What Can We Learn from JSTAR about the Relationship between Socioeconomic Status and Depression?

Abstract

I explored the relationship between socioeconomic status (SES) and depression of middle-aged and elderly people using a panel data, the Japanese Study of Aging and Retirement (JSTAR). Men who were employed at the baseline and not employed two years later had an increased risk of onset of depression than men who were employed at both time points. Similar results were observed for women who were not employed at both time points. Women who were not in the labor force at the baseline had an increased risk of onset of categorical depression two years later.

Keywords: depression, JSTAR, socioeconomic status (SES)

JEL classification: I14,

1. Introduction

Depression management is a significant issue worldwide (Moussavi et al., 2007). For example, depression is a major risk factor for suicide (Dumais et al., 2005). In Japan, nearly 30,000 people commit suicide every year, and Japan's suicide mortality rate is the fourth worst among the 34 countries in the Organisation for Economic Co-operation and Development (OECD) (OECD, 2013). In addition, the economic cost of depression should not be overlooked. The estimated economic burden of depression in Japan in 2008 was $11 billion (Okumura and Higuchi, 2011).

For countries with a rapidly aging society such as Japan, managing depression for middle-aged and older people is a crucial issue. Middle aged and older people tend to commit suicide more often than younger people. Depression is known as a possible risk factor for dementia (Diniz, Butters, Albert, Dew, and Reynolds, 2013) and functional decline (Iwasa et al., 2009) which are prevalent among elderly people and are becoming a burden for the whole country.

Although depression tends to be regarded as a purely medical problem and treated with medication and psychotherapy, there is growing evidence that it is associated with low socioeconomic status (SES) including educational attainment,

work status, household income, and wealth (Lorant et al., 2003). Such evidence suggests that some type of social intervention may be an effective complementary tactic to prevent or alleviate depression. However, the results of previous research are inconsistent, and obtaining any convincing policy implication from them is difficult. In addition, much of the research on the relationship between SES and depression, especially those using panel data, was carried out in Western countries. Therefore, it is not clear if the policy implication obtained from such research is applicable to Asian countries. Thus, we need to accumulate research in this area in Asia including Japan.

In the present study, I tried to confirm the results of previous studies on SES by using panel data of middle-aged and elderly people in Japan. In many of the previous studies on the relationship between depression and SES, cross-sectional data were used. By contrast, the Japanese Study of Aging and Retirement (JSTAR) comprises panel data consisting of three time points (2007, 2009, 2011), enabling us to explore the dynamic relationship between socioeconomic factors and depression.

2. Previous Studies

In JSTAR, in addition to the level of depressive symptoms measured by the

Center for Epidemiologic Studies Depression Scale (CES-D), many questions on socioeconomic variables were asked to respondents. These questions include educational attainment, work status, annual income, household savings, homeownership, and debt status. Although the association between such SES variables and depression has been explored in many studies, the results tend to be mixed, and there has been less research conducted in Asia than in Western countries. The following is a short survey of previous research conducted on each of the SES variables.

2.1. Education and Depression

Bjelland et al. (2008) indicated, using longitudinal data in Norway, that a higher level of education has a protective effect against depression and anxiety. By contrast, Kosidou et al. (2011) found, using longitudinal data in Sweden, that a low level of education has a lower risk for depression in older people. In Asia, Back and Lee (2011) showed that a higher level of education is associated with a lower level of depressive symptoms for elderly Korean people, but this association is less clear after controlling for health related variables especially for men.

Limiting to studies in Japan, an association between education and depression

(or other mental illnesses) is not clear. Honjo et al. (2006) showed that those who are in the lowest educational attainment category have a poorer self-rated mental health assessment than those in the highest category, but Honjo, Kawakami, Tsuchiya, and Sakurai (2014) showed that such association is attenuated and is insignificant after adjusting for household income and subjective social status. Murata, Kondo, Hirai, Ichida, and Ojima (2008) showed that the years of education attained are negatively associated with the prevalence of depression in elderly people, but after controlling for income level, this association becomes less clear. In Sakurai, Kawakami, Yamaoka, Ishikawa, and Hashimoto (2010), a significant negative association between psychological distress and household income is found in men only and is insignificant after adjusting for household income and subjective social status.

2.2. Work Status and Depression

The relationship between unemployment and mental health including depression has been explored in many research studies. The relationship between retirement and mental health also has been explored. Regarding unemployment, several studies including meta-analyses (Paul and Moser, 2009) and a longitudinal

study (Flint, Bartley, Shelton, and Sacker, 2013) indicated that unemployment has a negative impact on mental health. Regarding retirement, a systematic review by van der Heide, van Rijn, Robroek, Burdorf, and Proper (2013) showed evidence of the beneficial effect of retirement on mental health including depression. However, there are also studies which found no association between unemployment and depression (Lorant et al., 2007) and between retirement and depression (Andrés, 2004). Although the effects of retirement and unemployment on mental health tend to be in the opposite direction from that found in previous research, retirement and unemployment are overlapped to some extent. Mckenzie, Gunasekara, Richardson, and Carter (2014) categorized labor force into "employed, unemployed and looking for work (active unemployed) and unemployed and not looking for work (inactive unemployed)." They showed that those who move into inactive unemployment experience deteriorating mental health, but it is not the case for active unemployment. The definition of retirement in van der Heide et al. (2013) is "the exit from labour force, taken by individuals after middle age, and taken within the intention of reduced psychological commitment to work thereafter," based on Feldman (1994). Inactive unemployed people in Mckenzie et al. (2014) include retired people as defined by Feldman.

Limiting to Japanese studies, Fukuda and Hiyoshi (2012) showed that unemployment is associated with a higher prevalence of psychological distress. Using panel data, Kan and Arita (2010) found that being unemployed has a negative impact on mental health by using the fixed effects model, but this result was not maintained in the sub sample excluding those whose activities were restricted for health reasons. Kan (2013) showed, by using panel data of people younger than 50 years old, that being out of work negatively affects mental health. Miyake, Tanaka, Sasaki, and Hirota (2011) found that employed women have a lower risk of postpartum depression compared with unemployed women.

2.3. Income and Depression

The inverse association between household income and depression has been indicated by several cross-sectional research studies (Martikainen, Adda, Ferrie, Smith, and Marmot, 2003; Knesebeck, Lüschen, Cockerham, and Siegrist, 2003; Back and Lee, 2011). However, the results of panel data studies are mixed. Several studies found no significant association between household income and mental illness including depression (Mckenzie et al., 2014; Zimmerman and Katon, 2005; Andrés, 2004; Lorant et al., 2007). In contrast, other studies show that lower

household income is associated with an increased risk of mental illness (Sareen, Afifi, McMillan, and Asmundson, 2011; Kosidou et al., 2011)

Limiting to studies on Japanese people, Murata et al. (2008) showed the association of annual income with depression in elderly people even after controlling for other socioeconomic factors. Similar results not limited to elderly people have been found in Fukuda and Hiyoshi (2012) and Honjo et al. (2014). In contrast, Honjo et al. (2006) showed no significant association between household income and self-rated mental health including elderly people. According to Sakurai et al. (2010), psychological distress is negatively associated with household income after adjusting for age and marital status in men, but not in women. All of the above mentioned Japanese studies were cross-sectional.

2.4. Wealth and Depression

Although I could not find research on the relationship between household wealth and depression in Japan, several studies were conducted in other countries with mixed results. Martikainen et al. (2003) indicated a negative association between household wealth and depression. Carter et al. (2009) indicated similar results. In contrast, in Silveira, Kabeto, and Langa (2005), there is no significant association

between these factors. Back and Lee (2011) showed that there is a negative association between household wealth and depression in elderly males but not in elderly females.

Regarding homeownership and debt, an inverse association between homeownership and poor mental health was reported in the United Kingdom (Macintyre, Hiscock, Kearns, and Ellaway, 2001) and the United States (Manturuk, 2012). A positive association between debt and depression is shown in many studies, but demonstration of causality is difficult because of a lack of longitudinal studies (Richardson, Elliott, and Roberts, 2013). Limiting to studies on Japanese people, Kaji et al. (2010) indicated that late life depression is associated with debt.

2.5. Preventive Effect of SES Variables on Depression

Although there are several studies examining whether SES variables at the baseline are risk factors or predictors for future depression, their results are varied. Using panel data in Britain, Shapinakis, Weich, Lewis, Singleton, and Araya (2006) showed that no objective SES variables at the baseline are associated with common mental disorders 18 months later. Using panel data in Canada, Wang, Schmitz, and Dewa (2010) showed that a low education level with no other objective SES

variables at the baseline is associated with a higher risk of onset of depression in six years. Kosidou et al. (2011) found that occupational class and income at the baseline are associated with onset of depression five years later.

3. Methods

3.1. Dataset

Data used in the present study are from JSTAR. JSTAR aims at developing a panel data survey covering the data of middle-aged and elderly people living in Japan. JSTAR is conducted by the Research Institute of Economy, Trade and Industry (RIETI), University of Tokyo, and Hitotsubashi University. The baseline sample individuals are aged between 50 and 75. There are three waves available at the timing of the present study: 2007, 2009, 2011. The first wave research was carried out in five municipalities in 2007. The second wave research was carried out in seven municipalities, including the five original municipalities and two new ones in 2009. The third wave research was carried out in 10 municipalities including the already mentioned seven municipalities and an additional three new ones. Details

of JSTAR are available elsewhere (Ichimura, Shimizutani, and Hashimoto, 2009).

3.2. Measures

3.2.1 Depression

Depression was measured by using CES-D (Radloff, 1977). CES-D is a 20-item scale that assesses the presence and severity of depressive symptoms experienced during the previous week. Four items in CES-D are reverse-scored and used for assessing the absence of positive emotion. CES-D scores range from 0 to 60, with higher scores indicating a higher level of depression. In the present study, the CES-D cutoff score for depression was set at 19, meaning that people with a CES-D score of 19 or higher were defined as being categorically depressed. Although several studies including Radloff (1977) set the cutoff score at 16, the ratio of people who met this value is too large to regard it as practical for measuring depression (Kaji et al., 2010). Hence, in the present study, I defined categorical depression as a CES-D score of 19 or higher, following Wada et al. (2007) which argued that the optimal CES-D cutoff score for screening of major depressive disorders of Japanese workers should be 19 instead of 16. In the present study, both the raw CES-D score and categorical depression are used as dependent variables.

3.2.2 SES Variables

As SES variables, I used educational attainment, work status, household income, household savings, debt, and homeownership. Educational attainment was measured by the last school attended and whether the subject graduated or dropped out. The answers of the respondents were classified into four categories: (1) 11 years or less, (2) 12 years (equal to high school graduates), (3) 13-15 years, (4) 16 years or more (four-year college graduates or higher). Work status was classified into three categories; (1) employed, (2) unemployed (not employed and seeking employment), (3) not in labor force (not employed and not seeking employment). Those who are unemployed include those who are not seeking employment at the moment, but are planning to seek it in the future.

Household income was based on the respondents' annual income as well as their spouse's annual income. For household income, we added the respondents' income and their partner's income if they shared household expenses. We used the respondents' income only if they were not married or if they didn't share household expenses with their spouses. Household income squared was included in independent variables as well to understand whether the relationship between

household income and depression is linear or U-shaped. Regarding wealth, calculating the value of entire net assets in JSTAR data was difficult because of a large amount of missing data. Thus, I used data on household savings, existence of homeownership, and debt as separate independent variables. Household savings in JSTAR is composed of not only bank and postal ordinary deposits, but also time deposits and postal savings certificates (Ichimura et al., 2009). For household savings, we added the respondents' household savings and their partner's household savings when they shared household expenditure. We used the respondents' household savings only if they were not married or if they didn't share household expenditure with their spouses. Household savings squared was included in independent variables as well to understand whether the relationship between household savings and depression is linear or U-shaped. Debt was measured as a binary variable (no debt / with debt). House loans were not included in debt in the present study. Homeownership was also measured as a binary variable (renting / owning a home).

3.2.3. Other Variables

In addition to abovementioned SES variables, I used gender, age, and marital

status as independent variables. Age was measured as a continuous variable. Marital status was measured as a binary variable (married / not married).

3.3. Statistical Analysis

In order to address the question of whether depression and SES variables are associated with each other, I used both raw CES-D scores and categorical depression (categorical depression was defined as CES-D score of 19 or higher) as dependent variables independently.

3.3.1. CES-D Scores as a Dependent Variable

When the CES-D score is a dependent variable, three analytical methodologies were used. For the first analysis, I used the fixed effects model and the random effects model and selected the appropriate model by using the Hausman specification test. Although there were many respondents who responded only once, I used all of their corresponding data for the above analysis. Hence, this panel is unbalanced. For the second analysis, I used the first difference model in order to know whether the changes in SES variables during the two years (from 2007 to 2009 and from 2009 to 2011) were associated with change in CES-D scores during

the same period. For the binary variable, the first difference model cannot differentiate between those who had the characteristics in both periods and those who did not. Hence, I created new categorical variables for marriage, work status, debt, and homeownership. In case of work status, I collapsed "unemployed" and "not in labor force" into "not employed," and made new categorical variables: (1) continued to be employed (employed at both time points), (2) gaining employment (not employed at the first time point and employed at the second time point), (3) continued to be not employed (not employed at both time points), (4) losing employment (employed at the first time point and not employed at the second time point). Those who continued to be employed were used as reference. Similar categorical variables were created for marriage, homeownership, and debt (See the description in the first column of Table 2). For household income and household savings, changes in continuous variables were used as independent variables. Multiple ordinary least squares (OLS) regression was used for change in the CES-D score as a dependent variable. The third analysis was multiple OLS regression using SES variables at the baseline (2007 or 2009) as independent variables and changes in CES-D scores from 2007 to 2009 and from 2009 to 2011 as dependent variables.

3.3.2. Categorical Depression as a Dependent Variable

For categorical depression as a dependent variable, the basic idea of analytical methodology is the same as the CES-D scores mentioned above. For the first analysis, I used the pooled logit model, fixed effects logit model, and random effects logit model and selected the appropriate model by using Hausman specification test. For logit models of categorical depression, respondents were regarded as being depressed if their CES-D score were 19 or higher and coded as 1. Non-depressed respondents were coded as 0.

For the second analysis, independent variables were the same as the second analysis for CES-D scores using the first difference model. But, in order to know whether those who are free from categorical depression at the baseline experienced onset of categorical depression two years later, those who were depressed at the baseline (2007 or 2009) were excluded from the analytical sample. This made two categories; (1) not depressed at both time points (coded as 0), (2) not depressed at the baseline and depressed two years later (coded as 1). I used multiple logistic regressions for this analysis.

For the third analysis, the dependent variable was binary code used in the

second analysis for categorical depression. I used SES variables at the baseline (2007 or 2009) as independent variables. This analysis was carried out in order to understand whether some SES variables at the baseline are risk factors or predictors for categorical depression two years later. The basic idea of this analysis was the same as Skapinakis et al. (2006).

3.3.3. Missing Data

It is known that complete case analysis (CCA), which uses only data of respondents who have no missing values in all of the variables, not only reduces statistic power but also causes bias when data are not missing completely at random (Sterne et al., 2009). Hence, I dealt with missing values in the following way. For gender, age, education, marital status, and education in which there were few missing values, samples with missing values in these categories were not used in the analyses. For household income, household savings, homeownership, and debt, I carried out multiple imputation (MI) using the imputation by the chained equations (ICE) function of STATA (White, Royston, and Wood, 2010). As variables for imputation, in addition to all of the variables in the analysis model, life satisfaction, subjective health, and hand grip strength were used in order to predict incomplete

variables. One hundred copies of the data were formed in the imputation, and missing values were imputed by using all of these variables. Each copy with imputed values was analyzed separately, and the averages of the individual estimates were treated as the overall estimates based on Rubin's rule (Rubin, 1987). Although the CES-D score (dependent variable) was included in the imputed values, it was excluded from the analytical sample (Von Hippel, 2007). The results of both CCA and MI were indicated in the present study.

4. Results

Table 1 shows the sociodemographic characteristics of the respondents. In 2007, there were 3,861 respondents in the original five municipalities. In 2009, 2,723 from the original five municipalities participated in the second wave, and 1,440 respondents from the two new municipalities joined. In 2011, 2,193 people from the original five municipalities and 982 people from the subsequent two municipalities remained in the survey, and they were joined by 1,963 respondents from the three new municipalities. There was a large amount of missing data especially in CES-D, household income and household savings. The corresponding rates of missing variables were 21.0%, 53.3%, and 58.3%, respectively. Although the total number of

responses was 13,162 including answers from the same people in different years, 2,930 samples remained in CCA (Model 3 of Table 3) due to missing variables.

Table 2 shows the changes in the sociodemographic characteristics of the respondents. There were no newly married people among the respondents.

4.1. CES-D Score and Categorical Depression

The mean CES-D score of all responses was 12.03. There were no significant differences in CES-D scores between 2007, 2009, and 2011. Repeated measures of analysis of variance (ANOVA) showed there were no differences in the means of CES-D scores for those who responded in both 2007 and 2009, in both 2009 and 2011, and in all of 2007, 2009, and 2011 (data not shown). The prevalence of categorical depression was 10.4% in all responses. The prevalence of categorical depression of unemployed respondents was 18.0%, which is more than twice as large as that of employed respondents—8.2%. Respondents with the lowest education attainment, household income, or household savings had a higher prevalence of categorical depression and higher CES-D scores. Those who rent also had a higher prevalence of categorical depression and higher CES-D scores.

Approximately 20% of the respondents chose the far left column for all 20 items in the CES-D, and this phenomenon increased the number of respondents whose CES-D score was 12. The CES-D contains four reverse-scored items. Hence, if respondents read the questionnaire carefully and correctly answered it, this type of behavior is unlikely to happen. This problem was reported in several studies (Inaba et al., 2005; Carlson et al., 2011). Although Inaba et al. (2005) excluded those who chose the far left column for all items from their analysis, I decided to include them in the present study.

4.2. Relationship between CES-D Scores and SES Variables

Panel data analyses were carried out by pooled OLS, the fixed effects model, and the random effects model (Table 3). The fixed effects model was selected in Model 1 and the random effects model was selected in both Models 2 and 3 as the results of the Hausman specification test. Both lower household income and lower household savings were associated with higher CES-D scores. The square of household income and household savings was significantly positive, suggesting that an inverse U-curve shape relationship exists between these variables and the CES-D score. With regard to work status, those who were unemployed or not in the labor force

had significantly higher CES-D scores than those who were employed. There is no significant association between debt and CES-D scores. Homeownership is inversely associated with CES-D scores. The highest educational attainment is associated with lower CES-D scores in MI only (Model 2). Being married lowers CES-D scores after adjusting for SES variables only in MI (Model 2). Age is negatively associated with CES-D scores and age squared is positively associated with CES-D scores after adjusting for SES variables only in MI (Model 2), suggesting the existence of a U-curve shape relationship between age and CES-D score.

The result of the first difference model is shown in Table 4. Models 1 and 4 do not include variables on debt, homeownership, household income, and household savings which have many missing variables. Models 4, 5, and 6 add baseline CES-D scores as a covariate in order to adjust for them. Those who gained employment (not employed at the first time point and employed at the second time point) experienced a decrease in CES-D scores at the second time point in Models 1 and 2, but not in CCA (Model 3). Although this decrease is attenuated after adjusting for baseline CES-D scores, it is still significant, suggesting that both a higher level of CES-D scores at the first time point and the effect of gaining employment contribute to the decrease in CES-D scores. Changes in CES-D scores are inversely associated with

changes in household income in MI (Models 2 and 5). This is not the case for household savings. Continuing to rent increases CES-D scores after adjusting for baseline CES-D scores in CCA only (Model 6). Newly gaining homeownership decreases CES-D scores before adjusting for baseline CES-D score in MI only (Model 2).

The result of the third analysis (association between SES variables at the baseline and change in CES-D scores two years later) is shown in Table 5. Those who were unemployed experienced a decrease in CES-D scores two years later (Models 1 and 2) except in CCA. However, this decrease is attenuated and is not significant after adjusting for CES-D scores at the baseline (Models 4 through 6). There are no other significant associations between SES variables at the baseline and changes in CES-D scores two years later.

4.3. Relationship between Categorical Depression and SES Variables

In Tables 6, 7, and 8, categorical depression or changes in categorical depression status are dependent variables. Logistic regression was used, and their results are reported in odds ratio (OR) and 95% confidence intervals (CI).

Regarding the relationship between categorical depression (dependent variable)

and independent variables including SES variables, the result is shown in Table 6. As a result of the Hausman specification test, the pooled logit model was selected in Model 1 and the random effects logit model was selected in Models 2 and 3. Both lower household income and lower household savings are associated with categorical depression. There is no significant association between debt and categorical depression. Homeownership is inversely associated with categorical depression. The lowest education attainment is associated with categorical depression in Model 1, but this association is insignificant after adjusting for SES variables (Models 2 and 3). With regard to work status, those who were unemployed or not in the labor force had a higher prevalence of categorical depression than those who were employed. Being married is inversely associated with categorical depression (Models 1 and 2) except in CCA.

The result of the first difference model is shown in Table 7. Changes in household income and household savings are not significantly associated with the onset of categorical depression. Those who lost employment (employed at the first time point and not employed at the second time point) and those who continued to be not employed (not employed at the both time points) during the two years had an increased risk of onset of categorical depression than those who continued to be

employed even after adjusting for CES-D at baseline (Models 1, 2, 4, and 5), but not in CCA. No significant association between change in debt status and onset of categorical depression was found. Those who lost homeownership had an increased risk of onset of categorical depression at the second time point than those who continued homeownership in MI only (Models 2 and 5). Those who were not married at both time points and those who got divorced or became widowed between the two time points had an increased risk of onset of categorical depression at the second time point than those who were married at both time points (Models 1 and 2) except in CCA. These associations are attenuated after adjusting for CES-D at the baseline, but are still significant for those who continued to be unmarried (Models 4 and 5).

The result of the third analysis (association between SES variables at the baseline and onset of categorical depression two years later) is shown in Table 8. Those who were not in the labor force at the baseline had a significantly increased risk of onset of categorical depression two years later, compared with those who were employed at the baseline (Models 1 and 2), but not in CCA. There were no significant associations between other SES variables at the baseline and onset of categorical depression two years later. Those who were married had a decreased risk of onset of categorical depression two years later in Models 1, 2, and 4.

4.4. Gender Difference

I checked the gender difference in the relationship between categorical depression and SES variables focusing on work status. I show only the results of the analysis with the first difference model (Table 9) and the analysis on the association between SES variables at the baseline and onset of categorical depression two years later (Table 10) because of striking gender differences in these analyses. Table 9 shows that those who lost employment had a significantly increased risk of onset of categorical depression in men only (Models 2 and 5) except in CCA. Those who continued to be not employed during the two years had a significantly increased risk of onset of categorical depression in women only (Models 3 and 6) except in CCA. Table 10 shows that those who were not in the labor force at the baseline had a significantly increased risk of onset of categorical depression two years later in women only in all models.

5. Discussion

The result of the present study is summarized as follows. A change in household income is associated with changes in the presence and severity of depressive

symptoms as measured by the CES-D score. However, in respondents free from categorical depression at the baseline, there was no significant association between changes in household income during the two years and the onset of categorical depression as defined by a CES-D score of 19 or higher. The relationship between depression with household savings is less clear than that with household income. In respondents free from categorical depression at the baseline, men who lost employment (employed at the baseline and not employed two years later) had an increased risk of onset of categorical depression than men who were employed at both time points except in CCA. Similar results were observed for women who were not employed for both time points. Women who were not in the labor force (not employed and not seeking employment) at the baseline had an increased risk of onset of categorical depression two years later. There were no other SES variables at the baseline predicting onset of categorical depression two years later. Homeownership tends to be inversely associated with depression. The relationship between debt and depression is not clear from the present study.

The result of the present study suggests that household income and savings amount may not be a crucial SES factor for dealing with depression. A change in income by one million yen reduced CES-D scores by approximately 0.6 point in the

maximum case (Model 2 of Table 3). Considering that a clinically important level of CES-D score is 19 (Wada et al., 2007) and the mean CES-D score in the present study is approximately 12, the impact of change in household income may be small. By contrast, the impact of work status on depression may not be ignorable. The results of the present study suggest that encouraging middle-aged and elderly women to find work or continue working may be a good policy from the perspective of mental health. In the case of men, the present study suggests that they might want to take care of their mental health when they exit the labor force. However, the present study also suggests that men who are not in the labor force (mostly retired men) do not have a higher risk of developing depression unless they develop it at some point around the time they exit the labor force.

The findings from the present study seem to be meaningful in the sense that many of the previous studies on the relation between SES and depression were cross-sectional especially in Japan while the present study used a panel data. However, the results of this study should be viewed with caution. First of all, there was a large number of missing data in JSTAR. In order to deal with this problem, I used MI to compensate for the missing data and compared the analysis based on MI with CCA. Unfortunately, results from the two types of analysis were different in

many analyses. Although MI is generally a preferable approach in dealing with missing data because of the potential bias in CCA, several researchers have suggested that data that are missing 50%-60% or more would not lead to satisfactory results in MI (Barzi and Woodward, 2004; Royston, 2004).

Second, I used the CES-D score as an indicator of depression, which may have led to an inaccurate classification of depression. Although the CES-D can be a good screening tool for depression, interview-based classification can measure depression more accurately. In addition, in the present study, approximately 20% of respondents chose the far left column in all 20 questions in the CES-D, suggesting that they did not understand the questionnaire accurately. This fact suggests that CES-D scores shown in the present study may have deviated from the real score.

Third, a causal relationship between SES variables and depression is still not clear from the present study. Changes in household income may have led to changes in the CES-D, but changes in the CES-D may have led to changes in household income. Similarly, depression may have led to an exit from labor force. In addition, there may have been confounding factors affecting both change in SES variables and depressive symptoms. Although the first differential model which was used in the present study is known to control for time-invariant unobserved heterogeneity

and is more reliable than cross-sectional study, time variant heterogeneity which happened during the two years was not controlled for in the present study. For example, middle-aged and elderly people tend to experience deteriorating health and nursing of their elderly parents (or parents in law). These events can lead to both depression and changes in SES variables.

Although the present study suggests that not being in the labor force is a risk factor for developing depression especially for women, this result may be biased because those who have a history of depression were not excluded from the sample in the present study (Wang, Schmitz, and Dewa, 2010). Several studies showed that depressed people tend to retire early (Karpansalo et al., 2005; Doshi, Cen, and Polsky, 2008; Rice, Lang, Henley, and Melzer, 2010). Considering that depression is a recurrent disorder (Burcusa and Iacono, 2007), those who are not in the labor force include those who exited the labor force early because of depression and have a high risk of developing it again even though they are not suffering from it at the moment. Unless we control for the possibility of this reverse causality, it may be difficult to accurately claim that not being in the labor force is a risk factor of depression.

We need more research to explore the relationship between SES variables and

mental health including depression in Japan. In particular, the relationship between work status and depression needs be explored thoroughly using JSTAR and/or other panel data in order to indicate a convincing policy implication.

References

Andrés, A. R. (2004) "Determinants of self-reported mental health using the British Household Panel Survey", *Journal of Mental Health Policy and Economics*, Vol. 7, No. 3, pp. 99-106.

Back, J. H. and Y. Lee (2011) "Gender differences in the association between socioeconomic status (SES) and depressive symptoms in older adults", *Archives of Gerontology and Geriatrics*, Vol. 52, No. 3, pp. e140-e144.

Barzi, F. and M. Woodward (2004) "Imputations of Missing Values in Practice: Results from Imputations of Serum Cholesterol in 28 Cohort Studies", *American Journal of Epidemiology*, Vol. 160, No. 1, pp. 34-45.

Bjelland, I., S. Krokstad, A. Mykletun, A. A. Dahl, G. S. Tell, and K. Tambs (2008) "Does a higher educational level protect against anxiety and depression? The

HUNT study", *Social Science & Medicine*, Vol. 66, No. 6, pp. 1334-1345.

Burcusa, S. L. and W. G. Iacono (2007) "Risk for recurrence in depression", *Clinical Psychology Review*, Vol. 27, No. 8, pp. 959-985.

Carlson, M., R. Wilcox, C. Chou, M. Chang, F. Yang, J. Blanchard, A. Marterella, A. Kuo, and F. Clark (2011) "Psychometric properties of reverse-scored items on the CES-D in a sample of ethnically diverse older adults", *Psychological Assessment*, Vol. 23, No. 2, pp. 558-562.

Carter, K. N., T. Blakely, S. Collings, F. I. Gunasekara, and K. Richardson (2009) "What is the association between wealth and mental health?", *Journal of Epidemiology and Community Health*, Vol. 63, No. 3, pp. 221-226.

Diniz, B. S., M. A. Butters, S. M. Albert, M. A. Dew, and C. F. Reynolds (2013) "Late-life depression and risk of vascular dementia and Alzheimer's disease: Systematic review and meta-analysis of community-based cohort studies", *The British Journal of Psychiatry*, Vol. 202, No. 5, pp. 329-335.

Doshi, J. A., L. Cen, and D. Polsky (2008) "Depression and retirement in late middle-aged U.S. workers", *Health Services Research*, Vol. 43, No. 2, pp. 693-713.

Dumais, A., A. D. Lesage, M. Alda, G. Rouleau, M. Dumont, N. Chawky, ... G.

Turecki (2005) “Risk factors for suicide completion in major depression: a case-control study of impulsive and aggressive behaviors in men”, *American Journal of Psychiatry*, Vol. 162, No. 11, pp. 2116-2124.

Feldman, D. C. (1994) “The decision to retire early: a review and conceptualization”, *Academy of Management Review*, Vol. 19, No. 2, pp. 285-311.

Flint, E., M. Bartley, N. Shelton, and A. Sacker (2013) “Do labour market status transitions predict changes in psychological well-being?”, *Journal of Epidemiology and Community Health*, Vol. 67, No. 9, pp. 796-802.

Fukuda, Y. and A. Hiyoshi (2012) “Influences of income and employment on psychological distress and depression treatment in Japanese adults”, *Environmental Health and Preventive Medicine*, Vol. 17, No. 1, pp. 10-17.

Honjo, K., N. Kawakami, T. Takeshima, H. Tachimori, Y. Ono, H. Uda, ... T. Kikkawa (2006) “Social class inequalities in self-rated health and their gender and age group differences in Japan”, *Journal of Epidemiology*, Vol. 16, No. 6, pp. 223-232.

Honjo, K., N. Kawakami, M. Tsuchiya, and K. Sakurai (2014) “Association of subjective and objective socioeconomic status with subjective mental health and mental disorders among Japanese men and women”, *International Journal of*

Behavioral Medicine, Vol. 21, No. 3, pp. 421-429.

Ichimura, H., S. Shimizutani, and H. Hashimoto (2009) "JSTAR First Results 2009 Report", Research Institute of Economy, Trade and Industry (RIETI).

Inaba, A., P. A. Thoits, K. Ueno, W. R. Gove, R. J. Evenson, and M. Sloan (2005) "Depression in the United States and Japan: Gender, marital status, and SES patterns", *Social Science & Medicine*, Vol. 61, No. 11, pp. 2280-2292.

Iwasa, H., Y. Yoshida, S. Kumagai, K. Ihara, H. Yoshida, and T. Suzuki (2009) "Depression status as a reliable predictor of functional decline among Japanese community-dwelling older adults: A 12-year population-based prospective cohort study", *International Journal of Geriatric Psychiatry*, Vol. 24, No. 11, pp. 1192-1200.

Kaji, T., K. Mishima, S. Kitamura, M. Enomoto, Y. Nagase, L. Li, ... M. Uchiyama (2010) "Relationship between late - life depression and life stressors: Large-scale cross-sectional study of a representative sample of the Japanese general population", *Psychiatry and Clinical Neurosciences*, Vol. 64, No. 4, pp. 426-434.

Kan, M. and S. Arita (2010) "The effect of unemployment on the health and health-related behaviors among Japanese men: An analysis using fixed-effect

and first-differenced models", Discussion Paper Series, No.55. Panel Survey, Institute of Social Science, University of Tokyo.

Kan, M. (2013) "Being out of Work and Health among Younger Japanese Men: A Panel Data Analysis", *Industrial Health*, Vol. 51, No. 5, pp. 514-523.

Karpansalo, M., J. Kauhanen, T. Lakka, P. Manninen, G. A. Kapla, and J. Salonen (2005) "Depression and early retirement: Prospective population based study in middle aged men", *Journal of Epidemiology and Community Health*, Vol. 59, No.1, pp. 70-74.

Knesebeck, O. V. D., G. Lüschen, W. C. Cockerham, and J. Siegrist (2003) "Socioeconomic status and health among the aged in the United States and Germany: A comparative cross-sectional study", *Social Science & Medicine*, Vol. 57, No. 9, pp. 1643-1652.

Kosidou, K., C. Dalman, M. Lundberg, J. Hallqvist, G. Isacsson, and C. Magnusson (2011) "Socioeconomic status and risk of psychological distress and depression in the Stockholm Public Health Cohort: A population-based study", *Journal of Affective Disorders*, Vol. 134, No. 1, pp. 160-167.

Lorant, V., D. Deliège, W. Eaton, A. Robert, P. Philippot, and M. Ansseau (2003) "Socioeconomic inequalities in depression: A meta-analysis", *American Journal*

of Epidemiology, Vol. 157, No. 2, pp. 98-112.

Lorant, V., C. Croux, S. Weich, D. Deliège, J. Mackenbach, and M. Ansseau (2007) "Depression and socio-economic risk factors: 7-year longitudinal population study", *British Journal of Psychiatry*, Vol. 190, No. 4, pp. 293-298.

Macintyre, S., R. Hiscock, A. Kearns, and A. Ellaway (2001) "Housing tenure and car access: Further exploration of the nature of their relations with health in a UK setting", *Journal of Epidemiology and Community Health*, Vol. 55, No. 5, pp. 330-331.

Manturuk, K. R. (2012) "Urban homeownership and mental health: Mediating effect of perceived sense of control", *City & Community*, Vol. 11, No. 4, pp. 409-430.

Martikainen, P., J. Adda, J. E. Ferrie, G. D. Smith, and M. Marmot (2003) "Effects of income and wealth on GHQ depression and poor self rated health in white collar women and men in the Whitehall II study", *Journal of Epidemiology and Community Health*, Vol. 57, No.9, pp. 718-723.

Mckenzie, S. K., F. I. Gunasekara, K. Richardson, and K. Carter (2014) "Do changes in socioeconomic factors lead to changes in mental health? Findings from three waves of a population based panel study", *Journal of Epidemiology and Community Health*, Vol. 68, No.3, pp. 253-260.

Miyake, Y., K. Tanaka, S. Sasaki, and Y. Hirota (2011). "Employment, income, and education and risk of postpartum depression: The Osaka Maternal and Child Health Study", *Journal of Affective Disorders*, Vol. 130, No. 1, pp. 133-137.

Moussavi, S., S. Chatterji, E. Verdes, A. Tandon, V. Patel, and B. Ustun (2007) "Depression, chronic diseases, and decrements in health: Results from the World Health Surveys", *The Lancet*, Vol. 370, No. 9590, pp. 851-858.

Murata, C., K. Kondo, H. Hirai, Y. Ichida, and T. Ojima (2008) "Association between depression and socio-economic status among community-dwelling elderly in Japan: The Aichi Gerontological Evaluation Study (AGES)", *Health & Place*, Vol. 14, No. 3, pp. 406-414.

OECD (2013) *Health at a Glance 2013: OECD Indicators*. OECD Publishing.

Okumura, Y. and T. Higuchi (2011) "Cost of depression among adults in Japan", *The Primary Care Companion to CNS Disorders*, Vol. 13, No. 3.

Paul, K. I. and K. Moser (2009) "Unemployment impairs mental health: Meta-analyses", *Journal of Vocational Behavior*, Vol. 74, No. 3, pp. 264-282.

Radloff, L. S. (1977) "The CES-D Scale: A self-report depression scale for research in the general population", *Applied Psychological Measurement*, Vol. 1, No. 3, pp. 385-401.

Rice, N. E., I. A. Lang, W. Henley, and D. Melzer (2011) "Common health predictors of early retirement: Findings from the English Longitudinal Study of Ageing", *Age and Ageing*, Vol. 40, No. 1, pp. 54-61.

Richardson, T., P. Elliott, and R. Roberts (2010) "The relationship between personal unsecured debt and mental and physical health: A systematic review and meta-analysis", *Clinical Psychology Review*, Vol. 33 No. 8, pp. 1148-1162.

Royston, P. (2004) "Multiple imputation of missing values", *The Stata Journal*, Vol. 4, 227-2414.

Rubin, D. B. (1987) *Multiple Imputation for Nonresponse in Surveys*, New York: John Willey & Sons.

Sakurai, K., N. Kawakami, K. Yamaoka, H. Ishikawa, and H. Hashimoto (2010) "The impact of subjective and objective social status on psychological distress among men and women in Japan", *Social Science & Medicine*, Vol. 70, No. 11, pp. 1832-1839.

Sareen, J., T. O. Afifi, K. A. McMillan, and G. J. Asmundson (2011) "Relationship between household income and mental disorders: Findings from a population-based longitudinal study", *Archives of General Psychiatry*, Vol. 68, No. 4, pp. 419-427.

Skapinakis, P., S. Weich, G. Lewis, N. Singleton, and R. Araya (2006) "Socio-economic position and common mental disorders Longitudinal study in the general population in the UK", *The British Journal of Psychiatry*, Vol. 189, No. 2, pp. 109-117.

Silveira, M. J., M. U. Kabeto, and K. M. Langa (2005) "Net worth predicts symptom burden at the end of life", *Journal of Palliative Medicine*, Vol. 8, No. 4, pp. 827-837.

Sterne, J. A., I. R. White, J. B. Carlin, M. Spratt, P. Royston, M. G. Kenward, ... and J. R. Carpenter (2009) "Multiple imputation for missing data in epidemiological and clinical research: Potential and pitfalls", *Bmj*, Vol. 338, No. b2393.

van der Heide, I., R. M. van Rijn, S. J. Robroek, A. Burdorf, K. I. Proper (2013) "Is retirement good for your health? A systematic review of longitudinal studies", *BMC Public Health*, Vol. 13, No. 1180.

Von Hippel, P. T. (2007) "Regression with missing Ys: An improved strategy for analyzing multiply imputed data", *Sociological Methodology*, Vol. 37, No. 1, pp. 83-117.

Wada, K., K. Tanaka, G. Theriault, T. Satoh, M. Mimura, H. Miyaoka, and Y. Aizawa (2007) "Validity of the Center for Epidemiologic Studies Depression

Scale as a screening instrument of major depressive disorder among Japanese workers", *American Journal of Industrial Medicine*, Vol. 50, No. 1, pp. 8-12.

Wang, J. L., N. Schmitz, & C. S. Dewa (2010) "Socioeconomic status and the risk of major depression: The Canadian National Population Health Survey", *Journal of Epidemiology and Community Health*, Vol. 64, No. 5, pp. 447-452.

White, I. R., P. Royston, and A. M. Wood (2011) "Multiple imputation using chained equations: Issues and guidance for practice", *Statistics in Medicine*, Vol. 30, No. 4, pp. 377-399.

Zimmerman, F. J. and W. Katon (2005) "Socioeconomic status, depression disparities, and financial strain: What lies behind the income-depression relationship?", *Health Economics*, Vol.14, No. 12, pp. 1197-1215.

Table 1. Demographic and Socioeconomic Characteristics of Respondents[1]

	Five Municipalities			Two Municipalities		Three Municipalities	Total	(Ratio)	Prevalence of Categorical Depression	CES-D score	
Year	2007	2009	2011	2009	2011	2011				Mean	(SD)
Total Number	3,861	2,723	2,193	1,440	982	1,963	13,162	(100.0%)			
Gender											
Male	1,875	1,385	1,131	663	469	885	6,408	(48.7%)	9.2%	11.93	(5.74)
Female	1,866	1,338	1,062	748	492	1,077	6,583	(50.0%)	11.5%	12.14	(6.64)
Answer missing	120	0	0	29	21	1	171	(1.3%)			
Age											
Mean	63.47	65.66	67.58	63.53	65.58	62.44	64.63				
(SD)	(7.01)	(6.97)	(6.97)	(7.26)	(7.26)	(6.84)	(7.22)				
Answer missing	123	0	0	31	21	1	176	(1.3%)			
50s	1269	617	339	476	235	672	3608	(27.4%)	12.1%	12.26	(6.66)
60s	1515	1180	930	568	389	929	5511	(41.9%)	8.8%	11.70	(5.80)
70s[2]	954	926	924	365	337	361	3867	(29.4%)	10.8%	12.31	(6.26)
Education											
11 years or less	1,260	952	763	336	222	251	3784	(28.7%)	11.3%	12.58	(6.17)
12 years	1,555	1,121	892	628	432	854	5482	(41.7%)	9.8%	11.98	(6.22)
13-15 years	453	336	277	212	147	381	1806	(13.7%)	10.9%	11.82	(6.05)
16 years or more	453	303	250	225	156	467	1854	(14.1%)	9.6%	11.36	(6.24)
Answer missing	140	11	11	39	25	10	236	(1.8%)			
Marriage											
Not married	681	495	407	347	240	431	2601	(19.8%)	15.1%	13.17	(7.07)
Married	3,050	2,158	1,707	1,058	699	1527	10199	(77.5%)	9.2%	11.74	(5.94)
Answer missing	130	70	79	35	43	5	362	(2.8%)			
Employment Status											
Employed	2118	1402	1063	680	438	1101	6802	(51.7%)	8.2%	11.61	(5.61)
Unemployed	111	84	43	104	38	118	498	(3.8%)	18.0%	13.79	(7.69)
Not in labor force	1454	1180	1044	589	489	692	5448	(41.4%)	12.2%	12.35	(6.65)
Answer missing	178	57	43	67	17	52	414	(3.1%)			
Household Income											
Mean	393.89	360.74	342.81	325.62	291.32	371.46	360.21				
(SD)	(252.11)	(233.16)	(215.60)	(235.03)	(205.11)	(249.65)	(238.04)				
Answer missing	1,909	1307	1100	810	513	1372	7011	(53.3%)			
Lowest	493	384	312	236	193	171	1789	(13.6%)	15.0%	12.97	(7.22)
2nd lowest	360	330	273	123	101	125	1312	(10.0%)	8.5%	11.61	(5.51)
2nd highest	563	405	295	150	114	158	1685	(12.8%)	8.8%	11.34	(5.82)
Highest	536	297	213	121	61	137	1365	(10.4%)	7.2%	11.17	(6.10)
Household Savings											
Mean	700.28	810.90	755.63	592.24	511.04	644.62	703.74				
(SD)	(1011.99)	(1329.80)	(923.99)	(1232.75)	(826.29)	(1002.37)	(1095.63)				
Answer missing	2,049	1,466	1,269	825	564	1502	7675	(58.3%)			
Lowest	410	278	178	215	160	158	1399	(10.6%)	14.8%	13.51	(7.44)
2nd lowest	475	318	246	163	104	116	1422	(10.8%)	10.3%	12.00	(5.85)
2nd highest	563	353	283	137	87	103	1526	(11.6%)	8.3%	11.42	(5.96)
Highest	364	308	217	100	67	84	1140	(8.7%)	7.1%	10.97	(5.78)
Debt											
No debt	2,958	2,195	1,814	968	778	1258	9971	(75.8%)	10.3%	11.96	(6.16)
Debt	469	253	241	261	142	189	1555	(11.8%)	10.2%	12.23	(6.32)
Answer missing	434	275	138	211	62	516	1636	(12.4%)			
Homeownership											
Renting	453	295	207	349	218	400	1922	(14.6%)	14.9%	13.26	(7.16)
Owning home	3155	2266	1896	992	741	1471	10521	(79.9%)	9.5%	11.79	(5.99)
Answer missing	253	162	90	99	23	92	719	(5.5%)			
CES-D											
Mean	12.07	12.10	11.86	11.89	11.81	12.25	12.03				
(SD)	(5.96)	(5.95)	(6.12)	(6.69)	(6.67)	(6.56)	(6.20)				
Answer missing	713	564	398	427	240	425	2767	(21.0%)			
Categorical Depression (CES=D≧19)											
Not depressed	2850	1948	1607	912	644	1358	9319	(70.8%)			
Depressed[3]	298	211	188	101	98	180	1076	(8.2%)			
Answer missing	713	564	398	427	240	425	2767	(21.0%)			

1. There were repeated observations from 2,193 three-time respondents and 1,512 two-time respondents. The number of total respondents was 7,264.
2. 70s include those who were 80 years old at the survey in 2011 (n=23).
3. After omitting answer missing, the prevalence of categorical depression was 10.4%

Table 2. Changes in Demographic and Socioeconomic Characteristics of Respondents

	From 2007 to 2009		From 2009 to 2011		Total	
	N	(Ratio)	N	(Ratio)	N	(Ratio)
Marrital status						
Continued to be married	1,750	(81.9%)	1,803	(79.6%)	3,553	(80.7%)
Newly married						
Continued to be unmarried	366	(17.1%)	445	(19.7%)	811	(18.4%)
Newly divorced/widowed	20	(0.9%)	17	(0.8%)	37	(0.8%)
Work Status						
Continued to be employed	1,106	(51.8%)	937	(41.4%)	2,043	(46.4%)
Gaining employment	67	(3.1%)	187	(8.3%)	254	(5.8%)
Continued to be not employed	802	(37.6%)	855	(37.8%)	1657	(37.7%)
Losing employment	161	(7.5%)	286	(12.6%)	447	(10.2%)
Debt						
Continued to be not in debt	1,494	(80.8%)	1,574	(79.6%)	3,068	(80.2%)
Getting out of debt	151	(8.2%)	166	(8.4%)	317	(8.3%)
Continued to be in debt	93	(5.0%)	81	(4.1%)	174	(4.6%)
Got into debt	111	(6.0%)	156	(7.9%)	267	(7.0%)
Homeownership						
Continued homeownership	1,781	(89.1%)	1,721	(81.2%)	3,502	(85.0%)
Newly gaining homeownership	7	(0.4%)	109	(5.1%)	116	(2.8%)
Continued to rent	208	(10.4%)	166	(7.8%)	374	(9.1%)
Losing homeownership	4	(0.2%)	124	(5.9%)	128	(3.1%)
Change in categorical depression						
Continued to be not depressed	1,505	(86.2%)	1,546	(83.2%)	3,051	(84.6%)
Getting out of depression	74	(4.2%)	119	(6.4%)	193	(5.4%)
Continued to be depressed	69	(4.0%)	67	(3.6%)	136	(3.8%)
Developed depression	98	(5.6%)	127	(6.8%)	225	(6.2%)
	Mean	(SD)	Mean	(SD)	Mean	(SD)
Change in household income (million yen)	−0.43	(1.82)	−0.17	(2.18)	−0.30	(2.01)
Change in household savings (million yen)	0.69	(8.14)	−0.37	(9.24)	0.18	(8.70)
Change in CES-D	0.19	(5.83)	−0.19	(6.94)	−0.01	(6.43)

People with a CES-D score of 19 or higher are defined as being categorically depressed.

Table 3. Estimates of the relationship between SES variables and CES-D

Dependent variable: CES-D				
		Model 1	Model 2	Model 3
Gender (ref=men)		(omitted)	−0.328*	−0.155
			(0.157)	(0.273)
Age		0.306	−0.443**	−0.564
		(0.364)	(0.167)	(0.295)
Age squared		−0.003	0.003*	0.004
		(0.003)	(0.001)	(0.002)
Married (ref=not married)		0.023	−0.628**	−0.502
		(0.965)	(0.196)	(0.338)
Education (ref= 12 years)				
	11 years or less	(omitted)	0.356	0.116
			(0.185)	(0.326)
	13-15 years	(omitted)	−0.162	−0.313
			(0.222)	(0.387)
	16 years or more	(omitted)	−0.492*	−0.291
			(0.222)	(0.395)
Work Status (ref=employed)				
	Unemployed	1.117*	1.474***	1.977***
		(0.448)	(0.311)	(0.567)
	Not in labor force	0.772**	0.766***	0.921***
		(0.270)	(0.157)	(0.277)
Being in debt (ref=not being in debt)			0.228	−0.397
			(0.185)	(0.318)
Homeownership (ref=renting)			−0.693***	−0.879*
			(0.202)	(0.361)
Household income (million yen)			−0.622***	−0.482***
			(0.110)	(0.140)
Household income squared			0.045***	0.037**
			(0.010)	(0.013)
household savings (million yen)			−0.046***	−0.107***
			(0.013)	(0.027)
Household savings squared			0.000*	0.002***
			(0.000)	(0.001)
_cons		2.581	29.935***	33.818
		(11.838)	(5.334)	(9.438)
	N	9893	9893	2930

Model 1: Demographic factors (gender, age, and marital status), educational attainment, and work status were adjusted.
Model 2 and Model 3: Other SES variables (debt, homeownership, household income, and household savings) were additionally adjusted. In Model 2, multiple imputation (MI) was used. In Model 3, complete case analysis (CCA) was used.
As a result of the Hausman specification test, fixed effects model was selected in Model 1 and random effects model was selected in Model 2 and Model 3.
Coefficients; standard errors in parentheses
* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 4. Relationship between change in SES variables and change in CES-D scores during two years

	Dependent variable: △CES-D					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Marital status (ref=continued to be married)						
Continued to be unmarried	−0.481*	−0.328	−0.708	0.507*	0.542**	0.014
	(0.277)	(0.286)	(0.637)	(0.237)	(0.244)	(0.522)
Newly divorced/widowed	0.565	(0.288)	0.479	2.007	1.747*	1.564
	(1.220)	(1.221)	(2.937)	(1.036)	(1.038)	(2.403)
Work Status (ref=continued to be employed)						
Gaining employment	−1.611***	−1.420***	−2.151	−0.822*	−0.712*	−1.064
	(0.473)	(0.483)	(1.229)	(0.402)	(0.410)	(1.007)
Continued to be not employed	0.080	0.050	0.117	0.336	0.343*	−0.132
	(0.236)	(0.238)	(0.520)	(0.201)	(0.202)	(0.426)
Losing employment	0.414	(0.270)	0.862	0.323	(0.216)	0.238
	(0.369)	(0.379)	(0.825)	(0.313)	(0.322)	(0.675)
Debt (ref=continued to be not in debt)						
Getting out of debt		−0.470	0.555		−0.200	0.568
		(0.416)	(0.854)		(0.354)	(0.698)
Continued to be in debt		−0.618	1.163		−0.119	1.036
		(0.519)	(0.966)		(0.446)	(0.790)
Got into debt		0.217	0.304		0.365	0.407
		(0.452)	(0.998)		(0.384)	(0.816)
Homeownership (ref=continued homeownership)						
Newly gaining homeownership		−1.399*	0.986		−0.879	0.430
		(0.726)	(1.786)		(0.606)	(1.461)
Continued to rent		−0.184	0.288		0.387	1.478*
		(0.381)	(0.842)		(0.324)	(0.692)
Losing homeownership		(0.888)	−0.051		(0.901)	−0.619
		(0.664)	(1.820)		(0.567)	(1.489)
Change in household income (million yen)		−0.216***	−0.054		−0.158***	−0.095
		(0.073)	(0.127)		(0.060)	(0.104)
Change in household savings (million yen)		−0.027	−0.044		−0.022	−0.042
		(0.018)	(0.032)		(0.015)	(0.026)
CES-D				−0.581***	−0.578***	−0.581***
				(0.016)	(0.016)	(0.033)
_cons	0.099	(0.105)	−0.291	6.627***	6.500***	6.247***
	(0.160)	(0.178)	(0.381)	(0.221)	(0.230)	(0.486)
	3605	3605	632	3605	3605	632

Model 1: Changes in marital status and work status were adjusted.

Model 2 and Model 3: Other changes in SES variables (debt, homeownership, household income, and household savings) were additionally adjusted. In Model 2, multiple imputation (MI) was used. In Model 3, complete case analysis (CCA) was used.

Model 4, Model 5, Model 6: CES-D score at the baseline was further adjusted to Model 1, Model 2, and Model 3.

Coefficients; standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 5. Relationship between SES variables at the baseline and change in CES-D scores two years later (OLS)

	Dependent variable: △CES-D					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Gender (ref=men)	-0.111	-0.081	-0.022	-0.284	-0.312	-0.387
	(0.235)	(0.239)	(0.364)	(0.200)	(0.203)	(0.304)
Age	0.055	0.008	-0.361	-0.544*	-0.543*	-0.730
	(0.288)	(0.291)	(0.448)	(0.245)	(0.248)	(0.375)
Age squared	(0.000)	0.000	0.003	0.004*	0.004*	0.005
	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.003)
Married (ref=not married)	0.426	0.183	0.567	-0.514*	-0.385	0.249
	(0.283)	(0.321)	(0.474)	(0.241)	(0.272)	(0.396)
Education (ref= 12 years)						
11 years or less	-0.102	-0.005	-0.109	0.366	0.329	0.253
	(0.267)	(0.271)	(0.436)	(0.227)	(0.230)	(0.364)
13-15 years	0.185	0.181	0.755	-0.04	-0.024	0.458
	(0.335)	(0.336)	(0.504)	(0.284)	(0.285)	(0.420)
16 years or more	0.08	-0.011	-0.357	-0.322	-0.259	-0.405
	(0.338)	(0.345)	(0.515)	(0.287)	(0.293)	(0.429)
Work Status (ref=employed)						
Unemployed	-1.435*	-1.205*	-1.49	-0.236	-0.297	0.057
	(0.568)	(0.581)	(0.933)	(0.482)	(0.493)	(0.781)
Not in labor force	-0.004	0.012	0.254	0.389	0.338	0.279
	(0.263)	(0.272)	(0.415)	(0.223)	(0.230)	(0.346)
Being in debt (ref=not being in debt)		-0.548	0.107		-0.336	0.085
		(0.337)	(0.502)		(0.288)	(0.419)
Homeownership (ref=renting)		0.403	0.362		0.096	-0.022
		(0.355)	(0.550)		(0.303)	(0.459)
Household income (million yen)		0.166	0.15		-0.096	-0.125
		(0.177)	(0.225)		(0.151)	(0.188)
Household income squared		-0.011	-0.016		0.005	0.004
		(0.015)	(0.020)		(0.013)	(0.017)
Household savings (million yen)		0.023	0.052		-0.014	-0.009
		(0.026)	(0.036)		(0.023)	(0.030)
Household savings squared		0.000	-0.001		0.000	0.000
		(0.001)	(0.001)		(0.000)	(0.001)
CES-D				-0.586***	-0.588***	-0.583***
				(0.016)	(0.016)	(0.024)
_cons	-1.799	-0.883	10.327	25.522**	25.827**	30.944**
	(9.139)	(9.267)	(14.204)	(7.781)	(7.895)	(11.885)
N	3605	3605	1333	3605	3605	1333

Model 1: Demographic factors (gender, age, and marital status), educational attainment, and work status were adjusted.

Model 2 and Model 3: Other SES variables (debt, homeownership, household income, and household savings) were additionally adjusted. In Model 2, multiple imputation (MI) was used. In Model 3, complete case analysis (CCA) was used.

Model 4, Model 5, Model 6: CES-D score at the baseline was further adjusted to Model 1, Model2, and Model 3.

Coefficients; standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 6. Estimates of the Relationship between SES variables and categorical depression (Logit Model)

Dependent variable: Categorical Depression				
		Model 1	Model 2	Model 3
Gender (ref=men)		1.059	1.025	1.427
		[0.918,1.222]	[0.809,1.300]	[0.898,2.268]
Age		0.744***	0.679**	0.750
		[0.636,0.870]	[0.526,0.875]	[0.452,1.244]
Age squared		1.002***	1.003**	1.002
		[1.001,1.003]	[1.001,1.005]	[0.998,1.006]
Married (ref=not married)		0.587***	0.658**	0.963
		[0.505,0.682]	[0.498,0.868]	[0.563,1.647]
Education (ref= 12 years)				
	11 years or less	1.201*	1.084	1.239
		[1.019,1.416]	[0.822,1.429]	[0.724,2.120]
	13–15 years	1.07	1.151	0.815
		[0.876,1.308]	[0.827,1.602]	[0.418,1.589]
	16 years or more	1.011	1.066	1.540
		[0.818,1.250]	[0.752,1.510]	[0.786,3.018]
Work Status (ref=employed)				
	Unemployed	2.444***	2.749***	3.662**
		[1.845,3.236]	[1.759,4.296]	[1.512,8.869]
	Not in labor force	1.845***	2.253***	2.397**
		[1.575,2.162]	[1.740,2.917]	[1.415,4.063]
Being in debt (ref=not being in debt)			1.065	0.568
			[0.788,1.439]	[0.304,1.060]
Homeownership (ref=renting)			0.720*	0.499*
			[0.537,0.964]	[0.282,0.884]
Household income (million yen)			0.705***	0.674**
			[0.605,0.821]	[0.530,0.856]
Household income squared			1.024***	1.032**
			[1.010,1.039]	[1.010,1.054]
Household savings (million yen)			0.975*	0.942*
			[0.953,0.997]	[0.897,0.990]
Household savings squared			1.000	1.001
			[1.000,1.000]	[1.000,1.002]
	N	9893	9893	2930

Model 1: Demographic factors (gender, age, and marital status), educational attainment, and work status were adjusted.

Model 2 and Model 3: Other SES variables (debt, homeownership, household income, and household savings) were additionally adjusted. In Model 2, multiple imputation (MI) was used. In Model 3, complete case analysis (CCA) was used.

As a result of the Hausman Specification Test, pooled logit model was selected in Model 1 and random effects logit model was selected in Model 2 and Model 3.

Odds Ratio (OR); 95% confidence intervals [CI] in brackets

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 7. Relationship between change in SES variables and onset of categorical depression during two years (Logistic Regression)

	Dependent variable: Onset of categorical depression					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Marital status (ref=continued to be married)						
Continued to be unmarried	1.659**	1.709**	1.830	1.470*	1.537*	1.680
	[1.208,2.277]	[1.226,2.383]	[0.760,4.410]	[1.065,2.029]	[1.098,2.152]	[0.689,4.099]
Newly divorced/widowed	3.150*	3.054*	9.594	2.626	2.564	10.36
	[1.054,9.415]	[1.007,9.262]	[0.750,122.6]	[0.854,8.075]	[0.821,8.004]	[0.715,149.9]
Work Status (ref=continued to be employed)						
Gaining employment	1.231	1.060	0.776	1.111	0.978	0.566
	[0.656,2.309]	[0.553,2.032]	[0.0930,6.472]	[0.587,2.100]	[0.509,1.881]	[0.0647,4.950]
Continued to be not employed	1.493*	1.548**	1.277	1.488*	1.531**	1.519
	[1.097,2.030]	[1.132,2.116]	[0.569,2.864]	[1.091,2.030]	[1.116,2.099]	[0.664,3.478]
Losing employment	2.099***	1.860**	1.446	2.145***	1.900**	1.759
	[1.395,3.158]	[1.212,2.856]	[0.438,4.769]	[1.419,3.244]	[1.232,2.929]	[0.520,5.958]
Debt (ref=continued to be not in debt)						
Getting out of debt		1.372	2.074		1.375	2.307
		[0.838,2.245]	[0.720,5.976]		[0.834,2.268]	[0.770,6.914]
Continued to be in debt		1.238	1.272		1.160	1.300
		[0.629,2.436]	[0.279,5.795]		[0.585,2.301]	[0.282,5.987]
Got into debt		1.389	1.509		1.345	1.743
		[0.808,2.387]	[0.328,6.940]		[0.775,2.334]	[0.367,8.277]
Homeownership (ref=continued homeownership)						
Newly gaining homeownership		1.604	empty		1.527	empty
		[0.754,3.412]			[0.709,3.289]	
Continued to rent		0.957	1.166		0.858	1.086
		[0.587,1.562]	[0.352,3.867]		[0.523,1.406]	[0.322,3.662]
Losing homeownership		2.346**	1.676		2.418**	1.636
		[1.270,4.332]	[0.192,14.67]		[1.294,4.518]	[0.176,15.20]
Change in household income (million yen)		0.967	1.066		0.961	1.088
		[0.889,1.052]	[0.862,1.319]		[0.883,1.046]	[0.881,1.345]
Change in household savings (million yen)		0.991	0.990		0.991	0.991
		[0.971,1.010]	[0.942,1.041]		[0.972,1.011]	[0.943,1.042]
CES-D				1.180***	1.181***	1.248***
				[1.128,1.234]	[1.129,1.236]	[1.101,1.416]
N	3276	3276	565	3276	3276	565

Model 1: Changes in marital status and work status were adjusted.

Model 2 and Model 3: Other changes in SES variables (debt, homeownership, household income, and household savings) were additionally adjusted. In Model 2, multiple imputation (MI) was used. In Model 3, complete case analysis (CCA) was used.

Model 4, Model 5, Model 6: CES-D score at the baseline was further adjusted to Model 1, Model 2, and Model 3.

Respondents with categorical depression (CES-D≧19) at the baseline were omitted from the analysis. Respondents not depressed at both the baseline and two years later were coded as 0 and respondents not depressed at the baseline and depressed two years later were coded as 1.

Odds Ratio (OR); 95% confidence intervals [CI] in brackets

* p<0.05, ** p<0.01, *** p<0.001

Table 8. Relationship between SES variables at the baseline and onset of categorical depression two years later (logistic regression)

	Dependent variable: Onset of categorical depression					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Gender (ref=men)	0.902	0.878	1.048	0.937	0.915	1.162
	[0.669,1.216]	[0.648,1.189]	[0.633,1.733]	[0.694,1.267]	[0.673,1.243]	[0.698,1.935]
Age	0.626**	0.631*	0.459**	0.657*	0.657*	0.469*
	[0.443,0.885]	[0.444,0.896]	[0.260,0.807]	[0.463,0.932]	[0.461,0.937]	[0.262,0.838]
Age squared	1.003*	1.003*	1.006*	1.003*	1.003*	1.006*
	[1.001,1.006]	[1.001,1.006]	[1.001,1.010]	[1.000,1.006]	[1.000,1.006]	[1.001,1.010]
Married (ref=not married)	0.601**	0.673*	0.626	0.676*	0.716	0.700
	[0.435,0.830]	[0.465,0.975]	[0.346,1.133]	[0.487,0.938]	[0.494,1.039]	[0.384,1.275]
Education (ref= 12 years)						
11 years or less	1.325	1.267	1.231	1.282	1.244	1.253
	[0.951,1.847]	[0.904,1.774]	[0.670,2.263]	[0.917,1.792]	[0.885,1.747]	[0.680,2.309]
13–15 years	1.013	1.023	0.910	1.052	1.056	0.941
	[0.662,1.549]	[0.667,1.569]	[0.458,1.812]	[0.685,1.618]	[0.685,1.627]	[0.469,1.890]
16 years or more	0.809	0.872	1.149	0.903	0.950	1.268
	[0.508,1.287]	[0.542,1.404]	[0.564,2.337]	[0.564,1.447]	[0.587,1.539]	[0.612,2.627]
Work Status (ref=employed)						
Unemployed	1.149	1.020	1.508	1.013	0.938	1.353
	[0.542,2.432]	[0.473,2.199]	[0.420,5.412]	[0.474,2.167]	[0.431,2.042]	[0.362,5.052]
Not in labor force	1.517*	1.472*	1.653	1.519*	1.481*	1.777
	[1.081,2.128]	[1.037,2.090]	[0.912,2.996]	[1.076,2.142]	[1.037,2.114]	[0.959,3.292]
Being in debt (ref=not being in debt)		1.199	1.616		1.196	1.667
		[0.791,1.818]	[0.885,2.951]		[0.785,1.821]	[0.900,3.090]
Homeownership (ref=renting)		1.043	1.400		1.116	1.368
		[0.673,1.618]	[0.645,3.041]		[0.715,1.741]	[0.619,3.024]
Household income (million yen)		0.945	1.063		0.976	1.118
		[0.752,1.187]	[0.751,1.505]		[0.775,1.230]	[0.782,1.598]
Household income squared		0.999	0.989		0.997	0.985
		[0.978,1.021]	[0.955,1.024]		[0.975,1.019]	[0.950,1.022]
Household savings (million yen)		0.989	0.986		0.997	1.002
		[0.951,1.029]	[0.937,1.037]		[0.959,1.036]	[0.953,1.053]
Household savings squared		1.000	1.000		1.000	1.000
		[0.999,1.001]	[0.999,1.001]		[0.999,1.001]	[0.999,1.001]
CES-D				1.177***	1.176***	1.209***
				[1.126,1.231]	[1.123,1.230]	[1.121,1.305]
N	3276	3276	1214	3276	3276	1214

Model 1: Demographic factors (gender, age, and marital status), educational attainment, and work status were adjusted.
Model 2 and Model 3: Other SES variables (debt, homeownership, household income, and household savings) were additionally adjusted. In Model 2, multiple imputation (MI) was used. In Model 3, complete case analysis (CCA) was used.
Model 4, Model 5, Model 6: CES-D score at the baseline was further adjusted to Model 1, Model 2, and Model 3.
Respondents with categorical depression (CES-D≧19) at the baseline were omitted from the analysis. Respondents not depressed at both the baseline and two years later were coded as 0 and respondents not depressed at the baseline and depressed two years later were coded as 1.
Odds Ratio (OR); 95% confidence intervals [CI] in brackets
* p<0.05, ** p<0.01, *** p<0.001

Table 9. Gender comparison in the relationship between change in SES variables and onset of categorical depression during two years (Logistic Regression)

	Dependent variable: Onset of categorical depression								
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
	Total	Men only	Women only	Total	Men only	Women only	Total	Men only	Women only
Marital status (ref=continued to be married)									
Continued to be unmarried	1.470*	1.663	1.403	1.537*	1.748*	1.448	1.680	2.522	0.861
	[1.065,2.029]	[0.998,2.771]	[0.911,2.159]	[1.098,2.152]	[1.031,2.965]	[0.914,2.294]	[0.689,4.099]	[0.754,8.438]	[0.180,4.116]
Newly divorced/widowed	2.626	(empty)	5.693**	2.564	(empty)	5.654**	10.360	(empty)	11.370
	[0.854,8.075]		[1.598,20.28]	[0.821,8.004]		[1.551,20.61]	[0.715,149.9]		[0.257,502.7]
Work Status (ref=continued to be employed)									
Gaining employment	1.111	0.944	1.487	0.978	0.861	1.328	0.566	3.069	(empty)
	[0.587,2.100]	[0.328,2.719]	[0.645,3.429]	[0.509,1.881]	[0.293,2.529]	[0.554,3.184]	[0.0647,4.950]	[0.222,42.41]	
Continued to be not employed	1.488*	1.056	2.046**	1.531**	1.071	2.187**	1.519	1.204	2.480
	[1.091,2.030]	[0.660,1.689]	[1.268,3.300]	[1.116,2.099]	[0.665,1.726]	[1.340,3.570]	[0.664,3.478]	[0.317,4.572]	[0.697,8.816]
Losing employment	2.145***	2.302***	1.746	1.900**	2.075**	1.636	1.759	3.540	(empty)
	[1.419,3.244]	[1.411,3.755]	[0.800,3.813]	[1.232,2.929]	[1.219,3.532]	[0.737,3.629]	[0.520,5.958]	[0.853,14.69]	
Debt (ref=continued to be not in debt)									
Getting out of debt				1.375	1.619	1.035	2.307	0.782	6.304*
				[0.834,2.268]	[0.862,3.040]	[0.442,2.426]	[0.770,6.914]	[0.0936,6.536]	[1.179,33.72]
Continued to be in debt				1.160	0.734	1.667	1.300	(empty)	10.73*
				[0.585,2.301]	[0.230,2.336]	[0.684,4.065]	[0.282,5.987]		[1.211,95.05]
Got into debt				1.345	1.457	1.167	1.743	1.012	3.778
				[0.775,2.334]	[0.704,3.013]	[0.494,2.754]	[0.367,8.277]	[0.0947,10.81]	[0.347,41.14]
Homeownership (ref=continued homeownership)									
Newly gaining homeownership				1.527	1.460	1.690	(empty)	(empty)	(empty)
				[0.709,3.289]	[0.518,4.110]	[0.520,5.485]			
Continued to rent				0.858	0.742	1.077	1.086	0.577	2.641
				[0.523,1.406]	[0.358,1.539]	[0.539,2.155]	[0.322,3.662]	[0.0640,5.190]	[0.443,15.76]
Losing homeownership				2.418**	1.671	3.382**	1.636	(empty)	24.700
				[1.294,4.518]	[0.647,4.320]	[1.430,8.003]	[0.176,15.20]		[0.691,882.5]
Change in household income (million yen)				0.961	1.001	0.915	1.088	1.217	1.079
				[0.883,1.046]	[0.897,1.117]	[0.801,1.044]	[0.881,1.345]	[0.915,1.618]	[0.731,1.594]
Change in household savings (million yen)				0.991	0.989	0.992	0.991	0.990	0.988
				[0.972,1.011]	[0.966,1.013]	[0.956,1.029]	[0.943,1.042]	[0.935,1.049]	[0.896,1.089]
CES-D	1.180***	1.128***	1.237***	1.181***	1.130***	1.238***	1.248***	1.139	1.493***
	[1.128,1.234]	[1.061,1.199]	[1.157,1.323]	[1.129,1.236]	[1.063,1.202]	[1.157,1.324]	[1.101,1.416]	[0.972,1.333]	[1.185,1.881]
N	3276	1763	1504	3276	1763	1504	565	277	226

Models 1through 3: Changes in marital status and work status, and baseline CES-D score were adjusted.

Models 4 through 9: Other changes in SES variables (debt, homeownership, household income, and household savings) were additionally adjusted. In Models 4 through 6, multiple imputation (MI) was used. In Models 7 through 9, complete case analysis (CCA) was used.

Respondents with categorical depression (CES-D≧19) at the baseline were omitted from the analysis. Respondents not depressed at both the baseline and two years later were coded as 0 and respondents not depressed at the baseline and depressed two years later were coded as 1.

Odds Ratio (OR); 95% confidence intervals [CI] in brackets

* p<0.05, ** p<0.01, *** p<0.001

Table 10. Gender comparison in relationship between SES variables at the baseline and onset of categorical depression two years later (logistic regression)

		Dependent variable: Onset of categorical depression								
		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
		Total	Men only	Women only	Total	Men only	Women only	Total	Men only	Women only
Gender (ref=men)		0.937			0.915			1.162		
		[0.694,1.267]			[0.673,1.243]			[0.698,1.935]		
Age		0.657*	0.630	0.674	0.657*	0.621	0.695	0.469*	0.630	0.429*
		[0.463,0.932]	[0.388,1.023]	[0.401,1.134]	[0.461,0.937]	[0.380,1.015]	[0.409,1.180]	[0.262,0.838]	[0.262,1.513]	[0.186,0.990]
Age squared		1.003*	1.003	1.003	1.003*	1.004	1.003	1.006*	1.003	1.007*
		[1.000,1.006]	[1.000,1.007]	[0.999,1.007]	[1.000,1.006]	[1.000,1.007]	[0.998,1.007]	[1.001,1.010]	[0.996,1.010]	[1.000,1.013]
Married (ref=not married)		0.676*	0.626	0.692	0.716	0.686	0.718	0.700	0.625	0.839
		[0.487,0.938]	[0.373,1.051]	[0.446,1.074]	[0.494,1.039]	[0.387,1.216]	[0.432,1.191]	[0.384,1.275]	[0.264,1.483]	[0.346,2.032]
Education (ref= 12 years)										
	11 years or less	1.282	0.975	1.557	1.244	0.937	1.511	1.253	1.001	1.218
		[0.917,1.792]	[0.599,1.585]	[0.964,2.516]	[0.885,1.747]	[0.573,1.532]	[0.924,2.471]	[0.680,2.309]	[0.404,2.478]	[0.511,2.901]
	13-15 years	1.052	1.023	1.090	1.056	1.009	1.107	0.941	0.683	1.185
		[0.685,1.618]	[0.522,2.006]	[0.618,1.922]	[0.685,1.627]	[0.512,1.990]	[0.625,1.961]	[0.469,1.890]	[0.205,2.273]	[0.488,2.878]
	16 years or more	0.903	0.866	0.518	0.950	0.929	0.507	1.268	1.276	0.733
		[0.564,1.447]	[0.516,1.453]	[0.118,2.264]	[0.587,1.539]	[0.545,1.585]	[0.113,2.265]	[0.612,2.627]	[0.557,2.922]	[0.0858,6.268]
Work Status (ref=employed)										
	Unemployed	1.013	1.267	0.804	0.938	1.146	0.767	1.353	1.099	1.449
		[0.474,2.167]	[0.480,3.348]	[0.233,2.772]	[0.431,2.042]	[0.418,3.143]	[0.218,2.700]	[0.362,5.052]	[0.198,6.115]	[0.162,12.97]
	Not in labor force	1.519*	0.989	2.096**	1.481*	0.927	2.100**	1.777	1.019	2.641*
		[1.076,2.142]	[0.575,1.700]	[1.294,3.396]	[1.037,2.114]	[0.529,1.625]	[1.274,3.461]	[0.959,3.292]	[0.375,2.768]	[1.089,6.407]
Being in debt (ref=not being in debt)					1.196	1.200	1.147	1.667	1.155	2.286
					[0.785,1.821]	[0.682,2.112]	[0.607,2.167]	[0.900,3.090]	[0.464,2.874]	[0.951,5.497]
Homeownership (ref=renting)					1.116	1.225	1.050	1.368	1.820	1.078
					[0.715,1.741]	[0.656,2.289]	[0.554,1.991]	[0.619,3.024]	[0.577,5.741]	[0.344,3.381]
Household income (million yen)					0.976	1.018	0.922	1.118	1.127	1.105
					[0.775,1.230]	[0.709,1.459]	[0.670,1.269]	[0.782,1.598]	[0.627,2.023]	[0.688,1.775]
Household income squared					0.997	0.989	1.008	0.985	0.974	1.000
					[0.975,1.019]	[0.955,1.024]	[0.975,1.043]	[0.950,1.022]	[0.916,1.035]	[0.952,1.050]
Household savings (million yen)					0.997	0.999	0.992	1.002	1.023	0.943
					[0.959,1.036]	[0.947,1.055]	[0.932,1.056]	[0.953,1.053]	[0.958,1.092]	[0.838,1.062]
Household savings squared					1.000	1.000	1.000	1.000	1.000	1.002
					[0.999,1.001]	[0.999,1.001]	[0.998,1.002]	[0.999,1.001]	[0.999,1.001]	[0.998,1.005]
CES-D		1.177***	1.122***	1.238***	1.176***	1.121***	1.236***	1.209***	1.164**	1.265***
		[1.126,1.231]	[1.056,1.191]	[1.157,1.324]	[1.123,1.230]	[1.054,1.192]	[1.155,1.324]	[1.121,1.305]	[1.049,1.290]	[1.127,1.419]
N		3276	1772	1504	3276	1772	1504	1214	657	557

Models 1 through 3: Demographic factors (gender, age, and marital status), educational attainment, work status, and baseline CES-D score were adjusted.

Models 4 through Model 9: Other SES variables (debt, homeownership, household income, and household savings) were additionally adjusted. In Models 4 through 6, multiple imputation (MI) was used. In Models 7 through 9, complete case analysis (CCA) was used.

Respondents with categorical depression (CES-D≧19) at the baseline were omitted from the analysis. Respondents not depressed at both the baseline and two years later were coded as 0 and respondents not depressed at the baseline and depressed two years later were coded as 1.

Odds Ratio (OR); 95% confidence intervals [CI] in brackets

* p<0.05, ** p<0.01, *** p<0.001