Economic and Social Correlates of Regional Suicide Rates: A Pooled Cross-Section and Time-Series Analysis

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ABSTRACT: This paper uses a *cross-sectionally hetero scedastic* and *time-wise autoregressive* technique to examine the *pooled suicide rates* of 23 cities and counties in *Taiwan* from 1983 to 1993. A combination of *economic* and *sociological* variables were found to account for a significant proportion of the variations in suicide rates across regions and over time. Economic variables appeared to have a greater impact on regional suicide rates than sociological correlates. In particular, the level of *income per capita* in a region stood out as the most important predictor of the suicide rate. This study has also uncovered *gender differences* in the effect of some correlates on regional suicide rates, such as the proportion of the *poverty* population in the region and the presence of a local *life-line* center.

INTRODUCTION

Suicidal behavior and suicide rates have usually been studied in disciplines such as psychology and sociology. Some psychologists viewed suicide as the result of irrational behavior, while others like Freud (1917) believed suicide was the result of self-hatred which could not be resolved. Sociologist Durkheim (1897) used the notion of social integration and social regulation to demonstrate the social forces

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behind suicidal behavior. In his framework, Durkheim asserted that during times of economic prosperity and/or recession the suicide rate would increase due to less social integration and regulation.

Ever since Durkheim (1897), there have been numerous theoretical and empirical work attempting to unveil the mystery of the societal suicide rates, from either psychological, psychiatric, or sociological perspectives.[1] Research on suicide employing economic perspectives, however, has been scant (Lester & Yang, 1994), and the number of econometric studies of suicide rates is also quite limited. Among the few econometric studies, Hamermesh and Soss (1974) developed a purely economic model of individual life-time utility maximization to examine the 1970 cross-state suicide rates in the United States. They found that the income level and unemployment rate were negatively and positively related to the state suicide rates, respectively. Yang (1989, 1992) represents perhaps the first attempt to *integrate* economic and sociological approaches to studying suicide rates. Yang (1989) conducted a cross-sectional analysis of the state-level suicide rates in the United States, using 1980 Census data. Yang (1992) also conducted a time-series study of the U.S. annual suicide rates from 1940 to 1984. Both studies successfully established the linkages between societal suicide rates and some variables representing the surrounding economic and social environments. The results suggest that suicide is influenced by economic as well as social conditions, and therefore is not totally irrational and unpredictable.

The present study provides additional evidence bearing on Yang's (1992, p. 88) hypothesis that "the suicide rate of a society is the result of an *interplay* between economic and social variables." Specifically, we examined economic and social correlates of the suicide rates across 23 cities and counties in Taiwan over the period of 1983-1993. It is hoped that by following Yang's interdisciplinary approach, we can test the cross-cultural generality of Yang's "interplay hypothesis," and by comparing our results for Taiwan with Yang's (1989, 1992) for the United States, we can gain further insight into the determination of societal suicide rates in different cultural settings.

The remaining portion of the paper is organized as follows: Section II presents the conceptual framework relating suicide rates to several economic and social variables to be included in the study. Section III presents the empirical analysis, which contains a description of the data and its source, a brief discussion of econometric methodology dealing with the estimation of pooled data, and presentation and discussion of empirical findings. Section IV provides a summary and concluding remarks.

CONCEPTUAL FRAMEWORK AND RELATED VARIABLES

The basic premise of the economic model of suicide developed by Hamermesh and Soss (1974) is that an individual will commit suicide when the discounted

lifetime utility remaining to him reaches zero. From this premise they derived three determinants of suicide: income, unemployment, and age. They argued that a higher income level implies greater consumption and satisfaction and should reduce the probability of suicide, whereas unemployment lowers an individual's expectation of future income (and utilities) and would increase the probability of suicide.[2] Age was regarded as a negative element in the lifetime utility function because older age increases the maintenance cost of daily life and health. Altogether, at the aggregate level, a state or cohort's suicide rate is expected to be negatively associated with the corresponding aggregate indicator of income, and positively related to unemployment and age. These three variables are measured in the present study by, respectively, the inflation-adjusted income per capita, the unemployment rate, and the proportion of the elderly population in the city or county. Complementary to the above three variables, we also include the proportion of low income (below poverty line and in need of public assistance) population to capture another economic characteristic of the region.

The major sociological theory of suicide developed by Durkheim (1897) postulates that societal suicide rates are influenced by social integration (the degree to which members of the society are bound together in social relationships), and social regulation (the degree to which people's emotions and desires are controlled by social norms and rules). From this perspective, several social indicators are believed to have an impact on societal suicide rates and have been studied by sociologists, including divorce, fertility, female labor force participation, and migration, to which we now turn.

Divorce

Divorce is expected to lead to a reduction of social integration and regulation, as it involves disruption of family and social ties and itself is a deviation from social norms. Since divorce is viewed as a source of individual trauma that might trigger suicidal behavior, a society characterized by a high divorce rate is expected to have a higher suicide rate.[3] This variable is measured here by the proportion of individuals with divorced status in the population of the city or county. Along the same line of thought, we also include a widowhood variable (the proportion of widowed population), which represents the extent of social isolation and is expected to increase the societal suicide rate.

Fertility

Since the presence of children entails promotion of family and social ties, it increases social integration and should reduce the likelihood of suicide.[4] Fertility rate of a region is therefore expected to be negatively related to its suicide rate. Fertility is measured here by the birth rate per thousand childbearing age women in the city or county.

Female Labor Force Participation

Sociologists recognize the increasing female participation into the labor force as an important social phenomenon and argue that it would affect societal suicide rates, although the direction of its influence is not clear-cut. For one thing, women working may decrease social integration due to the possible role conflict and stress between men and women arising from participation, and thus may lead to higher suicide rates. On the other hand, women working may strengthen their social bonds and integration since labor market participation provides opportunities for women to develop themselves more fully. As a consequence of this role accumulation and expansion, societal suicide rates could be lower. Thus, the net impact of female labor force participation is theoretically indeterminate and needs to be empirically ascertained.[5] This variable is measured here by the percentage of economically active women out of the total civilian female population aged 15 and over.

Migration

Migration itself is a stressful process, and leaving friends and relatives behind also ruptures social relationships and reduces both social integration and regulation with the original community for the migrants. In addition to the uprooting pains, the move also exposes the migrants to social isolation in an unfamiliar community. All these are expected to increase the likelihood of suicide among maladjusted migrants and raise the suicide rate of a community.[6] This aspect is measured here by an in-migration rate variable (proportion of in-migrants per thousand population).

Apart from the above variables, Lester (1992) has suggested that the degree to which subgroups of a society are in the minority might affect the incidence of deviant behavior, including suicide. Also, it is commonly believed that the aboriginal people in Taiwan have a greater suicide propensity (Chang, 1988). In an attempt to capture the impact of this demographic dimension, we add a variable representing the proportion of aboriginal population into the study.

Finally, the Life-Line Association, an international suicide crisis intervention and counseling organization, has set up its regional offices in most of the cities and counties at different points of time. This provides a natural opportunity to test if the establishment and operation of a suicide crisis intervention center served to reduce suicide rates. To test the effectiveness of a life-line center, a dummy variable with 1 representing the existence and operation of such a center is included here too.

EMPIRICAL ANALYSIS

Data

Data were collected for the period 1983 to 1993 for all 23 judicial districts of Taiwan: 7 cities and 16 "hsiens" (counties). Nineteen ninety-three was chosen as the ending

year of study due to data availability, whereas 1983 was chosen as the beginning year because prior to 1983 two communities were not yet elevated to the provincial city level, and their statistical information was combined with two other counties. The data sources for the variables used in the study are as follows:

1. Suicide: from the annual issues of *Vital Statistics* published by National Bureau of Public Health, Executive Yuen. Three dependent variables (overall, male and female suicide rates) are obtained by dividing the number of suicides by the corresponding population totals age 15 and over in the region.
2. Per capita income: from the annual issues of *Report of Survey on Income Distribution*, published by Directorate-General of Budget, Accounting and Statistics. The aggregate disposable income figure for each region was divided by the corresponding year-end population to derive the income per capita variable for each cross section unit, which is further adjusted for inflation over time by the 1991-based consumer price index.
3. Whether or not the local Life-Line office is available to provide suicide intervention and assistance service in the region: from personal contact with the Taiwan headquarters of the International Life-Line Center Association.

Table 1. Overall, Male and Female Suicide Raes Per 100,000 Persons In 23 Cities and Counties, 1983-1993

	Total Suicide Rate		*Male Suicide Rate*		*Female Suicide Rate*	
Cities and Counties	*Mean*	*Standard Deviation*	*Mean*	*Standard Deviation*	*Mean*	*Standard Deviation*
Keelung City	13.20	5.78	16.60	7.38	9.46	5.20
Hsinchu City	10.62	4.69	13.69	6.26	7.29	4.22
Taichung City	8.22	2.30	10.78	3.51	5.62	1.95
Chiayi City	8.90	3.28	10.71	4.40	7.01	3.47
Tainan City	9.84	3.36	11.93	4.73	7.67	3.14
Taipei County	10.01	2.59	12.55	2.73	7.29	2.45
Ilan County	16.60	4.37	19.98	5.45	12.91	3.46
Taoyuan County	16.14	3.61	19.22	4.02	12.71	3.97
Hsinchu County	15.26	8.21	17.76	9.10	12.42	7.66
Miaoli County	16.40	4.66	17.94	4.79	14.71	4.92
Taichung County	12.11	4.44	15.43	5.37	8.55	3.60
Changhwa County	13.11	5.08	15.25	5.15	10.83	5.40
Nantou County	17.05	7.14	20.37	7.30	13.38	7.43
Yunlin County	16.24	5.14	18.33	6.12	13.92	4.35
Chiayi County	10.27	4.81	11.70	4.93	8.66	4.83
Tainan County	17.29	4.97	20.09	5.24	14.18	4.91
Kaohsiung County	14.51	2.96	17.14	3.05	11.59	3.60
Pingtung County	11.94	3.79	15.22	4.53	8.24	3.48
Taitung County	30.99	8.98	35.23	9.97	25.52	9.22
Hualien County	25.68	7.87	29.87	9.29	20.52	6.39
Penghu County	12.21	4.70	13.69	3.71	10.54	6.71
Taipei City	8.48	1.87	10.43	2.42	6.49	1.47
Kaohsiung City	8.47	1.45	9.89	1.49	7.00	1.83
Total (Taiwan)	14.07	7.19	16.69	8.05	11.15	6.58

4. All other variables: constructed from appropriate demographic and labor market information contained in the annual issues of *Taiwan-Fukien Demographic Fact Book* published by the Ministry of the Interior, Executive Yuen.

Table 1 displays the annual average of overall, male, and female suicide rates for each region and for the entire pooled sample. It can be seen that the annual average overall, male and female suicide rates for the whole country during the studying period are, respectively, 14.07, 16.69, and 11.15 per 100,000 persons 15-years-old and over. As is the case elsewhere, men tend to have higher suicide rates than women. It can also be seen from the magnitude of means that the average suicide rates varied tremendously across regions, and from standard deviations that the suicide rates also varied substantially over time in each region. Based on the conceptual framework in the preceding section, we will investigate these variations and attempt to provide some explanations. Before that, a brief discussion of methodology for empirical analysis is in order.

Empirical Methodology

The standard econometric procedure to examine variations in the dependent variable is to use the OLS (ordinary least squares) method of multiple regression. Such a method may pose a problem when applied to pooled cross-section and time-series observations, because as a result of pooling, the disturbance term may violate classical assumptions, rendering the parameter estimates inconsistent and inefficient. Several alternative procedures are available to deal with this problem,[7] depending on the assumptions of the error structure of the pooled data. A simple alternative is the fixed-effect model which assumes that pooling does not alter the error structure but results in shift of intercepts for either or both of the cross-section and time-series units. The fixed-effect model, also called the covariance model, is simple to execute because it still applies the OLS but suffers a loss of degrees of freedom from adding cross sectional and/or period dummy variables. Another alternative is the random effect (or error component) model, which assumes that the disturbance contains three components-one component associated with time, another associated with the cross-sectional units, and the third varying in both dimensions. This model is essentially a variate of the GLS (generalized least squares) method, and has a potential problem because it, while sophisticated enough to incorporate three error components, still assumes homoscedasticity and serial independence among the errors. To deal with this problem, another variate of the GLS method is often suggested, which is called a cross-sectionally heteroscedastic and time-wise autoregressive model. We initially employed the OLS method to obtain the base-line results and compared them with results obtained from the other methods mentioned above. Judging from the significance and reasonableness of the coefficient estimates, residual diagnostics, and application of specification tests,[8] we conclude that while the OLS results are reasonably good, the cross-sectionally heteroscedastic and time-wise autoregressive model (hereaf-

Table 2. Multiple Regression Results on the Suicide Rates in 23 Cities and Counties, 1983-1993

	Total Suicide Rates		*Male Suicide Rates*		*Female Suicide Rates*	
Explanatory Variables	*Standardized Coefficient*	*t Statistics*	*Standardized Coefficient*	*t Statistics*	*Standardized Coefficient*	*t Statistics*
Per Capita Income	-0.6936*	-6.67	-0.7426*	-6.77	-0.5887*	-5.67
Unemployment Rate	-0.0470	-1.18	-0.0546	-1.25	0.0186	0.40
Proportion of Elderly (>65Years) Population	0.3334*	2.89	0.1963*	2.14	0.1880	1.47
Proportion of Population in Poverty	0.1381*	2.37	0.0554	0.96	0.1485*	2.18
Proportion of Aboriginal Population	0.3772*	5.51	0.3015*	3.52	0.3217*	4.52
Proportion of Divorced in Population	-0.0623	-0.57	0.1448	1.23	0.0413	0.36
Proportion of Widowed in Population	-0.5573*	-4.58	-0.2351*	-2.65	-0.3443*	-2.38
Female Labor Force Participation Rate	-0.0935*	-2.02	0.0420	0.97	-0.0666	-1.11
In-Migration Rate	-0.2298*	-4.18	-0.1452*	-2.36	-0.1754*	-2.76
Birth Rate Per Thousand Childbearing Age Women	0.0547	0.87	0.0735	1.08	0.0899	1.25
Presence of Life-Line Center	-0.0887*	-2.12	0.0856#	-1.86	-0.1297*	-2.76
Adjusted R-Squared	0.70		0.64		0.60	

Notes: * significant at 5% level; # significant at 10% level.

ter CSHTWA model) performs the best. Hence, the estimation results from both the OLS and CSHTWA methods are reported here as Tables 2 and 3, respectively. We now turn to the discussion of these results.

Discussion of Estimation Results

In terms of the adjusted R^2s, Table 3 shows that the sophisticated CSHTWA model provides greater overall explanatory power than the OLS method, explaining at least 74% of the variation in regional suicide rates, a fairly satisfactory goodness-of-fit considering the cross sectional nature of the data. Barring few exceptions, the OLS results in Table 2 are generally in line with those in Table 3, suggesting that the OLS findings are already reliable for interpretation, and that the CSHTWA method serves to further improve the efficiency of the estimates. Thus, the following discussion of results refers to both tables, with any differences noted when applicable.

1. For the overall suicide rate, the significantly negative impact of income per capita on suicide is as expected. Since these two variables were expressed in natu-

Table 3. Multiple Regression (GLS) Results on the Suicide Rates in 23 Cities and Counties, 1983-1993 (Cross-Sectionally Heteroskedastic and Timewise Autoregressive Model)

	Total Suicide Rates		*Male Suicide Rates*		*Female Suicide Rates*	
Explanatory Variables	*Standardized Coefficient*	*t Statistics*	*Standardized Coefficient*	*t Statistics*	*Standardized Coefficient*	*t Statistics*
Per Capita Income	-0.7085*	-8.72	-0.7425*	-8.96	-0.5686*	-7.27
Unemployment Rate	0.0474	1.46	0.0637#	1.77	0.1068*	2.70
Proportion of Elderly (>65Years) Population	0.3809*	4.03	0.1944*	2.44	-0.0255	-0.27
Proportion of Population in Poverty	0.1508*	3.11	0.0284	0.62	0.0913*	1.81
Proportion of Aboriginal Population	0.3678*	6.47	0.3027*	4.40	0.2410*	4.08
Proportion of Divorced in Population	-0.1123	-1.28	0.1164	1.22	0.0069	0.08
Proportion of Widowed in Population	-0.5719*	-5.65	-0.1924*	-2.51	-0.0086	-0.08
Female Labor Force Participation Rate	-0.0802*	-1.94	0.0528	1.43	-0.0722	1.51
In-Migration Rate	-0.2003*	-4.52	-0.1385*	-2.58	-0.1331*	-2.80
Birth Rate Per Thousand Childbearing Age Women	0.0451	0.96	0.0291	0.64	-0.0006	-0.10
Presence of Life-Line Center	-0.0511	-1.50	-0.0626	-1.57	-0.1666*	-4.89
Adjusted R-Squared	0.79		0.77		0.74	

Notes: * significant at 5% level; # significant at 10% level.

ral logarithms in multiple regressions,[9] we can interpret the coefficient estimate as the income elasticity of suicide, that is, as the income per capita for a representative region increases by 1%, that region would experience about 0.7% reduction in suicides per 100,000 persons. Relatedly, the greater the proportion of low income people in the region, the higher the suicide rate. Another economic variable, unemployment rate, however, is insignificant, perhaps being dominated by the strong presence of income per capita, or perhaps due to its extremely small magnitude (mostly < 3%) and lack of variability. Consistent with Hamermesh and Soss (1974), the aging aspect (proportion of elderly population) significantly increases suicide risk in a region. This result also corroborates with other studies showing that the suicide rate tends to be higher among elderly persons.

Among the variables hypothesized to influence suicide rates from sociological perspectives, the divorce and fertility variables appear to be insignificant when other social and economic predictors are considered in the multiple regression context. Increasing female labor force participation is found to significantly reduce regional suicide rates. This implies that the society benefits from females'

role expansion through participation in the labor force more than the cost of role strain or conflict created by participation.

Contrary to the hypothesized direction of influence over suicide rate, migration and widowhood variables are significant and negative. We suspect that the in-migration rate here does not capture as much of the aspects of reduction in social integration and increase in social isolation as typically is the case in other studies. Unlike the interstate migration in the United States, the intercity or county migration in a small island country and a fairly homogeneous society like Taiwan involves only a short distance geographically, and no significant change in social milieu. Instead, a high in-migration rate could have reflected the amenity or quality of life aspect of a region, implying that such a region has many desirable attributes so as to attract the influx of migrants.[10] The consistently negative and significant impact of in-migration rate on total, male and female suicide rates in both Tables 2 and 3 strongly suggests that it has served as a proxy for the quality of life in the region. Thus, with higher quality of life or standard of living, the suicide rate would be lowered.

It is puzzling to note that a region with a greater proportion of widowed population has a significantly lower suicide rate. This anomaly, coupled with the unsatisfactory performance of the divorce variable measured in a similar way, raises some questions about the proper specification of these two social variables in the present study. In fact, as opposed to the ideal flow measure such as the percentage of married persons that lose their spouse in that year, the existing *stock* of the widowed population contains "experienced" widow(er)s who have sustained the loss of spouse for many years and may have built enough resilience from years of coping with the loss and hence have a significantly lower suicide risk than the recent victims. Unfortunately, data availability prevents us from exploring this conjecture further.[11]

As expected, the region with a greater presence of aborigines has a significantly higher suicide rate. This highlights the importance of identifying and directing suicide prevention effort toward a high risk minority group. Along the same line of suicide prevention and intervention, Table 2 shows that the regional life-line center worked to reduce the suicide rate, although the statistical significance of this variable was lowered in Table 3 after adjusting for the error structure of the pooled data.

All told, the variables conceptualized earlier to be of influence in determining regional suicide rates appear to have explained about 80% of the variation in the overall suicide rates over time and across regions. Among them, economic variables as a whole group have a stronger impact on regional suicide rates than the group of sociological correlates, with income per capita standing out as the most important predictor of suicide rate.

2. The estimation results for male suicide rates are generally similar to those for the total suicide rates. Thus, most of the findings and discussions in the above can be carried over here and need not be repeated. Some noteworthy differences

between the estimation results for overall and for male suicide rates are: (a) The male unemployment rate contributed to the male suicide rate significantly (in statistical sense—at the 10% level) but with a modest magnitude. (b) The male suicide rates were unaffected by the proportion of low income population in the region. As can be seen from both Tables 2 and 3, since this variable exerts a significant impact on the total and female suicide rates, it can be inferred that the low income households were primarily headed by females and thus this variable does not capture the misery faced by men as much as by women. To test the hypothesis that the feminization of poverty causes differential impacts of this variable on gender-specific suicide rates, we need to have a poverty variable disaggregated by sex for each region, which is unfortunately unavailable. (c) The dominant impact of per capita income on suicide rates is even more striking in the case of male suicide rates, compared to the case of overall or female suicide rates. It appears that men were most sensitive to the changes in general income condition of the region (as represented by income per capita).

3. The estimation results for female suicide rates are, again, not substantially different from those for the total or male suicide rates. Noted below are some differences in the regional pattern of female and male suicide rates that may have interesting implications of sexual differences in suicide: (a) Contrary to the male suicide rates findings, the proportion of the elderly and the widows in the female population played no significant role in affecting regional female suicide rates.[12] This is plausible because, unlike the overly individualistic Western society where the elderly and widowed are vulnerable to the onslaught of social isolation and reduction of social integration, the closely knitted family structure and traditional Chinese culture would protect the elderly and/or widowed females from those distressing circumstances. However, poverty-stricken women were vulnerable as indicated by the positive significant coefficient of the poverty variable, because this implies absence or weakness of the supporting network for women in hardship. (b) Both Tables 2 and 3 show that the presence of life-line center significantly lowered the female suicide rates. Assuming equal outreach effort by the life-line centers, it is not clear whether this reflects the fact that the distressed women were more actively seeking out help or that the agency was more effective in persuading female clients. In any case it underscores the importance of having such an agency around as an avenue for suicide reduction.

4. Finally, comparing our result with Yang's findings in the U.S. setting, some similarities and differences not yet mentioned can be noted: (a) Common to both the United States and Taiwan, the income variable was the most important predictor of the overall and male suicide rates across the states and cities/counties. While income is also the dominant predictor of Taiwan's regional female suicide rates, Yang (1988) found that U.S. females were insensitive to the income variations across states. (b) In contrast to the strong influence of divorce rate over the variation in state suicide rates in the United States, our divorce variable is insignificant throughout.

There is no telling if this represents a genuine difference in the impact of this sociological variable on suicide rates in different societies until we can specify the divorce variable in the same way in the future study. (c) Except for the overall suicide rates, female labor force participation has no significant effect on Taiwan's female or male regional suicide rates, as was the case in Yang's cross-state studies of the United States. Interestingly, in the time-series context, both Yang, et al. (1992) and Chuang and Huang (1995) found that female labor force participation significantly affected the total, male, and female suicide rates over time. Future research needs to address and reconcile these differences in findings.

SUMMARY AND CONCLUSIONS

This paper has used a cross-sectionally heteroscedastic and time-wise autoregressive technique to examine the pooled suicide rates of 23 cities and counties in Taiwan from 1983 to 1993. In support of Yang's (1992) advocacy that economics and sociology need to join force for a better understanding of the suicide rate in a society, we found a combination of economic and social variables significantly accounting for the tremendous variations in suicide rates across Taiwan's cities and counties and over time. On the whole, economic variables appeared to have greater impact on regional suicide rates than sociological correlates. In particular, the level of income per capita in a region stood out as the most important predictor of suicide rates.

This study has also uncovered a few gender differences in the determination of regional suicide rates. The proportion of male elderly significantly raised the male suicide rates, but the proportion of elderly females did not raise the female suicide rates. On the other hand, male suicide rates were not sensitive to the proportion of poor people in the region whereas female suicide rates were. Furthermore, the local suicide crisis intervention agency appeared to be especially effective in reducing female suicide rates in the region.

Inter-country comparison between our findings and Yang (1989) also revealed interesting similarities and differences. For example, the income variable dominated other economic and social correlates in accounting for variations in regional female suicide rates in Taiwan, but it was an insignificant determinant of state female suicide rates in the United States. Although some puzzling findings remain unresolved, this study demonstrates that a combined economic and sociological approach to the study of suicide rate is fruitful and is likely to generate more insights in future inquiries into suicide rates in other societies and/or other time periods.

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NOTES

1. See Lester (1992) for a comprehensive review of literature.
2. Researchers of other disciplines have also long recognized the link between unemployment and suicide. For example, Brenner (1983) argued that "the loss of a job leads to the loss of identity in the individual as a function of his work role, a severing of a fundamental link between the individual and his family to society, and a disruption of economic life. All these distresses ... are a primary source of individual trauma which may trigger suicidal behavior."
3. Divorce has long been documented to be associated with suicidal behavior; see, for example, Stack (1981).
4. The negative connection between fertility and suicide has been established by empirical evidence from, for instance, Lester and Yang (1992).
5. Empirical evidence bearing on this issue is inconclusive, depending on the time period and the society investigated. For example, Newman, et al. (1973) found a positive association between female labor force participation and suicide over census tracts in both Atlanta and Chicago, and so did Davis (1981) over time from 1950-1969 for the United States. However, Stack (1987) reported a negative association for the United States in 1948-1980, and so did Yang et al. (1992) for the United States and Taiwan in 1952-1984.
6. Taylor (1982) viewed migration as "both a structural cause of and an individual motivation for suicide." Lester's (1988) correlational study for the suicide rate and 27 other variables showed that divorce and interstate migration had the highest correlation with suicide.
7. See Kmenta (1986) for a detailed discussion on the estimation of pooled cross-section and time-series data.
8. For example, Hausman's specification test suggested selection of the fixed effects model over random effects model; the Lagrange multiplier test indicated that the fixed effect model explained more variations in the dependent variable than the simple OLS model without fixed effects; and the Akaike information criterion favors the cross-sectionally heteroscedastic and time-wise autoregressive model over the fixed effect model. The detailed test statistics for each model in the estimation of different dependent variables are available from the authors upon request.
9. The other variables are not expressed in logarithms as they were measured in percentages and a logarithmic transformation of them will generate negative values.
10. Liu (1980) and Hsieh and Liu (1983) are classical studies of the relationship between quality of life and interregional migration.
11. For future study, we are trying to obtain the ideal flow measure of divorce rate per year per region to test the conjecture that using stock or flow variables produce different results. We also suspected that multicollinearity could be the cause of this anomaly since many demographic variables were included in our regression equations. However, no discernable differences in estimation results were found from experiments of dropping the widowhood or divorce variable, or other variables of suspect, or from using some ad hoc procedures such as ridge regressions.
12. Readers may note that the widowhood variable was significant in Table 2 and would have led us to somewhat different interpretation of the results. This justifies the need of scrutinizing the simple OLS results in Table 2 with the Table 3 results from the CSHTWA model which deals with the complications of error structure resulting from pooling.

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