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INUI, Tomohiko
RIETI

KAWAKAMI, Atsushi
Toyo University

MA, Xin Xin
University of Toyama

ZHAO, Meng (KONISHI)
Gakushuin University

The Research Institute of Economy, Trade and Industry
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Does Mental Health Affect Labor Market Outcomes? Evidence from a National Representative Survey in Japan*

Tomohiko Inui (RIETI and Gakushuin University)
Atsushi Kawakami (Toyo University)
Xin Xin Ma (University of Toyama)
Meng Zhao (Konishi) (Gakushuin University)

Abstract

Japanese working hours are substantially longer than most advanced countries, and previous literatures has found adverse consequences of increasing working hours on several health measures, including mental health.

Our study confirms a large and heterogeneous effect of mental health on labor supply. We find that good mental health can significantly increase the probability of labor participation and the chance of becoming a permanent employee in Japan. The effect is stronger for women compared to men, and strongest among the middle age group. We also find an adverse effect from bad mental health on working hours of elderly self-employed male and female workers, and young, self-employed, female workers.

The Japanese government enacted "The Work Style Reform Bill" on June 2018 in order to reduce long working hours, and our results indicate that a potential improvement of mental health realized through these reforms could further lead to an increase in labor force participation.

Keywords: mental health, labor participation, permanent employee, working hours, Japan
JEL classification: I15, J21, J24

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1.Introduction

Good mental health is widely considered as an integral part of health and wellbeing, yet mental health problems are becoming increasingly prevalent and costly worldwide. It is estimated that, at any given time, one in five working-age adults has a mental health problem, with the lifetime prevalence rate reaching as high as 50% in OECD countries (OECD, 2012). Mental illness is now becoming the second largest cause of global burden of diseases and disability, accounting for 11.23% of all years lived with disability (WHO, 2013; Vigo, *et al.*, 2016).

Furthermore, there are widespread concerns over the substantial economic consequences of mental illness among policy makers. Based on the conservative estimates of the International Labor Organization (ILO), the member states of European Union spent an average of 3-4% of their annual GNP on providing healthcare and welfare related to mental disorders (ILO, 2000). A more recent study has estimated that the cumulative economic costs of mental disorders will amount to $16.3 trillion (2010 US Doller) from 2011-2030 (World Economic Forum, 2011). These costs arise from the direct medical costs associated with mental illness as well as the indirect costs mainly caused by the loss of labor productivity. Actually, the latter costs deserve more careful analysis, because they are often hard to observe and tend to be ignored or misunderstood. Mental illness may lead to *decreased labor supply* or *lower performance* at work, resulting in an inevitable loss of productivities of both individuals and firms. Considering the rapid process of population aging and rising burden on public finance faced by most developed countries, it has critically important policy implications for policy makers to develop a comprehensive understanding of the impacts of mental illness on labor market outcomes.[1]

[1] The labor market outcomes mainly compose of two parts-labor supply and wage level. The former includes the labor force participation, unemployment, working hours, employment status (regular worker or irregular worker), absenteeism and presenteeism. In this study, based

Using the data from a national representative survey conducted in Japan, this study empirically investigates the impacts of mental health on individuals' labor participation, chance of becoming a permanent employee and working hours. Japan is now faced with the most serious population aging problems, with the highest proportion of aging population in the world. Meanwhile, the number of workers with mental illness in Japan has been increasing noticeably since the 1980s. Based on the "Work Condition and Health Survey" conducted by Japan's Ministry of Health, Labor and Welfare (MHLW), the proportion of workers with strong anxiety and stress in their work and occupational life increased from 55.0% in 1987 to 61.5% in 2012 (see Figure 1). The low level of workers' mental health is also reflected by the high prevalence of suiciding behaviors in Japan. For example, Japan has been ranked as the highest or second-highest in a suicide rate ranking among all OECD countries during the past decades (Chen, *et al.*, 2009).

There is a large body of literature examining the relationship between mental health and labor market outcomes. There is possibly a two-way causality. On one hand, mental health may affect labor supply and/or labor productivity (e.g. Kessler and Frank, 1997; Chatterji *et al*., 2007, 2009, 2011; Darr and Johns, 2008; Johns, 2010; Tefft, 2012; Dawson *et al*., 2015; Bubonya *et al.*, 2017). On the other hand, many previous studies have also documented the influence of work situations on labor's mental health (Otsuka *et al.*, 2009; Ma, 2010; Artazcoa, 2013, 2016; Bannai and Tamakoshi, 2014; Song *et al.*, 2014; Cho *et al.*, 2015; Afonso *et al.*, 2017; Cayuela, 2018; Cygan-Rehm and Wunder, 2018). Furthermore, there may exist unobservable factors, often called "the third factors", that could affect both mental health and labor market outcomes. Therefore, the endogeneity problem should be addressed carefully when analyzing the effects of mental health on labor market outcomes. In contrast to the rich literature in other developed countries, the empirical studies on this issue for Japan are still scarce and often lack careful

on the survey data, we focus on the labor force participation, working hours, employment status (permanent employee or temporary worker).

treatment of the endogeneity problems discussed above (Wada *et al.*, 2013; Suzuli *et al.*, 2015; Kuroda and Yamamoto, 2018).

Using the rich household survey data collected from the recent waves of the Comprehensive Survey of Living Conditions (CSLC) in Japan, this study investigates the impacts of mental health on labor force participation, chance of becoming a permanent employee and working hours in Japan. The main contributions of this study are as follows. First, the large samples that could be generalized to the entire population are used in this study. The large scale CSLC is a national representative survey conducted by Japan's MHLW every three years since 1986. We use the data from the most recent three waves (2010, 2013 and 2016) for this research. Comprehensive information was collected from a total of 687,455 households, resulting a pooled sample of 1,780,656 individuals of working ages.[2] Second, we try to address the endogeneity of mental health carefully in the estimations based on the data collected from unique questions asked in the CSLC. To be more specific, using the rich information on the causes of stress, one of the major determinants of mental health, we exploit the exogeneous variation in individuals' mental health status that is driven by family and personal matters to predict the causal effects of mental health.

We find that good mental health can significantly increase the probability of labor participation and the chance of becoming a permanent employee in Japan. The effect is stronger for male than female and stronger for the middle age group than for the other ager groups. However, the effects of mental health on working hours are limited to elderly self-employed male and female workers, and young self-employed female workers.

The remainder of this paper proceeds as follows. Section 2 provides a discussion on the possible channels of the impacts of mental health on labor market outcomes, and reviews the related literature. Empirical identification strategies and a brief

[2] The sample size varies by model specification. See our regression results in section 4 for more details.

description of the data will be given in Section 3. Section 4 presents our estimation results, and Section 5 concludes.

2. Literature review

2.1 The mechanisms of the impact of mental health on worker' individual labor market outcomes

From the labor economics perspective, mental health may affect labor market outcomes through following channels.

Firstly, based on the neoclassical labor supply model, an individual decides to work or not based on her reservation wage and market wage. When the market wage is higher than her reservation wage, she will decide to work to maximize the utility. Based on the human capital theory (Becker, 1964; Mincer, 1974), the wage level is decided by the individual's human capital, which is reflected by factors such as education attainment, tenure years (or experience years). As Grossman (1972) points out that the health is also a kind of human capital, health could possibly affect labor supply through its impact on wage rates. For example, when one suffers from mental illness, her wage rate will decrease, and the worker may reduce her labor supply, leading to fewer working hours or a complete exit from the labor market.

Secondly, from the labor demand perspective, health may affect labor supply because of the information asymmetry problem. In many cases, employers often evaluate their employees based on observable signals such as education attainment, tenure years and health status. According to the signal effect and statistical discrimination hypotheses, compared to their healthier counterpart workers with mental illness tend to be less likely to be employed for a long-term, or as a permanent worker.

Thirdly, the impact of mental health may differ by various groups. For example, compared with the youth and middle-aged groups, the elderly decrease their labor supply because of the availability of public pension (Seike and Ma,

2008). In additions, since mandatory retirement is prevalent in most of Japanese firms, particular in the large-size firms, it is possible that firms prefer to hire younger labors in expectation of a longer period of working years. Secondly, regarding the difference by gender, the theory of the allocation of time (Gronau, 1977; Becker, 1985a,1985b) shows that women are more likely to spend their time on housework, whereas men tend to spend more time on work. Particularly, since the consciousness of gender role segregation persists deeply in Japan, heterogeneous effect of mental health may be expected across gender. We examine these heterogenous effects carefully in Section 4.

Moreover, it should be noticed that there may also be a reverse causality running from labor market outcomes to mental health. For example, longer working hours may cause mental health problems (Otsuka et al., 2009; Ma, 2010; Artazcoa, 2013, 2016; Bannai and Tamakoshi, 2014; Song et al., 2014; Afonso et al., 2017; Cayuela, 2018; Kamila and Wunder, 2018). Therefore, it is important to address the endogeneity problem and the detailed strategies to solve this problem will discussed in Subsection 3.1.

2.2 Previous empirical studies on the issue

There is a large body of literature on the effects of mental health on labor market outcomes from both the economics and psychological/medical perspectives (e.g. Ettner *et al.*, 1997; Hamilton *et al.,* 1997; Kessler and Frank, 1997; Chatterji *et al.*, 2007, 2009, 2011;Darr and Johns, 2008; Johns, 2010; Tefft, 2012; Frijter *et al.*, 2014; Dawson *et al.*, 2015; Bubonya *et al.*, 2017). The results of previous studies generally indicate that mental illness could negatively affect labor market outcomes, -i.e. labor force participation, working hours and wages. For example, Chatterji *et al.* (2011) find that mental disorders are associated with 9% and 14% reductions in labor force participation and employment for males, respectively. Tefft (2012) analyzes the impact of health-related quality of life (HRQOL) on employment status, using a constructed index related to Seasonal Affective Disorder (SAD) to

instrument HRQOL. The results show that each additional day of poor mental health per month increases the probability of unemployment by 0.76% among women. A more recent study by Bubonya *et al.* (2017) investigates the linkage between mental health and two workplace productivity measures – absenteeism and presenteeism (i.e. lower productivity while attending work). They find that absence rates were approximately 5% higher among workers who reported having poor mental health. Moreover, Kessler and Frank (1997), Darr and Johns (2008), and Johns (2010) show that mental health-related productivity loss could vary across occupations, and Chatterji *et al.* (2011) indicate that the impacts of mental health could differ by gender.

To address the endogeneity of mental health, previous studies generally rely on an instrumental variables (IVs) method approach and/or panel data. The parental psychological problems (e.g. Ettner *et al.*, 1997; Marcotte *et al.*, 2000; Chatterji *et al.*, 2011), individual experiences of mental illness in the past (Ettner *et al.*, 1997; Hamilton *et al.*, 1997; Chatterji *et al.*, 2007, 2011), degree of religiosity (Alexandre and French, 2001; Chatterji *et al.*, 2007), perceived social support (Hamilton *et al.*, 1997; Alexandre and French, 2001; Ojeda *et al.*, 2010), participation in physical activity (Hamilton *et al.*, 1997) and darkness days (Tefft, 2012) are used as IVs in these previous studies.

In contrast to the sizable literature in the United States and other developed countries, there are extremely few studies that investigate the *causal* effects of mental health in Japan.[3] From the psychological/medical perspectives, Wada *et al.* (2012) calculate the presenteeism costs of five kinds of illnesses (namely, low back pain and stiff shoulder, mental illness, headache, stomachache, and insomnia), and they find the presenteeism costs are the highest for those with mental illness. Suzuki *et al.* (2015) report that, compared to their healthy counterparts, the probability of low working performance is 3.67 times higher for the group with poor mental health.

[3] For a detailed survey on the relationship between the health and employment in Japan, please refer to Kuroda and Yamamoto (2019).

Using the data from the Survey of Companies and Employees on Human Capital Development and Work-Life Balance from 2012 to 2016, Kuroda and Yamamoto (2018) find that the relation between the supervisor and worker can positively affect labor performance through its influence on workers' mental health.

Previous studies for Japan generally suffer from several serious problems. Firstly, empirical studies that have appropriately addressed the endogeneity problems of mental health measures are still rare. Specifically, Wada *et al.* (2012) and Suzuki *et al.* (2015) did not consider the endogeneity problem in their estimations. Kuroda and Yamamoto (2018) may be the most relevant study and they used the fixed effects models to address the endogeneity problem, yet time variant unobservable factors may result in a bias in their estimates. To our knowledge, this study is the first one to use the IV method to address the endogeneity problem for the issue in Japan. Secondly, the survey data used in theses previous studies are often not national representative, thus it is hard to generalize the research findings to the entire population which is more useful for policy makers. For example, the sample size in Wada *et al.* (2012), Suzuki *et al.* (2015) and Kuroda and Yamamoto (2018) are 6,800, 1,800 and 4,439, respectively. Lastly, most of the previous studies fail to consider the heterogenous effects of mental health across various groups. This study bridges these gaps by adopting a new set of IVs to address the endogeneity problem of mental health, utilizing the unique national representative data with rich information on individuals' health and labor market outcomes and investigating how the effects vary by various groups (i.e. male vs. female; the youth, middle-aged, and elderly groups; employed workers vs. self-employed workers).

3. Methodology

3.1. Econometric models

This study investigates the causal effects of mental health on two major labor market outcomes: (a) labor participation and (b) working hours. For individual *i*,

the reduced form relationship between labor market outcomes and mental health and be described by the following equations, (1) for (a) and (2) for (b).

$$\Pr(Y_i = 1|MH_i, X_i) = \beta_1 + \beta_{1MH}MH_i + \beta_{1X}X_i + \varepsilon_i \quad (1)$$

$$Y_i = \beta_2 + \beta_{2MH}MH_i + \beta_{2X}X_i + v_i \quad (2)$$

where Y_i is a dummy variable that indicates whether individual *i* works for Eq. (1) and a continuous variable that measures working hours or labor earnings for Eq. (2). MH stands for mental health, and X is a set of individual and household characteristics which may affect labor supply. Specifically, we include in X educational attainment, age, marital status, family structure, number of children under 6 years old, number of family members and regional dummies. β's are the coefficients to be estimated and ε_i and v_i are error items. If *MH* and *X* are uncorrelated with the error terms, a standard Probit model and an Ordinary Least Square (OLS) model will produce unbiased estimates for β_1's and β_2's. Unfortunately, mental health is likely to be affected by some factors included in the errors, such as unobservable workplace characteristics or general health conditions that can affect both labor and mental health, resulting in biased estimates.

Following the literature, we adopt an instrumental variable approach to solve this problem. For individual *i*, assuming *Z* as a set of factors such that $corr(Z, \varepsilon) = 0$ and $corr(Z, v) = 0$, her mental health is determined by the following equation:

$$MH_i = \beta_3 + \beta_{3z}Z_i + \beta_{3X}X + u_i. \quad (3)$$

The β_1's and β_2's could be estimated by a two-step procedure: (1) estimate Eq. (3) and predict $\widehat{MH}$ in the first step; and (2) include $\widehat{MH}$ as an explanatory variable and estimate Eqs. (1) and (2) in the second step. Whether the estimates are unbiased hinges critically on the validity of the instrumental variables *Z*, that is, *Z*

needs to be correlated with *MH* while satisfying the conditions that $corr(Z, \varepsilon) = 0$ and $corr(Z, v) = 0$.

In our empirical analysis, we use as our instrumental variable whether one suffers from (a) any stress from daily housework; (b) any stress caused by her residential area environment; and (c) any stress from her relationship with other family members.[4] Such stress coming from daily life at home could have a direct negative impact on one's mental health, yet is unlikely to suffer from the reverse causality or correlate with other unobservable factors of labor supply after controlling for major personal and household characteristics.

There are three major concerns about our IVs. Firstly, stress could arise from either a generally bad residential area environment (i.e. an unsafe or noisy area) or due to some random and exogenous problems (i.e. unexpected construction in the neighborhood). If it is the former, the IV may be correlated with factors such as income. Secondly, it is possible that a very bad relationship between a couple may result in the consideration of divorce, which may directly affect the labor supply decision. This is particularly relevant to the labor supply of female, as many housewives will be faced with the need for financial independence after divorce. The third possible complication is that the self-reported stress may pick up some emotions related to work, such as troubles arise from interpersonal relationships in the workplace which could be an important determinant of whether one wants to work.

Regarding the first concern, since there could be a reverse causality between income and labor supply, so that we could not control for income levels, we instead control for education levels and household structure. Presumably, individuals generally choose a desirable residence at the beginning. And the reported stress

[4] As summarized in Section 2, even though a set of IVs such as the parental psychological problems, individual experiences of mental illness in the past, degree of religiosity, perceived social support, participation in physical activity and darkness days are used as IVs in these previous studies, they may still suffer from various possible problems. Moreover, since such information is not available in the CSLC data, we create original IVs based on the unique information collected in the CSLC.

from housing and residential environment mainly comes from unexpected problems that occur later. We take two approaches to deal with the second concern. Firstly, the impact of mental health on labor supply is estimated separately for males and females, and marital status, household structure and number of children are explicitly controlled in the estimation. Furthermore, we exclude married females from the female sample to avoid complication. As for the confounding effects of work-related stress, it is less likely to occur in our analysis, because the CSLC collected detailed information on 20 causes of stress, allowing us to accurately disentangle different types of stress. Actually, as indicated in the Results section, our IVs appear to be valid according to the overidentification tests and the weak instrument tests in most of the cases.

Finally, we also investigate how the effects of mental health vary by age group. Specifically, the total sample, for males and females respectively, is divided into three subgroups: the subsample aged 22-40, the subsample aged 41-55, and subsample aged 56-65.

3.2. Data and variables

CSLC is a nationally representative household survey conducted by Japan's MHLW every three years since 1986.[5] The survey follows the sample rules used for population census and draws the subjects on the stratified random sampling basis.

During the survey, selected households were visited by trained enumerators and receive a set of 5 questionnaires on household, health, nursing care, incomes, and savings. Household and health questionnaires were administered to all the selected households, whereas the nursing care, incomes, and savings questionnaires were to only the households from a randomly chosen subset of the sampled geographical

[5] In some years, a small-scale survey was also conducted. Yet, as the small-scale survey does not contain questionnaires on health, nursing care, and savings, we do not use these survey data in this study.

strata.[6] As a consequence, the sample size for those with information on incomes and savings is usually about 10-15% of that of the full sample. Besides the sample size, the timing is also different for the two parts of the survey: the survey on household and health questionnaires is usually conducted in June, followed by income- and savings-related survey in July.[7] In June of 2007, more than 287,807 households were randomly chosen for the survey from 5,440 population census districts. The sample size is similar for each wave and, throughout the four waves, the survey collected extremely rich information on household and individual characteristics from a total of 687,455 households. After dropping the observations with missing values and pooling the data from three waves, the sample size is 1780,656 individuals of working ages from 22 to 65. See Table 1 for the detailed sample sizes.

This study focuses on three types of labor market outcomes: labor participation, the chance of becoming a permanent employee and working hours. We rely on two dummy variables to measure labor participation: (a) a binary variable that is equal to 1 when an individual worked in May for a primary paid job, and 0 otherwise; (b) a binary variable that is equal to 1 when an individual worked in May as a permanent employee, and 0 if she did not work or worked as a self-employed or irregular employee.[8] (c) Working hours are the actual numbers of hours worked in

[6] Sampling for the household questionnaire excludes the following types of households: (a) households of a single person living away from his or her family for a business or study purpose for three months or longer; (b) individuals of selected households who are put in social welfare facilities or those whose officially registered residential address has been moved to a hospital; (c) children in foster care; (d) those who are imprisoned; (e) and those who live away for some other reasons.

[7] Sampling for the income questionnaire excludes those who move out or into the sampled households after the survey in June, those who form a single-person household, and those who serve as a live-in worker.

[8] Permanent employees in Japan are defined as the regular employees who are tenured to work in a company until mandatory retirement in former sectors.

a typical week in May. It is the total working hours if an individual has multiple jobs.[9]

Mental health is measured by a score that is calculated based on six questions regarding the sample subjects' mental status in the past 30 days: (a) About how often did you feel nervous? (b) Did you feel hopeless? (c) Did you feel restless or fidgety? (d) About how often did you feel depressed, sad and nothing could cheer you up? (e) About how often did you feel everything is an effort? (f) About how often did you feel worthless? These questions are essentially from a shorter version questionnaire (K6) of the Kessler Psychological Distress Scale which is commonly used to measure mental health condition in the literature (Hashimoto, 2005; Kessler, 2002).[10] Specifically, the mental health score (MHS) is calculated based on principal factor analysis to effectively integrate all the information captured in the responses to these questions. Actually, we have confirmed that the MHS has a strong predictive power for an individual's sleeping hours and the probability of being diagnosed of a mental disorder, which suggests that the MHS is a suitable measure of mental health status (results are available upon request).

The descriptive statistics of the major dependent variables used in the analysis are summarized in Table 1 and those of mental health scores are shown in Table 2. They are reported by age groups and sex. Clearly, both mental health scores and working participation rates are lower for females than males. Since we restrict the female sample to only those who are single, the numbers of observations in the middle-age and the elderly samples are small.

4. Results

[9] The maximum value of weekly working hours is 168, which is clearly beyond a reasonable range. To exclude such outliers from estimation sample, we removed all the observations reporting working hours over the 99th percentile, which is 86 hours per week.

[10] There are two versions of the Kessler Psychological Distress Scale, one with ten questions (K10) and one with six questions (K6). The questions and answer options in the CSLC are essentially the same as those in the K6 which is a truncated version of the K10. See the Appendix for a detailed comparison of the questions in the K6 and the K10.

The results of the estimations that do not account for the endogeneity problem in mental health are presented in Tables 3 and 4 for males and females, respectively. As explained in Subsection 3.1, to predict the exogenous variation in one's mental health status, whether one suffers from stress caused by housework and residential area environment are used as the IVs for males; while whether one suffers from stress caused by housework and troubling intrahousehold relationship are used as instrumental variables for single females.[11] All the estimations are conducted separately for men and single women in three different age groups. For each subsample, three regressions are estimated for (a) whether one works or not (1 = yes); (b) whether one works as a permanent employee or not (1 = yes); and (c) weekly working hours for only the self-employed.[12] An IV probit model is estimated for (a) and (b), whereas a standard 2-step IV estimation is conducted for (c). The IV results are presented in Tables 5 and 6: Columns (1)-(3) for those aged 22-40, Columns (4)-(6) for those aged 41-55, and Columns (7)-(9) for those aged 56-65.

The estimates of mental health score in Table 3 are generally significantly positive, indicating a positive effect of good mental health on labor supply. After controlling for the endogeneity problem of mental health, the IV results in Table 5 for males generally become smaller for labor participation, which implies an overestimation for the effect of mental health possibly driven by the reverse causality, i.e.- job participation improves mental health. In contrast, for the estimation of working hours, IV estimates are greater than the OLS estimates, which is probably because long working hours have a negative effect on worker's mental health.

[11] The different sets of IVs used for males and females were mainly determined by the results of the over-identification tests to ensure the they are uncorrelated with the unobservable factors of labor supply.

[12] We have also estimated the weekly working hours for the full sample as well for the employed sample only, yet find little effects and thus refrain from reporting those results. A possible explanation of the null effect is that most employees in Japan do not have much decision power on how much time to work and they usually receive fixed amount of salary.

We, therefore, focus on the IV results for causal inferences. For the young group, a higher mental health score increases the probability of both working and being a permanent employee. It also has a positive impact on the weekly working hours for the self-employed. The effects on labor participation are bigger for the middle age group, and get even larger for the elderly group. On the other hand, the estimate of mental health for working hours is statistically insignificant for the middle age group, which turns significant again for the elderly group. A possible explanation is that most Japanese middle-age men generally bear a heavy financial burden of their families, so that they may still have to work even when suffering from certain mental health conditions. Another possible reason is that the self-employed workers have to work longer hours than their counterparts (employees) to obtain similar earnings due to a lower wage rate. This situation lasts until their late middle age when they start to be able to receive public pensions. Pensionable ages in Japan range from 60 to 65, and many firms provide early retirement plans or reduce wage rates starting from the late 50s of their employees. In response, individuals usually have to be faced with working options such as whether to retire or whether to switch from formal sectors to informal ones or self-employment during this age period. Therefore, mental health conditions become a more important determinant of labor supply during this period.

The IV results for single women are reported in Table 6.[13] Similar to the male sample, the effects of mental health on labor participation tend to be overestimated without controlling for the endogeneity problem (compared to the results in Table 4). In contrast, the effects on working hours are likely to be underestimated due to possible reverse causality and/or the confounding effects of unobservable factors. The IV results indicate even greater effects of mental health for females than males. For a single woman aged 22-40, a higher mental health score could significantly increase her probability of both working and being a permanent employee, as well

[13] Both women who have never married and those who used to be married are included in the sample.

as her weekly working hours. The effect on labor participation gets greater for the middle age group, but turns insignificant for weekly working hours, following the similar pattern observed among the middle-age males. Recall that the study sample is single women who are also subject to tight constraints that may reduce their flexibility in adjusting the working time to their mental health status. During the old ages, the estimates of mental health score again turn significant for working hours, as individuals have more options, i.e. working or living on public pensions.

In sum, our results indicate large effects of mental health on labor supply and working time, for both males and single females, and the effects vary for different age groups. To visualize how large the effects are, the estimated marginal effects are reported in Table 7. According to our IV estimates, increasing the mental health score by 1 point will lead to an increase in the probability of labor participation by 8.9-14.2% for different male samples, and 13.7-15.4% for various female samples. Based on the 2018 total labors in Japan. Using this estimated coeffecients, we predicte the number of decreased labors from one unit decrease in mental health score and it is 4.1 million for males and 4,160,000 females, approximately 6.15% and 6.24% of the total labors in Japan, respectively. See Figure 2 for the details of the prediction.

Good mental health could be more important for the middle age group, especially for the males, to increase the chance to become a permanent employee: one-unit improvement in mental health score increases the probability by 15.5% (13.5) for males (females). As permanent employees usually enjoy better welfare packages and are guaranteed lifetime employment until mandatory retirement ages in Japan, the benefit of maintaining good mental health is potentially large. Lastly, the effect of mental health on weekly working hours varies by various groups, it is more significant for the elderly group who have more working options and decision power on working hours.

Lastly, it is important to examine the validity of the instrumental variables. In general, the IVs selected in the current study perform well and have passed all the

weak instrumental variable tests (see the Kleibergen-Paap LM test F statistics in Tables 4 and 6). As for the over-identification test, the IVs passed 15 tests out of a total of 18 (see the Hansen J statistics in Tables 4 and 6).[14] Although over-identification test does not provide the sufficient condition for the IVs to be exogenous, it is important to pass the test as a necessary condition of valid IVs.

A few caveats need to be noted. Firstly, since the IVs could not pass 3 over-identification tests, we suspect that there are probably some unobservable factors of labor participation during the elderly ages, as well as the middle ages for males, that may correlate with the stress caused by family life and environment; hence one needs to be cautious about these results. Secondly, the estimates for females are the LATE based on a sample of only single women, which may suffer from a sample selection bias and should not be applied to a general female population.

5. Conclusions

Existing literatures find that there is a negative correlation between individual's mental illness and her performance in the labor market. Average working hours in Japan has been found to be much longer than those of the other developed countries. According to OECD statistics, the average annual hours Japanese actually worked were 1,710 hours in 2017, which was substantially longer than the number for Germany (1,356 hours in 2017). Cygan-Rehm and Wunder (2018) find adverse consequences of increasing working hours on subjective and several objective health measures by using German survey data. In addition, Ma (2009) and Kuroda and Yamamoto (2014) find that longer working hours are associated with poorer mental health in Japan.

Our study confirms a large and heterogeneous effect of mental health on labor supply. We find that good mental health can significantly increase the probability of labor participation and the chance of becoming a permanent employee in Japan.

[14] The IVs fail the test for the estimation of labor participation for the middle age and the elderly males and the elderly females.

The effect is stronger for women compared with men, and strongest for the middle age group than for the other age group. On the other hand, we also find an adverse effect of bad mental health on working hours to the elderly self-employed male and female workers, and the young self-employed female workers.

The Japanese government enacted "The Work Style Reform Bill" on June 2018, and one of the most important aims of this reform is to correct the culture of long working hours and promote more diverse and flexible working styles. Our results indicate that improving labors' mental health by reduced working hours through such kind of reforms could further increase labor supply, and possibly lead to a positive cycle in the long run.

References

Alexandre, P. K., French, M. T., 2001. Labor supply of poor residents in Metropolitan Miami, Florida: the role of depression and the co-morbid effects of substance use. *Journal of Mental Health Policy Economics* 4, 161-173.

Afonso, P., Fonseca, M. and Pires, J F., 2017. Impact of working hours on sleep and mental health. *Occupational Medicine- Oxford* 67(5), 377-382.

Artazcoa, L., Cortes, I., Bernavides, F. G.. Escriba-Aguir, V., and Bartoll, X., 2013. Long working hours and health in Europe: between-country differences. *Scandinavian Journal of Work, Environment & Health* 39(4), 369-378.

Artazcoa, L.n Cortes, I., Bernavides, F. G., Escriba-Aguir, V., Bartoll, X., 2016. Long working hours and health in Europe: Gender and welfare state differences in a context of economic crisis. *Health & Place* 40, 161-168.

Bannai, A., Tamakoshi, A., 2014. The association between long working hours and health: A systematic review of epidemiological evidence. *Scandinavian Journal of Work, Environment & Health* 40(1), 5-18.

Barnay, T., 2016. Health, work and working conditions: A review of the European economic literature. *European Journal of Health Economics* 17, 693-709.

Becker, G. S., 1964. *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education.* New York, Columbia University Press.

Becker, G. S., 1985a. Human capital, effort, and the sexual division of labor. *Journal of Labor Economics* 3(1), 33-58.

Becker, G. S., 1985b. The allocation of effort, specific human capital, and the differences between men and women in earning and occupations. *Journal of Labor Economics* 3(1), 33-58.

Bubonya, M., Cobb-Clark, D. A., Wooden, M., 2017. Mental health and productivity at work: Does what you do matter? *Labour Economics* 46, 150-165.

Cai, L., 2010. The relationship between health and labor force participation: Evidence from a panel data simultaneous equation model. *Labour Economics* 17, 77-90.

Cayuela, A., Martinez, J. M., Ronda, E., Delclos, G. L., Conway, S., 2018. Assessing the influence of working hours on general health by migrant status and family structure: the case of Ecuadorian-, Colombian-, and Spanish-born workers in Spain. *Public Health* 163, 27-34.

Chatterji, P., Alegria, M., Lu, M., Takeuchi, D., 2007. Psychiatric disorders and labor market outcomes: Evidence from the National Latino and Asian American study. *Health Economics* 16, 1069-1090.

Chatterji, P., Alegria, M., Lu, M., Takeuchi, D., 2011. Psychiatric disorders and labor market outcomes: Evidence from the national comorbidity survey-replication. *Journal of Health Economics* 30, 858-868.

Chatterji, P., Alegria, M., Lu, M., Takeuchi, D., 2009. Racial/Ethnic differences in the effect of psychiatric disorders on employment. *Atlantic Economic Journal* 37, 243-257.

Chen, J., Choi, Y.J., Sawada, Y., 2009. How is suicide different in Japan, *Japan and the World Economy* 21(2), 140-150.

Cho, S., Li, M., Kim, K., Ju, Y., Paek, D., Lee, W., 2015. Working hours and self rated health over 7 years: gender differences in a Korean longitudinal study. *BMC Public Health* 15(1), 1-11.

Cygan-Rehm, K., Wunder, C. W., 2018. Do working hours affect health? Evidence from statutory workweek regulations in Germany. *Labour Economics* 53, 162-171.

Darr, W. and Johns, G., 2008. Work strain, health, and absenteeism: A meta-analysis. *Journal of Occupational Health Psychology* 13(4), 293-318.

Dawson, C., Veliziotis, M., Pacheco, G., Webber, D. J., 2015. Is temporary employment a cause ore consequence of poor mental health? A panel data analysis. *Social Science & Medicine* 134, 50-58.

Ettner, S.L., Frank, R.G., Kessler, R.C., 1997. The impact of psychiatric disorders on labor market outcomes. *Industrial and Labor Relations Review* 51(1), 64-81.

Frijter, P., Johnston, D.W., Shields, M.A., 2014. The effect of mental health on employment: Evidence from Australian panel data. *Health Economics* 23, 1058-1071.

Gronau, R., 1977. Leisure, home production, and work: The theory of the allocation of time revisited. *Journal of Political Economy* 85(6), 1099-1123.

Grossman, M., 1972. On the concept of health capital and the demand for health. *Journal of Political Economics* 80(2), 223-255.

Halla, M., Zweimuller, M., 2013. The effect of health on earnings: Quasi-experimental evidence from commuting accidents. *Labour Economics* 24, 23-38.

Hamilton, V. H., Merrigan, P., Dufresne, E., 1997. Down and out: estimating the relationship between mental health and unemployment. *Health Economics* 6, 397-406.

Hashimoto, H. 2005. Basic discussion on utilization of health indices in The Comprehensive Survey of Living Conditions (CSLC). *Indices of Welfare* 52(11), 14-22. (In Japanese)

International Labor Organization (ILO), 2000. *Mental Health in the Workplace*. Geneva.

Johns, G., 2019. Presenteeism in the workplace: A review and research agenda. J*ournal of Organization Behavior* 31(4, 519-542.

Kessler, R. C, Andrews, G, et al. 2002. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological medicine* 32, 959-976.

Kessler, R. C., Frank, R. G., 1997. The impact of psychiatric disorders on work loss days. *Psychological Medicine* 27(4), 861-873.

Kuroda, S., Yamamoto, I., 2014. Workers' Mental Health, Long Work Hours, and Workplace Management: Evidence from workers' longitudinal data in Japan, *RIETI Discussion Paper Series*, 14-J-20

Kuroda, S., Yamamoto, I., 2018. Good boss, bad boss, worker' mental health and productivity: Evidence from Japan, *Japan and World Economy* 48, 106-118.

Kuroda, S., Yamamoto, I., 2019. Policies and measures necessary for improving workers' health: Discussions based on labor economics studies, *RIETI Policy Discussion Paper Series*, 19-P-004

Lundbor, P., Nilsson, M., Vikstrom, J., 2015. Heterogeneity in the impact of health shocks on labor outcomes: Evidence from Swedish workers. *Oxford Economic Paper* 67(3), 715-739.

Ma, X., 2009. Does long working hours cause to the mental health problem? In *The Dynamic of Household Behavior in Japan V*, Higuqi, Y., Seiko, Y., Tarayama, H. (eds). Keio University Press, Tokyo. (In Japanese)

Marcotte, D. E., Wilcox-Gok, V., Redmon, D. P., 2000. The labor market effects of mental illness: the case of affective disorders. In *The Economics of Disability*, Salkever, D., Sorkin, A. (eds). JAI Press, Greenwich, CT, 181-210.

Mincer, J., 1974. *Schooling, Experience and Earning*. New York, Columbia University Press.

OECD. 2012. Sick on the Job? Myths and Realities about Mental Health and Work, *Mental Health and Work,* OECD Publishing: Paris.

Ojeda, V. D., Frank, R. G., McGuire, T. G., Giler, T.P., 2010. Mental illness, nativity, gender and labor supply. *Health Economics* 19, 396-421.

Otsuka, Y., Sasaki, T., Iwasakim, K., Mori, I., 2009. Working hours, coping skills, and psychological health in Japanese daytime workers. *Industrial Health* 47(1), 22-32.

Pelkowski, J. M., Berger, M. C., 2004. The impact of health on employment, wages, and hours worked over the life cycle. *The Quarterly Review of Economics and Finance* 44, 102-121.

Seike, A., Ma, X., 2008. The change of the determinants of elderly labor supply in Japan: 1980-2004. *Labor Policy Report, No.100*, The Japan Institute for Labour Policy and Training. (In Japanese)

Song, J., Lee, G., Kwon, J., Park, J., Choi, H., Lim, S., 2014. The Association between Long Working Hours and Self-Rated Health. *Annals of Occupational and Environmental Medicine* 26(2), 1-12.

Suzuki, T., Miyaki, K., Song, Y., Tsutsuki, A., Kawakami, N., Shimazu, A., Takahashi, M., Inoue, A., Kurioka, S., 2015. Relationship between sickness, presenteeism (WHO-HPQ) with depression and sickness absence due to mental disease in a cohort of Japanese workers. *Journal of Affective Disorders* 180, 14-20. (In Japanese)

Tefft, N., 2012. Mental health and employment: The SAD story. *Economics and Human Biology* 10, 242-255.

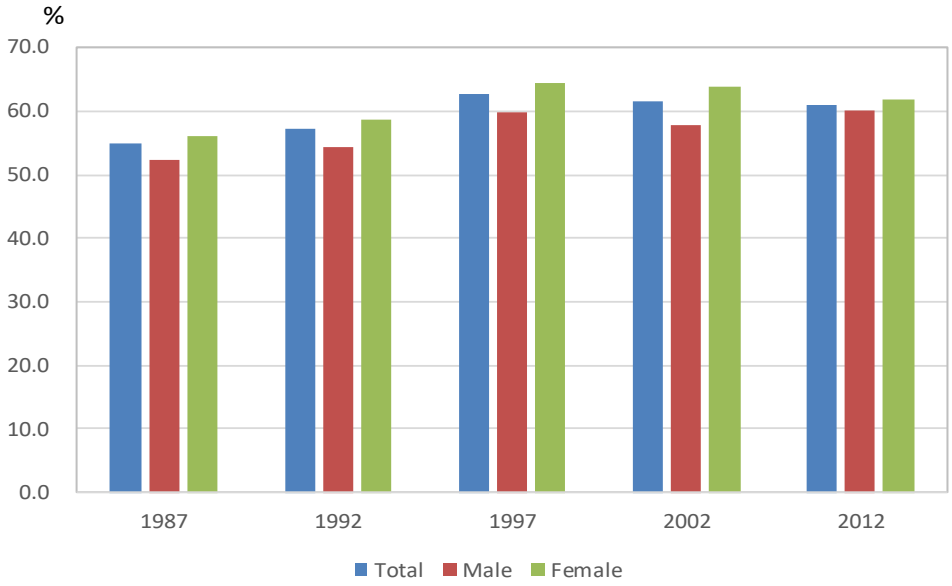
Vigo, D., Thornicroft, G., Atun, R., 2016. Estimating the true global burden of mental illness, *Lancet Psychiatry* 3(2), 171-178.

Wada, K., Arakida, M., Watanabe, R. , Negishi, M., Sato, J. and Tsutsumi, A., 2013. The economic impact of loss of performance due to absenteeism and presenteeism caused by depressive symptoms and comorbid health conditions among Japanese workers. *Industrial Health* 51(5), 482-489.

World Economic Forum, 2011. *The global economic burden of non-communicable diseases*. Harvard School of Public Health, Boston.

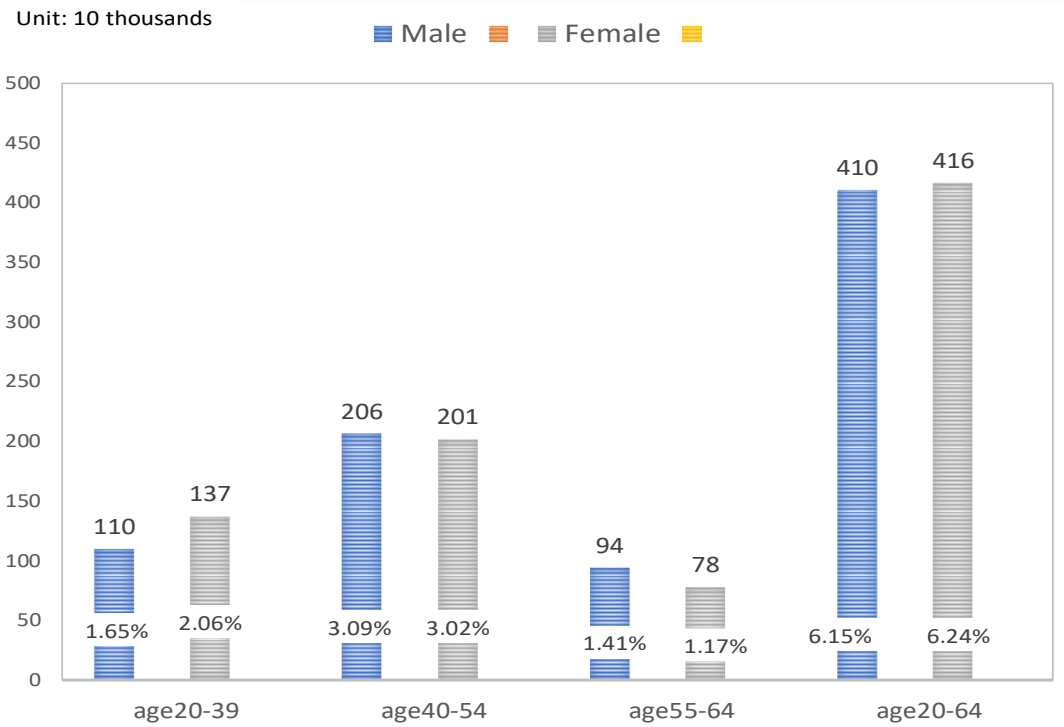
World Health Organization (WHO), 2013. *Mental Health Action Plan 2013-2020*. Geneva.

Figure1 Proportions of workers who answered that they are with strong anxiety, troubles and stress in their work and occupational life.



Source: Based on the data from the “Work Condition and Health Survey" conducted by the Ministry of Health, Labor and Welfare

Figure2 Predicted number of decreased labor supply due to 1-point increase in mental health score



Source: The calculation is based on the results in Table 7 and the data from 2018 Labor Force Survey by Ministry of Internal Affairs and Communications Statistics Bureau, Japan.

Note: the percentage values express the rates of decreased labors by mental health illness to national total labors in 2018.

Table 1 Descriptive statistics

	Male					Female				
	no. of obs	mean	s.d.	min	max	no. of obs	mean	s.d.	min	max
			22-40					22-40		
Work (1 = yes)	144,700	0.911	0.284	0.000	1.000	59,923	0.856	0.351	0.000	1.000
Permanent employee (1 = yes)	144,700	0.803	0.397	0.000	1.000	59,923	0.589	0.492	0.000	1.000
Weekly working hours	128,213	47.259	12.733	0.000	84.000	50,015	41.331	11.522	0.000	84.000
Employed (1 = yes)	130,814	0.638	0.480	0.000	1.000	50,742	0.650	0.477	0.000	1.000
Mental health PCA score	144,700	-0.095	2.188	-9.797	1.508	59,923	-0.476	2.354	-9.797	1.508
			41-55					41-55		
Work (1 = yes)	139,130	0.940	0.238	0.000	1.000	15,657	0.803	0.398	0.000	1.000
Permanent employee (1 = yes)	139,130	0.881	0.324	0.000	1.000	15,657	0.561	0.496	0.000	1.000
Weekly working hours	127,384	47.776	12.081	0.000	84.000	12,261	40.547	11.991	0.000	84.000
Employed (1 = yes)	129,905	0.634	0.482	0.000	1.000	12,389	0.703	0.457	0.000	1.000
Mental health PCA score	139,130	-0.004	2.032	-9.797	1.508	15,657	-0.467	2.280	-9.797	1.508
			56-65					56-65		
Work (1 = yes)	102,351	0.787	0.409	0.000	1.000	4,819	0.544	0.498	0.000	1.000
Permanent employee (1 = yes)	102,351	0.606	0.489	0.000	1.000	4,819	0.325	0.469	0.000	1.000
Weekly working hours	78,419	42.281	13.870	0.000	84.000	2,546	35.521	14.177	0.000	84.000
Employed (1 = yes)	79,638	0.593	0.491	0.000	1.000	2,542	0.666	0.472	0.000	1.000
Mental health PCA score	102,351	0.259	1.770	-9.797	1.508	4,819	-0.228	2.066	-9.797	1.508

Source: Calculated based on the Comprehensive Survey of Living Conditions (CSLC) in Japan

Table 2 Summaries of mental health scores

	Male			Female			Total
	22-40	41-55	56-65	22-40	41-55	56-65	
(a) About how often did you feel nervous? (1-5)	4.285	4.249	4.314	4.075	4.060	4.150	4.182
(b) Did you feel hopeless?	4.562	4.613	4.681	4.554	4.570	4.635	4.596
(c) Did you feel restless or fidgety?	4.438	4.479	4.567	4.395	4.429	4.529	4.464
(d) About how often did you feel depressed, sad and nothing could cheer you up?	4.351	4.368	4.486	4.217	4.226	4.361	4.324
(e) About how often did you feel everything is an effort?	4.393	4.380	4.457	4.344	4.264	4.389	4.365
(f) About how often did you feel worthless?	4.553	4.599	4.663	4.493	4.507	4.627	4.565
Total scores	26.609	26.728	27.249	26.109	26.107	26.803	26.548

Note: The scores are coded as follows. 1- All the time; 2- Always; 3-Sometimes; 4-Occasionally; Never

Source: Calculated based on the Comprehensive Survey of Living Conditions (CSLC) in Japan

Table 3 OLS results of the impact of mental health on male labor supply

	22-40			41-55			55-65		
	(1) work dummy (1 = yes)	(2) permanent employee (1 = yes)	(3) wekly working hours (self-employed)	(4) work dummy (1 = yes)	(5) permanent employee (1 = yes)	(6) wekly working hours (self-employed)	(7) work dummy (1 = yes)	(8) permanent employee (1 = yes)	(9) wekly working hours (self-employed)
Mental health PCA score	0.086 ***	0.066 ***	0.003 ***	0.113 ***	0.086 ***	0.002 **	0.077 ***	0.052 ***	0.007 ***
	(41.31)	(37.28)	(3.24)	(46.04)	(41.04)	(2.44)	(30.35)	(21.72)	(4.17)
Age	0.310 ***	0.215 ***	0.068 ***	0.018	0.120 ***	0.006	0.172 **	-1.333 ***	0.173 ***
	(26.10)	(22.28)	(13.65)	(0.53)	(4.34)	(0.70)	(2.10)	(-18.31)	(3.92)
Age squared	-0.005 ***	-0.003 ***	-0.001 ***	0.000	-0.001 ***	0.000	-0.003 ***	0.010 ***	-0.002 ***
	(-24.47)	(-19.56)	(-12.96)	(-1.26)	(-5.16)	(-1.20)	(-3.99)	(16.00)	(-4.67)
Unmarried (1 = yes) [1]	-1.079 ***	-1.057 ***	-0.091 ***	-1.208 ***	-1.150 ***	-0.111 ***	-0.838 ***	-0.684 ***	-0.120 ***
	(-43.16)	(-60.78)	(-16.45)	(-65.63)	(-77.53)	(-16.31)	(-35.66)	(-30.97)	(-7.03)
Widowed (1 = yes)	-0.576 ***	-0.612 ***	-0.076	-0.616 ***	-0.494 ***	-0.039 *	-0.419 ***	-0.266 ***	-0.085 ***
	(-2.76)	(-3.95)	(-1.24)	(-9.45)	(-9.01)	(-1.88)	(-12.67)	(-8.47)	(-3.44)
Divorced (1 = yes)	-0.660 ***	-0.613 ***	-0.038 ***	-0.785 ***	-0.746 ***	-0.036 ***	-0.503 ***	-0.489 ***	-0.068 ***
	(-15.45)	(-19.27)	(-2.94)	(-29.17)	(-34.35)	(-4.05)	(-19.91)	(-20.83)	(-4.12)
Resident single (1 = yes)[1]	0.849 ***	0.775 ***	0.039 ***	1.077 ***	0.347 ***	0.012	0.780 ***	0.234 ***	0.041
	(17.84)	(23.66)	(3.10)	(13.56)	(7.77)	(0.84)	(9.47)	(3.89)	(1.37)
Other single (1 = yes)	0.352 ***	0.351 ***	0.012	0.452 ***	0.371 ***	0.016 *	0.137 ***	0.112 ***	0.004
	(8.91)	(12.89)	(1.17)	(15.11)	(15.59)	(1.76)	(5.60)	(4.97)	(0.28)
Household of a couple and unmarried child(ren) (1 = yes)	0.000	0.109 ***	0.006	0.261 ***	0.246 ***	0.022 ***	0.088 ***	0.040 ***	0.014 *
	(0.00)	(4.25)	(0.84)	(9.48)	(11.78)	(3.61)	(5.52)	(2.82)	(1.73)
Household of a single parent and unmarried child(ren) (1 = yes)	0.005	0.040	-0.014	0.268 ***	0.238 ***	0.019 *	0.087 ***	0.141 ***	0.050 **
	(0.12)	(1.41)	(-1.19)	(8.60)	(9.39)	(1.69)	(2.73)	(4.67)	(2.28)
Three-generation-family household (1 = yes)	0.034	0.152 ***	0.012	0.281 ***	0.221 ***	0.023 ***	0.118 ***	0.111 ***	0.013
	(0.79)	(4.94)	(1.14)	(7.08)	(7.30)	(2.66)	(4.26)	(4.65)	(1.00)
Other household (1 = yes)	-0.004	0.013	-0.008	0.134 ***	0.047 *	-0.001	0.040 **	0.074 ***	0.011
	(-0.10)	(0.43)	(-0.69)	(4.09)	(1.86)	(-0.06)	(2.08)	(4.37)	(1.11)
One child unde age 6 (1 = yes) [1]	0.168 ***	0.076 ***	0.012 **	0.054	-0.040	-0.004	0.049	0.069	-0.009
	(5.36)	(3.76)	(2.28)	(1.40)	(-1.59)	(-0.60)	(0.38)	(0.65)	(-0.22)
Two children under age 6 (1 = yes)	0.164 ***	0.104 ***	0.008	-0.081	-0.144 ***	0.005	-0.364	-0.209	0.045
	(3.98)	(4.01)	(1.24)	(-1.11)	(-2.92)	(0.40)	(-1.37)	(-0.88)	(0.51)
Three and more children under age 6 (1 = yes)	0.194 *	0.140 **	0.031 *	-0.242	-0.337 **	0.026	0.000	0.000	
	(1.66)	(2.05)	(1.81)	(-1.00)	(-2.04)	(0.68)	.	.	
Junior high schoold (1 = yes) [1]	-0.543 ***	-0.491 ***	-0.030 ***	-0.435 ***	-0.446 ***	-0.052 ***	-0.042 ***	0.004	-0.004
	(-26.92)	(-28.88)	(-3.63)	(-21.59)	(-25.90)	(-6.20)	(-3.11)	(0.35)	(-0.54)
Career college (1 = yes)	0.050 ***	0.067 ***	0.020 ***	0.095 ***	0.058 ***	0.030 ***	0.154 ***	0.181 ***	0.001
	(2.99)	(5.22)	(4.13)	(4.33)	(3.43)	(5.36)	(6.56)	(8.99)	(0.08)
Junior college/ technical college (1 = yes)	0.185 ***	0.218 ***	0.016 *	0.184 ***	0.221 ***	0.015 *	0.024	0.040	-0.012
	(5.64)	(8.94)	(1.86)	(4.91)	(7.74)	(1.81)	(0.80)	(1.54)	(-0.83)
University (1 = yes)	0.008	0.187 ***	0.021 ***	0.177 ***	0.261 ***	0.021 ***	0.003	0.111 ***	-0.020 ***
	(0.64)	(17.98)	(5.45)	(11.56)	(21.74)	(6.07)	(0.29)	(10.75)	(-3.19)
Graduate university (1 = yes)	-0.428 ***	-0.110 ***	-0.054 ***	0.271 ***	0.403 ***	0.031 ***	0.267 ***	0.426 ***	0.035 *
	(-18.58)	(-5.56)	(-4.69)	(5.94)	(11.46)	(3.56)	(6.38)	(12.01)	(1.90)
Number of households members	0.024 ***	0.015 ***	0.002	0.007	0.021 ***	0.002	0.029 ***	0.036 ***	0.010 ***
	(3.64)	(3.03)	(1.19)	(0.83)	(3.16)	(0.95)	(3.95)	(5.73)	(2.66)
2013 (1 = yes) [1]	0.004	-0.025 ***	-0.024 ***	0.019	-0.015	0.013 ***	0.113 ***	0.020 *	0.080 ***
	(0.32)	(-2.58)	(-3.73)	(1.25)	(-1.29)	(2.91)	(10.03)	(1.93)	(12.55)
2016 (1 = yes)	0.092 ***	0.043 ***	-0.034 ***	0.080 ***	0.043 ***	-0.005	0.255 ***	0.067 ***	0.102 ***
	(6.89)	(4.08)	(-4.61)	(5.21)	(3.51)	(-0.92)	(20.84)	(6.21)	(15.34)
Constant	-3.012 ***	-2.526 ***	2.707 ***	1.875 **	-1.117 *	3.780 ***	0.274	45.670 ***	-0.556
	(-16.21)	(-16.63)	(33.53)	(2.24)	(-1.69)	(18.19)	(0.11)	(20.68)	(-0.42)
County dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	144700	144700	45804	139130	139130	46146	102349	102349	31217
F Statistics			24.420			13.390			25.150
Chi2 Statistics	15677.000	24963.300		12983.800	17856.700		12857.200	16549.200	
Prob > F, Prob>chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Psuedo R squared	0.181	0.174		0.205	0.175		0.121	0.121	
Adjusted R squared			0.043			0.024			0.054

Notes:

1. P-values are reported in the parenthesis; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
2. The omitted categories are "Married", "Household of a couple only", "No child under age 6", "High school" and "2010".

Source: Calculated based on the Comprehensive Survey of Living Conditions (CSLC) in Japan

Table 4 OLS results of the impact of mental health on female labor supply

	22-40			41-55			55-65		
	(1) work dummy (1 = yes)	(2) permanent employee (1 = yes)	(3) wekly working hours (self-employed)	(4) work dummy (1 = yes)	(5) permanent employee (1 = yes)	(6) wekly working hours (self-employed)	(7) work dummy (1 = yes)	(8) permanent employee (1 = yes)	(9) wekly working hours (self-employed)
Mental health PCA score	0.036 ***	0.045 ***	0.025 ***	0.060 ***	0.051 ***	0.020	0.056 ***	0.040 ***	0.083 **
	(15.56)	(16.60)	(4.45)	(12.28)	(9.82)	(1.37)	(4.57)	(3.61)	(2.15)
Age	0.056 ***	0.040 ***	0.040 ***	0.039 **	0.072 ***	-0.043	-0.185	-0.432 ***	0.362
	(16.05)	(8.51)	(5.48)	(2.14)	(3.19)	(-1.02)	(-1.64)	(-4.07)	(0.84)
Age squared	-0.001 ***	-0.001 ***	-0.001 ***	0.000 **	-0.001 ***	0.000	0.001	0.003 ***	-0.003
	(-15.82)	(-8.34)	(-5.21)	(-2.54)	(-3.35)	(0.94)	(1.23)	(3.71)	(-0.93)
Unmarried (1 = yes) [1]	0.110 ***	0.223 ***	0.053 *	0.134 ***	0.236 ***	0.051	0.076	0.170 **	0.421 **
	(10.22)	(14.04)	(1.89)	(4.98)	(5.60)	(0.64)	(1.00)	(2.07)	(2.14)
Resident single (1 = yes)[1]	0.081 ***	0.137 ***	0.029 *	0.056 ***	0.093 ***	-0.004	0.028	-0.033	0.236 ***
	(10.59)	(12.82)	(1.81)	(3.44)	(4.85)	(-0.10)	(0.99)	(-1.27)	(2.64)
Other single (1 = yes)	-0.017 ***	0.005	-0.025 **	-0.057 ***	-0.013	-0.063 **	-0.043	0.010	0.090
	(-2.88)	(0.66)	(-2.14)	(-4.56)	(-0.91)	(-2.27)	(-1.35)	(0.32)	(0.84)
Household of a couple and unmarried child(ren) (1 = yes)	-0.004	0.000	-0.036 **	-0.028 **	0.009	-0.029	-0.047 **	-0.033	0.047
	(-0.53)	(0.00)	(-2.43)	(-2.14)	(0.58)	(-0.99)	(-2.11)	(-1.55)	(0.59)
Household of a single parent and unmarried child(ren) (1 = yes)	-0.013 *	0.015	-0.028 **	-0.014	0.067 ***	-0.018	-0.002	0.039	-0.251
	(-1.84)	(1.49)	(-2.02)	(-0.68)	(2.69)	(-0.39)	(-0.02)	(0.59)	(-1.09)
Other household (1 = yes)	-0.072 ***	-0.144 ***	-0.244 ***	0.093	0.058	-0.169	-	-	-
	(-3.00)	(-5.52)	(-3.37)	(1.62)	(0.76)	(-1.06)	-	-	-
One child unde age 6 (1 = yes) [1]	-0.066	-0.332 ***	-0.425 ***	0.304 ***	-0.072	0.024	-	-	-
	(-0.91)	(-4.78)	(-4.06)	(5.98)	(-0.23)	(0.32)	-	-	-
Two children under age 6 (1 = yes)	-0.037	0.042	-0.227 **	-	-	-	-	-	-
	(-0.24)	(0.27)	(-2.29)	-	-	-	-	-	-
Junior high schoold (1 = yes) [1]	-0.223 ***	-0.219 ***	-0.193 ***	-0.249 ***	-0.198 ***	-0.128 **	-0.067 ***	-0.065 ***	-0.092
	(-18.25)	(-19.67)	(-6.43)	(-13.26)	(-11.30)	(-2.52)	(-3.05)	(-3.51)	(-1.32)
Career college (1 = yes)	0.055 ***	0.144 ***	0.075 ***	0.056 ***	0.127 ***	0.052 **	0.101 ***	0.092 ***	0.055
	(12.80)	(24.00)	(8.81)	(6.04)	(10.84)	(2.46)	(4.23)	(3.89)	(0.77)
Junior college/ technical college (1 = yes)	0.077 ***	0.142 ***	0.062 ***	0.063 ***	0.094 ***	0.020	0.030	0.046 **	-0.014
	(18.55)	(22.94)	(7.84)	(7.56)	(8.85)	(1.07)	(1.50)	(2.37)	(-0.19)
University (1 = yes)	0.048 ***	0.182 ***	0.077 ***	0.091 ***	0.181 ***	0.083 ***	0.063 ***	0.132 ***	-0.077
	(12.63)	(34.63)	(9.74)	(10.75)	(16.08)	(3.88)	(2.90)	(6.05)	(-1.01)
Graduate university (1 = yes)	-0.087 ***	0.022	-0.077 **	0.074 ***	0.206 ***	0.044	0.097	0.268 ***	-0.534
	(-7.51)	(1.58)	(-2.04)	(3.42)	(7.14)	(0.67)	(1.50)	(4.01)	(-1.15)
Number of households members	0.006 ***	0.002	0.003	-0.010 **	-0.014 **	0.007	-0.013	-0.005	0.104 ***
	(3.65)	(0.93)	(1.01)	(-2.10)	(-2.49)	(0.58)	(-1.22)	(-0.56)	(3.34)
2013 (1 = yes) [1]	-0.004	-0.018 ***	-0.142 ***	0.005	-0.013	-0.125 ***	0.024	-0.012	-0.169 **
	(-1.21)	(-3.79)	(-6.73)	(0.65)	(-1.31)	(-4.05)	(1.33)	(-0.70)	(-2.29)
2016 (1 = yes)	0.012 ***	0.001	-0.136 ***	0.035 ***	0.012	-0.147 ***	0.057 ***	-0.017	-0.038
	(3.50)	(0.27)	(-5.49)	(4.47)	(1.24)	(-4.81)	(3.17)	(-0.98)	(-0.56)
Constant	-0.023	-0.164 **	3.007 ***	0.073	-1.100 **	4.768 ***	7.564 **	14.600 ***	-6.518
	(-0.43)	(-2.32)	(26.61)	(0.17)	(-2.06)	(4.77)	(2.23)	(4.55)	(-0.51)
County dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	60061	60061	17300	15692	15692	3571	4827	4827	816
F statistics	34.480	71.160	7.538	18.170	19.770	1.963	9.795	8.967	1.606
Prob>F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
LM test statistic	2236.900	2236.900	577.800	684.400	684.400	122.500	154.300	154.300	26.540
Prob>Chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Kleibergen-Paap LM test F stat.	1957.300	1957.300	486.700	585.500	585.500	89.100	126.600	126.600	25.390
Hansen J Statistics	0.113	0.676	0.001	0.295	0.168	1.191 .	11.180	1.367	0.158
Prob>chi2	0.737	0.411	0.971	0.587	0.682	0.275	0.001	0.242	0.691

Notes:

1. P-values are reported in the parenthesis; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
2. The omitted categories are "Married", "Household of a couple only", "No child under age 6", "High school" and "2010".

Source: Calculated based on the Comprehensive Survey of Living Conditions (CSLC) in Japan

Table 5 IV results of the impact of mental health on male labor supply

	22-40			41-55			55-65		
	(1) work dummy (1 = yes)	(2) permanent employee (1 = yes)	(3) wekly working hours (self-employed)	(4) work dummy (1 = yes)	(5) permanent employee (1 = yes)	(6) wekly working hours (self-employed)	(7) work dummy (1 = yes)	(8) permanent employee (1 = yes)	(9) wekly working hours (self-employed)
Mental health PCA score	0.013 ***	0.024 ***	0.009	0.024 ***	0.034 ***	0.005	0.041 ***	0.044 ***	0.031 ***
	(7.52)	(9.92)	(1.60)	(11.68)	(13.37)	(1.00)	(10.11)	(9.97)	(2.89)
Age	0.057 ***	0.071 ***	0.068 ***	0.002	0.019 ***	0.011	0.308 ***	-0.249 ***	0.172 ***
	(27.94)	(27.66)	(13.62)	(0.45)	(4.05)	(1.18)	(15.25)	(-10.66)	(3.83)
Age squared	-0.001 ***	-0.001 ***	-0.001 ***	0.000	0.000 ***	0.000 *	-0.003 ***	0.002 ***	-0.002 ***
	(-27.28)	(-25.67)	(-12.88)	(-1.17)	(-4.85)	(-1.70)	(-17.09)	(8.11)	(-4.59)
Unmarried (1 = yes) [1]	-0.128 ***	-0.240 ***	-0.095 ***	-0.165 ***	-0.258 ***	-0.114 ***	-0.231 ***	-0.224 ***	-0.118 ***
	(-56.26)	(-74.56)	(-16.63)	(-51.15)	(-66.11)	(-16.52)	(-31.82)	(-28.39)	(-6.82)
Widowed (1 = yes)	-0.046 *	-0.105 ***	-0.089	-0.052 ***	-0.076 ***	-0.043 **	-0.112 ***	-0.085 ***	-0.078 ***
	(-1.82)	(-2.63)	(-1.45)	(-5.10)	(-5.81)	(-2.02)	(-10.57)	(-7.43)	(-3.13)
Divorced (1 = yes)	-0.057 ***	-0.111 ***	-0.039 ***	-0.084 ***	-0.146 ***	-0.035 ***	-0.122 ***	-0.153 ***	-0.053 ***
	(-11.22)	(-14.73)	(-2.99)	(-19.75)	(-26.27)	(-3.78)	(-16.01)	(-17.95)	(-3.09)
Resident single (1 = yes)[1]	0.126 ***	0.201 ***	0.045 ***	0.084 ***	0.050 ***	0.013	0.146 ***	0.069 ***	0.057 *
	(29.66)	(29.33)	(3.40)	(19.15)	(5.95)	(0.86)	(11.92)	(3.81)	(1.84)
Other single (1 = yes)	0.047 ***	0.077 ***	0.021 *	0.043 ***	0.062 ***	0.015 *	0.023 ***	0.037 ***	0.010
	(12.40)	(14.13)	(1.90)	(10.93)	(12.09)	(1.66)	(3.37)	(4.79)	(0.63)
Household of a couple and unmarried child(ren) (1 = yes)	-0.009 ***	0.006	0.006	0.015 ***	0.031 ***	0.022 ***	0.023 ***	0.016 ***	0.012
	(-3.58)	(1.46)	(0.81)	(6.64)	(9.81)	(3.48)	(5.84)	(3.34)	(1.49)
Household of a single parent and unmarried child(ren) (1 = yes)	-0.019 ***	-0.028 ***	-0.013	0.004	0.022 ***	0.017	0.024 **	0.052 ***	0.054 **
	(-3.80)	(-4.23)	(-1.07)	(0.80)	(3.34)	(1.47)	(2.42)	(4.70)	(2.43)
Three-generation-family household (1 = yes)	0.000	0.022 ***	0.006	0.017 ***	0.030 ***	0.022 **	0.029 ***	0.039 ***	0.014
	(-0.08)	(3.59)	(0.57)	(5.37)	(6.55)	(2.53)	(4.57)	(5.04)	(1.00)
Other household (1 = yes)	-0.010 **	-0.017 ***	-0.008	-0.002	-0.008 *	0.001	0.010 **	0.027 ***	0.013
	(-2.22)	(-2.67)	(-0.69)	(-0.59)	(-1.72)	(0.14)	(2.06)	(4.76)	(1.24)
One child unde age 6 (1 = yes) [1]	0.007 ***	0.009 ***	0.013 **	-0.004 **	-0.011 ***	-0.002	0.007	0.014	-0.004
	(5.27)	(3.75)	(2.37)	(-2.31)	(-4.06)	(-0.39)	(0.32)	(0.48)	(-0.11)
Two children under age 6 (1 = yes)	0.003	0.008 ***	0.012 *	-0.011 ***	-0.023 ***	0.005	-0.068	-0.059	0.035
	(1.61)	(2.78)	(1.71)	(-3.19)	(-4.20)	(0.42)	(-0.91)	(-0.67)	(0.37)
Three and more children under age 6 (1 = yes)	0.003	0.014 **	0.034 *	-0.015	-0.044 *	0.011	0.082 ***	0.213 ***	-
	(0.88)	(2.05)	(1.92)	(-1.08)	(-1.83)	(0.28)	(4.04)	(3.53)	-
Junior high schoold (1 = yes) [1]	-0.092 ***	-0.130 ***	-0.032 ***	-0.076 ***	-0.116 ***	-0.049 ***	-0.011 ***	0.005	-0.001
	(-22.68)	(-26.35)	(-3.74)	(-19.58)	(-24.54)	(-5.73)	(-2.66)	(1.05)	(-0.09)
Career college (1 = yes)	0.006 ***	0.015 ***	0.020 ***	0.011 ***	0.012 ***	0.031 ***	0.037 ***	0.061 ***	0.001
	(3.05)	(4.98)	(4.09)	(4.97)	(4.02)	(5.55)	(7.18)	(9.42)	(0.12)
Junior college/ technical college (1 = yes)	0.020 ***	0.046 ***	0.015 *	0.016 ***	0.034 ***	0.021 **	0.003	0.011	-0.008
	(6.17)	(9.51)	(1.72)	(5.72)	(8.70)	(2.44)	(0.40)	(1.31)	(-0.57)
University (1 = yes)	-0.002	0.037 ***	0.022 ***	0.014 ***	0.037 ***	0.020 ***	-0.002	0.033 ***	-0.023 ***
	(-0.99)	(16.01)	(5.55)	(10.30)	(20.79)	(5.64)	(-0.85)	(9.70)	(-3.62)
Graduate university (1 = yes)	-0.070 ***	-0.035 ***	-0.055 ***	0.015 ***	0.046 ***	0.038 ***	0.048 ***	0.122 ***	0.024
	(-18.08)	(-7.69)	(-4.74)	(5.71)	(13.08)	(4.15)	(6.07)	(12.40)	(1.29)
Number of households members	0.002 **	0.001	0.003	0.000	0.002 *	0.002	0.006 ***	0.012 ***	0.010 ***
	(2.33)	(1.21)	(1.41)	(0.15)	(1.90)	(1.02)	(3.64)	(5.71)	(2.77)
2013 (1 = yes) [1]	0.001	-0.006 ***	-0.016 **	0.000	-0.004 *	0.022 ***	0.028 ***	0.007 **	0.092 ***
	(0.45)	(-2.71)	(-2.38)	(0.29)	(-1.94)	(4.76)	(9.49)	(2.13)	(14.15)
2016 (1 = yes)	0.012 ***	0.009 ***	-0.031 ***	0.006 ***	0.005 **	0.001	0.063 ***	0.023 ***	0.111 ***
	(6.79)	(3.79)	(-4.17)	(4.10)	(2.53)	(0.25)	(20.71)	(6.40)	(16.43)
Constant	0.037	-0.339 ***	2.711 ***	0.977 ***	0.520 ***	3.694 ***	-7.344 ***	9.852 ***	-0.503
	(1.11)	(-8.13)	(33.33)	(11.62)	(4.58)	(17.34)	(-12.10)	(14.02)	(-0.37)
County dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	146415	146415	46496	140817	140817	46886	103034	103034	31575
F statistics	170.700	372.000	25.890	96.110	184.000	14.250	196.000	323.000	24.450
Prob>F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LM test statistic	1945.300	1945.300	567.500	1874.600	1874.600	557.700	1253.700	1253.700	322.300
Prob>Chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Kleibergen-Paap LM test F stat.	1515.500	1515.500	421.600	1410.500	1410.500	408.500	923.700	923.700	232.200
Hansen J Statistics	1.872	0.004	0.074	5.640	0.266	1.679	12.600	2.658	0.537
Prob>chi2	0.171	0.951	0.786	0.018	0.606	0.195	0.000	0.103	0.464

Notes:

1. P-values are reported in the parenthesis; $^{*}\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$
2. The omitted categories are "Married", "Household of a couple only", "No child under age 6", "High school" and "2010".

Source: Calculated based on the Comprehensive Survey of Living Conditions (CSLC) in Japan

Table 6 IV results of the impact of mental health on female labor supply

	22-40			41-55			55-65		
	(1) work dummy (1 = yes)	(2) permanent employee (1 = yes)	(3) wekly working hours (self-employed)	(4) work dummy (1 = yes)	(5) permanent employee (1 = yes)	(6) wekly working hours (self-employed)	(7) work dummy (1 = yes)	(8) permanent employee (1 = yes)	(9) wekly working hours (self-employed)
Mental health PCA score	0.036 ***	0.045 ***	0.025 ***	0.060 ***	0.051 ***	0.020	0.056 ***	0.040 ***	0.083 **
	(15.56)	(16.60)	(4.45)	(12.28)	(9.82)	(1.37)	(4.57)	(3.61)	(2.15)
Age	0.056 ***	0.040 ***	0.040 ***	0.039 **	0.072 ***	-0.043	-0.185	-0.432 ***	0.362
	(16.05)	(8.51)	(5.48)	(2.14)	(3.19)	(-1.02)	(-1.64)	(-4.07)	(0.84)
Age squared	-0.001 ***	-0.001 ***	-0.001 ***	0.000 **	-0.001 ***	0.000	0.001	0.003 ***	-0.003
	(-15.82)	(-8.34)	(-5.21)	(-2.54)	(-3.35)	(0.94)	(1.23)	(3.71)	(-0.93)
Unmarried (1 = yes) [1]	0.110 ***	0.223 ***	0.053 *	0.134 ***	0.236 ***	0.051	0.076	0.170 **	0.421 **
	(10.22)	(14.04)	(1.89)	(4.98)	(5.60)	(0.64)	(1.00)	(2.07)	(2.14)
Resident single (1 = yes) [1]	0.081 ***	0.137 ***	0.029 *	0.056 ***	0.093 ***	-0.004	0.028	-0.033	0.236 ***
	(10.59)	(12.82)	(1.81)	(3.44)	(4.85)	(-0.10)	(0.99)	(-1.27)	(2.64)
Other single (1 = yes)	-0.017 ***	0.005	-0.025 **	-0.057 ***	-0.013	-0.063 **	-0.043	0.010	0.090
	(-2.88)	(0.66)	(-2.14)	(-4.56)	(-0.91)	(-2.27)	(-1.35)	(0.32)	(0.84)
Household of a couple and unmarried child(ren) (1 = yes)	-0.004	0.000	-0.036 **	-0.028 **	0.009	-0.029	-0.047 **	-0.033	0.047
	(-0.53)	(0.00)	(-2.43)	(-2.14)	(0.58)	(-0.99)	(-2.11)	(-1.55)	(0.59)
Household of a single parent and unmarried child(ren) (1 = yes)	-0.013 *	0.015	-0.028 **	-0.014	0.067 ***	-0.018	-0.002	0.039	-0.251
	(-1.84)	(1.49)	(-2.02)	(-0.68)	(2.69)	(-0.39)	(-0.02)	(0.59)	(-1.09)
Other household (1 = yes)	-0.072 ***	-0.144 ***	-0.244 ***	0.093	0.058	-0.169	-	-	-
	(-3.00)	(-5.52)	(-3.37)	(1.62)	(0.76)	(-1.06)	-	-	-
One child unde age 6 (1 = yes) [1]	-0.066	-0.332 ***	-0.425 ***	0.304 ***	-0.072	0.024	-	-	-
	(-0.91)	(-4.78)	(-4.06)	(5.98)	(-0.23)	(0.32)	-	-	-
Two children under age 6 (1 = yes)	-0.037	0.042	-0.227 **	-	-	-	-	-	-
	(-0.24)	(0.27)	(-2.29)	-	-	-	-	-	-
Junior high schoold (1 = yes) [1]	-0.223 ***	-0.219 ***	-0.193 ***	-0.249 ***	-0.198 ***	-0.128 **	-0.067 ***	-0.065 ***	-0.092
	(-18.25)	(-19.67)	(-6.43)	(-13.26)	(-11.30)	(-2.52)	(-3.05)	(-3.51)	(-1.32)
Career college (1 = yes)	0.055 ***	0.144 ***	0.075 ***	0.056 ***	0.127 ***	0.052 **	0.101 ***	0.092 ***	0.055
	(12.80)	(24.00)	(8.81)	(6.04)	(10.84)	(2.46)	(4.23)	(3.89)	(0.77)
Junior college/ technical college (1 = yes)	0.077 ***	0.142 ***	0.062 ***	0.063 ***	0.094 ***	0.020	0.030	0.046 **	-0.014
	(18.55)	(22.94)	(7.84)	(7.56)	(8.85)	(1.07)	(1.50)	(2.37)	(-0.19)
University (1 = yes)	0.048 ***	0.182 ***	0.077 ***	0.091 ***	0.181 ***	0.083 ***	0.063 ***	0.132 ***	-0.077
	(12.63)	(34.63)	(9.74)	(10.75)	(16.08)	(3.88)	(2.90)	(6.05)	(-1.01)
Graduate university (1 = yes)	-0.087 ***	0.022	-0.077 **	0.074 ***	0.206 ***	0.044	0.097	0.268 ***	-0.534
	(-7.51)	(1.58)	(-2.04)	(3.42)	(7.14)	(0.67)	(1.50)	(4.01)	(-1.15)
Number of households members	0.006 ***	0.002	0.003	-0.010 **	-0.014 **	0.007	-0.013	-0.005	0.104 ***
	(3.65)	(0.93)	(1.01)	(-2.10)	(-2.49)	(0.58)	(-1.22)	(-0.56)	(3.34)
2013 (1 = yes) [1]	-0.004	-0.018 ***	-0.142 ***	0.005	-0.013	-0.125 ***	0.024	-0.012	-0.169 **
	(-1.21)	(-3.79)	(-6.73)	(0.65)	(-1.31)	(-4.05)	(1.33)	(-0.70)	(-2.29)
2016 (1 = yes)	0.012 ***	0.001	-0.136 ***	0.035 ***	0.012	-0.147 ***	0.057 ***	-0.017	-0.038
	(3.50)	(0.27)	(-5.49)	(4.47)	(1.24)	(-4.81)	(3.17)	(-0.98)	(-0.56)
Constant	-0.023	-0.164 **	3.007 ***	0.073	-1.100 **	4.768 ***	7.564 **	14.600 ***	-6.518
	(-0.43)	(-2.32)	(26.61)	(0.17)	(-2.06)	(4.77)	(2.23)	(4.55)	(-0.51)
County dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	60061	60061	17300	15692	15692	3571	4827	4827	816
F statistics	34.480	71.160	7.538	18.170	19.770	1.963	9.795	8.967	1.606
Prob>F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
LM test statistic	2236.900	2236.900	577.800	684.400	684.400	122.500	154.300	154.300	26.540
Prob>Chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Kleibergen-Paap LM test F stat.	1957.300	1957.300	486.700	585.500	585.500	89.100	126.600	126.600	25.390
Hansen J Statistics	0.113	0.676	0.001	0.295	0.168	1.191 .	11.180	1.367	0.158
Prob>chi2	0.737	0.411	0.971	0.587	0.682	0.275	0.001	0.242	0.691

Notes:

1. P-values are reported in the parenthesis; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
2. The omitted categories are "Married", "Household of a couple only", "No child under age 6", "High school" and "2010".

Source: Calculated based on the Comprehensive Survey of Living Conditions (CSLC) in Japan

Table 7 Results of marginal effects

	22-40			41-55			55-65		
	work dummy (1 = yes)	permanent employee (1 = yes)	wekly working hours (self-employed)	work dummy (1 = yes)	permanent employee (1 = yes)	wekly working hours (self-employed)	work dummy (1 = yes)	permanent employee (1 = yes)	wekly working hours (self-employed)
Male	0.090 ***	0.103 ***	0.011 **	0.161 ***	0.155 ***	0.006	0.144 ***	0.132 ***	0.037 ***
	(6.98)	(10.27)	(2.12)	(12.69)	(14.68)	(1.18)	(10.99)	(10.63)	(3.45)
Female	0.137 ***	0.120 ***	0.001 ***	0.193 ***	0.135 ***	0.018	0.157 ***	0.125 ***	0.079 **
	(17.66)	(17.02)	(0.13)	(14.70)	(9.99)	(1.24)	(4.86)	(3.53)	(2.10)

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

Source: Calculated based on the Comprehensive Survey of Living Conditions (CSLC) in Japan

Appendix Table:

Comprehensive Survey of Living Conditions (K6)		Kessler Psychological Distress Scale (K10)	
1	During the past 30 days, about how often did you feel nervous?	2	During the past 30 days, about how often did you feel nervous?
		3	During the last 30 days, about how often did you feel so nervous that nothing could calm you down?
2	During the past 30 days, did you feel hopeless?	4	During the last 30 days, about how often did you feel hopeless?
3	During the past 30 days, did you feel restless or fidgety?	5	During the last 30 days, about how often did you feel restless or fidgety?
		6	During the last 30 days, about how often did you feel so restless you could not sit still?
4	During the past 30 days, about how often did you feel depressed, sad and nothing could cheer you up?	7	During the last 30 days, about how often did you feel depressed?
		9	During the last 30 days, about how often did you feel so sad that nothing could cheer you up?
5	During the past 30 days, about how often did you feel everything is an effort?	8	During the last 30 days, about how often did you feel that everything was an effort?
		1	During the last 30 days, about how often did you feel tired out for no good reason?
6	During the past 30 days, about how often did you feel worthless?	10	During the last 30 days, about how often did you feel worthless?