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Impact of the Extent of Telework Effect on Employee Job Satisfaction and Labor Productivity in Japan

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Abstract

This study investigated the effects of telework on job satisfaction and labor productivity, and also found the factors which effected on telework. Telework was concluded to have a positive effect on both job satisfaction and labor productivity. The effect on job satisfaction was the greatest when the telework period was more than 10 to 30 hours a week. Job discretion, company evaluations, and career development strengthened job satisfaction by enhancing telework at the peak amount of time spent teleworking of more than 60 hours a week. These results implied the policy for companies to elicit the potential of telework. In contrast, the effect of labor productivity was maximized when the teleworking period was more than 30 to 60 hours a week.

Keywords: *telework, job satisfaction, labor productivity, job discretion, evaluation, career development*

INTRODUCTION

The purpose of this study is to empirically investigate the effects of telework on an employee's job satisfaction and labor productivity in Japan. The progress of information and communication technologies has influenced the workplace.[1)]

Japan faces an aging society. Japanese society promotes telework to encourage women and the elderly to work, which helps compensate for the nation's labor shortage caused by its declining population (Kazekami, 2020).

The Japanese government has attempted to promote telework and has established "Telework Day"[2)] in 2017, which aims to reduce traffic jams in Tokyo. Work-style reform is considered to soften a notoriously rigid work culture and is expected to increase telework.

In 2020, the spread of the novel coronavirus has forced employers and employees to perform telework in Japan. The Japanese government asked companies to allow their employees to work at home. Telework is a Business Continuity Planning (BCP) method under conditions such as the spread of the novel coronavirus. The Covid-19 pandemic has demonstrated how companies have used teleworking to ensure their employees' safety and to ensure continuity of economic activity (Belzunegui-Eraso Angel, and Erro-Garcés, 2020). Compared with conventional telework, the flexibility in location and working times that telework is supposed to offer is no longer allowed in epidemic-induced telework; in other words, home confinement is imposed (Kevin, et al., 2020).

The aforementioned situation that Japanese society faces indicates that Japanese society should cope more rapidly with the diffusion of telework. This study examines the effects of telework on job satisfaction and labor productivity in Japan.

1. TELEWORK

1-1 Definition of telework

Telework has a variety of definitions and has been identified in many ways. In addition, Qvortrup (1998) pointed out ambiguities in the definitions. One definition of telework by Fitzer (1997) is that it is a "work arrangement in which employees perform their regular work at a site other than the ordinary workplace, supported by technological connections." Telework also is defined as work performed from different locations (such as at home) that enables workers to access their labor activities by using information and communication technologies (Nakrošienė, et al., 2019, Nilles, 1997, Perez Perez, et al., 2003).

Baruch (2000) adopted the following definition of EC (1994). Telework constitutes three main elements: (1) location of the workplace, (2) use of information technology (IT), and (3) organizational form and communication link to the organizations.

Telework is a commonly used term in Europe and Japan. In the United States, the generally used term is telecommuting, which emphasizes the impact of travel on teleworking (Helminen and Ristimäki, 2007).

WorlddatWork (2009)[3)] defined telecommute and telework as follows. To telecommute is to either periodically or regularly perform for one's employer from home or another remote location. Telework is to perform all of one's work from home or another remote location either for an employer or through self-employment. Telecommuting and telework cover regular employees, non-regular workers, such as part-time workers, and self-employed individuals.

Initially, telework was primarily defined as home-based telework, that is, work performed by employees during paid hours at an alternative fixed worksite (primarily, the home place or a satellite office generally close to the home place) (Aguilera, et al., 2016). However, the definition tends to broaden to include nomadic work and home-based work performed outside working hours (Qvortrup, 1998). Nomadic workers are mobile workers who work on trains, in airport lounges, in cafés, in satellite offices, and at clients' premises (Aguilera, et al., 2016, Gareis, 2003, Hislop, and Axtell, 2007, Lyons, and Urry, 2005).

Previous studies could not provide a common concept of telework and telecommuting. In the database analyzed by this study, the hours per week spent performing telework is different between employees and managers of companies and self-employed individuals (Table 1). This period is obviously longer for employees and managers belonging to companies than self-employed individuals. The characteristics of individuals hired by companies and self-employed persons are different, especially in job discretion and how to be evaluated. The subordinate is generally evaluated by superior, and thus evaluation method is more important when teleworking. Therefore, this study focuses on the telework of employees and managers belonging to companies and excludes self-employed individuals.

1-2 Characteristics of telework

A teleworker's job is characterized by task independence and job discretion (Olson and Primps, 1984, Golden and Veiga, 2005, Morgeson, Delaney-Klinger, and Hemingway, 2005, Nakrošienė, 2019, Kazekami, 2020). Flexibility—the most important factor when teleworking—is associated with task independence and job discretion. Teleworking employees have greater freedom to structure their work activities and decide when, where, and how they engage with work, enabling them to, for instance, work according to their productivity cycles and times (Sebastian, et al., 2016, Morgan, 2004, Gajendran and Harrison, 2007, Pyöriä, 2011). Employees can gain flexibility from telework to support their work-life balance; therefore, telework could improve their satisfaction.

Performance evaluations are important for telework because conventional evaluations are based on face-to-face relationships between supervisors and employees. In contrast, teleworkers tend to be concerned about whether or not they are evaluated fairly. One important variable related to both telecommuting productivity and telecommuting satisfaction is the performance evaluation system (Hartman, et al., 1991). Teleworkers face lower visibility and lower supervisor support (Cooper and

Table 1: Hours Per Week Performing Telework

	Observations	Mean	Std. Dev.
Employees and managers of companies	106,897	0.954	5.247
Self-employed persons	8,758	3.336	10.667

	Observations	Mean	Std. Dev.
Regular workers	65,371	0.959	5.249
Part-time workers	23,436	0.602	4.090
Workers through temporary staffing agency	3,646	0.538	4.857

Kurland, 2002, Nakrošienė, et al., 2019). Mutual trust, or the appropriate relationship between employee and supervisor, is needed for telework to be successful (Gajendran and Harrison, 2007, Bentley, et al., 2016, Golden and Veiga, 2008, Makarius and Larson, 2017).

Face-to-face communications with colleagues and informal communication in the office may be needed to avoid and to mediate a sense of isolation. Professional and social isolation are among the factors cited as draw backs (Crossan and Burton, 1993). A lack of informal communication among teleworkers and colleagues ceases organizational identification with the organization's values and goals (Nakrošienė, et al., 2019, Ammons and Markham, 2004, Cooper and Kurland, 2002). Isolation is one drawback of telework (Gainey, et al., 1999, Bentley, et al., 2016). In contrast, the possibility exists that face-to-face communication causes distractions when workers attempt to concentrate on their jobs. Telework may lead to overwork because the boundary between working time and time for life activities becomes ambiguous when schedule management is lacking. In contrast, Hartman, et al. (1991) noted that a negative correlation was observed between family disruption and telecommuting satisfaction and productivity. Little consensus existed among studies on how telework arrangements affected organizational communications (Duxbury and Neufeld, 1999).

Teleworkers might worry that their career prospects are diminished because of reduced or social isolation. Khalifa and Davison (2000) surveyed almost 16% of 650 current North American telecommuter respondents and found that 22% disagreed that their future career development would be affected by their intention to telecommute—the worst perceived consequence. Maruyama and Tietze (2012) concluded that sales and marketing teleworkers were more likely to report reduced career visibility. In contrast, Nakrošienė, et al. (2019) indicated that the suitability of the home as a working place is associated with an increase in career opportunities. It must be said that the relationship between telework and career development has been ambiguous.

Demographic factors are associated with telework. Many previous studies referred to gender (Mokhtarian, et al., 1998, Belanger, 1999, Nakrošienė, et al., 2019, Golden and Veiga, 2005, Kazekami, 2020), and Kazekami (2020) considered gender as a control variable to estimate telework. Women are more likely to list family benefit as a motivation for telework than are men (Bailey and Kurland, 2002, Hartig et al., 2007, Mokhtarian, et al., 1998). Telework could also increase career opportunities for women because they are able to return to work earlier from maternity leave (Nakrošienė, et al., 2019). In contrast, Baruch (2000) conducted a statistical analysis and found that gender did not play a significant role. Age is also a demographic factor related to telework. According to Belanger (1999), gender but not age showed a significant difference between telecommuters and non-telecommuters.

1-3 Outcomes of Telework

A review of employers' motivation to adopt telework helps us understand the outcomes of telework. A direct effect of telework is a reduction in travel time. The effects of productivity are a more complicated issue because many factors can influence productivity, making it difficult to identify the effects on telework.

Table 2: Extent of Telework

Number of persons

Hours per week	Total	Employee	Executive
more than 0 to 10 hours	9,241	8,089	1,152
more than 10 to 30 hours	1,328	1,106	222
more than 30 to 60 hours	774	676	98
more than 60 hours	82	67	15

Baily and Kurland (2002) surveyed many previous studies on telework. As for outcomes, little clear evidence exists that telework increases job satisfaction and productivity, as it is often asserted to do (Baily and Kurland, 2002).

Teleworkers can be more productive because they can work during their most productive time and be less distructed by co-workers (Golden and Veiga, 2008, Martinez-Sanchez, et al., 2008, Tremblay and Genin, 2007, Nakrošienė, et al., 2019).

This study attempts to empirically investigate the effects of telework on employee satisfaction and productivity using nationwide panel data from 2017 to 2019 in Japan. This study analyzes the different statuses of workers (Table 1) and shows that regular workers work longer than others when teleworking.

The time spent teleworking is overwhelmingly shorter than 11 hours a week in Japan (Table 2), which is the same for both employees and executives at companies.

2. PREVIOUS TELEWORK STUDIES' OUTCOMES BY STATISTICAL ANALYSIS

In particular, two outcomes receive the most attention among the empirical studies examined: productivity and job satisfaction (Baily and Kurland, 2002). Representative previous studies that investigated telework outcomes of job satisfaction and productivity using statistical analysis are introduced as follows.

Nakrošienė, et al. (2019) adopted the job demands-resources theory and focused on ten factors that influenced telework: time-planning skill, possibility of working during the most productive time, reduced time for communication with coworkers, possibility of working from home in case of sickness, supervisor's trust, supervisor's support, possibility of saving travel expenses, possibility of taking care of family members, suitability of the home as a workplace, and possibility of accessing the organization's documents from home. A web-based survey of 128 teleworkers from the IT, insurance, and telecommunication sectors in Lithuania was conducted. Telework outcomes included overall satisfaction with telework, perceived advantages of telework, subjective career opportunities, and self-reported productivity. The possibility of working from home in case of sickness, supervisor's trust, and suitability of the home as a workplace were statistically significant (respectively, $p<0.05$, $p<0.01$, and $p<0.01$) for overall satisfaction. Reduced time for communication with coworkers, possibility of saving travel expenses, and possibility of taking care of family members affected self-reported productivity.

Bentley, et al. (2016) examined whether or not the organizational social support, teleworker support, and social isolation factors affected job satisfaction using partial least squares—structural equation modeling for data on 804 teleworkers at 28 New Zealand organizations that undertook knowledge work. The analysis results indicated that organizational social support had the strongest positive effect on job satisfaction ($p<0.001$) and that teleworker support significantly affected job satisfaction ($p<0.001$).

Fonner and Roloff (2010) utilized path analysis to examine the extent to which telework affected job satisfaction through the experiences of work-life conflicts, stress from meetings and interruptions, perceived organizational politics, and information exchange. The results revealed that high-intensity teleworkers (N=89) are more satisfied than office-based employees (N=103). In particular, the path analysis showed that telework

affected job satisfaction both directly and indirectly by mediating work-life conflict, information exchange frequency, information quality, stress from interruptions, and general politics. General politics are factors that assessed the prevalence of power abuse and favoritism in organizations, including promotions determined by politics.

Hartman, et al. (1991) conducted an empirical study to examine the effect of selected variables on telecommuting productivity and satisfaction (N=97). Telecommuter satisfaction with a performance evaluation system was correlated with both telecommuting productivity and satisfaction. Technical and emotional support from the supervisor was positively correlated with satisfaction ($p<0.01$). A significant negative correlation was observed between the ratio of telecommuting hours to total work hours and telecommuting productivity (-0.21, $p=0.04$). Demographic and occupational characteristics were not strongly correlated with either telecommuting satisfaction or productivity.

According to Baily and Kurland (2002), most teleworkers work at home or at telework centers only a few days a month. This result implies that the optimum number of teleworking hours exists. An existing threshold for which the amount of time spent teleworking can no longer yield positive productivity was investigated. Previous studies related to this issue are reviewed as follows.

Golden and Veiga (2005) conducted a hierarchical regression analysis on a sample of 321 professional-level employees because the analysis can be used to directly test curvilinear relationships. First, the relationship between the extent of telecommunication and job satisfaction was specified as curvilinear in an inverted U-shape. This finding denies the conventional research that the more employees telecommute, the more they are satisfied. The inverted U-shape of job satisfaction means that, as the extent of telecommuting increases, job satisfaction increases within a certain range and passes the peak after a maximum point because the disadvantages of telecommuting exceed its advantages. The negative beta weight for the quadratic term of extent of telecommuting is significant ($p<0.001$) Second, interaction terms composed of the quadratic telecommunicating term and each of the moderators, such as task interdependence and job discretion, are used to assess the moderation of the curvilinear relationship and were found to be statistically significant (respectively $p<0.05$, $p<0.001$). The sign of interaction terms in the case of task interdependence is negative, and on the contrary it is positive in the case of job discretion. This result is open to debate.

Kazekami (2020) conducted a weighted fixed-effect model using the Japanese Panel Study of Employment Dynamics by the Recruit Works Institute from 2017 to 2018. The curvilinear relationship between telework hours and labor productivity was examined by adopting telework hours and its square as an explanatory variable. The conclusion reached was that appropriate telework hours increase labor productivity; however, when telework hours are too long, telework decreases labor productivity. Moreover, telework was more efficient or improved labor productivity if workers commuted more than one hour by train or bus. Behind this finding, the mechanism through which telework increased life satisfaction and through which life satisfaction improved labor productivity was analyzed.

Gajendran and Harrison (2007) conducted a meta-analysis of 46 studies in natural settings involving 12,883 employees. High-intensity telecommuting, which was more than 2.5 days a week, was noted to accentuate telecommuting's beneficial effects on work-family conflicts but harmed relationships with coworkers.

Telework has both positive and negative effects on outcomes; therefore, the relationship between the time spent teleworking and outcomes are not linear, as indicated by Golden and Veiga (2005), Kazekami (2020), and Gajendran and Harrison (2007). This study also analyzes this relationship.

Table 2 describes the number of teleworkers by the extent of teleworking from 2017 to 2019 in Japan. This study has four categories of hours spent teleworking per week: more than 0 to 10 hours, more than 10 to 30 hours, more than 30 to 60 hours, and more than 60 hours. The effect of teleworking is examined by each category.

3. STATISTICAL ANALYSIS

This study reflects on several issues as causality, threshold, inverted U regarding the effects of tele-

work, as previously mentioned.

The database used in this study was gathered nationwide and includes 66 industries and 208 occupations in Japan from 2017 to 2019. The individual data are obtained from the Japanese Panel Study of Employment Dynamics by the Recruit Works Institute.[4)]

The effects of telework on job satisfaction and productivity—, which were examined in many previous, studies—are investigated statistically.

Both outcomes from previous studies are considered to be influenced by gender, age, marital status, industry, occupations, type of employment, and firm size (Baily and Kurland, 2002, Belanger France, 1999, Hartman, et al., 1991, Nakrošienė, et al., 2019, Golden and Veiga, 2005, Kazekami, 2020).

Therefore, these factors are used in estimations of job satisfaction and productivity.

One particularity of this study is to conduct estimations that consider the endogeneity of the explanatory variables. The main explanatory variable is telework, which might be correlated with other important factors. Thus, the telework variable is not independent. To address the endogeneity problem, this study conducts an extended ordered probit regression for job satisfaction and a panel IV estimation of fixed-effects IV and G2SLS random effects IV for productivity. Because of limitations with the data, this study focuses on gender, age, occupations, job discretion, evaluation, and career development to estimate telework in the first stage.

Another particularity of this study is the examination of the threshold of the effect of telework on job satisfaction and productivity. The optimal intensity of telework is examined using both job satisfaction and labor productivity.

Variables related to telework are developed as follows. The original data are hours spent teleworking. The dummy telework variable takes the value of 1 in the case of performing telework and 0 otherwise. In other words, if the time spent teleworking is greater than 0, the dummy telework variable has a value of 1; otherwise, it is 0. Then, the aforementioned explanation of Table 2 describes four categories of time spent teleworking: (1) more than 0 to 10 hours, (2) more than 10 hours to 30 hours, (3) more than 30 hours to 60 hours, and (4) more than 60 hours. These categories are represented by dummy variables with values of 1 or 0. Thus, five telework variables exist for two outcomes of job satisfaction and labor productivity.

Descriptive statistics are summarized in table3.

An ordered probit regression is adopted to estimate job satisfaction because the dependent variable of job satisfaction is ordinal. This study adopts an extended ordered probit regression to consider endogeneity, as previously mentioned. The explanatory variable for telework is estimated by gender, age, whether or not the person has children, and educational background, and is controlled by dummy variables for occupation and firm size. Previous studies indicated that demographic factors such as gender and age, occupation, autonomy (Harpaz, 2002, Tremblay and Genin, 2007), job discretion, evaluation, and career development were associated with telework. This study uses demographic factors and occupation to basically control the attribution of telework. Job discretion, evaluation, and career development are added to advanced estimations.

The dependent variable for job satisfaction is estimated by the telework variables, marital status, and frequency of job change, and controlled by dummy variables for industry and year (2018, 2019).

Labor productivity is defined as annual income divided by working hours per week multiplied by 48. A panel IV regression is adopted to estimate labor productivity. Fixed-effects IV and G2SLS random effects IV are specifically conducted. The adoption of either estimation result depends on the Hausman test. The overidentifying restrictions test is an approach to test the hypothesis that additional instruments are exogenous. Instrument variables are selected to satisfy the overidentifying restrictions test in estimating labor productivity. Each telework variable is estimated using a dummy of on-the-job-training (OJT), which takes the value of 1 in the case that on-the-job-training (OJT) is performed and 0 otherwise, and a dummy for occupation in the first-stage estimation. Labor productivity is estimated by each telework variable, the on-the-job-training (OJT) dummy variable, and the industry dummy variable in the second stage.

Table 4–8 provides the estimation results, Table

Table 3: The Descriptive Statistics

		Mean	Medium	Std.Dev.	Observations
hours per week of performing telework		0.8553	0	4.9641	100782
dummy of telework (more than 0 hours=1, otherwise 0)		0.0978	0	0.2970	100782
dummy of telework (more than 0 to 10 hours=1, otherwise 0)		0.0797	0	0.2708	100782
dummy of telework (more than 10 to 30 hours=1, otherwise 0)		0.0109	0	0.1036	100782
dummy of telework (more than 30 to 60 hours=1, otherwise 0)		0.0066	0	0.0810	100782
dummy of telework (more than 60 hours=1, otherwise 0)		0.0006	0	0.0254	100782
productivity		2.3323	0.1597	28.8293	100276
job satisfaction (very satisfied=1, unsatisfied=5)		2.9405	3	1.0404	100782
discretion to work (applicable=1, inapplicable=5)		2.8641	3	1.1198	100782
appropriately evaluated (applicable=1, inapplicable=5)		3.0225	3	1.0112	100782
carrer development (applicable=1, inapplicable=5)		3.4789	3	1.0113	100782
age		43.0071	42	12.6872	100782
gender (male=1, female=2)		1.4225	1	0.4940	100782
marital status (having a spouse=1,otherwise 0)		1.4367	1	0.4960	100782
dummy of having children (having children=1, otherwise 0)		1.4920	1	0.4999	100782
education (ph.D, graduated student=3, graduated from university=2, others=1)		3.8131	3	1.8722	100782
dummy for OJT offered opportunities by the company (offered case=1, not offered case=0)		0.5005	1	0.5000	100782
number of changing jobs (no change=2, more than 11=9)		3.8772	3	1.9760	100782
occupation dummy (1)	manager	0.0550	0	0.2280	100782
	general affairs, human resource management, judicial afairs, public relations, corporate planning	0.0612	0	0.2397	100782
	clerical worker	0.1233	0	0.3288	100782
	purchasing, inventory control	0.0129	0	0.1127	100782
	marketing	0.4300	0	0.4951	100782
	accounting,finance	0.0278	0	0.1645	100782
	sales	0.0423	0	0.2014	100782
	R&D	0.0384	0	0.1922	100782
	IT	0.0432	0	0.2032	100782
employment dummy (1)	regular employee	0.6456	1	0.4783	100782
	part-time worker	0.2286	0	0.4200	100782
	dispatched employee	0.0360	0	0.1862	100782
	contract employee	0.0687	0	0.2529	100782
	fixed-term employee	0.0152	0	0.1222	100782
firm size dummy (1)	less than 10 persons	0.1096	0	0.3124	100782
	10-299 persons	0.4534	0	0.4978	100782
	300-999 persons	0.1307	0	0.3371	100782
	not less than 1000 persons	0.2274	0	0.4191	100782
industry dummy (1)	agriculture, forestry, fishery,construction	0.0427	0	0.2021	100782
	food	0.0268	0	0.1615	100782
	textile	0.0051	0	0.0709	100782
	lumber,furniture,paper,pulp	0.0053	0	0.0729	100782
	printing	0.0076	0	0.0870	100782
	chemisry,oilcoal,plastic,rubber,ceramics	0.0260	0	0.1592	100782
	steel,metal	0.0281	0	0.1654	100782
	general machinery	0.0221	0	0.1471	100782
	general electric machine	0.0025	0	0.0500	100782
	industrial electric machine	0.0025	0	0.0494	100782
	computer,telecommunication equipment,office automation	0.0040	0	0.0633	100782
	home appliances, audiovisual equipment	0.0039	0	0.0622	100782
	game, amusement device	0.0005	0	0.0227	100782
	semiconductor, electronic components	0.0086	0	0.0923	100782
	other electric machinery	0.0057	0	0.0753	100782
	automobile,railway,aircraft	0.0154	0	0.1230	100782
	precision mchinery	0.0052	0	0.0721	100782
	other manufacturing	0.0121	0	0.1092	100782
	electricity, gas, heat supply	0.0142	0	0.1182	100782
	broadcasting,telecommunication	0.0143	0	0.1186	100782
	information services, surveys, internet	0.0422	0	0.2011	100782
	video pictures, sound information, and character information production	0.0038	0	0.0619	100782
	transportation,warehouse,travel,others	0.0668	0	0.2496	100782
	wholesale, retail	0.1156	0	0.3197	100782
	finance	0.0384	0	0.1921	100782
	other services	0.3903	0	0.4878	100782

Table 4: Estimation Results of Job Satisfaction

	[1]	[2]	[3]	[4]	[5]
	Estimation method: Extended ordered probit regression				
	Dependent varible: Job satisfaction				
marital stautus	0.2054 ***	0.20704 ***	0.0433 ***	0.0159 ***	0.0049 ***
	(0.0069)	(0.0068)	(0.0050)	(0.0012)	(0.0003)
frequency of job change	0.0151 ***	0.0156 ***	0.0093 ***	0.0035 ***	0.0011 ***
	(0.0018)	(0.0019)	(0.0010)	(0.0003)	(0.0001)
year dummy (2018=1)	-0.0101	-0.0092	-0.0019	-0.0007	-0.0002
	(0.0085)	(0.0085)	(0.0026)	(0.0010)	(0.0003)
year dummy (2019=1)	-0.0348 ***	-0.0339 ***	-0.0129 ***	-0.0048 ***	-0.0015 ***
	(0.0081)	(0.0081)	(0.0027)	(0.0009)	(0.0003)
dummy of telework	-0.2845 ***				
	(0.1015)				
dummy of telework (more than 0 to 10 hours=1, otherwise 0)		-0.1851			
		(0.1152)			
dummy of telework (more than 10 to 30 hours=1, otherwise 0)			-9.2129 ***		
			(0.1733)		
dummy of telework (more than 30 to 60 hours=1, otherwise 0)				12.2675 ***	
				(0.2365)	
dummy of telework (more than 60 hours=1, otherwise 0)					39.3662 ***
					(2.4398)
Dependent varible:	dummy of telework	dummy of telework (more than 0 to 10 hours=1, otherwise 0)	dummy of telework (more than 10 to 30 hours=1, otherwise 0)	dummy of telework (more than 30 to 60 hours=1, otherwise 0)	dummy of telework (more than 60 hours=1, otherwise 0)
gender	0.0005	-0.0001	0.0036 ***	-0.0011 ***	-0.0001 ***
	(0.0025)	(0.0023)	(0.0004)	(0.0001)	(0.0000)
age	-0.0004 ***	-0.0007 ***	0.0001 ***	0.0000 ***	0.0000 ***
	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0000)
dummy of having children	-0.0151 ***	-0.0155 ***	-0.0017 ***	0.0005 ***	0.0001 ***
	(0.0021)	(0.0019)	(0.0003)	(0.0001)	(0.0000)
education	0.0294 ***	0.0256 ***	0.0022 ***	-0.0005 ***	-0.0001 ***
	(0.0020)	(0.0019)	(0.0003)	(0.0001)	(0.0000)
constant	0.1033 ***	0.1008 ***	0.0113 ***	0.0061 ***	0.0006 ***
	(0.0169)	(0.0155)	(0.0019)	(0.0006)	(0.0001)
Observations	100,782	100,782	100,782	100,782	100,782
Wald chi2 (31)	1637.39	1615.74	5440.16	3247.43	1027.03
Prob > chi2	0.00	0.00	0.00	0.00	0.00

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.1$

Robust standard errors in parentheses.

Occupation, employment status, and firm seize are controlled in estimating variables of telework. Industry is controlled in estimating job satisfaction. Due to space limitations, their estimation results are omitted.

Table 5: Estimation Results of Job Satisfaction: Job Discretion

	[6]	[7]	[8]	[9]	[10]
	Estimation method: Extended ordered probit regression				
	Dependent varible: job satisfaction				
marital stautus	0.0257 ***	0.02465 ***	0.0090 ***	0.0019 ***	0.0018 ***
	(0.0024)	(0.0023)	(0.0007)	(0.0001)	(0.0001)
frequency of job change	0.0046 ***	0.0043 ***	0.0021 ***	0.0004 ***	0.0004 ***
	(0.0005)	(0.0004)	(0.0002)	(0.0000)	(0.0000)
year dummy (2018=1)	-0.0031	-0.0029	-0.0011 *	-0.0002 *	-0.0002 *
	(0.0020)	(0.0019)	(0.0007)	(0.0001)	(0.0001)
year dummy (2019=1)	-0.0107 ***	-0.0101 ***	-0.0040 ***	-0.0009 ***	-0.0008 ***
	(0.0019)	(0.0018)	(0.0006)	(0.0001)	(0.0001)
dummy of telework	-3.2932 ***				
	(0.0170)				
dummy of telework (more than 0 to 10 hours=1, otherwise 0)		-3.6207 ***			
		(0.0205)			
dummy of telework (more than 10 to 30 hours=1, otherwise 0)			-9.6279 ***		
			(0.1433)		
dummy of telework (more than 30 to 60 hours=1, otherwise 0)				12.3491 ***	
				(0.2373)	
dummy of telework (more than 60 hours=1, otherwise 0)					-39.3833 ***
					(2.4501)
Dependent varible:	dummy of telework	dummy of telework (more than 0 to 10 hours=1, otherwise 0)	dummy of telework (more than 10 to 30 hours=1, otherwise 0)	dummy of telework (more than 30 to 60 hours=1, otherwise 0)	dummy of telework (more than 60 hours=1, otherwise 0)
discretion	-0.0251 ***	-0.0216 ***	-0.0029 ***	0.0005 ***	-0.0001 ***
	(0.0011)	(0.0010)	(0.0001)	(0.0000)	(0.0000)
gender	0.0072 ***	0.0062 ***	0.0009 ***	-0.0002 ***	0.0000 ***
	(0.0006)	(0.0005)	(0.0001)	(0.0000)	(0.0000)
age	0.0001 **	0.0000	0.0000 ***	0.0000 ***	0.0000 ***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
dummy of having children	-0.0035 ***	-0.0031 ***	-0.0003 ***	0.0001 ***	0.0000 ***
	(0.0006)	(0.0006)	(0.0001)	(0.0000)	(0.0000)
education	0.0051 ***	0.0043 ***	0.0004 ***	-0.0001 ***	0.0000 ***
	(0.0006)	(0.0005)	(0.0001)	(0.0000)	(0.0000)
constant	0.1814 ***	0.1526 ***	0.0206 ***	0.0050 ***	0.0011 ***
	(0.0056)	(0.0051)	(0.0007)	(0.0002)	(0.0001)
Observations	100,782	100,782	100,782	100,782	100,782
Wald chi2 (31)	48833.31	39,395.97	5,238.61	3,323.56	890.15
Prob > chi2	0.00	0.00	0.00	0.00	0.00

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.1$

Robust standard errors in parentheses.

Occupation, employment status, and firm seize are controlled in estimating variables of telework. Industry is controlled in estimating job satisfaction. Due to space limitations, their estimation results are omitted.

Table 6: Estimation Results of Job Satisfaction: Evaluation

	[11]	[12]	[13]	[14]	[15]
	Estimation method: Extended ordered probit regression				
	Dependent varible: job satisfaction				
marital stautus	0.0036 ***	0.00361 ***	0.0015 ***	0.0015 ***	0.0015 ***
	(0.0003)	(0.0003)	(0.0001)	(0.0001)	(0.0001)
frequency of job change	0.0005 ***	0.0005 ***	0.0002 ***	0.0002 ***	0.0002 ***
	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0000)
year dummy (2018=1)	-0.0002	-0.0002	-0.0001	-0.0001	0.0000
	(0.0003)	(0.0003)	(0.0001)	(0.0001)	(0.0001)
year dummy (2019=1)	-0.0010 ***	-0.0009 ***	-0.0004 ***	-0.0004 ***	-0.0004 ***
	(0.0003)	(0.0003)	(0.0001)	(0.0001)	(0.0001)
dummy of teleworking	-3.3690 ***				
	(0.0144)				
dummy of telework (more than 0 to 10 hours=1, otherwise 0)		-3.6948 ***			
		(0.0180)			
dummy of telework (more than 10 to 30 hours=1, otherwise 0)			-9.6516 ***		
			(0.1435)		
dummy of telework (more than 30 to 60 hours=1, otherwise 0)				12.3495 ***	
				(0.2371)	
dummy of telework (more than 60 hours=1, otherwise 0)					-39.3837 ***
					(2.4200)
Dependent varible:	dummy of teleworking	dummy of telework (more than 0 to 10 hours=1, otherwise 0)	dummy of telework (more than 10 to 30 hours=1, otherwise 0)	dummy of telework (more than 30 to 60 hours=1, otherwise 0)	dummy of telework (more than 60 hours=1, otherwise 0)
evaluation	-0.0079 ***	-0.0072 ***	-0.0011 ***	0.0008 ***	-0.0003 ***
	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0000)
gender	0.0005 ***	0.0005 ***	0.0001 ***	-0.0001 ***	0.0000 ***
	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0000)
age	0.0001 ***	0.0000 ***	0.0000 ***	0.0000 ***	0.0000 ***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
dummy of having children	-0.0006 ***	-0.0005 ***	-0.0001 ***	0.0001 ***	0.0000 ***
	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0000)
education	0.0002 ***	0.0002 ***	0.0000 ***	0.0000 ***	0.0000 ***
	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0000)
constant	0.1214 ***	0.1012 ***	0.0143 ***	0.0041 ***	0.0014 ***
	(0.0012)	(0.0011)	(0.0004)	(0.0002)	(0.0001)
Observations	100,782	100,782	100,782	100,782	100,782
Wald chi2 (31)	55481.13	42,374.58	4,918.38	3,111.05	678.61
Prob > chi2	0.00	0.00	0.00	0.00	0.00

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.1$

Robust standard errors in parentheses.

Occupation, employment status, and firm seize are controlled in estimating variables of telework. Industry is controlled in estimating job satisfaction. Due to space limitations, their estimation results are omitted.

Table 7: Estimation Results of Job Satisfaction: Career Development

	[16]	[17]	[18]	[19]	[20]
	Estimation method: Extended ordered probit regression				
	Dependent varible: job satisfaction				
marital stautus	0.0098 ***	0.00847 ***	0.0036 ***	0.0025 ***	0.0017 ***
	(0.0009)	(0.0008)	(0.0003)	(0.0002)	(0.0001)
frequency of job change	0.0013 ***	0.0011 ***	0.0006 ***	0.0004 ***	0.0003 ***
	(0.0002)	(0.0002)	(0.0001)	(0.0000)	(0.0000)
year dummy (2018=1)	-0.0006	-0.0006	-0.0002	-0.0001	-0.0001
	(0.0008)	(0.0007)	(0.0003)	(0.0002)	(0.0001)
year dummy (2019=1)	-0.0038 ***	-0.0033 ***	-0.0014 ***	-0.0010 ***	-0.0006 ***
	(0.0008)	(0.0007)	(0.0003)	(0.0002)	(0.0001)
dummy of teleworking	-3.3592 ***				
	(0.0144)				
dummy of telework (more than 0 to 10 hours=1, otherwise 0)		-3.6877 ***			
		(0.0181)			
dummy of telework (more than 10 to 30 hours=1, otherwise 0)			-9.6481 ***		
			(0.1434)		
dummy of telework (more than 30 to 60 hours=1, otherwise 0)				-12.3474 ***	
				(0.2371)	
dummy of telework (more than 60 hours=1, otherwise 0)					-39.3820 ***
					(2.4679)
Dependent varible:	dummy of teleworking	dummy of telework (more than 0 to 10 hours=1, otherwise 0)	dummy of telework (more than 10 to 30 hours=1, otherwise 0)	dummy of telework (more than 30 to 60 hours=1, otherwise 0)	dummy of telework (more than 60 hours=1, otherwise 0)
career development	-0.0193 ***	-0.0150 ***	-0.0024 ***	-0.0013 ***	-0.0003 ***
	(0.0008)	(0.0005)	(0.0000)	(0.0000)	(0.0000)
gender	0.0038 ***	0.0030 ***	0.0005 ***	0.0003 ***	0.0001 ***
	(0.0003)	(0.0002)	(0.0000)	(0.0000)	(0.0000)
age	0.0001 ***	0.0001 ***	0.0000 ***	0.0000 ***	0.0000 ***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
dummy of having children	-0.0004	-0.0003	0.0000	0.0000	0.0000
	(0.0003)	(0.0002)	(0.0000)	(0.0000)	(0.0000)
education	0.0018 ***	0.0014 ***	0.0002 ***	0.0001 ***	0.0000 ***
	(0.0002)	(0.0002)	(0.0000)	(0.0000)	(0.0000)
constant	0.1627 ***	0.1304 ***	0.0189 ***	0.0109 ***	0.0015 ***
	(0.0034)	(0.0024)	(0.0005)	(0.0004)	(0.0001)
Observations	100,782	100,782	100,782	100,782	100,782
Wald chi2 (31)	55362.14	42,463.30	4,921.84	3,124.46	676.00
Prob > chi2	0.00	0.00	0.00	0.00	0.00

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.1$

Robust standard errors in parentheses.

Occupation, employment status, and firm seize are controlled in estimating variables of telework. Industry is controlled in estimating job satisfaction. Due to space limitations, their estimation results are omitted.

Table 8: Estimation Results of Labor Productivity

	dummy of telework		dummy of telework (more than 0 to 10 hours=1, otherwise 0)		dummy of telework (more than 10 to 30 hours=1, otherwise 0)		dummy of telework (more than 30 to 60 hours=1, otherwise 0)		dummy of telework (more than 60 hours=1, otherwise 0)	
	[21]	[22]	[23]	[24]	[25]	[26]	[27]	[28]	[29]	[30]
	Fixed-effects IV	G2SLS random-effects IV	Fixed-effects IV	G2SLS random-effects IV	Fixed-effects IV	G2SLS random-effects IV	Fixed-effects IV	G2SLS random-effects IV	Fixed-effects IV	G2SLS random-effects IV
Second stage: dependent variable: productivity										
telework	-101.87 **	6.56 ***	-164.91 **	9.24 ***	399.18 **	44.82 ***	-312.01 ***	92.31 **	-253.55	206.41
	(39.41)	(2.29)	(66.64)	(2.89)	(181.80)	(13.39)	(119.10)	(35.87)	(291.06)	(238.78)
dummy of OJT	0.80	-0.98 ***	1.28	-1.11 ***	0.10	-0.74 ***	0.32	-0.56 ***	-0.241	-0.671 ***
	(0.60)	(0.22)	(0.84)	(0.23)	(0.59)	(0.18)	(0.49)	(0.19)	(0.30)	(0.19)
constant	12.78 ***	2.39 ***	15.72 ***	2.31 ***	-2.82	2.35 ***	4.51 ***	2.23 ***	2.78 ***	3.00 ***
	(3.93)	(0.22)	(5.29)	(0.21)	(2.51)	(0.20)	(0.76)	(0.29)	(0.24)	(0.24)
First stage: dependent variable: telework										
dummy of OJT	0.01 ***	0.05 ***	0.01 ***	0.05 ***	0.00	0.00 ***	0.00 **	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
constant	0.13 ***	0.25 ***	0.11 ***	0.19 ***	0.00	0.04 ***	0.02 ***	0.02 ***	0.00	0.00 ***
	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Obsevations	106366		106366		106366		106366		106366	
Number of groups	57831		57831		57831		57831		57831	
Wald chi2 (7)	598.34	30.99	348.66	33.11	312.97	33.63	567.55	28.04	1258.91	20.18
Prob > chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hausman chi2	11.12		9.30		4.93		13.74		1.18	
Prob > chi2	0.13		0.23		0.67		0.06		0.99	
Sargan-Hansen statistic	4.06		4.11		2.78		5.48		2.51	
P-value	0.26		0.25		0.43		0.14		0.47	

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.1$

Robust standard errors in parentheses.

Occupation, employment status, and firm seize are controlled in estimating variables of telework. Industry is controlled in estimating job satisfaction. Due to space limitations, their estimation results are omitted.

4–7 provides the job satisfaction results, and Table 8 provides the labor productivity results.

The effect of telework on job satisfaction is examined in Table 4. The telework dummy variable is statistically significant ($p < 0.01$) in [1]. Therefore, on the whole, the teleworker's job satisfaction is higher than that of the non-teleworker. The estimation results of [2]–[5] indicate that the effect of telework is the largest when the time spent teleworking is more than 10 to 30 hours a week [3]. Job satisfaction is a variable measured using a five-point Likert scale (very satisfied = 1, unsatisfied = 5); therefore, the negative coefficient for the telework dummy variable (more than 10 to 30 hours) indicates that telework can improve job satisfaction (Table 4). In contrast, the coefficient for the telework dummy variable (more than 30 to 60 hours and more than 60 hours) means that telework leads to decreased job satisfaction [4] [5]. The largest negative effect on job satisfaction is observed when teleworking for more than 60 hours [5]. This estimation result suggests that the negative aspects of telework, such as isolation and stress, become predominant; therefore, job satisfaction declines when teleworking for long periods.

Table 5 provides the estimation results of job satisfaction in the case that job discretion is admitted.

The telework dummy variable is statistically significant ($p < 0.01$) in [6], which indicates that job discretion leads to increased job satisfaction in telework as a whole. The coefficient for job discretion in estimating the telework variable is statistically significant ($p < 0.01$) in all cases ([6], [7], [8], [9], [10]).

The case in which the effect of telework is the largest is [10], where time spent teleworking is more than 60 hours. This finding suggests that job

discretion has the strongest effect on job satisfaction when an employee engages in telework for more than 60 hours a week.

Table 6 shows the estimation results of job satisfaction in the case that teleworkers are evaluated appropriately by companies. The telework dummy variable is statistically significant ($p < 0.01$) in [11], indicating that an appropriate telework evaluation will bring higher job satisfaction. The coefficient of evaluation in estimating the telework variable is statistically significant ($p < 0.01$) in all cases ([11], [12], [13], [14], [15]), indicating that employees performing telework are appropriately evaluated by their companies. The case in which telework is performed most effectively is [15], in which the time spent teleworking is more than 60 hours. This result suggests that the evaluation of telework results in job satisfaction when employees engage in telework for more than 60 hours a week, which is the same for job discretion.

Table 7 shows the estimation results of job satisfaction in the case that teleworkers can sense their career development in the future. The telework dummy variable is statistically significant ($p < 0.01$) in [16], which indicates that the teleworker believes that career development is associated with higher job satisfaction. In all estimation results from [17] to [20], telework variables are statistically significant ($p < 0.01$). The coefficient of career development in estimating the telework variable is statistically significant ($p < 0.01$) in all cases ([16], [17], [18], [19], [20]). Career development leads to enhancing job satisfaction. As the time spent teleworking becomes longer, job satisfaction increases. Job satisfaction is highest when the time spent teleworking is more than 60 hours a week [20].

The peak of job satisfaction occurs for a longer period spent on telework (more than 60 hours), during which employees can sense that job discretion is evaluated by their companies, and they can develop their careers. This conclusion is remarkable.

Regarding the effect of telework on labor productivity, in Table 8, performing telework is recognized as increasing labor productivity. Performing telework has a negative effect on labor productivity in fixed-effects IV [21] and a positive effect on labor productivity in G2SLS random effects IV [22]. The G2SLS random effects IV regression [22] can be selected using the Hausman test. The *p*-value of the Sargan-Hansen statistic indicates that the overidentifying restrictions test is satisfied; thus, the instrument variables are appropriately selected. For the four categories of time spent teleworking, the fixed-effects IV or G2SLS random effects IV is selected by the Hausman test. The G2SLS random effects IV is selected in four cases, even if the p-value in chi-square was relatively low (0.06) in the case of using the telework dummy variable (more than 30 to 60 hours), and the results of the overidentifying restrictions test indicate that the instrument variables are appropriately selected. The telework variable is statistically significant at the 1% level in the case of using the telework dummy variable of more than 0 to 10 hours and more than 10 to 30 hours a week ([24] and [26], respectively). The 5% significant level is indicated in the case in which the time spent teleworking is more than 30 to 60 hours a week ([28]). The conclusion reached is that the impact of telework is strongest when engaging in telework for more than 30 to 60 hours a week (Table 8).

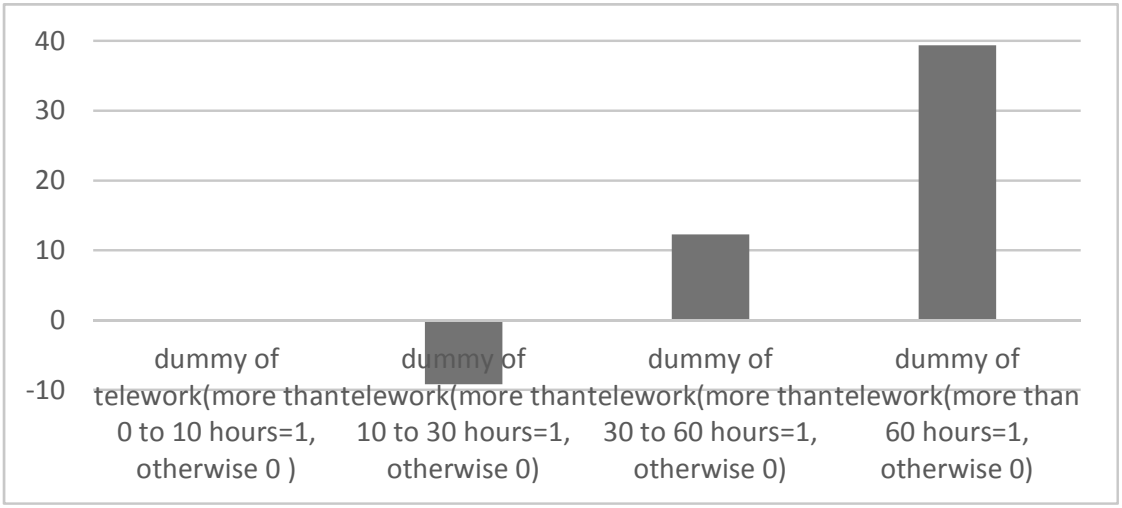
4. DISCUSSION

The telework could have both positive and negative effects on job satisfaction as Baily and Kurland (2002) mentioned. Golden and Veiga (2005) conducted that the relationship between the extent of telecommunication and job satisfaction was specified as curvilinear in an inverted U-shape. Kazekami (2020) also estimated labor productivity on the assumption of the inverted U-shape.

On the other hand, this study did not assume the inverted U-shape, when considering both positive and negative effects of telework. This point is different from Golden and Veiga (2005), and Kazekami (2020).

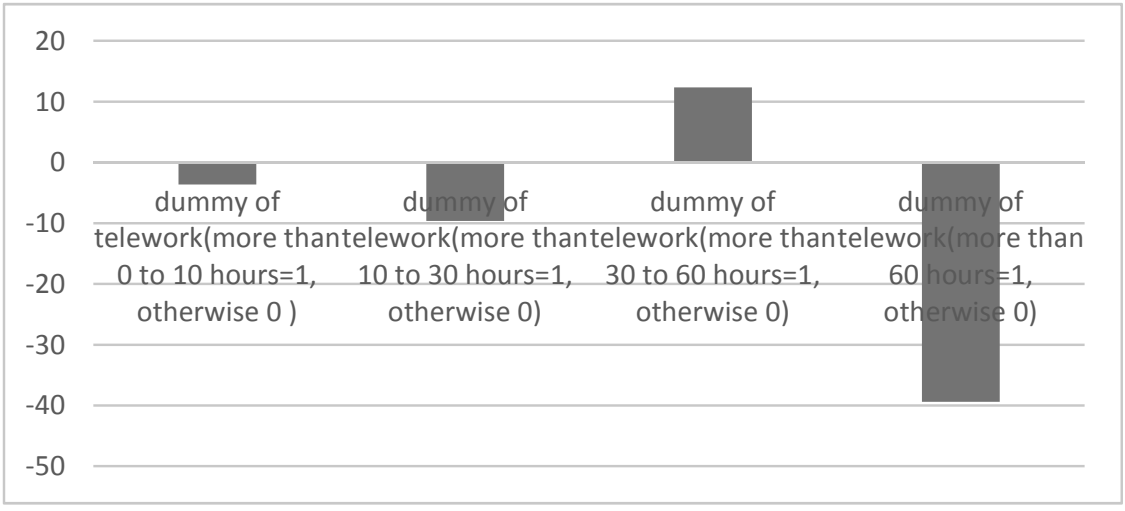
This study used the variables of telework as dummy variables where telework hours per week were more than 0, more than 10 to 30, more than 30 to 60, and more than 60.

Graph (1)–(4) indicated each coefficient of telework dummy variable. Graph (1) showed the relationship between each telework dummy and job satisfaction. Graph (2) was the case that the effect of job discretion on telework was considered.



Graph (1): Coefficient of Telework Dummy Variables on Job Satisfaction (Based on Table 4)

Note: Negative coefficient means that telework effects on job satisfaction positively, because of the sequential order of job satisfaction (very satisfied=1, unsatisfied=5).



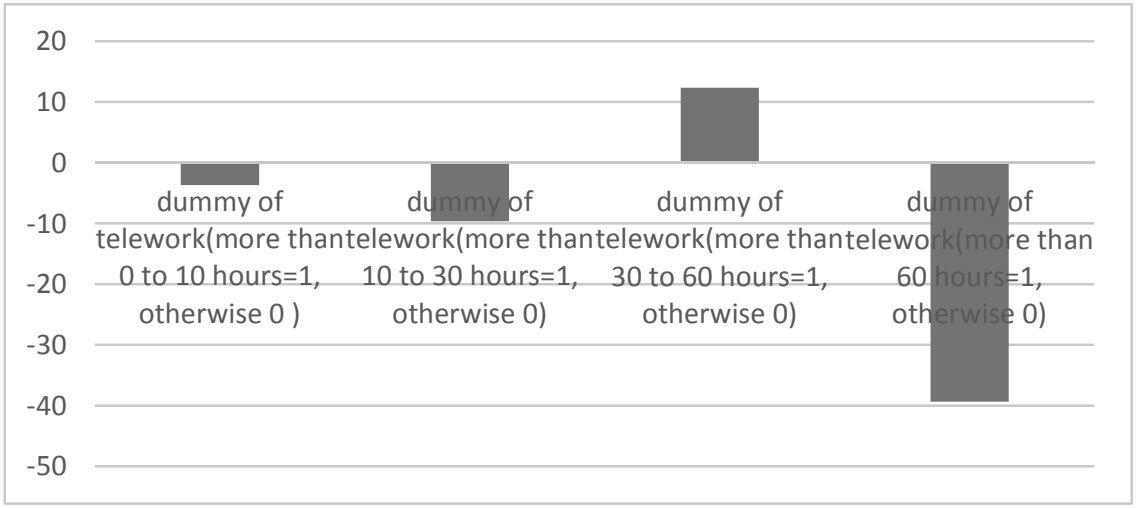
Graph (2): Coefficient of Telework Dummy Variables: Job Discretion (Based on Table 5)

Note: Negative coefficient means that telework effects on job satisfaction positively, because of the sequential order of job satisfaction (very satisfied=1, unsatisfied=5).

Graphs (3) and (4) were cases of considering evaluation, and career development on telework.

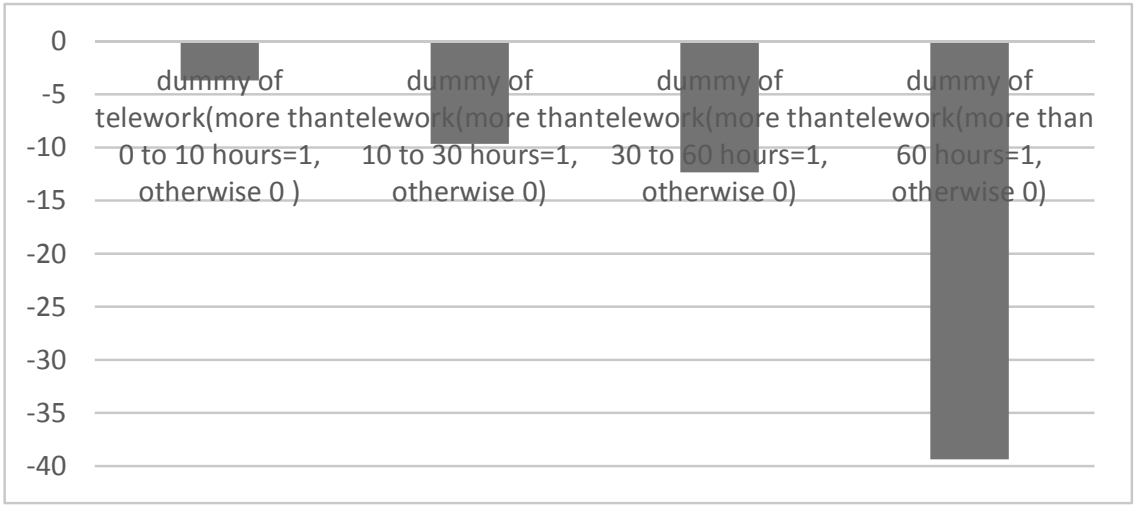
The shapes of graph were different. It suggested that the inverted U-shape should not be simply assumed. The effect of telework on job satisfaction was simply described U-shape where the maximum point was more than 10 to 30 hours per week (Graph [1]). When considering the effects of job discretion, evaluation, and career development on telework, the shapes were changed (Graphs [2]–[4]).

The difference between Kazekami (2020) and this study was the estimation method as aforementioned. Kazekami (2020) did not consider that telework was affected by other variables, and therefore conducted the weighted fixed-effect model



Graph (3): Coefficient of Telework Dummy Variables on Job Satisfaction: Evaluation (Based on Table 6)

Note: Negative coefficient means that telework effects on job satisfaction positively, because of the sequential order of job satisfaction (very satisfied=1, unsatisfied=5).



Graph (4): Coefficient of Telework Dummy Variables on Job Satisfaction: Career Development (Based on Table 7)

Note: Negative coefficient means that telework effects on job satisfaction positively, because of the sequential order of job satisfaction (very satisfied=1, unsatisfied=5).

using panel data, and ordered logit model using panel data. On the contrary, this study was conducted to estimate telework variable by using others on the first stage, and to estimate job satisfaction or labor productivity by using telework variable on the second stage. This study suggested that the maximum of telework hours became larger when considering the effects of job discretion, evaluation, and career development.

5. CONCLUSION

This study examines whether or not telework has a positive effect on job satisfaction and labor productivity by eliminating the statistical problem. The conclusion reached is that performing telework has

a positive effect on both job satisfaction and labor productivity.

Regarding the threshold of the time spent teleworking, different results are revealed for job satisfaction and labor productivity. The effect of telework on job satisfaction is the strongest in the case that time spent teleworking is more than 10 to 30 hours. Engaging in telework for more than 30 hours has a negative effect on job satisfaction. In contrast, for labor productivity, its effect is maximized when teleworking for more than 30 to 60 hours.

Job discretion, company evaluations, and career development can increase job satisfaction by enhancing telework at the peak, which is when the time spent on telework is more than 60 hours. Moreover, it is noteworthy that the peak of job satisfaction changes to the range of longer time spent teleworking when employees can sense discretion at their jobs, being evaluated by their companies, and developing their careers. This conclusion suggests cues for how to engage more efficiently in telework. This suggestion is important for both employees and employers. Job discretion, evaluations, and career—as pointed out by previous studies—are more sophistically confirmed in this study.

This study utilized a nationwide database in Japan. The advantage of this database is the panel data from 2017 to 2019, which provided observations in this study of 100,782 for job satisfaction and 106,366 for labor productivity. This study can conduct more advanced statistical analysis relative to previous studies.

However, this study has several limitations. First, this study is biased by Japanese corporate cultural characteristics, such as ambiguous job descriptions, ambiguous relationships with supervisors, and peer pressure related to employment circumstances.

Second, the period of this study is from 2017 to 2019; therefore, the influences of Covid-19 are not considered.

Third, reverse causality between telework and outcomes cannot be adequately eliminated because statistically meaningful estimation results cannot be obtained by conducting dynamic panel analysis, given the shortness of the period—three years. Those issues are left for further research.

APPENDIX: ESTIMATION METHODS

The author utilizes extended ordered probit regression model for estimation of [1] to [20]. First, dependent variable of job satisfaction is not continuous, but ordinal. Ordered probit regression model is, therefore utilized (assuming the normal distribution).

Second, variables related to telework can't be considered as exogenous, but endogenous. If the estimation method is OLS (Ordinary Least Square), it is proper to use IV (Instrumental Variable). When using endogenous variable related to telework, extended ordered probit model is used in this research, because it can accommodate any combinations of endogenous variables (Stewart M.B., 2004).

Job satisfaction is estimated by variables related to telework which are estimated by gender, age, dummy of having children, education, background, and occupation in equation [1]–[20]. This research can't treat the characteristic of panel data. To investigate the effects of telework by using the estimation method which can deal with ordinal and panel data including endogenous variable is the research task from now on.

Labor productivity is a continuous variable of panel data and therefore panel fixed effect model and random effect model are conducted (equation [21]–[30]). Hausman test can decide which model should be selected. Because variables related to telework can be considered as endogenous, fixed effect-IV and random effect-IV are utilized to estimate labor productivity. Sargan Hansen test can decide whether IV (instrument variables) are appropriately selected, or not.

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NOTES

1) Nilles (1975) pointed out that telecommunications motivate organizations to decentralize and first coined the term "telecommuting" (Baily and Kurland, 2002).
2) "Telework Day" aims to directly reduce congestion during the 2020 Olympic Games in Tokyo, and is expected to be an opportunity to promote telework.
3) WorlddatWork (2009) continued to categorize telecommuters in detail: An employee telecommuter is a regular employee (full- or part-time) who works at home or at another remote location at least one day a month during normal business hours. A contract telecommuter is an individual who works on a contract basis for an employer or who is self-employed and works at home or at a remote location at least one day a month during normal business hours. An employed telecommuter is an individual (either employees or contractors) who works at home or remotely at least one day a month during normal business hours and is the sum of employee telecommuters and contract telecommuters.
4) Both this study and Kazekami (2020) used the Japanese Panel Study of Employment Dynamics.

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