This paper has been accepted by *Environmental Hazards* Journal

Voluntary associations and hazard preparedness behavior amongst Taiwanese individuals

Juheon Lee

Midwestern State University

Abstract

This study examined how Taiwanese individuals' preparedness behaviors regarding natural hazards are linked to their social connections and to their direct/indirect exposure to previous natural hazards. Using 2013 Taiwan Social Change Survey data, this study investigated how the respondents' membership in voluntary associations, damage experience caused by previous hazards, and perceived risk of potential hazards affect their adoption of hazard preparedness behaviors. The study distinguished three types of associations—civic, reward-based, and social/recreational—and three types of damage from natural hazards—property loss, psychological trauma, and injury—to determine whether they have different effects on the adoption of hazard preparedness behaviors. The results of this study indicate that the members of voluntary associations were more prepared for natural hazards than non-members; the members of civic and reward-based associations tended to take significantly more preparedness measures than non-members, whereas the members of social/recreational associations did not. In particular, the members of reward-based associations were likely to initiate their first preparation measures. Meanwhile, both damage experience and risk perception showed positive effects on the adoption of preparedness behaviors, but these effects were stronger for typhoons than for earthquakes.

Keywords: natural hazards, social capital, hazard preparedness, Taiwan.

This paper has been accepted by *Environmental Hazards* Journal

1 Introduction

Hazard preparedness is important for the development of resilience in individuals, communities, and regions (Gerber and Robinson 2009; Najafi et al. 2017; Paton 2003). In particular, individuals' preparedness behaviors regarding natural hazards, such as stocking essential supplies, preparing disaster kits, and purchasing insurance, significantly reduce the risk of damage and increase their ability to cope with adverse situations during a disaster (Allen 2006; Hasegawa et al. 2018). Despite the importance of hazard preparedness, increasing it among individuals is very difficult. For example, considerable government expenditure on public hazard education has not always improved citizens' preparedness behaviors (see Lindell and Whitney 2000; Paton et al. 2001), particularly if there are not sufficient trust in government and the active roles of local institutions (Adiyoso and Kanegae 2012; Basolo et al. 2009). Moreover, people with experience and knowledge of hazards often resist making necessary behavioral changes owing to their confidence and optimism (Spittal et al. 2005). Even the residents in disaster-stricken or high-risk areas often heavily rely on government institutions or expect other institutions to take responsibility for their own problems (see Arceneaux and Stein 2006; Sadiq et al. 2016). Therefore, disaster scholars have searched for factors associated with individuals' hazard preparedness behaviors, such as socioeconomic elements, exposure to previous hazards, and their risk perception and cognitive processes, to determine how to trigger behavioral change (e.g., Lindell and Perry 2000; Paton 2003; Reininger et al. 2013).

Other studies have gone beyond the individual level to determine residents' connections and networking with other community members that affect their preparedness for natural hazards (e.g., Aldrich 2019; Nakagawa and Shaw 2004; Lee 2020). They have shown that social capital provides community members vital resources in times of need and therefore is an effective

predictor of disaster response and recovery. However, only few studies have empirically tested the extent to which, or which types of, social connections affect an individual's preparedness behaviors, particularly in the context of East Asia. This study focused on individuals' participation in voluntary associations, which is an important behavioral measurement of social capital (see Aldrich and Meyer 2015; Delhey and Newton 2003; Putnam 2001). Because more recent studies have found that different types of voluntary associations have different social impacts (e.g., Lee and Fraser 2019; Moore and Recker 2017), this study identified the three different types of voluntary associations and tested their different impacts on preparedness behaviors among Taiwanese individuals.

Using data from a survey conducted in 2013 across cities and counties in Taiwan, this study first investigated how people's involvement in voluntary associations, their experience of damage from previous natural hazards (i.e., typhoons and earthquakes), and their perceived risk of such hazards affect their adoption of preparedness behaviors. Furthermore, the study examined the role of three types of voluntary associations—civic, reward-based, and social/recreational—as well as three types of damage experience—property loss, psychological trauma, and injury—to show how the various association types and damage types have different effects on individuals' adoption of hazard preparedness behaviors.

This study contributes to the literature on disaster resilience and social capital using empirical evidence for all the cities and counties in Taiwan that are exposed to frequent natural hazards threatening large numbers of people. Table 1 shows the major disasters that occurred in Taiwan over the three decades preceding the 2013 survey (1983–2012) based on data provided by the Emergency Events Database (EM-DAT). According to the data, storms and earthquakes are the two major types of hazards that have affected Taiwan. Compared with earthquakes,

storms occur more frequently and affect a larger number of people; however, earthquakes are more deadly and cause greater economic damage. Because the 2013 survey asked Taiwanese individuals about their experiences of these two major types of natural hazards, this study focused on these natural hazards, and the findings were expected to reveal whether different hazards have different social impacts. Moreover, the study examined two dimensions of hazard preparedness: (1) adoption versus non-adoption of hazard preparedness behaviors and (2) the number of adopted preparedness behaviors. The former indicates which factors encourage people to adopt (or begin to adopt) preparedness measures, whereas the latter indicates which factors encourage people to increase the number of adopted preparedness behaviors. Finally, this study employed some measurements that are commonly used in national and international social surveys; therefore, the methods of this study are easily replicable and applicable in areas outside Taiwan, enabling the comparison or generalization of the results for future studies.

[Table 1 about here]

2 Hazard Preparedness, Social Capital, and Voluntary Associations

Hazard preparedness behaviors include various measures that individuals and households adopt to mitigate the risks of possible natural hazards, such as storing food and water, purchasing insurance, reinforcing house structure, relocating vehicles and house items, and participating in trainings or rehearsals (see Najafi et al. 2017; Kohn et al. 2012). Owing to the importance and effectiveness of such measures during and after a disaster, scholars have examined the factors determining the adoption of preparedness behaviors among individuals. One group of studies has focused on demographic and socioeconomic indicators, such as income, gender, education, age, and race (see King 2001; Murphy et al. 2009). For example, Fothergill and Peek (2004) found

that the effects of disaster vary by social class—poorer residents are more vulnerable than the wealthier ones owing to their lack of access to resources and information. Regarding education, Muttarak and Pothisiri (2013) showed that more years of education tend to increase the adoption of preparedness actions among individuals, in households, and at the village level, controlling for income. Women and men differ in their preparedness activities, but women are generally more likely to prepare themselves and their households for possible disasters (Enarson and Morrow 1998). Older people tend to prepare for disaster better than younger people, although the elderly need special assistance (Heller et al. 2005; Mishra and Suar 2005). Racial minority show a lower level of hazard preparedness, especially in the United States (Murphy et al. 2009). Home ownership and duration of residence are also positively related to hazard preparedness (Dooley 1992; Reininger et al. 2013). These studies have shown that, in general, those who are richer, more highly educated, and older in age as well as female and racial majorities are more likely to be prepared for hazards than those who are not. However, the implications of these studies have been limited because individuals' demographic factors are difficult to change; therefore, we cannot expect behavioral changes based on these factors.

Another group of studies has examined individuals' direct/indirect exposure to previous hazards, assuming that people's previous experience of a hazard event could raise their perception of risk, leading them to adopting more protective measures (see Terpstra 2011; Lee 2021; Lindell and Perry 2000; Tekeli-Yesil et al. 2010). For example, Sattler et al. (2000) suggested that individuals who have experienced a disaster tend to more easily acknowledge a threat or risk of disaster than individuals who did not have such experience, which leads them to take various preparedness actions for potential natural hazards. However, people's self-assessment of disaster risk has not always been translated to their actual preparedness behaviors.

Often, their knowledge and confidence can make them resistant to adopting new preparedness actions (Halpern-Felsher 2001; Spittal et al. 2005). Due to this inconsistency between people's risk assessment and their preparedness behaviors, scholars have investigated disaster victims' negative emotions evoked from their past hazard experiences that lead them to take preparedness actions (e.g., Siegrist and Gutscher 2008; Slovic et al. 2007). For example, Terpstra (2011) discussed people's cognitive and affective mechanisms regarding natural hazards—such as people's perceived consequences of a hazard or their feelings about their community facing a disaster—that shape their intention to prepare, leading to their preparedness behaviors. Paton (2003) pointed out that people's negative emotions from earlier disasters and their intentions to adopt preparedness behaviors can be significantly disturbed by their lack of resources for the implementation of these behaviors. This situation makes people lose a sense of belonging in their communities, lower their trust in the source of information, and shift the responsibility for their safety to others (Paton 2003).

A third group of studies has gone beyond individuals' cognitive and affective mechanisms and focused on their social connections and networks as a main source of resilience and preparedness (e.g., Aldrich 2019; Norris et al. 2008; Peacock et al. 2010). According to these studies, social connections and trust generate social capital, which is a critical resource that makes people more resilient in the face of an emergency. In particular, pre-disaster social capital plays a critical role in post-disaster recovery: when a hazard occurs, members of existing social organizations assist one another to more effectively recover from its effects, and social capital encourages people to take more preparedness actions (Reininger et al. 2013; Allen 2006; Hausman 2007). Some social capital scholars have particularly distinguished the types of social capital—bonding, bridging, and linking social capital—based on the types of resources an

individual can mobilize in times of need (see Aldrich and Meyer 2015; Szreter and Woolcock 2004). For example, family members, friends, and neighbors, as sources of bonding social capital, assist the vulnerable to evacuate during an emergency and handle stress and anxiety; community leaders reach out to other communities for resources, thus utilizing their bridging social capital; and networks of powerful politicians and non-government organizations, as sources of linking social capital, facilitate the recovery process (Aldrich 2019).

This study builds on the aforementioned three bodies of literature by examining how individuals' demographic characteristics, their perceptions of natural hazards, and their social capital affect their hazard preparedness behaviors; however, the primary goal of this study is to contribute to the third group of studies based on social capital. Social capital can be measured by various indicators, among which this study focuses on participation in voluntary associations, which represents the behavioral aspect of social capital (see Aldrich and Meyer 2012; Delhey and Newton 2003; Liu and Stolle 2017; Putnam 2001). In particular, this study attempts to advance previous discussions on different types of voluntary associations serving different functions. Knack and Keefer (1997) and Rupasingha (2006) identified the characteristics of different types of voluntary associations by classifying them into Putnam-type associations (i.e., associations based on civic interaction that promote trust and cooperation, such as social service groups and religious organizations) and Olson-type associations (i.e., "rent-seeking" associations, in which forming and joining are based on financial or other material incentives, such as political associations, professional associations, and unions). Moore and Recker (2017) advanced these studies by distinguishing recreational groups and sports clubs (without clear civic causes or public goals) from other Putnam-type associations. In other words, recreational associations tend to be informal and private, whereas Putnam-type associations are relatively

formal, with public meetings and civic goals. They found that Putnam-type associations without recreational associations are more significant indicators of social capital than those with recreational associations. Finally, focusing on the disaster context in Japan, Lee and Fraser (2019) found that people's disaster experience and risk perception are more closely associated with both civic (Putnam-type) and reward-based (Olson-type) associations than with social/recreational associations.

Based on previous studies, this study distinguished three types of associations—civic, reward-based, and social/recreational—and hypothesized that civic and reward-based types of associations are more closely related to the adoption of preparedness behaviors than social/recreational types of associations.

3 Data, Variables, and Methods

The data were collected from the Taiwan Social Change Survey (TSCS), a pan-Taiwan survey annually conducted by the Institute of Sociology, Academia Sinica, in Taiwan. This study used data from the 2013 survey that was designed to ascertain the experiences and perceptions of various societal risks among Taiwanese citizens. Although this 2013 survey was conducted almost a decade ago and was not designed for the current study, it is one of a few, if not the only, reliable pan-Taiwan survey that provides abundant information about the behaviors and perceptions of Taiwanese individuals in the context of natural hazards. A total of 2,005 respondents from 14 Taiwanese cities and counties participated in this survey between September and November 2013. The respondents were chosen based on three-stage stratified probability, proportional to size sampling, stratified by township, village, and individual person

(response rate: 52%). The dataset was accessible through the public website of the Institute of Sociology, Academia Sinica.

The output variable was individuals' self-reported adoption of preparedness behaviors (see Hausman et al. 2007; Reininger 2013). The TSCS asked respondents if they had recently implemented any of the following natural hazard prevention measures: (1) relocated vehicles or household items to a safe place, (2) obtained insurance protection against natural disasters, (3) secured cabinets and shelves or domestic appliances at home, (4) prepared disaster kits, (5) planned or become aware of emergency evacuation procedures, (6) attended emergency evacuation rehearsals, or (7) none of above. Two dependent variables were created from the responses to this question: one variable coded respondents' adoption of any of the suggested behaviors (Yes = 1/No = 0); the other variable coded the number of adopted behaviors (0–6). The purpose of this was to identify the factors that are more closely associated with adopting (or beginning to adopt) any preparedness behaviors and the factors that are more related to increasing the number of adopted preparedness behaviors.

Respondents' participation in voluntary associations was used as an independent variable. The TSCS asked the respondents if they were participating in the following suggested seven types of voluntary associations: political association, residential association, social service club (including nonprofit organizations, citizens' movements, and volunteer activities groups), religious group, recreational association, professional association, or other organizations or groups. Table 2 illustrates the frequency and percentage of participation in voluntary associations—39.8% of the respondents were members of at least one of the seven suggested types of associations. Furthermore, religious, professional, and recreational associations were the most popular types of associations in Taiwan. The associations were broadly categorized into

three types based on previous studies (Moore and Recker 2017; Lee and Fraser 2019): civic associations (groups with civic goals and public meetings), rent-seeking associations (groups based on financial or other material incentives), and social/recreational associations (groups without clear civic causes or public goals).

[Table 2 about here]

People's past experience of natural hazards was included as another key explanatory variable. The TSCS asked respondents if they had experienced damage from natural hazards in the past 10 years, including bodily injury, property loss, or psychological trauma from floods and earthquakes. Table 3 shows that 25% of the respondents had experienced damage from floods and 15% had experienced damage from earthquakes in the past. Most damage from floods was property loss (23%), followed by psychological trauma (6%), and injury (1%). Damage from earthquakes comprised property loss (13%), psychological trauma (5%), and injury (1%).

Peoples' perceptions of natural hazards were also included. The TSCS asked respondents about their perceived risk of hazards: "How likely do you think natural hazards, such as typhoons and earthquakes, are to occur in your neighborhoods?" Answers were provided on a five-point scale ranging from 1 (*very unlikely*) to 5 (*very likely*).

Other demographic factors were also included: age, education level, gender, social status, urbanization, and duration of residence (see Murphy et al. 2009; Lindell and Perry 2000; Reininger et al. 2013). Table 3 summarizes the list of variables with their labels, means, and standard deviations.

The output variables were binary (Yes = 1/No = 0) or count (0–6) variables. Logistic regression models were utilized for the binary variables, and negative binomial regression models were structured for the count variables with overdispersion (c-hat > 1). In all models,

dummy variables for the 14 county-level regions of Taiwan were included for fixed effects. Moreover, the standard errors were clustered by regions in Taiwan to net out regional variations and manage heteroscedasticity. The variance inflation factor for all models was below 2.0, which is generally accepted in social science research.

[Table 3 about here]

4 Results

Table 4 illustrates the effects of participation in voluntary associations and the experiences and perceptions of natural hazards on the adoption of preparedness behaviors. Two sets of regression models were hierarchically structured to determine whether adding independent variables contributed to explaining the overall variance of the dependent variables. Coefficients were shown as marginal effects at the means, which indicated the change in the predicted probability of the dependent variable for a one-unit change in an explanatory variable. Models 1–4 were logistic regression models showing the factors associated with people's adoption of any preparedness behaviors. The pseudo r^2 value for each model showed that independent variables contributed to the explanatory power of the models. As Model 4 shows, the respondents' participation in voluntary associations was positively associated with their preparedness behaviors: having membership in a voluntary association increased the probability of their adoption of preparedness behaviors by 7.1% (b = 0.071). This is in line with previous studies that report a positive relationship between social capital and hazard preparedness behaviors (e.g., Reininger et al. 2013; Allen 2006). Model 4 also shows that the respondents with damage experience from typhoons had 6.7% higher probability of adopting preparedness behaviors; however, damage experience from earthquakes did not have a significant effect on the adoption of preparedness behaviors. Perceived risks increased the probability of people adopting

any preparedness behaviors: perceived risks of typhoons and earthquakes increased the probability by 3.1% and 2.2%, respectively.

Models 5–8 were negative binomial models and were structured to determine how the explanatory factors were associated with increased numbers of adopted preparedness behaviors. The pseudo r^2 values showed that the five independent variables contributed to explaining the variance of the dependent variable. As Model 8 shows, the respondents' participation in voluntary associations increased the probability of their adoption of a larger number of preparedness behaviors. Model 8 also shows that the respondents' damage experience from typhoons increased the probability of their adoption of a larger number of preparedness behaviors; however, the respondents' damage experience from earthquakes showed a relatively weak effect on the adoption of preparedness behaviors. Perceived risks of typhoons and earthquakes also increased the respondents' probability of adopting a greater number of preparedness behaviors.

Among the demographic factors, education consistently showed a positive effect on adopting preparedness behaviors across models: in Model 4, a one-year increase in education meant a 0.6% higher probability of adopting any preparedness behaviors; in Model 8, a one-year increase in education meant a 2.3% higher probability of adopting a larger number of preparedness behaviors; however, age, gender, and social status did not show significant effects. Urbanization decreased the probability of adopting a larger number of preparedness behaviors. The duration of residence decreased the probability of adopting any or a larger number of preparedness behaviors. Finally, the city/county dummies generally showed statistically significant effects on both adopting any preparedness behaviors and the number of adopted preparedness behaviors.

[Table 4 about here]

Next, additional regression models were structured to test the effects of the types of voluntary associations and types of damage experience. Associations were divided into three types: civic, reward-based, and social/recreational associations. Damage experience from natural hazards was also divided into three types: property loss, psychological trauma, and injury. The three types of damage experience were closely related to one another; therefore, three separate models were structured for each type of damage experience. Again, two sets of regressions were structured for both adopting any preparedness behaviors (Models 1–3) and the number of adopted preparedness behaviors (Models 4–6). Table 5 presents the results.

The results for civic associations indicated that the respondents' participation in civic associations did not have a significant effect on adopting any preparedness behaviors but had a significant positive effect on the number of adopted preparedness behaviors: in Model 4, membership in a civic association increased the probability of respondents adopting a larger number of preparedness behaviors by 22.8%. The results for reward-based associations indicated that membership in a reward-based association increased the probability of both adopting any preparedness behaviors and the number of adopted preparedness behaviors. Comparison of the results of the two types of associations indicates that the members of both civic and reward-based associations took more preparedness measures than non-members; however, members of reward-based associations were also likely to begin adopting preparedness behaviors. Contrary to these two types of voluntary associations, membership in social/recreational associations did not show a significant effect on preparedness behaviors, which is consistent with previous studies showing that organizations without clear civic causes or goals, such as recreational organizations

and sports clubs, have different characteristics from religious and civic organizations (Moore and Recker 2017; Lee and Fraser 2019).

Damage experience from natural hazards showed slightly different results from the previous results shown in Table 4, in which the types of damage experience are distinguished. For typhoons, all types of damage experience showed significant effects on both adopting any preparedness behaviors and the number of adopted preparedness behaviors: property loss, psychological trauma, and injury all increased the probability of adopting any preparedness behaviors and the probability of a larger number of adopted preparedness behaviors. Compared with the damage experience from typhoons, damage experience from earthquakes did not always have strong effects with statistical significance on the adoption of preparedness behaviors. Property loss showed strong effects on the adoption of any preparedness behaviors and the number of adopted preparedness behaviors. Injury weakly affected the number of adopted preparedness behaviors; however, psychological trauma did not show any statistically significant effects.

The perceived risks of natural hazards did not always show strong effects on the adoption of preparedness behaviors, which is rather different from the results in Table 4. Risk perception for typhoons consistently showed strong positive effects: for example, in Models 1 and 4, perceived risks of typhoons increased the probability of adopting any preparedness behaviors and the number of adopted preparedness behaviors. Risk perception for earthquakes was more strongly associated with the adoption of any preparedness behaviors than with the number of adopted preparedness behaviors. The results for the demographic factors did not significantly differ from the previous results in Table 4.

[Table 5 about here]

This paper has been accepted by *Environmental Hazards* Journal

5 Discussion

This study aimed to discover whether, or how, involvement in voluntary associations promotes hazard preparedness. Because membership in voluntary associations was an important measurement of social capital in many previous studies, the findings of this study are expected to contribute to explaining the role of social capital in improving the adoption of hazard preparedness behaviors, which has been a difficult task for policy makers. The results show that Taiwanese individuals' participation in voluntary associations was positively associated with their adoption of hazard preparedness behaviors. This finding is consistent with that of previous studies concerning the relationship between social capital and hazard preparedness. A more important contribution of this study to the literature is the determination of the different effects of three types of voluntary associations on the two dimensions of hazard preparedness behaviors. This study found that the members of civic associations took more preparedness actions than non-members, whereas the members of social/recreational associations did not. This finding is consistent with that of previous studies: civic associations with clear civic causes or goals are different from social/recreational associations based on socializing and sports activities, and thus membership in civic associations is a better indicator of social capital than membership in social/recreational associations (Moore and Recker 2017). Similarly, this study found that membership in civic associations was more relevant to individuals' adoption of preparedness behaviors for natural hazards than membership in social/recreational associations.

The results of this study show that the members of reward-based associations were more likely to not only adopt a larger number of preparedness behaviors but also begin preparation. As Lee and Fraser (2019) indicated, this finding has some important implications concerning linking social capital. As discussed in the previous section, whereas bonding and bridging social capital

represent a person's horizontal relationships with people at different social proximities (e.g., family, friends, coworkers, people from different backgrounds, strangers, or fellow citizens), linking social capital focuses on a person's vertical relationships with those who have power or authority. This means that although membership in reward-based associations may seem less altruistic than membership in civic associations, it may connect people with officials or professionals who can channel various resources for the members in ways that best suit their needs. In addition, the finding that members of reward-based associations were more likely to begin adopting preparedness measures than non-members makes the role of linking social capital more prominent. Additional qualitative studies should be conducted regarding whether participation in reward-based associations can be equated with linking social capital and how people's connection to the ones with capability and authority can encourage them to adopt new preparedness measures.

Another key contribution of this study is the degree to which individuals' experience and perceptions of natural hazards are associated with their adoption of preparedness behaviors. This study distinguished the different types of natural hazards and damage experience resulting from natural hazards. It was evident that the effects of floods were different from the effects of earthquakes in Taiwan. Individuals' damage experience from floods significantly increased their hazard preparedness, whereas not all types of damage from earthquakes showed a statistically significant effect on their preparedness behaviors, which requires further research. Damage experience from earthquakes may increase people's preparedness behaviors through their risk perception. In other words, future studies can examine the potential relationship between independent variables.

In addition, people's risk perception of typhoons had stronger effects on their preparedness behaviors than their risk perception of earthquakes. Earthquakes are relatively infrequent and more difficult to predict than floods; therefore, it is possible that Taiwanese people are generally familiar with situations caused by flooding but do not need to, or do not know how to, deal with situations caused by earthquakes, despite their destructive impact on lives and property. These results may also be attributable to the relatively small number of victims of earthquakes represented in the survey (see Table 3). Compared with flood victims, a greater portion of earthquake victims lose their lives; therefore, it is understandable that earthquake victims were underrepresented among the survey respondents. Nevertheless, note that the very small number of people who suffered injury and/or psychological trauma from floods showed significantly high probabilities of adopting preparedness behaviors, indicating that victims of earthquakes are relatively less prepared than those of floods. Further studies should be conducted to determine whether this difference is attributable to the different types of hazards or to other factors, such as frequency, predictability, or damage range.

The results of Taiwanese demographic factors were not as expected, with the exception of education, which encourages further studies. Education level showed a significant positive effect on hazard preparedness, which is consistent with previous studies; however, in this study, age, gender, and social status did not show a statistically significant effect, which invites further studies. Urbanization and duration of residence showed a (weak) negative effect on the adoption of preparedness behaviors, which is also in contrast with the results of previous studies (Dooley et al. 1992). This inconsistency may reflect Taiwan's sociocultural characteristics or may simply be attributable to the different characteristics of the survey. In particular, the duration of residence was included based on the assumption that people who live in a community for a long

time tend to have long-term relationships with neighbors, thereby increasing the possibility of them participating in voluntary associations and adopting preparedness behaviors; however, duration of residence did not strongly increase social capital—and even reduced hazard preparedness—in Taiwanese society. This unexpected result, as some studies on another East Asian society have pointed out (e.g., Lee and Yi 2018), may be due to the rapid development and urbanization that have encouraged people to relocate to newly developed areas, leaving older areas underdeveloped and impoverished. Further studies are required regarding this aspect, and demographic factors require more in-depth research.

6 Conclusion

This study sought to draw attention to individuals' hazard preparedness behaviors, as these are affected by individuals' social connections and their experiences and perceptions of natural hazards. This study effectively showed that some types of social connections are more closely associated with individuals' hazard preparedness behaviors than other types of social connections, which sheds light on social capital and disaster studies; however, this study has many limitations. The data were collected from a single year survey; therefore, the relationship between independent and dependent variables indicated statistical associations rather than causality. Moreover, the variables in this study were chosen from a general social survey that was not specifically designed for this study; therefore, the key variables could be associated with other survey questions not included in the regression models of this study, causing omitted variable bias. Furthermore, the findings of this study reflect the cultural characteristics of Taiwan and therefore may not be generalizable to other social contexts. For example, according to an international social survey, the rate of participation in voluntary associations in Taiwan is lower

than that in neighboring East Asian countries, such as Japan and South Korea (see Lee 2020). Additional comparative studies may help to deepen the understanding of the different natural events that affect social behavior.

Reference

Adiyoso, W., & Kanegae, H. (2012). The effect of different disaster education programs on tsunami preparedness among schoolchildren in Aceh, Indonesia. *Disaster Mitigation of Cultural Heritage and Historic Cities*, *6*(1), 165-172.

Aldrich, D. P. (2019). *Black wave: how networks and governance shaped Japan's 3/11 disasters*. Chicago, IL: University of Chicago Press.

Aldrich, D. P., & Meyer, M. A. (2015). Social capital and community resilience. *American behavioral scientist*, *59*(2), 254-269.

Allen, K. M. (2006). Community-based disaster preparedness and climate adaptation: local capacity-building in the Philippines. *Disasters*, *30*(1), 81-101.

Arceneaux, K., & Stein, R. M. (2006). Who is held responsible when disaster strikes? The attribution of responsibility for a natural disaster in an urban election. *Journal of Urban Affairs*, *28*(1), 43-53.

Basolo, V., Steinberg, L. J., Burby, R. J., Levine, J., Cruz, A. M., & Huang, C. (2009). The effects of confidence in government and information on perceived and actual preparedness for disasters. *Environment and behavior*, *41*(3), 338-364.

Delhey, J., & Newton, K. (2003). Who trusts? The origins of social trust in seven societies. *European Societies*, *5*(2), 93-137.

Dooley, D., Catalano, R., Mishra, S., & Serxner, S. (1992). Earthquake Preparedness: Predictors in a Community Survey 1. *Journal of Applied Social Psychology*, *22*(6), 451-470.

EM-DAT: The OFDA/CRED International Disaster Database, www.em-dat.net, Université Catholique de Louvain, Brussels, Belgium.

Enarson, E., & Morrow, B. H. (1998). The gendered terrain of disaster. *Westport, CT*.

Fothergill, A., & Peek, L. A. (2004). Poverty and disasters in the United States: A review of recent sociological findings. *Natural hazards*, *32*(1), 89-110.

Gerber, B. J., & Robinson, S. E. (2009). Local government performance and the challenges of regional preparedness for disasters. *Public Performance & Management Review*, *32*(3), 345-371.

Halpern-Felsher, B. L., Millstein, S. G., Ellen, J. M., Adler, N. E., Tschann, J. M., & Biehl, M. (2001). The role of behavioral experience in judging risks. *Health Psychology*, *20*(2), 120.

Hasegawa, M., Murakami, M., Takebayashi, Y., Suzuki, S., & Ohto, H. (2018). Social Capital Enhanced Disaster Preparedness and Health Consultations after the 2011 Great East Japan Earthquake and Nuclear Power Station Accident. *International journal of environmental research and public health*, *15*(3), 516.

Hausman, A. J., Hanlon, A., & Seals, B. (2007). Social capital as a mediating factor in emergency preparedness and concerns about terrorism. *Journal of Community Psychology*, *35*(8), 1073-1083.

Heller, K., Alexander, D. B., Gatz, M., Knight, B. G., & Rose, T. (2005). Social and Personal Factors as Predictors of Earthquake Preparation: The Role of Support Provision, Network

Discussion, Negative Affect, Age, and Education 1. *Journal of Applied Social Psychology*, *35*(2), 399-422.

King, D. (2001). Uses and limitations of socioeconomic indicators of community vulnerability to natural hazards: data and disasters in Northern Australia. *Natural Hazards*, *24*(2), 147-156.

Knack, S., & Keefer, P. (1997). Does social capital have an economic payoff? A cross-country investigation. Quarterly Journal of Economics, 112, 1251–1288.

Kohn, S., Eaton, J. L., Feroz, S., Bainbridge, A. A., Hoolachan, J., & Barnett, D. J. (2012). Personal disaster preparedness: an integrative review of the literature. *Disaster medicine and public health preparedness*, *6*(3), 217-231.

Lee, J., & Fraser, T. (2019). How do natural hazards affect participation in voluntary association? The social impacts of disasters in Japanese society. International Journal of Disaster Risk Reduction, 34, 108–115.

Lee, J., & Yi, D. (2018). Still a new democracy? Individual-level effects of social trust on political trust in South Korea. *Asian Journal of Political Science*, *26*(2), 201-220.

Lee, J. (2020). Bonding and bridging social capital and their associations with self-evaluated community resilience: A comparative study of East Asia. *Journal of Community & Applied Social Psychology*, *30*(1), 31-44.

Lee, J. (2021). The social impact of natural hazards: a multi-level analysis of disasters and forms of trust in mainland China. *Disasters*, *45*(1), 158-179

Lindell, M. K., & Whitney, D. J. (2000). Correlates of household seismic hazard adjustment adoption. *Risk analysis*, *20*(1), 13-26.

Lindell, M. K., & Perry, R. W. (2000). Household adjustment to earthquake hazard: A review of research. *Environment and behavior*, *32*(4), 461-501.

Liu, C., & Stolle, D. (2017). Social capital, civic culture and political trust. In Zmerli and van der Meer (Eds.) *Handbook on political trust,* Edward Elgar Publishing, 338–352.

Mishra, S., & Suar, D. (2007). Do lessons people learn determine disaster cognition and preparedness? *Psychology and Developing Societies*, *19*(2), 143-159.

Moore, M. D., & Recker, N. L. (2017). Social capital groups and crime in urban counties. *Deviant behavior*, *38*(6), 655-667.

Muttarak, R., & Pothisiri, W. (2013). The role of education on disaster preparedness: case study of 2012 Indian Ocean earthquakes on Thailand's Andaman Coast. *Ecology and Society*, *18*(4).

Murphy, S. T., Cody, M., Frank, L. B., Glik, D., & Ang, A. (2009). Predictors of emergency preparedness and compliance. *Disaster Med Public Health Prep*, *3*(2), 1-10.

Najafi, M., Ardalan, A., Akbarisari, A., Noorbala, A. A., & Elmi, H. (2017). The theory of planned behavior and disaster preparedness. *PLoS currents*, *9*.

Nakagawa, Y., & Shaw, R. (2004). Social capital: A missing link to disaster recovery. *International Journal of Mass Emergencies and Disasters*, *22*(1), 5-34.

Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F., & Pfefferbaum, R. L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American journal of community psychology*, *41*(1-2), 127-150.

Paton, D. (2003). Disaster preparedness: a social-cognitive perspective. *Disaster Prevention and Management: An International Journal*, *12*(3), 210-216.

Paton, D., Millar, M., & Johnston, D. (2001). Community resilience to volcanic hazard consequences. *Natural hazards*, *24*(2), 157-169.

Peacock, W. G., Brody, S. D., Seitz, W. A., Merrell, W. J., Vedlitz, A., Zahran, S., ... & Stickney, R. (2010). Advancing Resilience of Coastal Localities: Developing, Implementing, and Sustaining the Use of Coastal Resilience Indicators: A Final Report. Hazard Reduction and Recovery Center.

Putnam, R. D. (2001). *Bowling alone: The collapse and revival of American community*. New York, NY: Simon and Schuster.

Reininger, B. M., Rahbar, M. H., Lee, M., Chen, Z., Alam, S. R., Pope, J., & Adams, B. (2013). Social capital and disaster preparedness among low income Mexican Americans in a disaster prone area. *Social Science & Medicine*, *83*, 50-60.

Rupasingha, Anil, Stephan J. Goetz, and David Freshwater. "The production of social capital in US counties." *The journal of socio-economics* 35.1 (2006): 83-101.

Sadiq, A. A., Tharp, K., & Graham, J. D. (2016). FEMA versus local governments: Influence and reliance in disaster preparedness. *Natural hazards*, *82*(1), 123-138.

Sattler, D. N., Kaiser, C. F., & Hittner, J. B. (2000). Disaster Preparedness: Relationships Among Prior Experience, Personal Characteristics, and Distress 1. *Journal of Applied Social Psychology*, *30*(7), 1396-1420.

Siegrist, M., & Gutscher, H. (2008). Natural hazards and motivation for mitigation behavior: People cannot predict the affect evoked by a severe flood. *Risk Analysis: An International Journal*, *28*(3), 771-778.

Slovic, P., Finucane, M. L., Peters, E., & MacGregor, D. G. (2007). The affect heuristic. *European journal of operational research*, *177*(3), 1333-1352.

Spittal, M. J., McClure, J., Siegert, R. J., & Walkey, F. H. (2005). Optimistic bias in relation to preparedness for earthquakes. *Australasian Journal of Disaster and Trauma Studies*, *1*, 1-10.

Szreter, S., & Woolcock, M. (2004). Health by association? Social capital, social theory, and the political economy of public health. *International journal of epidemiology*, *33*(4), 650-667.

Tekeli-Yeşil, S., Dedeoğlu, N., Tanner, M., Braun-Fahrlaender, C., & Obrist, B. (2010). Individual preparedness and mitigation actions for a predicted earthquake in Istanbul. *Disasters*, *34*(4), 910-930.

Terpstra, T. (2011). Emotions, trust, and perceived risk: Affective and cognitive routes to flood preparedness behavior. *Risk Analysis: An International Journal*, *31*(10), 1658-1675.

This paper has been accepted by *Environmental Hazards* Journal

Table 1. Natural Hazards in Taiwan, China (1983-2012)

	Occurrence	Deaths	Affected	Damage Amount (1,000 US$)
Storm (including floods and landslides caused by storms)	59	1,675	3,430,633	4,995,560
Earthquake	6	2,284	109,602	15,125,800
Epidemic	2	91	250,309	272,330
Total	**67**	**4,050**	**3,790,544**	**20,393,690**

EM-DAT records disaster events when there are (1) 10 or more people fatalities, (2) 100 or more people affected/injured/homeless, (3) declarations by the country of a state of emergency (see https://www.emdat.be).

This paper has been accepted by *Environmental Hazards* Journal

Table 2. Participation in Voluntary Associations in Taiwan

Association type	Association category	Membership	
		Frequency	% of total respondents
Civic associations	Residential association	123	6.1
	Social service club	215	10.7%
	Religious association	282	14.1%
Rent-seeking associations	Political association	63	3.1%
	Professional associations or unions	278	13.9%
Social/recreational associations	Recreational association	240	12.0%
	Other social associations	52	2.6
Total	Any of above associations	797	39.8%

This paper has been accepted by *Environmental Hazards* Journal

Table 3. Descriptive Statistics for Variables

Variables	Min	Max	Mean	SD
Preparedness behavior				
Adopting any preparedness behavior	0	1	0.73	0.45
Number of adopted preparedness behaviors	1	6	1.61	1.43
Participation in Association				
Having membership in any association	0	1	0.40	0.49
Civic associations	0	1	0.23	0.42
Rent-seeking associations	0	1	0.16	0.37
Social/recreational associations	0	1	0.14	0.35
Damage from natural hazards				
Typhoon	0	1	0.25	0.43
Property Loss	0	1	0.23	0.42
Psychological Trauma	0	1	0.06	0.23
Injury	0	1	0.01	0.10
Earthquake	0	1	0.15	0.36
Property Loss	0	1	0.13	0.33
Psychological Trauma	0	1	0.05	0.23
Injury	0	1	0.01	0.12
Perceived risks of natural hazards				
Typhoons	1	5	2.42	0.97
Earthquakes	1	5	2.34	1.23
Demographic factors				
Age	20	100	47.25	17.19
Education	0	21	10.48	6.51
Gender	0 (Male)	1 (Female)	0.49	0..50
Social status (self-evaluated)	1	10	4.63	1.75
Urbanization	1	6	4.26	1.40
Duration of residence	1	7	5.48	1.56

This paper has been accepted by *Environmental Hazards* Journal

Table 4. The regression of voluntary associations, disaster experience, and perceived risks on the adoption of preparedness behaviors

	Adopting any preparedness behavior				Number of adopted preparedness behaviors			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Participation in associations								
Membership in associations		0.077***	0.074***	0.071***		0.328***	0.311***	0.293***
		(0.014)	(0.014)	(0.016)		(0.038)	(0.034)	(0.034)
Damage from natural hazards								
Typhoons			0.087***	0.067***			0.259***	0.238***
			(0.025)	(0.023)			(0.070)	(0.069)
Earthquakes			0.053*	0.032			0.187***	0.106*
			(0.028)	(0.029)			(0.060)	(0.062)
Perceived risk of natural hazards								
Typhoons				0.031***				0.184***
				(0.011)				(0.036)
Earthquakes				0.022***				0.121***
				(0.008)				(0.039)
Demographic factors								
Age	0.001	0.0001	-0.0001	0.0004	0.002	0.0001	-0.0004	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
Education	0.007***	0.007**	0.007**	0.006**	0.030***	0.028***	0.029***	0.023***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.006)	(0.005)	(0.005)	(0.006)
Gender	-0.019	-0.017	-0.019	-0.013	-0.057	-0.048	-0.050	-0.035
	(0.012)	(0.012)	(0.012)	(0.013)	(0.043)	(0.044)	(0.044)	(0.047)
Social Status	0.006	0.006	0.006	0.008	0.036*	0.028	0.033*	0.029
	(0.007)	(0.007)	(0.006)	(0.007)	(0.019)	(0.019)	(0.019)	(0.019)
Urbanization	-0.030	-0.032	-0.028	-0.019	-0.102*	-0.108**	-0.098*	-0.083*
	(0.021)	(0.022)	(0.022)	(0.018)	(0.054)	(0.053)	(0.051)	(0.050)
Duration of residence	-0.0001	-0.001	-0.002	-0.008***	0.007	-0.011	-0.013	-0.025*
	(0.002)	(0.003)	(0.003)	(0.002)	(0.016)	(0.014)	(0.014)	(0.014)
City/county dummies (reference: Keelung city)								
Taipei city	-0.015	-0.025	-0.027*	-0.045**	-0.157***	-0.190***	-0.195***	-0.197***
	(0.015)	(0.015)	(0.015)	(0.018)	(0.037)	(0.037)	(0.036)	(0.037)
New Taipei city	0.057***	0.043***	0.043***	0.030***	0.137***	0.077***	0.074***	0.073***
	(0.010)	(0.011)	(0.010)	(0.010)	(0.024)	(0.024)	(0.023)	(0.026)
Taoyuan county	-0.169***	-0.192***	-0.183***	-0.171***	-0.497***	-0.549***	-0.530***	-0.474***
	(0.025)	(0.025)	(0.025)	(0.023)	(0.042)	(0.040)	(0.037)	(0.037)
Hsinchu city	-0.196***	-0.205***	-0.260***	-0.274***	-0.373***	-0.396***	-0.484***	-0.538***
	(0.022)	(0.022)	(0.032)	(0.035)	(0.065)	(0.060)	(0.057)	(0.054)
Hsinchu county	-0.248***	-0.276***	-0.248***	-0.289***	-0.287***	-0.370***	-0.318***	-0.348***
	(0.053)	(0.053)	(0.051)	(0.047)	(0.086)	(0.079)	(0.074)	(0.077)
Miaoli county	-0.297***	-0.323***	-0.315***	-0.282***	-0.771***	-0.810***	-0.796***	-0.756***
	(0.053)	(0.053)	(0.053)	(0.045)	(0.061)	(0.058)	(0.057)	(0.057)
Taichung city	-0.151***	-0.169***	-0.181***	-0.196***	-0.460***	-0.504***	-0.529***	-0.532***
	(0.012)	(0.012)	(0.018)	(0.018)	(0.023)	(0.022)	(0.026)	(0.026)
Changhua county	-0.257***	-0.276***	-0.258***	-0.262***	-0.707***	-0.739***	-0.710***	-0.663***
	(0.060)	(0.061)	(0.060)	(0.053)	(0.080)	(0.076)	(0.072)	(0.079)
Nantou county	0.024	-0.009	-0.084	-0.088	-0.178	-0.303**	-0.458***	-0.451***
	(0.062)	(0.067)	(0.093)	(0.085)	(0.143)	(0.128)	(0.132)	(0.139)
Yunlin county	-0.244***	-0.296***	-0.321***	-0.293***	-0.755***	-0.837***	-0.861***	-0.786***
	(0.082)	(0.082)	(0.088)	(0.078)	(0.088)	(0.078)	(0.080)	(0.093)
Chiayi county	-0.391***	-0.447***	-0.446***	-0.446***	-0.535***	-0.656***	-0.638***	-0.295***
	(0.028)	(0.028)	(0.031)	(0.032)	(0.051)	(0.044)	(0.041)	(0.072)
Tainan city	-0.121***	-0.144***	-0.143***	-0.151***	-0.451***	-0.514***	-0.501***	-0.482***
	(0.029)	(0.029)	(0.030)	(0.029)	(0.053)	(0.051)	(0.051)	(0.056)
Kaohsiung city	-0.062***	-0.073***	-0.086***	-0.092***	-0.306***	-0.335***	-0.361***	-0.339***
	(0.004)	(0.005)	(0.008)	(0.011)	(0.007)	(0.007)	(0.008)	(0.008)
Pingtung county	-0.304***	-0.330***	-0.313***	-0.299***	-0.611***	-0.663***	-0.631***	-0.574***
	(0.080)	(0.080)	(0.081)	(0.074)	(0.106)	(0.100)	(0.098)	(0.104)
Hualien county	0.007*	-0.023***	-0.014**	-0.081***	0.291***	0.151***	0.180***	0.051
	(0.004)	(0.006)	(0.006)	(0.008)	(0.012)	(0.019)	(0.017)	(0.038)
Yilan city	0.267***	0.266***	0.263***	0.255***	1.080***	1.251***	0.934***	0.683***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.092)	(0.093)	(0.073)	(0.095)
Others	0.267***	0.266***	0.263***	0.255***	-0.347***	-0.261***	-0.214***	0.100
	(0.001)	(0.001)	(0.002)	(0.002)	(0.068)	(0.065)	(0.071)	(0.108)
Observations	1,942	1,942	1,940	1,858	1,942	1,942	1,940	1,858
Log Likelihood	-1,103.960	-1,097.188	-1,085.215	-1,021.245	-3,183.040	-3,170.428	-3,157.490	-3,021.521
AIC	2,255.919	2,244.377	2,224.431	2,100.491	6,414.079	6,390.855	6,368.980	6,101.043
Theta (std.err)					8.506***	9.476***	10.512***	12.620***
					(1.921)	(2.334)	(2.821)	(3.983)
Pseudo r^2 (Nagelkerke)	0.130	0.139	0.155	0.239	0.151	0.162	0.174	0.295
Pseudo r^2 (CoxSnell)	0.092	0.098	0.110	0.173	0.146	0.157	0.168	0.287

Notes: *p<0.1; **p<0.05; ***p<0.01; (1) and (4) are logistic regression models, and (5) through (8) are negative binomial regression models; coefficients are marginal effects at the means; standard errors are clustered by cities and counties

Table 5. The regression of voluntary associations, disaster experience, and perceived risks on the adoption of preparedness behaviors: the types of voluntary associations and damage from natural hazards

	Adopting any preparedness behavior			Number of adopted preparedness behaviors		
	(1)	(2)	(3)	(4)	(5)	(6)
Having membership in associations						
Civic	0.029	0.025	0.027	0.228***	0.225***	0.224***
	(0.029)	(0.028)	(0.029)	(0.079)	(0.082)	(0.083)
Reward-based	0.083***	0.084***	0.086***	0.312***	0.323***	0.324***
	(0.025)	(0.026)	(0.027)	(0.066)	(0.070)	(0.071)
Social/recreational	0.044	0.042	0.044	0.174	0.171	0.175
	(0.037)	(0.037)	(0.038)	(0.111)	(0.113)	(0.115)
Damage from natural hazards						
Typhoons						
Property loss	0.055**			0.143**		
	(0.022)			(0.058)		
Psychological trauma		0.129***			0.490**	
		(0.043)			(0.196)	
Injury			0.179**			0.626**
			(0.082)			(0.331)
Earthquakes						
Property loss	0.056**			0.169***		
	(0.023)			(0.052)		
Psychological trauma		0.0001			-0.155	
		(0.068)			(0.125)	
Injury			0.063			0.331*
			(0.086)			(0.192)
Perceived risks of natural hazards						
Typhoons	0.032***	0.033***	0.035***	0.081***	0.080***	0.086***
	(0.011)	(0.012)	(0.012)	(0.027)	(0.028)	(0.028)
Earthquakes	0.021**	0.024***	0.023***	0.054	0.065*	0.056
	(0.008)	(0.009)	(0.009)	(0.036)	(0.038)	(0.036)
Demographic factors						
Age	0.0005	0.0005	0.0006	0.0007	0.0008	0.001
	(0.0008)	(0.0009)	(0.0009)	(0.001)	(0.001)	(0.001)
Education	0.006**	0.006**	0.006**	0.025***	0.025***	0.025***
	(0.002)	(0.002)	(0.002)	(0.005)	(0.006)	(0.006)
Gender	-0.010	-0.013	-0.010	-0.011	-0.015	-0.012
	(0.013)	(0.014)	(0.013)	(0.050)	(0.049)	(0.048)
Social Status	0.007	0.007	0.007	0.032	0.031	0.030
	(0.007)	(0.007)	(0.007)	(0.020)	(0.020)	(0.020)
Urbanization	-0.021	-0.019	-0.020	-0.083*	-0.075*	-0.075*
	(0.019)	(0.018)	(0.018)	(0.047)	(0.045)	(0.046)
Duration of residence	-0.008***	-0.008***	-0.007***	-0.026*	-0.028*	-0.026*
	(0.002)	(0.002)	(0.002)	(0.014)	(0.014)	(0.014)
City/county dummies (reference: Keelung city)						
Taipei city	-0.038**	-0.024	-0.037**	-0.199***	-0.166***	-0.197***
	(0.018)	(0.018)	(0.018)	(0.039)	(0.045)	(0.040)
New Taipei city	0.027**	0.044***	0.030***	0.063**	0.108***	0.068**
	(0.011)	(0.012)	(0.011)	(0.026)	(0.036)	(0.028)
Taoyuan county	-0.166***	-0.153***	-0.165***	-0.529***	-0.508***	-0.527***
	(0.025)	(0.024)	(0.024)	(0.034)	(0.033)	(0.033)
Hsinchu city	-0.262***	-0.209***	-0.226***	-0.440***	-0.358***	-0.383***
	(0.033)	(0.030)	(0.029)	(0.058)	(0.067)	(0.062)
Hsinchu county	-0.303***	-0.287***	-0.313***	-0.421***	-0.397***	-0.420***
	(0.053)	(0.049)	(0.054)	(0.079)	(0.080)	(0.081)
Miaoli county	-0.280***	-0.259***	-0.275***	-0.784***	-0.761***	-0.790***
	(0.048)	(0.042)	(0.046)	(0.054)	(0.051)	(0.054)
Taichung city	-0.199***	-0.165***	-0.186***	-0.546***	-0.472***	-0.529***
	(0.020)	(0.015)	(0.018)	(0.025)	(0.032)	(0.024)
Changhua county	-0.265***	-0.241***	-0.266***	-0.723***	-0.684***	-0.717***
	(0.059)	(0.052)	(0.058)	(0.072)	(0.069)	(0.070)
Nantou county	-0.114	-0.060	-0.043	-0.498***	-0.368***	-0.424***
	(0.093)	(0.076)	(0.073)	(0.136)	(0.129)	(0.124)
Yunlin county	-0.309***	-0.244***	-0.274***	-0.867***	-0.794***	-0.825***
	(0.086)	(0.073)	(0.081)	(0.081)	(0.077)	(0.078)
Chiayi county	-0.446***	-0.461***	-0.440***	-0.625***	-0.648***	-0.622***
	(0.039)	(0.042)	(0.039)	(0.048)	(0.046)	(0.048)
Tainan city	-0.152***	-0.128***	-0.151***	-0.514***	-0.475***	-0.511***
	(0.030)	(0.025)	(0.029)	(0.047)	(0.046)	(0.046)
Kaohsiung city	-0.085***	-0.065***	-0.076***	-0.341***	-0.306***	-0.329***
	(0.012)	(0.012)	(0.010)	(0.014)	(0.019)	(0.014)
Pingtung county	-0.304***	-0.275***	-0.302***	-0.606***	-0.562***	-0.594***
	(0.077)	(0.069)	(0.075)	(0.095)	(0.093)	(0.094)
Hualien county	-0.081***	-0.064***	-0.089***	0.012	0.055	-0.035
	(0.013)	(0.014)	(0.014)	(0.045)	(0.052)	(0.047)

Yilan city	0.255***	0.254***	0.254***	1.005***	1.206***	1.138***
	(0.002)	(0.003)	(0.003)	(0.088)	(0.113)	(0.105)
Others	0.255***	0.254***	0.254***	-0.124	-0.110	-0.142*
	(0.002)	(0.003)	(0.003)	(0.087)	(0.088)	(0.086)
Observations	1,860	1,860	1,860	1,860	1,860	1,860
Log Likelihood	-1,021.995	-1,022.589	-1,024.499	-3,021.147	-3,020.510	-3,020.343
AIC	2,105.990	2,107.178	2,110.998	6,104.295	6,103.020	6,102.687
Theta (std.err)				13.292***	13.294***	13.459***
				(4.394)	(4.390)	(4.497)
Pseudo r^2 (Nagelkerke)	0.238	0.238	0.235	0.296	0.298	0.296
Pseudo r^2 (CoxSnell)	0.172	0.173	0.170	0.288	0.289	0.288

Notes: *p<0.1; **p<0.05; ***p<0.01; (1) through (4) are logistic regression models, and (5) through (8) are negative binomial regression models; coefficients are marginal effects at the means; standard errors are clustered by region.