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Suicide and Life Insurance

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Abstract

In this paper, we investigate the nexus between life insurance and suicide behavior using OECD cross-country data from 1980 to 2002. Through semiparametric instrumental variable regressions with fixed effects, we find that for the majority of observations, there exists a positive relationship between suicide rate and life insurance density (premium per capita). Since life insurance policies pay death benefits even in suicide cases after the suicide exemption period, the presence of adverse selection and moral hazard suggests an incentive effect that leads to this positive relationship. The novelty of our analysis lies in the use of cross-country variations in the length of the suicide exemption period in life insurance policies as the identifying instrument for life insurance density. Our results provide compelling evidence suggesting the existence of adverse selection and moral hazards in life insurance markets in OECD countries.

Keywords: Suicide; Life Insurance; Asymmetric Information

JEL classification: D28; I30; J17

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Suicide is one of the most serious and vexing issues faced in all modern societies. According to the World Health Organization (WHO), approximately 3,000 people commit suicide every day, and every 30 seconds, one suicide-related death is reported. Moreover, in the last 45 years, suicide rate has increased by 60% worldwide (WHO, 2007). Many medical professionals consider suicide to be the results of depression and other psychiatric disorders (Mann et al., 2005). However, as early as in 1897, sociologist Émile Durkheim, in his seminal book—*Le Suicide*—developed the concept of social integration to understand suicides.[2] On the other hand, Hamermesh and Soss (1974), in their economic theory on suicide, employed an expected lifetime utility maximization framework to explain suicides as "rational" decisions. Nonetheless, existing literature has disregarded the role of economic or financial incentives in inducing suicide.

Suicides induced by economic incentives are not rare in real life; even government policies can induce suicides through moral hazard. For example, in some states in India, there has been an increase in the suicide rate; this is probably due to the government policy of compensating bereaved families for the loss of a breadwinner who has killed himself (The Economist, June 21, 2007). This study focuses on life insurance-induced adverse selection and moral hazard. Life insurance contracts also provide incentives to commit suicide as death benefits are paid in cases of suicides after the suicide exemption period.[3] In fact, Toyokawa and Shiromizu (1998) and Amemiya (2002) stated that there was an increase in the number of suicides among life insurance policy holders immediately after the suicide exemption period. Moreover, according to

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[2] Satī is an old Hindu funeral practice in which the widow sacrifices her life by burning herself on her husband's funeral pyre; satī has been cited by Durkheim as an example of altruistic suicides in cases when there is high social integration. Contemporary sociologists have employed the same concept to explain Kamikaze pilots and suicide bombers. Chen, Choi, and Sawada (2007b) also provide evidence that the co-guarantor borrowing system in Japan induces suicides of borrowers in cases where the magnitude of social stigma and the degree of altruism are high.

[3] A suicide exemption period (suicide provision; suicide clause) states that if the insured dies as a result of suicide within the period specified in the suicide clause, the death benefit would not be paid to

one media report, payments made by a major Japanese life insurance company increased by 50% from 1995 to 2005 due to suicides; further, in 2005, 10% of the company's total insurance payments went to suicide-related deaths (Mainichi Shinbun, October 4, 2005). These examples imply that some suicides were induced by adverse selection and moral hazard under asymmetric information.

According to asymmetric information models, in the presence of substantial adverse selection and moral hazard, life insurance participants would have a higher suicide rate compared to nonparticipants. However, there has been no economic research that directly explores this potential link between suicide and life insurance (Villeneuve, 2000). A closely related study by Tseng (2006) employed the mortality data submitted by large U.S. insurance companies to the Society of Actuaries (SOA); the results revealed that the suicide rate of the insured quadrupled after the expiry of the suicide exemption period. However, Tseng (2006) reveals contradictory data: the suicide rate of the general population was two to three times higher than that among the insured.

In this paper, we aim to investigate the causal relationship between life insurance density and suicide rate based on the asymmetric information theory. The primary difficulty in establishing the relationship between suicide and life insurance is the endogeneity associated with the use of the life insurance variable to explain the suicide rate. Controlling observable socioeconomic factors, the demand for life insurance rises with an increase in unobservable factors such as risk type (tendency to commit suicide), degree of risk aversion, and degree of altruism. These unobservable factors may also affect suicide decisions, thereby causing the endogeneity problem due to omitted variables. The novelty of our analysis lies in the use of cross-country variations in the length of the suicide exemption period of life insurance policies as the identifying instrument for life insurance demand.

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any beneficiaries; after this period lapses, suicide is treated the same as death caused by other reasons.

In theory, due to adverse selection and given a distribution of risk type, a shorter exemption period should be systematically correlated with a higher proportion of riskier types among the insured.[4] In reality, the length of the exemption period is the same within each Organization for Economic Cooperation and Development (OECD) country, and it is determined either by insurance laws or industrial norms; the only exception is the United States, where the length of the suicide exemption period differs across states (see Table 1 for details). In fact, the exemption periods during our sample period of 1980–2002 are constant in most OECD countries, and therefore, can be considered as exogenous. Even in Belgium, Greece, and Japan, where the lengths of the suicide exemption period changed, these changes were made with significant lags, and therefore, can be considered as predetermined.[5] Hence, cross-country variations in suicide exemption periods generate a situation of "quasi-natural experiments" where representative agents are faced with different incentive schemes for exogenous reasons (Chiappori, 2000). In summary, we use cross-country variations in the length of the suicide exemption periods as the identifying instrument for life insurance, in order to address the endogeneity problem in the suicide regression equation due to omitted variables.

The results obtained through semiparametric instrumental variable (IV) regressions using the data of OECD countries from 1980 to 2002 reveal that there exists a positive causality between life insurance density and suicide rate. This main result

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[4] In the extreme case when life insurance policies deny death benefits in suicide cases—i.e., the length of the exemption period is infinite—individuals who are seriously contemplating suicide would not purchase such life insurance policies.

[5] In Belgium and Greece, in the case of death by suicide, death benefits were denied in life insurance policies until 1992 and 1996, respectively. The lengths of the suicide exemption periods were one year in Belgium since 1993 and two years in Greece since 1997. In Japan, the length of the exemption period was one year until 1999. The extension of the length of the suicide exemption period in 2000 was a response to the sudden increase in the number of suicides in 1998. In that year, the total number of suicides in Japan increased by 34.7%, i.e., from 24,391 in 1997 to 32,863 in 1998. For readers' information, the length of the suicide exemption period in Japan was further extended to three years in

provides compelling evidence of the presence of adverse selection and moral hazard in life insurance markets. The existence of asymmetric information in the life insurance market—which is the largest private insurance market—has rarely been examined empirically, and existing studies such as Beliveau (1984) and Cawley and Philipson (1999) provide mixed results. [6,7]

The remainder of this paper is organized as follows. Section I presents an empirical model, and Section II describes the data used in this study. Section III presents the results of the empirical analysis, and Section IV provides some concluding remarks and implications for further study.

I. Empirical Model

There are at least two types of asymmetric information problems involved in the nexus between life insurance and suicides: moral hazard and adverse selection.[8] With respect to the moral hazard problem, we can postulate a model of suicide as a function of the amount of life insurance purchased. If suicide and life insurance purchase are positively correlated, the finding will be consistent with the hypothesis of life insurance-induced moral hazard. In order to analyze the model empirically, we employ the

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2005.

[6] In contrast, there has been a wide variety of empirical tests on the theoretical implications derived from asymmetric information models in non-life insurance markets, for example, the automobile insurance market in particular (Chiappori, 2000; Chiappori and Salanié, 2000).

[7] By using a data set from the Life Insurance Marketing Research Association (LIMRA), Beliveau (1984) found a positive relationship between life insurance premium rate and the amount of coverage purchased; this served as evidence in support of adverse selection. Nonetheless, this finding was challenged by Cawley and Philipson (1999). Using three data sets including LIMRA, they showed that unit prices did not rise with coverage, which is inconsistent with the theory of life insurance under asymmetric information.

[8] Here, the moral hazard is that some of the insured, who had no intention of committing suicide before purchasing the insurance, commit suicides. However, they would not have chosen to do so had they not been insured. Suicides are considered as *ex post*—costlessly verifiable events—and therefore exclude fake suicides by the insured or homicides staged as suicides by the beneficiaries.

following semiparametric regression model of suicide as a nonparametric function of life insurance density D:

(1) $$\log S_{it} = X_{it}\theta + f(\log D_{it}) + u_{it},$$

where i and t represent the countries and years, respectively. The dependent variable log S_{it} is the natural log of the suicide rate; X_{it} is the set of attributes including socioeconomic variables such as real GDP per capita, growth rate of real GDP per capita, Gini coefficient, female labor participation rate, birth rate, divorce rate, and per capita alcohol consumption; and D_{it} refers to the life insurance density. The final term, u_{it}, is an error term.

The econometric concern of Equation (1) is that the life insurance variable is likely to be correlated with the error term u_{it} due to unobserved factors simultaneously affecting both suicide and the demand for life insurance. Such factors may include the risk type, the degree of risk aversion, and the extent of altruism. Therefore, there can be correlation between the error term and insurance variable such that $E(u|\log D, X) \neq 0$. This will generate a bias in the estimation of the nonparametric function $f(\cdot)$ in Equation (1). In order to resolve this endogeneity problem, we impose two refinements on Equation (1). First, we decompose the error term in Equation (1) as follows: $u_{it} = \alpha_i + \beta_t + \delta_i T + \varepsilon_{it}$. This decomposition controls for unobserved country-specific and time-specific fixed effects through the addition of α_i and β_t respectively. Further, the decomposition controls for unobserved country-specific but time-varying effects by allowing country-specific coefficient δ_i for the linear time trend T. In this way, we attempt to cope with the endogeneity bias arising from the omitted variables.

Second, we introduce an IV regression equation for the life insurance density using the length of the exemption period variables as the instrument, in order to mitigate the endogeneity bias arising from the simultaneity problem. In general, there can be two opposing effects of the correlation between the life insurance density and the length of the exemption period. On the one hand, a shorter exemption period may increase the life insurance demand by attracting riskier types; on the other, the increase in the proportion of the riskier types among the insured may increase the insurance premium, decrease the proportion of safe types, and hence decrease the life insurance demand. Therefore, the net effect is an empirical question.

In terms of the econometric framework, we apply the augmented regression technique of Holly and Sargan (1982) to the IV regression equation for the life insurance density:

$$\log D_{it} = Z_{it}\,\gamma + \eta_{it}, \qquad (2)$$

where Z is the set of determinants of life insurance density; Z includes the length of the life insurance exemption period variables as identifying instruments as well as the lagged log life insurance density and the socioeconomic variables in Equation (1). Following Holly and Sargan (1982), Blundell et al. (1998), and Gong et al. (2005), we assume that $E(\eta|Z, X) = 0$ and $E(\varepsilon|\log D, Z, X, M) = \varrho\eta$, where M includes country-specific and time-specific fixed effects and the country-specific linear time trend. The first conditional mean assumption implies that the length of the exemption period—the key identifying instrument—is uncorrelated with the error term η in Equation (2); error term η includes unobserved factors such as the risk type, the degree of risk aversion, and the extent of altruism. The second conditional mean assumption provides the structure of the way in which ε and η are related.[9]

[9] The two assumptions, taken together, imply that $E(\varepsilon|Z, X) = 0$.

The validity of the first conditional mean assumption can be justified as follows. First, the length of the exemption period is held constant during our sample period of 1980–2002 in a majority of OECD countries, and hence can be considered to be exogenous.[10] Second, even in Belgium, Greece, and Japan, where the lengths of the exemption periods changed, the changes were made with significant lags, and hence can be considered as predetermined.

Finally, the semiparametric regression model of Equation (1) can be rewritten as follows:

$$\log S_{it} = X_{it}\theta + f(\log D_{it}) + \alpha_i + \beta_t + \delta_i T + \varrho\eta + v_{it}, \quad (3)$$

where $E(v|\log D, Z, X, M) = 0$. In Equation (3), if the estimated parametric part shows that $f'(\cdot) > 0$, we can interpret the derivative as being consistent with the presence of moral hazard and adverse selection in the life insurance market.

In order to estimate Equation (3), we use Lokshin's (2006) algorithm, which is based on the differencing method in the estimation of partial linear models introduced by Yatchew (1997).[11]

II. Data

Our data set includes all OECD countries for the period of 1980–2002. The raw number of suicides and population according to gender and age groups were obtained

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[10] The length of the exemption period is the same within each OECD country, and it is determined either by insurance laws or industrial norms, except in the United States where the length of the suicide exemption period differs across states.

[11] In particular, first-order differencing was used to estimate Equation (3). It is assumed that $f(\cdot)$ is a smooth function that belongs to a particular parametric family with bounded first derivatives.

from the WHO Mortality Database. The suicide rate per 100,000 inhabitants for specific gender-age groups was calculated by the ratio of the number of suicides to the population of the specific gender-age group. Furthermore, with regard to the total male and female groups, the suicide rates were converted into age-standardized suicide rates per 100,000 inhabitants by using the world standard population figures published by WHO.[12] By using this adjustment, the differences in the age structure across countries and time can be controlled by the age-standardized suicide rate. In other words, it is not necessary to include the share of specific age groups in the analysis (Neumayer, 2003).

A considerable amount of time and effort was devoted to the collection of information on the key identifying instrument, the length of the suicide exemption period, related laws and regulations, and industrial norms, through our own survey on the life insurance associations and/or companies in each OECD country. These data are unique to this study. One of the footnotes in Table 1 provides the list of contacts that we prepared for each country. Dummy variables that represent the length of the suicide exemption period were constructed as follows: *exemp1* = 1 if the exemption period is one year, and 0 otherwise; *exemp2* = 1 if the exemption period is two years, and 0 otherwise; *exemp3* = 1 if the exemption period is three years, and 0 otherwise; and *exemp4* = 1 if there is no payment for suicide-related deaths, and 0 otherwise.[13] The United States, the Netherlands, and the United Kingdom were excluded because the length of the exemption period differs across states in the United States, and the precise information

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[12] Unadjusted suicide rates assign equal weight to each suicide, while adjusted suicide rates assign different weights to the suicide rates of different age groups based on the world standardized age profile. This reduces the influence of the country-specific age structure on total population (aggregated) suicide rate.

[13] The number of observations for *exemp1*, *exampt2*, *exemp3*, and *exemp4* are 101, 103, 28, and 5, respectively (with a total of 237). The number of observations for zero exemption period is 75 and is taken as the default variable for exemption period dummy variables. Note that this is the case where life insurance benefits are paid for any kinds of death including suicide.

on the length of the suicide exemption period was not available in the cases of the Netherlands and the United Kingdom.

With regard to socioeconomic variables, the economic variable—real GDP per capita—was obtained from the Penn World Table 6.2, and the growth rate was calculated based on the real GDP per capita. The unemployment rate was obtained from the OECD health data. As a proxy for income inequality, Gini coefficients based on different definitions were acquired from the United Nations University's World Income Inequality Database (WIID), and the average of the available Gini coefficients for each country was used as a single index. The birth rate, measured by the ratio of live births to the total population, was taken from the WHO Mortality Database. The divorce rate, measured by the ratio of the number of divorces to the total population, was obtained from the United Nations Common Database.

The female labor force participation rate, measured as a percentage of female population ages 15-64 was acquired from the World Development Indicators of the World Bank. Finally, with respect to alcohol consumption, the sales data of pure alcohol, in liters, per individual over 15 years of age were taken from the OECD Health Data. Table 2 lists the definitions of socioeconomic variables and their sources. For a more detail explanation of the socioeconomic variables, please refer to Chen, Choi, and Sawada (2007a).

III. Results of the Empirical Analysis

As discussed in Section I, since we imposed two refinements in order to deal with the endogeneity problem, we conducted the estimations in the following order: first, Equation (1) was estimated without considering the omitted variables and the simultaneity problems (the baseline specification); second, only the simultaneity problem in Equation (1) was addressed by using the IV technique through Equation (2) (the IV specification); third, only the omitted variable problem in Equation (1) was addressed by including time- and country-specific fixed effects as well as country-specific time trend (the FE specification); finally, we estimated Equation (3), where both the omitted variable problem and the simultaneity problem were accounted for (the FE-IV specification). In the following discussion, the nonparametric estimation results are presented in Figures 1(a)–(d), and the parametric estimation results are provided in Table 3. Since the main focus is on the relationship between the suicide rate and life insurance density, we commence our discussion with the nonparametric estimation results.

Figures 1(a) and 1(b) present the nonparametric estimation results of the baseline and IV specifications, respectively. These two figures are quite similar, and this implies that either there is no endogenous problem or the IV method fails to appropriately address the endogeneity problem. Indeed, the estimate of the coefficient of η in Table 3 is not significant. Meanwhile, a slightly U-shaped relationship between suicide rate and life insurance density is revealed. Although the positive part of the U-shaped relationship is consistent with the existence of adverse selection and moral hazard in life insurance markets, it may be the result of not considering the fixed effects (omitted variables bias).

Figures 1(c) and 1(d) present the nonparametric estimation results of the FE and the FE-IV specifications, respectively. Taking into account the fixed effects, the results in these two figures are very different from the previous results. Figures 1(c) and 1(d) present a positive relationship between suicide rate and life insurance density, except in the right-end tails where the life insurance density is high. This positive relationship is consistent with the existence of adverse selection and moral hazard in life insurance markets. A steeper slope in Figure 1(c) suggests a more substantial adverse selection and moral hazard. However, the estimate of the coefficient of η in the fourth column of Table 3 is significantly positive. This implies that the FE specification overestimates the nonparametric part without taking into account the simultaneity pertaining to life insurance density and suicide. Since the results presented in Figure 1(d) and the fourth column of Table 3 take into account both refinements, we believe them to be the most convincing.

In addition, a negative relationship between suicide rate and life insurance density is shown in the right-end tails of Figures 1(c) and 1(d). This may be considered to be inconsistent with asymmetric information theories when life insurance density is sufficiently high. One plausible interpretation is the existence of some other relevant unobservable variables that the estimation equations failed to account for. One such example is wealth. On an average, wealthier individuals are likely to purchase more life insurance (life insurance is a normal good); nevertheless, the proportion of coverage for loss in the event of death is likely to decrease with an increase in wealth.[14] This implies that death benefits are less valuable for wealthier people. Hence, the financial incentives for suicides from insurance payments are weaker or minimum and hence lead to a negative relationship, as shown in the figures. However, to the best of our knowledge, there have been no asymmetric information studies exploring this potential "wealth effect."

As stated above, Equation (2)—a first-stage estimation of regressing the log life insurance density on the exemption period—is used in the IV and FE-IV specifications in order to address the simultaneity problem. In fact, since a short exemption period may induce self-selection of riskier types into life insurance contracts, the estimation result of Equation (2) can provide additional information on the existence of adverse selection. Table 4 shows the result of the first-stage estimation. We found that both *exemp3* and *exemp4* are significantly negative with regard to the level of life insurance density; this

[14] Enz (2000) provides evidence suggesting that life insurance is a normal good for high levels of income.

suggests that a longer exemption period or no life insurance payment in cases of suicides is associated with a decrease in the purchase of life insurance policies. In other words, a longer exemption period may deter riskier types from purchasing life insurance contracts.

With respect to the parametric part, a consistent finding is that the real GDP per capita is significantly negative. The female labor force participation rate is significant (at the 10% level) in the baseline specification; in addition, the fertility, divorce, and alcohol consumption rates are significant in the baseline and IV specifications. However, all these variables become insignificant after controlling for the fixed effects. The coefficient of the Gini index suggests a significantly negative relationship between suicide rate and inequality. This puzzling finding may result from the omitted variables bias. Indeed, the coefficient becomes significantly positive after controlling for the fixed effects. With respect to the FE-IV specification, the signs of most socioeconomic variables are consistent with the results presented in Chen, Choi, and Sawada (2007a) and other empirical studies on suicide.

IV. Concluding Remarks

In this paper, we investigate the nexus between life insurance and suicide using OECD cross-country data from 1980 to 2002. By using semiparametric IV regressions with fixed effects, this study finds a positive relationship between suicide rate and life insurance for a majority of observations. This suggests the presence of adverse selection and moral hazard in life insurance markets. Exceptions are the cases of high levels of life insurance density that may be explained by the wealth effect. This result challenges the current conception in the literature that problems associated with asymmetric information are less likely to occur in life insurance markets. The novelty of our analysis lies in the use of data on cross-country variations in the length of suicide exemption periods as the main identifying instrumental variables for life insurance density. In further studies, the issues of adverse selection and moral hazard should be investigated by using individual-level data.

Through this study, we would like to emphasize the importance of studying suicides by employing a somewhat "rational" approach. If people are willing to recognize that some suicides are rational, studies would be conducted to ascertain the different incentives behind suicides. By this way, we believe that suicide prevention can gather sufficient resources as the seriousness of the current situation warrants, and thereby effective measures of suicide prevention can be developed and implemented. Nevertheless, there is an important caveat to this study, particularly when deriving policy implications: not all suicides are driven by financial incentives. To stop paying suicide related death payments may eliminate the adverse selection and moral hazard problems as discussed in this paper, but it also questions the very basic function of life insurance—to protect the beneficiaries against the sudden economic loss associated with the death of their love ones. These issues should be investigated carefully in the future studies.

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Table 1. The Length of Exemption Periods in OECD Countries

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Law
Australia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Austria	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1
Belgium	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	1	1	1	1	1	1	1	1	1
Canada	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Czech Republic	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0
Denmark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Finland	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	1
France	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Germany	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1
Greece	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	2	2	2	2	1
Hungary	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Iceland	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ireland	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	NA
Italy	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0
Japan	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1
Korea	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Luxembourg	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mexico	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Netherlands											NA											1
New Zealand	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Norway	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Poland	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Portugal	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0
Slovak Republic	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0
Spain	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Sweden	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Switzerland	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1
Turkey	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1
United Kingdom	1~2	1~2	1~2	1~2	1~2	1~2	1~2	1~2	1~2	1~2	1~2	1~2	1~2	1~2	1~2	1~2	1~2	1~2	1~2	1~2	1~2	0
United States											Different by states											

Data sources: The authors' survey of life insurance associations in each OECD country. Australia: Accident Research Center: Monash University; Austria: UNIQA Versicherungen AG; Belgium: Vanbreda Insurance Policy (http://www.aiic.net.ViewPage.cfm/article1593); Canada: Judgements of the supreme court of Canada; Czech Republic: Insurance Contact Act: Act No. 37/2004; Denmark: The Danish Insurance Association; Finland: Veritas Life Insurance Company Ltd; France: Insurance code (www.legifrance.gouv.fr); Germany: AXA Konzern AG; Greece: Association of Insurance Companies; Hungary: Hungarian Financial Supervisory Authority; Iceland: Act on Insurance Contracts, No 30/2004; Ireland: Eagle Star; Italy: Assicurazioni Generali; Japan: Life Insurance Association of Japan; Korea: Korea Life Insurance Association, Luxembourg: Association des Compagnies d'Assurances; Mexico: Asociacion Mexicana de Instituciones de Seguros; Netherlands: Dutch Association of Insurers; New Zealand: Insurance Council of New Zealand Inc.; Norway: Norwegian Financial Services Association; Poland: Polish Chamber of Insurance; Portugal: Portuguese Insurers Association; Slovak: Republic Slovenská asociácia poisťovní; Spain: Association of Spanish Insurers; Sweden: Svenska Försäkringsföreningen; Switzerland: Swiss Insurance Association; Turkey: Association of the Insurance and Reinsurance Companies of Turkey; United Kingdom: Association of British Insurers; and United States: different across states.

Notes:

1. In the United States, most states(33) have a two-year suicide exemption period: Alabama, Alaska, Arizona, Arkansas, California, Delaware, Georgia, Hawaii, Idaho, Illinois, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, Nevada, New Hampshire, New Mexico, New York, North Carolina, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming. Two of the states—Colorado and North Dakota—specify a one-year provision. In the following fourteen states and the District of Columbia, the length of the suicide exemption period exclusion is not addressed: Connecticut, Florida, Indiana, Iowa, Kansas, Massachusetts, Michigan, Mississippi, New Jersey, Ohio, Oregon, Pennsylvania, Rhode Island, and Vermont. Finally, Missouri has a law that invalidates the suicide clause.

2. With the exception of the United States, among the OECD countries, there are laws governing the length of the suicide exemption period (in 20 countries; law = 1). The length of the suicide exemption period in the other nine countries were determined by industrial norms (law = 0).

Table 2. Variables and Data Sources

Variable	Definition	Source(s)
Suicide rate	Rate per 100,000 people	WHO Mortality Database (last updated: Nov 17, 2006)
Birth rate	Live birth to total population	
Population	--	
Life insurance density	Life insurance premium/population	Swiss Re Sigma database
Per capita GDP	Real GDP	Penn World Table 6.2, 2006
Per capita GDP growth rate	Real GDP growth rate	
Unemployment rate	% of total labor force	OECD Health Data 2005 Additional source for alcohol consumption (only for Japanese data): National Tax Agency, Japan
Alcohol consumption	liters per person aged 15 and above	
Divorce rate	% of total population	United Nations Common Database, 2007
Gini coefficient	Average of Gini indices from different definitions	World Income Inequality Database, V 2.0b, May 2007
Female labor force participation	% of female population ages 15-64	World Development Indicators, 2006

Table 3. Summary Results of the Parametric Part

Model specification	Baseline	IV	FE	FE-IV
Controlled for fixed effects	No	No	Yes	Yes
Instrumental variable estimation	No	Yes	No	Yes
Variables	Estimate	Estimate	Estimate	Estimate
Per capita GDP	–0.299***	–0.302***	–0.466***	–0.433***
	(0.052)	(0.053)	(0.1)	(0.098)
Per capita GDP growth rate	0.493	0.649	–0.09	–0.143
	(0.868)	(0.881)	(0.252)	(0.249)
Unemployment rate	–0.07	0.093	–0.003	–0.071
	(0.62)	(0.636)	(0.471)	(0.475)
Female labor force participation	0.018*	0.014	–0.021	–0.019
	(0.01)	(0.01)	(0.017)	(0.016)
Birth rate	0.371***	0.386***	–0.054	–0.065
	(0.129)	(0.13)	(0.086)	(0.085)
Divorce rate	0.293***	0.305***	0.032	0.036
	(0.046)	(0.047)	(0.033)	(0.033)
Alcohol consumption	0.043***	0.044***	–0.003	0.001
	(0.009)	(0.009)	(0.016)	(0.016)
Gini coefficient	–0.031***	–0.031***	0.004**	0.005**
	(0.006)	(0.006)	(0.002)	(0.002)
Eta	––	-0.01	––	0.082*
	––	(0.143)	––	(0.043)
Number of observations	259	256	259	256
R-squared	0.589	0.594	0.987	0.987
Significance test statistics for the nonparametric part	3.470	3.529	6.652	6.994
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]

Notes:
1. The estimation is done by using the nonparametric part for life insurance density country-fixed effect, time-fixed effect, and country-specific linear time trend, which are not shown in the table.
2. Robust standard errors provided in parentheses.
3. "*" significant at 10%; "**" significant at 5%; "***" significant at 1%.

Table 4. Life Insurance Density Equation Regression Results

(First-Stage Instrumental Variable Regression)

	Coefficient	Std. Err.
exemp1	0.0164	(0.0274)
exemp2	–0.0343	(0.0230)
exemp3	–0.0527*	(0.0311)
exemp4	–0.0945*	(0.0492)
Lag life insurance density	0.9637***	(0.0117)
Per capita GDP	–0.0083	(0.0237)
Per capita GDP growth rate	0.9567*	(0.5679)
Unemployment rate	–0.3363*	(0.1744)
Female labor force participation	0.0054*	(0.0032)
Birth rate	–0.0959**	(0.0413)
Divorce rate	–0.0288**	(0.0134)
Alcohol consumption	0.0031	(0.0030)
Gini coefficient	0.0007	(0.0018)
Cons	0.2521	(0.1786)
Overall R-squared	0.9852	
Wald statistics for zero coefficients	47884.59	
[p-value]	[0.0000]	
Number of observations	270	
Number of countries	26	

Notes:
1. The estimation is done by using random effects; robust standard errors are in parentheses.
2. "*" significant at 10%; "**" significant at 5%; "***" significant at 1%.

Figure 1. Nonparametric Plots of the Relationship between Suicide Rate and Life Insurance Density

Figure 1(a)

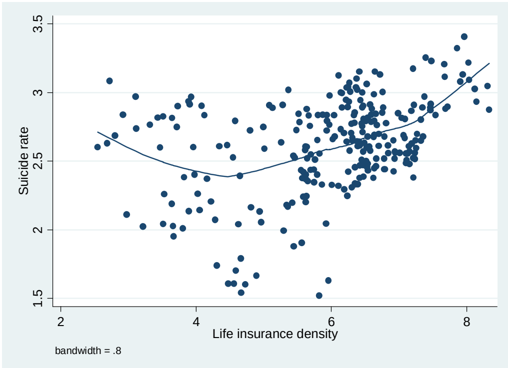

Figure 1(b)

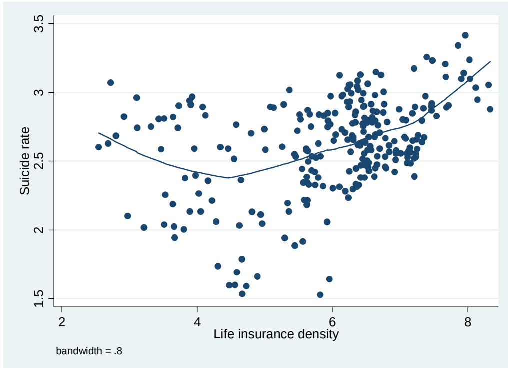

Figure 1(c)

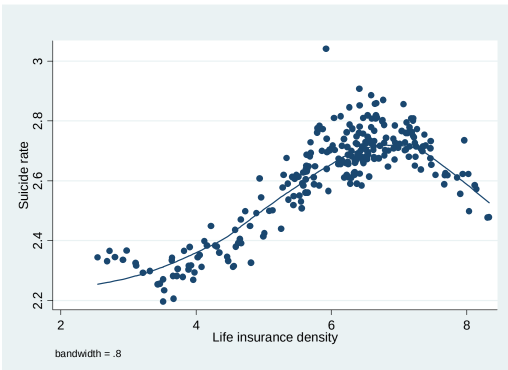

Figure 1(d)