

YUKINOBU KITAMURA AND TAKESHI MIYAZAKI

Marriage Promotion Policies and Regional Differences in Marriage

Abstract: Existing studies on marriage have highlighted the importance of paying attention to local characteristics, but few Japanese studies have been conducted on marriage, taking regional differences into account. This article examines the factors that influence marriage using data from localities across Japan with an eye toward identifying regional differences, and analyzes the effects of marriage promotion policies in depopulated localities. The results of a basic analysis and regression analysis reveal the following. First, the ever-married ratios among men and women vary significantly depending on the level of urbanization where they live, but the male employment rate has a positive correlation with male marriage while the male–female ratio has a negative correlation with male marriage and a positive correlation with female marriage. Second, the results confirmed that prefectural differences in marriage cannot be explained by factors such as the level of urbanization, the male–female ratio, or employment conditions. However, this study was not able to identify the factors that explain these findings. Third, the results

English translation © 2011 M.E. Sharpe, Inc., from the Japanese original, Yukinobu Kitamura and Takeshi Miyazaki, “Kekkon no chiiki kakusa to kekkon sokushin saku,” *Nihon keizai kenkyū*, no. 60 (January 2009): 79–102. Translated by Stacey Jehlik.

Yukinobu Kitamura is a professor at Hitotsubashi University Institute of Economic Research. Takeshi Miyazaki is a lecturer at Meikai University; e-mail: tmiyazak@meikai.ac.jp. The authors are grateful to the referees of this journal for the many extremely helpful comments.

revealed that marriage promotion policies in depopulated localities have a greater effect on the marriage of females than of males.

Japan's total birthrate began to fall rapidly in the 1990s, reaching the level of 1.32 in 2006 and causing rising interest in the phenomenon and its relation to the apparently rising age of first marriage in Japan. A great deal of research has been conducted on birth and marriage as it relates to ongoing birthrate decline, and many studies have been published on the topic.¹ In the postwar period, the decline in the marriage rate has been attributed to trends toward higher education, an increase in the rate of female employment, long courtships, and unemployment due to weak economic conditions.²

The time series data show that marriage postponement has occurred as a result of such factors, but they also show that there are regional differences at work on marriage.³ For example, the age at first marriage is low in Okinawa and Shikoku, and marriage postponement is more likely in urban areas than in rural areas. The higher the ratio of workers in tertiary industries in a region, the higher the age at first marriage in that region (Kitamura 2003; National Land Agency Planning and Coordination Bureau 1998).

Studies conducted in the United States have shown that it is important to take local characteristics into account when analyzing the effects of government policies on marriage. Analyses that do not take local characteristics into account may lead researchers to draw inaccurate conclusions since local views of marriage and family are reflected in local policies. In empirical analyses of the effects on marriage of the male–female ratio in the marriage market, the male–female ratio in the local marriage market is used as a variable, but they confirm the importance of taking into account local characteristics such as population movements. Thus, overseas studies have confirmed the importance of considering local characteristics in quantitative analyses of marriage, but in Japan, few empirical studies have been conducted on marriage that take such local distinctions into account.

Using local government data, this study examines the factors that influence marriage with due consideration to local characteristics. We examine the impact of the level of urbanization, male–female ratio, and employment conditions on marriage and birth, with consideration given to the prefectural differences in marriage. We also examine the prefectural differences that cannot be explained by these factors. This study further

examines the effects of marriage promotion policies implemented in depopulated localities on marriage.

First, we conducted a basic analysis of the factors that have an effect on marriage, with consideration of the local differences in marriage. The results show that the male marriage rate⁴ is low in regions with either extremely low or extremely high population density (in other words following an inverse U-shaped pattern when plotted against population density), and that the ever-married rate has a negative correlation with the male–female ratio and a positive correlation with male employment rates. Among women, the data show that the relationship between the ever-married rate and population density follows an inverse U-shaped pattern, but the data from the typical prefectures show that the ever-married rate is negatively correlated with population density within the prefecture. Regions with a high rate of married female employment have higher ever-married rates.

Next we conducted a grouped-data probit estimation using the ever-married rates of men and women as the dependent variables, and the following as independent variables: population density, population density squared, the male employment rate, married female employment rate, ratio of university graduates, and prefecture dummy. The results revealed that marriage follows an inverse U-shaped pattern in relation to population density, and that the coefficient of the male–female ratio is negative for men and positive for women, while the coefficient of the male employment rate is always positive. An examination of the relationship between the fixed effect of the prefecture and indicators relating to marriage revealed that there are regional differences in marriage, even when controlling for the independent variables. However, the nature of those factors was not entirely clear.

We also examined the impacts of marriage promotion programs implemented in depopulated localities on marriage behavior. Here we performed a probit estimation on grouped data using the ever-married rates as continuous dependent variables,⁵ and the following as independent variables: marriage promotion policies, population density, the male–female ratio, and the prefecture dummy. We found that while the effects of the policies are not entirely clear, it seems that the implementation of marriage grants as well as increases in the amounts of marriage grants cause an increase in the ever-married rate of males in certain age groups. Since marriage promotion policies have no effect at all on the marriage of women, marriage encouragement measures are expected to have a greater effect on men than women.

Research on Marriage Related to Regional Differences

First, this section introduces studies that have examined regional differences in marriage and studies that have highlighted the importance of regional differences in performing the relevant analyses.⁶ Several studies have analyzed the differences in the unmarried rates between different regions in Japan. Kitamura (2003) used prefectural data (National Census) from 1980 to 1990 to perform an analysis of variance and regression analysis, and found that employment was a condition of marriage among men, that employment and wage increases among women led to delayed marriage and childbirth, and that regional differences are not fixed, but change over time. The National Land Agency Planning and Coordination Bureau (1998) analyzed the problem of birthrate decline in various regions from different angles, and showed that there are large differences in urban and rural marriage rates among employed people, and that the unmarried rate increases as the ratio of tertiary industries in a region increases. These studies, which analyze regional differences in nonmarriage rates, cannot completely identify the factors behind these regional differences.

The necessity of paying attention to local differences when analyzing marriage policies⁷ in different regions has also been pointed out in U.S. studies.⁸ In the United States, the number of single-mother families had been increasing until the early to mid-1970s due to Aid to Families with Dependent Children (AFDC),⁹ but that trend turned around starting in the mid-1970s. Later, Moffitt (1990) and Schultz (1994) found a positive and significant correlation between AFDC and single-mother households using cross-sectional data, but because this analysis used a fixed variable for regions that did not allow the measurement of the correlation with the state's welfare policies, the estimates were biased.¹⁰ Both Moffitt (1994) and Hoyne (1997) measured the effects of AFDC using pooled cross-sectional data and repeated-cross-section data that took into account the fixed effects of the state, but neither found any significant results.¹¹ Thus, the research from Japan and the United States suggests there are significant regional differences in marriage and that it is important to take regional effects into consideration when conducting estimates.

In the United States, several studies have examined the relationship between regional male–female ratios and marriage. Becker (1991) conducted a series of studies that analyzed the effect of the male–female

ratio in the marriage market on marriage behavior using economic theory, and suggested that higher male–female ratios (the number of males/the number of females in a marriage market) increase the bargaining power of women by increasing demand for females, making it easier for women to marry than men. Empirical studies have shown that while an increase in the male–female ratio tends to increase marriage rates among women, it has virtually no effect on the marriage of men. Based on the lack of research studies in general, and the lack of studies on male marriage in particular, these studies conclude that there is only a weak relationship between the male–female ratio and male marriage (Angrist 2002; Chiappori, Fortin, and Lacroix 2002; Cox 1940). When the economic conditions of a region have an effect on the male–female ratio through population movements, studies that do not take into account the socioeconomic factors in effect in that region are likely to pose some problems (Angrist 2002; and others). The National Land Agency Planning and Coordination Bureau (1998) used local government data to study the relationship between female marriage and the local male–female ratio. The study concluded that while there were correlations between the male–female ratio and the age at first marriage among females as well as the female unemployment rate, they were not very strong correlations. Research on this topic has not been well promoted in Japan, so the correlation has not been confirmed, but a series of studies in the United States showed that the male–female ratio has an impact on female marriage rates.

In recent years, some studies have tried to highlight the effects on marriage rates of measures to combat nonmarriage and birthrate decline implemented by local governments, by focusing on regional differences.¹² Wakabayashi and Miyamoto (2004) examined cases of measures to combat birthrate decline, and argue that in Nisshin city in Aichi prefecture, where birthrates are rising, this is more likely because families with children are moving into the area and developments are being made in child-care services than because of the effectiveness of efforts to combat nonmarriage. In urban areas, the availability of private marriage counseling centers and the hesitance of local governments to get involved in the private matters of marriage also seem to be some of the reasons that these measures are not proving effective. Thus, few studies have explored effective marriage and birthrate promotion policies from actual surveys; concrete results have not been obtained.

Factor Analysis of Marriage Behavior

Basic Analysis

Marriage Behavior Among Males

Male nonmarriage rates are known to follow a U-shaped pattern, being high in urban areas, low in suburban areas, and high in depopulated rural areas. The relationship between population density and ever-married rates confirm this.¹³ This article uses cross-sectional data in the year 2000 from localities nationwide (prefectural data in some of the analyses), but because it aims to analyze marriage conditions by prefecture, the analysis is conducted by dividing the prefectures into five groups selected to ensure regional and population density variability.¹⁴ In this article, we refer to these five prefectures as the “typical” prefectures. Figure 1 plots the population density logarithm on the x -axis and the ever-married rate on the y -axis for males ages thirty to thirty-four and thirty-five to thirty-nine.¹⁵ As shown in the figure, ever-married rates among males ages thirty to thirty-four and thirty-five to thirty-nine are low in urban areas with high population densities, though this phenomenon was not observed for the age groups twenty to twenty-four or twenty-five to twenty-nine years. In the suburbs, ever-married rates are higher, but in areas with lower population densities, they tend to be slightly lower. When viewed by prefecture, the figures show a negative correlation (-0.62 [0.00]) in Osaka prefecture, where population density is high, while no particular trends were observed in the other localities.¹⁶

Furthermore, because of the vast amount of research on the male–female ratio and marriage rates in the United States, we examined whether there is a correlation between the male–female ratio in the thirty-five to thirty-nine age group and the ever-married rate of males aged thirty-five to thirty-nine. As shown in Figure 2, there was a negative correlation in all of the localities nationwide (-0.32 [0.00]), and the correlation was also negative in the five typical prefectures, excluding Yamagata prefecture.¹⁷ This is consistent with the theoretical research, which suggests that when the male–female ratio is high, the marriage rate of males will fall, but will yield results different from those produced by empirical studies in the United States, which show that the male–female ratio does not affect the marriage of males.

Both theoretical and empirical research findings show that the reasons

Figure 1. Population Density and Ever-Married Rates: Males Thirty-Five to Thirty-Nine Years

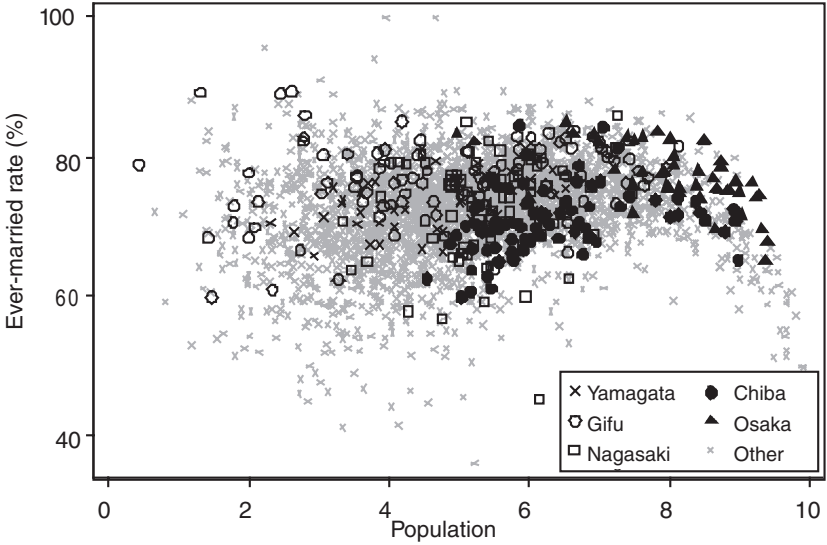


Figure 2. Male-Female Ratio and Ever-Married Rates: Males Thirty-Five to Thirty-Nine Years

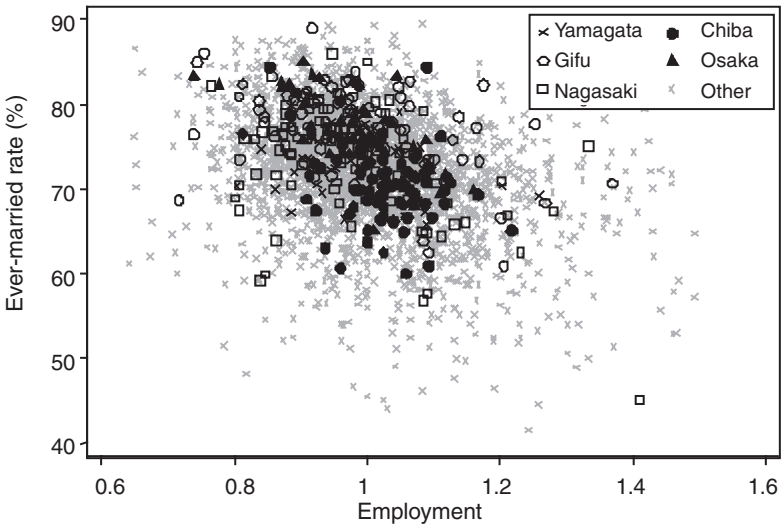
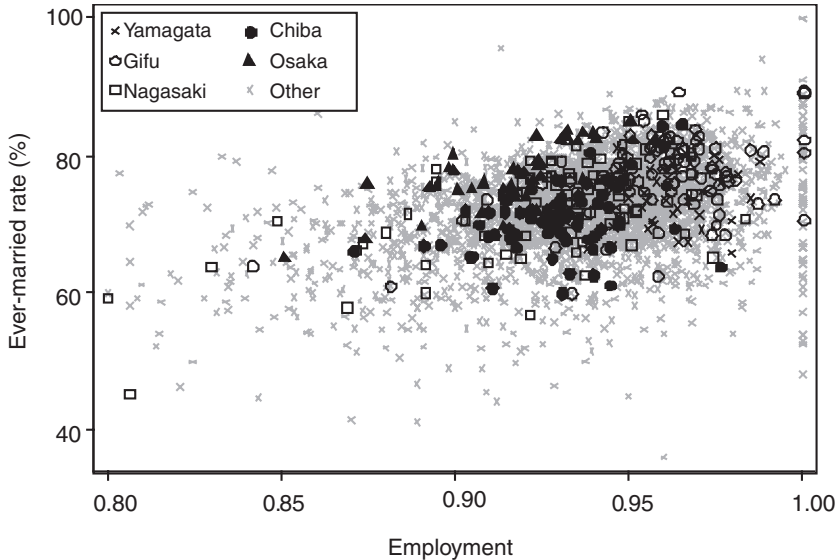


Figure 3. **Male Employment Ratio and Ever-Married Rates: Males Thirty-Five to Thirty-Nine Years**

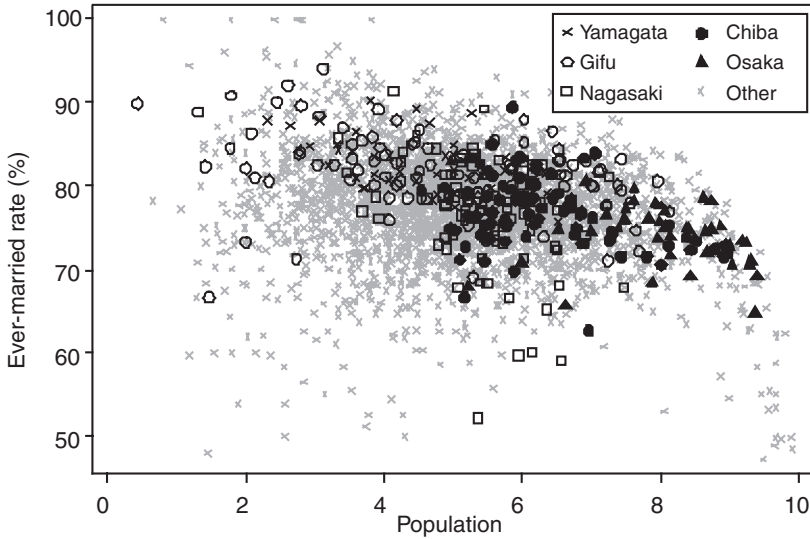


that men are not marrying are related to their employment status and wages. In both theoretical and empirical studies, an increase in male wages is shown to promote marriage among men and women, and this is supported by empirical research in both Japan and the United States. Many empirical studies that rely on Becker's theoretical analysis conduct their estimates by focusing on the relative size of wages, but because we cannot obtain wage data at the local level, the analysis in this article instead uses employment status. Figure 3 shows the relationship between male employment rates and male ever-married rates, but whether we look at the nationwide trends or focus on the localities in each prefecture, we find that regions with high male employment rates have higher ever-married rates among males.¹⁸

Marriage Behavior of Women

As with the men, we first look at the relationship between population density and the ever-married rates of women ages thirty to thirty-four. As shown in Figure 4, the coefficients overall follow an inverse U-shaped pattern with most observations on the rightward downward sloping seg-

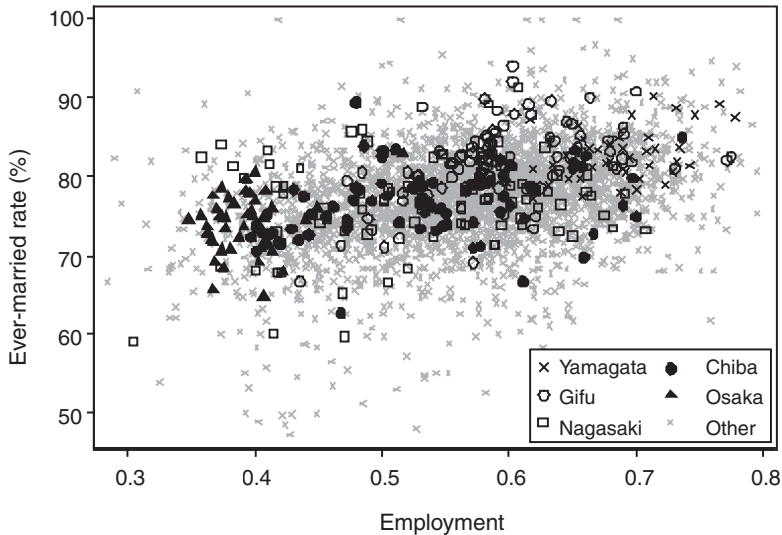
Figure 4. Population Density and Ever-Married Rates: Females Thirty to Thirty-Four Years



ment of the inverse-U, while the results for the typical prefectures follow a simple downward sloping pattern.¹⁹ That is, within the same prefecture, the ever-married rates of women tend to be lower in urban areas with high population densities. An analysis of the male–female ratio and female marriage (ages thirty to thirty-four) showed a significant positive correlation (0.07) for all localities nationwide, but no significant correlation by prefecture, except for Nagasaki (0.30 [0.01]).

While some have attributed this to the delay in women’s social participation up to this point, some studies show that in regions where women work after they get married, the marriage rates are high (National Land Agency Planning and Coordination Bureau 1998). Thus, an examination of the married female employment rates and the marriage of women ages thirty to thirty-four, revealed, as shown in Figure 5, a positive correlation both at the national level and in the five typical prefectures, excluding Nagasaki.²⁰ However, if the level of urbanization and male employment status are taken into account, the career orientation of women may cause a negative relationship between the married female employment rate and the overall female employment rate.

Figure 5. **Married Female Employment Ratios and Ever-Married Rates: Females Thirty to Thirty-Four Years**



Grouped-Data Probit Estimation

Based on the preceding analysis, this section uses a regression analysis to clarify whether the ever-married rate is affected by the level of urbanization, the male–female ratio, male employment rates, or married female employment rates, and examines the reasons for the prefectural differences that cannot be explained by these variables. Calculations were performed for each of five age groups in approximately 32,000 localities, but for population density, which does not rely on age groups, and those variables for which age-group-specific data were not available, the aggregate data were used without being broken down into age groups.

The descriptive statistics in Table 1 reveal that as age rises among both genders, ever-married rates also rise, and that ever-married rates rise higher among women in each age group than among men.

The explanatory variables used in the regression analysis were the ever-married rates for both men and women, population density (logarithm), population density squared (logarithm), male–female ratios, male employment rates, married female employment rates, gender ratios of

university graduates, and a prefecture dummy.²¹ The male–female ratio is an indicator of bargaining power in the marriage market. A higher male–female ratio means that there are relatively more men than women in a given population, and thus, theoretically, that the women have more bargaining power than men in that marriage market, leading to higher female marriage rates. By contrast, when the male–female ratio is low, men have more bargaining power, such that male marriage rates are higher. The male employment rate is a proxy variable for the wages earned by men. Men with higher wages are expected to be more attractive as marriage partners, thus causing the marriage rates of females to rise, while the marriage rates of males will also rise as male incomes increase. If the married female employment rate is viewed as a proxy variable for attitudes toward marriage in a given region, it might be expected to have a positive impact on female marriage. However, if it is viewed as an indicator of the career orientation of women, it could have a negative impact on female marriage. The results are unclear, since the signs of the coefficients are sometimes positive and sometimes negative. We have controlled for prefectural differences using a prefecture dummy, but the results of those calculations are omitted here.²² For more on the methods used to extract and create these variables, see the Appendix.

Because local and not individual data were used in this analysis, we conducted a probit estimation with grouped data, assuming that the residents of each locality make marriage choices under the same conditions.²³ According to Table 2, the coefficient of population density is positive for both men and women, the coefficient of population density squared is negative, and the population density and ever-married rates have an inverse U-shaped relationship. Since the coefficients of the male–female ratio and the married female employment rate are negative and significant among men, in localities where women outnumber men, and there are high rates of married female employment, the ratio of men who have ever been married is low. In addition, while the coefficient of the male employment rate is positive and significant, the coefficient increases in size with age, such that the impact of the employment rate grows larger.²⁴ Among women, the coefficients of the married female employment rate were neither uniformly positive nor uniformly negative, but the coefficients of the male–female ratio and male employment rate were positive and significant, a finding that is consistent with the conclusions of previous research. Previous studies by Lichter, LeClere, and McLaughlin (1991) and Wood (1995) assumed that the marriage market was made

Table 1

Descriptive Statistics: Localities Nationwide

	20–24 yrs.		25–29 yrs.		Male employment rate	Male–female ratio	Male employment rate	
	Ever-married rate: males	Ever-married rate: females	Ever-married rate: males	Ever-married rate: females				
Avg.	7.1	12.02	1.05	0.64	30.63	45.97	1.03	0.87
Standard deviation	3.16	4.38	0.14	0.11	6.05	7.08	0.09	0.05
Max.	47	80	4.7	1	81	86	4.7	1
Min.	0	0	0.0	0	0	17	0.4	0.48
No. of observed values	3,203	3,201	3,203	3,203	3,204	3,205	3,205	3,205
			30–34 yrs.		35–39 yrs.			
Avg.	57.06	73.33	1.02	0.9	72.28	85.29	1.02	0.92
Standard deviation	6.23	6.63	0.09	0.04	5.84	5.63	0.09	0.03
Max.	90	100	4.3	1	100	100	3.6	1
Min.	14	47	0.4	0.44	36	54	0.4	0.49
No. of observed values	3,198	3,198	3,198	3,198	3,188	3,188	3,188	3,188

	Population density	Married female employment rate	Ratio of university graduates: males	Ratio of university graduates: females
Avg.	3.41	0.48	0.22	0.07
Standard deviation	10.15	0.08	0.09	0.04
Max.	198.54	0.95	0.51	0.23
Min.	0	0.23	0.02	0
No. of observed values	3,205	3,205	3,205	3,205

Notes: The ever-married rates, male–female ratios, male employment rates, and ratio of university graduates are all weighted averages. The ever-married rate is expressed as a percentage.

Table 2

Grouped-Data Probit Estimation

Dependent variable	Ever-married rates among men					Ever-married rates among women				
	20–24 yrs.	25–29 yrs.	30–34 yrs.	35–39 yrs.	20–39 yrs.	20–24 yrs.	25–29 yrs.	30–34 yrs.	35–39 yrs.	20–39 yrs.
Population density	0.026** (0.001)	0.047** (0.001)	0.068** (0.001)	0.071** (0.001)	0.043** (0.001)	0.021** (0.001)	0.023** (0.002)	0.033** (0.001)	0.034** (0.001)	0.024** (0.001)
Population density squared	-0.0017** (0.0001)	-0.0030** (0.0001)	-0.0049** (0.0001)	-0.0056** (0.0001)	-0.0031** (0.0001)	-0.0013** (0.0001)	-0.0015** (0.0001)	-0.0032** (0.0001)	-0.0034** (0.0001)	-0.0022** (0.0001)
Male-female ratio	-0.019** (0.001)	-0.078** (0.003)	-0.064** (0.004)	-0.051** (0.003)	-0.089** (0.002)	0.076** (0.002)	0.185** (0.003)	0.153** (0.003)	0.084** (0.003)	0.209** (0.002)
Male employment ratio	0.202** (0.003)	0.573** (0.008)	0.758** (0.011)	0.869** (0.011)	0.714** (0.004)	0.329** (0.004)	0.771** (0.009)	0.709** (0.008)	0.587** (0.007)	0.780** (0.004)
Married female employment ratio	-0.093** (0.005)	-0.109** (0.006)	-0.051** (0.007)	-0.018** (0.006)	-0.096** (0.004)	-0.126** (0.006)	-0.089** (0.007)	0.019** (0.006)	0.044** (0.004)	-0.092** (0.003)
Ratio of university graduates	-0.189** (0.004)	-0.250** (0.005)	-0.021** (0.005)	0.096** (0.005)	-0.019** (0.003)	-0.545** (0.011)	-0.551** (0.011)	-0.308** (0.009)	-0.207** (0.006)	-0.248** (0.006)
No. of observed values	3,203	3,204	3,198	3,188	3,203	3,201	3,205	3,198	3,188	3,201
Log likelihood	-1,076,787	-3,025,980	-3,005,366	-2,388,014	-1,076,787	-1,482,918	-3,294,464	-2,480,473	-1,639,127	-1,482,918

Notes: This grouped-data probit model is estimated using the maximum-likelihood method. The prefecture dummy is omitted. The coefficients are the marginal effects evaluated at the average. Figures in parentheses are standard errors that take into consideration distribution heterogeneity. Markers ** and * indicate statistical significance at the 5 percent and 10 percent levels, respectively.

Table 3

Correlation Coefficients for the Fixed Effects of Prefecture

Men	20–24 yrs.	25–29 yrs.	30–34 yrs.	Women	20–24 yrs.	25–29 yrs.	30–34 yrs.
25–29 yrs.	0.8933			25–29 yrs.	0.8029		
30–34 yrs.	0.5725	0.7994		30–34 yrs.	0.1356	0.4609	
35–39 yrs.	0.2954	0.528	0.9139	35–39 yrs.	-0.1249	0.143	0.9109

Notes: The correlation coefficients for men are all significant at the 5 percent level. The correlation coefficients among women were significant in the adjacent cohort, but were not otherwise significant.

up of males and females ages twenty to thirty-nine, and this article also conducted a broader analysis of that age group. However, as shown in Table 2, the estimates performed on separate age groups produced virtually the same results. Thus, the ratio of ever-married people among both men and women changes depending on the level of urbanization, but the results consistently show that in localities with high male employment rates, ever-married rates among men are higher; and in localities with high male–female ratios, ever-married rates among men are lower while ever-married rates among women are higher.²⁵

Lichter, LeClere, and McLaughlin (1991) and Wood (1995) used commuting areas and metropolitan areas as their regional marriage markets, and analyzed marriage behavior using metropolitan area data. However, because data are not organized by metropolitan areas in Japan, we reconfigured the data into locality data based on the definition of a metropolitan area given by the Nikkei Research Institute of Industry and Markets (2003), and performed the same analysis.²⁶ The results are provided in the Appendix, but the results obtained were approximately the same as those obtained using the local government data.

Regional Differences in Marriage

Table 3 shows the correlation coefficients of the fixed effects of prefecture by age group estimated in the grouped-data model (Table 2), and reveals a positive correlation with the fixed effects among men and a particularly high correlation in the adjacent cohort.²⁷ Thus, since factors that cannot be explained by the controlled variables are causing prefectural differences, we must investigate the factors that are causing regional differences in

Table 4

Relationship Between the Fixed Effects of Prefecture and Views of the Family

	20–24 yrs.	25–29 yrs.	30–34 yrs.	35–39 yrs.
Men				
Nuclear family ratio	–0.16 (0.29)	–0.19 (0.20)	0.06 (0.69)	0.23 (0.12)
Age at first marriage	–0.67 (0.00)	–0.84 (0.00)	–0.85 (0.00)	–0.66 (0.00)
Women				
Nuclear family ratio	–0.18 (0.23)	–0.24 (0.11)	0.07 (0.62)	0.22 (0.14)
Age at first marriage	–0.44 (0.00)	–0.58 (0.00)	–0.13 (0.40)	0.16 (0.29)

Notes: The upper row shows the correlation coefficients. Figures in parentheses are the *p*-values.

marriage. In regions with low ratios of nuclear families, fixed effects that express regional differences in marriage may be higher because of pressures from relatives toward marriage or strong cohesiveness within the family.²⁸ However, the signs of the correlation coefficients differ by age group, as shown in Table 4, such that no correlative relationship could be found between the fixed effects and nuclear family ratios in all age groups.

On the other hand, the average age at first marriage reflects regional attitudes toward family, conservatism, and marital pressures. When the age at first marriage is low, the fixed effects are predicted to be larger. As shown in Table 4, there is a negative correlation between the fixed effects of prefecture and the age at first marriage of males in every age group. However, since the ever-married rate is expected to be higher in areas where the age at first marriage is lower, this result may not be especially compelling. Thus, the results showed that there are regional differences in marriage that cannot be explained by this regression analysis, but we do not know whether peripheral pressure or attitudes toward marriage or family are having an effect.

Even when the same type of analysis was conducted on the marriage of women, although there was a strong correlation with the adjacent

cohort as shown in Table 3, the correlation weakened as the ages grew further apart, making it difficult to suggest that the regional differences in marriage were fixed. Table 4 also shows that there is no correlation between the fixed effects of prefecture and the nuclear family ratio. It shows a negative correlation between age at first marriage and the fixed effects among those in their twenties, and no correlation among those in their thirties. Thus, we were unable to identify the effects of regional views of family and marriage on the marriage of women.

Effects of Marriage Promotion Policies in Depopulated Regions

Analysis

The previous sections examined the regional differences in marriage and the related factors in localities across Japan. We particularly wanted to shed some light on the effects that marriage encouragement programs are having on the ever-married rates in localities in depopulated regions.

Few local governments have actively developed nonmarriage countermeasures as ways to combat birthrate decline, but in depopulated regions, many localities have long been implementing marriage encouragement programs as a means of addressing their depopulation challenges. According to a survey conducted by the Depopulated Local Areas Research Council in 2000, an accumulation of information on the “implementation status of the *UJI-turn* promotion policy in depopulated localities”²⁹ showed that 174 localities, or 13.6 percent of all depopulated localities, had developed marriage promotion policies. Research has already been conducted on the effects of childbirth promotion policies, such as child-care leave systems, on marriage, but thus far no research has been conducted on whether marriage promotion policies at the local government level actually promote marriage. Thus, this section uses local government data to show whether the marriage encouragement programs adopted in depopulated areas are actually promoting marriage, with particular attention paid to the effects of local characteristics.³⁰

Data and Estimation Methods

This section presents an overview of the number of depopulated localities by prefecture and their marriage promotion policies. Table 5 shows

Table 5

Localities Implementing Depopulation Measures by Prefecture

Prefecture	No. of localities	No. of de-populated localities	Marriage grant	Marriage grant amount (yen)	Perma-nent residency promotion policy	Housing subsidy
Hokkaido	212	164	14	98,000	14	45
Aomori	67	34	1		0	0
Iwate	58	24	1	100,000	0	2
Miyazaki	69	19	0		0	0
Akita	69	38	2	100,000	1	8
Yamagata	44	21	1	10,000	1	4
Fukushima	90	39	2	75,000	0	4
Ibaraki	83	10	0		0	1
Tochigi	49	4	0		0	0
Gunma	69	16	5	136,000	1	5
Saitama	90	5	0		0	0
Chiba	79	8	0		0	0
Tokyo	62	5	0		0	0
Kanagawa	37	0	0		0	0
Niigata	110	45	6	70,000	6	7
Toyama	35	5	1		1	3
Ishikawa	41	15	2	100,000	1	2
Fukui	35	8	0		1	1
Yamanashi	58	21	3	110,000	1	4
Nagano	118	52	9	135,000	14	13
Gifu	96	34	4	500,000	9	9
Shizuoka	73	14	3	100,000	2	1
Aichi	87	12	4	80,000	4	2
Mie	69	14	1	100,000	1	1
Shiga	50	2	0		0	0
Kyoto	44	12	3	115,000	1	3
Osaka	44	0	0		0	0
Hyogo	88	22	2	50,000	4	9
Nara	47	16	1		1	2
Wakayama	50	19	6	90,000	4	7
Tottori	39	12	1		1	3
Shimane	59	40	7	40,000	12	9

Prefecture	No. of localities	No. of depopulated localities	Marriage grant	Marriage grant amount (yen)	Permanent residency promotion policy	Housing subsidy
Okayama	79	44	11	131,250	23	11
Hiroshima	79	52	12	175,000	14	16
Yamaguchi	53	27	6	80,000	11	3
Tokushima	50	30	4	100,000	2	2
Kagawa	37	6	0		0	1
Ehime	69	45	7	125,714	10	11
Kochi	53	38	8	160,000	2	5
Shizuoka	96	29	0		0	1
Saga	49	14	0		0	2
Nagasaki	79	52	5	112,500	7	2
Kumamoto	90	51	2	100,000	3	2
Oita	58	46	19	186,667	16	30
Miyazaki	44	23	3	100,000	1	4
Kagoshima	96	72	12	122,727	14	18
Okinawa	52	22	6	216,667	4	5
Total	3,205	1,281	174	125,725	187	258

Notes: The numbers for the marriage grants, permanent residency promotion policies, and housing subsidies are the numbers of localities implementing each type of program. The marriage grant (yen) figure is the average prefectural marriage grant issued by the 131 localities that reported their marriage grant amounts.

the number of depopulated localities in each prefecture in 2000 and the number of localities that pay marriage grants. The ratio of depopulated localities³¹ is 79.3 percent in Oita prefecture, followed by 77.4 percent in Hokkaido, and 75 percent in Kagoshima. Oita prefecture has the largest number of localities awarding marriage grants, at nineteen, followed by Hokkaido with fourteen, and Hiroshima and Kagoshima with twelve.³² The average marriage grant amount is highest in Gifu prefecture, at ¥500,000, followed by Okinawa at ¥217,000 and Oita at ¥187,000. Permanent residency promotion policies and housing subsidies were adopted by 187 and 258 local governments, respectively, showing that they had been adopted as antidepopulation measures in many localities.

The data used in this section come from 1,281 depopulated localities in 2000. The descriptive statistics are shown in Table 6. In localities that offer marriage grants, the ever-married rates are low except in the

Table 6

Descriptive Statistics: Depopulated Localities

	Men				Women			
	20–24 yrs.	25–29 yrs.	30–34 yrs.	35–39 yrs.	20–24 yrs.	25–29 yrs.	30–34 yrs.	35–39 yrs.
Ever-married rate								
No grant	10.74 (4.08)	33.98 (6.38)	57.22 (6.63)	70.91 (6.11)	17.60 (6.18)	51.58 (7.74)	77.22 (5.66)	88.55 (4.19)
Grant	11.30 (5.29)	32.58 (9.08)	56.16 (8.36)	69.65 (7.44)	18.03 (7.72)	52.47 (9.05)	78.18 (6.83)	88.99 (4.89)
Total								
	20–24 yrs.	25–29 yrs.	30–34 yrs.	35–39 yrs.	Population density	Married female employment rate	Ratio of university graduates: males	Ratio of university graduates: females
Male–female ratio								
No grant	1.05 (0.22)	1.04 (0.15)	0.97 (0.14)	0.99 (0.12)	0.045 (0.061)	0.577 (0.085)	0.090 (0.031)	0.024 (0.010)
Grant	1.10 (0.30)	1.07 (0.26)	1.02 (0.21)	1.01 (0.18)	0.031 (0.033)	0.584 (0.089)	0.087 (0.028)	0.024 (0.011)

Notes: “No grant” indicates localities that do not pay marriage grants. “Grant” indicates localities that pay marriage grants. Figures in parentheses indicate the standard deviation. The ever-married rates, male–female ratios, male employment rates, population densities, and ratios of university graduates are all weighted averages. The ever-married rate is expressed as a percentage. The male employment rates are omitted. The total number of observed values is 1,106 for localities that do not offer grants and 174 for localities that do offer grants. However, those figures are 1,105 for localities that do not offer grants in the male age group twenty to twenty-four years and 172 for localities that do offer grants in the female age group twenty to twenty-four years.

twenty to twenty-four age group, and the male–female ratios are higher than in those localities that do not offer such grants. Thus, males tend to face marriage problems in these areas. The descriptive statistics on women show the same general trends as men for most variables, but are different insofar as the ever-married rates among women are higher in localities that offer marriage grants.

In these estimates, we examine the effectiveness of marriage promotion policies using the ever-married rate as the dependent variable, and the population density (log), age-specific male–female ratios, age-specific male employment rates, married female employment rates, gender-specific ratios of university graduates, and a prefecture dummy as the control variables.³³ The policy variables are a “marriage grant dummy,” such that localities that offer marriage grants are assigned a variable of 1 (with all others assigned 0), and a “marriage grant amount” which is a logarithm reflecting the marriage grant amounts. Because the data used in this study are tabulated by locality, the analysis is performed using a grouped-data probit model. However, because localities starting out with low ever-married rates have a tendency to implement marriage and childbirth encouragement programs, the results of estimates that regress the ever-married rate by the policy variables may be biased toward the lower end.³⁴ Because of this, we perform the estimation using the full-information maximum-likelihood (FIML) method in which the permanent residency promotion policies, housing subsidies, and control variables are used as the instrumental variables. Details regarding the derivation of the likelihood function can be found in the Appendix.

Estimation Results

The coefficient of the marriage grant dummy variable from Table 7 was positive and significant for the twenty to twenty-four and thirty to thirty-four age groups, where the implementation of marriage grants raised the ever-married rates by 2.4 percent and 3.4 percent, respectively. However, since the marriage grants did not have any marriage-promoting effects in the twenty-five to twenty-nine and thirty-five to thirty-nine age groups, we cannot conclude that marriage grants promote marriage. In most age groups, the coefficients of the population density and male employment rate were positive, and the coefficient of the male–female ratio was negative, yielding findings consistent with those obtained using the nationwide data. Furthermore, Table 8 shows that as was the case

Table 7

Grouped-Data Probit Estimation with Endogenous Variables: Male, Marriage Grant Dummy Variable Model

	20–24 yrs.		25–29 yrs.		30–34 yrs.		35–39 yrs.		20–39 yrs.	
	Coeffi- cient	Avg. marginal effect	Coeffi- cient	Avg. marginal effect	Coeffi- cient	Avg. marginal effect	Coeffi- cient	Avg. marginal effect	Coeffi- cient	Avg. marginal effect
Marriage grant dummy	0.133** (0.039)	0.024	-0.005 (0.021)	-0.002	0.086** (0.027)	0.034	-0.004 (0.015)	-0.001	0.052** (0.014)	0.021
Population density	0.019** (0.006)	0.003	0.010 (0.006)	0.003	0.031** (0.004)	0.012	0.023** (0.005)	0.008	0.010** (0.002)	0.004
Male–female ratio	-0.116** (0.017)	-0.021	-0.198** (0.049)	-0.072	-0.149** (0.019)	-0.059	-0.169** (0.046)	-0.059	-0.218** (0.012)	-0.086
Male employment rate	0.919** (0.056)	0.166	0.868** (0.144)	0.314	0.991** (0.074)	0.390	1.479** (0.301)	0.512	1.257** (0.037)	0.496
Married female employment rate	-0.441** (0.065)	-0.080	-0.0015 (0.077)	-0.001	0.352** (0.047)	0.139	0.452** (0.084)	0.157	0.046** (0.023)	0.018

Ratio of university graduates	0.443** (0.183)	0.080	0.248** (0.223)	0.090	0.845** (0.133)	0.333	1.142** (0.175)	0.396	0.730** (0.065)	0.288
Constant	-1.464** (0.078)	-0.265	-0.988** (0.147)	-0.357	-1.050** (0.082)	-0.414	-1.242** (0.228)	-0.430	-1.123** (0.042)	-0.443
River-Vuong <i>t</i> -test	-1.95*		-1.33		-2.90**		-1.47		-3.04**	
Model	FIML	Probit	FIML	Probit	FIML	Probit	FIML	Probit	FIML	FIML
No. of observed values	1,278	1,279	1,280	1,280	1,280	1,280	1,280	1,280	1,280	1,280
Pseudo log likelihood	108,454	-124,290	50,528	-126,099	50,528	-126,099	50,528	-126,099	212,121	212,121
LR test H0										
Constant terms only	965	598	1,169	908	1,169	908	1,169	908	4,474	4,474

Notes: We estimated the grouped-data probit model using the full-information maximum-likelihood (FIML) method for a case of continuous endogenous variables, with marriage promotion policies as the endogenous variable, and the permanent residency promotion policies and housing subsidies as the exclusion restrictions. The marriage grant dummy is a binary variable, but we assumed a linear stochastic model. The prefecture dummy is omitted. Figures in parentheses are standard errors that take into consideration distribution nonuniformity, where markers ** and * indicate statistical significance at the 5 percent and 10 percent levels, respectively. The right side of the coefficient estimate shows the marginal effects evaluated at the average. The River-Vuong *t*-test is estimated from a two-tiered approach. In models rejected at the 10 percent level, figures are estimated using the endogenous variable grouped-data probit model.

Table 8

Grouped-Data Probit Estimation with Endogenous Variables: Other Models

Model	20–24 yrs.		25–29 yrs.		30–34 yrs.		35–39 yrs.		20–39 yrs.	
	Coeffi- cient	Avg. marginal effect	Coeffi- cient	Avg. marginal effect	Coeffi- cient	Avg. marginal effect	Coeffi- cient	Avg. marginal effect	Coeffi- cient	Avg. marginal effect
Dependent variable Ever-married rate among males										
Marriage grant amount	0.008** (0.003)	0.0015	-0.001 (0.001)	-0.0002	0.005** (0.002)	0.0021	-0.001 (0.001)	-0.0004	0.003** (0.001)	0.001
Model	FIML		Probit		FIML		Probit		FIML	
Dependent variable Ever-married rate among males										
Childbirth grant	0.051** (0.017)	0.0092	0.0001 (0.0061)	0.0001	0.029** (0.012)	0.0115	-0.003 (0.005)	-0.001	0.017** (0.006)	0.007

Model	Probit	Probit	Probit	Probit	Probit	Probit
Dependent variable Ever-married rate among females						
Marriage grant dummy	0.010 0.023	0.003 0.018	0.009 0.022	0.014 0.018	0.004 0.019	0.001 0.006 (0.013)

Notes: We estimated the grouped-data probit model using the full-information maximum-likelihood method (FIML) for a case of continuous endogenous variables, with marriage promotion policies as the endogenous variable, and the permanent residency promotion policies and housing subsidies as the exclusion restrictions. The marriage grant dummy is a binary variable, but we assumed a linear stochastic model. The prefecture dummy is omitted. Figures in parentheses are standard errors that take into consideration distribution nonuniformity, where markers ** and * indicate statistical significance at the 5 percent and 10 percent levels, respectively. The right side of the coefficient estimate shows the marginal effects evaluated at the average. The River-Yuon *t*-test is the estimated ever-married rate among females from a two-tiered approach. In models rejected at the 10 percent level, figures are estimated using the endogenous variable grouped-data probit model.

with marriage grants, the coefficients of the marriage grant amount and childbirth grant were both positive and significant in the twenty to twenty-four and thirty to thirty-four age groups. As shown in Tables 7 and 8, the estimates that use the expanded age range of twenty to thirty-nine show that the coefficients for the marriage grant, marriage grant amount, and childbirth grant are all positive. Thus, it is unclear whether the marriage encouragement programs implemented as depopulation countermeasures are having an effect, but in some age groups, they can be said to be raising the ever-married rates in depopulated areas.³⁵

Also, an examination of the effect on female marriage showed that the coefficient of marriage grants, as shown in Table 8, was not significant, thus revealing no policy effects. Because marriage promotion measures are being taken as a means of solving the nonmarriage problem among males, there seems to be no effect on the marriage of females. These types of policies are believed to have an effect on male marriage, but not on female marriage. Many of the promotion policies require the individuals to live in that particular locality, suggesting that the desire to marry is increasing in the home localities of the men rather than in the home localities of the women, who are highly likely to move after marriage.

Conclusions

Average age at first marriage has been rising in Japan, in part because of the social advancement of women and the attainment of higher education levels by women. Marriage postponement was one of the factors in the lowest ever birthrate recorded in 2005. Many studies have been conducted in Japan on the effects of higher levels of education and greater social involvement among women, and the effects of the wages of men on marriage behavior, but there have been no empirical studies of the regional differences in marriage behavior and policies related to marriage. In the United States, studies have been conducted on the effects of policies such as the AFDC on marriage behavior, and these highlighted the importance of taking into consideration regional differences regarding views of marriage and family. In Japan, it is known that the age at first marriage and marriage rates do, in fact, differ by region. This study analyzed a topic that has received little research coverage in Japan, regional differences in marriage and the effects of marriage

promotion policies, using data from localities across the country.

We conducted a basic analysis of the variables that impact ever-married rates and regional differences in marriage, and confirmed that the level of urbanization affects the marriage of both men and women, and that male employment has a positive effect on marriage. Our results also suggested that higher male–female ratios are associated with lower ever-married rates among men, but higher levels of ever-married rates among women.

Our regression analysis confirmed the inverse U-shape of the relationship between marriage and population density. As was also shown in our basic analysis, ever-married rates among both men and women are higher in localities with higher male employment rates, and the male–female ratio has a negative correlation with male marriage but a positive correlation with female marriage. We examined the relationship between marriage and region-specific attitudes toward family and marriage, which cannot be explained by the variables in our regression analysis, but did not find any clear trends.

We also examined whether marriage promotion policies in depopulated areas actually promote marriage. The results suggested the possibility that marriage grant programs increase the ever-married rates among men in certain age groups, and that marriage encouragement programs in depopulated areas are more effective among men and than women.

This study examined the factors believed to have an impact on marriage and childbirth using data from localities nationwide, but did not go so far as to examine in detail the effects of local customs or local attitudes toward marriage and childbirth. In the future, studies should not only analyze these issues using national data, but should include case studies by locality and area to further uncover the realities of marriage and childbirth. By developing marriage-matching models, which have been the topic not only of theoretical research but also of extensive empirical research in recent years, it may become possible to identify the factors underlying the regional differences in marriage.³⁶ Because regional differences in marriage differ by locality, we would normally want to see estimates calculated that take into consideration the fixed effects of locality using panel data. Because this study presents an analysis using cross-sectional data, it cannot go so far as to consider the fixed effects of prefecture, but it highlights the need to conduct further studies that

take into consideration the fixed effects of locality. These issues should be addressed in the future.

Notes

1. For example, see the Social Security Research Institute (1994) and Higuchi and Iwata (1999).

2. The decline in the birthrate among married couples was largely due to a decline in the births of fourth children in the 1950s and a decline in the births of third children in the 1990s. Date and Shimizutani (2005), and Kato (2001) perform time series analyses on birthrates.

3. The National Land Agency's Planning and Coordination Bureau conducted a comprehensive analysis using local government data. Research has also been conducted on regional differences in birthrates, and the results reveal that birthrates tend to be low in regions with high levels of female wages and education, and high housing prices, and in regions where large education expense subsidies are available. Further, the results reveal prefectural differences in birthrates due to factors not attributable to educational background or employment. For example, birthrates are low in Hokkaido and Tokyo, but high in Tohoku and Kyushu.

4. The ever-married rate is defined as: (no. of married people + the no. of widowed people + the no. of divorced people) / total population.

5. There are models in which the endogenous variables are continuous and models in which they are discrete, but this study uses a model with continuous endogenous variables to allow for simpler calculations.

6. In Japan, more research has focused on regional differences in birthrates than in marriage rates. Hiroshima and Mita (1995) conclude that the reason for low birthrates among thirty-five- to thirty-nine-year-old women in large cities is due to low marriage rates and low birthrates among married couples resulting from the difficulties involved in getting married, giving birth, and raising children. Kaneko and Shiraishi (1994) showed that there are differences in birthrates between central and peripheral neighborhoods even within the greater Tokyo metropolitan area, and that birthrates tend to be lower in more urban neighborhoods, even within the same prefecture. In addition, other studies have analyzed the effects of child-care services on female employment, taking into consideration prefectural distinctions (Research Association for the Economic Analysis of Social Impediments 1997; Shigeno and Okusa 1998).

7. This refers to all policies designed to ensure that marriage has an impact on changes in income. These include, for example, the income tax, welfare programs, and social security programs.

8. Alm, Dickert-Conlin, and Whittington (1999) conducted a survey on this topic.

9. AFDC is a public assistance program that was adopted after the enactment of the Social Security Act in 1935. Its goal was to provide assistance to single-parent households and households in which the parents were unemployed. Because the eligibility standards for two-parent households were quite strict, most aid was given to single-mother households.

10. For example, states that are strongly committed to ensuring that children are raised by both parents tend to receive less AFDC.

11. Even Lichter, LeClere, and McLaughlin (1991) and Wood (1995), who examined the relationship between the employment status and wages of males, and marriage highlighted the importance of taking into consideration the distinct characteristics of the local marriage market.

12. Iwabuchi (2004) examined the effects of birthrate decline countermeasures on childbirth in several local governments, and showed that birthrates are increasing in areas where the population is growing or efforts are being made to promote population growth, where child-care support policies tailored to the area are implemented, and where residents feel that the environment is conducive to raising children.

13. See Harada (2001), the National Land Agency Planning and Coordination Bureau (1998), and Tokuno (1998).

14. The following were selected as the typical prefectures in each of five regions: Yamagata prefecture (Hokkaido-Tohoku region), Chiba prefecture (Kanto region), Gifu prefecture (Hokuriku-Tokai region), Osaka prefecture (Kinki-Chugoku region), Nagasaki prefecture (Shikoku-Kyushu region). Details regarding the method by which these prefectures were selected can be found in the Appendix.

15. For more on the methods of extracting and creating these data, see the Appendix. We tried to perform the same analysis for all of the age groups, twenty to twenty-four, twenty-five to twenty-nine, thirty to thirty-four, and thirty-five to thirty-nine years, but we focused on the thirty-five to thirty-nine age group, since this is believed to be the group where the nonmarriage problem among males is greatest. However, the analytical results for other age groups are presented in the footnotes. When studying the marriage behavior of females, we looked at the thirty to thirty-four age group.

16. Figures in parentheses and brackets show the *t*-test *P*-values related to whether the correlation coefficient is anything other than zero.

17. The correlation coefficients were -0.24 in Yamagata, -0.31 in Chiba, -0.31 in Gifu, -0.23 in Osaka, and -0.40 in Nagasaki, with all except Yamagata having a significance level of 5 percent.

18. With the exception of Yamagata, the correlation coefficients were positive and significant at the 1 percent level. In all groups from ages twenty to thirty-nine, a positive correlation was found between male employment rates and ever-married rates. The correlation coefficients of the employment rate and ever-married rate among men is 0.38 for ages twenty to twenty-four, 0.24 for ages twenty-five to twenty-nine, 0.31 for ages thirty to thirty-four, and 0.40 for ages thirty-five to thirty-nine, all of which are significant at the 1 percent level.

19. The correlation coefficients in the five prefectures are -0.51 in Yamagata, -0.36 in Chiba, -0.34 in Gifu, -0.25 in Osaka, and -0.39 in Nagasaki, with all except Osaka having a significance level of 1 percent.

20. The coefficients are 0.48 in Yamagata, 0.34 in Chiba, 0.44 in Gifu, 0.29 in Osaka, and 0.16 in Nagasaki, with all except Nagasaki having a significance level of 10 percent.

21. It has been pointed out that the age at first marriage is high among university graduates (Kaneko 1995; Kitamura and Sakamoto 2002; National Land Agency Planning and Coordination Bureau 1998) so this was added to the explanatory variables.

22. In this article, the prefectural differences in marriage are explained by

the fixed effects of the prefecture, but as originally noted by Wood (1995), the calculations really need to be performed using a fixed effect model at the local level.

23. There is some correspondence in the estimated coefficients between the grouped-data probit model and this one, but because this study uses variables at the local level instead of at the individual level, it cannot control for individual characteristics. This means that compared with an ordinary probit analysis, the standard error will be smaller, thus making it easier for coefficients to appear significant. For details, see Greene (2003) and Maddala (1983).

24. Some studies show that income levels, not employment status, have an impact on marriage (Wood 1995), so we examined the effects of male wages at the prefectural level on marriage. The impact of wages on marriage was negative among both men and women ages twenty to twenty-four, but in the other age groups, the results obtained were the same as those obtained from the use of local data. The reason for the opposite results in the younger age group may be because people tend to marry younger in regions with lower wage levels such as Okinawa and Shikoku. However, these local factors were not controlled for in this study.

25. Because marriageable females may be younger than their male counterparts, we performed the same estimate for the male–female ratio where the females were one age bracket younger than the males (e.g., using the ratio of males ages thirty-five to thirty-nine and females ages thirty to thirty-four). The signs of the coefficients for the ratios using twenty-five- to twenty-nine-year-old males and thirty- to thirty-four-year-old males were the opposite, but we speculate that in these age groups, there are likely to be a lot of marriages between people with small age differences. Also, since the coefficient of the male–female ratio among men ages thirty-five to thirty-nine, for whom the age difference between spouses at the time of marriage is likely to be larger, the coefficient of the male–female ratio was negative. Thus, the results obtained are consistent with the theoretical predictions. The National Land Agency Planning and Coordination Bureau (1998) showed that nonmarriage rates tend to be higher in regions with high ratios of tertiary industries, and thus performed its calculations by including secondary and tertiary industry ratios among its explanatory variables. The coefficients of the married female employment rate and university graduate ratio differed in some cases, but on other variables, such as the male–female ratio and male employment rate, the same results were obtained as in previous estimates.

26. A metropolitan area is defined as the area containing localities that have interactions with a core city center through individuals who commute to school or work. For detailed methods, see Nikkei Research Institute of Industry and Markets (2003).

27. Because the estimation formulas include prefecture dummies, except for Okinawa, and constant terms, the correlation of the dummies indicates the differences in the fixed effects of Okinawa prefecture.

28. Tokuno (1998) states that “in rural villages, traditional marriage pressures (the social idea that marrying is a given) are high,” (p. 178) and that “in suburban rural areas, the family and community also exert high pressure toward marriage” (p. 179).

29. This survey was conducted in 2000 to examine the implementation status of policies in 1999. Thus, the data from the survey reflect the implementation status in 1999. For this reason, our calculations cannot account for the time periods in which the series of marriage promotion policies were launched. (“UJI-turn” is a shorthand reference to three phenomena: reverse migration from city to country [U-turn], migration from big cities to medium-size cities by those who had first moved from the country to the big cities [J-turn], and migration from country to city and then back to the country [I-turn]).

30. Of course, because the sample in this analysis is limited to depopulated localities, care must be taken in the interpretation of the results.

31. A depopulated locality refers to an area where it is becoming difficult to sustain the basic infrastructure, such as education, disaster preparedness, and medical services, due to population decline.

32. For example, the town of Kimobetsu in Hokkaido is implementing a Marriage Grant Program as a measure to promote permanent residency. It offers ¥100,000 to successors who take over family farms or commercial businesses, as well as an additional ¥50,000 in subsidies. So far, thirty-two couples (twenty-one individuals who have moved into the area from other areas) have taken advantage of the program. The town is also offering childbirth grants for the births of second and subsequent children. Thirteen families have taken advantage of this program (*Kimobetsu News*, no. 614).

33. Because there are no depopulated localities in either Kagawa or Osaka prefectures, they have been excluded from the prefecture dummy.

34. The descriptive statistics show that the localities that have developed marriage grant programs have low ever-married rates among males. The old Depopulation Law was in place from 1989 to 1999. Since the ever-married rates are from 2000, there is no problem with regard to any simultaneity bias.

35. Because the ever-married people in 2000 include people who were married before the policy was implemented, the results for the higher age cohorts are not very reliable.

36. The marriage matching model analyzes marriage behavior based on the idea that mismatching can occur due to the limited availability of information at the time a person is deciding whom to marry. For details, see Burdett and Coles (1997) and Ermisch (2003).

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Appendix

Construction of Variables Used in the Analysis

Gender and age specific ever married rate (percent) = (No. of married people + the no. of widowed people + the no. of divorced people) / total population * 100

Male age-specific employment rate = No. of employed males by age / male population by age

Married female employment rate = No. of married female employed people / No. of married couple households

Male–female ratio by age group = No. of males by age / No. of females by age

Population density = Population (people) / area (square km)

Gender-specific ratio of university graduates = No. of university graduates by gender / population aged 20 and older by gender

Nuclear family ratio = No. of nuclear families / total no. of households

Sources

Population, male and female populations by age group, male and female married individuals by age group, male and female widowed individuals by age group, male and female divorced individuals by age group, number of nonmarried males and females by age group, number of employed males and females by age group, number of extended family households, number of nuclear families, and university graduates by gender: Ministry of Internal Affairs and Communications Statistics Bureau, *National Census*.

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Average age at first marriage by prefecture: singulate mean age at marriage (SMAM) by prefecture and gender reported by the National Institute of Population and Social Security Research.

Prefecture Selection Methods

The prefectures were selected according to the following procedures to ensure variability in terms of region and population: (1) they were divided according to the log of the population density into, 2.25 up to 2.5, 2.5 up to 3.0, 3.0 up to 3.5, 3.5 and higher; (2) typical prefectures were selected to ensure that all five regions (Hokkaido/Tohoku, Kanto, Hokuriku/Tokai, Kinki/Chugoku, Shikoku/Kyushu) were represented, using the median values for each category. When there was some overlap in the regions with median values, they were extracted from the figures around the median.

Grouped-Data Probit Estimation with Continuous Endogenous Variables

We performed a probit estimation with grouped-data with continuous endogenous explanatory variables, taking into consideration the possibility of a correlation with the ever-married rate through variables that cannot be measured in marriage grant and childbirth grant programs (see Appendix Table 1).

Because the ever-married rate is a form of grouped data (which are based not on individuals, but on groups of individuals, such as a locality) the following model was created:

$$Y_{ij} = (y_{ij}^* > 0)$$

$$y_{ij}^* = x'_{1i} \beta + x_{2i} + \varepsilon_{ij} \quad i = 1, \dots, n, \quad j = 1, \dots, n_i \tag{1}$$

$$x_{2i} = x'_{1i} \gamma_1 + z'_{1i} \gamma_2 + u_i = z'_i \gamma + u_i \tag{2}$$

where, i is the number of groups, and j is the number of individuals in each group. If y_{ij} is married, the value is 1, and if not, the value is 0; y_{ij}^* is a latent variable corresponding to y_{ij} ; ε_{ij} and u_i are independent of z'_i , and follow a bivariate normal distribution with zero expected value. Further, the variance of u_i is σ_u , but the variance of ε_{ij} is standardized at 1; x_{1i} is an exogenous variable, x_{2i} is a continuous endogenous variable and is correlated with ε_{ij} and u_i . (Marriage grants are binary variables, but we assumed a linear stochastic model in performing the calculations.) Thus, ε_{ij} and u_i are expressed as follows:

$$\varepsilon_{ij} = \theta u_i + e_{ij} \tag{3}$$

Appendix Table 1

Probit Estimation with Grouped Data: Analysis Using Data from Metropolitan Areas

Dependent variables	Ever-married rate among men				Ever-married rate among women			
	20–24 yrs.	25–29 yrs.	30–34 yrs.	35–39 yrs.	20–24 yrs.	25–29 yrs.	30–34 yrs.	35–39 yrs.
Population density	0.006** (0.001)	0.024** (0.002)	0.066** (0.002)	0.060** (0.002)	-0.011** (0.002)	0.001 (0.002)	0.037** (0.002)	0.042** (0.002)
Population density squared	-0.0006** (0.0001)	-0.0021** (0.0001)	-0.0046** (0.0002)	-0.0041** (0.0002)	0.0006** (0.0001)	-0.0004** (0.0002)	-0.0030** (0.0001)	-0.0033** (0.0001)
Male-female ratio	-0.051** (0.002)	-0.263** (0.004)	-0.328** (0.004)	-0.354** (0.004)	0.052** (0.002)	0.057** (0.004)	0.109** (0.003)	0.076** (0.003)
Male employment rate	0.112** (0.003)	0.464** (0.010)	0.976** (0.014)	1.110** (0.014)	0.233** (0.004)	0.796** (0.011)	0.974** (0.012)	0.842** (0.010)
Married female employment rate	-0.084** (0.004)	-0.130** (0.005)	-0.147** (0.006)	-0.117** (0.005)	-0.098** (0.004)	-0.103** (0.006)	-0.018** (0.005)	0.040** (0.004)
Ratio of university graduates	-0.316** (0.004)	-0.398** (0.006)	-0.176** (0.006)	-0.054** (0.006)	-0.673** (0.012)	-0.599** (0.013)	-0.358** (0.011)	-0.225** (0.009)
No. of observed values	470	470	470	470	470	470	470	470
Log likelihood	-1,336,193	-3,844,744	-3,834,894	-2,998,560	-1,854,206	-4,200,759	-3,154,916	-2,055,585

Notes: The probit model with grouped data is estimated using the maximum-likelihood method. The coefficients are averages of the assessed marginal effects. Figures in parentheses are standard errors that take into consideration distribution nonuniformity. Markers ** and * indicate statistical significance at the 5 percent and 10 percent levels, respectively. Metropolitan area data were created by collecting and adjusting municipal data in accordance with Nikkei Research Institute of Industry and Markets, *Heibou suru toshiken 2004 Nenban—ban 04 su Nen kokusei chousa ni miru zenkoku toshiken no seisui* [Changing Metropolitan Areas, 2004 Edition: Changes in Metropolitan Areas Nationwide According to the National Census] (Tokyo: Nihon keizai shimbunsha, 2003).

However, $\rho = \theta\sigma_u$ and e_{ij} are stochastic variables that adhere to $N(0, 1 - \rho)$. Also, z_{ij} is an excluded variable that meets the ordinary assumptions. $\sum_j^{n_i} y_{ij}$ is the number of ever-married people in the locality; x_{1i} is the exogenous variable; endogenous variable x_{2i} is created from the marriage and childbirth promotion policies; and exogenous variable z_{1i} reflects permanent residency promotion policies and housing subsidies.

If the calculation is performed by replacing (3) with (1), the result is (4):

$$P(y_i | x_{2i}, z_i) = \Phi \left(\frac{x_{1i}'\beta_1 + x_{2i} + \rho(x_{2i} - z_i'\gamma) / \sigma_u}{\sqrt{1 - \rho^2}} \right). \tag{4}$$

Because y_{ij} is grouped data, if the ratio of married people in the group is defined as $P_i = \sum_j^{n_i} y_{ij} / n_i$, the following can be derived from (4):

$$P_i = \Phi(w_i) + \varepsilon_{ij}.$$

However,

$$w_i = (x_{1i}'\beta_1 + x_{2i} + \rho(x_{2i} - z_i'\gamma) / \sigma_u) / \sqrt{1 - \rho^2}.$$

Thus, the simultaneous density function is

$$f(y_{ij}, x_{2i} | z_i) = \Phi(w_i)^{y_{ij}} (1 - \Phi(w_i))^{1 - y_{ij}} - \frac{1}{\sigma_u} \phi \left(\frac{x_{2i} - z_i'\gamma}{\sigma_u} \right)$$

and the maximization purpose function is expressed as

$$\begin{aligned} & \sum_i^n \sum_j^{n_i} \left[y_{ij} \log \Phi(w_i) + (1 - y_{ij}) \log (1 - \Phi(w_i)) - \frac{1}{2} \log \sigma_u^2 - \frac{1}{2} \log \left(\frac{x_{2i} - z_i'\gamma}{\sigma_u} \right)^2 \right] \\ & = \sum_i^n \left[P_i \log \Phi(w_i) + (1 - P_i) \log (1 - \Phi(w_i)) - \frac{1}{2} \log \sigma_u^2 - \frac{1}{2} \log \left(\frac{x_{2i} - z_i'\gamma}{\sigma_u} \right)^2 \right]. \end{aligned} \tag{5}$$

Under the maximum-likelihood method, (5) is maximized with regard to $(\beta_1, \beta_2, \rho, \gamma, \sigma_u)$. Also, because the estimation is performed using the information from the density functions $f(y_{ij} | x_{2i}, z_i)$ and $f(x_{2i} | z_i)$ at the same time, it is an estimation using the FIML model. (As was pointed out in Wooldridge [2002], the two-stage approach of Rivers and Vuong [1988] is a limited-information method in which two formulas are estimated separately).

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