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A dynamic panel analysis of suicide in Japanese municipalities

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Abstract

We construct a regional panel dataset spanning the period 1984-2012 and covering about 1,000 municipalities in Japan and applied a careful treatment of the regional fixed effects, time effects, persistence of suicide risk, and potential endogeneity of economic variables in a dynamic panel regression framework. The results indicate that (a) the removal of regional fixed effects and time effects is necessary but not sufficient for a robust analysis of suicide risk in Japan, (b) the balance of lagged and current savings and lagged real-estate liabilities are anti-risk factors for Japanese males, whereas widowed status and non-estate liabilities are risk factors for them, and (c) the balance of payments for life insurance premiums and the unemployment rate for the same gender are weak risk factors for males but significant anti-risk factors for females.

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1. Introduction

Suicide has drawn significant public attention in Japan over the last decade. Figure 1 plots the time series of Japanese male and female "suicide rates" based on suicide deaths per 100,000 individuals in each of 16 five-year age cohorts during the period 1990-2010. The data is sourced from the "Regional Statistics", to be explained later in Section 3. All patterns for males are N-shaped, with the first peak coming around late 50s. More striking is the upward shift in males' suicides after 1997, with the total number of suicide victims exceeding 30,000 amid a deep recession and a series of bankruptcies due to the collapse of the economy boom in the late 1980s and the Asian/Russian financial crises from 1997-1998. The patterns for females are flatter and lower than those for males, but they are still among the highest rates in comparison with other OECD countries.[1] Figure 2 details the geographic distribution of suicides, pointing to the most frequent suicide "hot" spots, generally located in sparsely populated areas.

To counteract this suicide epidemic, the government of Japan legislated the Basic Act on Suicide Prevention in 2006 to support municipalities as the minimum approach to implementing suicide-preventive measures. An important question to ask is: what are the potential risk and anti-risk (risk-lowering) factors of suicide at the municipality level? Until recently, there have been few studies on this subject due to a lack of suicide data with detailed segmentation. Local governments individually analyze and report potential suicide factors[2]; however, these factors may be confused with latent regional characteristics if they are identified as correlates of suicide rates within these regions. Moreover, the regional boundaries shifted during the boom of municipal mergers around 2004-2006 (Weese, 2015), initiated by the central government as a means to reduce the number of and transfers to local governments. Unfortunately, the post-merger sample is considerably small and misses the surge in suicide rates around 1998.

This study attempts to overcome these issues to foster a better understanding of suicide risk in Japan. To accomplish this purpose, first, we construct a regional panel dataset of suicide rates matched against socioeconomic variables. We track all transitions of municipal boundaries and synthesize variables in accordance with the regional segmentation in the suicide data. Our sample consists of six waves, each of a five-year length, from 1984-2012 and covers about 1,000 municipalities. Second, we separately estimate suicide factors for Japanese males and females by applying a generalized method of moments (GMM)-based dynamic panel method to the dataset while controlling time effects, municipal fixed effects, persistence of suicide risk, and potential endogeneity of economic variables. Our results

[1] See `https://data.oecd.org/healthstat/suicide-rates.htm`, accessed on August 1, 2015.

[2] See the public report `http://www.pref.nara.jp/secure/53597/30matome.pdf` (in Japanese) from the Nara prefecture in Japan, suggesting savings as a potential anti-risk factor.

suggest that the following suicide risk and anti-risk factors exist in Japan. For males, the balance of current and lagged savings and lagged real-estate liabilities are considered anti-risk factors, whereas widowed status and the balance of lagged non-estate liabilities are considered risk factors. For females, the current balance of payments for life insurance premiums and the female current unemployment rate are anti-risk factors. Moreover, these anti-risk factors for females are weak risk factors for males, suggesting interesting differences and inter-dependences of suicide risk between males and females in Japan.

2. A Review of Recent Literature

Studies by Sugano and Matsuki (2014) and Koo and Cox (2008) are pure cross-sectional and time-series analyses of (or inspired by) Japanese suicide epidemics. Unfortunately, the one-way nature of their data hinders complete elimination of municipal fixed effects or time effects. Nishiyama (2010) and Matsubayashi and Ueda (2013) apply static panel regression models to Japanese prefecture data and suggest that livelihood protection, public investment, unemployment benefits, and urbanization are anti-risk factors, whereas the unemployment rate is a risk factor for males. On the other hand, the birthrate and female labor force participation are risk factors for females. Kuroki (2014) applies a simple ordinary least squares (OLS) method to the Japanese prefecture data from the same source as ours and suggests that the sex ratio is a risk factor for males. Smith, Mercy and Conn (1988), Classen and Dunn (2012) and Daly, Wilson and Johnson (2013) suggest that non-married status, unemployment duration of 15-26 weeks, and others' income, respectively, are risk factors for Americans. They respectively use gender and age aggregates, state-level monthly panel data, and individual-level data. On the other hand, Lang (2013) reveals the anti-risk nature of the insurance company's mandatory benefit for mental health by using a difference-in-differences method. Johansson et al. (1997), Smits, Keij-Deerenberg and Westert (2005) and Breuer (2015) respectively imply the following risk factors: living in rented flats for Swedish females, clustering in a lower social status for Dutch males, and unemployment for Europeans. We employ some of these in our empirical model.

Yip and Chen (2014) document a surge of suicide risk among the life-insured immediately after the exemption period. Choi, Chen and Sawada (2015) suggest a causal link between suicide risk and life insurance demand by instrumenting the latter using variations of suicide exemption periods and of market shares of foreign insurance companies among OECD countries. Our study is a rare attempt to examine how the balance of payments for life insurance premiums and municipal suicide rates correlate and how these differ across genders.

Neumayer (2004), Minoiu and Andrés (2008) and Bussu, Detotto and Sterzi (2013) adopt dynamic panel regressions and respectively suggest that unemployment rates (anti-risk in Germany), public welfare spending (anti-risk in the United States), and social conformity (risk in Italy) have explanatory powers. Our study differs from these studies on the following points: (a) we include more socioeconomic variables, e.g., savings, life insurance, liabilities, single and widowed status; (b) we employ a finer geographic segmentation of the whole country; (b) we remove regional fixed effects by forward orthogonal deviation; (d) we include both current and lagged variables instead of selecting either one arbitrarily; and (e) we address the potential endogeneity of economic variables. The aforementioned studies do not account for all of these simultaneously.

3. Materials and Methods

3.1. Variables

The municipal suicide data in this study are sourced from the Regional Statistics of Suicide Deaths for Suicide Prevention (henceforth Regional Statistics).[3] They are based on the mortality records found in the vital statistics, covering all cases of births, deaths, marriages and divorce of legal residents reported to local governments. Our data contain six periods: (i) 1983-1987, (ii) 1988-1992, (iii) 1993-1997, (iv) 1998-2002, (v) 2003-2007, and (vi) 2008-2012. In each period, the suicide numbers are aggregated separately for males and females over the age of nine. There are three types of suicide measures in our data: crude suicide rates, age-adjusted suicide rates, and standardized suicide mortality ratios. The last two measures are based on the 1985 standard population data for Japan to fairly compare municipalities with different age distributions. All three measures in the Regional Statistics have already been filtered by an empirical Bayesian method to deal with excess variations of ratios due to a smaller-sized population in the denominator. The regional municipality boundaries in Regional Statistics generally align with the boundaries as of March 31, 2013. Our original data have 1,818 municipalities with regional codes beginning with the prefecture number 1-47, followed by a three-digit municipal number.

We retrieve municipal socioeconomic information from the National Survey of Family Income and Expenditure ("NSFIE") and demographic information from the Population Census (henceforth Census). We adopt 6-11 waves of the NSFIE data surveyed from September-November of the years 1984, 1989, 1994, 1999, 2004, and 2009, and 13-19 waves of the Census data surveyed on October 1 of the years 1985, 1990, 1995, 2000, 2005, and 2010. The NSFIE covers over 50,000 multiple-membered households across all cities and many towns and villages. The Census covers all municipalities.

We select the following variables from the NSFIE: "income" for the annual income, "saving", "lifeins", "hloan", and "debt" for the current balances of savings, payments for life insurance premiums, real-estate liabilities, and non-estate liabilities, respectively; and "hown"

[3] This dataset is open to the public on the website of the Center for Suicide Prevention in Tokyo, Japan: see `http://ikiru.ncnp.go.jp/toukei/index.html`, accessed on April 1, 2015.

for the fraction of house-owning households per all surveyed households. The annual income is based on September-October surveys, whenever possible; alternatively, November surveys with similar information are used. From the Census, we extract the number of unemployed individuals in the labor force, older than 14, who had no job but were able to work and were seeking work during the week before October 1 of the survey year. Then, we divide this number by the size of the corresponding labor force to arrive at the municipal unemployment rate ("mue" for males and "fue" for females). Similarly, we assess the number of middle-aged individuals (aged 50-64) and those of old age (in their 80s) for each gender ("mmid" and "mold", respectively, for males; "fmid" and "fold", respectively, for females); and infants aged below 10 ("inf"). Finally, we assess the fraction of people that are divorced, widowed or single ("div", "wid", "single", respectively) by the numbers of such people according to their working ages (15-64) in relation to the entire population.

We match the non-suicidal variables of a particular wave against the suicide data in the overlapping wave. For instance, the variables in the 1984 NSFIE and 1985 Census are matched against the 1983-1987 suicide data. The matched data cover from 1025-1088 municipalities in each wave. We reaggregate the non-suicidal variables retrospectively, according to the regional segmentation in the suicide data. For instance, the municipality with code 2307 was created on March 28, 2005 by merging smaller municipalities with codes 2302, 2305, and 2306. Therefore, the 1999 NSFIE and 2000 Census data for these smaller municipalities are aggregated within code 2307, according to the segmentation of suicide data as of March 31, 2013. The total number of observations in the final sample of the unbalanced panel data is 5,401. Figure 3 displays the histograms of the suicide rates of 1,818 municipalities in the original sample, superimposed by those in the final sample. The histograms show that the final sample misses municipalities of medium suicide risk, whereas it contains most of the municipalities with the highest suicide risk. Table 1 collects the descriptive statistics of variables in the natural log scale, indicating that all variables have sufficient variations over the entire sample.

3.2. A Dynamic Panel Regression Model

We have already suggested several features that our empirical model should capture: (i) time effects for the surge of suicide rates after 1997, (ii) municipal fixed effects representing the geographic "hot" spots, (iii) aging and population sparsity as time-varying regional risk factors, (iv) persistence of suicide risk, and (v) controls. The dynamic panel approach serves well to incorporate all of them:

$$\ln SR_{it} = \gamma \ln SR_{i,t-1} + \theta' \ln x_{it} + \alpha_i + \delta_t + \epsilon_{it}. \tag{1}$$

SR is either crude, age-adjusted or standardized suicide rate, for males or females separately.

x_{it} is the vector of covariates for both genders, and for both current and lagged variables. α_i is the municipality-i fixed effect. It may correlate with $\ln SR_{i,t-1}$ and $\ln x_{it}$, hence we employ the fixed effect approach rather than random effect approach. Note that the pretest bias prevents us from applying a Hausman test of whether included regressors are exogenous or not.[4] δ_t is the wave-t time dummy with its coefficient. ϵ_{it} is the idiosyncratic error without serial correlation, as justified by including the lagged dependent variable and the time effect. The demographic variables are strictly exogenous controls. The lagged dependent variable in the right hand side accounts for (i) a parsimonious representation of an infinite distributed lag (IDL) model (Neumayer, 2004, (4)), and (ii) "suicide contagion", induced by media reporting of suicide, the tendency for similar individuals to preferentially associate with one another interacted with shared life stress, or exposure to a suicidal peer (Gould and Lake, 2013). The second feature is especially important for our municipality-level study because a suicide incidence may be covered by local news media even though the victim may not be a pop star, or transmitted through a local social network of those in a similar living environment, and may trigger another suicide.

We estimate (1) using OLS and fixed effect panel regression (FE) given $\gamma = 0$ purely as classical benchmarks, and using difference GMM and system GMM dynamic panel methods, given strict exogeneity of economic variables (D.GMM and S.GMM), and given endogeneity of the current economic variables (D.GMMe and S.GMMe). A similar instrumenting strategy is employed for the endogenous economic variables as for the lagged dependent variable (Roodman, 2009, p.112). We use the forward orthogonal deviation for any GMM procedures to eliminate municipal fixed effects. This may prove better than within transformation or differencing (Hayakawa, 2009) and avoids the loss of data in our unbalanced panel (Roodman, 2009, p.104). The standard errors are heteroskedasticity and autocorrelation consistent (HAC), with Windmeijer's (2005) correction additionally used for GMM-based procedures. "a,b,c" on the estimates indicate significance at the 1%, 5%, and 10% levels, respectively; whereas "†" means insignificance at the 10% level. To conserve space, we only report the results for crude suicide rates, but other types of suicide rates produce parallel results.[5] For a particular estimation method and gender, we call a coefficient as, for example, "(almost) uniform risk factors", if it is significantly positive at the 10% level for (two) all types of suicide rates.

[4] In fact, Guggenberger (2010) proves that the statistical size of inference in the second stage after the selection of either a fixed effect or random effect model in the first stage is severely distorted upwardly, so that we tend to reject the null hypothesis of insignificance of regression coefficients more often than desired. He recommends that we should (i) never use a Hausman pretest, and (ii) stick to the fixed effect framework, in order for the associated t-test to achieve a correct size both in the limit and in finite samples.

[5] See `http://www3.grips.ac.jp/~s-ikeda/municipalitysuicide_supplementary.pdf` for Tables 2 to 7 in the supplementary file.

4. Results

Three male-specific characteristics can be seen in Table 1. First, the significance of several economic variables using OLS disappears from the FE and D.GMM. This warns against the correlation-based search for suicide factors without controlling regional characteristics (cf., Footnote 2). Second, S.GMM passes the overidentifying tests whereas the other GMMs fail. This well-diagnosed S.GMM suggests that the balance of current and lagged saving and lagged real-estate liabilities are uniform anti-risk factors, whereas the fraction of widowed people and the balance of lagged non-estate liabilities are uniform risk factors. Third, the positive estimates on the current male unemployment rate and lagged balance of payments for life insurance premiums are consistent with (but less salient than) the results in the previous studies cited in Section 2.

Table 2 highlights three female-specific characteristics. First, economic variables for females are less significant than those for males in general. Second, the D.GMMe passes the diagnostic tests but other GMM methods fail, especially regarding GMM instruments for the level equation. This well-diagnosed D.GMMe indicates that the current balance of payments for life insurance premiums and the current female unemployment rate are almost uniform anti-risk factors, as opposed to the case for males. Third, the current fraction of divorced people may not be significant.

Some factors may be gender-free. For instance, the fractions of middle-age males and females may be uniform risk and anti-risk factors, respectively, regardless of gender. This is intuitive given the spread of suicide risk between males and females, especially in middle age, as Figure 1 suggests, and is consistent with Kuroki (2014). The mean reversion of many demographic variables may be another gender-free feature, i.e., the opposite signs of the estimates for current and lagged variables. This result indicates that even these demographic variables may have dynamic impacts on suicide risk and suggest the importance of including current and lagged variables simultaneously. Some coefficients for the current and lagged regressors have the same signs and similar magnitudes, defying the possibility that the log suicide rate may follow a static panel regression model with autocorrelated unobserved heterogeneity (cf., Blundell and Bond, 1998, p.117).

5. Discussions and Robustness

Savings is an intuitive anti-risk factor as it is partly driven by a precautionary stance, and it helps alleviate poverty (e.g., Linardi and Tanaka, 2013). Nevertheless, it is missing from previous socioeconomic analyses of suicide risk, including Chen et al.'s (2008) comprehensive survey. Note that our claim is justified by the S.GMM-based results and therefore is more robust than the correlation-based ones (cf., Footnote-2). The anti-risk nature of the balance of lagged real-estate liabilities seems unlikely. However, this may be capturing the effect of reduced liabilities after five years of loan payments as Japanese households usually rely on housing loans and the remaining borrowing is counted in the "hloan" variable. The uniformly risky nature of widowed status and balance of non-estate liabilities is intuitive and consistent with Smith et al. (1988) and Chen, Choi and Sawada (2010).

Our results also present novel information around gender differences. First, the current balance of payments for life insurance premiums is a weak risk factor for males but almost uniform anti-risk factors for females. This contrast may arise from the fact that wives are typically recipients of their husbands' life insurance policies. Therefore, a husband's suicide for any reason may exogenously endow a large amount of money to his wife. This possibility should be examined in a future study. Second, the negative association between female suicide risk and the unemployment rate is less intuitive, as it contrasts with the case of males and is inconsistent with Breuer (2015). There are two potential explanations. First, the aforementioned negative association may be because quitting a job may reduce females' stress from work or reflect new eligibility of single mothers for better welfare programs. Second, it may stem from a positive association between female suicide risk and the size of the female labor force in the denominator of the unemployment rate (e.g., the progress of female labor force participation may induce females to accept male-like ways of thinking, including a higher propensity to commit suicide).

To distinguish between these two explanations, we separate the number of unemployed females and the size of the female labor force in our dynamic panel model. Table 5 reports the estimates for these separate variables, whose ratios define "fue" variables in the previous model. The table suggests that both the number of unemployed females and the size of the female labor force negatively correlate with suicide risk, favoring the first explanation and defying the second one. This result has an implication for female labor issues in Japan: females should be encouraged to participate in the labor force to reduce their suicide risk, but a separate treatment is needed for reducing female employee's stress in the workplace.

The significance of the AR_2 test of differenced residuals from the D.GMMe raises a concern about the validity of instruments for female suicide rates. To reduce this concern, we modify the D.GMMe and S.GMMe by skipping the immediate lags of endogenous economic variables as instruments (D.GMMm and S.GMMm, respectively). Table 6 suggests that these modified versions pass all diagnostic tests and produce results almost parallel to before. The notable exception is the estimate on the current divorce rate, which turns from negative in Table 3c to positive in Table 6c. This is distinct from the FE-based negative association between female suicide risk and divorce rate as indicated by Nishiyama (2010) and our Table 2 results. This distinction suggests the importance of using an efficient estimation technique, such as a dynamic panel method rather than an OLS or FE method, as well as addressing the potential endogeneity of economic variables in searching for suicide factors, even among demographic variables.

6. Concluding Remarks

We constructed a regional panel dataset spanning the period 1984-2012 and covering about 1,000 municipalities in Japan and applied a careful treatment of the regional fixed effects, time effects, persistence of suicide risk, and potential endogeneity of economic variables. The results indicate that (a) the removal of regional fixed effects and time effects is necessary but not sufficient for a robust analysis of suicide risk in Japan, (b) the balance of lagged and current savings and lagged real-estate liabilities are anti-risk factors for Japanese males, whereas widowed status and non-estate liabilities are risk factors for them, and (c) the balance of payments for life insurance premiums and the unemployment rate for the same gender are weak risk factors for males but significant anti-risk factors for females. The last point raises a future research question about the difference and interdependence of suicide risk across genders.

There are several limitations to this study. The size of the matched data is largely determined by the coverage of municipalities in the NSFIE. Because the NSFIE is intended to provide the big picture of the purchasing power of households in Japan, it may systematically miss municipalities with small economic potential. Moreover, it is totally voluntary for households to respond to the NSFIE. Both rich and poor households have less incentive to respond to the NSFIE due to the high opportunity costs, incurring another bias in the sample toward middle-income households. Measurement errors, as is typical in any survey data, may exaggerate this bias. To overcome these issues in the future, we may need to utilize clean and credible exogenous variations in socioeconomic variables due to, for example, natural disasters.

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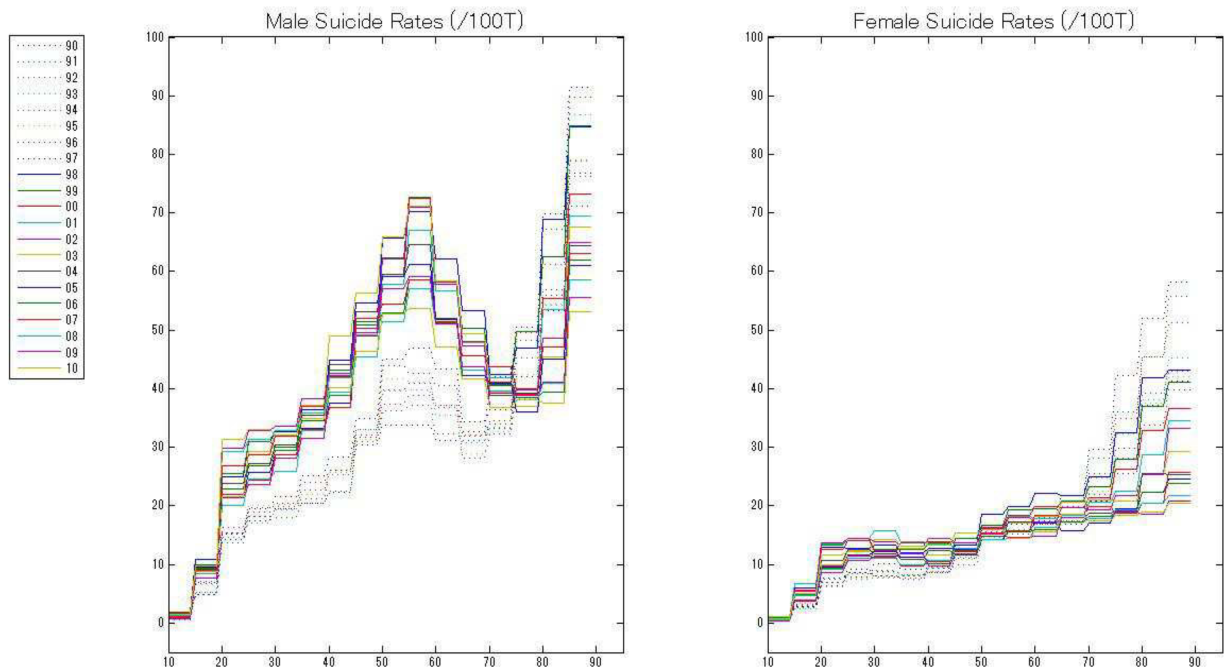
Figure 1: The age pattern of suicide rates of Japanese males (left) and females (right), 1990-2010.



Notes. The dotted curves represent the rates before 1998, and the real curves are in and after 1998. Male suicide rates show a clear N-shaped pattern and the surge after 1998.

Figure 2: The regional pattern of suicide rates for males (top) and females (bottom).

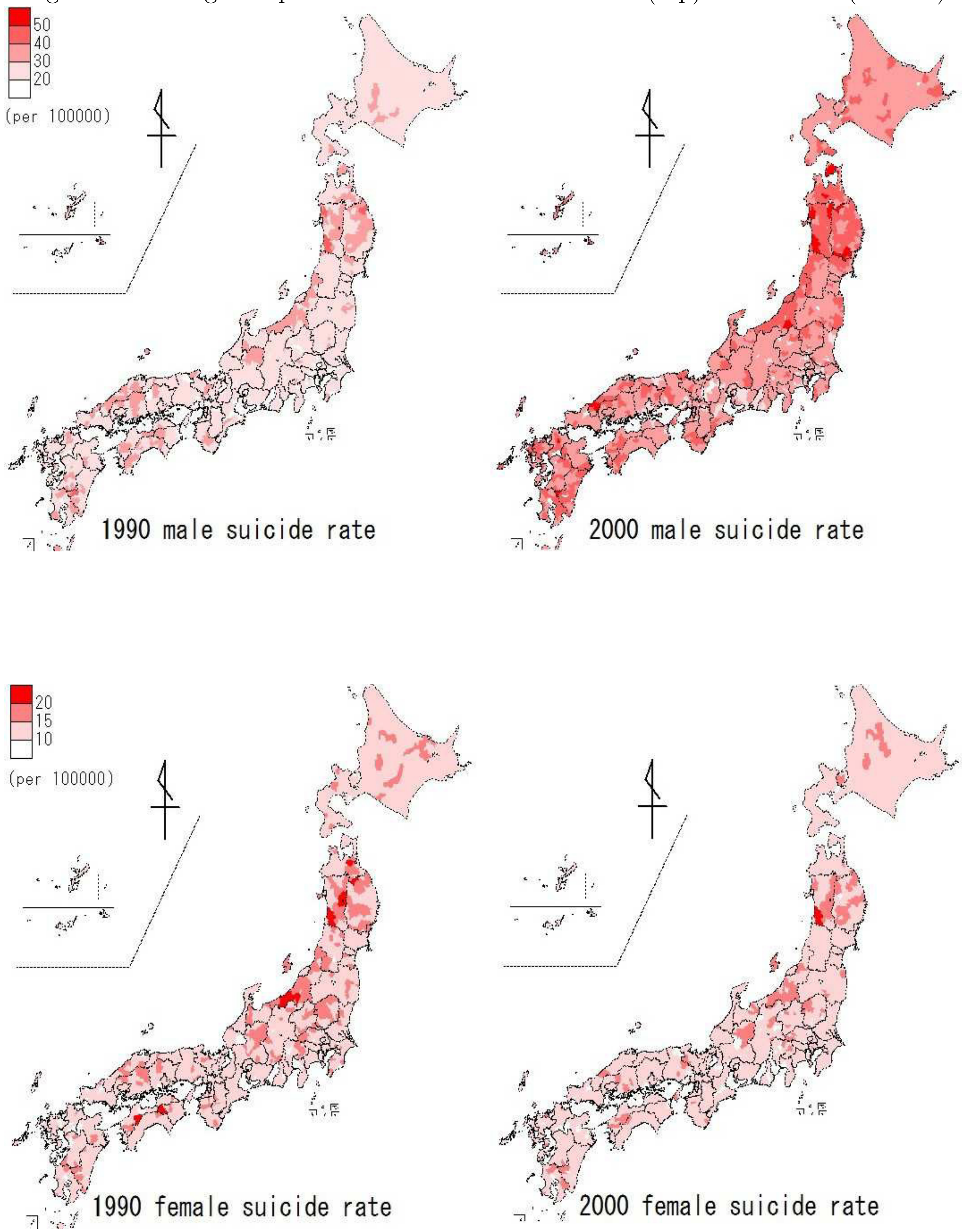
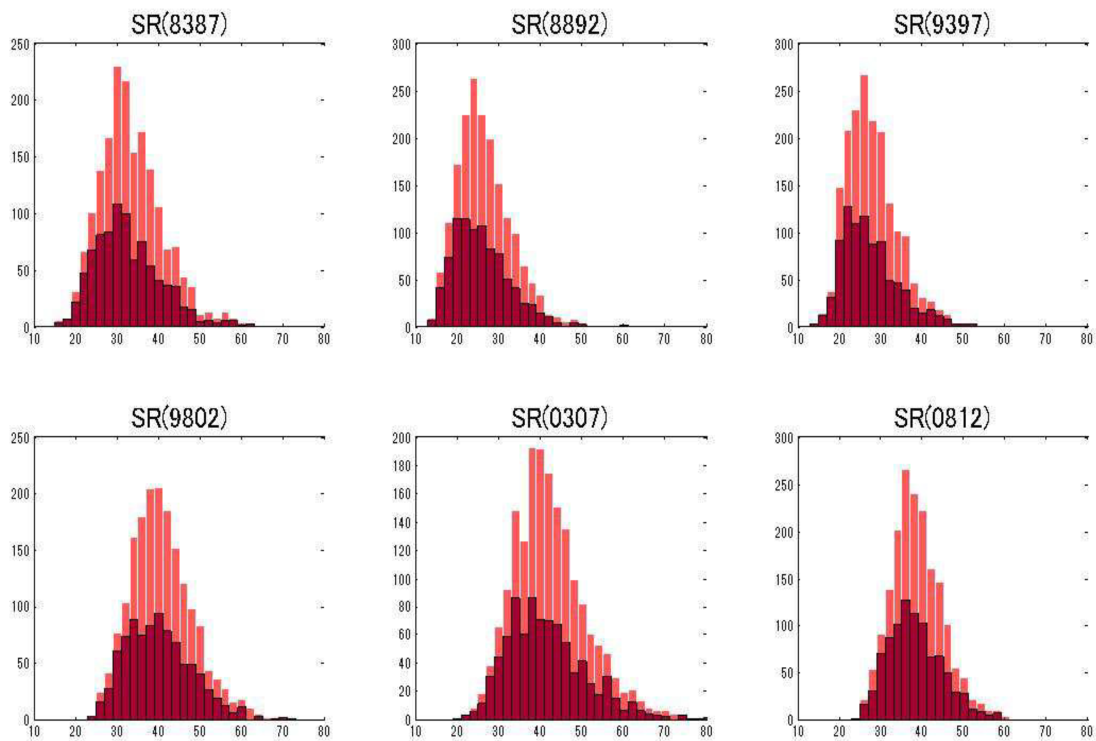


Figure 3: The histograms of the male suicide rats of the municipalities in the Regional Statistics and of those covered in the final sample



Notes. The light red bars describe the histograms of the original data in the Regional Statistics, while darker bars represent those covered by the final sample matched against the NSFIE.

Table 1: Descriptive Statistics of Variables.

variables	mean	stdev	skew	kurt	min	max
mSR1	3.499	0.294	-0.157	2.769	2.398	4.637
mSR2	3.446	0.224	-0.261	2.645	2.674	4.251
mSR3	4.620	0.202	0.291	3.237	3.791	5.442
fSR1	2.666	0.235	0.384	3.916	1.629	3.664
fSR2	2.539	0.176	0.295	3.602	1.988	3.336
fSR3	4.601	0.191	0.415	4.045	3.777	5.474
income	8.795	0.226	-0.294	3.490	7.795	9.801
saving	9.328	0.480	-0.555	3.345	7.231	10.776
lifeins	7.936	0.548	-0.644	3.220	5.094	9.530
debt	8.183	0.647	-0.555	4.146	4.500	10.574
hloan	7.962	0.749	-0.872	5.156	3.091	10.573
hown	4.388	0.234	-2.919	21.477	1.099	4.605
mue	1.550	0.460	-0.076	2.779	-0.249	3.323
fue	1.214	0.467	-0.515	3.094	-0.712	2.734
mmid	-1.602	0.154	-0.836	4.082	-2.376	-1.116
mold	-3.762	0.559	-0.129	2.759	-5.507	-1.946
fmid	-1.613	0.140	-1.097	4.925	-2.376	-1.194
fold	-3.193	0.545	-0.185	2.707	-4.865	-1.628
infant	-2.299	0.210	-0.113	3.166	-3.333	-1.502
single	-1.422	0.188	0.041	2.772	-2.034	-0.831
mar	-0.721	0.143	-0.473	2.971	-1.537	-0.381
wid	-4.078	0.298	0.167	2.732	-5.052	-3.164
div	-3.660	0.371	-0.197	2.711	-4.969	-2.338
dense	6.451	1.598	0.231	2.203	1.805	9.971
mUE	6.968	1.061	0.045	2.873	3.135	10.019
fUE	6.274	1.139	0.032	2.831	2.079	9.500
mLF	10.023	0.961	0.153	2.906	6.773	12.834
fLF	9.665	0.925	0.154	3.063	6.229	12.435

Notes. This table reports the summary statistics of all variables in this study. mean, stdev, skew, kurt, min and max columns show the sample means, standard deviations, skewnesses, kurtoses, minimum and maximum numbers, respectively, over the entire matched unbalanced panel data. mSRa and fSRa are male and female crude suicide rates ($a = 1$), age-adjusted suicide rates ($a = 2$), and standardized suicide mortality ratios ($a = 3$). mUE and mLF are the number of the unemployed males and the size of the male labor force; similarly for fUE and fLF. Their ratios define mue and fue. All variables are in the natural log scale.

Table 2a: Male Suicide Rates vs. Economic Variables.

	OLS	FE	D.GMM	D.GMMe	S.GMM	S.GMMe
income	0.035	0.018	**0.050**[c]	0.099	**0.051**[c]	**0.243**[b]
	(0.022)	(0.021)	(0.028)	(0.106)	(0.030)	(0.099)
L.income	0.030	0.015	0.022	-0.013	0.038	0.055
	(0.024)	(0.020)	(0.027)	(0.079)	(0.029)	(0.036)
saving	**-0.065**[a]	0.012	0.010	-0.028	**-0.057**[a]	**-0.179**[a]
	(0.012)	(0.012)	(0.016)	(0.068)	(0.016)	(0.055)
L.saving	**-0.102**[a]	-0.019	-0.010	-0.009	**-0.086**[a]	-0.029
	(0.012)	(0.012)	(0.017)	(0.018)	(0.014)	(0.018)
hown	0.014	0.002	0.018	-0.014	0.031	0.063
	(0.015)	(0.015)	(0.018)	(0.078)	(0.024)	(0.077)
L.hown	0.019	0.006	0.013	0.010	0.034	-0.005
	(0.015)	(0.016)	(0.022)	(0.023)	(0.023)	(0.024)
lifeins	**0.019**[c]	-0.007	-0.015	-0.044	0.016	0.036
	(0.010)	(0.010)	(0.014)	(0.064)	(0.010)	(0.054)
L.lifeins	**0.028**[b]	0.003	-0.005	-0.001	**0.023**[b]	0.007
	(0.011)	(0.010)	(0.013)	(0.015)	(0.011)	(0.014)
debt	0.009	-0.008	-0.019	-0.005	0.004	-0.040
	(0.014)	(0.012)	(0.016)	(0.069)	(0.012)	(0.067)
L.debt	**0.047**[a]	0.017	0.021	0.015	**0.039**[a]	**0.026**[c]
	(0.013)	(0.012)	(0.018)	(0.017)	(0.013)	(0.016)
hloan	-0.011	0.013	**0.025**[c]	0.002	-0.007	0.012
	(0.012)	(0.011)	(0.015)	(0.060)	(0.011)	(0.058)
L.hloan	**-0.036**[a]	-0.004	-0.010	-0.010	**-0.030**[b]	-0.015
	(0.012)	(0.011)	(0.016)	(0.017)	(0.012)	(0.015)
mue	0.032	**0.052**[c]	0.022	**0.176**[c]	**0.104**[c]	**0.205**[b]
	(0.030)	(0.028)	(0.042)	(0.093)	(0.059)	(0.084)
L.mue	**-0.054**[c]	-0.033	**-0.086**[c]	**-0.105**[c]	-0.037	**-0.106**[c]
	(0.028)	(0.032)	(0.047)	(0.055)	(0.029)	(0.057)
fue	0.046	**0.056**[c]	**0.157**[a]	0.034	-0.008	-0.149
	(0.031)	(0.030)	(0.056)	(0.113)	(0.052)	(0.104)
L.fue	-0.041	-0.024	-0.005	-0.051	**-0.079**[c]	-0.006
	(0.028)	(0.029)	(0.041)	(0.062)	(0.042)	(0.059)

Notes. The table shows the estimates based on ordinary least squares (OLS), fixed-effect static panel (FE), difference-GMM (Arellano and Bond, 1991) treating the economic variables as exogenous (D.GMM) and endogenous (D.GMMe), and system-GMM (Blundell and Bond, 1998) treating the economic variables as exogenous (S.GMM) and endogenous (S.GMMe). a, b, c on the estimates indicate their significance at the 1%, 5%, and10% levels, respectively, according to two-sided t-tests based on parenthesized HAC standard errors for OLS and FE and two-step HAC standard errors with Windmeijer's small-sample corrections additionally used for GMMs. Estimates in bold font are significant at the 10% level. The underlined "S.GMM" indicates its passage of the diagnostic tests in Table 2c.

Table 2b: Male Suicide Rates vs. Demographic Variables (1).

	OLS	FE	D.GMM	D.GMMe	<u>S.GMM</u>	S.GMMe
dense	**-0.178**^{b}	0.041	-0.221	-0.070	**-0.305**^{c}	**-0.218**^{b}
	(0.079)	(0.114)	(0.170)	(0.120)	(0.164)	(0.106)
L.dense	**0.146**^{c}	0.134	-0.025	0.088	**0.268**^{c}	**0.190**^{c}
	(0.079)	(0.101)	(0.159)	(0.120)	(0.158)	(0.105)
mmid	**0.765**^{a}	-0.055	-0.260	**-0.278**^{c}	**0.552**^{a}	0.237
	(0.131)	(0.130)	(0.177)	(0.162)	(0.173)	(0.168)
L.mmid	**-0.343**^{b}	-0.035	-0.022	0.084	-0.090	0.058
	(0.135)	(0.130)	(0.180)	(0.165)	(0.174)	(0.167)
mold	-0.033	0.072	-0.058	0.021	0.281	-0.011
	(0.051)	(0.053)	(0.282)	(0.132)	(0.303)	(0.112)
L.mold	**-0.124**^{b}	-0.031	**0.885**^{b}	**0.322**^{b}	0.306	**0.387**^{a}
	(0.052)	(0.053)	(0.348)	(0.139)	(0.467)	(0.124)
fmid	**-1.031**^{a}	0.061	0.114	0.209	**-0.734**^{a}	**-0.631**^{a}
	(0.141)	(0.147)	(0.233)	(0.171)	(0.200)	(0.192)
L.fmid	**0.767**^{a}	0.116	0.345	0.050	0.271	**0.260**^{c}
	(0.132)	(0.140)	(0.287)	(0.182)	(0.235)	(0.147)
fold	**0.236**^{a}	-0.008	0.419	0.087	-0.533	0.319
	(0.067)	(0.066)	(0.790)	(0.337)	(0.846)	(0.279)
L.fold	0.018	-0.006	**-1.923**^{b}	**-0.687**^{b}	-0.139	**-0.715**^{a}
	(0.054)	(0.057)	(0.783)	(0.267)	(0.661)	(0.217)
infant	-0.066	**-0.190**^{b}	0.002	-0.136	-0.108	-0.049
	(0.076)	(0.085)	(0.185)	(0.108)	(0.139)	(0.093)
L.infant	0.055	0.012	-0.200	-0.029	0.102	0.098
	(0.082)	(0.092)	(0.152)	(0.106)	(0.104)	(0.095)

Notes. income for the annual income; saving, lifeins, debt, and hloan for the current balance of savings, payments for life insurance premiums, non-estate and real-estate liabilities, respectively; and hown for the fraction of home-owning households. mue and fue are the male and female unemployment rates. dense is the size of population per square kilometer of municipal area. mmid, mold, fmid, fold are the fractions of middle aged males and females (50-64), old-age males and females (80-89). infants, single, wid, and div are the fractions of individuals who are infant (<10), never-married, widowed, and divorced to the corresponding population in municipality. Y's are the wave dummies. All variables with "L." indicate their first-wave lags. Therefore, L.SR represents the lagged suicide rate (in natural log).

Table 2c: Male Suicide Rates vs. Demographic Variables (2).

	OLS	FE	D.GMM	D.GMMe	S.GMM	S.GMMe
single	-0.173	**-0.410**[a]	**-0.402**[b]	**-0.417**[a]	**-0.259**[c]	-0.194
	(0.110)	(0.124)	(0.183)	(0.145)	(0.146)	(0.129)
L.single	**0.294**[a]	0.069	0.097	0.083	**0.412**[a]	**0.362**[a]
	(0.106)	(0.112)	(0.193)	(0.137)	(0.138)	(0.134)
wid	**0.163**[b]	0.105	0.140	0.076	**0.144**[b]	**0.152**[b]
	(0.065)	(0.066)	(0.086)	(0.079)	(0.064)	(0.076)
L.wid	**0.157**[b]	0.022	0.142	0.110	**0.290**[c]	**0.253**[a]
	(0.065)	(0.067)	(0.099)	(0.073)	(0.152)	(0.073)
div	0.091	**-0.085**[c]	**-0.160**[b]	-0.112	0.095	0.074
	(0.058)	(0.050)	(0.077)	(0.068)	(0.067)	(0.070)
L.div	0.055	0.004	0.110	0.077	0.046	0.094
	(0.052)	(0.049)	(0.073)	(0.058)	(0.060)	(0.058)
Y95	0.023	0.016	**0.224**[a]	**0.102**[b]	0.120	**0.109**[b]
	(0.019)	(0.024)	(0.079)	(0.051)	(0.094)	(0.047)
Y00	**0.432**[a]	**0.420**[a]	**0.899**[a]	**0.647**[a]	**0.602**[a]	**0.609**[a]
	(0.025)	(0.042)	(0.171)	(0.073)	(0.175)	(0.052)
Y05	**0.414**[a]	**0.431**[a]	**1.032**[a]	**0.692**[a]	**0.652**[b]	**0.618**[a]
	(0.035)	(0.061)	(0.249)	(0.110)	(0.258)	(0.082)
Y10	**0.361**[a]	**0.364**[a]	**1.135**[a]	**0.689**[a]	**0.615**[b]	**0.600**[a]
	(0.042)	(0.082)	(0.312)	(0.136)	(0.297)	(0.101)
L.SR			0.111	0.058	0.050	**0.118**[a]
			(0.108)	(0.040)	(0.036)	(0.032)
N	4079	4079	3107	3107	4079	4079
$Adj.R^2/J$	0.733	0.790	b	a	†	a
(AR_1,AR_2)			(a,†)	(a,†)	(a,†)	(a,†)
(J_{demo}, C_{eco})				(a,a)		(a,b)
(J_{dif}, C_{sys})					(†,†)	(a,†)

Notes. N is the sum of the numbers of municipalities over waves. a, b, c in the last three rows suggest the significant rejection of the corresponding null hypothesis at the 1%, 5%, and 10% levels, whereas † means non-rejection at the 10% level. $Adj.R^2/J$ shows the adjusted R^2 for OLS and FE, and significance of the J-statistics for GMMs under the null of all model assumptions including the validity of instruments. (AR_1,AR_2) reports the pair of significance of the first- and second-order autocorrelations of differenced residuals. J_{demo} shows significance of J-statistics for the model excluding economic variables to validate the demographic variables, and C_{eco} is the difference between J and J_{demo} to validate the economic instruments. J_{dif} shows significance of J-statistics for the model excluding instruments for the level equation, and C_{sys} is the difference between J and J_{dif} to validate instruments for the level equation specific to S.GMM's. The ideal diagnoses are (a,†) for (AR_1,AR_2), † for J, and (†,†) for (J,C).

Table 3a: Female Suicide Rates vs. Economic Variables.

	OLS	FE	D.GMM	D.GMMe	S.GMM	S.GMMe
income	0.007	-0.007	0.007	0.156	-0.022	**0.211**^{c}
	(0.027)	(0.026)	(0.031)	(0.133)	(0.043)	(0.124)
L.income	0.006	-0.008	0.002	0.061	-0.021	-0.033
	(0.027)	(0.026)	(0.028)	(0.096)	(0.036)	(0.041)
saving	-0.019	0.007	0.007	0.121	-0.006	0.083
	(0.015)	(0.015)	(0.016)	(0.086)	(0.021)	(0.069)
L.saving	-0.011	**0.024**^{c}	0.025	0.034	0.000	0.005
	(0.014)	(0.014)	(0.016)	(0.023)	(0.016)	(0.021)
hown	0.018	0.007	0.012	0.000	-0.003	**0.151**^{c}
	(0.015)	(0.015)	(0.017)	(0.100)	(0.032)	(0.082)
L.hown	-0.009	-0.023	-0.025	-0.003	-0.033	0.013
	(0.017)	(0.017)	(0.019)	(0.026)	(0.034)	(0.023)
lifeins	-0.013	-0.022	**-0.028**^{c}	**-0.150**^{c}	-0.015	**-0.158**^{b}
	(0.013)	(0.014)	(0.015)	(0.088)	(0.013)	(0.064)
L.lifeins	-0.021	**-0.033**^{a}	**-0.033**^{b}	-0.025	-0.017	**-0.036**^{b}
	(0.013)	(0.012)	(0.014)	(0.020)	(0.013)	(0.015)
debt	-0.009	**-0.028**^{c}	**-0.030**^{c}	-0.099	-0.011	-0.086
	(0.017)	(0.016)	(0.017)	(0.091)	(0.017)	(0.081)
L.debt	-0.001	-0.011	-0.007	-0.023	-0.006	-0.001
	(0.017)	(0.018)	(0.019)	(0.026)	(0.018)	(0.022)
hloan	0.007	**0.032**^{b}	**0.037**^{b}	0.055	0.014	0.060
	(0.015)	(0.013)	(0.015)	(0.077)	(0.015)	(0.069)
L.hloan	-0.005	0.014	0.009	0.018	0.007	-0.002
	(0.015)	(0.016)	(0.016)	(0.022)	(0.017)	(0.019)
mue	-0.027	0.002	-0.007	0.034	-0.059	0.053
	(0.037)	(0.037)	(0.041)	(0.123)	(0.083)	(0.100)
L.mue	**-0.102**^{a}	-0.022	-0.047	-0.063	**-0.082**^{b}	-0.037
	(0.034)	(0.036)	(0.047)	(0.065)	(0.035)	(0.063)
fue	-0.001	**-0.078**^{b}	-0.044	**-0.261**^{c}	-0.015	**-0.307**^{a}
	(0.036)	(0.038)	(0.061)	(0.149)	(0.063)	(0.115)
L.fue	0.016	-0.025	0.004	0.049	0.053	0.029
	(0.032)	(0.034)	(0.038)	(0.076)	(0.065)	(0.070)

Notes. The table shows the estimates based on ordinary least squares (OLS), fixed-effect static panel (FE), difference-GMM (Arellano and Bond, 1991) treating the economic variables as exogenous (D.GMM) and endogenous (D.GMMe), and system-GMM (Blundell and Bond, 1998) treating the economic variables as exogenous (S.GMM) and endogenous (S.GMMe). a, b, c on the estimates indicate their significance at the 1%, 5%, and 10% levels, respectively, according to two-sided t-tests based on parenthesized HAC standard errors for OLS and FE and two-step HAC standard errors with Windmeijer's small-sample corrections additionally used for GMMs. Estimates in bold font are significant at the 10% level. The underlined "D.GMMe" indicates its passage of the diagnostic tests in Table 3c.

Table 3b: Female Suicide Rates vs. Demographic Variables (1).

	OLS	FE	D.GMM	D.GMMe	S.GMM	S.GMMe
dense	-0.092	0.070	-0.078	-0.045	0.042	-0.078
	(0.072)	(0.107)	(0.156)	(0.125)	(0.214)	(0.098)
L.dense	0.069	0.126	0.078	0.103	-0.055	0.065
	(0.072)	(0.101)	(0.135)	(0.119)	(0.204)	(0.096)
mmid	**0.846**[a]	**0.316**[b]	0.250	0.210	**0.719**[a]	**0.467**[b]
	(0.156)	(0.157)	(0.184)	(0.204)	(0.192)	(0.191)
L.mmid	**-0.407**[a]	0.093	0.083	0.248	-0.312	-0.055
	(0.149)	(0.155)	(0.172)	(0.202)	(0.226)	(0.161)
mold	**-0.129**[b]	0.005	-0.067	-0.073	-0.090	-0.159
	(0.058)	(0.061)	(0.251)	(0.162)	(0.330)	(0.126)
L.mold	-0.021	0.043	0.383	0.143	-0.605	0.134
	(0.057)	(0.060)	(0.426)	(0.175)	(0.809)	(0.146)
fmid	**-1.190**[a]	**-0.572**[a]	**-0.543**[a]	**-0.506**[b]	**-0.904**[a]	**-0.814**[a]
	(0.155)	(0.171)	(0.202)	(0.208)	(0.208)	(0.184)
L.fmid	**1.124**[a]	**0.424**[a]	**0.504**[b]	0.267	**0.949**[a]	**0.568**[a]
	(0.150)	(0.161)	(0.255)	(0.227)	(0.278)	(0.170)
fold	**0.366**[a]	0.038	0.221	0.243	0.112	0.486
	(0.079)	(0.083)	(0.715)	(0.417)	(0.927)	(0.329)
L.fold	**-0.241**[a]	-0.065	-0.797	-0.369	0.692	**-0.554**[b]
	(0.061)	(0.066)	(0.879)	(0.349)	(1.169)	(0.267)
infant	0.125	-0.091	-0.032	0.009	-0.081	0.046
	(0.086)	(0.093)	(0.182)	(0.137)	(0.213)	(0.114)
L.infant	**-0.316**[a]	**-0.221**[c]	**-0.277**[c]	-0.151	-0.153	-0.190
	(0.093)	(0.113)	(0.162)	(0.142)	(0.150)	(0.116)

Notes. income for the annual income; saving, lifeins, debt, and hloan for the current balance of savings, payments for life insurance premiums, non-estate and real-estate liabilities, respectively; and hown for the fraction of home-owning households. mue and fue are the male and female unemployment rates. dense is the size of population per square kilometer of municipal area. mmid, mold, fmid, fold are the fractions of middle aged males and females (50-64), old-age males and females (80-89). infants, single, wid, and div are the fractions of individuals who are infant (<10), never-married, widowed, and divorced to the corresponding population in municipality. Y's are the wave dummies. All variables with "L." indicate their first-wave lags. Therefore, L.SR represents the lagged suicide rate (in natural log).

Table 3c: Female Suicide Rates vs. Demographic Variables (2).

	OLS	FE	D.GMM	D.GMMe	S.GMM	S.GMMe
single	0.050	**-0.268**^{c}	-0.272	-0.245	-0.213	-0.179
	(0.130)	(0.142)	(0.175)	(0.184)	(0.212)	(0.158)
L.single	0.049	0.159	0.168	0.273	0.170	**0.328**^{b}
	(0.125)	(0.133)	(0.173)	(0.177)	(0.156)	(0.158)
wid	0.086	0.047	0.070	0.088	0.055	0.095
	(0.072)	(0.079)	(0.086)	(0.103)	(0.072)	(0.088)
L.wid	**0.147**^{b}	0.025	0.036	0.046	-0.012	0.134
	(0.072)	(0.085)	(0.115)	(0.101)	(0.218)	(0.087)
div	-0.012	**-0.130**^{b}	**-0.151**^{c}	-0.019	-0.028	**0.174**^{b}
	(0.065)	(0.064)	(0.080)	(0.089)	(0.078)	(0.081)
L.div	-0.042	**-0.146**^{b}	-0.089	**-0.163**^{b}	-0.015	-0.028
	(0.059)	(0.062)	(0.079)	(0.083)	(0.068)	(0.071)
Y95	**-0.105**^{a}	**-0.110**^{a}	-0.022	-0.012	-0.165	0.031
	(0.023)	(0.031)	(0.089)	(0.071)	(0.122)	(0.053)
Y00	**0.116**^{a}	**0.096**^{c}	0.297	**0.243**^{b}	-0.070	**0.293**^{a}
	(0.029)	(0.051)	(0.206)	(0.099)	(0.272)	(0.061)
Y05	**0.081**^{b}	0.077	0.307	**0.253**^{c}	-0.187	**0.268**^{a}
	(0.041)	(0.076)	(0.295)	(0.147)	(0.389)	(0.097)
Y10	**0.126**^{b}	0.083	0.382	**0.314**^{c}	-0.209	**0.312**^{a}
	(0.049)	(0.101)	(0.370)	(0.180)	(0.451)	(0.118)
L.SR			**0.179**^{a}	**0.148**^{a}	**0.082**^{b}	**0.176**^{a}
			(0.058)	(0.037)	(0.039)	(0.029)
N	4079	4079	3107	3107	4079	4079
$Adj.R^2/J$	0.306	0.248	†	†	a	a
(AR_1,AR_2)			(a,b)	(a,b)	(a,†)	(a,b)
(J_{demo}, C_{eco})				(†,†)		(a,b)
(J_{dif}, C_{sys})					(†,a)	(c,a)

Notes. N is the sum of the numbers of municipalities over waves. a, b, c in the last three rows suggest the significant rejection of the corresponding null hypothesis at the 1%, 5%, and 10% levels, whereas † means non-rejection at the 10% level. $Adj.R^2/J$ shows the adjusted R^2 for OLS and FE, and significance of the J-statistics for GMMs under the null of all model assumptions including the validity of instruments. (AR_1,AR_2) reports the pair of significance of the first- and second-order autocorrelations of differenced residuals. J_{demo} shows significance of J-statistics for the model excluding economic variables to validate the demographic variables, and C_{eco} is the difference between J and J_{demo} to validate the economic instruments. J_{dif} shows significance of J-statistics for the model excluding instruments for the level equation, and C_{sys} is the difference between J and J_{dif} to validate instruments for the level equation specific to S.GMM's. The ideal diagnoses are (a,†) for (AR_1,AR_2), † for J, and (†,†) for (J,C).

Table 4. Unemployed and Work-Force Population on Female Suicide Risk.

	D.GMM		D.GMMe		S.GMM		S.GMMe	
	UE	LF	UE	LF	UE	LF	UE	LF
FSR1								
mue	-0.028	-0.227	0.003	0.554	-0.110	-0.488	0.027	0.306
	(0.052)	(0.212)	(0.113)	(0.488)	(0.087)	(0.387)	(0.093)	(0.464)
L.mue	-0.041	-0.156	-0.058	**-1.018**^{b}	**-0.077**^{b}	0.255	-0.003	**-0.691**^{c}
	(0.039)	(0.167)	(0.059)	(0.448)	(0.037)	(0.355)	(0.057)	(0.420)
fue	-0.052	**0.358**^{c}	-0.114	-0.474	0.075	0.552	-0.135	-0.182
	(0.069)	(0.195)	(0.151)	(0.479)	(0.088)	(0.405)	(0.119)	(0.449)
L.fue	0.030	0.174	**0.127**^{c}	**0.954**^{b}	0.091	-0.271	0.037	**0.714**^{c}
	(0.043)	(0.159)	(0.071)	(0.438)	(0.058)	(0.392)	(0.062)	(0.408)
FSR2								
mue	-0.021	-0.190	0.037	0.045	-0.069	-0.431	0.009	-0.066
	(0.038)	(0.158)	(0.084)	(0.374)	(0.072)	(0.324)	(0.067)	(0.344)
L.mue	-0.021	-0.085	-0.050	-0.470	-0.037	0.247	-0.027	-0.138
	(0.029)	(0.118)	(0.046)	(0.338)	(0.025)	(0.290)	(0.043)	(0.311)
fue	-0.041	**0.278**^{c}	-0.118	-0.103	0.064	0.451	-0.072	0.120
	(0.049)	(0.145)	(0.116)	(0.367)	(0.073)	(0.337)	(0.087)	(0.333)
L.fue	0.011	0.099	**0.101**^{c}	0.435	0.048	-0.263	0.032	0.176
	(0.031)	(0.113)	(0.053)	(0.331)	(0.041)	(0.321)	(0.045)	(0.303)
FSR3								
mue	-0.048	-0.077	0.019	0.478	-0.041	-0.115	-0.010	0.443
	(0.048)	(0.194)	(0.104)	(0.453)	(0.079)	(0.349)	(0.084)	(0.423)
L.mue	-0.043	-0.113	-0.070	**-0.813**^{c}	**-0.068**^{b}	-0.013	-0.035	-0.529
	(0.036)	(0.152)	(0.055)	(0.415)	(0.029)	(0.316)	(0.053)	(0.380)
fue	-0.031	0.193	-0.133	-0.445	0.028	0.128	-0.076	-0.351
	(0.062)	(0.177)	(0.140)	(0.447)	(0.078)	(0.365)	(0.109)	(0.412)
L.fue	0.031	0.130	**0.131**^{b}	**0.752**^{c}	0.041	0.049	0.042	0.581
	(0.039)	(0.145)	(0.065)	(0.406)	(0.045)	(0.349)	(0.057)	(0.370)

Notes. This table shows estimates on the number of unemployed people (UE) and on the size of labor force (LF) for an appropriate gender indicated by mue or fue. FSRa represents the results for female crude suicide rates (a=1), female age-adjusted suicide rates (a=2), and female standardized suicide mortality ratios (a=3). Note that the D.GMMe-based estimates on "fue" in Table 2 are negative. If an estimate on LF is negative for females, then LF in the denominator of "fue" has a positive impact on the suicide rate through its reciprocal. They are compatible with each other only if an estimate on UE for females is strongly negative, and we indeed observe such patterns of estimates.

Table 5a: Female Suicide Rates with 2+ lags of economic variables as instruments.

	FSR1		FSR2		FSR3	
	D.GMMm	S.GMMm	D.GMMm	S.GMMm	D.GMMm	S.GMMm
income	0.059	**0.328**^{c}	-0.099	0.146	-0.003	**0.277**^{c}
	(0.234)	(0.184)	(0.169)	(0.130)	(0.208)	(0.168)
L.income	-0.030	-0.119	-0.086	-0.147	-0.132	-0.110
	(0.265)	(0.175)	(0.210)	(0.128)	(0.243)	(0.159)
saving	0.013	0.040	0.039	0.005	-0.020	-0.008
	(0.125)	(0.099)	(0.094)	(0.069)	(0.114)	(0.089)
L.saving	0.170	0.175	0.172	**0.157**^{c}	0.224	**0.207**^{b}
	(0.168)	(0.109)	(0.127)	(0.080)	(0.153)	(0.099)
hown	0.066	0.081	0.042	0.007	0.052	0.052
	(0.172)	(0.128)	(0.137)	(0.093)	(0.157)	(0.116)
L.hown	-0.183	0.110	-0.105	0.056	-0.141	0.067
	(0.180)	(0.113)	(0.138)	(0.079)	(0.172)	(0.107)
lifeins	-0.087	**-0.206**^{b}	-0.087	**-0.119**^{c}	-0.054	**-0.145**^{c}
	(0.137)	(0.086)	(0.105)	(0.061)	(0.123)	(0.078)
L.lifeins	-0.128	**-0.171**^{c}	-0.121	**-0.129**^{c}	-0.175	**-0.175**^{b}
	(0.174)	(0.096)	(0.127)	(0.069)	(0.158)	(0.088)
debt	0.018	0.051	-0.065	-0.024	-0.012	0.051
	(0.165)	(0.113)	(0.117)	(0.081)	(0.153)	(0.107)
L.debt	0.084	0.077	0.108	0.115	0.087	0.111
	(0.179)	(0.133)	(0.130)	(0.093)	(0.159)	(0.120)
hloan	-0.046	-0.063	0.021	0.000	-0.007	-0.064
	(0.132)	(0.095)	(0.093)	(0.067)	(0.121)	(0.089)
L.hloan	-0.184	-0.121	-0.163	**-0.136**^{c}	-0.160	-0.137
	(0.162)	(0.118)	(0.115)	(0.081)	(0.141)	(0.106)
mue	0.135	-0.056	0.165	0.026	0.210	0.042
	(0.237)	(0.204)	(0.188)	(0.150)	(0.234)	(0.190)
L.mue	**-0.259**^{c}	**-0.352**^{b}	-0.117	**-0.231**^{b}	**-0.245**^{c}	**-0.350**^{a}
	(0.151)	(0.138)	(0.113)	(0.100)	(0.138)	(0.128)
fue	**-0.558**^{b}	**-0.446**^{c}	**-0.430**^{b}	**-0.354**^{b}	**-0.558**^{b}	**-0.443**^{b}
	(0.261)	(0.230)	(0.206)	(0.166)	(0.259)	(0.214)
L.fue	0.258	**0.530**^{a}	0.064	**0.311**^{b}	0.253	**0.509**^{a}
	(0.255)	(0.199)	(0.184)	(0.138)	(0.231)	(0.182)

Notes. FSRa indicate the results for female suicide rates (a=1), female age-adjusted suicide rate (a=2), and female standardized suicide rates (a=3). All economic variables are assumed endogenous, and are instrumented by their second lags and onward, rather than their first lags and onward. D.GMMm and S.GMMm correspond to D.GMMe and S.GMMe in the previous tables, but modified by skipping the first order lags for instruments. Both of them pass all of the diagnostic tests, but the latter additionally passes the tests concerning the instruments in the transformed and level equations, as shown in Table 5c.

Table 5b: Female suicide rates with demographic variables (1).

	Female SR1		Female SR2		Female SR3	
	D.GMMm	S.GMMm	D.GMMm	S.GMMm	D.GMMm	S.GMMm
dense	-0.089	-0.064	-0.075	0.050	-0.106	-0.012
	(0.177)	(0.138)	(0.134)	(0.099)	(0.162)	(0.123)
L.dense	0.197	0.050	0.069	-0.053	0.068	-0.007
	(0.162)	(0.136)	(0.124)	(0.098)	(0.150)	(0.121)
mmid	0.071	**0.453**^{c}	0.073	**0.317**^{c}	0.000	0.343
	(0.339)	(0.262)	(0.257)	(0.190)	(0.311)	(0.237)
L.mmid	0.475	0.268	0.373	0.177	0.375	0.186
	(0.331)	(0.222)	(0.254)	(0.156)	(0.311)	(0.201)
mold	-0.218	**-0.386**^{b}	-0.201	**-0.321**^{b}	-0.274	**-0.422**^{b}
	(0.247)	(0.175)	(0.179)	(0.130)	(0.224)	(0.164)
L.mold	0.200	0.337	0.003	**0.264**^{c}	0.135	0.238
	(0.251)	(0.205)	(0.190)	(0.150)	(0.225)	(0.185)
fmid	**-0.577**^{c}	**-1.095**^{a}	-0.406	**-0.799**^{a}	-0.471	**-0.955**^{a}
	(0.347)	(0.252)	(0.267)	(0.175)	(0.324)	(0.224)
L.fmid	0.082	**0.652**^{a}	-0.121	**0.351**^{b}	-0.007	**0.473**^{b}
	(0.394)	(0.231)	(0.301)	(0.166)	(0.373)	(0.213)
fold	0.695	**1.346**^{a}	0.491	**0.879**^{b}	0.673	**1.239**^{a}
	(0.652)	(0.473)	(0.471)	(0.351)	(0.592)	(0.445)
L.fold	-0.685	**-1.286**^{a}	-0.253	**-0.887**^{a}	-0.604	**-1.123**^{a}
	(0.579)	(0.391)	(0.395)	(0.281)	(0.494)	(0.356)
infant	0.039	0.157	0.031	0.048	0.058	0.134
	(0.194)	(0.152)	(0.144)	(0.107)	(0.176)	(0.138)
L.infant	-0.123	-0.198	0.010	-0.141	-0.153	**-0.253**^{c}
	(0.245)	(0.166)	(0.184)	(0.116)	(0.228)	(0.152)

Table 5c: Female suicide rates with demographic variables (2).

	Female SR1		Female SR2		Female SR3	
	D.GMMm	S.GMMm	D.GMMm	S.GMMm	D.GMMm	S.GMMm
single	-0.122	0.035	-0.056	0.080	-0.006	0.113
	(0.266)	(0.207)	(0.187)	(0.142)	(0.241)	(0.184)
L.single	0.153	0.155	0.119	0.089	0.067	0.000
	(0.277)	(0.212)	(0.200)	(0.146)	(0.254)	(0.193)
wid	0.150	0.160	0.094	**0.144**^{c}	0.095	0.145
	(0.165)	(0.116)	(0.124)	(0.080)	(0.154)	(0.106)
L.wid	0.031	0.171	-0.025	0.076	-0.010	0.129
	(0.153)	(0.119)	(0.110)	(0.085)	(0.138)	(0.108)
div	0.061	**0.251**^{b}	0.081	**0.156**^{b}	0.062	**0.182**^{c}
	(0.139)	(0.108)	(0.106)	(0.076)	(0.130)	(0.099)
L.div	-0.127	-0.087	-0.124	-0.043	-0.102	-0.077
	(0.111)	(0.086)	(0.081)	(0.060)	(0.100)	(0.078)
Y95	0.109	0.109	0.030	0.029	**0.221**^{c}	**0.191**^{a}
	(0.121)	(0.078)	(0.092)	(0.055)	(0.115)	(0.073)
Y00	**0.436**^{b}	**0.390**^{a}	**0.314**^{b}	**0.305**^{a}	**0.353**^{c}	**0.276**^{a}
	(0.193)	(0.107)	(0.144)	(0.075)	(0.184)	(0.099)
Y05	**0.463**^{c}	**0.399**^{a}	0.318	**0.342**^{a}	**0.415**^{c}	**0.346**^{b}
	(0.258)	(0.153)	(0.200)	(0.107)	(0.242)	(0.140)
Y10	**0.536**^{c}	**0.459**^{b}	0.366	**0.417**^{a}	0.467	**0.418**^{b}
	(0.313)	(0.188)	(0.245)	(0.132)	(0.293)	(0.173)
L.SR	**0.148**^{b}	**0.138**^{a}	**0.133**^{c}	**0.121**^{a}	0.095	**0.134**^{a}
	(0.073)	(0.038)	(0.076)	(0.035)	(0.102)	(0.037)
N	3107	4079	3107	4079	3107	4079
J	†	†	†	†	†	†
(AR_1,AR_2)	(a,†)	(a,†)	(a,†)	(a,†)	(a,†)	(a,†)
(J_{demo}, C_{eco})	(†,†)	(†,†)	(†,†)	(†,†)	(†,†)	(†,†)
(J_{dif}, C_{sys})		(†,†)		(†,†)		(†,†)

Notes. N is the sum of the numbers of municipalities over waves. a in the third to the last row suggests the significant rejection of the corresponding null hypothesis at the 1% level, whereas † in the last four rows means non-rejection at the 10% level. J shows significance of the J-statistics under the null of all model assumptions including the validity of instruments. (AR_1,AR_2) reports the pair of significance of the first- and second-order autocorrelations of differenced residuals. J_{demo} shows significance of J-statistics for the model excluding economic variables to validate the demographic variables, and C_{eco} is the difference between J and J_{demo} to validate the economic instruments. J_{dif} shows significance of J-statistics for the model excluding instruments for the level equation, and C_{sys} is the difference between J and J_{dif} to validate the instruments for the level equation specific to S.GMM. The ideal diagnoses are (a,†) for (AR_1,AR_2), † for J, and (†,†) for (J,C).