Why Do People Overwork at the Risk of Impairing Mental Health?

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Abstract

Using longitudinal data of Japanese workers, this study investigates the relationship between overwork and mental health. Conventional labor supply theory assumes that people allocate their hours of work and leisure to maximize personal utility. However, people sometimes work too long (overwork) and, by doing so, impair their physical and/or mental health. We introduce non-pecuniary factors into the conventional utility function. Empirical analysis reveals a non-linear relationship between the number of hours worked and job satisfaction. We find that job satisfaction rises when people work more than 55 hours weekly. However, we also find that hours worked linearly erode workers' mental health. These findings imply that people who overvalue job satisfaction work excessive hours and, as a consequence, damage their mental health. We find that people form incorrect beliefs about the mental health risks of overwork, leading them to work longer hours. These results might justify interventions, such as capping the number of hours worked to reduce related mental issues.

Keywords: Mental health, Job satisfaction, Overwork, Hours worked, Overemployment,
　　　　　　Underemployment

JEL classification: I12, J22, J81

1. Introduction

Conventional labor supply theory assumes that people allocate hours worked and leisure to maximize his/her utility. Were that assumption correct, the concept of *overwork* (weary or exhaust with too much or too long work) associated with physical and mental health deterioration would be meaningless. As Figure 1 indicates, however, the presence of and increases in worker compensation for mental ailments are apparent among Japanese workers from 2000 through 2014. It is believed that overwork is among the main causes.[1]

If people allocate hours of work and leisure to maximize utility, it is difficult to explain why people overwork to the extent of damaging their mental health. Extensive psychological literature investigates mental wellbeing and work-related burnout, fatigue, or distress. The economic literature considers relationships between job satisfaction and hours worked. Results from both disciplines are ambiguous: some studies document the detrimental effects of working long hours; others confirm that there is no significant relationship between wellbeing and hours worked. Besides examining that relationship from the perspective of economic theory and econometric research, this study explains that people might overwork to the detriment of their mental health in order to maximize personal utility.[2]

One explanation for overwork is that work hour is not genuinely determined by supplier side. Rather, it is the result negotiated between employers and workers. If employers have bargaining power, they can enforce whatever hours worked they deem optimal (Stewart and Swaffield 1997). If so, the gap between workers' desired and

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[1] A relevant term in the *Oxford English Dictionary* is *karoshi*, defined as "death caused by overwork or job-related exhaustion." It originates in the Japanese ka (excess) + ro (labor) + shi (death). See also Appendix Figure 1 which indicates that the number of working age population who consult with doctors because of mental health problem has been growing throughout these two decades.

[2] According to Kuroda and Yamamoto (2016), even after controlling for individual fixed effects and other detailed individual and job characteristics, long hours worked are among the principal causes of impaired mental health. Their finding implies that people recognize their mental health deteriorates when hours worked increases.

actual hours worked may lower their utility, with a resultant damage to their mental health.

The explanation this study explores is that people try to maximize personal utility, which consists not only consumption and leisure but also non-pecuniary rewards, such as self-realization, self-affirmation, or the satisfaction derived from feeling needed. We hypothesize that satisfaction from non-pecuniary factors rises with hours worked. Furthermore, we assume that people form non-standard beliefs about the risk of incurring mental illness as they overvalue the utility obtained from non-pecuniary factors or underestimate the disutility of working long hours. The source of these nonstandard beliefs could be overconfidence and/or projection bias. If our hypotheses prove valid, workers might willingly choose to overwork for objectively irrational reasons.

After discussing these explanatory mechanisms, we investigate the relationship among hours worked, job satisfaction, and mental health using longitudinal data from Japanese workers. Among our main empirical findings, there is a non-linear relationship between hours worked and job satisfaction (a proxy for non-pecuniary utility). In particular, we found that job satisfaction rises when hours worked exceed 55. We also found that hours worked linearly affect workers' mental health (a proxy for disutility from working). These findings imply that people who overvalue job satisfaction likely work excessive hours and may erode their mental health. We also found that people may form incorrect beliefs about risks to their mental health that lead them work excessive hours. Our results may justify legal and regulatory intervention to prevent excessive overwork.

This study proceeds as follows. Section 2 explains the theoretical background and empirical specifications. Section 3 explains our data and mental health measures and observes basic statistics. Section 4 presents estimation results. Section 5 concludes.

2. Theoretical background and empirical specifications

2.1 Theoretical background

To show that people may willingly overwork to the point of incurring mental disorders, we discuss the nature of utility maximization presented in the model proposed by Rätzel (2012), who incorporates non-pecuniary utility into the standard neoclassical utility function. Rätzel (2012) assumes that work generates both labor disutility and non-pecuniary utility from confirmatory feelings such as job security, belonging, or social status. Under that assumption, the conventional neoclassical utility function, $V^n = U(C, F)$ where C is consumption and F is leisure, is modified as follows.

$$V = U(C, F) + N(L),$$
$$U_C > 0, U_F > 0, N_L > 0, U_{Cc} < 0, U_{FF} < 0, N_{LL} < 0, \qquad (1)$$

where $N(L)$ is non-pecuniary utility of work. L is working hours defined as the difference between available hours T and leisure L ($L = T - F$).

This utility function indicates that an additional hour worked generates marginal disutility (U_L<0) and marginal utility ($N_L > 0$). Therefore, utility maximizers supply longer working hours given a market wage and budget constraint, since they incur less marginal disutility compared with the case without non-pecuniary utility.

Using the *German Socio-Economic Panel*, Rätzel (2012) confirms that the empirical relationship between life satisfaction and working hours implies the positive non-pecuniary utility of work in Equation (1). In addition, he indicates that wellbeing can be represented on an inverse U-shaped curve along which life satisfaction rises with shorter working hours (fewer than nine), but declines as they extend. The paper explains that the ascending wellbeing associated with fewer hours worked is consistent with volunteer work and findings in studies of happiness that demonstrate a huge welfare

loss when one becomes unemployed.[3]

We extend Rätzel (2012)'s utility function; such that very long hours worked bring workers greater non-pecuniary utility. Furthermore, some workers may irrationally work extremely long hours, despite potential impairment of their mental health. For example, people with work addictions may spend nearly all available time working, even when doing so impairs their health and efficiency.

To account for this aspect, we extend Rätzel's (2012) utility function in two ways. First, unlike Rätzel (2012), who investigated employees who worked fewer hours, we focus on fulltime workers. The non-pecuniary utility of work $N(L)$ for fulltime workers includes self-realization, self-affirmation, or satisfaction from feeling needed which are obtained by being in charge of important or difficult work, and achievement of work that requires great effort. Under such circumstances, non-pecuniary utility rises as people are assigned important work or spend very long hours accomplishing assigned tasks. In this case, the non-pecuniary utility of work for fulltime workers can be illustrated by the half-U-shaped relation with working hours in Figure 2.[4]

Concerning the first term in Equation (1), $U(C, F)$, we suppose that with the consumption level constant, rising fatigue and declining leisure reduce workers' utility $U(F|C)$ as hours worked extend (Figure 3). To describe the relationship with hours worked, we interpret the decline in mental health as the disutility arising from one additional hour of work. Thus, Figure 3 illustrates that working longer hours is associated with declining mental health.

Second, to allow that fulltime workers can irrationally choose to overwork despite damaging their mental health, we assume total utility is a weighted average of

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[3] Clark and Oswald (1994), Winkelmann and Winkelmann (1998), and Blanchflower and Oswald (2004) confirm the large reduction in happiness and satisfaction indexes for the unemployed.

[4] Rätzel (2012) indicates an inverse U-shaped relation between life satisfaction and hours worked. However, he considers all individuals, including the unemployed and part-time workers. Thus, we think the U-shaped relation between non-pecuniary utility and hours worked for fulltime workers does not contradict his findings.

standard utility $[U(C,F)]$ and non-pecuniary utility of work $[N(L)]$ as formulated in Equation (2).

$$V = \pi U(C,F) + (1-\pi)N(L), \quad 0 < \pi < 1, \tag{2}$$

where $(1-\pi)$ is a subjective weight to value non-pecuniary utility from work. In the context of our research, π is a subjective belief about the risks to mental health from working more hours. Since an additional work-hour increases both disutility (risk of mental distress) and non-pecuniary utility, total utility depends on how workers evaluate risks to their mental health.

Then we consider that workers underestimate their mental health risk $(\pi < \pi^*)$, where π^* is the optimal weight they assign to a balanced evaluation of disutility and utility of labor. Insofar as workers' beliefs are optimal $(\pi = \pi^*)$, long working hour does not erode mental health. However, if workers underestimate the risk $(\pi < \pi^*)$ and overvalue non-pecuniary utility from work, they choose to work excessive hours and potentially endanger their mental health. Hence, this model explains how it is that people can overwork at peril to their mental health.

There are several reasons why workers might hold subjective and erroneous beliefs about risks to their mental health $(\pi < \pi^*)$. In his survey of research into nonstandard (incorrect) beliefs, DellaVigna (2009) highlights an *overconfidence effect* as a typical cause for holding incorrect beliefs. Confirmed in psychology, this effect is a cognitive bias whereby people's subjective confidence in their ability, knowledge, or outcomes exceeds an objective assessment.[5] Extensive survey and laboratory evidence establishes that people are likely to consider their abilities as *better-than-average*,

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[5] Unlike the studies in phycology, there are several studies in economics that cast doubt on the premise of overconfidence effect such as Das and van Soest (1999) and Clark and Friesen (2009), while the studies such as Hamermesh (1985) and Domintiz (1998) find overconfidence effect in many applications.

through unrealistic optimism or miscalibration. At the same time, overconfident individuals hold *below-average* assessments of negative outcomes, such as health problems. Weinstein (1980, 1982, and 1987) indicates that people systematically underestimate the probability of experiencing health problems owing to unrealistic optimism. Following their literature survey, Sandroni and Squintani (2004) conclude that there is a strong evidence that people underestimate risks attendant to activities they believe are within their control (e.g., driving or financial planning) or reflect their self-image (e.g., health).[6] According to these studies, it is reasonable to think that workers who overestimate their abilities and health may dismiss the mental health risks associated with overwork and form beliefs characterized by $\pi < \pi^*$.

A second reason people may hold systematically incorrect beliefs is *projection bias* (DellaVigna, 2009)—that is, they project a future that mirrors the present. In our case, workers mistakenly assume their sound mental health in the past will persist and that they are immune to the effect of working long hours. Given the utility function (2) and findings in psychology and behavioral economics, we assume some workers willingly overwork and incur mental disorders.

2.2 Empirical specification

Now we investigate the empirical implications derived from our model incorporating non-pecuniary utility from work and subjective weightings. We suppose that total utility in Equation (2) is unobservable, but that non-pecuniary utility from work $[N(L)]$ can be proxied by an index for job satisfaction, such as that received from being promoted. It is understood that non-pecuniary utility increases if fulltime workers attain senior positions after extensive effort and hours worked. Thus, we expect their job satisfaction rises with hours worked. To confirm this relation, we estimate this equation using panel

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[6] On the contrary, they suggest that there is no empirical evidence that people underestimate the risk of other uncertain events which are believed to be uncontrollable; such as fires, floods, earthquakes, theft, malfunctioning of durable goods etc.

data:

$$JS_{it} = \alpha_0 + \alpha_1 L_{it} + \alpha_2 L_{it}^2 + X_{it}\gamma + f_i + \varepsilon_{it}, \tag{3}$$

where JS_{it} is an index for job satisfaction of worker i in year t, L_{it} is number of hours worked, X_{it} is a vector of control variables, f_i is an individual worker's heterogeneity, and ε_{it} is an error component. We expect $\alpha_1 > 0$ and $\alpha_2 > 0$ for coefficients of work hour variables, since longer hours worked accelerates the rising satisfaction indicated as the half-U-shaped relation.

We also suppose that disutility from work in the standard utility function with the consumption constant $U(T - L|C)$ can be proxied by an index for workers' mental health. We therefore estimate the equation

$$MH_{it} = \beta_0 + \beta_1 L_{it} + \beta_2 C_{it} + X_{it}\delta + f_i + v_{it}, \tag{4}$$

where MH_{it} is an index for mental health. We expect $\beta_1 < 0$ since working long hours generates disutility.

We must consider that hours worked are not set optimally by workers but by factors such as contracts with employers, government regulations, or family matters. To control for this problem, we also estimate the following equations by adding a deviation term between desired and actual hours worked in Equations (3) and (4) as follows.

$$JS_{it} = \alpha_0 + \alpha_1 L_{it} + \alpha_2 L_{it}^2 + \alpha_3 OE_{it} + \alpha_4 UE_{it} + X_{it}\gamma + f_i + \varepsilon_{it}, \tag{3'}$$

$$MH_{it} = \beta_0 + \beta_1 L_{it} + \beta_2 C_{it} + \beta_3 OE_{it} + \beta_4 UE_{it} + X_{it}\delta + f_i + v_{it}. \tag{4'}$$

where OE_{it} and UE_{it} stand for overemployment (actual hours worked exceed desired hours) and underemployment (actual hours are fewer than desired).

3. Data

We employ data from the Survey of Companies and Employees on Human Capital Development and Work-Life Balance by the Research Institute of Economy, Trade, and Industry, which includes firms with more than 100 employees and their workers. This employee-employer matched panel survey was initiated in February 2012 and has been repeated at the same time yearly from 2013 to 2015.

The 2012 wave asked each firm to choose at least five white-collar, regular employees to be surveyed. Those employees were asked to fill in and return the questionnaire by mail. Since 2013, questionnaires are mailed directly to firms and employees surveyed in 2012. The second and third waves added refresh sampled firms, and we asked them to choose at least five white-collar, regular employees to be surveyed.

We use survey information about employees' mental health and job satisfaction, personal characteristics (e.g., education and family information), and work-related information (occupation, tenure, industry, firm size).

We asked 'How satisfied are you with job promotion?' to create a proxy variable for job satisfaction. Respondents had five choices: 1 (very unsatisfied), 2 (moderately unsatisfied), 3 (Neither satisfied nor dissatisfied), 4 (moderately satisfied), and 5 (very satisfied).

To measure employees' mental health, we use the General Health Questionnaire (GHQ). GHQ is a screening survey developed at Maudsley Hospital in London (Goldberg 1972). It is a self-completion questionnaire translated into several languages (the Japanese version is translated by Nakagawa and Ohbo 1985) and used worldwide for decades. Our survey uses the abbreviated version of GHQ (GHQ-12,[7]

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[7] The GHQ is consisted of 60 questions in total, however, in order to lighten respondents' load, there are some simplified versions, such as the GHQ-28 and the GHQ-12 which consists of 28 and 12 questions respectively.

which poses 12 questions). Respondents were asked to characterize their feelings over the past few weeks from four choices: 'not at all,' 'no more than usual,' 'rather more than usual,' and 'much more than usual.'

Question: Have you recently…
1. been able to concentrate on whatever you're doing?
2. lost much sleep over worry?
3. felt that you were playing a useful part in things?
4. felt capable of making decisions about things?
5. felt constantly under strain?
6. felt you couldn't overcome your difficulties?
7. been able to enjoy your normal day-to-day activities?
8. been able to face up to problems?
9. been feeling unhappy or depressed?
10. been losing confidence in yourself?
11. been thinking of yourself as a worthless person?
12. been feeling reasonably happy, all things considered?

To construct an index for mental health status, we use Likert scoring: 0,1,2,3 for 'much more than usual,' 'rather more than usual,' 'no more than usual,' and 'not at all,' respectively. Totals range from 0 to 36 with higher scores implying better mental health.[8] Although GHQ scoring[9] is generally used in epidemiology, Banks et al. (1980) argue Likert scoring is more appropriate for parametric analysis.

To construct the deviation term between actual and desired hours worked, we asked 'Would you like to increase/decrease number of hours worked given your current wage rate?' and 'If so, by how many hours?' We converted responses indicating the desired number of hours (increases and reductions) into variables for overemployment

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[8] As GHQ is customarily calculated, a lower score indicates better mental health. We score GHQ inversely for easier comparison with estimation results for job satisfaction.

[9] Another common scoring method is the GHQ scoring (0-0-1-1). Responses "Not at all" and "No more than usual" are scored 0, and responses "Rather more than usual" and "Much more than usual" are scored 1. Total scores span 0 to 12.

and underemployment. We entered 0 for both terms when respondents indicated they preferred no change in hours worked. We dropped responses indicating 'Do not know' from the sample. Summary statistics of data used in the following estimation appear in Table 1.

4. Empirical results

4.1 Job satisfaction and the number of hours worked

We first look at estimation results of Equation (3), which investigates the effect of hours worked on job satisfaction. Covariates other than number of hours worked are non-labor income, age, tenure, dummy variables (= 1 if respondents are married and have children and 0 otherwise), occupation, industry, scale, and year dummies. We also include deviation terms between actual and desired hours worked, taking into consideration that not everyone can choose his or her desired number of hours. FE and RE in Table 2 stand for the fixed- and random-effects models, respectively. We estimated both effects, and only models selected by the Hausman test appear in each column.

Columns (1) and (2) of Table 2 indicate that number of hours worked exerts nonlinear effects on job satisfaction at 1% significance. Estimated coefficients of hours worked imply that workers' job satisfaction deteriorates with an increase in number of hours worked, but increases beyond a certain number of hours worked. In Figure 4, to visualize the nonlinearity between job satisfaction and hours worked, we plot the relationship based on estimated coefficients in Column (2). Figure 4 shows that job satisfaction does not differ significantly for 40 to 55 hours worked but increases dramatically above 55 hours.

Similar relationships between job satisfaction and hours worked appear in Column (3), which includes dummies for hours worked instead of continuous variables. Job satisfaction among respondents working 40 to 55 hours is significantly lower than

among respondents working fewer than 40 hours (indicated by the dummy for work hours). However, differences in job satisfaction are small among respondents who work 40 to 55 hours. Results from a *t*-test indicate we cannot reject the null-hypothesis that differences in coefficients of hours worked (40–45, 45–50, and 50–55 hours) are 0 at 1% significance. Thus, we suppose job satisfaction is unchanged among respondents who work 40 to 55 hours.

However, Column (3) in Table 2(1) indicates that job satisfaction starts to rise among respondents who work more than 55 hours: the coefficient of the dummy for more than 65 hours worked does not differ significantly from 0. This result indicates that job satisfaction among respondents who work more than 55 hours per week is no less than among the reference group (less than 40 hours per week).

Since we use the likelihood of promotion to measure job satisfaction, we determine the relationship between probability of promotion and hours worked. Table 3 presents estimation results of the random-effect probit model in which the dependent variable is scored as 1 if respondents were promoted since the previous year and 0 if not. The indicated covariates are hours worked, individual characteristics, and dummies for occupation, industry, and year. Columns (1) to (3) confirm that the longer the number of hours worked, the higher the probability of being promoted. This finding implies that the relationship between long hours and promotion may prompt people to work hyper-optimal hours.

4.2 Mental health and the number of hours worked

Table 4 presents the estimation results of Equation (4), which examines how the number of hours worked affects mental health. The dependent variable is GHQ-12 score, which represents respondents' self-assessed mental health. Covariates are non-labor income, age, tenure, dummies are scored as 1 if respondents are married and have children and 0 otherwise, occupation, industry, scale, and year dummies, deviation terms between

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actual hours worked and desired hours worked, and annual income. In all estimations, the Hausman test supports the random-effects over the fixed-effects model.

Columns (1) and (2) reveal that the coefficient of total hours worked is significantly negative (Column (1). Both coefficients become insignificant we use both total hours worked and its squared term, however. Unlike job satisfaction, no non-linear relationship is evident between hours worked and mental health.

This result is confirmed in Column (3) when we use dummy variables for hours worked. Their coefficients increase in absolute terms as number of hours worked increases. Other things being equal, self-assessed mental health of respondents who work more than 65 hours per week is 2.4 points worse than among respondents who work fewer than 40 hours.

It is important to recall that job satisfaction rises among respondents who worked more than 65 hours per week (Table 2). Working extreme hours exerts opposing effects on utility: an increase in non-pecuniary utility (higher job satisfaction) and a decrease in utility (deterioration of mental health). Therefore, Section 3 discussed, if workers overweight job satisfaction or underweight risks to mental health, they may choose to work extreme hours to enjoy higher job satisfaction but damage their mental health.

4.3 Who underestimates risks to mental health?

Finally, we investigate what type of worker is likely to hold incorrect beliefs and work extreme hours. We use two variables: personality traits (the 'big five') and regard for colleagues who suffer from mental illness.

The first variable consists in five factors that psychologists use to categorize personality traits: extraversion, neuroticism, openness to experience, conscientiousness, and agreeableness. Since the Five Factor Personality Questionnaire to calculate all five scores is incorporated in our fourth wave survey, we can use this information to construct variables for personality traits. We consider personality traits because findings

from psychology demonstrate a relation between overconfidence and personality. Schaefer et al. (2004) show that among the five factors, people who score higher for extraversion are more likely to be overconfident than people with lower scores. Since the overconfidence effect generates incorrect beliefs about risk of mental illness, we surmise that people with higher extraversion scores work long hours, given other factors are controlled.

The second variable seeks to grasp respondents' reactions to mental illness by asking how they feel about afflicted coworkers. Respondents chose among four answers: (1) That coworker could be me, since problems in the workplace create mental disturbance, (2) I am bothered because the colleague's mental illness takes a toll on other staff, (3) I am bothered because that collegues's mental illness lowers coworkers' motivation, and (4) I have no particular feelings. We assume respondents who are overconfident and/or exhibit projection bias are more likely to choose (3) and work longer hours because they underestimate their vulnerability and overweight non-pecuniary utility. Under that assumption, we estimate the following equation.

$$L_i = a_0 + P_i a_1 + F_i a_2 + X_i \gamma + \varepsilon_i, \qquad (5)$$

where L_i is the number of hours worked (log term), P_i is a vector of personality traits, F_i is a vector of variables indicating regard toward colleagues with mental issues, X_i is a vector of control variables, and ε_i is the error term. Since we have cross-section data for P_i and F_i, we estimate Equation (5) by OLS. Also, since our data are from an employer-employee matched survey, we can identify which respondent works for which firm. Thus, we also estimate Equation (5) as a firm-level fixed-effects model.

Table 6 displays the results. Regarding extraversion as one of the five personality traits, Columns (2)–(4) indicate all coefficients are positive at 5% significance. Concerning reactions to colleagues with mental issues, the coefficient is positive and significant at 5% for the dummy that takes 1 if respondents chose 'I am

bothered because that person's presence lowers coworkers' motivation.'[10] These results provide side evidence that people who hold incorrect beliefs are likely to work longer hours.

5. Conclusion

Using longitudinal data from Japanese workers, this paper investigated the relationship between overwork and mental health. Conventional labor supply theory assumes that people allocate consumption and leisure (hours worked) to maximize personal utility. However, people sometimes work excessive hours, which afflicts physical and/or mental health. We introduce into the conventional utility function non-pecuniary factors that may motivate people to work long hours even if they recognize the possibility of injuring their mental health. They included satisfaction brought about by self-realization, self-affirmation, or feeling one is needed.

Our results uncovered a non-linear relation between hours worked and job satisfaction. Job satisfaction rises among respondents who work more than 55 hours weekly. However, hours worked linearly impair workers' mental health. These findings imply that people who overvalue job satisfaction likely work excessive hours and, as a consequence, may damage their mental health.

Further, people are likely to form incorrect beliefs about risks to mental health and therefore work longer hours: *overconfidence* and *projection bias*. Because of these incorrect belief, people who overweigh non-pecuniary utility over conventional disutility of work tend to do deleterious overwork which ends up with deterioration in

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[10] Two other dummy variables for feelings are positive and statistically significant. We assume that is because respondents work more hours for reasons related to employers or contracts, not personal choice.

mental health. Since these characteristics are endemic to human nature and their consequences are prevalent in the workplace, legal and regulatory interventions such as capping hours worked may become justifiable.

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Table 1. Summary Statistics

	Mean	Std. Dev.	Min	Max
work hours	44.781	7.629	20	88.75
job satisfaction (promotion)	2.980	0.993	1	5
GHQ	14.573	5.788	0	36
nonlabor Income	213.046	277.021	0	1600
male	0.665	0.472	0	1
age	41.425	10.276	19	85
university graduates	0.495	0.500	0	1
tenure	11.555	9.261	0	46
spouse	0.641	0.480	0	1
having a child	1.050	1.077	0	6
occupation				
professional/skilled	0.185	0.389	0	1
managerial workers	0.229	0.420	0	1
clerical staffs	0.428	0.495	0	1
clerks	0.024	0.154	0	1
sales	0.116	0.320	0	1
other service workers	0.018	0.133	0	1
industry (manufacutrure=1)	0.235	0.424	0	1
firm size (number of employees)				
less than 29	0.331	0.471	0	1
less than 100	0.363	0.481	0	1
less than 500	0.265	0.442	0	1
less than 1000	0.024	0.152	0	1
more than 1000	0.017	0.130	0	1
want to increase work hours	0.063	0.243	0	1
want to decrease work hours	0.292	0.455	0	1
observations	4392			

Table 2. Job satisfaction (promotion)

	(1)	(2)	(3)
Total work hours	-0.0043**	-0.1556***	
	(0.0021)	(0.0488)	
Total work hours squared		0.0015***	
		(0.0005)	
Work hours (ref.=less than 40)			
40 to 45 hours			-0.3983**
			(0.1709)
45 to 50 hours			-0.5827**
			(0.2269)
50 to 55 hours			-0.4915**
			(0.2058)
55 to 65 hours			-0.3659
			(0.2285)
More than 65 hours			0.1085
			(0.2662)
Deviation from preferred working hours			
Underemployment	-0.3056***	0.1492	0.1350
	(0.0661)	(0.2001)	(0.2005)
Overemployment	-0.2312***	-0.1624	-0.1829
	(0.0337)	(0.1213)	(0.1237)
The number of observations	4392	4392	4392
Model type	RE	FE	FE
Adj.-R2	0.0295	0.0004	0.0005

Notes: 1. Numbers in parentheses are robust standard errors.

2. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

3. Estimation also includes non-labor income, age, education, spouse, parenthood, occupation, industry, firm scale, and year dummies.

4. FE and RE stand for fixed- and random-effects models, respectively.

Table 3. Probability of promotion (random-effects probit model)

	(1)	(2)	(3)
Total hours worked	0.0152**		
	(0.0062)		
Worked more than 55 hours		0.2927**	
		(0.1388)	
Work hours (ref.=less than 40)			
40 to 45 hours			0.1657
			(0.1531)
45 to 50 hours			0.1633
			(0.1691)
50 to 55 hours			0.4299**
			(0.1936)
55 to 65 hours			0.4798**
			(0.2142)
More than 65 hours			0.5163*
			(0.2813)
Male	0.2647*	0.2567*	0.2891**
	(0.1394)	(0.1417)	(0.1402)
Age	0.3500***	0.3541***	0.3516***
	(0.0896)	(0.0931)	(0.0897)
Age squared	-0.0041***	-0.0042***	-0.0042***
	(0.0010)	(0.0011)	(0.0011)
Tenure	-0.0171	-0.0162	-0.0160
	(0.0173)	(0.0175)	(0.0172)
Tenure squared	0.0005	0.0005	0.0005
	(0.0005)	(0.0006)	(0.0005)
University graduate	-0.1246	-0.1278	-0.1314
	(0.1025)	(0.1041)	(0.1030)
Married	-0.0804	-0.0748	-0.0889
	(0.1192)	(0.1204)	(0.1197)
Having a child	0.0524	0.0517	0.0547
	(0.0516)	(0.0522)	(0.0519)
The number of observations	4388	4388	4388
Log pseudolikelihood	-844.825	-845.946	-842.66

Notes: 1. Marginal effects. Numbers in parentheses are robust standard errors.

2. ***, **, and * indicate statistical significance at 1%, 5%, and 10%.

3. Estimation also includes occupation, industry, scale and year dummies.

Table 4. Condition of mental health

	(1)	(2)	(3)
Total work hours	-0.0794***	-0.0717	
	(0.0121)	(0.0847)	
Total work hours squared		-0.0001	
		(0.0008)	
Work hours (ref.=less than 40)			
40 to 45 hours			-0.3202
			(0.2319)
45 to 50 hours			-0.9394***
			(0.2848)
50 to 55 hours			-1.0623***
			(0.3139)
55 to 65 hours			-1.6112***
			(0.3933)
More than 65 hours			-2.4225***
			(0.5806)
Deviation from preferred working hours			
Underemployment	-0.7775**	-0.7769**	-0.7724**
	(0.3716)	(0.3714)	(0.3722)
Overemployment	-1.6029***	-1.6035***	-1.6398***
	(0.1998)	(0.2000)	(0.1994)
The number of observations	4392	4392	4392
Model type	RE	RE	RE
Adj.-R2	0.0628	0.0628	0.0614

Notes: 1. Numbers in parentheses are robust standard errors.

       2. ***, **, and * indicate statistical significance at 1%, 5%, and 10%.

       3. Estimation also includes non-labor income, annual income, age, education, spouse, parenthood, occupation, industry, firm scale, and year dummies.

       4. RE stands for random-effects model.

Table 5. Long hours worked and personality traits

	(1)	(2)	(3)	(4)
Personality Big Five				
Extraversion	0.0026	0.0034**	0.0040**	0.0046**
	(0.0017)	(0.0017)	(0.0019)	(0.0019)
Neuroticism	0.0001	0.0013	0.0014	0.0022
	(0.0020)	(0.0020)	(0.0022)	(0.0023)
Openness to experience	0.0042**	0.0042**	0.0027	0.0027
	(0.0019)	(0.0019)	(0.0021)	(0.0021)
Conscientiousness	0.0007	0.0005	0.0008	0.0007
	(0.0020)	(0.0020)	(0.0023)	(0.0023)
Agreeableness	0.0024	0.0024	-0.0005	-0.0003
	(0.0021)	(0.0021)	(0.0024)	(0.0024)
Feelings toward colleague who suffers from mental illness				
the person can be me since the main reason of mental illness		0.0346***		0.0220***
comes from boss and/or workplace problems		(0.0053)		(0.0063)
I feel troublesome since the colleague's mental illness		0.0396***		0.0219***
takes a toll on retained staff		(0.0071)		(0.0083)
I feel troublesome since the colleague's mental illness		0.0246***		0.0229**
lowers other workers' motivation at my workplace		(0.0075)		(0.0089)
The number of observations	4634	4547	4635	4547
Model type	OLS	OLS	FE	FE
R2	0.1288	0.1389	0.302	0.3081

Notes: 1. Numbers in parentheses are robust standard errors.

2. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%.

3. Dependent variable is number of hours worked in log term. Explanatory variables also include the log wage rate, non-work income, sex, age, education, tenure, spouse, child, occupation, industry, and firm scale dummies.

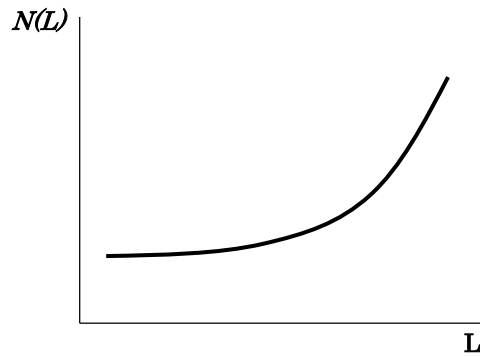4. Model type FE indicates fixed-effects estimation controlling for firm fixed effects.

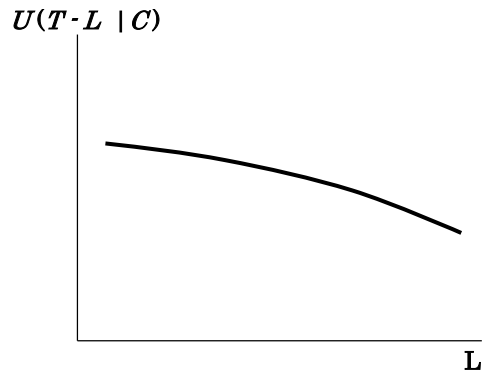# Figure 1: Workers' Compensation Insurance (Number of Applications and Approved Claims)

the number of applications   the number of recognitions
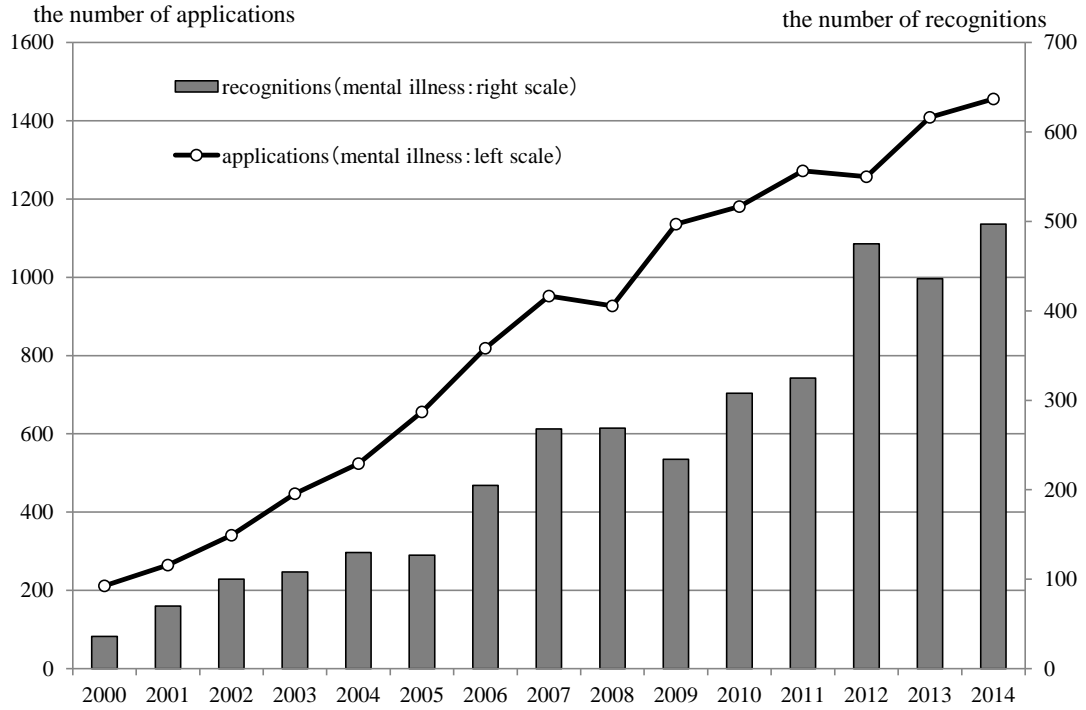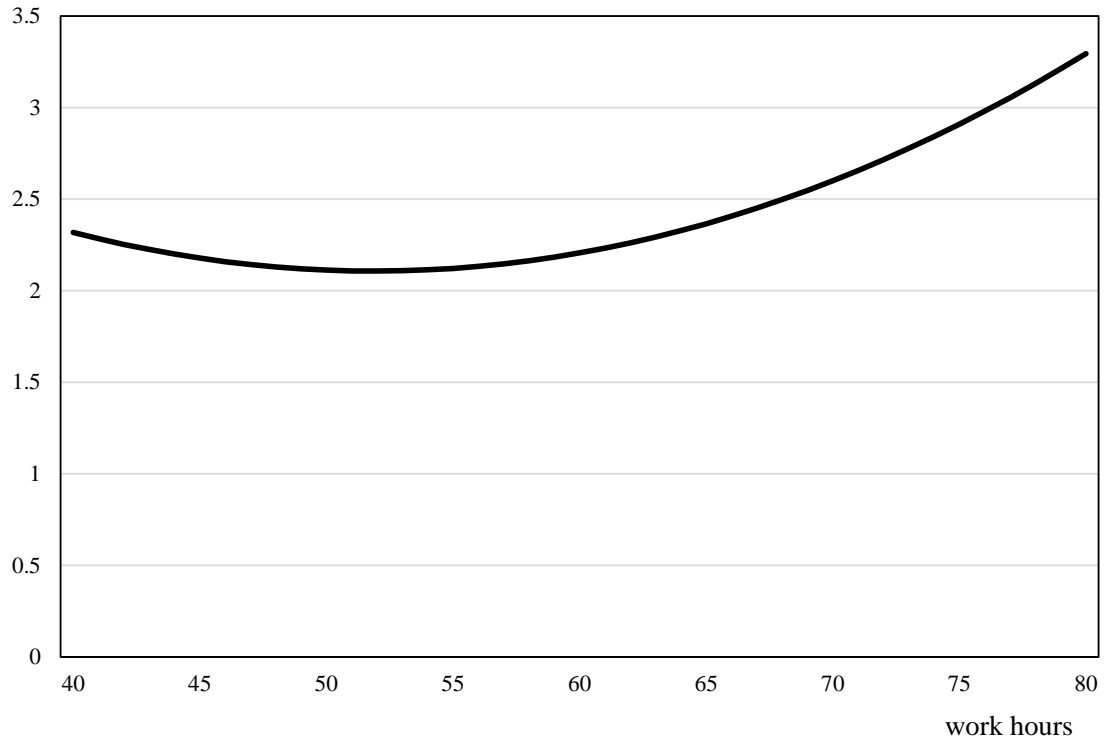

Source) Ministry of Health, Labour, and Welfare, Japan

Figure 2. Hours worked and non-pecuniary utility derived from work

Figure 3. Hours worked and utility with consumption fixed
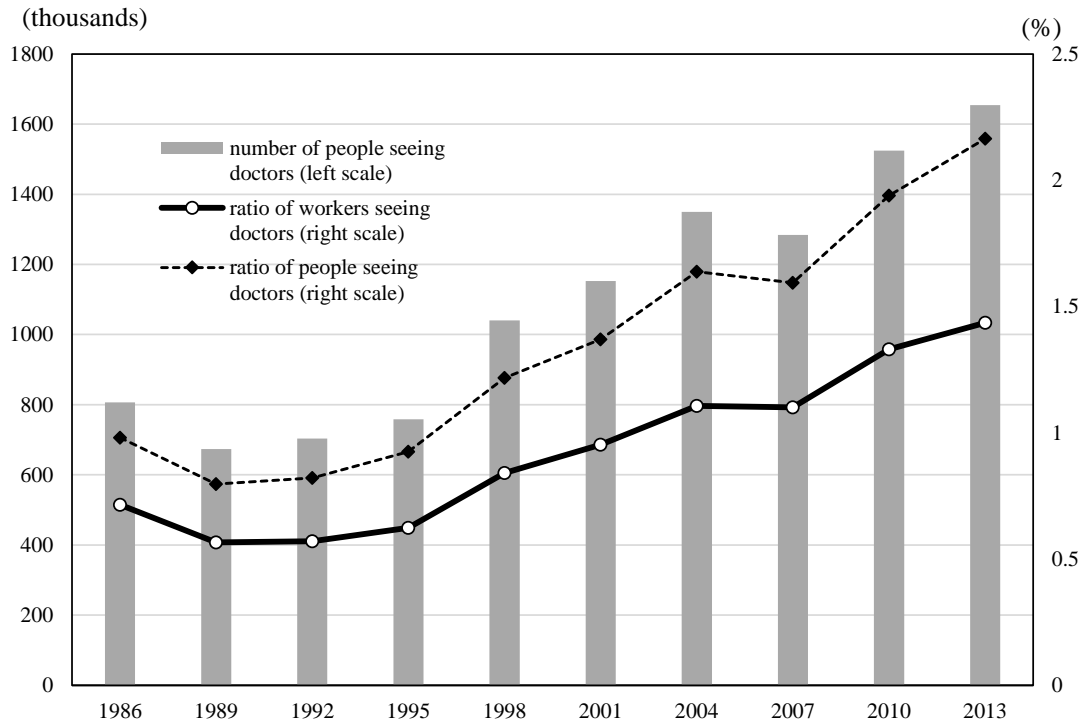
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Figure 4. Relationship between job satisfaction and hours worked

Note: Calculation based on estimation result obtained in column (2) in Table 2(1).

Appendix Figure 1. The number and ratios of people at working age (15-64) seeing doctors because of mental illness

Source: Calculated using microdata from *Comprehensive Survey of Living Conditions* (Ministry of Health, Labour and Welfare).