The effects of the social norm on cigarette consumption: evidence from Japan using panel data

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Abstract

Using Japan's prefecture-level panel data from 1989-2001, this paper examines the influence of the social norm on a person's smoking behavior when the complementary relationship between smoking and drinking is taken into account. The key findings through a dynamic panel model controlling for unobserved prefecture-specific fixed effects are as follows: (1) Influence from others is stronger when people live more closely and cohesively. A tightly knit society results in a reduction of smoking through smoking-related interaction. (2) Smoking and drinking have a complementary relationship: greater initial consumption of alcohol results in larger consumption of cigarettes. (3) The complementary relationship between smoking and dinking is attenuated if the cost of committing the annoying conduct (i.e., smoking) is high.

Overall, this empirical study provides evidence that the psychological effect of the presence of surrounding people has a direct significant effect upon smoking behavior and, furthermore, that it attenuates the complementary relationship between smoking and drinking, thereby reducing cigarette consumption. These results indicate that not only formal rules but also tacitly formed informal norms are effective deterrents to smoking.

1. Introduction

It is generally acknowledged that Japan's per capita cigarette consumption and smoking rate has been remarkably high among major industrialized nations (World Bank, 1999). However, in Japan, some literature has pointed out that compared with other industrialized nations, the government did not sufficiently make an effort to raise public awareness about the health hazards of smoking (Yorozu and Zhou, 2002; Luo et al., 2003)[1]. For instance, Yorozu and Zhou (2002) refer to the absence of antismoking ordinances and regulations and the lack of dissemination of information about the health hazards of smoking. Nonetheless, the consumption of cigarettes has declined gradually in Japan. Thus, given that the formal rules and laws enacted by the government were not sufficiently effective in reducing cigarette consumption, there should be other mechanisms involved in the control of smoking which has lead to a reduction of cigarette consumption.

A person innately does not pay much attention to which side of the road they drive on, and thus they would normally choose to simply drive on the same side as everyone else. This phenomenon shows an aspect of human nature that relates to social existence. The influence of the attitude and conduct of others on a person's behavior seems apparent among neighbors and colleagues in schools and workplaces (Beker and Murphy, 2000; Brock and Durlauf, 2001; Crane, 1991; Evans et al., 1992; Gaviria and Rapahel, 2001; Glaeser et al., 1996; Manski, 1993). The interactive mechanism above also applies to a person's choice of demand behavior. What others consume stimulates a person's demand for it as well. That is to say, the more popular goods are, the more people want them. Consequently, interactions among people through conversations and daily life may affect aggregated demand behavior toward goods such as cigarettes (Powell et al., 2005). When this interactive mechanism is considered, as Coleman (1990) pointed out, actors harmed by an action that benefits the actor in control of the action experience negative externalities, as exemplified by nonsmokers sitting near a smoker. The problem for nonsmokers, therefore, is how to limit such actions taken by smokers.

Compared with Europe or North America, in general the smoking prevalence of females is remarkably lower than that of males in the Asian nations of Japan, Korea,

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[1] The situation in Korea is similar (Kim and Seldon, 2004).　Other existing work examining smoking behavior in Asia includes Japan (Haden, 1990) and China (Yuanliang and Zongyi, 2005).

Thailand, and Singapore. For example, the smoking prevalences of males and females in the United States are 27.7% and 22.5 %, respectively. On the other hand, those of Japan are 59.0 % and 14.8 %, respectively (Worldbank, 1999). These data imply that as a whole the smoking prevalence of Japan is higher than that of the United States, although that of females is distinctly lower in Japan than in the United States. Japan ratified its "Convention on the Elimination of all Forms of Discrimination Against Women" in 1979 at the United Nations General Assembly[2]. Consequently, females have risen in social standing and therefore have a larger influence on the social lives of the Japanese. With regard to smoking, most females in Japan are non-smokers who dislike smoking behavior. As the social status of females has risen, the anti-smoking atmosphere has become more prevalent[3]. Such an atmosphere also seems to shape the general anti-smoking social norm in Japan.

If one smokes in a public place and the surrounding people indicate their annoyance against him, then the person may feel embarrassed and thereby generate the psychological cost of committing the impolite behavior of smoking. The psychological cost of smoking depends on anti-smoking social norms, which are shaped by local interactions (Funk, 2005). Furthermore, the apprehension of bad behavior such as crime or smoking depends on the watchfulness of citizens (Huck and Kosfeld, 2007). Neighborhood watch efforts are likely to be more effective if the community members have closer relationships. Accordingly, assuming that neighborhood watch and psychological cost are complementary and that the majority of a community's members consist of nonsmokers, then the social norm that bans community members from smoking will be stronger in a more cohesive community. In the long run, the entire community will come to ostracize those who break such informal rules, such as smokers (Posner and Rasmusen, 1999). I believe that informal rules such as social norms are the key determinants of the attitudes of smokers in Japan. This is why, in this study, I pay particular attention to the role of social norms in the regulation of smoker attitudes and thus include the proxy variables of social disorganization[4].

The empirical studies of Dee (1999) and Gruber et al. (2003) provide evidence of a robust complementarity between cigarettes and alcohol[5]. To put it differently,

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[2] See http://www.un.org/womenwatch/daw/cedaw/.
[3] Due to limitations of data, the effect of females on cigarette consumption is not directly estimated in this research.
[4] The cohesiveness of society has another aspect as well.　According to Putnam (2000), social networks built in a cohesive society may reinforce healthy norms, and socially isolated people are more likely to smoke or engage in various health damaging behaviors.
[5] Recently, Arcidacono et al. (2007) also investigated the relationship between smoking

reductions in drinking are associated with a lower prevalence of smoking. Such a complementarity seems to be affected by the informal social norm created through the watchfulness of the neighborhood or colleagues at work. The anti-smoking social norm appears to attenuate the complementarity between smoking and drinking. Nevertheless, the empirical links between social norms and complementary goods has yet to be considered in the literature. Therefore, the object of this paper is to explore such links using the panel data of Japan from 47 Japanese prefectures for the years 1989-2001 and controlling for unobservable fixed effects. The contribution of this paper is a combined analysis of the importance of the social norm and complementary goods on smoking behavior.

This paper also contributes to the cigarette demand literature by examining the determinants of smoking incorporating both the direct and indirect effects of the social norm (via reduction of the complementarity of alcohol consumption) on smoking behavior. The organization of this paper is as follows: Section 2 surveys cigarette consumption in Japan and advances a testable hypothesis. Section 3 presents the simple econometric framework. Section 4 discusses the results of the estimations. The final section offers concluding observations.

2. Review of cigarette consumption in Japan
2.1. Review

I begin this section by studying the figures that outline the current state of smoking in Japan. A cursory examination of Figure 1, which demonstrates the transition of per capita consumption of cigarettes in Japan, suggests that consumption declined gradually over time until 1996[6]. Subsequently, Figure 2 illustrates the average per capita consumption of cigarettes by prefecture for both high alcohol consumption and low consumption groups, which are equally divided by the initial year's alcohol consumption[7]. Figure 2 reveals that the consumption of cigarettes by the high alcohol consumption group is obviously higher than that of the low alcohol consumption group. Monthly expenditures of cigarettes declined from 1500 yen (in 1988) to 1100 yen (after 1996) in the high alcohol consumption group, whereas it declined from 1100 yen (in 1988) to 950 yen (after 1996) in the low alcohol consumption group. Thus the reduction in cigarette expenditures was approximately 400 yen for the

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and drinking.

[6] The evolution of cigarette consumption is unchanged even when expenditures on cigarettes are divided by the unit price of cigarettes. That is, consumption had been in decline until 1996, even when the unit price change is taken into account.

[7] The initial year is defined as 1989.

high alcohol consumption group but only 150 yen for the low alcohol consumption group, indicating a difference in cigarette consumption between these two groups. Furthermore, the consumption of alcohol was positively associated with that of cigarettes, and the decrease in cigarette consumption was more evident in the high alcohol consumption group than in the low consumption group.

The relationship between cigarette and alcohol consumption is shown in Figure 3, in which alcohol and cigarette consumption are represented in the horizontal and the vertical axis, respectively. Alcohol and cigarette consumption per year are measured in millions of yen. I used their log forms to create the figures. Furthermore, Figures 3 a) and 3 b) show the high and low alcohol consumption groups, respectively, which are divided in the same manner used in Figure 2. As I explain later, the data comprises panel data, consisting of 47 prefectures and spanning 13 years. There were a total of 611 observations, which were then divided into the high alcohol consumption group (312 observations) and the low alcohol consumption group (299 observations). From these figures it can be seen that the sample regression line in Figure 3a) is steeper than that in Figure 3 b). That is, a positive relationship is observed more clearly in Figure 3 a) than in Figure 3 b), indicating that the complementarity between drinking and smoking is more obvious if the consumption of alcohol is higher.

To sum up the evidence presented above, smoking is associated more positively with drinking despite the fact that their complementarity declines more rapidly in the areas where the consumption of alcohol is higher.

2.2. Hypothesis

As suggested earlier, the per capita cigarette consumption in Japan has dominated industrialized nations in recent years. However, there is a remarkable difference in the smoking prevalences of males and females, which are about 60 % and 15 %, respectively (World bank, 1999). A growing body of literature suggests that social interaction mechanisms may be crucial determinants of behavior. It has been asserted that an increase in the prevalence of a given behavior at the peer level may lead to an increased probability of such behavior at the individual level (Manski, 1993; Becker, 1996; Becker and Murphy, 2000; Glaeser et al., 1996). Assuming that society consists mainly of males in Japan, there may be a social interaction mechanism that enhances the prevalence of smoking since the majority of people in the society are smokers. Indeed, it is widely acknowledged that females have a relatively low social position in Japan. Under such circumstances, it is generally believed to be merely a matter of etiquette in Japan to ask another person sitting beside one for permission to smoke

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(Yorozu and Zhou, 2002).

However, in recent years, the social position of females has improved and females have become influential in the modern society of Japan. This change reflects the Equal Employment Opportunities Law for Men and Women, which was enacted in 1985 in order to improve the employment opportunities of females. In the process of their rise in social position, females tend to increase their influence on modern social behaviors such as smoking at workplaces and accelerate the social norm of "not smoking for the sake of nonsmokers" through smoking-related interaction[8]. The higher the psychological cost, the stronger the nonsmoking norm becomes. The strength of nonsmoking norms plays a critical role in deterring members of a society from smoking. In short, as the social standing of females improves, the nonsmoking social norm emerges and leads to decreases in cigarette consumption. Informal norm enforcement among interacting male and female members of society tends to be stronger and more effective if the members communicate more cohesively and closely (Putnam, 2000). Accordingly, I raise the following Hypothesis 1 concerning the effect of social norms on smoking.

Hypothesis 1: A tightly knit society can achieve a reduction in smoking through smoking-related interaction.

Dee (1999) presents evidence of the complementarity of drinking and smoking in line with the findings shown in the figures presented in the previous subsection. In addition to their complementarity, both cigarettes and alcohol are considered addictive goods. Hence, the initial consumption of alcohol is positively associated with the subsequent consumption of cigarettes[9]. Accordingly, I advance the following empirical Hypothesis 2.
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Hypothesis 2: Greater consumption of alcohol in the past results in greater current consumption of alcohol, eventually leading to greater current consumption of cigarettes*.*

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[8] Smoking related interactions are supposed as follows: Females tend to ask smokers at work not to smoke. When females are employed equal numbers to males, then smokers are more likely to be informed that their smoke bothers someone at work.
[9] From a medical and health science point of view, if people can become addicted to both types of products, then a cure should be sought for both. Hence, addictiveness should be regarded as a kind of disease rather than simply a habit.

The psychological cost of committing an impolite behavior comes from the watchfulness of the neighborhood or colleagues at a workplace. On the condition that the cost rises, smokers drink but are less likely to smoke at a party where nonsmokers are present, even if smokers would like to jointly consume cigarettes and alcohol. This psychological cost is expected to have an influence not only directly on smoking but also indirectly on its complementarity. As a consequence, I postulate Hypothesis 3 with respect to the effects of the informal social norm upon smoking.

Hypothesis 3: The complementarity between smoking and drinking is attenuated if the cost of committing the annoying conduct of smoking is high.

3 Model
3.1. Data

Except for cigarette price, data used in the regression estimation as independent variables are collected from Asahi Shimbun (various years). The price data are obtained from the Japan Statistical Yearbook (various years) published by the Statistics Bureau of the Ministry of Internal Affairs and Communication. The structure of the data is panel, consisting of 47 prefectures and spanning 13 years (1989 - 2001). The raw data set includes various prefecture-level data on various variables. Table 1 depicts the descriptive statistics for all of the variables used in the regression estimation.

3.2. Econometric Framework

To test the hypotheses raised in the previous section, first I examine whether the social norm reduced the current cigarette consumption directly. Second, I examine how the social norm attenuates the complementarity of alcohol and cigarette consumption.

Following Becker and Murphy (2000), the estimated function takes the following myopic addiction form[10]:

$$CIGA_{it} = \alpha_1 CIGA_{it-1} + \alpha_2 PRIC_{it} + \alpha_3 DENS_{it} + \alpha_4 SN1_{it} + \alpha_5 SN2_{it} + \alpha_6 DSN1_{it} + \alpha_7 DSN2_{it} + \alpha_8 ALCOL_{it} + \alpha_9 INCOM_{it} + \alpha_{10} SERVIC_{it} + \alpha_{11} CAR_{it} + \alpha_{12} POP_{it} + \delta_t$$

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[10] The focus of this paper is not on rational addictive behavior. I thus used the myopic function form. Nonetheless, when the rational addiction model is employed, the results of estimation are unchanged.

$+v_i + u_{it}$,

where $CIGA_{it}$ represents the dependent variable in prefecture i and year t. α's represents the regression parameters. In this estimation, as the main stress does not fall on the rational addictive behavior, I hypothesized that current cigarette consumption depends on past consumption but not future consumption. If the myopic addictive behavior holds, then the expected signs of the lagged $CIGA$ and $PRIC$ become positive and negative, respectively[11].

δ_t, v_i, u_{it} represent the unobservable specific effects in the t th year (a fixed effect time vector), the individual effects of i's prefecture (a fixed effects prefecture vector) and an error term, respectively. δ_t represents the year specific effects and v_i holds the time invariant feature, while u is an error term. The structure of the data set used in this study is panel, and the independent variables include a lagged dependent variable. To address potential endogenous problems with the lagged independent variable, I carry out dynamic panel estimation developed by Arellano-bond (Arellano and Bond, 1991), because dynamic panel models allow past realizations of the dependent variable to affect its current level. In this model, the set of valid instruments is $CIGA_{i1}$, $CIGA_{i2}$,..., $CIGA_{i,t-2}$. In addition, special attention must be paid to the omitted variable bias stemming from unobservable individual specific effects. This can be also controlled for by means of dynamic panel estimation. Year dummies were also incorporated to subdue δ_t, which represents the conditional and structural changes at the macro level that could affect cigarette consumption.

The problem of simultaneous consumption between alcohol and cigarettes seems to remain, however, resulting in estimation bias. To control for this bias, I conducted fixed effect model estimation, in which past alcohol consumption was used as the instrument. Then, the predicted value of alcohol consumption was used for the estimation of cigarette consumption.

3.3. Proxies for social norms

Nonsmokers would suffer seriously from the smoking of surrounding people if they lived in a densely populated area since the externality of smoking is strong and directly affects others. Nonsmokers have a tendency to request that smokers not smoke or to express their annoyance with the smoking behavior. This is why the expected signs of $DENS$ representing the density of the population measured by the

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[11] Although the price measure is a single nationwide uniform cigarette price in Japan, the deflator is different among prefectures. The cigarette price can be deflated by the consumer price index, and therefore the relative cigarette price varies across prefectures.

population per km^2 are negative.

I now proceed to characterize the social norm that captures the informal social pressure on smokers from nonsmokers[12]. The cost of annoying others depends on the social norms, which are shaped by local interactions (Funk, 2005). As pointed out by Jacobs (1969), in urban areas, face-to-face communication is easier, resulting in economic benefits. This suggests that interpersonal interactions are more frequent in denser areas because the distances among people are shorter, allowing social norms to form. Individuals are more apt to smoke due to the decrease in the expected cost of annoying surrounding people such as community members or workplace colleagues if the community is disorganized and social norms are weak. According to the view of Putnam (2000), social disorganization can be regarded as the engine of impolite behavior. Such disorganization undermines the social norms and marks urban areas where population turnover is high, one's neighbors are anonymous, and local organization is rare. The degree to which one is integrated into one's community depends upon the community's condition. To borrow an argument of Putnam (2000), frequent movers have weaker ties within the community, and so mobile communities seem to have less interactivity among neighbors than more stable communities. To put it differently, the more mobile a community is, the weaker the connectedness within it becomes. Hence, *DSN 1* and *DSN2,* denoting the number of population turnovers within a prefecture and the number of immigrants from other prefectures, respectively, can be considered as proxies for the decay of social norms[13]. Accordingly, these coefficients are predicted to take a positive sign.

The following independent variables are used as proxies of the social norm. In traditional Japanese daily life, public baths were used by community members who, apart from the wealthy, ordinarily lived in houses without a private bath. Through the use of such baths, people could get acquainted with neighbors and generate social networks. In modern Japan, most residences have their own baths, and people are therefore more likely to take a bath at home. However, a new type of public bath

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[12] The proxies of social norms are constructed based on the prefecture-level aggregated data. It should be noted that prefecture may not be adequate as the unit of analysis because social norms are formed through interpersonal interaction in neighborhoods and workplaces. Thus, attention should be paid to the possible limitations of the data. Future studies will need to incorporate micro data to examine the effects of social norms.

[13] In previous studies (e.g., Yamamura, 2008a; 2008b; 2010), the number of population turnovers within a prefecture and the number of immigrants from other prefectures are also used as proxies of social norms in prefectural-level data. These studies provide evidence that these social norm proxies have significant influences on the demands for lawyers, driving mannerisms, and voting behavior.

featuring more deluxe baths and saunas has recently developed, and these are used by all sectors of society, thus providing a place to meet neighbors and form social networks. The community center can be also considered as a place where people interact closely and enhance the cohesiveness among community members. Closely-knit networks formed through interpersonal interactions are thought to ostracize their members if they are considered to be against the informal rules that exist within the network (Hayami, 2001). The higher the cost of suffering from ostracism, the more tightly the network is knitted (Greif, 1993; 1994). The degree of the cost of suffering from ostracism can therefore be considered a measure of the strength of social norms. Therefore, the number of public baths and community centers, represented as *SN1* as *SN2*, respectively, where people can contact neighbors and deter them from annoying the others surrounding them, can thus also serve as a proxy for social norms[14]. Therefore, I expect the signs of *SN1* and *SN2* to be negative.

3.4. Control variables

In addition to social norms, I also focus on the effects of drinking[15] following the argument of Dee (1999) that the consumption of alcohol and cigarettes might constitute an important case as these products are complementary. Thus, the *ALCOL* standing for alcohol consumption is expected to take a positive sign[16].

The cost of smoking is not only psychological but also economic. In the workplace, if ones customers, business partners, or counterparts dislike smoking, then a smoker cannot build good relationships with them, and as a result, team performance in the workplace is lowered. In particular, the cost of smoking appears to be high in the service sector, as employees tend to work within a locked room and can suffer more health damage from smoking. Following the enactment of a restrictive smoking policy (Gottlieb et al., 1990; William et al., 1999), informal rules of preventing smoking should also form naturally and necessarily become effective. Hence, *SERVI*, denoting the number of people employed in the service sector, would take a negative

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[14] Yamamura (2009) considered the number of public baths and the number of community centers as proxies of social norms by using prefectural level data, and found that these variables were negatively associated with the number of crimes committed.

[15] The case Dee (1999) presents is of teenage smoking and drinking. I conjecture that this relationship holds in not only teens but also in other generations.

[16] It should be noted that the price of alcohol must be used as the explanatory variable in order to more precisely examine the complementarity.　However, I found difficulty in measuring the price of alcohol since there are a number of kinds of alcohol, such as beer, whiskey and wine.

sign. Similarly, because the space inside vehicles is closed, people riding inside vehicles should be more sensitive to smoking and the likelihood of more serious damage to their health from its effects. The sign of *CAR*, which represents the number of vehicles, is expected to be negative.

3.5. Interaction terms with alcohol

In the subsequent estimation, I incorporate the additional cross-products of $ALCOL_{it}$ and some dependent variables as follows: $DENS_{it}*ALCOL_{it}$, $SN1_{it}*ALCOL_{it}$, $SN2_{it}*ALCOL_{it}$, $DSN1_{it}*ALCOL_{it}$, and $DSN2_{it}*ALCOL_{it}$. As stated previously in Hypotheis 3, the complementarity between smoking and drinking becomes weaker when the cohesiveness of a tightly knit community leads to raising the psychological cost of smoking. If this holds, then the expected signs of $DENS_{it}*ALCOL_{it}$, $SN1_{it}*ALCOL_{it}$, and $SN2_{it}*ALCOL_{it}$ become negative. On the other hand, $DSN1_{it}*ALCOL_{it}$ and $DSN1_{it}*ALCOL_{it}$ are expected to take a positive sign.

As explained in subsection 3.2, to control for the problem of simultaneous consumption of alcohol and cigarettes, I use past alcohol consumption as the instrument and then obtain the predicted value. I construct the cross-products of the predicted value of *ALCOL* and the other variables described above. I then perform the estimation using these cross-products.

4. Results
4.1. Basic results

Tables 2 presents the results of the dynamic panel estimations. Results that do not control for the endogenous bias are shown in columns (1)-(3). Results that control for the endogenous bias are shown in columns (4)-(6). Furthermore, estimations were conducted using not only the entire sample shown in (1) and (4), but also the high alcohol consumption prefectures shown in columns (2) and (5) and the low alcohol consumption prefectures shown in (3) and (6). Information derived from the estimations of splitting samples can be of great use for comparing the differences of social norm effects on smoking behavior between the two groups. Looking at the second row from the bottom of Tables 2 and 3 reveals that there is no second-order serial correlation for disturbances of the first-differenced equation for any of the dynamic panel (GMM) estimations. Therefore, Arellano-Bond type GMM estimators are consistent.

From the results of columns (1) and (4), it can be seen that *CIGA* and *PRIC* take positive and negative signs, respectively, which is in line with the myopic

addiction model. Turning to the key variables of this research, most of the proxies for the social norm or the decay of the social norm such as *DENS, SN1, SN2, DSN1,* and *DSN2*, take the predicted signs. In particular, *DSN1,* and *DSN2* are statistically significant, which is consistent with Hypothesis 1. *ALCOHOL, SERVI*, and *CAR* also take the expected signs and are statistically significant. *INCOM* takes a negative sign, implying that cigarettes are inferior goods. This finding is contrary to that of the existing literature (Haden, 1990; Yorozu and Zhou, 2002). The reason why cigarettes become inferior goods is likely due to the emergence of substitute goods in the process of the economic development in Japan. These results strongly support my prediction that the social norm plays an important role in the decrease of cigarette consumption.

Next, let us compare the results of the high and low alcohol consumption groups. In columns (2) and (5), whereas the coefficients of *DENS* and *SN2* take negative signs, those of *DSN1* and *DSN2* take positive signs, and they are all statistically significant with the exception of *DENS.* The fact that the coefficient of *ALCOL* takes the expected positive sign implies that the complementarity of drinking and smoking is valid. On the other hand, it is interesting to observe that in columns (3) and (6) most of the proxies for the social norm or the decay of the social norm do not take the predicted signs, and none of them are statistically significant. Furthermore, contrary to the expected result, the coefficient sign of *ALCOL* is negative. Considering Figure 2 and Table 2 together, the social norm effects on smoking depend upon the initial consumption of alcohol, which is positively associated with the initial consumption of cigarettes. The effects of antismoking norms declined as the initial consumption of smoking and drinking fell, presumably because the smaller the externality from smoking, the less aggressive nonsmoker attitudes toward smokers became, which is in line with previously published results finding that the proportion of nonsmokers that suggested to smokers that they quit smoking decreased after the implementation of restrictive smoking policies in the United States. (Gottlieb et al., 1990). Another likely reason for the decrease in the effectiveness of antismoking norms is that when the number of places where people are allowed to smoke decreases, there are fewer opportunities for nonsmokers to express their opinions of annoyance to smokers. In short, these results can be interpreted to mean the following. (1) Social norms have a tremendous effect on smoking when the consumption of alcohol is high, but not when it is low. (2) The degree of current consumption of cigarettes depends upon the initial consumption of alcohol, thus confirming Hypothesis 2.

4.2. The impact of norms on complementarity

Switching now to the interaction terms of $ALCOL_{t-1}$ and the proxy variables for the social norm or its decay, the results are shown in Table 3. Column (1) presents the result when the endogeneity bias of alcohol is not controlled for. Column (2) shows the result when the endogeneity bias of alcohol is controlled for. Because the focus of this study is on the impact of the social norm on the complementarity of smoking and drinking, it can be seen from Table 3 that in all estimations, as expected, the signs of $DENS_{it}*ALCOL_{it}$ are negative while those of $DSN1_{it}*ALCOL_{it}$ and $DSN2_{it}*ALCOL_{it}$ are positive and statistically significant. With respect to $SN2_{it}*ALCOL_{it}$, its coefficients take the predicted negative signs and but are not statistically significant. As shown in Tables 2, $SERVI$ and CAR take significant negative signs, conforming to the expectations. My interpretation of the results drawn from Tables 3 is consistent with the prediction described earlier and supports Hypothesis 3.

Up to this point I have presented the various estimated results of this study. Summing them up, I arrive at the conclusion that the estimation results examined in this section are consistent and reasonably support Hypotheses 1 to 3 raised in the preceding section.

5. Conclusion

The consumption of cigarettes is considered to be influenced by the informal social norm and social interaction. Therefore, the mechanisms related to the social norm and social interaction seem to be more influential among industrialized countries, and especially in Japan since it is a relatively homogeneous society. However, researchers have heretofore not paid attention to this relationship, and therefore little is known about the effect of the social norm on smoking behavior.

The key findings through a dynamic panel model controlling for unobserved fixed effects are as follows:

(1) Influence from others is stronger when people live more closely and cohesively together. Thus, a tightly knit society can help to create a reduction of smoking through smoking-related interaction.

(2) Smoking and drinking have a complementary relationship; greater initial consumption of alcohol results in greater consumption of cigarettes.

(3) Complementarity between smoking and drinking is attenuated if the cost of committing the annoying conduct (i.e., smoking) is high.

Summing up the evidence presented here, overall this empirical study provides evidence that the high psychological cost caused by those surrounding smokers has a direct significant effect upon smoking behavior and, furthermore, that it attenuate the

complementarity between smoking and drinking, thereby reducing cigarette consumption. I found that this research helps to explain one aspect of human nature related to social existence. The influence of the attitude of others on a person's behavior seems apparent. The findings derived from the current investigation using regression analysis can further bridge the complementary relationship between social norms and smoking behavior, and as such they are of value to researchers.

Social norms are thought to be formed through the interpersonal interactions among people in close proximity. This paper used prefecture-level aggregated data, but due to limitations inherent in such data, the effects of social norms could not be investigated as accurately as this inquiry requires. Therefore, for more precise estimation, it is necessary to use micro-level data to better analyze the effects of social norms; we intend to incorporate such date in our future work. Moreover, my chief argument in this paper is in part based on the critical assumption that as the social position of females improved, it more strongly affected smoking behavior. Nevertheless, it is not clear whether this assumption is valid. A future direction for this study will be to examine how the improvement of the social position of females has an influence on smoking behavior and thereby helps reduce the consumption of cigarettes in Japan.

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TABLE 1 Variable definitions, means, and standard deviations.

Variables	Definition	Mean	Standard Deviation
CIGA	Cigarette expenditure [a]	9,370	12,909
PRIC	Cigarette price (Yen)	227.2	13.9
DENS	Population density of (number of population per km^2)	623	1,060
SN1	Number of public baths	547	525
SN2	Number of community centers	377	277
DSN1	Population turnover within prefecture (number of people) [b]	72.1	86.1
DSN2	Number of immigrants from other prefectures [b]	64.0	79.9
INCOM	Regional real income [a]	8,228	9,297
ALCOL	Alcohol consumption [a]	41.9	41.9
SERVI	Number of employments of service sector [b]	834.0	867.3
CAR	Number of cars [b]	142.8	122.2
POP	Total population [b]	2,645	2,387

Notes: [a] In Millions of Yen.

[b] In 1000s.

Values are the simple averages of the yearly values over the period 1988-2001. Data source is *Minryoku* edited by Asahi Shimbun.

TABLE 2   Comparison of regression results for cigarette smoking between high and low alcohol consumption areas.

Variables	Endogeneity of Current Alcohol Consumption Not Controlled			Endogeneity of Current Alcohol Consumption Controlled		
	(1)	(2)	(3)	(4)	(5)	(6)
	All Areas	High Alcohol Consumption Areas	Low Alcohol Consumption Areas	All Areas	High Alcohol Consumption Areas	Low Alcohol Consumption Areas
$CIGA_{-1}$	0.12**	0.15**	0.002	0.11**	0.15**	-0.005
	(2.98)	(2.76)	(0.04)	(2.63)	(2.53)	(-0.08)
PRIC	-30.0	-135.3	74.1	-32.8	-149.5	15.0
	(-0.14)	(-0.38)	(0.98)	(-0.15)	(-0.40)	(0.19)
DENS	-63.3	-62.1	-129.6	-79.9	-80.5	-73.9
	(-1.24)	(-0.90)	(-1.39)	(-1.51)	(-1.09)	(-0.78)
SN1	-1.86	6.08	-2.67	-8.08	-3.64	-1.66
	(-0.25)	(0.63)	(-0.44)	(-1.08)	(-0.37)	(-0.27)
SN2	-7.58	-63.3*	0.24	-7.92	-59.8*	-0.93
	(-0.65)	(-2.16)	(0.09)	(-0.66)	(-1.95)	(-0.36)
DSN1	190.1**	173.9**	-138.2	164.9**	121.6*	-189.1*
	(4.01)	(2.61)	(-1.44)	(3.33)	(1.73)	(-1.93)
DSN2	230.7**	224.9**	-98.7	205.2**	187.0*	-74.1
	(3.85)	(2.91)	(-1.14)	(3.33)	(2.33)	(-0.85)
ALCOL	224.9**	251.2**	-30.9	201.6**	166.6**	63.1
	(6.14)	(4.79)	(-1.32)	(4.06)	(2.39)	(1.56)
INCOM	-2.13**	-1.44*	-1.00	-2.05**	-1.43*	-1.16
	(-3.75)	(-1.93)	(-1.02)	(-3.48)	(-1.82)	(-1.19)
SERVIC	-141.4**	-129.2**	-43.0**	-147.0**	-136.4**	-39.4**
	(-12.9)	(-8.51)	(-3.08)	(-13.1)	(-8.64)	(-2.80)
CAR	-128.5**	-140.6**	-67.8*	-118.0**	-122.2**	-48.0
	(-6.19)	(-4.71)	(-2.27)	(-5.54)	(-3.99)	(-1.60)
POP	96.6**	86.3**	47.1*	106.8**	102.5**	28.6
	(4.67)	(3.06)	(1.68)	(4.88)	(3.35)	(0.99)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Second-order autocorrelation	Z=0.55 p-value=0.58	Z=0.15 p-value=0.88	Z=1.61 p-value=0.10	Z=0.47 p-value=0.63	Z=0.27 p-value=0.78	Z=0.71 p-value=0.47
Sample	564	288	276	564	288	276
Groups	47	47	47	47	47	47

Notes: Numbers in parentheses are z-statistics obtained by robust standard error. * and ** indicate significance at 5 and 1 percent levels respectively (one-sided tests). 'Yes' indicates that year dummies are included.

TABLE 3. Regression results of cigarette smoking considering the interaction between alcohol consumption and social norm proxies.

Variables	(1)	(2)
	Endogeneity of Current Alcohol Consumption Not Controlled	Endogeneity of Current Alcohol Consumption Controlled
$CIGA_{-1}$	0.05	0.04
	(1.31)	(1.08)
PRIC	-42.7	-113.8
	(-0.02)	(0.54)
ALCOL	-37.3	112.4
	(-0.32)	(1.01)
DENS* ALCOL	-0.15**	-0.15**
	(-6.46)	(-5.59)
SN1* ALCOL	0.10*	0.05
	(2.05)	(1.19)
SN2* ALCOL	-0.28	-0.30
	(-1.43)	(-1.62)
DSN1* ALCOL	2.07**	1.77**
	(6.68)	(6.51)
DSN2* ALCOL	0.63*	0.84**
	(2.14)	(2.93)
INCOM	-2.76**	-2.52**
	(-4.99)	(-4.46)
SERVIC	-137.2**	-142.7**
	(-13.3)	(-13.1)
CAR	-126.8**	-139.2**
	(-6.76)	(-6.91)
POP	68.8**	73.4**
	(7.49)	(6.68)
Year dummy	Yes	Yes
Second-order autocorrelation	Z=0.50 p-value=0.61	Z=-0.39 p-value=0.68
Sample	564	564
Groups	47	47

Notes: Numbers in parentheses are z-statistics obtained by robust standard error. * and ** indicate significance at 5 and 1 percent levels respectively (one-sided tests). 'Yes' indicates that year dummies are included.
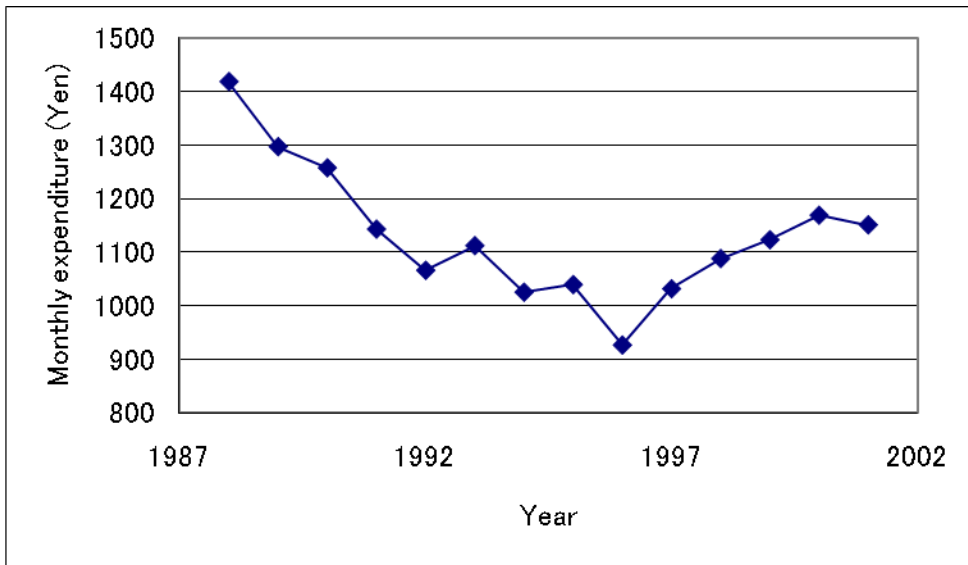
Fig 1. Monthly household expenditures on cigarettes.

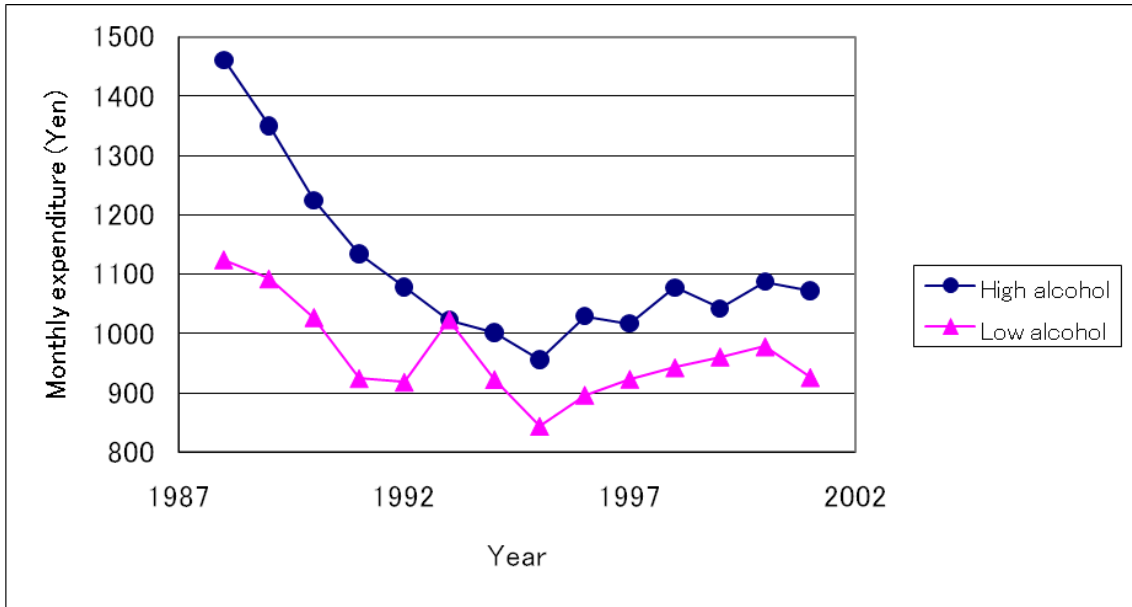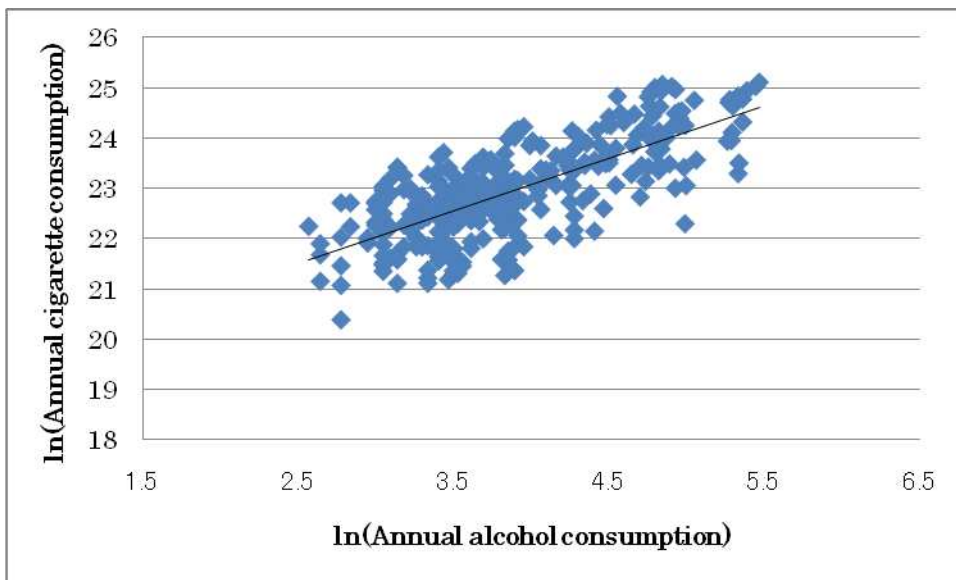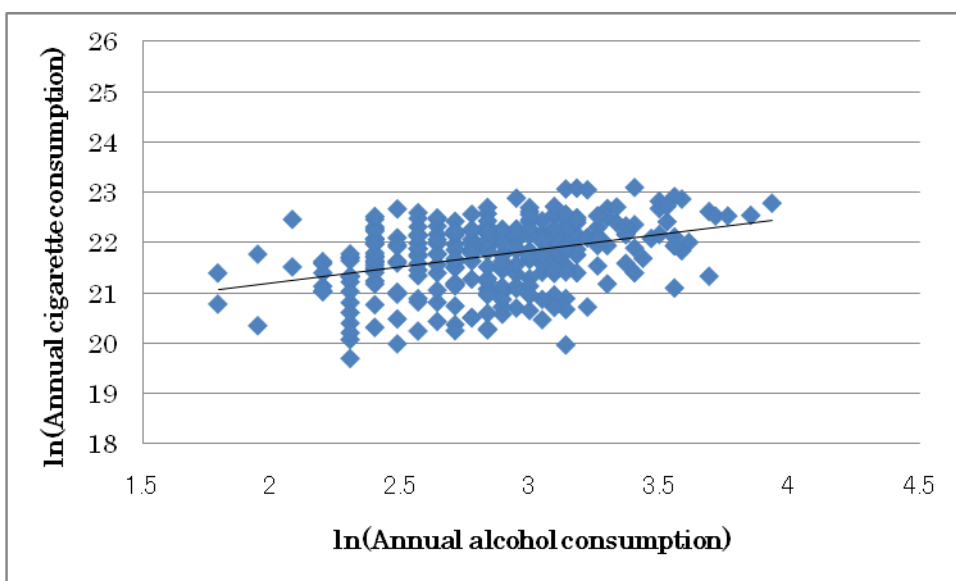*Note:* Data source: *Minryoku,* edited by Asahi Shinbunsha.

Fig 2. Monthly household expenditures on cigarettes for high alcohol consumption and low alcohol consumption areas.

Note: Data source: *Minryoku,* edited by Asahi Shinbunsha.

a) High alcohol consumption region

b) Low alcohol consumption region

Fig 3. Relationship between monthly household cigarette expenditures and alcohol consumption for high alcohol consumption and low alcohol consumption areas.

Note: The log form of annual alcohol and cigarettes consumption (millions of yen) was applied.

Source: Data collected from *Minryoku,* edited by Asahi Shinbunsha.