Happiness, self-rated health, and income inequality:

Evidence from nationwide surveys in Japan

Takashi Oshio[1] and Miki Kobayashi[2]

[1]Institute of Economic Research, Hitotsubashi University, Tokyo, Japan

[2]Graduate School of Economics, Kobe University, Kobe, Japan

Abstract

We examine how regional inequality affects happiness and self-rated health at an individual level by using micro data from nationwide surveys in Japan. Individuals who live in the area of high inequality tend to report themselves as both unhappy and unhealthy, even after controlling for various individual and regional characteristics and taking into account the correlation between the two subjective outcomes. We also investigate how their sensitivities to regional inequality change by key individual attributes. People with an unstable work status are most affected by inequality when assessing both happiness and health.

Keywords

happiness, self-rated health, income inequality

Correspondence to: Takashi Oshio, Institute of Economic Research, Hitotsubashi University, 2-1 Naka, Kunitachi, Tokyo 186-8603, Japan
Email: oshio@ier.hit-u.ac.jp
Tel/fax +81-42-580-8658

Introduction

Happiness and good health are the key elements of individual well-being, but they tend to be discussed separately. With respect to happiness, many economists have been examining the factors that determine it, given that individual well-being and social welfare are central issues to be addressed in economics. Since the late 1990s, economists have started to contribute large-scale empirical analyses of the determinants of happiness in different countries and periods, as surveyed by Frey and Stutter (2002). For example, Blanchflower and Osward (2004) and Easterlin (2001) showed that income increases the level of happiness, while Clark and Oswald (1994), Korpi (1997), Winkelmann and Winkelmann (1998) and Di Tella, MacCulloch, and Oswald (2001) found that unemployment makes individuals unhappy. Further, various empirical studies suggest that other socioeconomic factors including gender, age, marital status, educational background have also been found to have a significant impact on happiness.

Meanwhile, many studies on social epidemiology have investigated the association between health and socioeconomic factors. It is now widely recognized that inequalities in health status associated with socioeconomic status are substantial (Kawachi and Kennedy, 1997; Subramainan, Kawachi, and Kennedy, 2001). In particular, evidence suggesting that income and educational attainment significantly affect health has important implications on economic and educational policies (Smith, 1999; Lleras-Muney, 2005). In recent years, the association between income distribution in society and individual health has been increasingly focused upon. As surveyed by Subramanian and Kawachi (2004), many attempts of multilevel analyses

indicated a significant correlation between income inequality and health.

It should be noted, however, that happiness and health are likely to be closely related to each other in nature. Indeed, some empirical studies have reported that healthier individuals tend to feel happier (Perneger, Hudelson, and Bovier, 2004), while a better assessment of happiness can lead to a higher level of self-rated health (Pettit and Kline, 2001). Moreover, the common socioeconomic factors—income, age, gender, educational background, relations with family members and neighbors—may affect both happiness and health, albeit not in a uniform manner. Therefore, it is incorrect to view the relation between the two subjective outcomes in a unidirectional manner, because their observed correlation may reflect their associations with the common socioeconomic factors.

In this paper, we examine how regional inequality affects both happiness and self-rated health at an individual level by using micro data obtained from nationwide surveys in Japan. Our analysis has three distinctive features as compared to the existing studies. First, we explicitly take into account a possible correlation between happiness and self-rated health. To this end, we estimate the ordered probit models of happiness and self-rated health simultaneously, rather than separately estimating them. This attempt is inspired by a multilevel analysis conducted by Subramanian, Kim, and Kawachi (2005), who investigated the individual determinants of happiness and self-rated health and the correlations between the two outcomes at the community and individual levels. However, they did not explore the impact of regional equality on the two subjective outcomes.

Second, our analysis extends the existing empirical analyses of social epidemiology, which have concentrated largely on the impact of regional inequality on health, by

investigating that the impact on happiness as well. In fact, Alesina, Di Tell, and MacCulloch (2004) observed that higher inequality in society tends to reduce individual happiness by using micro data in the United States and European countries. However, they did not examine the impact on self-rated health. We examine how regional inequality affects both happiness and self-rated health based on a common dataset and the simultaneous equation system.

Finally, we compare the sensitivities to regional inequality with respect to happiness and self-rated health across individuals of different gender, age, income, work status, and political views. It is widely recognized that these individual attributes influence happiness and health, but it remains virtually unexplored how they affect their sensitivities to regional inequality. The observed correlations between regional inequality and subjective outcomes for the society as a whole may be misleading, if the associations differ substantially across individuals with different characteristics. Alesina et al. (2004) pointed out that the poor and left-wingers are sensitive to inequality in Europe, while in the United States, the happiness of these groups is uncorrelated with inequality. It is also relevant to compare the sensitivities of self-rated health.

Our analysis is based on the data collected from nationwide surveys in Japan. There have been a growing number of empirical analyses on happiness and self-rated health in Japan in recent years, against the background of rising concerns for the risk of widening income inequality and rising poverty (Tachibanaki, 2005). Indeed, multilevel analyses of the association between regional inequality and self-rated health at a nationwide level has been initiated by Shibuya, Hashimoto, and Yano (2002) and recently followed by Oshio and Kobayashi (2009).

With respect to happiness, Ohtake (2004) and Sano and Ohtake (2007) in their original survey observed that unemployment reduces happiness. Based on the same survey, Ohtake and Tomioka (2004) showed that the Gini coefficient and the perception of rising inequality have a weak but positive correlation with happiness, a result that appears to be counter-intuitive and difficult to interpret. Our analysis in this paper is expected to add something new to the findings from these preceding studies and make the case in Japan comparable with those in other advanced countries.

Methods

Source of data

We utilize the micro data obtained from two nationwide surveys in Japan following Oshio and Kobayashi (2009): (i) the Comprehensive Survey of Living Conditions of People on Health and Welfare (CSLCPHW), which is compiled by the Ministry of Health, Labour, and Welfare and (ii) the Japanese General Social Survey (JGSS), which is compiled and conducted by the Institute of Regional Studies at the Osaka University of Commerce in collaboration with the Institute of Social Science at the University of Tokyo.

To calculate the regional inequality, we collect data from 2001, 2004, and 2007 CSLCPHWs, which include household income data in 2000, 2003, and 2006, respectively. Further, to obtain detailed information about the socioeconomic background of each respondent, we collect data from 2000, 2003, and 2006 JGSSs. By matching these data from the two datasets for each year depending on where each respondent resided, we can conduct a multilevel analysis based on the three-year pooled data.

The CSLCPHW randomly selected 2,000 districts from the Population Census divisions, which were stratified in each of the 47 prefectures according to population size. Next, all the households in each district were interviewed. The original sample size was 30,386, 25,091 and 24,578 households (with a response rate of 79.5, 70.1 and 67.7 percent) in 2000, 2003, and 2006, respectively. In this survey, we collected information on household income in order to calculate the income inequality measures and mean income for each of the 47 prefectures. While both pre-tax and post-tax household incomes are available from the CSLCPHW, we focus on pre-tax household following Shibuya et al. (2002) and Oshio and Kobayashi (2009). As in most previous studies, we equivalize household income by dividing it by the root of the number of household members.

Although the CSLCPHW includes basic information on each individual—household income, age, gender, marital status, and self-rated health—it does not provide other important information about each individual. Hence, we also utilize the JGSS for the three years. The JGSS divided Japan into six blocks and subdivided those according to the population size into three (in 2000 and 2003) or four (in 2006) groups. Next, the JGSS selected 300 (in 2000) or 489 (in 2003 and 2006) locations from each stratum using the Population Census divisions. Next, the JGSS randomly selected 12 to 15 individuals aged between 20 and 89 from each survey location. Data were collected through a combination of interviews and self-administered questionnaires. The number of respondents was 2,893, 1,957, and 2,124 (with a response rate of 63.9, 55.0 and 59.8 percent) in 2000, 2003, and 2006 surveys, respectively. From these surveys, we obtain happiness, self-rated health, educational background, and subjective assessments about individuals' relationships

with the community and other people.

In this empirical analysis, we eliminated the respondents aged below 25 and above 80, whose sample sizes were limited, and those with missing key variables. As a result, the respondents used in our estimation are 4,467 individuals (aged between 25 and 80) in total (1,872 in 2000, 1,237 in 2003, and 1,358 in 2006). The summary statistics of all variables are presented in Table 1. We briefly explain the dependent and independent variables used in our empirical analysis in what follows.

Happiness and self-rated health. With respect to happiness, the JGSS asked the respondents to choose from among 1 (= happy), 2, 3, 4 and 5 (= unhappy) in response to the question "How happy are you?" With respect to self-rated health, it asked them to choose from among 1 (= good), 2, 3, 4 and 5 (= poor) in response to the question "How would you rate your health condition?" We reverse the order of choices such that "unhappy" and "poor" equal 1 and "happy" and "excellent" equal 5.

Individual-level predictors. We consider both individual- and prefecture-level factors as predictors in our analysis, following various preceding studies (Subramanian and Kawachi, 2004). The former factors are divided into two groups. The first group comprises factors that are used as predictors for both happiness and self-rated health. The second group comprises those that are used only for happiness models, because they appear to be at least partly affected by or simultaneously determined by the status of health or self-rated health.

To begin with the first group, household income is one of the most important variables and is expected to substantially affect both happiness and self-rated health. The JGSS asked respondents to choose their household annual income for the previous year from among 19 categories. We take the median value of each category, equivalize

it, and evaluate it at the 2005 consumer prices. We then transform it into log, considering the non-linear association between income and health. In addition to income, we consider educational background, i.e., whether the respondents graduated from junior high school, high school, college, or beyond.

With respect to demographic factors, we consider gender, age, and marital status (married, never married, and separated/divorced). We also consider relations with others, which can be interpreted as the key aspects of individual social capital, as the potential predictors of happiness and self-rated health (Fujiwara & Kawachi, 2008; Kim & Kawachi, 2006; Subramanian, Kim, & Kawachi, 2002). Next, we collected the following three variables obtained from the JGSS to attain an individual assessment of social capital: (i) whether the individual belongs to any hobby group or club; (ii) whether he/she is satisfied with his/her relationships with friends; (iii) whether he/she thinks that most people can be trusted. Finally, we consider the size of the area where a respondent lives (1 = small, 2 = medium, 3 = large).

With respect to the second group of variables that are used only to predict happiness, work status is potentially most important. Many economic researches have observed that unemployment or unstable work status reduces subjective well-being even after controlling for income. The JGSS asked each respondent about his/her work status. We summarize the answers into eight categories: a regular employee (including a management executive), non-regular employee, self-employment, family worker, unemployed, retired, doing housework, and other. We consider a regular employee as a reference category. Finally, we consider the number of children that has also been widely used as a predictor of happiness.

Prefecture-level predictors. The most important variable at a prefecture level is the

Gini coefficient, which is calculated from the CSLCPHW. The Gini coefficient is one of the most widely used inequality measures, and Kawachi and Kennedy (1997) showed that the choice of inequality measures does not much affect the relationship between income inequality and health. We also control for (log-transformed) prefecture mean income, the share of people aged 60 and above, size of residential area (in both happiness and self-rated health models), and per capita budget expenditure of the local government (in happiness models only).

Additionally, we include indicator variables for 11 regional blocks, each of which comprises three to six prefectures (except Hokkaido) in order to control for the unspecified characteristics of a region wider than a prefecture and those for three years to control for year-specific factors.

Empirical models

We assume that the subjective assessments of happiness and health are correlated, and run an ordered bivariate probit model of the form:

$$y_1^* = \boldsymbol{x}_1'\boldsymbol{\beta}_1+\varepsilon_1;\ y_1=1 \text{ if } y_1<\mu_{11},\ =2 \text{ if } \mu_{11}<y_1<\mu_{12},\ \ldots,\ =5 \text{ if } \mu_{14}<y_1,$$

$$y_2^* = \boldsymbol{x}_2'\boldsymbol{\beta}_2+\varepsilon_2;\ y_2=1 \text{ if } y_2<\mu_{21},\ =2 \text{ if } \mu_{21}<y_2<\mu_{22},\ \ldots,\ =5 \text{ if } \mu_{24}<y_2.$$

Here, y_1 and y_2 are the outcomes for happiness and self-rated health, respectively; y_1^* and y_2^* are their latent variables; $\boldsymbol{x}_1$ and $\boldsymbol{x}_2$ are the vectors of predictors; $\mu_{11},\ldots, \mu_{14}$ and $\mu_{21},\ldots, \mu_{24}$ are the threshold parameters; $\boldsymbol{\beta}_1$ and $\boldsymbol{\beta}_2$ are the vectors of coefficients; and ε_1 and ε_2 are the disturbances. For multilevel analysis, predictors $\boldsymbol{x}_1$ and $\boldsymbol{x}_2$ include individual- and prefecture-level factors as well as dummy variables for regional blocks and years.

For disturbances, ε_1 and ε_2, we assume the binomial standard normal distribution:

$$\begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix} \right),$$

where ρ is the covariance of disturbances. We estimate $\boldsymbol{\beta}_1$, $\boldsymbol{\beta}_2$, $\mu_{11},\ldots, \mu_{14}$, $\mu_{21},\ldots, \mu_{24}$, and ρ by the maximum likelihood method. If the null hypothesis that ρ equals zero cannot be rejected, running two ordered probit models separately lead to biased estimation results.

Furthermore, we estimate the two ordered probit models for happiness and self-rated health separately (assuming that ρ equals zero) and compare the estimated coefficients with those obtained from the bivariate probit model. In all estimations, we use JGSS-provided sampling weights and compute robust standard errors to correct for potential heteroscedasticity.

Results

Overview of descriptive statistics

Before estimating the regression models, we present an overview of happiness and health on an aggregated basis. Table 1 presents the joint frequency distribution of reported happiness. As seen from the rightmost column and the bottom row of this table, the top two categories share 48 percent for happiness and 63 percent for self-rated health, while the share of the bottom two categories is limited to 20 and 6 percent, respectively. We also notice that the cells at the diagonal have higher frequencies than others, indicating that happier individuals tend to feel healthier and vice versa. Indeed, the correlation coefficient between the two outcomes is calculated as 0.358, which is significantly positive. However, two points should be noted. First, this positive correlation could be accounted for by their associations with the common

socioeconomic variables, and not by any causality. Second, a strong correlation does not imply a tight correspondence; healthy people are not necessarily happy, and vice versa. Indeed, only 38 percent of the respondents lie at the diagonal of this matrix.

Next, we compare the outcomes by five categories: gender, age, income, work status, and political view. Age groups are divided into "young" (aged 25–39), "middle" (40–59), and "old" (60–79). Income groups are divided into the three classes of almost the same size as "low" (with equivalized household income below 2,317 thousand yen), "middle" (2,317 to 4,041 thousand yen), and "high" (above 4,041 thousand yen). Work status is categorized into "stable" (management, regular employee, and self-employed), "unstable" (non-regular employee, family worker, unemployed, and other) and "out of labor force" (retired and staying home (mainly housewives)). Since it might be arguable whether the self-employed should be categorized as "stable" or "unstable," we consider two types of grouping: work status (A) in which the self-employed are categorized as "stable" and work status (B) in which they are categorized as "unstable." With respect to political views, the JGSS asked a respondent to choose from among five categories (1 = conservative to 5 = progressive) to the question "Where would you place your political views on a 5-point scale?" We categorize the answers into "conservative" (= 1, 2), "neutral" (= 3), and "progressive" (= 4, 5).

Table 3 compares the means of reported happiness and self-rated health by category and tests their differences. The following findings are noteworthy: (i) females fell happier and healthier than males; (ii) the young feel the happiest and healthiest, while there is no significance in happiness between the middle and old; (iii) money makes people happier, but its impact on self-rated health diminishes as it rises; (iv) unstable work status makes people unhappier—regardless of considering the

self-employed “stable” or “unstable”—while leaving the labor force adds to happiness. It is difficult, however, to interpret the relation between work status and self-rated health, because the latter likely affects the former; and (v) the conservative feel happier and healthier. However, this does not imply any causality, because happier and healthier people are more likely to be satisfied with life and hence are conservative.

Results of model estimations

Table 4 presents the estimation results of the bivariate ordered probit model for happiness and self-rated health (Model 1) and two ordered probit models that are separately estimated for each outcome (Models 2 and 3). The table summarizes the estimated coefficients, their robust standard errors, and marginal effects for each predictor. The marginal effect measures how much a marginal increase of the predictor (or a discrete change from zero to one for a dummy variable) raises the probability of choosing the top two answers (4 or 5) for happiness or health.

The results of the bivariate ordered probit model (Model 1) are divided into the top part (happiness) and the bottom (self-rated health). We first notice that the coefficient on the Gini coefficient is significantly negative for both outcomes. This confirms the negative impact of regional inequality on both happiness and self-rated health, a result consistent with those of the previous studies that analyzed the two outcomes separately. The magnitude of the marginal effect of the Gini coefficient is somewhat larger for happiness (0.856) than for self-rated health (0.719).

The next focus is on ρ, the covariance of disturbances, which is reported at the bottom of the table. The estimate of ρ is 0.367, with a standard error of 0.0017. The Wald statistic for the test of the null hypothesis that ρ equals zero is 384.43, which is

well above 6.63, the critical value of the chi-squared with a single restriction at the one percent level. Hence, we can reject this hypothesis and conclude that a correlation between omitted variables after the influences of key factors in the two equations is significantly positive.

Besides the coefficient on the Gini coefficient, the household income positively affects both happiness and self-rated health, consistent with the results of many previous studies. Females feel healthier but not necessarily happier than males. Age affects negatively both. Married people feel happier than those who have never married or divorced/widowed, while marital status does not matter for health. Favorable relations with others—belonging to hobby groups/clubs, satisfied with the relationships with friends, and trust in people—make people feel both happier and healthier. For happiness, the unemployed feel less happy and those out of labor force—retired and those who are doing housework—feel happier. The number of children and the size of the residential area do not matter. With respect to the prefecture-level factors, prefecture mean income and the share of old people do not have a significant impact on both the outcomes, while the per capita budget expenditure raises happiness.

Thus, we confirm that key socioeconomic factors—income inequality, household income, age, and relations with others—affect happiness and health in the same directions, respectively, with statistical significance. It is likely that these relations account for the observed positive correlation between the two subjective outcomes. In addition, it is noteworthy that favorable relations with others, which are interpreted as social capital at an individual level, uniformly and strongly enhance happiness and self-rated health. This fact points to the possibility that improving social capital can

mitigate adverse conditions surrounding happiness and health.

The table also shows the results of ordered probit models, which are estimated separately for happiness and health (Models 2 and 3). The pattern of significance of each variable is mostly unchanged from the bivariate probit model (Model 1), while the magnitude of the marginal effect of the Gini coefficient declines modestly for both the outcomes (from 0.856 to 0.726 for happiness and from 0.719 to 0.663 for self-rated health). This result suggests that separate estimations slightly underestimate the magnitude of the association between regional inequality and individual assessment of happiness and health.

Comparing sensitivities to inequality

Next, we compare the estimation results across key groups of individuals. Table 5 divides individuals by gender, age, house income, work status, and political view and compares the sensitivities to regional inequality by category in terms of the coefficient on the Gini coefficient as well as its marginal effect on the probability of reporting two top choices.

The key findings are summarized as follows. First, females are more sensitive to regional inequality than males for both happiness and self-rated health. Second, the young are most sensitive to inequality when assessing happiness, but their sensitivity is not significant, while in terms of self-rated health, the middle-aged are slightly more sensitive to inequality than other age groups.

Third, individuals with higher income are somewhat more sensitive to inequality than others. This counter-intuitive result may suggest that rich people tend to be cautious about the risk of a reduction in their income when they live in the area of high

inequality. In contrast, the low-income individuals are most sensitive to inequality for self-rated health.

Fourth, individuals with an unstable work status are much more affected by inequality when assessing both happiness and health than those in a stable work status and those out of labor force. This result holds regardless of categorizing the self-employed as stable (in the case of work status (A)) or unstable (in the case of work status (B)). Widening inequality most directly reduces the well-being of those in an unstable status who face the most serious uncertainty about future employment and income. This highlights the importance of policies that aim to enhance job security and prospects of income earnings.

Finally, those who are politically neutral are most sensitive to inequality for happiness, while progressive individuals are most sensitive to self-rated health. It is likely, however, that there is no clear distinction in political views among the Japanese people. Combining those who are progressive and neutral as “non-conservative,” we find that they are more sensitive to inequality than those who are conservative.

Alesina et al. (2004) found that the rich and the right-wingers are largely unaffected by inequality, while inequality has strongly negative effects on the happiness of the poor and left-wingers in Europe. They also observed that the poor and the left-wingers are not affected by inequality, while the effect on the rich is negative and well-defined in the United States. The case of Japan differs from that of both Europe and the United States; while the rich Japanese are affected by inequality, and the politically neutral rather than progressive or conservative ones are most sensitive to it. In addition, the effect of inequality tends to show different patterns across individual features between happiness and self-rated health. It should be noted, however, that

those with an unstable work status are strongly affected by inequality in terms of both happiness and health. Along with the fact that they are unhappier than others as seen from Table 3, it suggests that work status is one of the key determinants of individual well-being.

Conclusions

We examined how regional inequality affects the subjective assessment of happiness and health at an individual level, based on the three-year pooled data obtained from nationwide surveys conducted in Japan. We jointly estimated the models of these two outcomes assuming their correlated disturbances, and controlled for various factors at both individual- and prefecture-level characteristics.

Our estimation results are basically consistent with those of preceding studies, which discuss the impact of regional inequality on happiness and heath separately. Individuals who live in the area of high inequality tend to report themselves as both unhappy and unhealthy. The estimated sensitivities to the regional inequality of happiness and self-rated health are somewhat higher than those obtained by their separated estimations. In addition, these two outcomes are correlated with each other even after controlling for key individual- and prefecture-level factors.

Another noticeable finding is that the sensitivities to regional inequality differ substantially across some individual characteristics as well as for the two outcomes. In particular, people with an unstable work status, such as non-regular employees and the unemployed, are most strongly affected by inequality when assessing both happiness and health. These people also feel unhappier than those in a stable work status or those

who are out of the labor force. These facts should be taken seriously, given that a steadily declining share of regular employees in the labor market in Japan. Our estimation results also imply that as policy efforts to improve social capital, as well as those to reduce uncertainty about employment and income, can be effective in mitigating the adverse impact of regional inequality on the individual well-being.

This analysis has various limitations and suggests future research issues. First, while we took into account the correlation between happiness and health when estimating regression models, how these two aspects of individual welfare interact with each other remains to be addressed. Second, as is often the case with a multilevel analysis of this type, pathways or mediation process from income inequality in society to subjective outcomes at an individual level should be further investigated. Third, we have disregarded the possibility that subjective outcomes change individual characteristics, which we assumed to be exogenous. These issues should be explicitly addressed in future research.

Acknowledgement

The data from Comprehensive Survey of Living Conditions of People on Health and Welfare were made available by the Ministry of Health, Labor and Welfare of Japan under the Kosei Rodo Kagaku Kenkyuhi Joseikin project entitled “Research on Social Security Benefit and Contributions with reference to Income, Asset and Consumption” in 2008 (No. 1211006). The micro-data from this survey were accessed and analyzed exclusively by Takashi Oshio.

Data from the Japanese General Social Surveys (JGSSs) was made available to us by the Social Science Japan Data Archive, Information Centre for Social Science Research on Japan, Institute of Social Science, the University of Tokyo. The JGSSs were designed and conducted by the JGSS Research Center at Osaka University of Commerce (Joint Usage/Research Center for Japanese General Social Surveys accredited by the Minister of Education, Culture, Sports, Science and Technology), in collaboration with the Institute of Social Science at the University of Tokyo.

References

Alesina A., Di Tell, R., & MacCulloch, R. (2004). Inequality and happiness: Are Europeans and Americans different? *Journal of Public Economics*, 88, 2009-2042.

Blanchflower, D. G., & Oswald, A. J. (2004). Well-being over time in Britain and the USA. *Journal of Public Economics*, 2004, 88, 1359-1386.

Clark, A. E., & Oswald, A. J. (1994). Unhappiness and unemployment. *Economic Journal*, 104, 648-59.

Di Tella, R., MacCulloch, R. J., & Oswald A. J. (2001). Preferences over inflation and unemployment: Evidence from surveys of happiness. *American Economic Review*, 91, 335-41.

Easterlin, R. A. (2001). Income and happiness: Towards a unified theory. *Economic Journal*, 111, 465-84.

Frey, B. S., & Stutter, A. (2002). What can economists learn from happiness research? *Journal of Economic Literature*, 40, 402-435.

Fujiwara, T., & Kawachi, I. (2008). A prospective study of individual-level social capital and major depression in the United States. *Journal of Epidemiology and Community Health*, 62, 627-633.

Kawachi, I., & Kennedy, B. P. (1997). The relationship of income inequality to mortality: Does the choice of indicator matter? *Social Science & Medicine*, 45, 121-127.

Kim, D., & Kawachi, I. (2006). A multilevel analysis of key forms of community- and individual-level social capital as predictors. *Journal of Urban Health*, 83,

813-826.

Korpi, T. (1997). Is well-being related to employment status? Unemployment, labor market policies and subjective well-being among Swedish youth. *Labour Economics,* 4, 125-47.

Lleras-Muney, A. (2005). The relationship between education and adult mortality in the United States. *Review of Economic Studies*, 72, 189-221.

Ohtake, F. (2004). Unemployment and happiness. *The Japanese Journal of Labour Studies*, 528, 59-68 [in Japanese].

Ohtake, F., & Tomioka, J. (2004). Happiness and income inequality in Japan. A paper presented at International Forum for Macroeconomic Issues, ESRI Collaboration Project, February 2004.

Oshio, T., & Kobayashi, M. (2009). Income inequality, area-level poverty, perceived aversion to inequality and self-rated health in Japan. *Social Science & Medicine*, forthcoming.

Perneger, Th. V., Hudelson, P. M., & Bovier, P. A. (2004). Health and happiness in young Swiss adults, *Quality of Life Research*, 13, 171-178.

Pettit, J. W., & Kline, J. P. (2001). Are happy people healthier? The specific role of positive affect in predicting self-reported health symptoms. *Journal of Research in Personality*, 35, 521-536.

Sano, S., & Ohtake, F. (2007). Labor and happiness. *The Japanese Journal of Labour Studies*, 558, 4-18 [in Japanese].

Shibuya, K., Hashimoto, H., & Yano, E. (2002). Individual income, income distribution, and self rated health in Japan: Cross sectional analysis of nationally representative sample. *British Medical Journal*, 324, 16-19.

Smith, J. P. (1999). Healthy bodies and thick wallets: The dual relation between health and economics status. *Journal of Economic Perspectives*, 13, 145-166.

Subramanian, S. V., & Kawachi, I. (2004). Income inequality and health: What have we learned so far? *Epidemiologic Reviews*, 26, 78-91.

Subramainan, S.V., Kawachi, I., & Kennedy, B. P. (2001). Does the state you live in make a difference? Multilevel analysis of self-rated health in the US. *Social Science & Medicine*, 53, 9-19.

Subramanian, S. V., Kim, D., & Kawachi, I. (2002). Social trust and self-rated health in US communities: A multilevel analysis. *Journal of Urban Health*, 79, S21-S34.

Subramanian, S. V., Kim, D., & Kawachi, I. (2005). Covariation in the socioeconomic determinants of self rated health and happiness: A multivariate multilevel analysis of individuals and communities in the USA. *Journal of Epidemiology and Community Health*, 59, 664-669.

Tachibanaki, T. (2005). *Confronting income inequality in Japan.* Cambridge: MIT Press.

Winkelmann, L., & Winkelmann, R. (1998). Why are the unemployed so unhappy? Evidence from panel data. *Economica*, 65, 1-15.

Table 1. Selected descriptive statistics (pooled data for 2000, 03, 06)

	Mean	S.D.	Min	Max
(1) Prefecture-level variables, N=141 (47 prefectures * 3 years, not weighted)				
Gini coefficient	0.370	0.027	0.308	0.436
Mean household income (million yen)[a]	3.104	0.496	1.677	4.437
Per capita budget expenditure (million yen)[b]	0.451	0.128	0.195	0.873
Share of people aged 65 and above (%)	20.8	3.1	12.8	27.6
(2) Individual-level variables, N=4,467 (1,872 in 2000; 1,237 in 2003; 1,358 in 2006)				
Household income (thousand yen)[a]	3,683	2,542	0	32,200
Age	52.7	14.4	25	80
Number of children	1.83	1.08	0	10
Size of residential area (1=small, 2=middle, 3=large)	1.98	0.64	1	3
Executive	0.044			
Regular employee	0.328			
Non-regular employee	0.141			
Self-employed	0.094			
Family worker	0.028			
Unemployed	0.013			
Retired	0.097			
Housework	0.208			
Other	0.045			
Females	0.506			
Never married	0.087			
Divorced/widowed	0.102			
Graduated from college and beyond	0.304			
Belonging to hobby groups/clubs	0.262			
Satisfied with relationships with friends	0.894			
Trust in people	0.224			
(3) Regional blocks				
Hokkaido, Tohoku, Kanto1&2, Hokuriku, Tokai, Kinki1&2, Chugoku, Shikoku, Kyushu1&2				

Note: a. household size adjusted, pre-tax, and evaluated at 2005 prices. b. evaluated at 2005 prices.

Table 2. Joint frequency distribution of hapiness and self-rated health

(percent)

Happiness	Self-rated health					
	1 (= poor)	2	3	4	5 (= excellent)	Total
1 (= unhappy)	0.3	0.8	1.4	0.6	0.7	3.8
2	0.3	2.0	6.7	4.6	2.2	15.9
3	0.3	1.3	12.6	10.6	7.0	31.9
4	0.1	0.7	5.9	10.3	7.4	24.4
5 (= happy)	0.2	0.3	3.7	7.0	12.8	24.0
Total	1.3	5.1	30.3	33.2	30.1	100.0

Note: The correlation coefficient is 0.358 (p =0.000).

Table 3. Comparing happiness and self-rated health by category

Happiness (1=unhappy, 2, 3, 4, 5=happy)								
Gender	Male	(3.84)	<	Female	(3.88)			
Age	Middle	(3.82)	=	Old	(3.85)	<	Young	(3.94)
Income	Low	(3.72)	<<	Middle	(3.83)	<<	High	(4.03)
Work status (*A*)	Unstable	(3.74)	<<	Stable	(3.87)	<	Out of labor force	(3.93)
Work status (*B*)	Unstable	(3.78)	<<	Stable	(3.87)	<	Out of labor force	(3.93)
Political view	Neutral	(3.81)	=	Progressive	(3.83)	<<	Conservative	(3.97)
Self-rated health (1=poor, 2, 3, 4, 5=excellent)								
Gender	Male	(3.44)	<<	Female	(3.53)			
Age	Old	(3.33)	<<	Middle	(3.53)	<<	Young	(3.67)
Income	Low	(3.31)	<<	Middle	(3.55)	=	High	(3.60)
Work status (*A*)	Out of labor force	(3.34)	<<	Unstable	(3.49)	=	Stable	(3.57)
Work status (*B*)	Out of labor force	(3.34)	<<	Unstable	(3.51)	=	Stable	(3.57)
Political view	Progressive	(3.44)	=	Neutral	(3.48)	<<	Conservative	(3.55)

Note: 1. The numbers in parentheses are means (μ) of answers for each group.

2. *A* "<<", "<", and "=" *B* means that $H_0: \mu_A = \mu_B$ is rejected at the one and five percent significance levels and accepted at the five percent significant level, respectively, against $H_1: \mu_A < \mu_B$.

3. The self-employed are categorized as "stable" and "unstable" in Work status (A) and (B), respetcively.

4. The numbers of observations of each group are reported in Table 5.

Table 4. Estimation results of probit models

Dependent variable /Independent variables	Bivariate ordered probit model			Ordered probit models		
	Coef.	Robust S.E.	Marginal effect	Coef.	Robust S.E.	Marginal effect
Happiness (1=unhappy, 2, 3, 4, 5=happy)		*Model* 1			*Model* 2	
Gini	-2.296	(0.934) **	-0.856	-1.947	(0.937) **	-0.726
Log of household income	0.144	(0.029) ***	0.054	0.140	(0.029) ***	0.052
Female+	0.071	(0.046)	0.027	0.071	(0.047)	0.027
Age	-0.005	(0.002) ***	-0.002	-0.005	(0.002) ***	-0.002
Never married+	-0.638	(0.070) ***	-0.249	-0.621	(0.071) ***	-0.242
Divorced/widowed+	-0.344	(0.065) ***	-0.133	-0.342	(0.065) ***	-0.132
Graduated from college and beyond+	0.047	(0.039)	0.018	0.053	(0.039)	0.020
Number of children	-0.002	(0.019)	-0.001	0.009	(0.020)	0.003
Non-regular employee+	-0.073	(0.058)	-0.027	-0.067	(0.061)	-0.025
Self-employed+	0.011	(0.063)	0.004	0.033	(0.066)	0.012
Family worker+	-0.085	(0.105)	-0.032	-0.070	(0.104)	-0.026
Unemployed+	-0.643	(0.186) ***	-0.252	-0.600	(0.196) ***	-0.235
Retired+	0.203	(0.070) ***	0.073	0.159	(0.073) **	0.058
Housework+	0.169	(0.058) ***	0.062	0.154	(0.061) **	0.056
Other+	0.150	(0.092)	0.054	0.097	(0.097)	0.035
Belonging to hobby groups/clubs+	0.106	(0.040) ***	0.039	0.109	(0.040) ***	0.040
Satisfied with relationships with friends+	0.591	(0.057) ***	0.230	0.589	(0.057) ***	0.230
Trust in people+	0.331	(0.042) ***	0.118	0.328	(0.042) ***	0.117
Size of residential area	0.088	(0.263)	0.003	0.027	(0.266)	0.010
Log of mean household income	0.007	(0.030)	0.033	0.012	(0.030)	0.005
Share of people aged 65 and above	-0.019	(0.012)	-0.007	-0.011	(0.012)	-0.004
Per capita budget expenditure	0.782	(0.243) ***	0.291	0.524	(0.258) **	0.195
Self-rated health (1=poor, 2, 3, 4, 5=excellent)					*Model* 3	
Gini	-1.803	(0.850) **	-0.719	-1.663	(0.845) **	-0.663
Log of household income	0.113	(0.028) ***	0.045	0.115	(0.027) ***	0.046
Female+	0.115	(0.034) ***	0.046	0.117	(0.034) ***	0.047
Age	-0.010	(0.001) ***	-0.004	-0.010	(0.001) ***	-0.004
Never married+	-0.081	(0.062)	-0.032	-0.082	(0.062)	-0.033
Divorced/widowed+	0.027	(0.065)	0.011	0.021	(0.064)	0.008
Graduated from college and beyond*	0.008	(0.039)	0.003	0.006	(0.039)	0.002
Belonging to hobby groups/clubs+	0.182	(0.039) ***	0.072	0.179	(0.039) ***	0.002
Satisfied with relationships with friends+	0.560	(0.056) ***	0.213	0.551	(0.056) ***	0.210
Trust in people+	0.242	(0.042) ***	0.096	0.244	(0.042) ***	0.097
Size of residential area	-0.002	(0.028)	-0.001	-0.002	(0.028)	-0.001
Log of mean household income	0.275	(0.253)	0.110	0.273	(0.251)	0.109
Share of people aged 65 and above	0.017	(0.010) *	0.007	0.015	(0.010)	0.006
atnhρ	0.385	(0.020) ***			-	
ρ	0.367	(0.017)			-	

Note: 1. All models include regional block and year dummies.

2. For the bivariate ordered probit model, Wald test of ρ=0: $\chi^2(1)$ = 384.43, Prob. > χ^2 = 0.0000.

3. For each independent varibale without +, the marginal effect means the effect of its maginal increase of each predictor without * on the probabilty of answering 4 or 5 for happiness and health. For dummy variables (with +), the marginal effect is for a discrete change from 0 to 1.

4. ***, **, and * are significant at the one, five, and ten percent levels, respectively.

5. The numbers of observations are 4,443, 4,443, and 4,463 for Model 1-3, respectively.

Table 5. Comparing sensitivities to inequality by category

Category	Happiness			Self-rated health			Number of observations
	Coef.	Robust S.E.	Marginal effect	Coef.	Robust S.E.	Marginal effect	
Gender							
Male	-0.999	(1.343)	-0.374	-1.842	(1.203)	-0.732	2,196
Female	-3.574	(1.326) ***	-1.324	-1.866	(1.219)	-0.745	2,247
Age							
Young	-3.505	(1.869) *	-1.226	-2.193	(1.777)	-0.868	1,149
Middle	-1.276	(1.483)	-0.483	-2.496	(1.295) *	-0.995	1,831
Old	-2.242	(1.503)	-0.857	-1.477	(1.409)	-0.578	1,604
Household income							
Low	-1.760	(1.492)	-0.693	-3.038	(1.452) **	-1.186	1,477
Middle	-1.024	(1.614)	-0.389	0.085	(1.576)	0.034	1,466
High	-3.286	(1.741) *	-1.068	-1.840	(1.453)	-0.733	1,500
Work status (*A*)							
Stable	-0.921	(1.353)	-0.338	-1.871	(1.233)	-0.746	2,136
Unstable	-5.120	(1.972) ***	-1.993	-3.559	(1.798) **	-1.418	1,097
Out of labor force	-1.738	(1.661)	-0.634	-0.576	(1.547)	-0.228	1,352
Work status (*B*)							
Stable	-0.314	(1.513)	-0.115	-1.180	(1.370)	-0.471	1,717
Unstable	-4.452	(1.647) ***	-1.715	-3.609	(1.546) **	-1.440	1,542
Out of labor force	-1.738	(1.661)	-0.634	-0.576	(1.547)	-0.228	1,352
Political view							
Progressive	0.040	(2.074)	0.015	-3.526	(1.827) *	-1.401	990
Neutral	-3.707	(1.382) ***	-1.423	-0.984	(1.215)	-0.391	2,162
Conservative	-2.151	(1.714)	-0.740	-1.676	(1.610)	-0.667	1,225
Cf. Non-conservative	-2.487	(1.131) **	-0.946	-1.831	(0.998) *	-0.728	3,218

Note: 1. This table compares the coefficients on the Gini coefficient and the marginal effects of an increase in the Gini coefficient on the probability of answering 4 or 5 for happiness and health, based on the bivariate ordered probit models.

2. The self-employed are categorized as "Stable" and "Unstable" in Work status (A) and (B), respetcively.

3. ***, **, and * are significant at the one, five, and ten percent levels, respectively.