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Good Boss, Bad Boss, Workers' Mental Health and Productivity:
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Abstract

It is widely believed that the relationship between a supervisor and his/her employees greatly affects employees' well-being and/or productivity. However, only a few papers in the economics literature analyze how supervisors influence employees' well-being and enhance productivity. This paper uses longitudinal data of employees with information about their immediate bosses' ability, management skills, and characteristics (such as competency, communication skills, and personality traits) to investigate the influence of supervisors on employees. The main findings are as follows. First, even after controlling for individual-specific fixed effects and other job characteristics, such as those proposed in the job strain model, we find that supervisors' good communication with staff and competency in managerial tasks significantly improve employees' mental health. Second, we find that good communication between the boss and his/her staff enhances the latter's productivity and lowers presenteeism. Third, supervisors' bad communication and low competency increase the probability of quitting. Fourth, good communication partially depends on boss-staff compatibility, which is governed in part by their combined personality traits.

Keywords: Supervisors, Workplace relationships, Supervisor competence, Workplace communication, Mental health, Productivity, Employee retention

JEL classification: I10, J24, J28, J63, M54

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1. Introduction

Every community in an industrialized society is guided by a leader, supervisor, or boss. Although it is widely assumed that leaders affect organizational performance, only a few empirical studies in the economics literature have focused on the relationship between bosses and their workers in a general workplace setting (e.g., Artz et al. [2016]). For instance, previous researchers in the economics field have focused on specific designations, such as school principals, sports coaches, and CEOs, to identify the importance of leadership on performance.²

Moreover, many advanced economies have started paying heed to mental health problems of employees. For example, OECD (2012) reports that, on average, around 20% of the working-age population in OECD countries suffers from a mental disorder in a clinical sense. However, very few economics literature³ has investigated the mental health problem thoroughly.

This paper contributes to the literature on economics by bridging these two issues. Specifically, we study the effect of bosses on 1) their employees and 2) workers' mental health. For example, we try to answer specific queries such as does workers' mental health depend on their boss's quality of management? If a good boss makes his/her workers happier, are there any specific factors that enhance their productivity? To answer these questions, we investigate the effect of supervisors' management, communication, and capability on workers' mental health and productivity using two-year longitudinal data of Japanese full-time white-collar workers.

² For example, Branch et al. (2013) provide evidence of the importance of school leadership by estimating individual principals' contributions to growth in student achievement. Goodall et al. (2011) analyze the data of basketball players and coaches and report a correlation between a player's brilliance and the winning percentage and playoff success of that person as a team coach in later periods. Using data from the top-100 U.S. hospitals in 2009, Goodall (2011) classify the CEOs as physician managers and non-physician managers, and find a strong positive association between the ranked quality of a hospital and whether the CEO is a physician. All of these findings suggest that the quality (job competency) of a boss affects organizational performance.

³ Although the corresponding studies in the economics literature are scant, several researchers in other areas have analyzed the effects of work-related factors on employees' mental health. For example, the job demands-resources model in the occupational health literature suggests that *resources* at the workplace are important for workers' well-being. Job resources include, for example, pay, career opportunities, job security (at the organization level), supervisor's feedback, coworker's support, and team climate (at the interpersonal and social relations levels).

Among the few economics papers that assess the effect of bosses,⁴ that of Lazear et al. (2015) and Artz et al. (2016) match our concerns the best. Lazear et al. (2015) investigate the relationship between the quality of a boss and the productivity of his/her subordinates, while Artz et al. (2016) focus on the relationship between a boss's competency and his/her workers' happiness. Using personnel data of the individual productivity of workers within a large service company, Lazear et al. (2015) find that replacing a boss who falls within the lower 10% of boss quality with one who ranks within the upper 10% of quality increases the team's total output by an amount greater than that derived by adding one worker to a nine-member team. Using data of workers from the US and the UK, Artz et al. (2016) report that a boss's technical competency is the single strongest predictor of a worker's job satisfaction.⁵ Our paper adds to the empirical

⁴ Certain papers in the occupational health literature focus on the influence of a boss on his/her workers' well-being. For example, Schonfeld (2001) reports that the support of supervisors and colleagues directly affects job satisfaction of newly hired female teachers. Using data of the work demands of Swedish male and female employees, decision authority, as well as support and conflicts at work, Magnusson et al. (2009) conduct a 3-year follow-up study and report that male employees' conflicts with fellow workers are associated with depressive symptoms in later years. However, support from fellow workers lowers this possibility for female workers. Stoetzer et al. (2009) conduct a Swedish cohort study and also find that problematic interpersonal relationships at work can be determinants of depression. Using data of Finnish employees, Sinokki et al. (2009) report that low social support at work is associated with a 12-month prevalence of depressive or anxiety disorders. Kivimäki et al. (2003) and Rugulies et al. (2012) study the effects of bullying at the workplace on employee mental health. For a general survey of work-related factors, including leadership and well-being, see also Kelloway and Barling (2010) and Theorell et al. (2015), who review the occupational health psychology literature.

⁵ Oswald et al. (2015) also report information of our interest; although they do not directly investigate the effects of bosses on employees, they focus on whether workers' happiness enhances their productivity. Oswald et al. (2015) use laboratory experiments (simple piece-rate settings) to show that happier people are likely to be more productive. The relationships between employees' moods at work and organizational outcome variables, including employee task performance, have gained increasing attention in the psychology literature over the past two decades. For example, using data of Taiwanese insurance sales agents, Tsai et al. (2007) report that employees' positive moods can help predict task performance indirectly through both interpersonal (helping other coworkers and receiving help from coworkers) and motivational (self-efficacy and task persistence) processes. For a literature review in this area, see Tsai et al. (2007). Another active area of research extends the importance of "work engagement." The opposite of "burn out," work engagement consists of three factors: dedication, absorption, and vigor toward work. Improving work engagement is believed to improve workers' mental health and firms' profits by increasing worker motivation (Schaufeli et al. [2002]). Also refer to Salanova et al. (2005) and Xanthopoulou et al. (2009). Note that while many more studies exist in

evidence of these seminal studies by investigating the relationship of a boss's management, communication, and capability with his/her workers' mental health and productivity.

Our paper is unique for the following four points. First, we investigate workers' well-being using a mental health scale instead of job satisfaction. We employ the General Health Questionnaire (GHQ), which is globally used in epidemiological studies. Second, we use the data of workers employed in different types of companies. Third, we evaluate workers' productivity using two measures: 1) the presenteeism scale, which is popularly used in epidemiological and occupational health studies; specifically, we employ the Work Productivity and Activity Impairment (WPAI) Questionnaire, and 2) worker retention. Fourth, we also use information of both supervisors' and subordinates' attributes, including personal traits, to investigate whether a combination of these attributes or the compatibility of personal traits enhances communication between the two parties. Fifth, unlike the studies in other related areas, such as occupational health psychology, we take individual-specific fixed effects into account to control for individual differences.

Our main findings are as follows. First, even after controlling for individual-specific fixed effects and other job characteristics, such as those proposed in the job strain model in the occupational health psychology literature, we find that supervisors' good communication with subordinates and competency at managerial tasks significantly improve employees' mental health. Second, we observe that good communication between the boss and his/her staff enhances the latter's productivity and lowers presenteeism. Third, supervisors' bad communication and low competency increase the probability of quitting. Fourth, good communication, such as that brought about by a combination of personality traits, partially depends on boss-worker compatibility.

This paper proceeds as follows. Section 2 explains our simple theoretical framework to assess how supervisors' management, communication, and capability influence worker's well-

this area, most of them mainly analyze the possible existence of a correlation between the concerned variables; they do not strictly control other factors. Nor do they pay heed to unobserved heterogeneity and reverse causality. Therefore, it is worth investigating these issues using economics method.

being and productivity. Section 3 explains the study's data and provides details of the measures used in the estimation. Section 4 presents the empirical results, and Section 5 concludes the paper.

2. Theoretical Framework

2.1 Human Capital and Effort

We first consider an output of individual worker i at time t , Q_{it} , which is determined as the product of human capital, H_{it} , and effort level, E_{it} as the equation (1).⁶

$$Q_{it} = H_{it} \times E_{it} \quad (1)$$

Second, as seen in equation (2), we assume that human capital depends on the accumulated skills taught by and learned from current and previous supervisors, and other skill-related factors such as experiences, X_{it} , and innate ability, α_i . Note that the worker's skills are, in part, accumulated through supervisors' capability, B_{it}^C , which includes their competency and knowledge of subordinates' jobs.

$$H_{it} = H(B_{it}^C, X_{it}, \alpha_i) \quad (2)$$

Third, we assume that the worker's effort level, E_{it} , depends on personality traits such as conscientiousness and diligence, γ_i , as well as his/her effort induced by the current supervisor's management and communication skills, B_{it}^M , as in equation (3).

$$E_{it} = E(B_{it}^M, \gamma_i) \quad (3)$$

It is understood that a workers' effort is highly correlated with his/her engagement and motivation toward work, which can vary depending on the supervisor's management and communication skills. For example, proper evaluation feedback, sharing of necessary information, and good communication would enhance the worker's motivation and self-efficacy. On the contrary, bad

⁶ The framework introduced in section 2 is partially adapted from Artz et al. (2015) and Lazear et al. (2015).

communication (including ignorance or harassment) would discourage the worker from performing well.

Substituting equations (2) and (3) into equation (1) yields

$$Q_{it} = q(B_{it}^C, B_{it}^M, X_{it}, \alpha_i, \gamma_i) \quad (4)$$

Equation (4) implies that output (productivity) depends on human capital and effort, which varies depending on not only individual workers' ability, personality, and other skill-related factors including experience (α_i , γ_i , and X_{it}), but also on his/her boss's capability and management skills (B_{it}^C and B_{it}^M , respectively).

Next, consider that the output is divided among a worker, a supervisor, and an employer. Assume that the worker gets a share φ of the output. The remainder goes to the supervisor and employer. Therefore, the worker is able to consume amount φQ_{it} . Then, the conventional neoclassical utility function, $V_{it} = U(C, F)$, where C denotes consumption and F denotes leisure, is modified as follows.

$$V_{it} = U(C_{it}, F_{it}) = U(\varphi Q_{it}, F_{it}) \quad (5)$$

The utility function shown in equation (5) refers to φQ_{it} , which includes an individual worker's ability, including general skills acquired during school education, personality, and other skill-related factors such as experience (α_i , γ_i and X_{it}), and human capital accumulated through the boss's capability and effort induced by management skills (B_{it}^C and B_{it}^M , respectively).

2.2 Estimation Methods

In this subsection, we investigate the empirical implications derived from section 2.1. Regarding the utility function in equation (5), we assume that total utility can be proxied by an index for mental health and estimate the following equation using panel data:

$$MH_{it} = \beta_0 + \beta_1 L_{it} + \beta_2 B_{it}^C + \beta_3 B_{it}^M + \mathbf{X}_{it} \boldsymbol{\delta} + f_i + v_{it} \quad (6)$$

where MH_{it} denotes an index for mental health of worker i in year t , L_{it} refers to number of hours worked, C_{it} indicates consumption, B_{it}^C denotes the current supervisor's capability, B_{it}^M refers to the current supervisor's management and communication skills, \mathbf{X}_{it} indicates a vector of control variables including skill-related factors, f_i represents a time-invariant individual worker's heterogeneity (including innate ability and personality), and v_{it} refers to an error component. We expect $\beta_2, \beta_3 < 0$ since the current supervisor's competency, management, and communication skills improve workers' well-being by increasing their productivity through human capital and effort. \mathbf{X}_{it} includes hourly wage rate in order to capture a worker's accumulated skills acquired because of previous supervisors and a share of the output φ , which reflects the worker's bargaining power.

Regarding the output function in equation (4), we use an index of subjective productivity measure to proxy output Q_{it} and estimate the following equation using panel data:

$$PD_{it} = \mu_0 + \mu_1 B_{it}^C + \mu_2 B_{it}^M + \mathbf{X}_{it} \boldsymbol{\delta} + f_i + v_{it}, \quad (7)$$

where PD_{it} denotes an index for the subjective productivity of worker i in year t , B_{it}^C and B_{it}^M are the same as in equation (6), and \mathbf{X}_{it} denotes a vector of control variables. \mathbf{X}_{it} includes hourly wage rate and the number of hours worked in order to capture a worker's accumulated skills acquired by previous supervisors, and accumulated fatigue, which may influence productivity. f_i denotes a time-invariant individual worker's heterogeneity, and v_{it} refers to an error component. We expect $\mu_1 < 0$ and $\mu_2 < 0$ since a supervisor's capability, management, and communication skills decrease presenteeism and enhance productivity.

In general, individual-specific factors are often correlated with other covariates, and thus result in inconsistent estimates via the ordinary least squares (OLS) approach. Therefore, equations (6) and (7) are estimated by the fixed effects model, using the longitudinal data that enable us to account for the time-invariant individual-specific factors.

3. Data and variables

3.1 Data

We use an original survey, namely, the Survey of Companies and Employees on Human Capital Development and Work-Life Balance conducted by the research project at the Research Institute of Economy, Trade and Industry (RIETI).⁷ Both authors of this study are members of the project and engaged in designing the survey, including the contents of the questionnaires. The survey is an employer–employee matched panel survey conducted via mail with questionnaires directed toward both the human resource departments of firms (with more than 100 employees) and the employees who work at those firms. The first wave was initiated in February 2012 and has been repeated at the same time yearly from 2013 to 2016, resulting in five waves in total for this study.

The first wave in 2012 was administered to firms with more than 100 employees. Each firm was randomly selected from the registration data held by the Ministry of Economy, Trade and Industry of the Japanese Government, and the human resource departments of each firm were asked to choose at least five white-collar regular employees to participate in the employee survey. Both firms and employees were asked to fill in and return the questionnaire by mail. The first wave collected information from 719 of 5,677 firms (representing a response rate of 12.7%) and 4,439 matched employees. The questionnaires for the second wave were mailed directly to the firms and employees surveyed in 2012. The second and fourth waves added new firms, which were asked to choose at least five white-collar regular employees to be surveyed.⁸

In this study, we use information collected from the employees. Since information regarding supervisors' capability is only available in the fourth and fifth waves, we only use the data collected in the relevant years (2015 and 2016, respectively). The total sample size is 5,839.

⁷ The RIETI is a policy think tank established in 2001 under the Ministry of Economy, Trade and Industry of the Japanese Government.

⁸ We added information from newly responding firms (176 out of 5,008 firms, representing a response rate of 3.51%) and 505 matched employees in the second wave. The corresponding numbers for the fourth wave are 848 out of 10,000 firms (representing a response rate of 8.48%) and 5,433 matched employees.

3.2 Measures for mental health and productivity

3.2.1 Mental health

To measure employees' mental health, we use the GHQ. The GHQ is a screening survey developed by Dr. David Goldberg at Maudsley Hospital in London (Goldberg [1972]). It is a self-completion questionnaire translated into several languages (the Japanese version was translated by Nakagawa and Ohbo [1985]) and used worldwide for decades. The GHQ comprises 60 questions in total; however, to lighten respondents' load, there are some simplified versions, such as the GHQ-28 and the GHQ-12, which comprise 28 and 12 questions, respectively.⁹ Our survey uses the abbreviated version of GHQ, namely, GHQ-12, which poses 12 questions.

Specifically, the respondents were asked to characterize their feelings over the past few weeks from four choices in response to the questions seen below: "not at all," "no more than usual," "rather more than usual," and "much more than usual."

Questions: Have you recently...

1. been able to concentrate on whatever you were 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 could not 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?

⁹ Goldberg et al. (1997), who conduct a comparison experiment with 5,438 patients between the long and short versions, concluded that "if investigators wish to use a screening instrument as a case detector, the shorter GHQ (the GHQ-12) is remarkably robust and works as well as the longer instrument." Since the GHQ is a self-completion type questionnaire and not diagnosed by medical doctors, it is subjective to respondents. However, according to the survey conducted by Goldberg et al. (1997), both the sensitivity (the ability of a test to correctly classify an individual as "diseased") and the specificity (the ability of a test to correctly classify an individual as "disease-free") of the GHQ-12 are 70 to 90% and valid for the screening.

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 the following Likert scoring: 0, 1, 2, and 3 for “much more than usual,” “rather more than usual,” “no more than usual,” and “not at all,” respectively. The totals range from 0 to 36, with higher scores implying better mental health. Although GHQ scoring¹⁰ is generally used in epidemiology, Banks et al. (1980) argue that Likert scoring is more appropriate for parametric analysis. A lower GHQ score indicates better mental health, and a higher GHQ score, the opposite.

3.2.2 Productivity

For the productivity measure, we employ a presenteeism index proposed in the WPAI questionnaire constructed by Margaret Reilly. The WPAI questionnaire has been translated into more than 80 languages and is used worldwide (see Prasad et al. [2004]).¹¹

Specifically, the respondents were asked to characterize their feelings, scaling from 0 (“health problems had no effect on my work”) to 10 (“health problems completely prevented me from working”) in response to the following questions:

During the past seven days, how much did your health problems affect your productivity while you were working? Think about days you were limited in the amount or kind of work you could do, days you accomplished less than you would like, or days you could not do

¹⁰ Regarding the GHQ scoring (0-0-1-1), the 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.

¹¹ Prasad et al. (2004) review the literature and compare six major self-reported health-related productivity instruments. The paper concludes that, “Each productivity instrument has benefits in certain research settings, but the psychometric properties of the WPAI have been assessed most extensively. It was the most frequently used instrument and has also been modified to measure productivity reductions associated with specific diseases.”

your work as carefully as usual. If health problems affected your work only a little, choose a low number. Choose a high number if health problems affected your work a great deal.

We use the WPAI index as the productivity measure in our survey. We also add another proxy for productivity influenced by supervisors' capability, management, and communication skills: worker retention. We assume that if a worker thinks that his/her supervisor is skilled and that he/she is able to learn a considerable amount from that supervisor, or that the supervisor practices good management and as a result, provides a good workplace environment, the worker would choose to stay at his/her current job. If a worker leaves the firm, productivity declines to 0. Therefore, although it is a somewhat indirect measure, we also use the probability of worker retention as another proxy of productivity.

Specifically, we use two questionnaires to assess worker retention. The first records whether the respondent has a desire to quit his/her current job, and the second collects information on whether the respondent is actually conducting a job search at the time of the survey. Therefore, the first measure is a modest version of intent to quit, whereas the second measure shows a rather stronger measure, the will to quit. For the first retention measure, we use a questionnaire asking respondents, "Have you ever thought about quitting your current job and moving to another firm within the last three years?" We create a dummy variable that takes 1 for those who responded "Yes, quite often" or "Yes, sometimes," and 0 otherwise. Regarding the second retention measure, we use a questionnaire asking respondents, "Are you currently conducting a job search?" We create a dummy variable that takes 1 for those who answered "Yes, I am currently searching for a job," and 0 otherwise.¹²

¹² Note that since the Japanese labor market is less liquid compared to the international norm, we do not have enough samples to determine the number of employees who actually quit during the survey period.

3.3 Measures pertaining to bosses

3.3.1 Supervisor's management and communication skills

We use three measures to assess the immediate boss's management and communication skills: (1) proper feedback, (2) good communication, and (3) satisfactory circulation of information within the office. These three measures are derived from the following questions in our survey. (1) Does your supervisor give you proper feedback as part of your evaluation? (2) Does your boss communicate well with his/her subordinates? (3) Does your boss circulate the necessary information within the workplace in a satisfactory manner? Respondents are asked to choose one of the five following answers while responding to each of these queries: "very true," "somewhat true," "neither," "slightly not true," and "not at all true." Figure 1(a) shows the distribution of answers to each question. We construct three dummy variables corresponding to these questions; the variables take 1 if the respondent answers either "very true" or "somewhat true," and 0 otherwise.

3.3.2 Supervisor's capability

We use four measures to assess the immediate boss's capability at work: (1) competency, (2) expertise, (3) knowledge, and (4) replacement. These four measures are derived from the following questions in our survey: (1) Is your supervisor competent at his/her job? (2) Is your supervisor career successful? (3) Is your supervisor well aware of the nature of the tasks conducted by you? (4) Could your supervisor do your job if you were away? Respondents are asked to respond to these four questions using one of the following answers: "very true," "somewhat true," "slightly untrue," and "not at all true." Figure 1(b) shows the distribution of answers to each question. We construct three dummy variables corresponding to these questions, which take 1 if the respondent answers either "very true" or "somewhat true," and 0 otherwise.

3.4 Other variables

3.4.1 Job characteristics

Following Karasek's (1979) job strain (demand–control) model, we categorize job characteristics into four types: (1) job strain, (2) passive work, (3) active learning, and (4) low strain. He argues that different kinds of jobs introduce different levels of work stress owing to the following main factors: 1) the amount of work needed to be done (known as job demands), and 2) the degree of decision-making authority an individual has and the extent to which he/she can choose to employ his/her skills (known as decision latitude). According to Karasek (1979), (1) job strain is a combination of high job demands but low control latitude, (2) passive learning is a combination of low job demands and low control latitude, (3) active learning is a combination of high job demands but high control latitude, and (4) low strain is a combination of low job demands but high control latitude. Similar to OECD (2012), we use the following four questions to compile a score in order to categorize respondents' jobs into four types: 1) can you choose the order and method with which to work, 2) can you decide the volume of tasks to be done, 3) do you often deal with unforeseen interruptions, 4) do you need to fulfill a high quota or many goals. For each question, respondents are asked to choose one among five answers: “very true (=1),” “somewhat true (=1),” “neither (=0),” “slightly untrue (=0),” and “not at all true (=0),” where the numbers inside the parentheses refer to the corresponding scores. Questions (1) and (2) evaluate the level of control latitude, whereas 3) and 4) evaluate the level of psychological demands. Adding up the scores provides us with a 2×2 dimension (control latitude: 1 and 2 and demand latitude: 3 and 4) to categorize the four job types. The cut-off score for each dimension is 2.

3.4.2 Number of work hours, consumption, and other control variables

The log of number of hours worked is the actual worked hours per week reported by each respondent who took the survey. We also include deviation terms between actual and desired hours worked, considering that not all workers can choose their desired number of hours. To construct the deviation term between actual and desired hours worked, we asked the following

questions in our survey: “Would you like to increase/decrease the number of hours worked given your current wage rate?” and “If so, by how many hours?” For those whose actual hours worked did not equal the desired hours, we convert the gaps into dummy variables for overemployment and underemployment as follows.

Overemployment = 1 if actual hours worked per week exceed desired work hours per week and
= 0 otherwise, and

Underemployment = 1 if desired work hours per week exceed actual hours worked per week and
= 0 otherwise.

We exclude responses indicating “Do not know” from the sample.

For the consumption variable in Equation (6), we include hourly wage rate as a proxy. Other control variables include non-labor income, age, tenure, dummy variables for marriage and having children (taking 1 if respondents are married and have children, and 0 otherwise), and dummy variables for occupation.

3.4.3 Workplace atmosphere

Importantly, we also recognize that not only the supervisor but also the workers’ colleagues may affect their well-being and productivity. Therefore, we also add two variables that reflect the workplace atmosphere: 1) whether a worker shares good communication with his/her colleagues at the workplace, and 2) whether the worker shares his/her knowledge among colleagues. For each question, respondents were asked to choose one response from the following five choices: “very true,” “somewhat true,” “neither,” “slightly untrue,” and “not true at all.” We construct two dummy variables, each of which takes one if the respondent answers either “very true” or “somewhat true,” and zero otherwise.

3.4.4 Personality traits and compatibility

We find that bosses' management and communication skills, especially having good communication with subordinates, is an essential factor in improving workers' well-being and productivity (for more details, see the next section). Given this finding, we investigate whether good communication between supervisors and subordinates is in any way driven by either party's personality, their backgrounds, or a combination of the characteristics of both parties. The term "backgrounds" refers to basic individual characteristics, such as sex, age, marital status, and whether one or both parties has/have a child. We also control for the number of years since the current supervisor becomes the worker's supervisor.

We employ the "big five" personality traits, which comprise five factors: extraversion, neuroticism, openness to experience, conscientiousness, and agreeableness. According to the five-factor model (FFM), these five independent categories are sufficient to describe individual personality differences at the broadest level of abstraction (Costa and McCrae 1992; Goldberg 1990). Specifically, we use the Ten-Item Personality Inventory (TIPI) introduced by Gosling et al. (2003), which is incorporated in the fourth and fifth waves of the survey. The TIPI is a brief measure with 10 questions measuring 5 different facets of personality traits (the big 5 personality dimensions). The specific questions are as follows.

Questions: I see myself as...

1. extraverted, enthusiastic
2. critical, quarrelsome
3. dependable, self-disciplined
4. anxious, easily upset
5. open to new experiences, complex
6. reserved, quiet
7. sympathetic, warm
8. disorganized, careless
9. calm, emotionally stable
10. conventional, uncreative

Each of the 10 items was rated on a 7-point scale, with the responses ranging from “strongly disagree” (1) to “strongly agree” (7). The average of the two bipolar items that make up each scale is then calculated and used in the subsequent analyses. A unique feature of our survey is that we also asked each respondent to evaluate his/her immediate boss’s personality traits. There may be a concern that personality traits evaluated by other people differ from actual personality traits. According to Borkenau et al. (2004), however, the personality traits evaluated by oneself and other people are highly correlated. We therefore compile bosses’ personality traits using the same method explained above.

With regard to these basic individual characteristics and personality traits, we also consider the compatibility between the supervisor and subordinate. For example, two persons of the same sex, similar age, or identical personality may enjoy better communication than those who belong to different categories. We investigate whether any combination may result in good communication.

4. Empirical results

4.1 Basic Results

Table 1 shows the summary statistics of the data used in this analysis. Table 2 presents the preliminary results, where the independent variable is workers’ mental health measured by the GHQ. Columns (1) to (3) present the results of the estimations considering bosses’ individual variables. All the three variables indicating bosses’ management and communication skills are statistically significant and negative, suggesting that, other things being equal, workers’ mental health depends on supervisors’ management and communication. The coefficient of “communicates well” is the largest of the three coefficients, implying that having good communication improves workers’ GHQ scores by 1.2.

Columns (4) to (7) display the results of the estimations considering supervisors’ capability instead of his/her management and communication skills. Columns (4) and (6) show

that bosses' "competency" and "knowledge" improve workers' mental health, and the coefficient of competency is larger than that of knowledge.

Regarding other control variables, longer work hours damage workers' mental health, other factors being equal. In addition, both job strain and passive work harm workers' mental health; notably, the coefficient of the job strain dummy is large, which accords with Karasek's (1979) job strain model. The bottom row of Table 2 depicts the other work and life events that occurred during the past year. The results indicate that task change constitutes a big stress factor for workers. Although not statistically significant, the mental health of workers who started providing parental care tends to suffer.¹³

In Table 3, we examine which boss-related variables are associated with specific components of workers' mental health, by employing each of the 12 subcategories of the GHQ12 as a dependent variable. Table 3 shows that the variable "communicates well" (CP) is statistically and negatively significant for 10 out of 12 subcategories, suggesting that the variable is extremely important for workers' mental health. Regarding the variables of supervisor's capability, both "competency" and "knowledge" are statistically and negatively significant for 3 out of 12 subcategories. Given the results from Tables 2 and 3, we focus specifically on two specific variables pertaining to bosses ("communicates well" and "competency") and further investigate bosses' influence on workers' mental health and productivity.

4.2 Impact of bosses and workplace atmosphere

In Table 4, we add two variables that reflect workplace atmosphere: "good communications with colleagues" and "sharing knowledge among colleagues." The dependent variable is "GHQ12" (total score) and the other covariates are the same as those used in Table 2. This is to check whether interactions with colleagues affect workers' mental health to a greater extent, since for many workers, the time spent with colleagues may be much longer than that with their bosses.

¹³ Kuroda (2016) reports that the working-age population in Japan caring for their own parents has grown significantly in the last two decades.

The result in column (1) indicates that the variable “sharing knowledge among colleagues” is statistically significant, suggesting that not only bosses but colleagues too affect workers’ mental health. Note that the supervisor-centric variable “communicates well” is still statistically significant, and the coefficient is larger than that of “sharing knowledge among colleagues.” In addition, it is worth noting that “good communications with colleagues” is not statistically significant. These results indicate that although good interaction with colleagues is an important factor, communication with the boss seems to be relatively more important in determining workers’ mental health. Columns (2) and (3) display the results of the estimations for the variables “competency” as well as “communicates well.” The results remain robust even though we add the colleague-related variables and those concerning supervisors’ communication and competency simultaneously.

Columns (4) to (7) incorporate information on whether the immediate supervisor of each respondent changed during the two-year period. About 13% of workers had a change in their immediate bosses, implying that the other 87% continued with the same boss. ‘The results shown in the previous estimations include variations may come from workers’ evaluation of same bosses varies year to year. Columns (4) and (5) indicate that a change in the worker’s immediate boss worsens his/her GHQ12 scores by 1.203 to 1.208 points. This implies that such an event damages workers’ mental health, other things being controlled. We interpret that a change in the immediate boss not only affects various factors such as job demand, controllability of tasks, and work hours, which may influence workers’ mental health, but is also a source of stress to workers in itself. However, the cross term of columns (4) and (5) indicates that such stress can be fully offset if the new boss is good at communication. These results confirm that supervisors’ good communication is extremely important to determine workers’ well-being.

Since labor mobility is relatively low in Japan compared to other advanced economies, particularly the US (Ono [2010]), we check whether any experiences with regard to job change in the past may influence workers’ perception. More specifically, we consider a worker who has not experienced a job change and test whether this is so because he/she might feel that there is no

choice but to put up with a bad boss. In doing so, we assess if his/her mental health worsens compared to those who have experienced a job change. Thus, we split our sample into two groups, one consisting of workers who have had one or more experiences of a job change and the other of those who have never changed their jobs (depicted as “job changers” and “non-job changers,” respectively).

The results are shown in Table 5. The coefficients for “communicates well” in columns (1) and (2) are statistically significant. Moreover, the size of the coefficient for the sample of non-job changers is larger than that of job changers in absolute terms. These results imply that workers with no experience of a job change tend to have more stress than those with experiences of a job change. However, columns (3) and (4) do not provide similar results for the “competency” variable.

Another interesting result in Table 5 is that the coefficients of job characteristics are statistically significant only for the sample of job changers, while the number of hours worked are statistically significant only for the sample of non-job changers. This result implies that the mental health of workers who have never changed jobs is more vulnerable to issues pertaining to the workplace environment, such as communication and work hours, while that of workers who have changed their jobs is more sensitive to the nature of the jobs they are engaged in.

4.3 Boss Productivity Measures: Presenteeism and Worker Retention

We now investigate supervisors’ influence on productivity. Table 6 shows the results, wherein we employ the WPAI index as a proxy of productivity. Since this index measures the degree of presenteeism, a high index implies less productivity.

The results in Table 6 indicate that the variables related to bosses affect productivity, although the statistical significances are lower than those in Tables 2 to 4. In addition, it is interesting to note that unlike mental health, the variables related to colleagues do not affect presenteeism.

Next, we examine the effect of worker retention. As explained in section 3.2.2, we use two measures to assess worker retention: 1) a desire to quit the current job and 2) currently conducting a job search. Both variables are dummy variables, and therefore, we conduct the estimation using a random effect probit model. Table 7 indicates that both bosses and colleagues play an important role in determining whether a worker wants to quit his/her job. The first measure is relatively modest, whereas the second indicates a stronger willingness to quit. Thus, all the coefficients in columns (5) to (8) are smaller than those in columns (1) to (4). Note that the coefficients of the variable “communicates well” are larger in overall terms than the variables related to competency or colleagues, suggesting that bosses’ communication skills are vital for worker retention.

4.4 Worker–Boss Attribute Combinations

We showed that good communication between a supervisor and his/her subordinates is a key factor for workers’ mental health as well as productivity.¹⁴ In the final part of this section, we assess whether any specific factors enhance good communication. More specifically, we investigate whether good communication is brought about by a supervisor’s individual characteristics, an evaluator’s (a subordinate’s) individual characteristics, a combination of the two, or some other factor(s). Thus, we estimate the random effect probit model, employing the variable “communicates well” as the dependent variable. The results are shown in Table 8. Column (1) displays a simple case, including the only basic characteristics of the boss, and workers’ age, sex, and number of years spent as the workers’ supervisor. Column (2) adds several worker–boss combinations of basic attributes as explanatory variables, including sex, age, marital status, and having a child. Column (3) further adds the big five personality traits and combinations of these traits between the two parties.

Table 8 shows that older workers tend to be less communicative, whereas older supervisors tend to have better communication with their subordinates. These results may be attributed to the Asian culture, which puts considerable weightage on seniority; however, the combination of the ages of two

¹⁴ See also Miles et al. (1996) regarding the importance of communication at the workplace.

parties is not statistically significant. The combination of gender is also not statistically significant,¹⁵ although some combinations of marital status indicate statistically negative significance.

Lastly, column (3) indicates that specific personality traits are statistically significant. The results regarding the combinations of personality traits are also interesting. Specifically, if a supervisor's emotional stability is higher than that of his/her subordinate, the communication between the two parties becomes better than the base combination. On the other hand, if a supervisor's emotional stability is lower than that of his/her subordinate, the communication between the two parties worsens. A few recent studies in the economics literature analyze the relationship of married couples in light of compatibility of individual attributes.¹⁶ Our findings contribute to the recent literature on relationships, in that person-to-person compatibility is not only important for couples but also for bosses and workers.

5. Conclusion

Does workers' mental health depend on bosses' quality and management skills? Assuming that a good boss makes workers happier, are there any specific factors that enhance workers' productivity? To answer these questions, we investigated the effect of supervisors' management, communication, and capability on workers' mental health and productivity using two-year longitudinal data of Japanese full-time white-collar workers.

¹⁵ Although good communication does not depend on gender combinations, they may influence some outcomes via different channels. For example, Artz and Taengnoi (2013) provide evidence that women are much less happy when they have a female boss, whereas men are unaffected. Using personnel data of a large manufacturing company, Kawaguchi et al. (2016) find that (1) supervisors tend to evaluate subordinates more candidly when they share the same demographic characteristics such as family structure, education, and age, and that (2) supervisors' grasp of workers' ability seems to be slower for female than male workers.

¹⁶ For example, Lundberg (2012) reports that divorce is associated with low emotional stability in women and male extroversion for German couples. De Paola and Gioia (2013) find that an increase in impatience increases the probability of experiencing divorce, whereas more risk-averse individuals are less likely to experience divorce. Dupuy and Galichon (2014) also find that personality traits affect the sorting of spouses in the marriage market. For related literature in psychology, see also Dyrenforth et al. (2010).

We found that even after controlling for individual-specific fixed effects and other job characteristics proposed in the job strain model, supervisors' good communication with staff and competency at managerial tasks significantly improve employees' mental health. Our findings also suggest that good communication between bosses and staff enhances the latter's productivity and lowers presenteeism. In addition, supervisors' bad communication and low competency increase the probability of quitting. All these findings suggest that bosses' management and communication skills, especially having good communication with subordinates, is an essential factor in improving worker's well-being and productivity. Finally, good communication partially depends on boss-worker compatibility such as the combination of their personality traits. Borghans et al. (2008) summarize that personality traits predict important outcomes in social aspects, including schooling, wages, crime, teenage pregnancy, and longevity. Further, among many outcomes, certain personality traits (agreeableness, openness to experience, and extraversion) are more predictive than others. Our findings add to this stream of the literature, in that specific combinations of personality traits may be also important for outcomes at the workplace.

The findings of our paper agree with the results of OECD (2012), which state that the role of supervisor is critical in mitigating the adverse effects of work-related stress. Our findings, which show that supervisors' management and capability have a significant impact on workers' mental health and productivity, have important implications with respect to actions and policies required at the workplace. Our implications also match those of Kelloway and Barling (2010), who suggest that good leadership and appropriate management styles are the two most critical factors in promoting a good working environment, and that supervisors' training (leadership development) is an effective intervention. Future research will focus on the nature of such specific interventions.

Although this study has provided an evidence bosses' management and communication skills are essential factors in improving worker's well-being and productivity, there are limitations with respect to the sample and measures. First, data used in this paper is only two-year panel.

Good or bad relationship with supervisors may influence workers' mental health in a longer period. Analysis in a longer perspective remains for the future research. Second, this study used the WPAI index as the productivity measure in the survey. In the future, we aim to use an objective productivity index, which measures overall productivity and is not limited to health-related matters. Third, we show an evidence that a worker's mental health influenced by supervisors heavily depends on whether the worker had an experience of changing jobs in the past. Using other counties' data to compare whether workers in less mobile labor markets are more being affected by supervisors that those of highly mobile markets may also be the future agenda.

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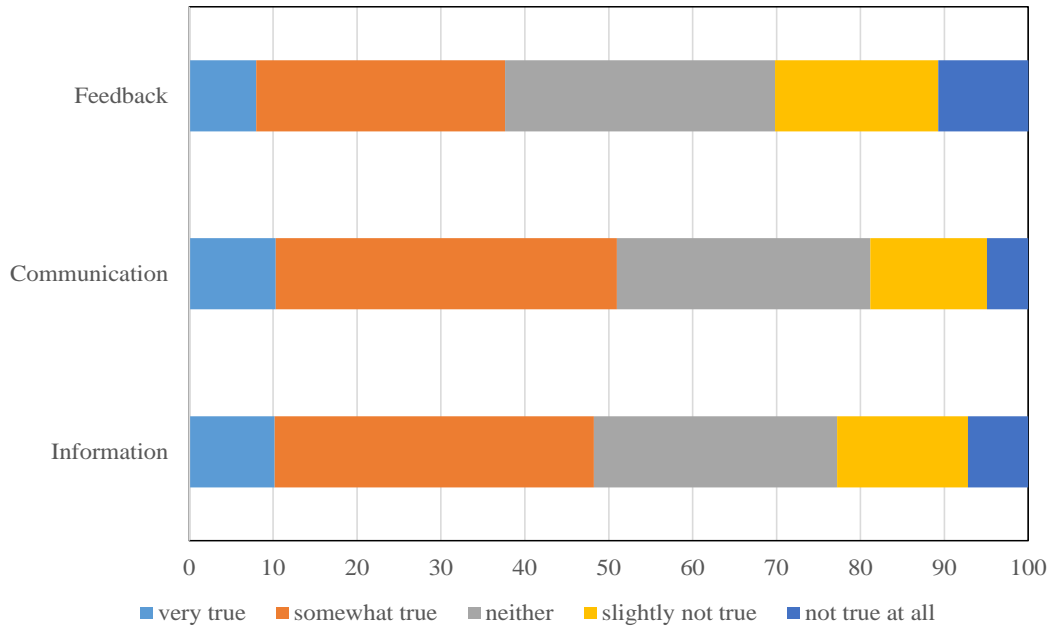
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Figure 1: Distribution of respondents' answers regarding supervisors' qualities

(1) Supervisors' management and communication skills



(2) Supervisors' capability

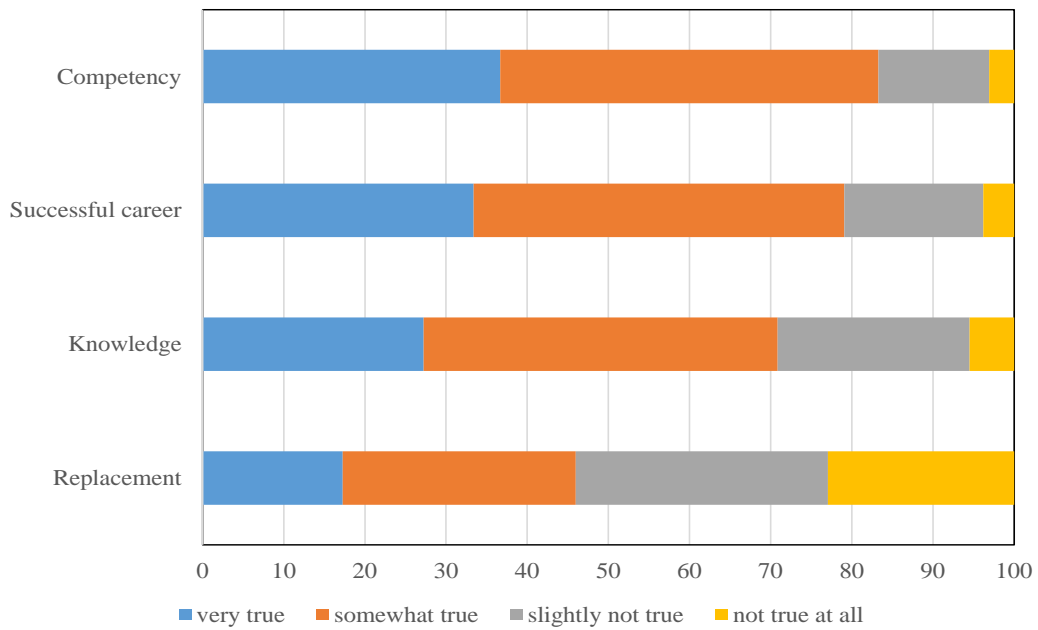


Table 1: Summary Statistics

	Mean	Std. Dev.	Min	Max
Mental health (GHQ12)	14.755	5.782	0	36
Productivity (WPAI)	3.402	2.914	0	10
Desire of quitting current job	0.523	0.500	0	1
Currently doing job search	0.019	0.137	0	1
Weekly hours worked (log)	3.792	0.161	2.996	4.500
Desire for increasing work hours	0.055	0.228	0	1
Desire for decreasing work hours	0.245	0.430	0	1
Job characteristics				
Job strain	0.158	0.365	0	1
Passive work	0.397	0.489	0	1
Active learning	0.115	0.319	0	1
Low strain	0.319	0.466	0	1
Age	41.339	9.984	19	65
Male	0.673	0.469	0	1
Occupation				
Specialist/Technician	0.192	0.394	0	1
Management	0.224	0.417	0	1
Clerical	0.421	0.494	0	1
Sales/Marketing	0.025	0.156	0	1
Sale representative	0.118	0.323	0	1
Service and others	0.019	0.137	0	1
Exempt	0.354	0.478	0	1
Tenure of current job	11.648	9.297	0	47
Married	0.631	0.483	0	1
Child	1.030	1.075	0	6
Hourly wage (10 thousand yen)	0.206	0.105	0.037	0.955
Nonlabor income (10 thousand yen)	210.642	272.492	1	1600
Supervisor's management & communication				
Proper feedback	0.375	0.484	0	1
Communicates well	0.508	0.500	0	1
Properly circulates information within office	0.480	0.500	0	1
Supervisor's capability				
Competency	0.830	0.376	0	1
Successful career	0.787	0.409	0	1
Knowledge	0.706	0.456	0	1
Replacement	0.458	0.498	0	1
Workplace atmosphere				
Good communication with colleagues	0.610	0.488	0	1
Sharing knowledge among colleagues	0.526	0.499	0	1
Any changes from previous year				
Being promoted	0.061	0.239	0	1
Being transferred to other department	0.097	0.296	0	1
Job task changed	0.308	0.462	0	1
The number of staffs has increased/decreased	0.308	0.462	0	1
Started parental care	0.052	0.222	0	1
Death of family member or close friends	0.114	0.317	0	1
sample sizes	5,839			
number of individuals	4,930			

Table 2: Results of the fixed effects model (dependent variable: mental health)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Supervisor's management & communication							
Proper feedback	-0.670*						
	(-1.894)						
Communicates well		-1.204***					
		(-3.345)					
Properly circulates information within office			-0.636**				
			(-2.013)				
Supervisor's capability							
Competency				-1.017**			
				(-2.128)			
Successful career					-0.007		
					(-0.019)		
Knowledge						-0.712*	
						(-1.927)	
Replacement							-0.157
							(-0.451)

Weekly hours worked (log)	1.913*	1.893*	1.982*	1.874*	1.897*	1.834	1.843
	(1.714)	(1.679)	(1.763)	(1.666)	(1.695)	(1.637)	(1.639)
Desire for increasing work hours	0.678	0.731	0.696	0.694	0.680	0.675	0.686
	(1.181)	(1.287)	(1.211)	(1.214)	(1.181)	(1.157)	(1.190)
Desire for decreasing work hours	0.441	0.386	0.412	0.435	0.465	0.435	0.466
	(1.205)	(1.064)	(1.128)	(1.192)	(1.267)	(1.193)	(1.276)

Job characteristics (base=Low strain)							
Job strain	1.558***	1.471***	1.567***	1.585***	1.633***	1.568***	1.638***
	(3.058)	(2.879)	(3.054)	(3.078)	(3.174)	(3.008)	(3.184)
Passive work	0.959**	0.943**	0.946**	0.998***	0.981**	0.943**	0.981**
	(2.487)	(2.454)	(2.446)	(2.580)	(2.530)	(2.456)	(2.533)
Active learning	0.212	0.275	0.243	0.202	0.255	0.239	0.258
	(0.505)	(0.647)	(0.575)	(0.483)	(0.604)	(0.567)	(0.612)

Being promoted	0.297	0.307	0.298	0.346	0.287	0.267	0.292
	(0.531)	(0.546)	(0.529)	(0.614)	(0.513)	(0.472)	(0.521)
Being transferred to other department	0.218	0.185	0.132	0.156	0.153	0.187	0.162
	(0.334)	(0.289)	(0.204)	(0.240)	(0.235)	(0.289)	(0.248)
Job task changed	0.722**	0.749**	0.730**	0.679**	0.714**	0.687**	0.717**
	(2.186)	(2.267)	(2.223)	(2.063)	(2.165)	(2.089)	(2.175)
The number of staffs has changed	0.280	0.211	0.289	0.287	0.336	0.282	0.328
	(0.769)	(0.583)	(0.803)	(0.794)	(0.929)	(0.768)	(0.902)
Started parental care	1.075	1.070	1.115	1.078	1.119	1.018	1.109
	(1.446)	(1.417)	(1.481)	(1.452)	(1.507)	(1.374)	(1.490)
Death of family member or close friends	-0.106	-0.120	-0.0913	-0.0887	-0.119	-0.149	-0.132
	(-0.207)	(-0.235)	(-0.176)	(-0.171)	(-0.229)	(-0.291)	(-0.253)
Constant	11.70	8.929	12.21	16.21	12.96	15.53	16.57
	(0.586)	(0.445)	(0.612)	(0.554)	(0.440)	(0.531)	(0.562)

Observations	5839	5839	5839	5839	5839	5839	5839
Number of ID_I	4930	4930	4930	4930	4930	4930	4930

Note: Other covariates are age, age squared, tenure, occupation dummies, exempted dummy, spouse dummy, child dummy, hourly wage rate, and non-labor income. Numbers in parentheses are *t*-statistics. ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 3: Results of the fixed effects model (dependent variable: mental health (12 subcategories))

	Supervisor's management & communication			Supervisor's capability			
	FB	CM	IF	CP	SC	KN	RP
GHQ1	-0.111* (-1.899)	-0.179*** (-2.988)	-0.0829 (-1.436)	-0.186** (-2.498)	-0.0193 (-0.295)	-0.0721 (-1.255)	-0.0198 (-0.332)
GHQ2	-0.0235 (-0.413)	-0.135** (-2.230)	-0.0991* (-1.792)	-0.207*** (-2.734)	0.0450 (0.693)	-0.108* (-1.871)	-0.0787 (-1.292)
GHQ3	-0.0677 (-1.238)	-0.105* (-1.828)	-0.0544 (-1.049)	-0.0690 (-0.967)	0.105* (1.672)	-0.0454 (-0.778)	-0.0526 (-0.941)
GHQ4	-0.140** (-2.318)	-0.176*** (-2.684)	-0.0227 (-0.383)	-0.0896 (-1.092)	-0.0161 (-0.205)	-0.0523 (-0.803)	-0.0756 (-1.236)
GHQ5	-0.0795 (-1.404)	-0.0454 (-0.770)	-0.0634 (-1.169)	-0.120 (-1.539)	0.0534 (0.788)	-0.0783 (-1.297)	-0.0102 (-0.174)
GHQ6	-0.120** (-2.227)	-0.112* (-1.940)	-0.0563 (-1.048)	-0.137* (-1.853)	-0.0196 (-0.331)	-0.0579 (-1.028)	-0.0190 (-0.334)
GHQ7	0.0254 (0.477)	-0.0513 (-0.957)	0.0685 (1.393)	-0.0246 (-0.351)	-0.146** (-2.368)	0.0228 (0.421)	-0.0796 (-1.619)
GHQ8	-0.00714 (-0.154)	-0.0927* (-1.955)	-0.0461 (-1.041)	-0.00524 (-0.086)	-0.0505 (-0.940)	-0.0169 (-0.348)	0.0746* (1.738)
GHQ9	-0.0251 (-0.578)	-0.0871* (-1.791)	-0.0449 (-0.971)	0.0430 (0.692)	0.0651 (1.213)	-0.0498 (-1.067)	0.0304 (0.626)
GHQ10	0.00966 (0.222)	-0.0860* (-1.818)	-0.0944** (-2.367)	-0.0343 (-0.560)	-0.0301 (-0.593)	-0.0345 (-0.785)	0.00757 (0.162)
GHQ11	-0.0600 (-1.198)	-0.0976* (-1.838)	-0.0168 (-0.355)	-0.0775 (-1.074)	-0.00317 (-0.053)	-0.113** (-2.106)	0.0363 (0.730)
GHQ12	-0.0717 (-1.580)	-0.0376 (-0.727)	-0.123*** (-2.685)	-0.110* (-1.793)	0.00859 (0.151)	-0.107** (-2.211)	0.0299 (0.649)

Notes: The other covariates are the same as in Table 2. Numbers in parentheses are *t*-statistics. ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

FB (feedback): My supervisor provides feedback in an appropriate manner

CM (communication): My supervisor communicates well with his/her staff

IF (information): My supervisor circulates information in an appropriate manner within the office

CP (competency): My supervisor is competent at his/her job

EP (expertise): My supervisor worked his/her way up through the ranks

KN (knowledge): My supervisor knows my job well

RP (replacement): My supervisor could do my job if I were away

**Table 4: Results of the fixed effects model including workplace atmosphere and cross terms
(dependent variable: mental health)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Supervisor's management & communication							
Communicates well	-1.058*** (-2.870)		-0.997*** (-2.731)	-0.949*** (-2.602)	-0.829** (-2.208)		
Supervisor's capability							
Competency		-0.930* (-1.935)	-0.827* (-1.736)			-0.780 (-1.494)	-0.699 (-1.338)
Workplace atmosphere							
Good communication with colleagues	0.0795 (0.203)	-0.106 (-0.276)	0.111 (0.286)		0.0856 (0.219)		-0.118 (-0.307)
Sharing knowledge among colleagues	-0.839*** (-2.604)	-0.931*** (-2.883)	-0.817** (-2.530)		-0.793** (-2.486)		-0.916*** (-2.858)
Immediate supervisor had changed from previous year							
				1.287* (1.889)	1.203* (1.794)	1.406 (1.518)	1.353 (1.492)
cross term							
× Communicates well				-1.541* (-1.881)	-1.443* (-1.771)		
× Competency						-1.295 (-1.275)	-1.265 (-1.265)
Observations	5839	5839		5839	5839	5839	5839
Number of ID	4930	4930		4930	4930	4930	4930

Note: The other covariates are the same as in Table 2. Numbers in parentheses are *t*-statistics. ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 5: Results for job changers versus non-job changers (dependent variable: mental health)

	(1)	(2)	(3)	(4)
	Job changers	Never changed job	Job changers	Never changed job
Supervisor's management & communication				
Communicates well	-0.772*	-1.280**		
	(-1.711)	(-2.350)		
Supervisor's capability				
Competency			-0.867	-1.039
			(-1.645)	(-1.137)

Weekly hours worked (log)	0.556	2.708	0.393	2.945*
	(0.368)	(1.606)	(0.258)	(1.741)
Job characteristics (base=Low strain)				
Job strain	3.062***	-0.381	3.093***	-0.245
	(4.722)	(-0.513)	(4.760)	(-0.329)
Passive work	1.726***	0.142	1.757***	0.241
	(3.567)	(0.236)	(3.610)	(0.396)
Active learning	1.187**	-0.835	1.139**	-0.933
	(2.257)	(-1.254)	(2.194)	(-1.416)

Observations	3323	2515	3323	2515
Number of ID	2836	2095	2836	2095

Note: The other covariates are the same as in Table 2. Numbers in parentheses are *t*-statistics. ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 6: Results of the fixed effects model (dependent variable: productivity (presenteeism))

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Supervisor's management & communication								
Communicates well	-0.402*	-0.363	-0.399*	-0.361				
	(-1.725)	(-1.492)	(-1.719)	(-1.488)				
Supervisor's capability								
Competency					-0.420	-0.397	-0.417	-0.395
					(-1.531)	(-1.435)	(-1.524)	(-1.428)
Workplace atmosphere								
Good communication with colleagues		-0.131		-0.130		-0.191		-0.189
		(-0.552)		(-0.547)		(-0.825)		(-0.818)
Sharing knowledge among colleagues		-0.0426		-0.0411		-0.0716		-0.0700
		(-0.202)		(-0.195)		(-0.338)		(-0.331)
Physical health deterioration within a year	no	no	yes	yes	no	no	yes	yes
Observations	5802	5802	5802	5802	5802	5802	5802	5802
Number of ID	4898	4898	4898	4898	4898	4898	4898	4898

Note: The other covariates are the same as in Table 2. Numbers in parentheses are *t*-statistics. ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 7: Results of the random effect probit model (worker retention)

	Desire of quitting current job				Currently doing job search			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Supervisor's management & communication								
Communicates well	-0.949***	-0.670***			-0.854***	-0.563***		
	(-10.610)	(-7.442)			(-3.760)	(-2.787)		
Supervisor's capability								
Competency			-0.753***	-0.593***			-0.478**	-0.326**
			(-7.061)	(-5.810)			(-2.459)	(-1.980)
Workplace atmosphere								
Good communication with colleagues		-0.369***		-0.557***		-0.242		-0.402**
		(-4.166)		(-6.457)		(-1.466)		(-2.471)
Sharing knowledge among colleagues		-0.346***		-0.450***		-0.394**		-0.462***
		(-4.196)		(-5.518)		(-2.268)		(-2.705)
Observations	5839	5839	5839	5839	5839	5839	5839	5839
Number of ID	4930	4930	4930	4930	4930	4930	4930	4930

Notes: The other covariates are the same as in Table 2. Numbers in parentheses are *t*-statistics. ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

The dependent variables are “desire to quit the current job within the last three years=1” for (1) to (4), and “currently conducting a job search=1” for (5) to (8).

Table 8: Determinants of good communication (random effect probit model)

		(1)	(2)	(3)	continue	
					(3)	
Age (base=20s)	30s	-0.367*** (-3.335)	-0.485*** (-4.129)	-0.454*** (-3.916)	Personality big 5	
	40s	-0.483*** (-4.306)	-0.635*** (-4.588)	-0.638*** (-4.649)	Extraversion	0.114*** (3.371)
	50s and older	-0.458*** (-3.756)	-0.645*** (-3.043)	-0.834*** (-3.927)	Emotional stability	0.146*** (3.681)
Supervisor's age (base=20s)	30s	0.311** (2.304)	0.395** (2.275)	0.117 (0.683)	Openness	-0.0116 (-0.287)
	40s	0.230** (2.325)	0.286** (2.534)	0.163 (1.466)	Conscientiousness	0.00766 (0.202)
	50s and older	0.187** (2.075)	0.205** (2.270)	0.210** (2.335)	Agreeableness	0.102** (2.238)
Sex	male	0.382*** (5.029)	0.588 (0.982)	0.464 (0.682)	Supervisor's personality big 5	
Supervisor's sex	male	-0.158 (-1.306)	-0.456 (-0.782)	-0.276 (-0.413)	Extraversion	0.179*** (4.887)
					Emotional stability	-0.0256 (-0.637)
Number of years of being his/her supervisor		-0.00708 (-1.102)	-0.00843 (-1.309)	-0.00187 (-0.292)	Openness	0.134*** (3.411)
					Conscientiousness	0.183*** (4.663)
Combination (sex) (base=same sex)	sp(male) & sb(female)		0.285 (0.473)	0.147 (0.215)	Agreeableness	0.456*** (9.262)
	sp(female) & sb(male)		-0.209 (-0.335)	-0.146 (-0.208)	Combination(personality)	
Combination (age) (base=same age)	sp (age) > sb(age)		-0.0477 (-0.388)	-0.126 (-1.028)	Extraversion (higher)	-0.107 (-1.013)
	sp (age) < sb(age)		-0.179 (-1.131)	-0.0937 (-0.594)	(lower)	0.0772 (0.685)
Combination(spouse) (base=both married)	sp(married) & sb(not married)		-0.298*** (-3.161)	-0.173* (-1.867)	Emotional stability(higher)	0.190* (1.852)
	sp(not married) & sb(married)		-0.130 (-0.847)	-0.0366 (-0.241)	(lower)	-0.229** (-2.099)
	sp(not married) & sb(not married)		-0.457*** (-2.705)	-0.267 (-1.583)	Openness(higher)	-0.0602 (-0.594)
	sp(w/child) & sb(w/o child)		-0.0573 (-0.616)	-0.0730 (-0.795)	(lower)	-0.172 (-1.608)
Combination(children) (base=both has child)	sp(w/o child) & sb(w/child)		-0.182 (-1.352)	-0.0989 (-0.735)	Conscientiousness(higher)	0.0471 (0.456)
	sp(w/o child) & sb(w/o child)		-0.0495 (-0.346)	0.0153 (0.108)	(lower)	-0.105 (-0.964)
	Constant	0.161 (0.993)	0.534** (2.167)	-6.688*** (-11.913)	Agreeableness(higher)	-0.0832 (-0.821)
Observations		5769	5769	5542	(lower)	0.0703 (0.682)
Number of ID		4875	4875	4703		

Notes: "sp" and "sb" stand for supervisor and subordinate, respectively.

For the combination (personality), "higher" means the supervisor's score is higher than that of the subordinate, and "lower" means the opposite.

Numbers in parentheses are *t*-statistics. ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.