Association of smoking and drinking with socioeconomic factors: A comparative study based on bivariate probit model analysis

Takashi Oshio

Institute of Economic Research, Hitotsubashi University

Miki Kobayashi

Graduate School of Economics, Kobe University

ABSTRACT

In this study, we examined the differences between smoking and drinking in regard to their associations with socioeconomic factors among about 7,000 Japanese workers. Using microdata from nationwide surveys in Japan, we estimated bivariate probit models to jointly explore how smoking and drinking are related to a wide variety of socioeconomic factors. We found that only educational attainment is consistently and negatively associated with both smoking and drinking for both genders. The associations with other socioeconomic factors are not uniform between smoking and drinking and between men and women. A notable finding is that smoking is more sensitive than drinking to daily or continuous stress related to one's jobs and perceptions of one's income class, especially among men.

***Keywords*:** Smoking, Drinking, Bivariate probit model

Corresponding author: Takashi Oshio, Professor, Institute of Economic Research, Hitotsubashi University, 2-1 Naka, Kunitachi, Tokyo, 186-8601, Japan. Tel/fax: +81-3-580-8372. E-mail: oshio@ier.hit-u.ac.jp.

Introduction

It is well known that cigarette smoking and excess alcohol consumption have negative associations with health and economic activities. In particular, smoking is a leading risk factor for several diseases and causes of death, and this is now of great interest in public health across countries (WHO, 2009). Recent studies of public health also reveal that smoking is related to lower levels of pleasure and poorer quality of life (Lang, Gardener, Huppert, & Melzer, 2007), and empirical analysis of happiness studies tends to find a negative association between smoking and perceived happiness (Blanchflower & Oswald, 2008; Easterlin, 2001; Frey & Stutzer, 2002). Meanwhile, alcohol consumption has health implications and social consequences via intoxication and other biochemical effects; it is estimated to cause about 20% to 30% of esophageal cancer, besides liver cancer, cirrhosis of the liver, homicide, epilepsy, and motor vehicle accidents (WHO, 2010). However, its relationship with subjective well-being appears to be mixed; moderate drinkers tend to enjoy a better health status than abstainers, while heavy drinkers tend to assess their health as suboptimal (Poikolainen, Vartiainen, & Kortionen, 1996).

The association of smoking and drinking with health and subjective well-being is multi-dimensional in nature. While smoking and drinking are likely to directly affect health and subjective well-being, they may also reflect various socioeconomic factors that are potentially related to health and subjective well-being. If both smoking and drinking are positively related to socioeconomic disadvantages, it is reasonable to expect their negative correlations with health or subjective well-being. However, two things should be noted here. First, associations with socioeconomic factors should

differ between smoking and drinking as well as between men and women. It is reasonable to expect that an individual's choice to drink or smoke depends on the nature of stress and differs by gender due to sociological and/or biological reasons. Second, even if smoking and drinking are associated with socioeconomic disadvantages, it is unclear how they mediate or confound their adverse effects on health and other outcomes. While moderate drinking is likely to at least partly reduce some kind of stress, this may not be the case with excess drinking or smoking. In general, we should be cautious in drawing general conclusions about an association between socioeconomic factors and smoking or drinking behavior.

There is a rich body of literature on how smoking and drinking are associated with socioeconomic factors at the individual level, although issues addressed and highlighted differ substantially across studies. As for smoking, many previous studies have found lower levels of educational attainment to be associated positively with smoking (Grimard & Parent, 2007; Laaksonen, Rahkonen, Karvonen, & Lahelma, 2005; Stronks, van de Mheen, Looman, & Mackenbach, 1997; Winkleby, Jatulis, Frank, & Fortmarm, 1992). It may also be natural to suppose that lower-income individuals tend to smoke. However, after controlling for education and other socioeconomic factors, income tends to have a limited association with smoking (Huisman, Kunst, & Mackenbach, 2005; Laaksonen, Prättälä, Helasoja, Uutela, & Lahelma, 2003). Equally important, smoking is closely related to job stress and work environment; employees with high stress are more likely to be smokers than those with low stress (Kouvonen, Kivimäki, Virtanen, Pentti, & Vahtera, 2005), and the social differences in smoking behavior are explained largely by differences in work-environment exposures (Albertsen, Hannerz, Borg, & Burr, 2003). In recent years, more focus has been placed

on the association with the perception of one's social class or individual-level social capital. Being a smoker is associated with perceptions of income inequality, relatively low material well-being, and living in a community with a lower degree of trust (Lindström, 2009; Siahpush. Borland, Taylor, Singh, Ansari, & Serraglio, 2006), as observed for perceived happiness or self-rated health (Alesina, Di Tell, & MacCulloch, 2004; Ferrer-i-Carbonell, 2005; Subramanian, Kim, & Kawachi, 2002). Furthermore, there is evidence that smoking behavior is affected by marital status as well (Cho, Jun, & Kawachi, 2008).

As for drinking, there are many research studies on its associations with economic and material stress. It is shown that the prevalence of binge drinking tends to increase during economic downturns (Dee, 2001) and that the duration of poverty and unemployment throughout the transition to adulthood is a significant predictor of heavy drinking (Mossakowski, 2008). Further, social-class differences with regard to drinking tend to be wider when determined on the basis of achieved social class rather than social class of origin (Hemmingsson, Lundberg, & Diderichsen, 1999). These findings are consistent with the view that socioeconomic disadvantages in life predict drinking behaviors (Caldwell, Rodgers, Clark, Jefferis, Stansfeld, & Power, 2008). In addition, higher educational levels tend to reduce the probability of binge drinking (Cowell, 2006), although there is a study pointing to the opposite direction (Huerta & Borgonovi, 2010). Further, there is some evidence that social capital exerts strong protective effects on alcohol abuse (Weitzman & Chen, 2005).

It is fairly interesting to jointly investigate the association of smoking and drinking with socioeconomic factors, because both are likely linked to health and subjective well-being and also because they seem to be related, albeit differently, to the same

socioeconomic factors. In fact, there have been some studies that examined both smoking and drinking using a common framework of analysis. Chuang & Chuang (2008) and Poortinga (2006) compared smoking and drinking behavior in relation to social capital. Monden, van Lenthe, De Graaf, & Kraaykamp (2003) demonstrated that a partner's as well as his/her own educational attainment is negatively associated with smoking but not excess drinking. Granö, Virtanen, Vahtera, Elovainio, & Kivimäki (2004) showed that higher impulsivity is associated with increased likelihood of both smoking and drinking.

However, these studies have two serious limitations. First, they did not take into account the potential relationship between smoking and drinking in their regression model analysis. This might have resulted in biased estimation results. It may well be that decisions on smoking and drinking are made jointly; people might choose to smoke or drink selectively in response to different types of stress. Second, the issues addressed in these studies were not comprehensive enough to present the full picture of the associations of smoking and drinking with socioeconomic factors. The relationship of health behavior with one socioeconomic factor may well be confounded and/or mediated by another factor, suggesting the risk that analysis focusing on a single factor or a limited range of factors yields a biased and/or irrelevant conclusion.

In this study, we attempted to overcome these two limitations. First, we utilized bivariate probit models to jointly explain smoking and drinking, taking into account possible correlations between estimation errors. This approach can also help us clearly compare the magnitude and statistical significance of the association of smoking and drinking with each socioeconomic factor. Second, in our regression models we included a wide variety of socioeconomic variables, which have been separately and

independently examined by previous studies in most cases. In addition to key demographic and socioeconomic variables such as age, marital status, income, and educational background, we investigate how job satisfaction, work environment, class identification, individual-level social capital, and other variables are related to smoking and drinking. We limited our analysis to workers—that is, we excluded the unemployed and those not in the labor force—in examining the association with job stress and other job-related factors along with other variables.

Our analysis was based on microdata from nationwide surveys in Japan, which cover a wide range of socioeconomic factors. According to OECD (2009), the proportions of daily smokers among men and women aged 15 years and above in Japan were 41.3% and 12.4%, respectively, in 2006, compared to the OECD averages of 28.9% and 19.2%, respectively. The prevalence of smoking in Japan is higher among men and lower among women than in other advanced nations. Alcohol consumption per capita was 7.9 liters in Japan in 2006, somewhat lower than the OECD average of 9.6 liters. Some researchers have carried out multivariate analyses on smoking behavior in Japan (Fukuda, Nakamura, & Takano, 2005; Nakamura, Sakata, Kubo, Akizawa, Nagai & Yanagawa, 1994; Ohida, Kamal, Takemura, Sone, Mochizuki, & Kawaminami, 2001), but they covered only core socioeconomic factors, and did not compare smoking and drinking behaviors. Our estimation results for Japan can be compared with those for other countries, including its Asian neighbors such as Korea (Cho, Khang, Jun, & Kawachi, 2008) and Taiwan (Chuang & Chuang, 2008).

Data and method

Data

Our empirical analysis used 6-year (2000–2003 and 2005–2006) pooled data collected from Japanese General Social Surveys (JGSS), conducted and compiled 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 (the 2004 Survey was not conducted). The JGSS divided Japan into six blocks and further subdivided the blocks according to population size into three (in 2000–2005) or four (in 2006) groups. Next, the JGSS selected 300–526 locations (varying each survey year) from each stratum based on Population Census divisions. Then, the JGSS randomly selected 12 to 16 individuals aged between 20 and 89 years from each survey location. Data were collected through a combination of interview-based and self-administered questionnaires. Respondents for each survey year numbered between 1,957 (in 2003) and 2,953 (in 2002), with the response rate ranging between 50.5% (in 2005) and 64.9% (in 2000). The total sample size for the six years was 14,750. We excluded those aged 70 years and above, the unemployed or those not in the labor force, and those with missing key variables. As a result, the total sample size was reduced to 7,068—comprising 3,924 men and 3,144 women—about a half of the original sample. 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 the following paragraphs.

Smoking and drinking. With respect to smoking, the JGSS asked respondents to select an answer from "I am a smoker," "I used to smoke, but I have stopped smoking," and "I have scarcely/never smoked." We used a binary variable, allocating 1 to the first answer (current smoker) and 0 to the other two. As for alcohol drinking, the JGSS asked the respondents, "How often do you drink alcohol beverages?" and

presented seven choices: “Almost every day,” “Several times a week,” ... , “About once a year,” and “Never.” We allocated 1 to the first answer (daily drinker) and 0 to the remaining six. It should be noted that problem drinkers cannot be distinguished from daily drinkers in this dataset.

Basic demographic and socioeconomic factors. We divided the respondents into five age groups (20s to 60s). As for marital status, we considered three categories: married, never married, and divorced/widowed; we divided respondents into those with one child or more and those with no child. We also categorized educational attainment into three groups: those who have graduated from college or above (including 2-year junior college), high school, and junior high school or below. As for earnings, the JGSS asked respondents to choose their own annual income for the previous year from 19 categories. We took the median value of each category and evaluated it at 2005 consumer prices.

Job satisfaction and variables related to job stress. We collected the subjective measure of job satisfaction as well as some variables which were expected to affect job stress. The JGSS asked respondents, “On the whole, how satisfied are you with the (main) job you have?” on a 5-point scale: “Satisfied,” “Somewhat satisfied,” “Neither satisfied nor dissatisfied,” “Somewhat satisfied,” and “Dissatisfied.” The Survey also asked about the risk of unemployment: “Thinking about the next 12 months, how likely do you think it is that you will lose your job or be laid off?” on a 5-point scale: “Very likely,” “Fairly likely,” “Not too likely,” “Not at all likely,” and “Don’t know.” We allocated 1 to the first two choices and 0 to the remaining three for these two questions. In addition to these subjective assessments, we collected continuous data of total hours worked during a week before the survey time expecting that lower hours

worked add to job stress. Job satisfaction and stress are likely affected by occupational status as well; we consider five categories: management-level worker, regular employee, non-regular employee, self-employed worker, and family business worker. Furthermore, we examined whether a respondent had experienced any traumatic event over the past 5 years, considering that some existing studies found a higher risk of heavy drinking is positively related to a history of depression (Dixit and Crum, 2000).

Perceptions of income class and its change. The JGSS asked two questions about a respondent's perceptions of income class: "Compared with Japanese families in general, what would you say about your family income?" and "Considering the time when you were about 15 years old, what would you say about your family income compared with Japanese families in general?" on a 5-point scale: "Far below average," "Below average," "Average," "Above average," and "Far above average." First, we dichotomized the answers into below average and average or above. Second, we compared current and retrospective perceptions and defined a deteriorated perception—such as down from "Above average" to "Below average"—as a downslide from young age.

Individual-level social capital and political preference. We collected two aggregate proxies for social capital at the individual level: trust in people and social participation. The JGSS asked respondents, "Generally speaking, would you say that most people can be trusted?" and we defined those who answered "Yes" as people who generally have trust in others. The JGSS also asked respondents whether they were members of each of six organizations, such as a social service group and sports club. We considered those who belonged to at least one organization as people with social participation. In addition, we considered the political views of respondents. Politically

conservative people are more likely to have higher political trust than others. The JGSS asked respondents to choose from five categories (1 = conservative to 5 = progressive) to answer the question, "Where would you place your political views on a 5-point scale?" We defined those who chose 1 or 2 as politically conservative.

Housing tenure and urbanity. In addition to the above-mentioned demographic and socioeconomic factors, we included variables of housing tenure and urbanity. We examined whether the health behaviors of house owners and others or those living in metropolitan areas and others are different based on data collected from the JGSS, following Laaksonen et al. (2005), Macintyre, Ellaway, Hiscock, Kearns, Der, & McKay (2003), and others.

Analytic strategy

We employed regression analyses to assess the association of smoking and drinking with demographic and socioeconomic variables. Assuming that smoking and drinking are correlated, we ran a bivariate probit model of the following form:

$$y_1^* = \boldsymbol{x}'\boldsymbol{\beta}_1 + \varepsilon_1;\ y_1 = 1 \text{ if } y_1^* > 0, = 0 \text{ otherwise}$$

$$y_2^* = \boldsymbol{x}'\boldsymbol{\beta}_2 + \varepsilon_2;\ y_2 = 1 \text{ if } y_2^* > 0, = 0 \text{ otherwise}$$

Here, y_1 and y_2 are binary variables for smoking and drinking, respectively (yes = 1), y_1^* and y_2^* are their latent variables, $\boldsymbol{x}$ is the vector of the common predictors, $\boldsymbol{\beta}_1$ and $\boldsymbol{\beta}_2$ are the vectors of coefficients, and ε_1 and ε_2 are the disturbances. These two equations are correlated and were jointly estimated on the assumption that the two disturbances, ε_1 and ε_2, have binomial standard normal distributions,

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

with ρ being the covariance of disturbances. In estimating this bivariate probit model we included indicator variables for 47 prefectures and six survey years to control for regional- and year-specific factors, such as regional income inequality and mean income (Henderson, Liu, Roux, Link, & Hasin, 2004; Shohaimi, Luben, Wareham, Day, Bingham, Welch, et al., 2003) and macroeconomic conditions (Novo, Hammarström, & Janlert, 2000). We also utilized the sampling weights provided by the JGSS.

Results

Descriptive analysis

The proportion of smokers in our dataset is 50.6% among men and 16.7% among women (see Table 1), slightly higher than the averages of 48.1% and 13.6%, respectively, during 2000 and 2006, according to official statistics released by OECD (2009), probably because our dataset is limited to workers aged 20 years and above. The proportion of daily drinkers is 41.9% and 9.7% for men and women, respectively, slightly lower than that of smokers. The proportion of those who both smoke and drink daily is 23.3% among men and 3.5% among women.

Before discussing regression analyses, we compared how perceived happiness and self-rated health differ between smokers and non-smokers and between daily drinkers and others. The JGSS asked respondents to choose from 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 1 (= excellent), 2, 3, 4, and 5 (= poor) in response to the question, “How would you rate your health condition?” We reversed the order of choices such that “unhappy” and “poor” equaled 1 and “happy” and “excellent”

equaled 5. Table 2 presents the unweighted means of the 5-point scores of perceived happiness and self-rated health, with standard deviations, based on smoking and drinking behavior. We also tested the null hypothesis that the means of happiness and health scores differ between smokers and non-smokers and between daily drinkers and others.

From this table, we found that smokers are less happy than non-smokers among both men and women and that daily drinkers are happier than others among men, but not among women. As for self-rated health, we did not find any clear difference between smokers and non-smokers or between daily drinkers and others. We should be cautious in interpreting these results, because this table does not control for other factors which potentially confound the relationship between smoking/drinking and subjective well-being, nor does it indicate any causality. On the whole, however, the findings from this table point to significant differences between smoking and drinking in their associations with socioeconomic factors. We can at least suspect that smoking is more sensitive than drinking to socioeconomic disadvantages that are expected to weigh on perceived happiness.

Results of bivariate probit models

Tables 3 and 4 present estimation results of bivariate probit models for men and women, respectively. The estimation results are expressed in terms of how the probability of smoking or drinking changes in response to a change of each binary variable from 0 to 1. As for the continuous variables—hours worked and income (both log-transformed in regressions)—the table shows how the probability of smoking or drinking changes in response to a 1% increase in their values over the sample means.

First of all, we note that the estimate of the covariance of disturbances, ρ, is 0.203 with a standard error of 0.028 for men and 0.365 with a standard error of 0.042 for women. The Wald statistic for the test of the null hypothesis that ρ equals zero is 48.75 for men and 61.64 for women, both of which are well above the critical chi-squared value with a single restriction at the 1% level, 6.63. 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 for both genders.

As for the associations of smoking and drinking with demographic and socioeconomic factors, we note several important findings. First, as age increases, the prevalence of smoking declines for both men and women. The magnitude of the negative effect from aging, which is higher than those of other variables, steadily increases with increase in age. By contrast, the association between age and drinking differs by gender; it is positive for men and insignificant for women. Thus, drinking tends to replace smoking as age increases for men, but not for women. It should be noted, however, that this analysis does not distinguish age and cohort effects.

Second, lower levels of educational attainment are positively associated with both smoking and drinking and for both men and women. For men who graduated from junior high school or below, the probability of smoking is 15.6% higher than those who graduated from college or above, and 12.4% higher for those who graduated from high school, other things being equal. The association is lower with drinking and for women, but consistently significant. The spouse's higher educational attainment is negatively associated only with male smoking. This contrasts with the result in Monden et al. (2003), who found significant associations between partners' education and smoking and, to a lesser extent, excess drinking for both men and women in the Netherlands.

Third, the pattern of associations with marital status is commonly observed for men and women: divorce and separation are positively associated with smoking, while unmarried individuals tend to drink less than others. Although it is difficult to identify any causality, psychological stress caused by divorce and separation appears to make individuals more inclined to keep or relapse into smoking. By contrast, marriage raises the probability of drinking, which is not much affected by divorce or separation. Having children also raises the possibility of drinking, albeit only for men, suggesting additional evidence that expanding family relationship stimulates drinking.

Fourth, job satisfaction is negatively associated with smoking for both men and women; this is also the case with drinking for women. This is in line with the results observed from many preceding studies of the relationship between job stress and smoking. Smoking is more sensitive to job stress factors, especially for men; longer hours worked and the occupational status of management are positively related to male smoking. The risk of unemployment is not much related to smoking or drinking. Meanwhile, unlike job satisfaction and job stress factors, traumatic experiences tend to predict drinking rather than smoking, especially for men.

Fifth, smoking is more sensitive than drinking to perceptions of one's income class and its change. The perception that one belongs to lower than middle classes is significantly and positively associated with smoking but not drinking for both men and women. In addition, the perception of a downslide from the income class of one's young age increases the possibility of smoking, albeit only for men. It is noteworthy that these results are obtained after controlling for one's own income, which is found to be positively related to only drinking, for men.

Sixth, individual-level social capital significantly affects smoking and drinking,

albeit somewhat differently for men and women. Social participation, which is defined by membership of at least one social group, is negatively associated with male smoking. Meanwhile, general trust in people is related positively to male drinking and negatively to female smoking. Related to this issue, we find that politically conservative men are inclined to avoid both smoking and drinking. This finding is comparable with that of Lindström (2009), who demonstrated a negative association between political trust and smoking, especially if political conservatism is linked to political trust.

In addition to these results, we noticed that living in one's own house is negatively associated with female smoking only, and that living in the metropolitan areas is not significantly related to smoking or drinking.

Discussion and conclusion

This study attempted to jointly examine the associations of smoking and drinking with a comprehensive set of socioeconomic factors, utilizing bivariate probit models, which are expected to capture an individual's joint decisions on smoking and drinking. Most of all, our estimation results confirmed the importance of education, which is the only socioeconomic factor that has a consistent and significant association with smoking and drinking for both men and women. There are several economic explanations for the link between education and smoking and drinking (Cowell, 2006). One example is that a more educated individual is more inclined to efficiently allocate resources to obtain better health and hence avoid unhealthy behavior. An alternative explanation is that time preference may account for the link, as an individual who

highly discounts future outcome tends to prefer smoking or drinking to education, the benefit of which will not be realized until the future. We also found that the association with education is stronger with smoking than drinking, and for men than women.

Another noticeable finding was that smoking and drinking are not uniformly associated with different types of stress. In general, smoking tends to be more closely related than drinking to daily or continuous stress, especially for men. Those who are less satisfied with their jobs and forced to work longer hours tend to smoke. Perceptions of lower income class and of a downslide in income class from childhood are positively associated with smoking. The latter finding is comparable with the results from preceding happiness studies that relative income (compared to others' or one's own past income) affects subjective well-being, even after controlling for the absolute level of current income (Ferrer-i-Carbonell, 2005). In contrast, the observed positive association between traumatic experiences and drinking suggests that stress caused by unusual shocks makes individuals inclined to drink.

Observed differences between the association of smoking and drinking with socioeconomic factors are also consistent with their different relationships with perceived happiness for men: smokers are less happy, while daily drinkers are happier. First, as discussed above, smoking is more sensitive than drinking to socioeconomic disadvantages in general. Second, income, which is a key economic determinant of happiness, is associated negatively with smoking but positively with drinking. Finally, the fact that smoking tends to be replaced by drinking as age increases is consistent with the positive association between drinking and happiness, given smokers' relative unhappiness. These relationships among smoking, drinking, and happiness were not clearly observed for women, pointing to their gender specificity.

Furthermore, our findings suggest that more studies are needed to understand the association of smoking and drinking with social capital, which have been demonstrated by several preceding studies (Chuang & Chuang, 2008; Poortinga, 2006; Weitzman & Chen, 2005). Stronger associations with social participation on smoking were found for men than for women, while trust in people was associated positively with male drinking and negatively with female smoking. These gender differences are not consistent with those observed in Taiwan (Chuang & Chuang, 2008), suggesting that social capital is not uniformly related to health behavior across countries with different social and cultural backgrounds.

This study has a number of limitations. First, our dataset did not distinguish problem or excess drinking from daily drinking, making it difficult to fully capture the risky aspects of smoking behavior. Second, as is the case with cross-sectional studies, no clear causal inference can be drawn from our estimation results. It may well be that unhealthy behaviors lead to lower satisfaction with work or family life and/or lower social participation. The case that unobserved heterogeneity accounts for spurious correlations of smoking and drinking with socioeconomic factors cannot be ruled out, either. We need longitudinal data to precisely indentify causal pathways from socioeconomic factors to health behaviors. Another limitation is that we did not explore multilevel analysis; our regression analysis focused on individual-level variables and used prefecture indicator variables to capture area-level fixed effects. However, many multilevel studies point to interactions of individual- and area-level factors (Henderson et al., 2004; Poortinga, 2006).

Despite these caveats, the estimation results clearly indicate that the associations with socioeconomic factors are not uniform between smoking and drinking and that

their patters differ substantially across genders. These findings are consistent with observed differences in relationships with subjective well-being between smoking and drinking. This study implies that more comprehensive analyses are needed to further investigate the mechanisms linking socioeconomic factors and health behaviors, using the framework to grasp relative importance of each factor that most existing studies have separately examined.

Acknowledgement

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. We also appreciate the financial support provided by Grant-in-Aid for Scientific Research on Innovative Areas (21119004) and Grant-in-Aid for Scientific Research (B) (21330057).

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Table 1. Selected descriptive statistics.

	Men	Women	Total
Number of observations	3924	3144	7068
Year 2000	793	699	1492
Year 2001	770	557	1327
Year 2002	804	643	1447
Year 2003	497	414	911
Year 2005	491	436	927
Year 2006	569	395	964
Categorical variables			(percentage)
Smoking	50.6	16.7	35.5
Drinking almost everyday	41.9	9.7	27.6
Age 20s (reference)	15.1	16.1	15.5
30s	20.1	19.0	19.6
40s	21.5	25.0	23.1
50s	27.7	27.8	27.7
60s	15.7	12.1	14.1
Marital status			
Married (reference)	77.0	71.9	74.7
Never married	20.3	19.6	20.0
Divorced/widowed	2.7	8.5	5.3
Have one child or more	72.6	73.7	73.1
Educational background: graduated from			
Junior high school or below	13.9	12.6	13.3
High school	47.2	52.2	49.4
College or above	39.0	35.2	37.3
Spouse: junior high school or below	10.2	12.2	11.1
Spouse: high school	43.5	37.0	40.6
Spouse: college or above	23.7	25.5	24.5
Occupational status			
Management-level worker	8.5	3.2	6.1
Regular employee (reference)	68.0	38.7	55.0
Non-regular employee	8.3	43.8	24.1
Self-employed worker	14.0	6.3	10.6
Family business worker	1.2	7.9	4.2
Job satisfaction/stress			
Satisfied with job	63.9	47.2	56.5
Risk of unemployment	17.7	38.6	27.0
Traumatic experience	58.4	66.5	62.0
Class identification			
Belong to lower than middle classes	42.7	37.0	40.2
Income class downslide from young age	28.4	31.3	29.7
Individual-level social capital			
Social participation	51.6	47.6	49.8
Trust in people	25.8	20.4	23.4
Politically conservative	28.6	21.4	25.4
Living in own house	77.3	79.2	78.2
Living in metropolitan area	18.2	19.6	18.8
Continuous or five-point score variables			
Men	Mean	S.D.	Max	Min
Own income (million yen, 2005 prices)	5.23	3.49	3.49	32.20
Hours worked per week (hour)	45.86	14.18	2	120
Perceived happiness (1 = least happy, 5 = happiest)	3.81	0.93	1	5
Self-rated health (1= poor, 5 = excellent)	3.56	1.07	1	5
Women				
Own income (million yen, 2005 prices)	2.13	2.21	0.3	32.1
Hours worked per week (hour)	33.75	14.69	1	105
Perceived happiness (1 = least happy, 5 = happiest)	3.86	0.93	1	5
Self-rated health (1= poor, 5 = excellent)	3.67	1.08	1	5

Table 2. Perceived happiness and self-rated health by smoking and drinking.

		Mean	S.D.	Difference	*p* -value
Perceived happiness (1 = least happy, …, 5 = happiest)					
Men	Not smoking	3.88	(0.90)		
	Smoking	3.74	(0.95)	-0.14	<0.001
	Not drinking	3.75	(0.93)		
	Drinking	3.90	(0.91)	0.15	<0.001
Women	Not smoking	3.89	(0.91)		
	Smoking	3.71	(1.00)	-0.18	<0.001
	Not drinking	3.86	(0.92)		
	Drinking	3.92	(0.97)	0.06	0.271
Self-rated health (1 = poor, …, 5 = excellent)					
Men	Not smoking	3.59	(1.07)		
	Smoking	3.53	(1.07)	-0.06	0.101
	Not drinking	3.54	(1.08)		
	Drinking	3.59	(1.05)	0.05	0.158
Women	Not smoking	3.69	(1.08)		
	Smoking	3.59	(1.10)	-0.10	0.052
	Not drinking	3.67	(1.08)		
	Drinking	3.72	(1.06)	0.05	0.461

Table 3. Associations of independent variables with smoking and drinking for men estimated by the bivariate probit model.

N = 3924

	Smoking		Drinking	
	dPr/dx	Robust S.E.	dPr/dx	Robust S.E.
Age [reference = 20s]				
30s	-0.062	(0.032) *	0.049	(0.035)
40s	-0.114	(0.035) ***	0.111	(0.036) ***
50s	-0.147	(0.036) ***	0.157	(0.037) ***
60s	-0.233	(0.041) ***	0.160	(0.043) ***
Marital status [reference = married]				
Never married	-0.031	(0.043)	-0.136	(0.040) ***
Divorced/widowed	0.192	(0.055) ***	-0.013	(0.052)
Have one child or more	-0.051	(0.036)	0.061	(0.034) *
Education [reference = graduated from college or above]				
Junior high school or below	0.156	(0.034) ***	0.121	(0.036) ***
High school	0.124	(0.021) ***	0.050	(0.021) **
Spouse: junior high school or below	0.074	(0.041) *	0.029	(0.041)
Spouse: high school	0.069	(0.025) ***	0.022	(0.024)
Job satisfaction/stress				
Satisfied with job	-0.064	(0.019) ***	0.013	(0.019)
Risk of unemployment	0.022	(0.024)	0.039	(0.024) *
Hours worked (log)	0.070	(0.025) ***	-0.020	(0.023)
Occupational status [reference = regular employment]				
Management-level worker	0.078	(0.034) **	0.006	(0.034)
Non-regular employee	0.017	(0.039)	0.008	(0.041)
Self-employed worker	0.037	(0.028)	0.063	(0.027) **
Family business worker	0.009	(0.088)	0.138	(0.094)
Traumatic experience	-0.027	(0.018)	0.039	(0.018) **
Class identification				
Belong to lower than middle classes	0.069	(0.019) ***	0.016	(0.019)
Income class downslide from young age	0.057	(0.020) ***	-0.019	(0.020)
Own income (log)	0.021	(0.018)	0.051	(0.018) ***
Individual-level social capital				
Social participation	-0.046	(0.020) **	0.017	(0.020)
Trust in people	0.005	(0.021)	0.054	(0.021) ***
Politically conservative	-0.048	(0.020) **	-0.041	(0.019) **
Living in own house	-0.031	(0.023)	0.032	(0.023)
Living in metropolitan area	0.005	(0.028)	-0.018	(0.027)
ρ (covariance of disturbances)	0.203	(0.028) ***		

Notes: 1. dPr/dx indicates a change in the probability of each outcome in response to a change in each binary variable from 0 to 1. For hours worked and own income, it indicates the change in response to 1% change in it.

2. Indicator variables for prefectures and survey years are included but not reported to save space.

3. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 4. Associations of independent variables with smoking and drinking for women estimated by the bivariate probit model.

N = 3144

	Smoking		Drinking	
	dPr/dx	Robust S.E.	dPr/dx	Robust S.E.
Age [reference = 20s]				
30s	-0.015	(0.022)	0.021	(0.014)
40s	-0.065	(0.023) ***	0.022	(0.017)
50s	-0.102	(0.023) ***	0.009	(0.015)
60s	-0.132	(0.022) ***	-0.009	(0.016)
Marital status [reference = married]				
Never married	0.013	(0.032)	-0.041	(0.012) ***
Divorced/widowed	0.081	(0.028) ***	0.004	(0.011)
Have one child or more	0.000	(0.028)	-0.010	(0.012)
Education [reference = graduated from college or above]				
Junior high school or below	0.078	(0.035) **	0.029	(0.016) *
High school	0.075	(0.017) ***	0.020	(0.008) **
Spouse: junior high school or below	0.039	(0.031)	0.008	(0.013)
Spouse: high school	0.002	(0.019)	-0.010	(0.008)
Job satisfaction/stress				
Satisfied with job	-0.033	(0.014) **	-0.015	(0.007) **
Risk of unemployment	0.025	(0.017)	-0.007	(0.008)
Hours worked (log)	0.005	(0.014)	0.004	(0.006)
Occupational status [reference = regular employment]				
Management-level worker	0.061	(0.044)	0.018	(0.018)
Non-regular employee	0.011	(0.019)	0.006	(0.008)
Self-employed worker	0.044	(0.033)	0.027	(0.017)
Family business worker	-0.040	(0.027)	0.011	(0.013)
Traumatic experience	0.015	(0.014)	0.011	(0.006) *
Class identification				
Belong to lower than middle classes	0.034	(0.014) **	-0.002	(0.007)
Income class downslide from young age	0.023	(0.014)	0.010	(0.007)
Own income (log)	0.007	(0.011)	0.005	(0.004)
Individual-level social capital				
Social participation	-0.022	(0.015)	-0.001	(0.007)
Trust in people	-0.037	(0.016) **	0.006	(0.008)
Politically conservative	-0.006	(0.016)	0.003	(0.008)
Living in own house	-0.069	(0.018) ***	0.002	(0.008)
Living in metropolitan area	0.031	(0.020)	0.006	(0.009)
ρ (covariance of disturbances)	0.365	(0.042) ***		

Notes: 1. dPr/dx indicates a change in the probability of each outcome in response to a change in each binary variable from 0 to 1. For hours worked and own income, it indicates the change in response to 1% change in it.

2. Indicator variables for prefectures and survey years are included but not reported to save space.

3. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.