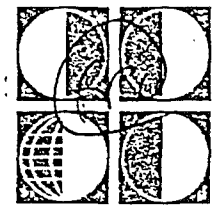
Ecological Determinants of Divorce: A Structural Approach to the Explanation of Japanese Divorce



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ABSTRACT: This paper examines the ecological determinants of contemporary Japanese divorce rates on the prefectural level. LISREL and computer-generated graphics are the analytic methods used. The aggregate level of analysis demands the use of the ecological model which posits that demographic changes, economic activities, migration patterns, and the level of urbanization are significant predictors of divorce rate. Our analysis demonstrates that sex ratio, female labor force participation, female in-migration patterns, population increase, and net household income all play a significant role in affecting the divorce rate. Our findings also confirm the well-supported hypothesis that both population density and modernization positively influence modern Japan's divorce rates. The residual analysis also points out that in order to account for the large proportion of the unexplained variance of Japanese divorce, behavioral-related variables and island- or prefecture-specific dimensions need to be included in the ecological model of divorce.

The present paper examines the ecological model and its ability to determine the variation of the divorce rate in contemporary Japan at the prefectural (regional) level. We investigate the conditions suggested by the ecological model on the variations of intra-national divorce rates (Glick, 1963).

Like other advanced nations, the industrialization of Japan, labeled since the middle 1950's as Japan's "economic miracle," has been accompanied by a number of social problems (Glickman, 1979; Shoji, 1988), including an increase in the divorce rate. Japan's divorce rate has increased by one-third in recent years (1975–88), though Japan's divorce rate is relatively low in comparison to other industrialized nations. During the late 1970's, the divorce rate for Japan was a low 1.22 per 1,000 population (1980) in contrast to the United States' 5.30 (in 1980), Russia's 3.47 (in 1977), the United Kingdom's 3.47 (in 1977), and Denmark's 2.51 (in 1978) (Kumagai, 1983). While Japan's divorce rate has risen slightly to a 1986 level of 1.37, it nevertheless remains low in comparison to other industrialized nations.

A problem in studying regional or intra-national variations in divorce rates in the United States and other industrialized nations is the question of determining the extent to which such rates are influenced by legal rather than socioeconomic variables. That is, the divorce rate in a geographic area may be influenced by its regional-specific legal system as well as its social conditions. For example, in the United States, regional and state variations in divorce rate may be influenced by the

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fact that some states or groups of states have less stringent divorce laws than others (Kalback, 1975; Pang and Hanson, 1968).

Japan, however, provides a uniquely advantageous setting for the analysis of divorce. Prefectures, equivalent to state units in the United States or provinces in Canada, enjoy social and economic diversity, while the legal system dealing with divorce in Japan is nationally uniform (Fukurai and Alston, 1990). Although the legal system in Japan is centralized and uniform, prefectural units continue to maintain a high degree of social and economic heterogeneity. We can therefore eliminate the possibility that the different legal systems and their enforcement cause variability in inter-regional divorce rates.

The divorce rate in Japan has fluctuated throughout the twentieth century, experiencing a cycle of highs and lows. The divorce rate is presently at the same high level as found during the early 1900's and is double the rate found during the early 1940's when Japan experienced the lowest divorce rates in its modern history. Figure 1 illustrates the cyclical change of Japan's divorce rate since 1900.

The Japanese experienced an increase in the divorce rate during Japan's post-war stage of industrialization (Goode, 1971). This post-war increase is assumed to be primarily due to a decline in the importance of traditional values of the extended family, an increase in married women's participation in labor force, and women's decreased role in the reproduction of la-

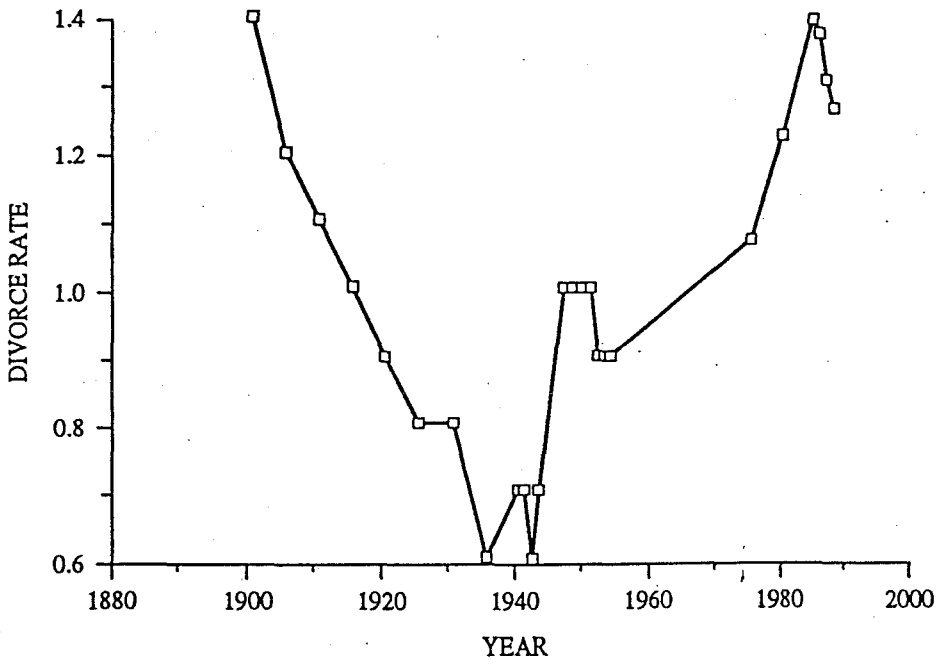

FIG. 1.—Divorce rates in Japan between 1900 and 1990.

bor (Kesler and McRae, 1982; Lee, 1982; Morioka, 1987). This reasoning, however, does not explain Japan's more recent rising divorce rate, the relatively high divorce rate around the 1900's (Kumagai, 1983), or the diversity in divorce rates from one prefecture to another.

The national divorce rate of Japan obscures very large variations from one region (prefecture) to another. While contemporary Japanese society is relatively homogeneous as measured by social class and income, educational, racial and linguistic divisions, Figure 2 below indicates that there are nevertheless high regional variations in divorce rates. As a result, little is understood concerning the social dynamics underlying the present level of divorce in Japan.

THE ECOLOGICAL APPROACH

Much of the research on the ecology of American divorce has focused on the impact of urbanization and economic development on marital stability. The ecological model has focused on macro-level, structural variables and is more amenable to national and regional samples. This model also has greater utility for comparative, cross-national levels of analysis. Trent and South (1989), using a sample of 66 countries to analyze the correlates of divorce, found that the ecological variables, including the demographic factors, migration patterns, and the level of regional economic development, were strongly associated with national divorce rates. While the research found that the relationship was curvilinear rather then linear, macro variables such as regional economic development and changing demographic factors, including population distributions, were found to be important predictors of the divorce rate.

Other researchers have used aggregate data to examine how the changing characteristics of organizational and labor market structures affect regional economic activity and the divorce rate. The overall employment opportunities in the regional economy facilitate the development of a highly segmented labor force that eventually absorbs the female labor force (Cherlin, 1981; Huber and Spitze, 1980; South, 1985). That is, while the increase in women's employment status is strongly correlated with high incidences of divorce, the extent of female labor force participation (FLFP) is contingent upon the degree of the regional development of both organizational structures and labor market forces that subsequently promote FLFP.

Reynolds et al. (1984), for instance, show that the aggregate analysis is a useful approach to explain variations in divorce rates when various economic activities in the region are taken into consideration. Others, notably Glenn and Shelton (1985) and Fenelon (1971), suggest that larger units of analysis should be used, such as state or region, because their research suggests that both regional demographic changes and economic activities are significant predictors of the divorce rate. Their analyses suggest that aggregate information provides the highest form of generalizability since it represents population parameters rather than sample statistics. The following discussion focuses on the ecological variables and their impact on the divorce rate.

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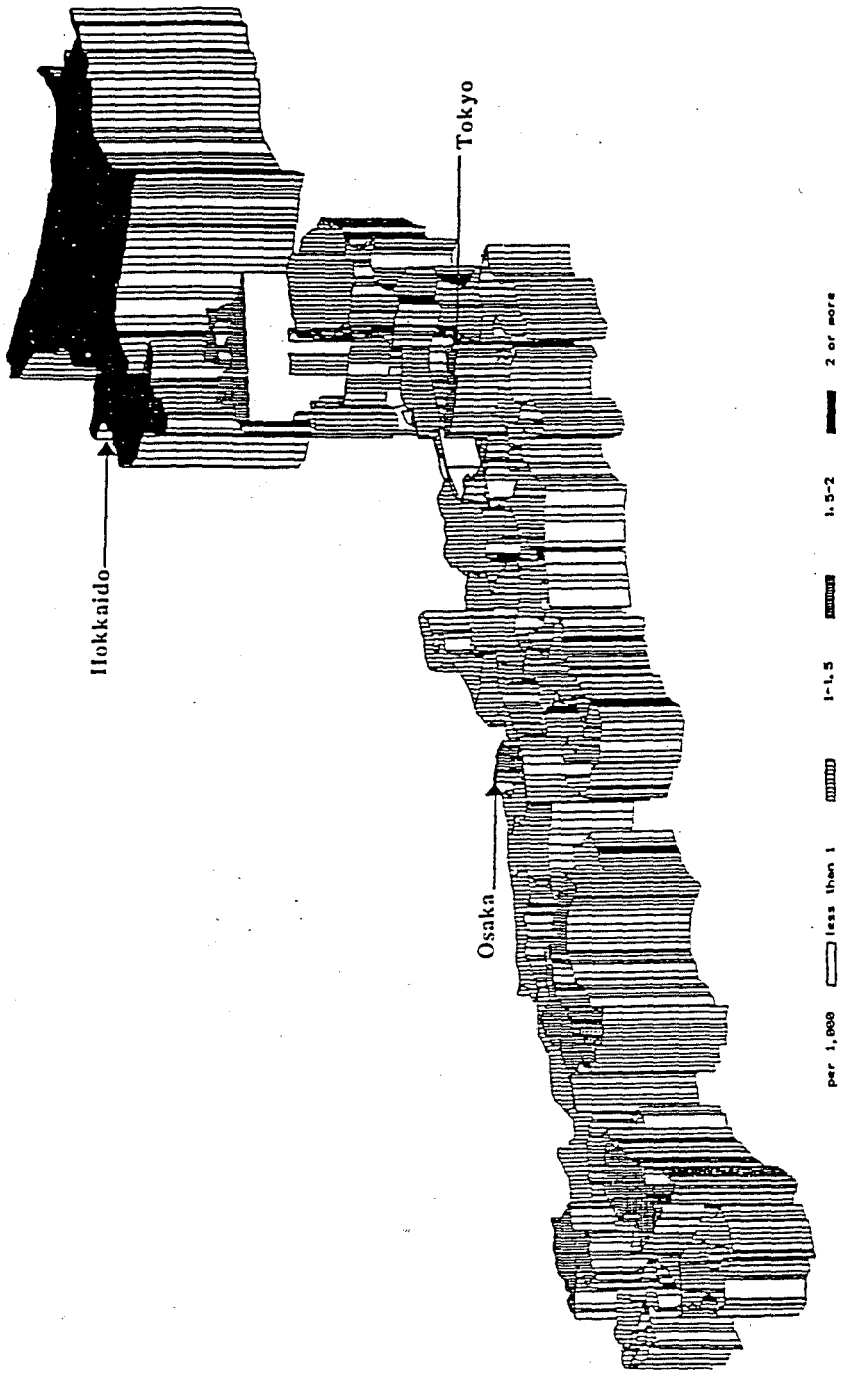

FIG. 2.—Divorce rates in Japan by prefectures, 1985 (excluding Okinawa Prefecture).

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Female Labor Force Participation

Past research suggests that female labor force participation (FLFP) in the region is found to be a significant predictor of divorce. While it is possible that the patterns of behavior at a group level might not reflect corresponding patterns on an individual level, the extent of female labor force participation (FLFP) has been proven to be an important determinant of divorce.

The analysis of divorce rates and their causes has increasingly focused on the ecological variables reflecting psychological and attitudinal variables, such as feelings of social isolation among women and distress and dissatisfaction among husbands, particularly associated with their wives' work outside the home (Arnott, 1972; Kessler and McRae, 1982; Roos, 1983; Reimers, 1985). The extent of FLFP then reflects the dimension of behavioral patterns at the individual level.

The FLFP and marital dissatisfaction are positively related in that the FLFP increased psychological distress among spouses and led to the high incidence of divorce. Kessler and McRae (1982), for instance, examined married women's increased participation in the labor force and how their higher employment status affected psychological distress among their spouses. The researchers found that, while the increase in spouses' earnings did not influence men's marital satisfaction, negative attitudes toward spouses' employment were closely related to the spouses' failure to adjust to changing gender-based behaviors, leading to a subsequent increase in psychological distress among men. Key variables in this model are the entry of women into nonfarming occupations and their occupational status in the labor market.

Reimers (1985) examined the relationship of labor force participation among married women from six different ethnic groups and their marital stability. The study pointed out that indicators of cultural differences such as language, family size, age, and educational differences, explained the large variation in the economic status of married women. For instance, in examining the changing roles of Hispanic women in the United States,the influence of Hispanic culture as measured by such variables as the maintenance of large extended family ties, educational attainment, the use of the Hispanic language, and ties to ethnic communities were found to be the major predictors of both economic status among Hispanic women and levels of marital stability.

Arnott (1972) and Perlin and Johnson (1977) examined the relation between husbands' attitude and adjustment to wives' employment and how the changing sex role behavior affected marital status. Their research indicated that cultural factors such as parental roles and responsibilities, and psychological factors, such as feeling of social isolation among married women, are closely related to the degree of psychological distress among men.

Thus, past research on marital stability and the factors leading to divorce suggests that marital instability depends substantially on the degree of female labor force participation. At the ecological level of analysis, we would expect that women in areas with high levels of FLFP will have greater opportunities for their economic indepen-

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dence that subsequently lead to higher incidences of divorce.

Sex Ratio

The accessibility and availability of both eligible men and women plays an important role in predicting the marital stability in the region. The availability of both sexes is represented by the sex ratio.

Guttentag and Secord (1983, p. 23) suggest that the individual whose gender is in short supply has a stronger position and is less dependent on the partner because of the larger number of alternative relationships available to his/her gender. Sex ratio places constraints on women's behavior and on the roles they can play, especially when they are in short supply. In contrast, when there is a surplus of women, the proportion of unmarried women increases, and women begin to strive for greater independence and involvement in a variety of roles in the society.

As applied to the divorce rate, this finding would suggest that in areas with a low sex ratio, women will have greater opportunities in the economic sectors which will increase their independence and lead to higher divorce rates. As the proportion of women in an area decreases, there would be a relative scarcity of available women and this would lead to reduction in the divorce rate.

Migration

A number of scholars (Glenn and Shelton, 1985; Shelton, 1987; Trovato, 1986) have suggested that intranational migration is associated with the divorce rate. Migration is linked to the change in the development and increased complexity of regional organizational structures and labor market. Thus, regional migration forces change in divorce rates by: (1) unbalancing the sex ratio in the region and changing the gender composition of available labor in the work force and (2) creating greater economic opportunities for women.

Shelton (1987) examined the relationship between migration patterns and divorce rates even when human capital variables, such as cultural differences, religious affiliation (Roman Catholicism), and socioeconomic variables are held constant. She concluded that community size makes possible a higher level of residential mobility which in turn leads to lower levels of social integration and hence higher rates of divorce. Shelton's measure of mobility included the following three migration patterns: in- and out-migration and intra-community residential mobility. Those three migration variables explained a large proportion of the total variance in the divorce rate.

Fukurai et al. (1989) examined regional income inequality, migration patterns, and the gender-based labor market in the U.S.-Mexico borders. Using 1980 municipio-level Mexican census data for six Mexican border states (equivalent to U.S. counties), they found that migration was strongly linked to the regional development of organizational structures and labor market growth. Specific economic activities taking place in the region were better able to absorb female rather than male laborers and take advantage of the gender-based labor market. The research further suggested that the disintegration of traditional male-dominated ethnic values occurred as females became increasingly finan-

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cially independent and the main source of family income. Subsequently there has been high unemployment and underemployment among male workers. The main finding is that the regional development of both organizational structure and labor markets were closely tied to migration patterns and greater economic opportunities for female laborers, which in turn influenced the traditional marital authority pattern.

Urbanization

The ecological model of divorce stresses the importance of traditional sex roles and how industrialization promotes or allows the evasion of traditional roles by women and eventually leads to increases in divorce rates. For example, urbanization and its related factors of modernization promote the disintegration of traditional norms and values stressing the importance of extended families (Goode, 1963; Trent and South, 1989). Such factors as urbanization increase married women's participation in the labor force, change the role of women in the family, and subsequently increase psychological distress among their spouses. Thus, this model posits that divorce rates will be higher in more urban areas and under conditions of urban living than in rural areas and farming communities. This model has gained empirical support (Glick, 1963).

Socioeconomic Context

It seems clear, then, that divorce is not influenced merely by population parameters or the extent of FLFP in the region, but by personal traits of the individuals who live there. It is the product also of the social context. Social context, however, will vary from region to region. To demonstrate and account for such variation, we need to incorporate the social and economic conditions of the regions under analysis.

The ecological model of divorce relies on regional income variations (in our case, prefectural levels) to account for different levels of economic activities. The income level in the region is assumed to have a positive relation with the divorce rate. That is, greater economic activity leads to greater economic independence and employment opportunities for women, which in turn increase the likelihood of divorce. Another measurement of socioeconomic activities in the region is the level of overall educational attainment. It affects the divorce rate because it increases the human capital levels and economic opportunity for women.

Following the suggestions of Trent and South (1989) and Reynolds et al. (1984), we analyze the intra-national divorce rates in Japanese prefectures. The present analysis examines the extent to which Japan's current divorce rate is influenced by various social and demographic dimensions, including population characteristics, labor market participations, regional economic structures, and the level of interregional migration.

MATERIALS AND METHODS

Japanese census data for 1985–86 are utilized to examine the structural relationship between the divorce rate among Japan's forty-seven prefectures and selected variables. Prefectures form the basic administrative unit below the national government. Each

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prefecture has officials elected by popular vote and is essentially self-governing. Prefectures are subautonomous political and economic units and provide social services (welfare, health, law enforcement, etc.) based on special local needs and demands. The Japanese prefecture is equivalent to a combination of America's state and regional socio-political units (United States Government, 1983).

Prefecture limits were drawn during the late nineteenth century to reflect social and historical distinctiveness. Even today, Japanese prefectures exhibit a wide variation of social customs and values recognized and honored by government officials. As such, prefecture-level analysis reflects social as well as political reality.

The divorce rate also reflects the social diversity of the prefectures (see Figure 2). The current divorce rate per 1,000 population varies from a high of 2.13 in Okinawa, an island in southern Japan with a population of 1.19 million to a low of 0.87 for the Shimane prefecture, an area also located in southern Japan. The population densities of Okinawa and Shimane, as a further example of the social diversity of Japan's prefectures, are 528 and 120 persons per square kilometer, respectively.

Variables

The Japanese divorce rate is measured by the number of divorces per 1,000 population during 1985. Five measures of population and demographic parameters are included in the model. Sex ratio indicates the number of males to the number of females in each prefecture. The female labor force participation is measured by the ratio of the number of employed females to the total number of the economically active female population. Population increase is represented by the per cent increase in population for a given prefecture between 1980 and 1985. Population density is based on the number of persons per square kilometer. The proportion of population between 15 and 54 years of age is also included in the model. This age group is associated with higher incidences of divorce rates and is included in order to control for variations in the age-related profiles of Japan's prefectures.

Urbanization is also included in the model since higher divorce rates are generally found in urban areas rather than in rural areas (Goode, 1963). Urbanization is generally defined as the ratio of population living in places of 2,500 population or more to total population (SPP, 1985), although other investigators have utilized places of 15,000-or-more population as the criterion (Unikel, 1977). In Japan, however, high population concentration results in small intra-prefectural variation, thereby rendering the conventional urban/rural index inadequate. In addition, because of limited geographical and spatial resources, there is little variation of rural/urban distinctions based on population. Urbanization in Japan is better measured by the prefecture's proportion of nonfarm land in privately owned land areas. This is a more appropriate measurement because the scarcity of land is more reflected in urban sectors than rural sectors (Fukurai and Alston, 1990; Glickman, 1979).

Migration is measured by two variables: the amount of in- and out-female migrants at prefectural levels. These two variables represent overall

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1985 migration activities and are measured by the percentage of females who migrated to or from other prefectures.

The total prefectural income as well as the net real-monthly income per working household (in 1,000 yen) represent two economic activities. Finally, the per cent of the prefecture's population aged 25–54 with college experience represents the overall educational attainment in the region. The descriptive statistics and relationships among the structural variables is shown in Table 1.

In sum, the ecological model of Japanese divorce is represented by the following twelve structural variables: (1) divorce rate, (2) population increase, (3) population density, (4) urbanization, (5) age distribution, (6) female in-migration patterns, (7) female out-migration patterns, (8) prefectural income in 1985, (9) a net real-monthly income per working household (in 1,000 yen), (10) the proportion of those age 25–54 with college experience, (11) sex ratio, and (12) female labor force participation (FLFP).

Following the ecological model, we hypothesize that the divorce rate is positively associated with higher levels of population increase, population density, urbanization, and the proportion of age groups between 15 and 54. Female in- and out-migration patterns at both origin and destination are also assumed to have a significant effect on the divorce rate, since the influx of females and their migration patterns influences the divorce by unbalancing the gender ratio and by changing the level of social integration and the cohesiveness of traditional family ties and values in the region.

Regional income activity is also assumed to have a positive relation with the divorce rate. That is, the greater the economic activity, the greater the economic independence and employment opportunities to women which increase the likelihood of divorce. Educational attainment also influences the divorce rate because it increases the human capital levels and economic opportunity for women. Education also impacts on the economic status of women and has been found to increase psychological distress among their spouses, thereby increasing the divorce rate. While psychological dimensions of divorce are not dealt here, we attempt to integrate the interpretation of their effects on the divorce with other themes in the article.

The Covariance Structure Analysis

In assessing the ecological model of divorce, the measurement parameters are estimated using correlation matrices and standard deviation of twelve ecological variables as input to LISREL-VI (Joreskog and Sorbom, 1985). This computer program provides maximum likelihood estimates (ML) of model parameters that are specified as "free." The estimation process is an iterating procedure that minimizes a function of the differences between observed covariance patterns and the expected covariances estimated by the model.

The likelihood ratio chi-square statistic and the likelihood-ratio indices, Delta and Rho, are employed in comparing fits in order to control for sample size (Bentler and Bonett, 1980; Fukurai, 1991). Two indices, delta and

TABLE 1

PEARSON CORRELATION COEFFICIENTS AMONG STRUCTURAL VARIABLES

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Sex ratio	...	...	...	...	...	...	...	...	...	...	...	...
(2) FLFP (%)	−0.337[a]	...	...	...	...	...	...	...	...	...	...	...
(3) Prefecture income[b]	0.641[c]	−0.407[a]	...	...	...	...	...	...	...	...	...	...
(4) Net monthly income[d]	0.243	0.255	0.088	...	...	...	...	...	...	...	...	...
(5) College education (%)	0.399[a]	−0.333[a]	0.704[c]	0.022	...	...	...	...	...	...	...	...
(6) Urbanization[e]	0.656[c]	−0.408[c]	0.885[c]	0.133	0.628[c]	...	...	...	...	...	...	...
(7) Age group (15–54) (%)	0.831[c]	−0.618[c]	0.812[c]	0.091	0.610[c]	0.783	...	...	...	...	...	...
(8) In-mig. (female) (%)	−0.325[a]	−0.147	−0.141	0.046	−0.046	−0.090	−0.189	...	...	...	...	...
(9) Out-mig. (female) (%)	−0.351[a]	0.130	−0.156	0.051	−0.118	−0.110	−0.308[a]	0.882	...	...	...	...
(10) Population increase[f]	0.710[c]	−0.432[c]	0.203	0.188	0.078	0.293[a]	0.573[c]	0.004	−0.201	...	...	...
(11) Population density[g]	0.583[c]	−0.404[c]	0.917[c]	0.096	0.661[c]	0.970[c]	0.738	−0.041	−0.047	0.187	...	...
(12) Divorce rate[h]	−0.033	−0.525[c]	0.301[a]	−0.532[c]	0.256	0.234	0.290[c]	−0.138	−0.227	−0.005	0.284	...
Mean	94.54	48.12	5,264.13	452.82	1.46	65.66	55.52	42.39	42.43	2.92	613.65	...
S.D.	3.63	4.94	6,225.93	44.44	1.18	10.65	31.23	1.84	1.67	2.23	1,080.38	...
Minimum	88.90	36.00	1,016.90	343.00	.43	46.37	50.25	38.25	38.14	−0.20	72.00	...
Maximum	105.10	58.00	35,615.80	542.00	6.44	86.15	63.70	48.15	46.89	8.70	5,696.00	...

[a] $p < 0.05$.
[b] In billion yen.
[c] $p < 0.01$.
[d] In 1,000 yen.
[e] Per cent non-farm lands in privately owned areas.
[f] Per cent population increase between 1980 and 1985.
[g] Per square kilometer.
[h] Per 1,000 population.

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rho, are calculated in the following equations.

$$\text{Delta} = \frac{\text{chi-square (null)} - \text{chi-square (model)}}{\text{chi-square (null)}}$$

$$\text{Rho} = \frac{\frac{\text{chi-square (null)}}{\text{df (null)}} - \frac{\text{chi-square (model)}}{\text{df (model)}}}{\frac{\text{chi-square (null)}}{\text{df (null)}} - 1.0}$$

When failure to reject the null hypothesis can be taken as an indication that the model is consistent with the data, it is important to bear in mind that alternative models may also be consistent with the data (Joreskog and Sorbom, 1985). Moreover, because the chi-square test is affected by sample size, it follows that (1) given a sufficiently large sample, an overidentified model may be rejected even when it fits the data well; and (2) when the sample size is small, one may fail to reject the null hypothesis even when the model fits the data poorly (Fukurai et al., 1991). Therefore, a general null model based on modified independence among variables is also proposed to provide an additional reference point for the evaluation of covariance structure models.

The estimation of the single-indicator latent construct is determined by the fixed reliability estimate for the ecological variables in the model. This value is determined to be 1.0 and the variables attain perfect reliability and assume error-free ecological measurements. Such assumptions are often unattainable in census information from other nations.[1]

Numerous studies have addressed the accuracy of Japanese census data both before and after World War II (Smith, 1943, Taeuber, 1958; Farris, 1985). The studies suggest that the Japanese census may exhibit the highest accuracy and quality levels of those done in developed nations. Comparable accuracy and quality of census data were also reported in preindustrialized Japan (Hanley and Yamamura, 1977). Hanley and Yamamura (1977) attribute such distinctive accuracy of the population survey to the highly centralized role of the government and smaller geographical regions. Compared with the U.S. census, sources of errors in the decennial census of Japan remain minimal in both human and mechanical areas (Taeuber, 1958; U.S. Department of Commerce, 1981).

RESULTS

The patterns of Japanese divorce are examined in Table 2. The first three columns contain measurement parameter estimates for the saturated model that specifies correlated relations among eleven exogenous variables and eleven direct effects on the divorce rate. Both unstandardized and standardized estimates are reported from the LISREL program. Those estimates are equivalent to multiple regression estimates except that the covariance structural model provides chi-square values as an additional reference point for the evaluation of the overall goodness-of-fit of the ecological model.

[1]For example, several studies have addressed the accuracy of the census information from Third World countries (Lopez, 1982; Peach, 1984). The 1980 Mexican census, like the U.S. census, has some problems of undercount and age correction, but not to an excessive degree. For example, the U.S. census indicates an undercount for the 1980 Mexican census equal to 3.7 per cent, which is not unusual (Peach, 1984).

TABLE 2

REGRESSION ANALYSIS OF THE DIVORCE RATE: UNSTANDARDIZED AND STANDARDIZED REGRESSION COEFFICIENTS

	The Saturated Model			The Parsimonius Model		
Variable	Unstandardized Coefficient	Standardized Coefficient	S.D.[a]	Unstandardized Coefficient	Standardized Coefficient	S.D.
Sex ratio	−0.089	−0.828	0.022[b]	−0.057	−0.739	0.018[c]
FLFP	−0.019	−0.341	0.010[d]	−0.023	−0.406	0.007[c]
Prefecture income	1.075[e]	0.222[e]	1.506	na	na	na
Net monthly income	−0.001	−0.306	0.000[c]	−0.002	−0.337	0.000[c]
College education	5.341[f]	0.022[f]	3.513	na	na	na
Urbanization	−0.015	−0.575	0.014	na	na	na
Age group bet. 15–54	3.550	0.392	3.007	na	na	na
In-migrants (female)	−0.119	−0.776	0.051[c]	−0.061	−0.404	0.018[c]
Out-migrants (female)	0.060	−0.361	0.051	na	na	na
Population increase	0.067	0.536	0.028[c]	0.039	0.315	0.023
Population density	2.007[g]	0.767[g]	1.525	1.327	0.507	0.406[c]
Intercept	11.698	. . .	. . .	11.239	. . .	. . .
R-square	0.673	. . .	. . .	0.615	. . .	. . .
R-square (adj.)	0.571	. . .	. . .	0.559	. . .	. . .

[a]Standard deviations.
[b]$p < 0.001$.
[c]$p < 0.01$.
[d]$p < 0.05$.
[e]Unstandardized coefficients and standard deviations are based on E-07.
[f]Based on E-03.
[g]Based on E-05.

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Several findings are noteworthy. First, the sex ratio is a significant predictor of Japanese divorce, indicating that the higher the proportion of males, the higher the divorce rate. This finding suggests that competition among males is higher when there are more males in relation to females in the region.

Second, population increase from 1980 to 1985 shows a positive relationship with the divorce rate. The unstandardized regression coefficient (0.067) indicates that a 1 per cent population increase between 1980 and 1985 was associated with the increase of 67 divorces.[2] This finding supports the findings of Glick (1963) and Goode (1963). It is almost a truism, as developed by the "urbanization" and functional (i.e., Parsons, 1959) schools of divorce that population increase and its related factor of modernization promote the disintegration of traditional norms and values and create pressures or opportunities for higher divorce rates.

Third, migration activities significantly influence the divorce rate. A greater supply of females (due to female in-migration) increases the incidence of divorce. A gender imbalance and the subsequent competition in search of compatible mates reduces the likelihood of divorce. These patterns support the findings of Shelton (1987).

Since higher levels of female in-migration reduce the divorce rate, the social status of women in the community, as influenced by their relative numbers due to migration, is an important variable. The relative increase of women due to in-migration significantly reduces the divorce rate in Japan, as Trent and South (1989) and South (1985, 1988) found in their American samples.

Fourth, female labor force participation is also a significant predictor of the divorce rate. The higher the labor force participation among Japanese females, the lower the divorce rate in the region. This specific finding is contradictory to the relationship found in the west. In Japan, however, labor force participation among women shows a bimodal distribution according to age: (1) high labor force participation prior to the marriage and the immediate termination following their marriage, and (2) postmarital occupational career and their underemployment status for supplementing the family income (Gibney, 1985). The largest category of postmarital FLFP is found in the service and support sector and is usually on a part-time basis (Krooth and Fukurai, 1990). Thus, in Japan, the FLFP does not reflect an overall economic independence of the female population but indicates the extent of supplementing the family income as part of the age-specific gender roles designated for single and married women.

Last, monthly household income is negatively associated with the divorce

[2]Since our analysis depends on Japanese census variables at the prefectural levels, it is of great significance that potential dangers of spatial autocorrelation on statistical inference are critically examined. We have examined a Toeplitz matrix structure to examine the covariance of the data values that might depend on the data values of adjacent spatial units. The analysis of the Toeplitz matrix is superior to that of the Dubin-Watson test as the latter test merely allows the examination of first-order autoregressive errors (Judge et al., 1985).

We examined the three levels of autoregressive parameters with Toeplitz structures, (1) first, (2) second, and (3) third autoregressive errors. *T*-test statistic showed −1.11, 0.06, and 1.20, respectively, and suggested that there were no significant serial correlations among residuals.

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rate: the greater the household income, the lower the divorce rate. This finding is also contradictory to our hypothesis in that higher monthly household income reflects the greater economic independence to women that increases the likelihood of divorce. Our finding, however, shows the negative effect of monthly household income on divorce rates. It would seem that Japanese society is unique in several ways.

It is reasonable to assume that average monthly income reflects the extent of household variations based on social class. The higher the average monthly household income in the prefecture, the greater the number of households in higher social classes and vice versa. The prefectures with larger proportions of households in the higher social classes can be characterized as having more families who need not depend on female labor to supplement their income. A nonworking wife still remains a strong value among Japanese (Kitagawa, 1987). Thus, there should be less FLFP in prefectures with larger concentrations of households at higher social strata. The prefectures with larger concentrations of households in the lower social class, on the other hand, are characterized by lower levels of economic independence. There is more likelihood of spouses working outside the home to support the family, leading to higher FLFP which in turn increases the incidence of divorce. Thus, the average household income as a proxy for social class variations explains the negative effect of income on divorce rates.

In addition, as suggested by the negative impact of FLFP on divorce, highly limited occupational opportunities for women in Japan may not allow for greater independence of working women as compared to those who are nonworking single women or housewives. The common pattern for Japanese women is to work primarily before marriage and after their children have finished their education (Mosk, 1983). Such a lack of occupational career or long-term work expectations by both firms and husbands may reduce a working woman's potential economic independence in Japan in contrast to working wives in other countries.

Unfortunately, the level of data available precludes a definite explanation. Additional data on the individual family/household level, or on the intra-prefectural level, are needed to support our hypothesis related to the influence of household income on divorce. Nevertheless, we suspect that the key to better understanding of the dynamics of divorce in Japan lies in household status based on social class and social contexts, measured by prefecture-level average household income, the migration pattern of these prefectures, and their levels of urbanization.

Residual Analysis

An ecological model provides an empirical model explaining inter-prefectural divorce patterns in Japan. However, several shortcomings of the model need to be examined. First, our unit of analysis is at the prefecture level, while divorce can be captured at either the regional level (e.g., northwestern and west-central regions) or intra-regional levels (e.g., counties of respective prefectures). While the analysis at the county level might be ideal, such data is not yet available.

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A second limitation in our analysis is the potential problem of ecological fallacies. The ecological fallacy, first described by Robinson (1950), has received extensive attention by sociologists and demographers. Yet, despite all their attention, the ecological fallacy is often poorly understood and has given way to other fallacies. For instance, some researchers have been suspicious of research using ecological units rather than individuals as the unit of analysis. Such concern is appropriate if we are interested in the belief and attitude system of the individual. However, if we are to understand better the community or regional variation in divorce, we should be using ecological units for analysis. As Lieberson pointed out, "The ecological fallacy is nothing more or less than a specific example of a widespread tendency in social research to mix up and confuse the appropriate levels of analysis" (Lieberson, 1985, p. 107). Thus, the use of aggregate information is more useful in explaining the regional variation of the divorce rate than are human capital variables, since the ecological model takes into consideration the demographic and socioeconomic factors that pre-exist divorce.

A third limitation in our model is the relative lack of explanatory power of eleven exogenous variables on Japanese divorce. Our model explained approximately 57 per cent of the total variation of the dependent variable (an adjusted R^2 in Table 2). Approximately another half of the total variation of the dependent variable is still left unexplained by the model. The adjusted coefficient of determination is not large, particularly considering the small number of prefectures in the analysis ($n=47$), though it partially controls for both the number of independent variables and sample size in the LISREL model. This unexplained variation suggests that all the causal variables of inter-prefectural divorce rates are not included in our empirical model.

The second three columns of Table 2 contain the measurement parameter estimates that both simplified and significantly improved the ecological model of divorce and attained statistical significance (except population increase).[3] By fixing the nonsignificant paths to zero, we gained the five degrees of freedom with a chi-square value of 6.879. We judge the ratio of chi-square to its degrees of freedom, as a method for assessing fit, to be adequate (6.879 to 5 = 1.37), considering the small sample size ($n=47$). In addition, the goodness-of-fit index (GFI) is extremely large (0.997) and is very near the unity. Two indices, Delta and Rho, are also large (0.989 and 0.958) and are near the maximum value of 1.0. Those measures refer to the excellent overall fit of the parsimonious model. The parsimonious model also

[3]In the saturated model, the direct effect of population density on the divorce rate did not attain statistical significance (t test-statistic = 1.3). The LISREL estimates excluding all the nonsignificant direct paths resulted in a chi-square value of 17.594 and 6 degrees of freedom. By observing the modification index, the freeing the constraint of a previously fixed direct path in response to population density on Japanese divorce improved the overall goodness-of-fit of the model with a chi-square value of 6.879 and 5 degrees of freedom. The finding suggests that the direct effect of population density on the divorce rate can be suppressed because of the significant indirect effects of the variables that are fixed to zero in the parsimonious model estimation. Thus, it is not surprising to observe that the direct path between population density and the divorce rate attained statistical significance when other nonsignificant variables are deleted from the model.

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implies that there is little difference between the saturated and the present models since the chi-square value shows statistically nonsignificant ($p < 0.05$). Nevertheless, still half of the variance of the divorce rate is unexplained (0.559 for an adjusted R^2), and further elaborations are necessary to account for the large proportion of the unexplained variance.

One of the most effective ways to examine possible effects of other extraneous variables is to spatially display the residual of the dependent variable by controlling for the structural variables in the model. That is, unique divorce rate patterns can be graphically observed by examining the spatial distribution of unexplained residuals in each prefecture.

The residual distribution of Figure 3 contains two key findings. First, the effect of regional characteristics on migration is related to the model's over- and under-estimation of the divorce rate. Table 3 presents the model's residual values for the divorce rate in 47 prefectures. Not only are there variations among different prefectures, but there are also inter-prefecture variations within major islands as well. For example, our empirical model overestimated the divorce rate of four prefectures with large negative residuals: Tokyo (13), Niigata (15), Shiga (25), and Kagawa (37). Our empirical model also underestimated the divorce rate of four prefectures with large positive residuals: Hokkaido (1), Aomori (2), Kanagawa (14), Tottori (31), Kochi (39), Fukuoka (40), Miyazaki (45), and Okinawa (47). The prefectures with underestimated divorce rates are located in those regions that are physically separated from Japan's main islands. These are viewed by the Japanese as frontier regions. Hokkaido, forming the northern most island, is characterized in Japanese folklore and contemporary stereotypes as wild and untamed; its inhabitants, including the ethnic minority group called Ainu, also share the same characteristics and stereotypes (De Vos, 1973; De Vos and Wagatsuma, 1966).

Hokkaido and Okinawa constitute two unique island-prefectures where the migration is characterized by intra-prefectural migration rather than inter-prefectural or inter-island migration. Because of the important functions played by both supply and demand pools of female migrants impacting regional variations of divorce rates, those geographically-separated prefectures are culturally more isolated from the rest of Japanese regions and show higher incidences of divorce rates.

Another factor leading to the underestimation of the divorce rate in those two islands is found in the level of analysis necessitated by our data, i.e., the ecological fallacy. Hokkaido and Okinawa are characterized by distinct cultures and traditions different from the main-stream Japanese culture and values (De Vos and Wagatsuma, 1966). The explanation of behavioral variations, such as divorce, using aggregate information, requires certain assumptions of the linkage between individual behavioral and areal phenomena. Although the use of aggregate information is undoubtedly useful in explaining the variation of divorce rates because such variables best capture socioeconomic and demographic factors in the region, aggregate data neither reflect behavioral patterns of individuals, nor individual specific patterns or decisions

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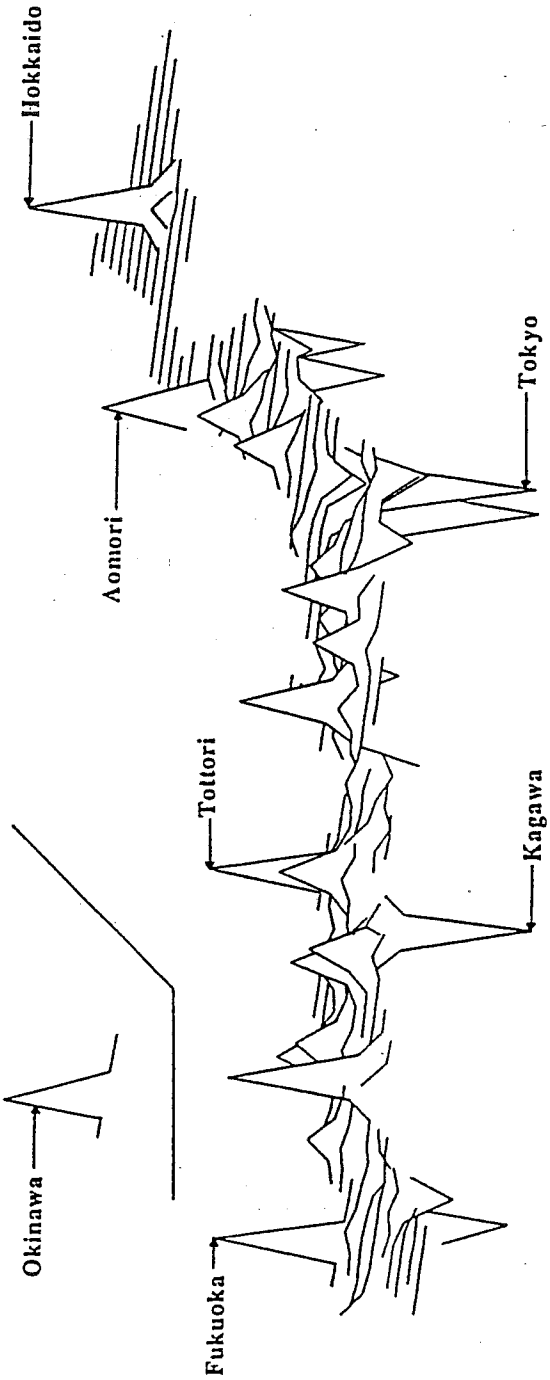

FIG. 3.—Standardized residuals of divorce rates in 1985.

TABLE 3

DIVORCE RATE PER 1,000: PREDICTED VALUES, RESIDUALS, AND STANDARDIZED RESIDUALS

Prefecture	Predicted Value	Residual	Standardized Residual[a]
Hokkaido Island			
1 Hokkaido	1.79001	0.25999	1.9092[b]
Honshu Island			
2 Aomori	1.44454	0.20546	1.3671
3 Iwate	1.15876	−0.12876	−0.7743
4 Miyagi	1.36828	−0.16828	−0.9994
5 Akita	1.24739	−0.15739	−0.9252
6 Yamagata	0.91898	0.00102	0.0062
7 Fukushima	1.08816	0.07184	0.4093
8 Ibaragi	1.01710	0.06290	0.3668
9 Tochigi	0.98431	0.19569	1.1295
10 Gunma	1.22399	−0.08399	−0.4952
11 Saitama	1.20884	0.03116	0.1916
12 Chiba	1.44188	−0.16188	−1.0268
13 Tokyo	1.67415	−0.12415	−1.5392
14 Kanagawa	1.20124	0.22876	1.7018[b]
15 Niigata	1.12343	−0.22343	−1.3812
16 Toyama	1.01226	−0.07226	−0.4463
17 Ishikawa	1.32298	−0.14298	−0.8872
18 Fukui	1.17225	−0.11225	−0.7007
19 Yamanashi	1.20431	−0.10431	−0.6076
20 Nagano	1.04186	−0.03186	−0.1851
21 Gifu	0.97895	0.05105	0.3187
22 Shizuoka	1.32343	−0.05343	−0.3145
23 Aichi	1.14596	0.05404	0.3799
24 Mie	1.17387	−0.04387	−0.2589
25 Shiga	1.20313	−0.24313	−1.5069
26 Kyoto	1.17702	0.09298	1.0105
27 Osaka	1.69833	0.00167	0.0154
28 Hyogo	1.42192	−0.06192	−0.3920
29 Nara	1.36411	−0.21411	−1.7715[b]
30 Wakayama	1.51851	−0.03851	−0.2394
31 Tottori	0.91381	0.31619	1.8664[b]
32 Shimane	0.75702	0.11298	0.7285
33 Okayama	1.12136	0.09864	0.5505
34 Hiroshima	1.45445	−0.15445	−0.8858
35 Yamaguchi	1.36623	−0.04623	−0.2716
Shikoku Island			
36 Tokushima	1.28463	−0.18463	−1.0883
37 Kagawa	1.30858	−0.19858	−1.1288
38 Ehime	1.54304	−0.04304	−0.2504
39 Kochi	1.39608	0.22392	1.4147
Kyushu Island			
40 Fukuoka	1.67822	0.18178	1.1743
41 Saga	1.15888	0.06112	0.3531
42 Nagasaki	1.56807	−0.15807	−0.9743
43 Kumamoto	1.41810	−0.13810	−0.8118
44 Ohita	1.39695	0.09305	0.5256
45 Miyazaki	1.27899	0.35101	2.0708[c]
46 Kagoshima	1.42581	0.00419	0.0261
Okinawa Island			
47 Okinawa	1.73981	0.39019	2.97032[d]

[a]A standardized residual is equivalent to a t test statistic.
[b]$p < 0.10$.
[c]$p < 0.05$.
[d]$p < 0.01$.

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related to divorce. The personal and more subjective aspects of behavior patterns are not directly reflected in the aggregate information. The indigenous values and traits unique to those two islands need to be carefully examined in order to account for the underestimation of divorce rates in those regions.

Kephart (1966) and Leslie (1976) suggest that the existence of a frontier tradition in the American West characterized by rootlessness and nonconformity are partly responsible for higher divorce rates in the West than in the East. We concur with this hypothesis, except that in Japan the "frontier" seems to be found in its rural areas rather than elsewhere, especially in its northern and southern islands.

Another notable finding is the interprefecture variation among and within islands (esp. Honshu, Shikoku, and Kyushu). Inter-island divorce variations suggest that extraneous and more micro and behavioral-related variables may need to be incorporated in the general model in order to account for the large proportion of the unexplained variance. Such variables might include unique regional and island-specific characteristics, different psychological and behavioral variables related to intensities of economic activities in the region, and prefecture-specific traditional values and cultures.

CONCLUSION

This paper has examined the ecological determinants of contemporary Japanese divorce rates on the prefectural level. Such a level of analysis demanded the use of the ecological model which posits that demographic changes, economic activities, migration patterns, and the level of urbanization are significant predictors of divorce rate.

The present analysis of the ecological model substantiated the argument that sex ratio, female labor force participation, and female in-migration patterns all played a significant role in affecting the divorce rate. Population increase and net household income were also important predictors of the Japanese divorce. Our findings also confirmed the well-supported hypothesis that both population density and modernization had positive influences on modern Japan's divorce rates (Makabe, 1980). The residual analysis also pointed out that in order to account for the large proportion of the unexplained variance of Japanese divorce, behavioral-related variables and island- or prefecture-specific dimensions needed to be included in the ecological model of divorce.

The evidence indicated that demographic and aggregate variables such as migration, urbanization, and socioeconomic variables have promise when organized under an ecological model. The findings of Fenelon (1971), offering a structural explanation based on the ecological rubric, also had promise on the cross-national level (see also Trent and South, 1989) as well as the intra-national level. Future studies can refine and extend the ecological model by determining which socioeconomic variables linked to relevant demographic variables, such as female labor participation, gender ratios, and migration, can best be included.

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