RIETI Discussion Paper Series 24-E-048

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RIETI Discussion Paper Series 24-E-048
April 2024

Personality Traits as Moderators of the Effects of Working Hours on Mental Health*

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Abstract

Although theoretical models of job stress have suggested that various worker characteristics and workplace conditions may moderate the effects of occupational burdens on workers' health, few studies have investigated the impact of working hours on mental health while considering individual and workplace characteristics. In this paper, we explore the impact of personality traits on the relationship between job burdens associated with long working hours and workers' mental health and evaluate these impacts over several measurement periods. Our findings are as follows. First, long working hours have more negative effects over long periods of time than over short periods. Second, people who are less extroverted and less open are more susceptible to the mental health effects associated with long overtime hours. These results suggest that company HR personnel and managers should consider the needs of employees who are less extroverted and less open, particularly if they consistently have long working hours.

Keywords: Mental health, Working hours, Overtime, Personality, Occupation
JEL classification: J08, J81, J22, I12

*This study is conducted as a part of the Project "Productivity Effect of HRM Policies and Management Quality" undertaken at the Research Institute of Economy, Trade and Industry (RIETI). The authors are grateful for helpful comments and suggestions by Sachiko Kazekami (Keio University), Kanami Tsuno (Kanagawa University of Human Services), Nobuyoshi Kikuchi (Economics and Social Research Institute, Cabinet Office), Meiji Economics Workshop participants, and Discussion Paper seminar participants at RIETI.

1. Introduction

Working hours are one of the few aspects of working conditions that have been subject to intervention by governments and labor unions (Ganster et al., 2018). OECD countries have implemented regulations on working hours to safeguard and enhance workers' health (Cygam-Rehm and Wounder 2018). Long working hours are associated with adverse health outcomes, including mental health problems (Caruso et al., 2006), and employees with increased mental health issues may have decreased productivity, potentially leading to increased economic costs. The World Health Organization (WHO) provides guidelines for mental health in the workplace and recommends that management take proactive measures to prevent workers from experiencing such mental health conditions by implementing interventions aimed at safeguarding workers' mental health (WHO, 2022).

Many empirical studies have examined the relationship between long working hours and mental health problems, predominantly within the fields of epidemiology, psychiatry, and occupational medicine. Additionally, several meta-analyses have been performed to investigate this relationship (Fujino et al. 2006; Sparks et al. 1997; Van der Hulst 2003; Virtanen et al. 2018; Watanabe et al. 2016; Rugulies et al. 2021). In recent years, some economic studies have explored the relationship between working conditions, including working hours, and workers' health status (Belloni, Carrino, and Meschi 2022; Barnay 2016; Cottini and Lucifora 2013; Sato, Kuroda, and Owan 2020). While the above studies have shown the potential association between long working hours and mental health, recent research has suggested that several additional factors impact this relationship (Tucker and Rutherford, 2005; Ganster et al., 2015: Hino et al., 2015; Marchand et al. 2015; Tsuno et al., 2019). For example, several theoretical models of job stress have posited that various worker characteristics and workplace conditions may moderate the effects of occupational burdens on workers' health (Hurell & McLaney,

1988; Karasek 1979)[2]. However, few empirical studies have investigated the impact of working hours on mental health considering individual and workplace characteristics (Vander Hulst, 2003; Ganster et al., 2018; Tsuno et al., 2019; Hino et al., 2015).

Our purpose and contribution in this paper is to examine the relationship between working hours and workers' mental health considering individual and occupational characteristics using personnel records from a Japanese manufacturing firm. Our dataset includes the results of a 122-item personality test administered by the company to its employees. This represents an advantage for our study, as the personality score data represent a broad range of personality characteristics. We focus on personality traits that may moderate the impact of job stress due to long working hours for the following reasons. Previous works have revealed that personality traits are strongly associated with a wide variety of mental health indicators, such as depression and anxiety (Ozer et al. 2006, Hakulinen et al. 2015, Strickhouser et al. 2017). The mechanism underlying this relationship can be explained by the theory of stress, suggesting that the tendency to perceive job environments as stressful is related to personality traits (Lazarus and Folkman, 1984). Consequently, individuals exposed to similar workplace conditions may exhibit diverse psychological responses due to their different personality characteristics (Makikangas and Kinnunen 2003, Marchand et al. 2006). This suggests that certain personality traits may moderate the relationship between working hours and mental health outcomes. However, few empirical studies have explored the relationship between working hours and mental health while considering the influence of personality traits (Makikangas and Kinnunen 2003; Parent-Lamarche and Marchand, 2019; Tsuno et al. 2019).

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[2] For instance, the NIOSH job stress model delineates numerous moderating factors, including individual and workplace characteristics, in the development of physical and mental illnesses (Hurrell & McLaney, 1988). Similarly, the job demand-control model (JDC model) proposes that the interplay between job demands and job decision latitude contributes to job stress (Karasek, 1979).

In addition, in this paper, we investigated the impact of long working hours over relatively long periods. Most previous research has concentrated on only a single period due to the lack of a dataset containing precise working records over extended durations. We use a longitudinal dataset from a Japanese firm that includes employees' monthly attendance records. This allows us to evaluate the relationship between employees' mental health and overtime hours over periods of up to 6 months. Investigating how long working hours over long periods affect workers' mental health may elucidate the policies related to regulating working hours by governments and management practices by companies. Moreover, by using longitudinal personnel records of a single firm, we can consider the influence of differences in tasks, workplace environments, and management styles because all employees in the dataset work for the same company, and information about their occupation and workplace is available. Furthermore, estimating the model with worker fixed effects allows us to account for unobservable individual characteristics. These advantages may lead to increased internal validity (Sato, Kuroda, and Owan 2019).

The results from our empirical analyses suggest that the effect sizes of overtime are larger for longer periods of three and six months than for the shorter period of one month. This suggests that long working hours over long periods have more negative impacts on mental health than long working hours over short periods. Furthermore, people who are less extroverted and open are more susceptible to the mental health effects associated with overtime over longer periods. This suggests that company human resource (HR) personnel and managers should consider the needs of employees who are less extroverted and open, particularly if they consistently have long working hours.

The remainder of the paper is organized as follows. Section 2 provides a survey of the related literature. Section 3 explains the dataset used in our analyses, and Section 4 presents the empirical strategy. Section 5 explains the results, and Section 6 provides a discussion and conclusions.

2. Related Literature

Theoretical models explaining stress development have emphasized the importance of the cognitive and psychological aspects of the stressor. The transactional model of stress and coping (Lazarus and Folkman, 1984) assumes that a potentially stressful event triggers an appraisal process, in which an individual evaluates whether the event is considered threatening. In the appraisal process, individual characteristics, especially personality traits, can influence how individuals perceive stressful events. This may explain why individuals' interpretations of the severity of a threat and their response to the given stimulus may vary according to personality traits, even in the case of an identical stressor. This process also applies to work stress. The extent to which work circumstances are perceived as stressful may depend in part on personality traits (Makikangas and Kinnunen, 2003; Ognska-Bulik 2006); consequently, differences in personality traits may lead to different mental health outcomes (Marchand et al., 2006). Thus, certain personality traits may moderate the relationship between working conditions and workers' mental health (Parent-Lamarche and Marchand, 2019).

According to the above discussion, we suggest that personality traits may moderate the relationship between long working hours and mental health. Specifically, with the same long working hours, a worker with certain personality traits may experience worse mental health outcomes, while a worker with other personality traits may not have this experience. However, few empirical studies have examined the interaction between working hours and personality traits on workers' mental health, and the findings have been inconsistent. Makikangas and Kinnunen (2003) showed that optimism moderated the relationships between time pressures at work, job insecurity, and poor organizational climate and mental health outcomes of female employees even after controlling for the prior well-being of the employees. Parent-Lamarche and Marchand (2019) investigated the interaction between a wide variety of working conditions, including the number of working hours and personality traits (self-esteem, locus of control, and Big Five

personality traits), and workers' well-being using data on employees at Canadian firms. Their results showed that none of the investigated personality traits could be used to explain workers' level of well-being considering working conditions. Finally, Tsuno et al. (2019) analyzed cross-sectional data on Japanese employees and found significant associations between long working hours and depressive symptoms according to workplace and employee characteristics, including neuroticism.

However, none of the above studies considered unobservable individual effects. Failure to control for unobservable individual attributes and work environment factors may introduce bias in the estimates of the impact of overtime hours on workers' mental health. Controlling for occupation type is particularly important in evaluating the relationship between personality traits and working hours. Workplace factors associated with worker distress, such as time pressure, may be unevenly distributed across occupations, resulting in varying effects of long working hours across different types of occupations (Karasek and Theorell, 1990; Marchand et al., 2006). In addition, some studies have reported an association between personality traits and occupational performance. For example, personality traits related to the Big 5 theory, such as extroversion and conscientiousness, could be used to predict sales performance (Vinchur et al. 1998; Barrick and Mount, 1991). Thus, sales workers who are not extroverted may find it particularly stressful to work long hours due to the limited rewards for their efforts. However, the above studies did not control for occupation type in their analyses. In this work, we use a longitudinal design and control for unobserved individual effects and occupation information to precisely evaluate the moderating role of personality traits on the relationship between long working hours and mental health.

Our main contributions are twofold. First, the use of highly accurate working hour data in our longitudinal study allows us to consider within-worker variations in working hours to identify causal effects of long working hours, thus enhancing the internal validity of our results. Second, the information on occupation and timing of job transfers within the

company in our dataset allows us to eliminate the effects of confounding factors that impact the influence of personality traits on the relationship between working hours and mental health.

3. Data and Methods

3.1 Data

In this paper, we use personnel records provided by a large Japanese consumer goods manufacturing company, C-Dur Corporation, which is a fictitious name used to conceal the company's identity. The data were collected from 2011-2015. The detailed characteristics of the employees at the C-Dur Corporation are explained by Sato, Kuroda, and Owan (2020), who used the same dataset. The dataset includes (1) employees' monthly attendance and working hour records, (2) responses to the employee survey, (3) employee characteristics (gender, age, education level, marital status, etc.), (4) pay and benefits records, (5) job assignment records, which include the department to which each employee belongs, and (6) aptitude test scores that include information on personality traits. Although the monthly working hours of the workers were self-reported, the HR staff investigated any cases that showed persistent differences between the self-reported leaving times and electronically recorded computer log-off times. This verification process ensures the accuracy of the monthly working hours for the workers, as described in Sato, Kuroda, and Owan (2020).

3.2 Employee's mental status

In our analyses, we used a section of the responses to the annual employee survey, which all regular employees of C-Dur Corporation answered every September. This survey included a question that asked the employees to self-assess their mental health status. The respondent chose the most appropriate description of their mental health status among the following four choices: "1. My mental status is healthy"; "2. I feel a little mental burden"; "3. I feel a considerable mental burden"; and "4. I am consulting a doctor for my mental

health problem." The answer to this question was also used as a dependent variable indicating workers' mental health status in a previous study by Sato, Kuroda, and Owan (2020), and more detailed characteristics of this variable are described in their article.

3.3 Information on employee personality traits

We used the scores of a personality test from an aptitude test administered as part of the examination for promotion to management positions at C-Dur Corporation as indicators of personality traits. As is the case in many large Japanese companies, employees in the same cohort are promoted at a similar pace until they reach their early 30s, at which point they are considered candidates for managerial positions.[3] For example, 3.57% of employees were promoted to pre-managerial jobs at age 35, while 86.36% of employees were promoted to managerial jobs at age 38 in 2015, meaning that most employees take this examination in their mid-30s. This suggests that the sample selection bias due to differences in the timing of the aptitude test is minor in our analysis[4].

C-Dur Corporation uses an aptitude test named "Cubic", which consists of two parts: a basic cognitive ability test and a personality test developed by the Japanese HR assessment company AGP Corporation. The Cubic personality test includes 123 items that assess four aspects of individual personality traits and values, including personality traits, social orientation, motivation, and values. Among these four aspects, we use the measures for personality traits and social orientation, including 20 items, as indicators of employees' personalities.

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[3] Late promotion patterns observed among Japanese firms are discussed in Aoki (1988), Prendergast (1993), Owan (2004).

[4] When the employees pass the examination for promotion, they are qualified to become a manager. If employees fail this examination, they could take the examination several times until they can pass it. The average number of tests taken per person is 3.21 in our sample.

3.4 Sample

We restrict the sample to regular white-collar workers in nonmanagerial positions who took the examination for promotion to management positions during the observation period, because personality test scores were available only in the records of employees who had taken the promotion examination. Since an individual's personality is known to be stable over time, we treat the scores as time-invariant and use the same scores in the pretest periods. However, precise working hours records were not available for employees who passed the exam and were promoted to a managerial position. Therefore, we excluded regular employees in managerial positions. To account for the possibility that personality traits may differ between employees who were promoted and those who were not, robustness checks that correct for selection bias were conducted, as described in the Appendix. We excluded employees who selected the final option in the mental health status question ("4. I am consulting a doctor for my mental health problem") in the employee survey because, according to C-Dur Corporation, workers who choose "4" were placed under special considerations, with reduced assignments and reduced working hours[5]. Finally, we only analyzed employees who were male and university or graduate school graduates due to the small number of female employees and high school graduates in our dataset.

3.5 Descriptive statistics

Table 1 shows the summary statistics for our dataset. The average age of the participants ranges from 32 to 55 years because our sample is restricted to those who have completed the promotion exam. The average overtime for one month is approximately 27.1 hours, which means that employees perform overtime work for approximately one

[5] The impact of excluding the workers who selected "4," from our analysis is expected to be minimal, because the limited number of workers. For more information, please detail Sato, Kuroda, and Owan (2020) that followed similar procedures.

hour every day. C-Dur Corporation is a highly regarded company in terms of working conditions, so the distribution of working hours has a very thin tail. The low average amount of overtime work in our dataset reflects this. Table 2 shows the summary statistics of overtime by occupation. These data suggest that average overtime hours are highest in administrative occupations, followed by sales occupations. The maximum value of overtime hours is also the largest for administrative occupations, which means that workloads may be unevenly distributed in certain administrative departments.

4. Estimation Strategy

4.1 Principal component analysis for personality scores

We conducted principal component analysis for the twenty subscales of the Cubic test to categorize similar personality measures and improve interpretability. We extracted five factors based on their eigenvalues along the criteria of eigenvalue 1 or greater. Table 3 reports the factors associated with the first five components. Each component can be interpreted according to the Big 5 personality model (McCrae and John 1992, Barrick and Mount 1991). For the first component, “high physical activity”, “proactiveness”, “cooperativeness”, “self-assurance”, “leadership”, and “sociability” have strongly positive coefficients. Thus, this component can be interpreted as the degree of agreeableness according to the Big 5 model. For the second component, “patience”, “cautiousness”, “conformist”, and “a strong sense of responsibility” have strongly positive coefficients, while “conceit”, has a negative coefficient, so this component can be considered the degree of conscientiousness according to the Big 5 model. For the third component, “acting on emotions”, “prone to worrying”, and “perplexed” have strongly positive coefficients, and this component can be considered similar to neuroticism in the Big 5 model. For the fourth component, for “aggressiveness” and “autonomy” have strongly positive coefficients, while “submissive personality” has a negative coefficient. This component can be regarded as the indicator representing extroversion in the Big 5

model. Finally, for the fifth component, for “prudence”, “introversion”, and “emotional stability” have strongly positive coefficients. Therefore, this component can be considered similar to openness in the Big 5 model. In the remainder of the paper, we refer to the first to fifth components as agreeableness, conscientiousness, neuroticism, extroversion, and openness.

Table 2 shows the summary statistics of the personality scores by occupation. The average agreeableness score is greater for sales roles than for administration, production and R&D roles, while the average conscientiousness score is lower for administration and sales roles than for production and R&D roles. The average neuroticism score is negative only for sales roles. The mean extroversion scores are positive for administration and R&D roles, and the mean openness score is negative only for sales roles.

4.2 Linear probability with fixed effects model

We convert the categorical variable representing mental health status into a binary dependent variable and develop linear probability models with fixed effects because the simple ordered logit model does not allow for the inclusion of worker fixed effects (Sato, Kuroda, and Owan, 2020). We develop the following linear probability model with individual fixed effects and interaction effects between personality traits and overtime hours, where the dependent variable is the indicator representing mental health issues.

$$Y_{it} = \beta' X_{it} + \gamma_1 Overtime_{it} + \sum_{k}^{5} \gamma_{2k} \text{Personality}_{\text{ik}} * Overtime_{it} + \alpha_i + \text{u}_{it} \quad (1)$$

Y_{it} denotes the indicator representing mental health issues, which has a value of 1 if worker *i* choses either “2. I feel a little mental burden” or “3. I feel a considerable mental

burden" in the survey and 0 if the worker chose "1. My mental status is healthy" as their mental health status in the employee survey conducted in year t. $Overtime_{it}$ denotes the total overtime hours for a certain month. We use the average overtime hours per month to compare the effect size of overtime hours for three periods: one month, three months, and six months. $\text{Personality}_{\text{ik}}$ represents the five personality scores that were calculated via principal component analysis: agreeableness, conscientiousness, neuroticism, extroversion, and openness. We also include the interaction terms between overtime hours and the five personality indicators to examine whether the relationship between mental health status and overtime hours worked depends on the employees' personality traits. X_{it} is a vector of control variables that include age, tenure, age squared, wage rate, number of working days, evaluation in year t-1, job level, year dummies, and group company dummies, and occupation types. Four occupation types were considered, sales, production, and R&D, as well as the reference category administration. α_i represents the worker fixed effect, which represents the influence of time-invariant individual characteristics on the model results. Clustered standard errors are used in the analysis.

In our analyses, we have an issue regarding attrition from the panel data since we excluded employees who were promoted to managerial positions. While nonmanagerial employees who took the promotion examination are included in our sample, such employees are removed from our sample if the employee was promoted to a managerial position, because time records are not precise for the managers in C-Dur Corporation. Therefore, we also conducted the estimation of the fixed effect model with correction for attrition bias and show the results in the Appendix and Table A1.

4.3 Hausman–Taylor model

When time-varying factors affect both overtime hours and mental health status, the fixed effect model may still show biased estimates reflecting spurious correlations between the two variables. To correct for such biases, we use the Hausman-Taylor model (Hausman

and Taylor, 1981). Unlike fixed effect models, the Hausman-Taylor model allows us to include time-invariant exploratory variables. The model is formulated as shown in the following equation.

$$Y_{it} = \beta_1' x_{1it} + \beta_2' x_{2it} + \alpha_1' z_{1i} + \alpha_2' z_{2i} + c_i + u_{it} \qquad (2)$$

x_{1it} is a vector that contains time-varying exogenous variables that are assumed to be uncorrelated with the individual unobserved effect c_i. x_{2it} is a vector that contains time-varying endogenous variables that are assumed to be correlated with c_i. z_{1i} is a vector that contains time-invariant exogenous variables that are assumed to be uncorrelated with the individual unobserved effect c_i. Finally, z_{2i} is a vector that contains time-invariant endogenous variables that are assumed to be correlated with c_i. The crucial assumption of the model is that one can distinguish sets of variables x_1 and z_1 that are uncorrelated with c_i from sets of variables x_2 and z_2 that are correlated with c_i by using prior information (Hausman and Taylor 1981, Greene 2008). Hausman and Taylor (1981) proposed a method for obtaining consistent estimators of (β, α) according to instrumental variable estimates using the group means for x_1 as instrumental variables for z_2.

Our model categorizes the explanatory variables into the above four types of variables as follows: age, tenure, age squared, tenure squared, year dummy, and company dummy are defined as time-varying exogenous regressors and included in x_1. Overtime, working days, wage rate, evaluation in the year t-1, occupation, job level and the interaction terms between personality traits and overtime are defined as time-varying endogenous regressors and included in x_2. We also include education level as a time-varying exogenous regressor in z_1 and marital status and personality traits as time-varying endogenous regressors in z_2. The dependent variable Y_{it} is the dummy variable representing mental health, as defined in Equation (1).

5. Results

5.1 Linear probability with fixed effects model

Table 4 shows the results from the analysis of the fixed-effect linear probability model. In all models, we controlled for age, tenure, age squared, wage rate, number of working days, evaluation in the year t-1, job level, year dummies, and group company dummies. Model 1 is a baseline model. In Model 2, we additionally control occupation, which is our preferred approach. Since the dependent variable is the indicator representing mental health issues, a positive coefficient for overtime hours indicates a positive association between overtime hours and reduced mental health outcomes. First, in both cases, the coefficients of overtime for 3 months and 6 months are positive and larger than that for 1 month; however, these coefficients are significant only at the 10% level. The coefficients of overtime represent an increase in the probability of experiencing mental burdens in response to a one-hour increase in overtime hours for a person with average personality scores because overtime hours and personality trait scores are mean centered. The results indicate that overtime working hours over longer periods may deteriorate workers' mental health, even after controlling for unobserved individual effects. According to our calculation using the results of Model 1, a one standard deviation increase in overtime hours, raises the probability of having worse mental health outcomes by 3.4% for 1 month of overtime, 4.8% for 3 months of overtime, and 5.1% for 6 months of overtime. This increase is notable considering the mean probability of having poor mental health outcomes for each period, with probabilities of 41.3% for 1 month of overtime, 41.0% for 3 months of overtime, and 40.6% for 6 months of overtime. This suggests that long working hours over a long period of time have a more negative impact on mental health than long working hours over a short period of time.

Second, the coefficients of the interaction term between overtime and extroversion for all periods are negative, and the terms for 1 month and 6 months are significant at the 5% level in Model 1. The coefficients of the interaction term between overtime and

openness for all periods are also negative, and the terms for 3 months and 6 months are significant at the 10% level in Model 1. Although the coefficients of the interaction terms between overtime and extroversion and openness are less significant in Model 2, the coefficients values are only slightly smaller. These results imply that employees who are more extroverted and open are less susceptible to the mental health effects associated with overtime over longer periods. For example, in the 6 months period, when either the extroversion or openness score was one standard deviation higher than the mean, the effect of overtime on mental health was essentially negligible.

5.2 Hausman–Taylor model

Table 5 shows the results from the analysis of the Hausman–Taylor model for Model 1. In all periods, we controlled for the variables used in the fixed effect model and for gender, education level, and marital status. These results are not qualitatively different from those obtained for the linear probability fixed effect models. The coefficients of overtime are positive and significant at the 10% level for periods of 3 months and 6 months, and the magnitudes of the coefficients increase with increasing period length. The coefficients of all five personality indicators are not significant. However, similar to the results shown in Table 3, the coefficients of the interaction term between overtime and extroversion are significantly negative for periods of 1 month and 6 months, and the coefficient of the interaction term between overtime and openness are negative for periods of 3 months and 6 months, although they are only weakly significant. In summary, the results reveal that employees who are less extroverted and open are more susceptible to the mental health effects associated with overtime over longer periods.

6. Discussion and Conclusion

This paper examines the impact of long working hours on workers' mental health

considering individual personality traits using personnel records provided by a large Japanese manufacturing firm. Fixed effect models controlling for workers' unobserved characteristics and occupation types and Hausman-Taylor models were developed, revealing the following findings. First, workers who have long working hours for three to six months have increased likelihoods of poorer mental health outcomes. This suggests that long working hours over long periods of time have more negative impacts on mental health than long working hours over short periods of time. This finding suggests that greater attention should be given to employees who consistently work longer hours over several months in an effort to protect workers' health. Several articles have noted the lack of investigation into the effects of long working hours over long periods on mental health (Ganster et al. 2018, Hino et al., 2015). Our findings regarding long working hours address this gap in the current literature.

Second, a greater degree of extroversion and openness may mitigate the negative effects of overtime work for longer periods on mental health. Conversely, this finding implies that employees who are less extroverted and open are more vulnerable to the mental health effects associated with longer periods of overtime. Extraversion includes traits such as sociability, orientation toward others, and optimism (Costa and McCrae, 1992). Openness refers to being intellectually curious, acting flexibly, and having an open mind (McCrae and Costa, 1985). Extroversion and openness are both associated with higher levels of well-being and lower levels of depression (Hakulinen et al., 2015; Anglim and Grant, 2016; Ha and Kim, 2013) and are strongly associated with work engagement (Fukuzaki and Iwata, 2022). Work engagement is characterized by positive emotions regarding work and may be related to decreases in psychological distress (Shimazu et al., 2015). Given the findings of previous studies, our results can be interpreted as follows: people who are less extroverted and open tend to have a lower degree of work engagement and commitment to work, so they may suffer stress due to increased overtime. This suggests that company HR personnel and managers should carefully consider the needs

of employees who are less extroverted and open, particularly if they consistently have long working hours.

Finally, we discuss the limitations of our paper. The first concerns external validity. Since our results were derived from male employees aged between 30 to 50 years who worked at a single company, our findings should be generalized with caution. As mentioned in the descriptive statistics section, no employees in our dataset had extremely long working hours. Future work should examine whether openness and extroversion mitigate the negative effects of long working hours using the data of other companies, which may contain more variation in working hours. The second limitation is related to the internal validity of the mental health measures. The mental health indicators used in this paper may not be valid because their correlations with widely used tests of mental health risk are not known; thus, our findings should be reexamined using different psychometric measures in the future. Similarly, the personality trait measures used in this paper were obtained from a unique assessment developed by a Japanese firm. Thus, the results should be reexamined using valid personality measures developed based on the Big Five model, such as the NEO PI-R (Costa and McCrae, 1992).

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Table 1. Basic Statistics

Category	Variable	Obs	Mean	Standard Deviation	Min	Max
	Age	961	43.9220	4.8057	32	55
	Tenure	961	18.8356	5.9552	1	32
	Job Rank	961	6.1925	0.3945	6	7
	Marriage	961	25.8606	0.4273	24	26
	Evaluation(L1)	961	0.8429	0.3641	0	1
	University	961	0.8075	0.3945	0	1
	Graduate School	961	0.1925	0.3945	0	1
Occupation	Administration	961	0.3933	0.4887	0	1
	Production	961	0.0354	0.1848	0	1
	Sales	961	0.3944	0.4890	0	1
	R&D	961	0.1769	0.3818	0	1
	Mental Status	961	1.4849	0.6242	1	3
	Mental Status Dummy	961	0.4152	0.4930	0	1
Personality	P1(Agreeableness)	961	0.0000	2.6499	-6.9391	6.9953
	P2(Conscientiousness)	961	0.0000	1.7133	-6.4799	4.5673
	P3(Neurotism)	961	0.0000	1.4842	-2.8744	4.7600
	P4(Extraversion)	961	0.0000	1.2135	-3.0321	3.4271
	P5(Openess)	961	0.0000	1.0255	-3.7451	3.1880
	Wage Rate	961	2434.8890	222.9188	1724.1660	3207.9160
Work Related Variables	Work days(6months)	961	122.9136	4.1865	105	144
	Overtime(6months)	961	172.5172	88.1805	0	590
	Work days(3months)	961	64.1207	2.2347	50	74
	Overtime(3months)	961	87.1374	46.8279	0	340
	Work days(1months)	961	21.1540	1.4969	14	26
	Overtime(1months)	961	27.8054	16.0463	0	118

Table 2. Average Overtime and Personality Score by Occupation

		Overtime (1months)	Agreeableness	Conscientiousness	Neuroticism	Extraversion	Openess
Administration	Mean	31.437	-0.372	-0.069	0.084	0.004	0.011
(N=378)	Standard Deviation	19.467	2.624	1.581	1.524	1.114	1.046
	Min	0.000	-6.939	-4.170	-2.874	-2.889	-2.995
	Max	118.000	6.390	3.586	3.205	3.327	2.989
Production	Mean	22.765	-0.639	1.096	0.476	-0.042	0.485
(N=34)	Standard Deviation	12.915	3.880	1.039	1.595	1.068	1.255
	Min	2.000	-4.970	-0.719	-1.943	-1.993	-1.075
	Max	46.000	5.204	2.492	2.425	1.166	2.787
Sales	Mean	27.797	0.762	-0.108	-0.130	-0.151	-0.110
(N=379)	Standard Deviation	12.117	2.480	1.895	1.428	1.189	1.053
	Min	0.000	-6.087	-6.480	-2.874	-3.032	-3.745
	Max	64.000	6.995	4.567	4.760	2.776	2.399
R&D	Mean	20.759	-0.744	0.173	0.008	0.337	0.124
(N=170)	Standard Deviation	13.105	2.363	1.597	1.474	1.429	0.809
	Min	0.000	-6.747	-4.049	-2.632	-1.800	-1.428
	Max	69.000	3.258	3.549	3.224	3.427	3.188

Table 3. Principal
Component Analysis on Personality Scales (Cubic): Factor Loadings

Scale	Comp1	Comp2	Comp3	Comp4	Comp5
High physical activity	0.3094	0.0177	0.0353	-0.2181	-0.1149
Proactiveness	0.3577	0.0477	0.0688	-0.0976	0.0527
Cooperativeness	0.2973	0.1189	0.1696	-0.2768	-0.0039
Self-assurance	0.3220	0.0283	-0.1145	-0.0344	0.2940
Leadership	0.3080	0.0800	0.1940	0.0373	0.0233
Sociability	0.2830	0.0569	0.2303	-0.2335	-0.0253
Patience	0.1794	0.4099	0.1143	0.1226	-0.1406
Cautiousness	-0.0999	0.3254	0.2165	0.2633	-0.1937
Conformist	-0.1823	0.3060	0.2200	-0.1722	-0.0408
Conceit	0.0559	-0.3394	0.1643	-0.0615	-0.3397
A strong sense of responsibility	0.1461	0.4304	-0.0258	0.1739	-0.2527
Acting on emotions	0.0734	-0.3213	0.3487	-0.2701	0.2070
Prone to worrying	-0.2663	0.0467	0.3263	0.1355	0.0250
Perplexed	-0.1584	-0.0818	0.4379	0.1166	0.1893
Aggressiveness	0.2195	-0.2052	0.1828	0.2673	-0.0801
Submissive personality	-0.2240	0.2437	0.0803	-0.4221	0.0514
Autonomy	0.2332	-0.1985	-0.0332	0.4753	-0.0668
Prudence	0.1500	0.1120	0.3134	0.2101	0.3009
Introversion	-0.1265	0.0688	0.1627	0.1889	0.4983
Emotional stability	0.1293	0.1859	-0.3741	0.0306	0.4759
Eigenvalue	6.8136	3.1735	2.4930	1.6052	1.1702

Table 4. Estimation for linear probability with fixed-effects model

	Model 1			Model 2		
Variable	1 month	3 months	6 months	1 month	3 months	6 months
Overtime	0.0021	0.0031*	0.0034*	0.0023*	0.0032*	0.0032*
	[0.0014]	[0.0017]	[0.0019]	[0.0013]	[0.0016]	[0.0019]
Agreeableness × Overtime	-0.0001	-0.0004	-0.0002	0.0000	-0.0003	-0.0002
	[0.0006]	[0.0007]	[0.0008]	[0.0006]	[0.0007]	[0.0007]
Conscientiousness × Overtime	-0.0003	-0.0001	0.0003	-0.0004	-0.0002	0.0002
	[0.0009]	[0.0011]	[0.0012]	[0.0008]	[0.0011]	[0.0012]
Neurotism × Overtime	0.0011	0.0011	0.0008	0.0010	0.0008	0.0004
	[0.0008]	[0.0010]	[0.0010]	[0.0008]	[0.0010]	[0.0011]
Extraversion × Overtime	-0.0026**	-0.0019	-0.0028**	-0.0021*	-0.0013	-0.0023
	[0.0012]	[0.0013]	[0.0014]	[0.0013]	[0.0014]	[0.0016]
Openess × Overtime	-0.0012	-0.0024*	-0.0030*	-0.0011	-0.0022	-0.0027*
	[0.0014]	[0.0014]	[0.0016]	[0.0013]	[0.0014]	[0.0016]
Controls:						
Occupation	No	No	No	Yes	Yes	Yes
Occupation × Overtime	No	No	No	No	No	No
Age, Squared age, job level	Yes	Yes	Yes	Yes	Yes	Yes
Evaluation, company dummy	Yes	Yes	Yes	Yes	Yes	Yes
Wage rate, working days	Yes	Yes	Yes	Yes	Yes	Yes
Observation	961	960	959	961	960	959

Notes: Robust standard errors are reported in parentheses. * p<.1; ** p<.05; *** p<.01.

Table 5. Estimation for Hausman-Taylor model

Variable		*Model 1*		
		1 month	3 months	6 months
Overtime		0.0021	0.0031*	0.0034*
		[0.0014]	[0.0017]	[0.0019]
P1(Agreeableness)		-0.0276	-0.0311	-0.0704
		[0.2055]	[0.2063]	[0.2324]
P1(Agreeableness) × Overtime		-0.0001	-0.0004	-0.0002
		[0.0006]	[0.0007]	[0.0008]
P2(Conscientiousness)		-0.4118	-0.3979	-0.4515
		[0.3511]	[0.3510]	[0.3768]
P2(Conscientiousness) × Overtime		-0.0003	-0.0001	0.0003
		[0.0009]	[0.0011]	[0.0012]
P3(Neurotism)		-0.0557	-0.0534	-0.0407
		[0.4815]	[0.4950]	[0.5237]
P3(Neurotism) × Overtime		0.0011	0.0011	0.0008
		[0.0008]	[0.0010]	[0.0010]
P4(Extraversion)		-0.2866	-0.3128	-0.3541
		[0.3987]	[0.3987]	[0.4507]
P4(Extraversion) × Overtime		-0.0026**	-0.0019	-0.0028**
		[0.0012]	[0.0013]	[0.0014]
P5(Openess)		0.4534	0.4368	0.5001
		[0.4458]	[0.4319]	[0.4677]
P5(Openess) × Overtime		-0.0011	-0.0024*	-0.0030*
		[0.0014]	[0.0014]	[0.0016]
Sargan-Hansen Statistic				
	F value	0.4350	0.5640	0.5770
	P value	0.9943	0.9896	0.9890
Controls:				
Occupation		No	No	No
Occupation × Overtime		No	No	No
Age, Squared age, job level		Yes	Yes	Yes
Evaluation, company dummy		Yes	Yes	Yes
Wage rate, working days		Yes	Yes	Yes
Observation		961	960	959

Notes: Robust standard errors are reported in parentheses. * p<.1; ** p<.05; *** p<.01.

Appendix

Correction for Attrition Bias

Wooldridge (2002) proposed a method for correcting for attrition bias. In the method, we assume that once a person is removed from the data, the person is completely removed. We apply the method for correcting for attrition bias developed by Wooldridge (2002) with the Mundlak approach of controlling for fixed effects (Mundlak, 1978) and present the following model:

$$y_{it} = \beta' x_{it} + c_i + u_{it}\,, \qquad c_i = \bar{x}_i + \tau\eta_i,\ \ \eta_i \sim N(0,1) \tag{A1}$$

$$s_{it} = 1[\theta_i + \sigma_t' w_{it} + v_{it} > 0\ ]\,, \tag{A2}$$

$$\theta_i = \bar{w}_i + \tau\varepsilon_i, \qquad \varepsilon_i \sim N(0,1),$$

$$v_{it} | \{x_{it}, w_{it}, s_{i,t-1}\} \sim Normal(0,1) \tag{A3}$$

$$E[u_{it} | x_{it}, w_{it}, s_{i,t-1}] = \rho_t v_{it} \tag{A4}$$

Equation (A1) is the linear unobserved effects model. x_{it} is the vector that includes all the explanatory variables and interaction terms with overtime hours used in Equation (1), and $\bar{x}_i$ is the time average of x_{it}. Equation (A2) is the selection equation. s_{it} is the selection indicator, which has a value of 1 when individual *i* is in the dataset, that is, the employee is in a nonmanagerial position, and a value of 0 when individual *i* is removed from the sample, that is, the employee was promoted to a managerial position. Since the model neglects samples once they initially leave the sample, s_{it}= 1 means s_{ir}= 1 for *r* < *t*. w_{it} is a vector that contains variables observed at time *t* for all units with $s_{i,t-1}$ =1. We define w_{it} as the vector that contains age, age squared, tenure, tenure squared, year, evaluation in the year t-1, and wage rate information. We also include the job level in the year t-1, the number of promotion examinations taken, and the number of transfers within the firm as exogenous variables that are not included in the second step estimation in w_{it}. $\bar{w}_i$ is the time average of w_{it}. The model also assumes that the relationship between u_{it}

and v_{it} in Equation (A4) follows a standard linear functional form. In accordance with Wooldridge (2002), we apply the Heckman 2 step estimation to the above model. In the first step, we estimate σ_t in Equation (A2) with a probit model and derive the inverse Mills ratio, $\lambda(\widehat{\sigma_t' w_{it}})$. In the second step, we apply pooled OLS of y_{it} on x_{it}, $\widehat{\lambda_{\iota,2012}}$, $\widehat{\lambda_{\iota,2013}}$, $\widehat{\lambda_{\iota,2013}}$, $\widehat{\lambda_{\iota,2013}}$, $\widehat{\lambda_{\iota,2014}}$, and $\widehat{\lambda_{\iota,2015}}$. The standard errors are estimated using bootstrapping.

Table A1 shows the results for the model after applying the above sample selection correction. These results are not largely different from those obtained with the linear probability model (Table 4). Thus, the sample selection problem resulting from excluding employees who had been promoted to managerial positions may not have had a substantial impact on the model results.

Table A1. Estimation for Fixed Effect Model with Attrition Correction

Variable	*Model 1*			Model 2			Model 3		
	1 month	3 months	6 months	1 month	3 months	6 months	1 month	3 months	6 months
Overtime	0.0019	0.0031*	0.0034*	0.0021	0.0032*	0.0032*	0.0029	0.0036	0.0042
	[0.0015]	[0.0018]	[0.0021]	[0.0015]	[0.0017]	[0.0019]	[0.0024]	[0.0023]	[0.0026]
P1(Agreeableness) × Overtime	-0.0003	-0.0004	-0.0002	-0.0002	-0.0003	-0.0002	-0.0001	-0.0004	-0.0001
	[0.0007]	[0.0008]	[0.0008]	[0.0007]	[0.0009]	[0.0009]	[0.0007]	[0.0008]	[0.0008]
P2(Conscientiousness) × Overtime	-0.0003	-0.0001	0.0004	-0.0004	-0.0002	0.0003	-0.0002	0.0000	0.0005
	[0.0009]	[0.0010]	[0.0012]	[0.0008]	[0.0010]	[0.0011]	[0.0008]	[0.0009]	[0.0010]
P3(Neurotism) × Overtime	0.0002	0.0012	0.0010	0.0001	0.0009	0.0007	0.0001	0.0008	0.0006
	[0.0009]	[0.0010]	[0.0011]	[0.0010]	[0.0010]	[0.0012]	[0.0010]	[0.0009]	[0.0011]
P4(Extraversion) × Overtime	-0.0027**	-0.0021*	-0.0033**	-0.0022	-0.0015	-0.0026*	-0.0021	-0.0011	-0.0022
	[0.0013]	[0.0012]	[0.0013]	[0.0014]	[0.0013]	[0.0016]	[0.0015]	[0.0013]	[0.0015]
P5(Openess) × Overtime	-0.0014	-0.0026	-0.0032*	-0.0012	-0.0023	-0.0030*	-0.0008	-0.0017	-0.0021
	[0.0017]	[0.0016]	[0.0018]	[0.0021]	[0.0019]	[0.0018]	[0.0019]	[0.0016]	[0.0016]
Controls:									
Occupation	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Occupation × Overtime	No	No	No	No	No	No	Yes	Yes	Yes
Age, Squared age, job level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Evaluation, company dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wage rate, working days	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1,214	1,214	1,214	1,214	1,214	1,214	1,214	1,214	1,214

Notes: Robust standard errors are reported in parentheses. * p<.1; ** p<.05; *** p<.01.