supervision, managerial staff often voices skepticism and dissatisfaction with  
161 the telework format (Greer and Payne, 2014).

162 **Hypothesis 3** *Managers and recipients of “seniority-merit” wages are less productive in an online*  
163 *environment than, respectively, ordinary employees and recipients of “performance-based” wages.*

### 164 **3 Statistical analysis**

165 Our data-set encompasses 500 subjects (200 of whom are females) sourced from the registered  
166 participant pool of a web-based questionnaire survey conducted by the research organization Cross  
167 Marketing Inc. in Japan. The sample size is partly determined by the budget and time constraints  
168 we face. Half of the respondents are employed by small/medium enterprises (SMEs) of “300~1000”  
169 workers, while another half is equally divided between firms of “1000~4999” and “5000 or more”  
170 workers. The data was collected from 40 (out of 47) Japanese prefectures, whereby the share of  
171 respondents from each municipal unit approximately corresponds to the real population distribution.

172 [Table 1 about here.]

173 The summary statistics are included in table 1. Most of the variables are ordered factors, taking  
174 the integer value between “1” (negative extreme) and “5” (positive extreme). This corresponds to the  
175 5-point Likert scale of the questions related to subjective perceptions of online working environment.  
176 The numeric variables are: “Age,” “Working hours pre Corona,” “Sleep before Corona” and “Com-  
177 muting time.” Respondents’ age distribution is displayed in figure 1. According to it, the mode value  
178 is 61 years old and the median value is 50.5 years old. This picture resembles the real working pop-  
179 ulation tendencies, whereby, as of 2020, the age category of “45-54” years old was the most widely  
180 represented, accounting for 16.26 % of Japan’s population.

181 [Figure 1 about here.]

182 The correlation coefficients between analyzed variables are included in table 2. Among others, it  
183 shows high correlation ( $r = 0.7$ ) between overall online- and simple individual online-productivity.  
184 As expected, comfort of online environment is highly correlated ( $r = 0.67$ ) with the willingness  
185 to continue telework in the aftermath of the pandemic. Granting significantly positive relationship  
186 between various subjective displays of telework-perception, we do not include them in the same re-  
187 gression models to avoid multicollinearity problem. Next, we analyze the differences in perceptions  
188 of telework between ordinary employees and managerial staff according to gender. As table 3 shows,  
189 our sample is distributed between employee categories in a following way. 44 % of male subjects are  
190 ordinary employees, while 56 % hold managerial positions. The respective distribution for females  
191 is 78 % vs. 22 %. This inter-gender discrepancy partially reflects the real population phenomenon,  
192 whereby the relatively small share of women occupy advanced corporate positions.

193 [Table 2 about here.]

194 [Table 3 about here.]

195 [Figure 2 about here.]

196 According to the results of the exploratory analysis, general perception of the telework environ-  
197 ment can be described as follows. First, as figure 1(a) demonstrates, both men and women clearly  
198 find it comfortable to work remotely. In fact, 17 % of women and 12.7 % of men are “completely  
199 satisfied” with the telework arrangements. Additionally, 27.5 % of women and 34.3 % of men express  
200 their overall approval of this format. While the respective distribution among regular employees re-  
201 sembles the general tendency, the perception of comfort in an online environment is slightly stronger  
202 than average among managers. Second, in agreement with the previous finding, figure 1(b) shows  
203 that an overwhelming majority of the respondents would like to continue working remotely even after  
204 the relaxation of COVID-19 restrictions. This readiness is particularly high among females, 34 % of  
205 whom feel “absolutely positive” about continued telework. The respective figure of 24.7 % for males  
206 can also be viewed as high. Moreover, additional 24.5 % of females and 31.3 % of males express their

207 general willingness to keep the telework arrangement going. Very similar tendencies are observed  
208 when disaggregating the sample into regular and managerial ranks.

209 [Figure 3 about here.]

210 In the context of the overall-positive assessment of remote work, it is interesting that subjective  
211 perception of labor productivity is rather mixed, as figure 1(c) shows. In case of women, it can be  
212 described as “ambivalent,” with 27 % of female respondents holding an opinion that productivity in an  
213 online environment has decreased, and 30.5 % expressing the opposite positive view. Regarding men,  
214 the perception is more negative, with 30.6 % of male respondents being critical regarding the telework  
215 productivity, and only 20.6 % seeing this aspect in a bright light. The patterns of perceived telework  
216 productivity among ordinary employees are similar to those observed on a general level according  
217 to figure 1(c). As for the managers, while opinions among males resemble the overall average, fe-  
218 male attitudes are relatively more critical, manifesting themselves in lower share of “optimists” and  
219 higher share of “pessimists.” Next, when disaggregating performance in an online environment into  
220 individual and collective, the perceptions appear highly critical. All in all, it can be said that remote  
221 work is responsible for the clear decrease in productivity across all the presented domains as seen  
222 from figure 3. Following aspects are the most notable when disaggregating this picture: (i) group pro-  
223 ductivity has much lower self-assessment scores than individual productivity; (ii) creative tasks yield  
224 lower self-rated productivity levels than simple tasks. This difference is more apparent for collec-  
225 tive than for individual setting. In order to understand what drives subjective perceptions of different  
226 assignments depicted on figure 3, we run separate regressions and present their results below.

227 1. The **individual productivity** has been perceived in a following way:

228 (a) Critical assessment of the *simple individual productivity* (SIP) in an online format ap-  
229 pears to be strongly and significantly associated with the remuneration type as table 4  
230 demonstrates. Namely, employees under the “seniority-merit” wage system experience  
231 consistently lower levels of telework-productivity both with and without controlling for  
232 other variables. Compared to the “performance-based” wage system, workers belonging

233 to the discussed group show on average 0.24 points (of the 5-point Likert scale) less self-  
234 attributed online-SIP. In addition, employees that experienced sleep deprivation prior to  
235 the pandemic, display consistently higher levels of online-SIP across all models. Finally,  
236 higher educational degree is associated with the moderate increase of online-SIP in two  
237 out of three models included in table 4.

238 [Table 4 about here.]

239 (b) Regarding the *creative individual productivity* (CIP), table 5 demonstrates several aspects  
240 resembling the SIP tendencies. Namely, seniority-merit wage system and sleeping hours  
241 are negatively associated with online productivity in this setting. While the “seniority-  
242 wage” coefficients are slightly lower for CIP than for SIP, the opposite holds true for  
243 sleeping hours. In addition to this, one-point increase in life satisfaction is associated with  
244 0.06 point increase in the online-CIP.

245 [Table 5 about here.]

246 2. The **group productivity** has been perceived in a following way:

247 (a) As for the *simple group productivity* (SGP), table 6 shows the following. Similarly to  
248 individual simple and creative jobs, SGP is negatively affected by seniority-merit wage  
249 system. On top of that, managers tend to be 0.17 points less productive than ordinary  
250 employees when holding other variables constant, as shown in the Model 3. Finally, when  
251 holding some of the variables constant (Model 2), married respondents appear to be 0.16  
252 points less productive than singles when carrying out simple group tasks online.

253 [Table 6 about here.]

254 (b) *Creative group productivity* (CGP) is associated with the similar factors as SGP. Namely,  
255 table 7 demonstrates that compared to recipients of performance-based wages, those under  
256 seniority-merit remuneration system have consistently lower online-CGP with and without  
257 controlling for other factors. Furthermore, managers display 0.14 points lower online-  
258 CGP than ordinary employees.

259 [Table 7 about here.]

260 Table 8 provides insights into the factors associated with the overall willingness among the re-  
261 spondents to continue teleworking regardless of the pandemic-related measures. Here, we observe  
262 the important role of *education*, *age* and pre-pandemic *sleeping hours*. An additional educational  
263 degree is associated with a 0.09 points increase in the willingness to keep teleworking. The respective  
264 increase constitutes 0.19 points for belonging to a one-level-higher income bracket. Finally, one hour  
265 of sleep deprivation before the pandemic is associated with 0.15 point increase in the telework-related  
266 enthusiasm. Among other significant findings is the higher readiness to continue telework for females  
267 and younger people.

268 [Table 8 about here.]

269 Based on the discussed results, our findings reveal that self-reported telework productivity is  
270 higher for individual than for collective tasks, in accordance with the Hypothesis 1. This holds true  
271 both for routine and creative assignments, pointing at the fact that while online environment can  
272 be conducive for the execution of individual tasks, collective duties mostly require face-to-face in-  
273 teraction. Since telework is frequently associated with deterioration of both vertical and horizontal  
274 communication, this naturally leads to difficulties for performing group tasks. This is all the more  
275 relevant for the Japanese corporate context, where inter-subjective cooperation at the shop-floor level  
276 has been one of the main prerequisites for nurturing idiosyncratic comparative advantages. Looking  
277 at another corporate dichotomy, employees appear to be more productive when carrying out simple  
278 as compared to creative tasks, confirming the Hypothesis 2. While respondents tend to have an am-  
279 bivalent assessment of their creative performance for individual tasks, the evaluation becomes highly  
280 critical in case of a group format. In other words, group creativity tends to drastically drop in an  
281 online- as compared to a face-to-face environment.

282 Among the factors negatively impacting online productivity, *seniority-merit* wage system is con-  
283 sistent significant across all domains analyzed, as stated in the Hypothesis 3. Shaw and Gupta  
284 (2007) note that this type of remuneration comes at a cost of highly productive employees: rather  
285 than aiming at their best performance, recipients of seniority-merit wages are merely interested in

286 maintaining their employment stability. However, differently from the classical “fixed salary” sys-  
287 tem, free-riding behavior has been historically mitigated within large Japanese corporations thanks  
288 to a collectivist mode of production. Yet, due to the decreased intensity and quality of interactions  
289 between employees in an online environment, productivity of this secured employee cohort has natu-  
290 rally dropped — both in the absolute terms and vis-à-vis the recipients of “performance-based wages.”  
291 Another cohort that has experienced substantial drop in productivity are managers. At the same time,  
292 the negative effect of managerial affiliation is only present in the group format, partially confirming  
293 the Hypothesis 3. This finding points at difficulties associated with monitoring employees in an online  
294 environment and the resulting burden experienced by managers.

295 In addition to answering the hypotheses, we obtained the following findings. Transition to an  
296 online working environment has been welcomed by most of the employees, translating into higher  
297 rates of job satisfaction and higher willingness to keep teleworking even upon being granted an op-  
298 tion of returning to office. Several factors appear significant in this regard. First (i), the desire to keep  
299 working remotely is consistently more pronounced among females, which can be explained by their  
300 higher involvement into domestic chores and childcare. In addition, various face-to-face corporate  
301 practices originally geared towards males make telework more employee-friendly from an average  
302 female standpoint. Second (ii), respondents with higher educational degrees appear to be more satis-  
303 fied with an online working format. This might be due to the fact that better-educated workers tend  
304 to have stronger self-discipline, which is critical under the situation of supervisors’ physical absence.  
305 Third (iii), in agreement with Morikawa (2022), more positive perception of telework is observed  
306 among employees with higher income-levels. Wealthy respondents are likely to be permanent regular  
307 workers protected from possible layoffs who would be more interested in maintaining employment  
308 stability than in pursuing ambitious career goals. Finally, workers who had fewer sleeping hours prior  
309 to the pandemic show higher levels of telework-satisfaction and productivity. This indicates the in-  
310 creased average amount of sleep for those working remotely, which, along with other physical and  
311 psychological improvements, leads to higher job satisfaction (Lister and Harnish, 2019). Granting  
312 the legacy of long working hours (including partially unpaid overtime work) at Japanese enterprises  
313 (Mizunoya, 2002), transition to an online environment means partial alleviation of this burden, en-

314 abling employees to skip numerous customary duties, often leading to higher workplace satisfaction.

## 315 **4 Conclusion**

316 Our paper shows that collective productivity in an online environment has significantly decreased  
317 as compared to a face-to-face format, especially when carrying out creative tasks. Despite feeling  
318 overall positive about online working format, respondents are critical in self-assessing their telework-  
319 performance. Among the factors associated with the decreased productivity in an online environment  
320 the most prominent ones are seniority-based wages and managerial affiliation. At the same time, tele-  
321 working becomes more productive with the increase of sleeping hours. On one hand, it is clear that  
322 individually-gearred telework format is less suitable for group operations that are extremely important  
323 for Japanese firms. On the other hand, transition to an online format entails multiple opportunities  
324 for the local companies. Telework can naturally alleviate environmental problems and drastically  
325 decrease commuting costs, providing much-needed flexibility in finding optimal work-life balance,  
326 including a better childcare environment. Thereby, online format can prove instrumental in tack-  
327 ling the prolonged demographic crisis and, by extension, lifting the burden of expanding social cost  
328 incurred by working population as the share of elderly people in Japan is growing.

329 Although we believe that our paper presents important results, it nevertheless has following lim-  
330 itations. Subjective self-assessment of online productivity that we use in our study would be more  
331 credible, had it been combined with evaluation from corporate superiors. Furthermore, as our paper  
332 identified the problem of carrying out collective tasks in an online environment, it would be logi-  
333 cal to include the variables related to horizontal and vertical communication quality. In addition,  
334 while showing format- and task-specific responses to telework, our paper does not touch upon inter-  
335 corporate heterogeneity encapsulated by industrial patterns as well as the degree of digitalization.  
336 One possible research avenue is therefore to test the claim of Greer and Payne (2014) and Yoshino  
337 and Hendriyetty (2020) who suggest that advance implementation of digital technologies fosters the  
338 reconstruction of habitual shop-floor operations for those working remotely. Finally, our paper would  
339 benefit from expanding the analysis to other institutional contexts beyond Japan, allowing us, among



340 others, to test wider implications of fixed salaries for workers' motivation in an online environment.

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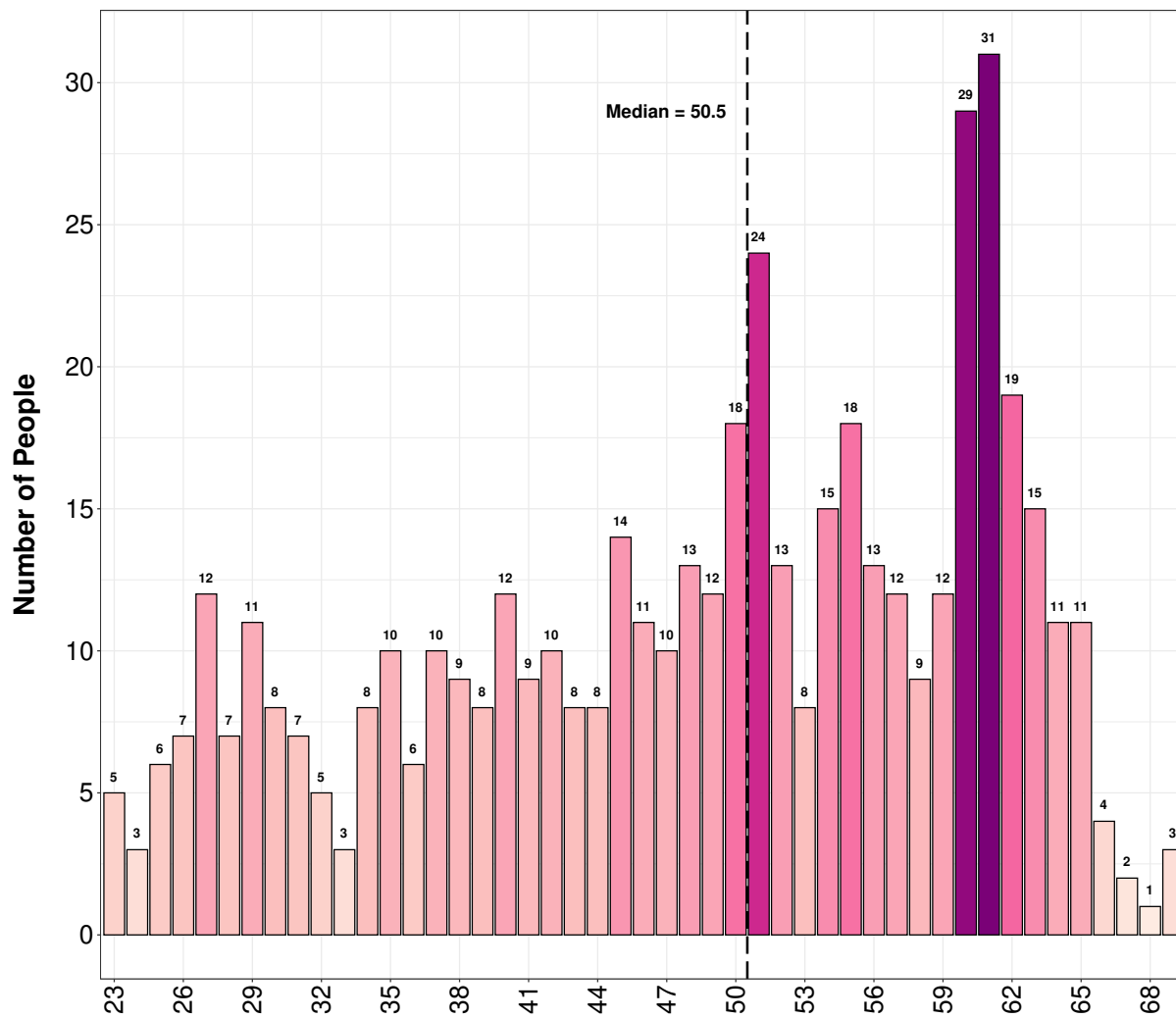
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Figure 1: Age distribution



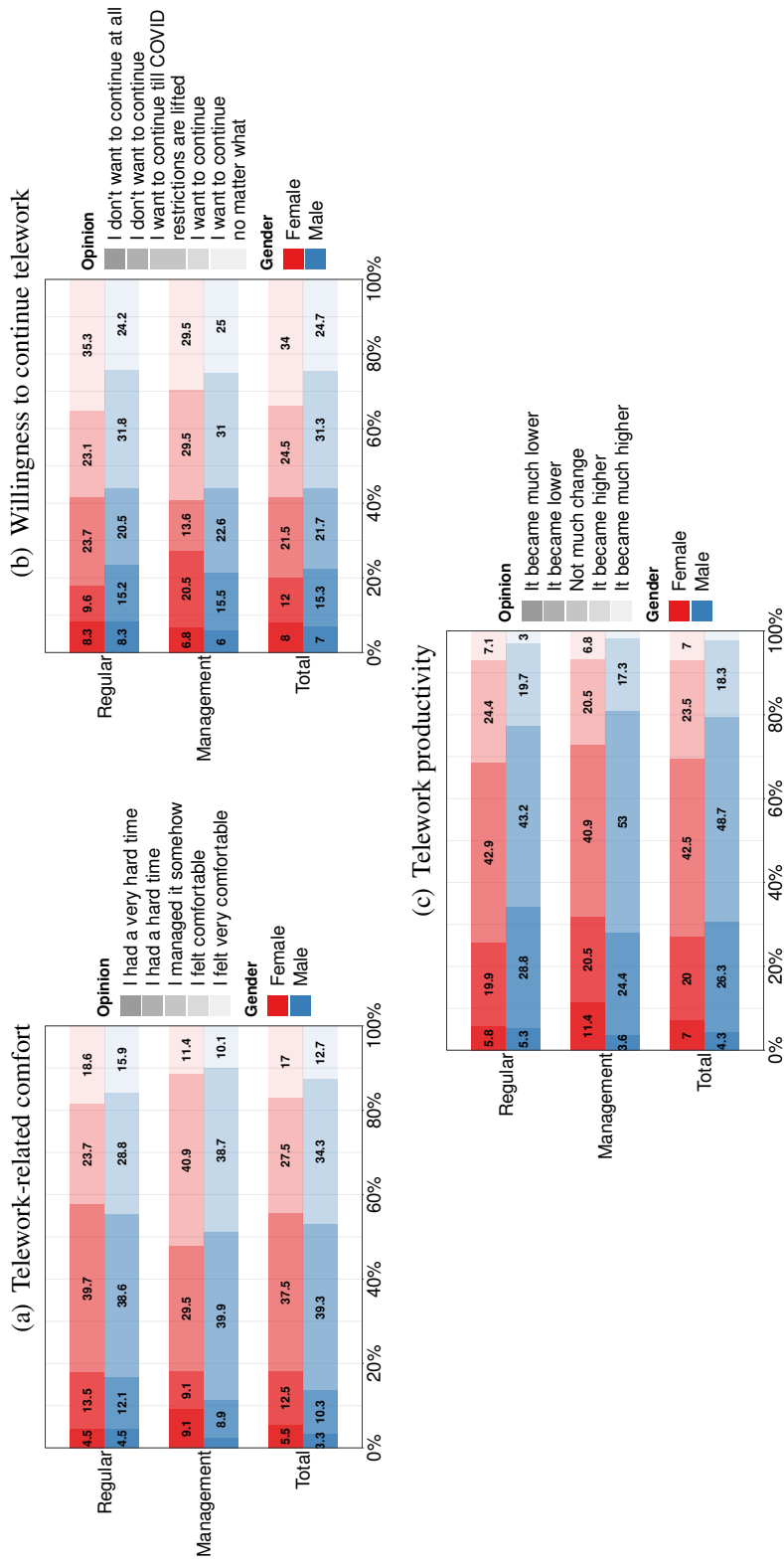
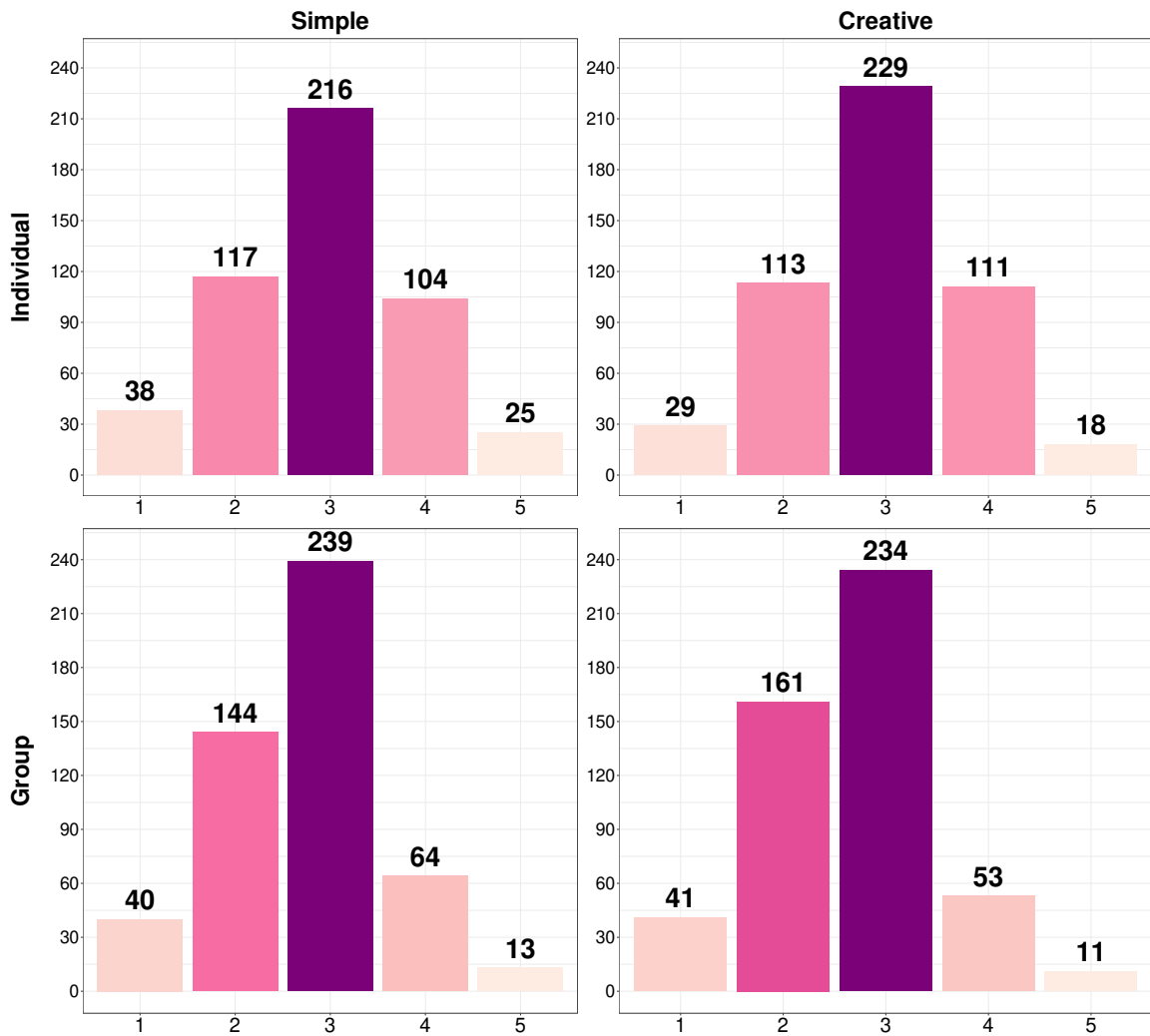


Figure 2: Subjective perceptions of telework



Figure 3: Online productivity: variations across main domains



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Table 1: Descriptive statistics

	N	Mean	Median	Min	Max	St. Dev.
Age	500	48.462	50.5	23	69	11.965
Firm size	500	2.546	2.5	1	4	1.076
Commuting time	500	1.188	1	0	20	1.738
Education	500	6.566	7	2	8	1.364
Income	500	4.148	4	1	6	1.090
Working hours	500	8.495	8	2	20	1.400
Sleeping hours	500	6.138	6	1	8	1.104
Life satisfaction	500	4.014	4	1	7	1.446
SPP	500	2.922	3	1	5	0.970
CPP	500	2.952	3	1	5	0.907
SGP	500	2.732	3	1	5	0.877
CGP	500	2.664	3	1	5	0.856
Productivity	500	2.942	3	1	5	0.908
Telework comfort	500	3.408	3	1	5	1.004
Telework continuation	500	3.566	4	1	5	1.241

Table 2: Pearson correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age														
2. FirmSize	0.02													
3. Commuting	-0.03	-0.05												
4. Education	-0.10*	-0.02	-0.14**											
5. Income	0.18***	0.09*	-0.05	0.23***										
6. WorkHours	-0.19***	0.02	0.01	0.19***	0.21***									
7. SleepHours	-0.11*	-0.03	-0.07	0.07	0.01	-0.17***								
8. LifeSatis	0.07	0.01	-0.01	0.00	0.10*	-0.08	0.08							
9. SPP	-0.07	-0.06	0.01	0.04	0.00	0.00	-0.09*	0.02						
10. CPP	-0.03	0.00	-0.02	0.04	0.00	0.04	-0.10*	0.06	0.50***					
11. SGP	-0.08	0.06	0.00	0.02	0.03	0.00	0.00	-0.07	0.35***	0.28***				
12. CGP	-0.03	0.04	0.00	0.00	-0.03	0.00	-0.07	-0.04	0.36***	0.46***	0.48***			
13. Productivity	-0.10*	-0.05	-0.04	0.04	0.02	0.02	-0.06	0.08	0.70***	0.51***	0.49***	0.50***		
14. TeleComfort	-0.07	0.03	-0.06	0.04	0.13**	0.04	-0.05	0.16***	0.52***	0.38***	0.29***	0.29***	0.53***	
15. TeleContinue	-0.17***	0.07	-0.06	0.12**	0.12**	0.12**	-0.11*	0.01	0.49***	0.37***	0.26***	0.28***	0.53***	0.67***

\*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; \*  $p < 0.05$

Table 3: Employment ranks by gender

	<b>Overall</b> ( $N = 500$ )	<b>Males</b> ( $N = 300$ )	<b>Females</b> ( $N = 200$ )
Regular	288 (58%)	132 (44%)	156 (78%)
Management	212 (42%)	168 (56%)	44 (22%)

Table 4: Simple Individual Productivity

	Model 1	Model 2	Model 3
Wage system ( <i>base group</i> = “ <i>Performace-based</i> ”)			
<i>Seniority-based</i>	−0.23** (0.09)	−0.23*** (0.09)	−0.26*** (0.09)
<i>Other</i>	−0.19 (0.19)	−0.20 (0.19)	−0.15 (0.20)
Gender ( <i>base group</i> = “ <i>Male</i> ”)	0.18** (0.09)	0.15 (0.10)	0.15 (0.10)
Sleep before Corona	−0.07* (0.04)	−0.07* (0.04)	−0.08** (0.04)
Education	0.06* (0.03)	0.06* (0.03)	0.05 (0.03)
Employment rank ( <i>base group</i> = “ <i>Managerial</i> ”)			
<i>Regular</i>		0.07 (0.09)	0.08 (0.10)
Marital status ( <i>base group</i> = “ <i>Single</i> ”)			
<i>Married</i>		−0.05 (0.09)	−0.03 (0.10)
Life satisfaction			0.03 (0.03)
Age			−0.01 (0.00)
Income before Corona			0.03 (0.05)
Commuting time			0.01 (0.03)
<i>Intercept</i>	3.04*** (0.33)	3.04*** (0.34)	3.18*** (0.48)
R <sup>2</sup>	0.03	0.03	0.04
Adj. R <sup>2</sup>	0.02	0.02	0.02
Num. obs.	500.00	500.00	500.00

\*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$

Table 5: Creative Individual Productivity

	Model 1	Model 2	Model 3
Wage system ( <i>base group</i> = “ <i>Performace-based</i> ”)			
<i>Seniority-based</i>	−0.20** (0.08)	−0.20** (0.08)	−0.23*** (0.09)
<i>Other</i>	−0.12 (0.18)	−0.13 (0.18)	−0.10 (0.18)
Gender ( <i>base group</i> = “ <i>Male</i> ”)	0.04 (0.09)	0.01 (0.09)	−0.01 (0.09)
Sleep before Corona	−0.08** (0.04)	−0.08** (0.04)	−0.09** (0.04)
Education	0.04 (0.03)	0.04 (0.03)	0.04 (0.03)
Employment rank ( <i>base group</i> = “ <i>Managerial</i> ”)			
<i>Regular</i>		0.01 (0.09)	0.01 (0.10)
Marital status ( <i>base group</i> = “ <i>Single</i> ”)			
<i>Married</i>		−0.11 (0.09)	−0.12 (0.09)
Life Satisfaction			0.06** (0.03)
Age			−0.00 (0.00)
Income before Corona			−0.00 (0.04)
Commuting time			−0.01 (0.02)
<i>Intercept</i>	3.25*** (0.31)	3.31*** (0.32)	3.35*** (0.45)
R <sup>2</sup>	0.02	0.03	0.04
Adj. R <sup>2</sup>	0.01	0.01	0.02
Num. obs.	500.00	500.00	500.00

\*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$

Table 6: Simple Group Productivity

	Model 1	Model 2	Model 3
<i>Wage system (base group = "Performace-based")</i>			
<i>Seniority-based</i>	-0.21** (0.08)	-0.23*** (0.08)	-0.22*** (0.08)
<i>Other</i>	-0.17 (0.18)	-0.19 (0.18)	-0.16 (0.18)
<i>Gender (base group = "Male")</i>	0.06 (0.08)	-0.03 (0.09)	-0.01 (0.09)
<i>Sleep before Corona</i>	0.00 (0.04)	0.00 (0.04)	0.00 (0.04)
<i>Education</i>	0.02 (0.03)	0.02 (0.03)	0.01 (0.03)
<i>Employment rank (base group = "Managerial")</i>			
<i>Regular</i>		0.13 (0.09)	0.17* (0.09)
<i>Marital status (base group = "Single")</i>			
<i>Married</i>		-0.16* (0.08)	-0.13 (0.09)
<i>Life satisfaction</i>			-0.03 (0.03)
<i>Age</i>			-0.00 (0.00)
<i>Income before Corona</i>			0.07* (0.04)
<i>Commuting time</i>			-0.00 (0.02)
<i>Intercept</i>	2.65*** (0.30)	2.68*** (0.31)	2.77*** (0.43)
<i>R<sup>2</sup></i>	0.01	0.03	0.04
<i>Adj. R<sup>2</sup></i>	0.00	0.01	0.02
<i>Num. obs.</i>	500.00	500.00	500.00

\*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$



Table 7: Creative Group Productivity

	Model 1	Model 2	Model 3
<i>Wage system (base group = "Performace-based")</i>			
<i>Seniority-based</i>	-0.21*** (0.08)	-0.22*** (0.08)	-0.23*** (0.08)
<i>Other</i>	-0.17 (0.17)	-0.19 (0.17)	-0.19 (0.17)
<i>Gender (base group = "Male")</i>	0.02 (0.08)	-0.04 (0.09)	-0.04 (0.09)
<i>Sleep before Corona</i>	-0.05 (0.03)	-0.05 (0.03)	-0.05 (0.04)
<i>Education</i>	0.01 (0.03)	0.01 (0.03)	0.01 (0.03)
<i>Employment rank (base group = "Managerial")</i>			
<i>Regular</i>		0.14* (0.08)	0.13 (0.09)
<i>Marital status (base group = "Single")</i>			
<i>Married</i>		-0.04 (0.08)	-0.02 (0.09)
<i>Life satisfaction</i>			-0.01 (0.03)
<i>Age</i>			-0.00 (0.00)
<i>Income before Corona</i>			-0.01 (0.04)
<i>Commuting time</i>			-0.00 (0.02)
<i>Intercept</i>	2.99*** (0.30)	2.93*** (0.30)	3.19*** (0.42)
<i>R<sup>2</sup></i>	0.02	0.03	0.03
<i>Adj. R<sup>2</sup></i>	0.01	0.01	0.01
<i>Num. obs.</i>	500.00	500.00	500.00

\*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$

Table 8: Willingness to continue telework

	Model 1	Model 2	Model 3
Wage system ( <i>base group</i> = “ <i>Performace-based</i> ”)			
<i>Seniority-based</i>	−0.13 (0.11)	−0.13 (0.11)	−0.18 (0.11)
<i>Other</i>	−0.27 (0.25)	−0.27 (0.25)	−0.14 (0.24)
Gender ( <i>base group</i> = “ <i>Male</i> ”)	0.22* (0.12)	0.22* (0.13)	0.24* (0.12)
Sleep before Corona	−0.13** (0.05)	−0.13** (0.05)	−0.15*** (0.05)
Education	0.14*** (0.04)	0.14*** (0.04)	0.09** (0.04)
Employment rank ( <i>base group</i> = “ <i>Managerial</i> ”)			
<i>Regular</i>		−0.00 (0.12)	0.09 (0.13)
Marital status ( <i>base group</i> = “ <i>Single</i> ”)			
<i>Married</i>		−0.04 (0.12)	0.05 (0.12)
Life Satisfaction			0.02 (0.04)
Age			−0.02*** (0.00)
Income before Corona			0.19*** (0.06)
Commuting time			−0.04 (0.03)
<i>Intercept</i>	3.38*** (0.42)	3.41*** (0.44)	4.00*** (0.59)
R <sup>2</sup>	0.04	0.04	0.09
Adj. R <sup>2</sup>	0.03	0.03	0.07
Num. obs.	500.00	500.00	500.00

\*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$