Available online at www.sciencedirect.com
ScienceDirect
Mathematics and Computers in Simulation 81 (2011) 1507–1517
MATHEMATICS AND COMPUTERS IN SIMULATION
www.elsevier.com/locate/matcom

Social security and divorce in Japan

K. Sakata[a,b], C.R. McKenzie[c,*]

[a] Faculty of Economics, Ritsumeikan University, 1-1-1 Noji Higashi, Kusatsu, Shiga, Japan
[b] Faculty of Economics and Commerce, University of Melbourne, Melbourne, Victoria 3010, Australia
[c] Faculty of Economics, Keio University, 2-15-45 Mita, Minato-ku, Tokyo 108-8345, Japan

Received 17 February 2010; received in revised form 11 May 2010; accepted 16 May 2010
Available online 24 May 2010

Abstract

The purpose of this paper is to explain variations in the divorce rates across prefectures in Japan over the 20-year period between 1982 and 2002. This paper examines the various factors which may affect divorce rates including: the effects of the generosity of social welfare; the income of females relative to males; the female employment rate; the vacancy rate; a shift to no-fault divorce; and social stigma. There are three major findings of this paper. First, the generosity of a particular prefecture in approving the livelihood protection benefits (LPBs) has a statistically negative impact on the divorce rate. Moreover, social stigma has negative impacts both on the divorce rate and the generosity of social security benefits. Finally, political conservatism has a negative impact on the proportion of needy people who receive LPB. The findings of this paper imply that in order to become eligible for the social security benefits, married couples may be more likely to dissolve their marriage in those prefectures where the provision of the LPB is not so generous.

Keywords: Divorce; Panel data; Stigma; Welfare

1. Introduction

Over the past 60 years, family structure in Japan has changed remarkably. One of the important changes relates to the number of divorces and the divorce rate. As in many other developed countries, the Japanese divorce rate has gradually increased.

There is large literature relating to divorce in the United States (for example, Refs. [2–4,19,20]). In contrast, despite the attention that has been given to divorce in the Japanese media in recent years, there are very few empirical studies relating to divorce in Japan [10,11,16,17].

One of the interesting aspects of Japanese divorces is that there is great deal of diversity in divorce rates across regions and prefectures in Japan. An examination of the divorce rates across prefectures over time shows that particular prefectures (for example, Fukuoka and Hokkaido) consistently appear to have high divorce rates (see Table 1a). This trend is not so pronounced among those prefectures with the lowest divorce rates (see Table 1b). A key question for economists is whether these regional differences are caused by differences in culture across regions or are caused by

* Corresponding author.
E-mail address: mckenzie@z8.keio.jp (C.R. McKenzie).

0378-4754/$36.00 © 2010 IMACS. Published by Elsevier B.V. All rights reserved.
doi:10.1016/j.matcom.2010.05.015

Table 1a
Crude divorce rates: top five prefectures.

	1970		1980		1990		2000	
1	Hokkaido	1.43	Hokkaido	1.86	Okinawa	1.90	Okinawa	2.74
2	Kochi	1.36	Okinawa	1.85	Hokkaido	1.73	Osaka	2.63
3	Aomori	1.24	Fukuoka	1.58	Fukuoka	1.61	Hokkaido	2.51
4	Fukuoka	1.22	Kochi	1.53	Osaka	1.58	Fukuoka	2.42
5	Yamaguchi	1.16	Aomori	1.52	Tokyo	1.53	Miyazaki	2.32

Source: *Vital Statistics*.

differences in economic conditions or a mixture of the two. None of the existing empirical studies for Japan cited earlier have examined regional differences in divorce rates across Japan.

The purpose of this paper is to examine what causes the regional variations in the divorce rates in Japan. This paper particularly looks into the relationship between the divorce rate, and the income of females relative to males, the female employment rate, the business cycle and the accessibility of social security benefits. Unlike the United States, the Japanese legal system is unitary, and, therefore, it is very difficult to find any major legal or systematic differences across prefectures (Akabayashi and Toda [1] provide an example of a rare exception). However, there is a clear difference in the accessibility to some social security benefits across prefectures/regions.

In the United States, there is a sizeable literature investigating how the social security system affects decisions on marital dissolution. Previous studies in this field have examined the extent to which the generosity of the Aid to Families with Dependent Children (AFDC) program has had an impact on marital dissolution, and how social welfare reform in the 1990s affected marriage and divorce. Moffitt [15] and Bitler et al. [5] find a statistically significant positive relationship between divorce and social welfare. On the other hand, Blackburn [6] and Hoffman and Duncan [7] contend that the effects of the AFDC program on divorce are limited.

In Japan, it is often claimed that in order to become eligible for livelihood protection benefits (LPBs), couples with low income intentionally dissolve their marriage even though they do not have problems with their marriage. However, there is little empirical evidence to support such a claim. This paper seeks to uncover whether regional differences in divorce rates can be partly explained by regional differences in the generosity of accessibility to social security benefits.

There are three major contributions of this paper. First, it is found that there is a significant negative relationship between divorce and the generosity of social security benefits. Second, this paper examined the effects of political conservatism on the generosity of social security benefits. Finally, the empirical results suggest that stigma can play an important role influencing both divorce and the approval of social security applications.

Section 2 provides a brief discussion of social security benefits provided by the livelihood protection law (*Seikatsu hogoho*) in Japan. Section 3 discusses the economic variables that might be expected to affect the divorce rate, while Section 4 details the definitions of the variables used and data sources. Estimation results are reported in Section 5, and Section 6 contains a brief conclusion.

2. Livelihood protection law (*Seikatsu hogoho*)

The legal framework for assistance to the poor and needy in Japan is provided by the national livelihood protection law (*Seikatsu hogoho*). It is a system designed to help the needy maintain a minimum standard of living and to provide

Table 1b
Crude divorce rates: bottom five prefectures.

	1970		1980		1990		2000	
1	Shiga	0.58	Hiroshima	0.74	Osaka	0.81	Kyoto	1.45
2	Nagano	0.59	Yamagata	0.79	Kanagawa	0.83	Oita	1.47
3	Shimane	0.60	Chiba	0.80	Saga	0.87	Ishikawa	1.55
4	Niigata	0.62	Akita	0.81	Okayama	0.92	Aichi	1.58
5	Ibaragi	0.63	Tokushima	0.82	Chiba	0.94	Saga	1.62

Source: *Vital Statistics*.

incentives for them to become self-supporting as soon as possible. Livelihood protection benefits are subject to severe means tested so that if a household whose only income is a pension or some sort or an allowance, and the total income level is lower than the specified minimum level of assistance for that household, only the difference between the two will be paid to the applicant. Applicants with an income level greater than the specified minimum level of assistance for that household receive nothing. For people who work, the income that matters is not their gross income, but their income after the subtraction of certain deductions (here referred to as "net" income). Again, these people are only entitled to receive livelihood benefits if their net income is below the minimum level of benefits specified for the household concerned, and they are entitled to the difference between their net income and the minimum level of benefits specified.

In addition to this severe means test, according to the livelihood protection law, benefits will be provided if and only if the applicant demonstrates that: (1) if he/she is able to work that he/she is working in accordance with his/her ability; (2) he/she has disposed of all of his/her available excess assets (real estate, bank deposits and savings, life insurance and assets like a car, etc) and appropriated them for living expenses; (3) he/she have sort the assistance of their immediate family (parents, children, bothers or sisters; in Japanese, these relatives are referred to as being relatives within the third degree of kinship); and (4) he/she has applied for all available alternative social security like child allowances and pensions. Since the applicant has to show that there are no relatives within the third degree of kinship that he/she can depend on, potential applicants may have an incentive to divorce so that the husband who is capable of working is no longer a relative within the third degree of kinship. Divorce per se will also reduce the number of relatives in the third degree of kinship, and thus increase the likelihood of receiving benefits.

Assistance under this law can be classified into the following eight categories: (1) maintenance allowance; (2) education allowance; (3) housing allowance; (4) medical allowance; (5) nursing care allowance; (6) child birth allowance; (7) vocational allowance; and (8) funeral allowance. One or more of these allowances may be paid to a poor or needy household.

Komamura [12] argues that even though households with income levels below the livelihood protection benefit are more likely to be eligible for receiving these benefits, many of these households do not actually receive the benefits. Using individual data from the *National Survey of Family Income and Expenditure* (Zenkoku Shohi Jittai Chosa), Komamura [12] defines low-income households as households whose income is below the amount of the livelihood protection benefit, and estimates the number of these households. He further computes the ratio of households which receive LPB to the number of low-income households. According to Komamura, only 4–10% of low-income households actually received the livelihood protection benefit between 1984 and 1999.

While this system is a national one, there are reasons for suspecting that there may be significant variations in the generosity of the accessibility to the system across prefectures. Under the present system, 75% of the cost of livelihood protection assistance is paid for out of the national treasury, with the burden for the remaining 25% being on the local government body responsible for providing the assistance. In order to reduce its fiscal burden, a local government body has an incentive to strictly control its certification of households that are eligible for livelihood protection. Given that the fiscal position of prefectures differs significantly across Japan, the incentive for local governments to certify individuals and provide benefits can also be expected to differ across Japan.

In this paper, the ratio of the number of households with an income under 2 million yen to the number of households who are receiving likelihood protection benefits is used to measure the generosity of the accessibility to social security. The benchmark of 2 million yen was chosen since it was the only consistent category for low-income households, which is consistently available in the *Employment Status Survey*. In addition, if an application is for livelihood benefits accepted, a couple with two kids will receive around 2 million yen per year. Since the amount is considered by government to maintain the minimum standard of living, the 2 million yen benchmark was chosen.

For every 5 years between 1982 and 2002, Tables 2a and 2b present details of the five prefectures with the highest and lowest ratio of the number of households with an income under 2 million yen to the number of households who are receiving livelihood protection benefits, respectively. There is a great deal of variations across the prefectures even though the criteria for granting the livelihood protection benefit are supposed to be the same. Comparing the ratios for the best and worse prefectures suggests that the ratio in the prefecture with the highest ratio can be as much as four times the ratio in the prefecture with the lowest ratio. Although there are some timing differences between Tables 1 and 2, many of the prefectures in the top five prefectures for divorce rates (Table 1a) also appear among the top five prefectures for the generosity of their accessibility to welfare benefits (Table 2a).

A cursory examination of the figures in Tables 2a and 2b indicates that there is a noticeable drop in the ratio after 1987. This is due to an important change in the definition of "household" in the *Employment Status Survey*. In the data

Table 2a
Estimated proportion of the needy receiving livelihood protection: top five prefectures.

	1982		1987		1992		1997		2002	
1	Fukuoka	0.445	Fukuoka	0.470	Fukuoka	0.150	Osaka	0.150	Osaka	0.144
2	Hokkaido	0.339	Tokyo	0.469	Hokkaido	0.147	Hokkaido	0.133	Hokkaido	0.143
3	Tokyo	0.322	Kyoto	0.439	Osaka	0.143	Fukuoka	0.132	Tokyo	0.126
4	Kyoto	0.320	Kanagawa	0.383	Kyoto	0.138	Nara	0.121	Kanagawa	0.125
5	Osaka	0.284	Hokkaido	0.361	Hyugo	0.129	Kanagawa	0.118	Fukuoka	0.114

Source: Estimated from data reported in the *Reports on Social Welfare Affairs* and the *Employment Status Survey*.
Note: The figures reported in this Table are the values for socsec, the estimated ratio of the number of people who receive livelihood protection benefits to the number of households whose annual income is less than 2 million yen.

Table 2b
Estimated proportion of the needy receiving livelihood protection: bottom five prefectures.

	1982		1987		1992		1997		2002	
1	Gunma	0.091	Yamanashi	0.093	Yamanashi	0.038	Yamanashi	0.032	Toyama	0.029
2	Yamanashi	0.095	Gunma	0.107	Ishikawa	0.039	Ishikawa	0.035	Nagano	0.034
3	Gifu	0.097	Gifu	0.117	Fukui	0.039	Toyama	0.036	Yamanashi	0.034
4	Shizuoka	0.105	Kagoshima	0.120	Gifu	0.043	Fukui	0.036	Fukui	0.034
5	Ibaragi	0.121	Shizuoka	0.121	Shizuoka	0.044	Gifu	0.037	Gifu	0.037

Source: Estimated from data reported in the *Reports on Social Welfare Affairs* and the *Employment Status Survey*.
Note: The figures reported in this Table are the values for socsec, the estimated ratio of the number of people who receive livelihood protection benefits to the number of households whose annual income is less than 2 million yen.

for 1992, 1997 and 2002, single households are included in the definition of a "household", while in the data prior to 1992, single households were excluded.

Table 3 provides details of the proportion of female-headed households receiving livelihood protection benefits to the total recipients of livelihood protection benefits. Female-headed households consist of 8–9% of the total recipients.

3. Model

Becker et al. [4] in their theory of divorce assume that a couple dissolves their marriage/partnership if, and only if, their combined wealth when the marriage is dissolved exceeds their combined married wealth. According to this theory, even when one party finds his/her wealth higher when divorced than when married, and the other part does not, side payments allow the party with the larger difference between the two states to compensate the party with the smaller difference. The impact of any variable in this model relies on it having a differential impact on the two states

Table 3
Recipients of livelihood protection benefits by household type.

Household type	1995	2000	2005
Elderly households	253,250	362,350	470,090
	43.7	47.2	44.7
Disabled/injured households	245,110	295,230	401,420
	42.3	38.4	38.2
Female-headed households	49,960	62,870	86,770
	8.6	8.2	8.3
Other households	31,680	47,420	92,370
	5.5	6.2	8.8
Total	580,095	767,964	1,050,741
	100.0	100.0	100.0

Source: *Reports on Social Welfare Affairs*.
Note: For each household type and each year, the first row is the actual number of recipients of livelihood protection benefits, and the second row is the share of this group in the total number of recipients for that year.

of marriage and divorce. For the sake of argument, we take as a "model" married couple the case where the husband works, and the wife is a housewife. In this case, changes in the husband's income would affect wealth in both states in the same way suggesting that they would not affect the likelihood of divorce. In contrast, assuming the wife only works in the divorced state means an increase in the wife's expected income from working in the case of divorce would increase the likelihood of divorce. In a similar way, an increase in the probability of being able to work when the wife wants to work would lead to an increase in the likelihood of divorce. For married couples where both partners work, these effects will not be so strong.

Since both wages and employment rates are pro-cyclical, these arguments would suggest that divorce rates will be pro-cyclical. There is however some disagreement in the literature about whether divorce rates are pro-cyclical or counter-cyclical. Becker [3] points out that divorce rates, marriage rates and birth rates are pro-cyclical in many developed countries. On the other hand, Huang [8] suggests using monthly time series data for Taiwan that Taiwan's marriage and divorce rates are counter-cyclical. Using annual data for Japan, Sakata and McKenzie [17] find that in Japan when the unemployment rate rises, the divorce rate rises suggesting that the divorce rate in Japan is also counter-cyclical.

There are of course several problems with Becker et al.'s [4] analysis. First, there are various stigmas associated with divorce, and it would appear that the importance of these stigmas have changed significantly over time in Japan. Second, the analysis is (implicitly) premised on the Coase theorem, so that changes in the law relating to divorce do not affect the divorce rate, but affect the distribution of assets in a divorce. Given that the Japanese civil code permits divorce by consent (*kyogi rikon*), this assumption is consistent with the Japanese law. Recourse to a divorce suit (*chotei rikon*) is possible when one of the two parties wants a divorce, but the other does not. If the Coase theorem is valid in the case of Japanese divorces, an increase in the probability of winning a divorce suit has no impact on the divorce outcome, but it only changes the distribution of assets.

Some recent economic research has focused on the impact of time discount rates on economic activity (see, for example, Ref. [9]). An individual's time discount rate may be one factor that determines the degree to which a married couple is well matched. Compared to individuals with low time discount time rates, individuals with high time discount rates are likely to spend less time searching for a partner. As a result, they are likely to be less well matched. If it is the case that poorly matched couples are more likely to divorce, then this would suggest that individuals with high time discount rates who marry will be more likely to divorce. If at the prefectural level, there are differences in the average time discount, these differences may explain some of the differences in divorce rates across prefectures.

There are two possible effects of livelihood protection benefits. Since the receipt of the livelihood protection benefit potentially increases out of marriage income for a divorced woman, it is expected that it would increase the probability of divorce. That is, in prefectures where there is a high proportion of households receiving livelihood protection benefits, it is easier for an individual to be certified as being in need of the livelihood protection benefit, and this makes divorce more likely. It should be noted that unlike some of the American social welfare programs discussed in Section 1, the livelihood protection benefit is not limited to single mother families. As a result, it could lead to income supplementation in a case where the husband faces a loss of income for some reason. In this case, by raising the household's level of minimum income livelihood protection benefits could work to prevent marriage dissolutions.

In order to explain variations in divorce rates, the existing literature often controls for increases in the earnings ability of females, variations in the business cycle, and changes in legal changes [19]. This paper estimates the following model:

$$\log(\text{mwdiv}_{it}) = \beta_0 + \beta_1 \log(\text{socsec}_{it}) + \beta_2 \log(\text{relinc}_{it}) + \beta_3 \log(\text{femp65}_t) + \beta_4 \log(\text{vr}_{it}) + \beta_5 \log(\text{pred}_t) + \beta_6 \log(\text{comtie}_{it}) + \beta_7 \log(\text{loan}_{it}) + \beta_8 t + \alpha_i + e_{it} \quad (1)$$

where the subscripts i and t refer to prefecture i and time t, respectively; mwdiv is the divorce rate for married women (the number of divorces per 1000 married women); socsec is a variable related to the likelihood of receiving livelihood protection benefits; relinc is the income of females relative to males; femp65 denotes the employment rate of females aged less than 65 years; vr is the vacancy rate; pred is the estimated probability of victory in a divorce suit where one of the parties is at fault; comtie is a stigma variable; loan is a proxy variable for the time discount rate of the representative individual in prefecture i at time t, the time trend is included to take account of changes in social attitudes towards divorce over time; and eit is a disturbance term. The fixed prefectural effects, α_i, are included to take account of differences in social attitudes towards divorce that exist across prefectures.

If the generosity of access to livelihood protection benefits provides an incentive for recipients to divorce then it is expected that $\beta_1 > 0$. Both β_2 and β_3 are expected to be positive as improvements in women's position in the public and private spheres are expected to lead to an increase in the divorce rate. As Sakata and McKenzie [17] suggest that Japanese divorce rate is counter-cyclical and the legal shift to no-fault divorce increases the divorce rate, it is expected that $\beta_4 < 0$ and $\beta_5 > 0$. Social stigma can be a strong disincentive to divorce, so that $\beta_6 < 0$ is expected. As explained earlier, the higher a person's time discount rate is the more impulsive he or she is likely to be. An impulsive marriage may lead to a bad matching and, therefore, it is expected that $\beta_7 > 0$.

Although this paper attempts to examine the effects of the generosity of livelihood protection benefit certification on divorce, there may be causality in the reverse direction, namely, an increase in the number of divorces may result in an increase in the generosity of livelihood protection benefit certification. As mentioned in Section 2, applicants who can rely on their relatives within the third degree of kinship are not accepted for livelihood protection benefits because the system requires that they depend on their relatives first. As a result of this rule, single mothers who have fewer relatives than a married couple are more likely to be certified for the LPB, which subsequently increases socsec.

As Table 3 indicates, female-headed households consist of 8–9% of the total recipients of LPB on average, which is not a trivial proportion. It is therefore reasonable to take account of the possibility of this reverse causality. In a time series analysis of the determinants of public assistance, Schade and Nemoto [18] found that the number of seats held by the Liberal Democratic Party in the diet had a significant negative impact on the level of spending on public assistance and its coverage. Following on this idea, in this paper, political variables are used as instruments for socsec. If the criteria for granting livelihood protection benefits vary across the regions, the variation may be caused by differences in political conservatism. In order to allow for the endogeneity of the generosity of accessibility to the welfare system, the share of votes in the relevant prefecture for the Liberal Democratic Party (LDP) and for the Communist Party (JCP) in the Lower House election immediately prior to the year of interest. These variables denoted as ldpvr and commvr, respectively, are used as instruments.

Over the period being analyzed (1982–2002), there have been a number of major realignments of the political parties in Japan. As a result, it should be noted that only these two political parties have been in existence for the whole period examined. In order to be good instruments, these variables need to be correlated with socsec, but uncorrelated with the error term in Eq. (1). If the political conservatism of a prefecture is independent of the criteria for granting livelihood protection benefits, the coefficients of these instruments will not be statistically significant in the first stage model for socsec.

4. Data

This paper uses Japanese prefectural panel data for the following years; 1982, 1987, 1992, 1997, and 2002. The data for the number of low-income households is categorical, and it is not possible to control for price changes over a long time period. As a result, only data from 1982 was used. Details of variable definitions and data sources are summarized in Table 4.

In order to focus on the appropriate risk group for divorce, the divorce rate is computed as the number of divorces divided by the number of married women. As a result, mdivr denotes the divorce rate per 1000 married women. The data for the number of divorces are obtained from *Vital Statistics* (*Jinko Dotai Chosa Hokoku*), and data for the number of married women are taken from the *Employment Status Survey* (*Shugyo Kozo Kihon Chosa Hokoku*). Since data on the number of married women is not available in 2002 from this source, *Census* (*Kokusei Chosa*) was used to obtain data on the number of married women in 2002. An alternative measure of the divorce rate would be to use the number of divorces per 1000 population of females over a certain age. It goes without saying that marriage is a precondition for a divorce, so that the number of divorces per 1000 married women provides a better measure of the probability (risk) of divorce for married women. Furthermore, using the general population as the denominator introduces the impact of many factors that are unrelated to divorce per se. In what follows, the logarithm of any of the variables in Eq. (1) is indicated by the prefix *l*, so that log(mdivr), the log of the divorce rate for married women, is denoted by lmdivr.

For the purpose of measuring the generosity of accessibility to social security benefits, socsec is constructed as the ratio of the number of households receiving livelihood protection benefits to the number of households whose annual income is below 2 million yen. The data for the number of households receiving benefits comes from *Reports on Social Welfare Affairs* (*Shakai Fukushi Gyosei Gyomu Hokoku*), and the data for the number of households with an income below 2 million yen is obtained from the *Employment Status Survey* (*Shugyo Kozo Kihon Chosa*), which is

Table 4
Variable definitions and data sources.

Variables	Definitions	Data Sources
mdivr	Divorce rate per 1000 married women	*Vital Statistics*, *Employment Status Survey*, and *Census*
socsec	Number of Households receiving Livelihood Protection Benefits/ Number of households with an annual income below 2 million yen	*Reports on Social Welfare Affairs* and *Employment Status Survey*
minc	Male annual salary = (monthly salary × 12) + annual bonus	*Basic Survey on Wage Structure*
finc	Female annual salary = (monthly salary × 12) + annual bonus	*Basic Survey on Wage Structure*
relinc	Relative income = finc/minc	
femp65	Employment rate for females aged above 15 and below 65	*Employment Status Survey*
vr	Job vacancy rate: a job offers-to-seekers ratio	*Reports on Employment Security Bureau*
pred	Predicted probability of winning a model divorce case	Sakata and McKenzie (2009)
stigma	Participation rate in local improvement activities	*Survey on Time Use and Leisure Activities*
loan	Loans (excluding home loans) per household	*National Survey of Family Income and Expenditure*
ldpvr	Share of votes for the Liberal Democratic Party at the Lower House election	*Japan National Politician Database*: http://www.senkyo.janjan.jp/index.html
commvr	Share of votes for the Communist Party at the Lower House election	*Japan National Politician Database*: http://www.senkyo.janjan.jp/index.html
year	Year effect	

only collected every 5 years. The denominator of socsec, the number of households with an income below 2 million yen, is used because the annual amount of the likelihood protection benefit for a couple is currently around 2 million yen. Of course, it is inappropriate to use this income benchmark over a long time period. However, it is very difficult to make a judgment about changing the income benchmark of a needy family. Furthermore, the income categories in the *Employment Status Survey* change over the sample period, and the only consistent category for low incomes is the category of income below 2 million yen. As it is not possible to control for inflation due to the categorical nature of the data, the analysis focuses on divorce rates from the 1980s. As noted in Section 2, it is also important to note that the treatment of single households has changed: they were excluded from the statistics until and including the 1987 survey, but they were included from 1992. This may be one of the reasons why the values of socsec in Tables 2a and 2b drop after 1992. It is assumed that effects of this change in the definition of a household are absorbed in the time effects in the regression analysis that follows.

In Sakata and McKenzie [17], a probit model is used to explain Supreme Court and High Court decisions in divorce suits. Based on recursive estimates of this probit model, the probability of winning a divorce suit after each court case is computed for a 'model' divorce case. Using information about the date of each court case, it is possible to compute a probability of winning a model divorce case in any given year, pred. The data for pred are taken directly from Sakata and McKenzie [17]. It should be noted that this variable does not vary over prefectures, and in the period being analyzed it contains a strong upward trend.

Link and Phelan [13] define stigma as "the co-occurrence of its components – labeling, stereotyping, separation, status loss, and discrimination". There is no regional panel data relating to people's perceptions of divorce. In this paper, rather than measuring stigma directly, a proxy variable that reflects stigma is used. Stigma requires peer pressure. If an individual's ties to the community are very strong, the person may not dissolve his/her marriage because he/she cares about their reputation within their community. Here, the average participation rate for local improvement activities in the *Survey on Time Use and Leisure Activities* is used as a proxy for stigma. There is considerable variation in this variable across prefectures and over time.

The model presented in Section 3 contains a variable relating to the time discount rate. Obviously data is not available directly on this variable. Ikeda et al. [9] argue that individuals with low (high) time discount rates are likely to have high (low) savings rates. As an extension of this argument, individuals with low (high) time discount rates are likely to have a small (large) amount of loans outstanding. The amount of loans outstanding per household in a prefecture is

Table 5
Descriptive statistics.

Variables	Obs.	Mean	Std. Dev.	Min.	Max.
mwdivr	235	5.929	1.853	2.973	13.241
secsec	235	0.124	0.082	0.029	0.470
relinc	235	0.599	0.042	0.345	0.747
femp65	235	59.146	5.394	44.262	69.742
vr	235	0.793	0.382	0.140	2.080
pred	235	0.145	0.056	0.072	0.212
stigma	235	21.096	5.812	6.400	38.428
loan	235	373.681	182.892	87.000	965.000
ldpvr	235	49.595	12.101	15.294	80.943
commvr	235	8.630	5.071	1.445	26.422

used as a proxy for the discount rate in the prefecture. Data on the amount of loans per household in each prefecture was collected from the *National Survey of Family Income and Expenditure*.

The data for the instruments used in the two stage least squares estimation, the share of votes for the Liberal Democratic Party in the National Lower House election and for the Japanese Communist Party in the National Lower House election, ldpvr and commv, respectively, are collected from the *Japan National Politician Database*. As the election years do not exactly match with the years of the data set used, data for the nearest Lower House election prior to the relevant year were used. In theory, it would have been possible to use information on the voting patterns in elections for prefectural governors and/or prefectural assemblies, but these elections are not all held at the same time.

5. Results

Descriptive statistics for the variables used in the analysis are presented in Table 5. Initially, Eq. (1) was estimated by both pooled ordinary least squares (OLS) and by OLS with fixed prefectural effects. Since the null hypothesis that all the coefficients on the fixed prefectural effects are zero is strongly rejected in every case, only the results for the fixed effect case are reported. Table 6 reports the estimated fixed effect models for Eq. (1) when estimated by OLS and two staged least squares. When Eq. (1) is estimated by OLS, the social security variable is statistically significant, but has an estimated coefficient that is negative. That is, when the likelihood of receiving social security benefits increases, the divorce rate is found to fall. There are some other consistent findings across these equations. First, the relative income of females has a significant and positive impact on the divorce rate. This is consistent with the idea that as women's economic positions in the household improve, the divorce rate increases. Second, reductions in the job vacancy rate lead to significant increases in the divorce rate. This finding suggests that in Japan the divorce rate is counter-cyclical. This finding is consistent with the time series evidence in Sakata and McKenzie [17] for Japan, but is in contrast to the pro-cyclical findings for the United States. Third, the amount of loans per household which is used as a proxy for the time discount rate is always insignificant.

The estimated coefficient of the log of the female employment rate has a negative sign and is significant. This finding is perhaps a little surprising since it is often argued that increases in the work opportunities for non-working married women lead to an increase rather than a decrease in the divorce rate. The estimated coefficient of the stigma variable is negative and significant in all specifications. The sign of this estimated coefficient is consistent with our expectations. Strong community ties appear to play an important role in the divorce decision-making process. An examination of the evidence for the impact of the expected probability of winning a divorce suit indicates that this variable has a positive and significant coefficient. Although not reported, the qualitative results are not influenced by the inclusion of a time trend is included or by the choice of functional form, and are consistent with Sakata and McKenzie [17]. That is, the Coase theorem does not apply to Japanese divorces, since if the probability of wining a divorce suit increases, marriage are more likely to dissolved.

In order to allow for the endogeneity of the generosity of the accessibility to livelihood protection benefits across prefectures, Eq. (1) was also estimated using fixed effects two stage least squares (2SLS), and the results are also reported in Table 6. For the purpose of computing the 2SLS estimates, lldpvr and lcommvr were used as instruments. The *F*-statistics testing the null hypothesis that all the coefficients (except the constant) are zero in the first stage model

Table 6
Estimates of the divorce equation assuming fixed effects.

	OLS	2SLS	
		2nd stage	1st stage
Explanatory Variables/Dependent Variables	lmwdiv	lmwdiv	lsocsec
lsocsec	−0.068	−0.279	
	(0.030)**	(0.131)**	
lrelinc	0.468	0.337	−0.613
	(0.183)**	(0.176)*	(0.211)***
lfemp65	−0.417	−0.409	0.445
	(0.202)**	(0.228)*	(0.412)
lvr	−0.231	−0.273	−0.181
	(0.021)***	(0.035)***	(0.044)***
lpred	0.166	0.013	−0.834
	(0.036)***	(0.101)	(0.069)***
lstigma	−0.202	−0.319	−0.560
	(0.059)***	(0.099)***	(0.123)***
lloan	−0.025	−0.058	−0.135
	(0.019)	(0.029)**	(0.035)***
year	0.012	0.009	−0.017
	(0.002)***	(0.003)***	(0.006)***
lldpvr			−0.163
			(0.061)***
lcommvr			0.112
			(0.033)***
Constant	−19.068	−13.452	29.955
	(4.627)***	(6.698)**	(10.915)***
Observations	235	235	235
Number of id	47	47	47
R-squared	0.91	0.67	0.93
Hausman test		0.948	

Notes: The figures in parentheses are robust standard errors for OLS and standard errors for 2SLS. The figure for the Hausman test is a *p*-value.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

was well above 10. The Hausman test is used to test for the endogeneity of the social security benefit variable, and the value reported in Table 6 suggests that the benefit variable was not endogenous in the divorce equation, so that fixed effect OLS is the appropriate estimator.

The first stage estimates for lsocsec presented in Table 6 contain some interesting findings. The estimated coefficient of lldpvr is negative and significantly different from zero, and the estimated coefficient of lcommvr are positive and significantly different from zero. This means that the political conservatism does have an influence on the accessibility to livelihood protection benefits. Furthermore, the estimated coefficient of stigma is negative and significantly different from zero. Consistent with Komamura's [12] findings, this suggests that those who are actually eligible for livelihood protection benefits may be reluctant to claim their rights because they fear a loss of reputation in their community (for example, Ref. [14]).

To reiterate, in contrast to the results for the United States, it is found that increases in the likelihood of being able to receive social security appear to lower the divorce rate. This difference in the empirical results between Japan and the United States in relation to the impact of the social security may be explained by a difference in their respective social security systems, that is, a difference between AFDC and livelihood protection benefits. The American AFDC is particularly targeted at female-headed households, while the Japanese livelihood protection benefits are targeted at lower income households in general. Therefore, it may be argued that when marriage becomes unstable due to a reduction or a loss of income, the livelihood protection benefit reduces the likelihood of divorce via the income support it provides to married households.

Another reason for the negative correlation between the generosity of the LPB and the divorce rates is that in order to become eligible for the LPB, married couples are more likely to get divorced in the prefectures where the ratios of the households certified for the LPB to the low-income households are low – the prefectures where the provision of the PLB is strict. Since a structural equation for lsocsec is not estimated here, the possibility that there is an incentive for married couples to get divorced and to "cheat" the system in order to become eligible for livelihood protection benefits cannot be ruled out. However, whether this happens in practice is not relevant for the direct interpretation of our estimates of the structural Eq. (1).

6. Conclusion

This paper has examined the various factors which may affect the divorce rates in Japan at the prefectural level: the effects of the generosity of accessibility to social welfare; the income of females relative to males; the female employment rate; the vacancy rate; a shift to the no-fault divorce; and social stigma. Even though the livelihood protection benefit is a national system, there exist non-trivial variations in take up rates across prefectures. Previous studies in the United States suggest that there is positive or no correlation between divorce and the generosity of the social welfare system. In contrast, an increase in the generosity of accessibility to livelihood protection benefits in a particular prefecture has a negative impact on the divorce rate. It is also found that the variations in the generosity of accessibility to livelihood protection benefit across regions are affected by political conservatism and stigma. The results also suggest that some of the regional variation in divorce rates can be partially explained by economic factors such as increases in the income of females relative to males and reductions in the job vacancy rate lead to significant increases in the divorce rate. The finding for the job vacancy rate suggests that in Japan the divorce rate is counter-cyclical. Furthermore, the proxy variable for stigma is significant in explaining regional variations in the Japanese divorce rate. It is often argued that the existence of social security benefits can provide an incentive for married couples to get divorced. The evidence presented in this paper suggests this is not the case for Japan. Rather, it is found that an increase in the accessibility to livelihood benefits lower the divorce rate. That is, the Japanese livelihood protection benefit system would appear to work to stabilize marriages in Japan.

Acknowledgements

The authors would like to thank Nobuyuki Kitamura, Keiko Tamada, members of the Family Economics Research Group, participants of the Kansai Labour Economics Seminar, and two anonymous referees for their comments on earlier versions of this paper. The first author wishes to acknowledge the financial assistance provided by the Japan Society for the Promotion of Science Grant in Aid for Scientific Research No. 20730195 for a project on the "The Impact of Judicial Decisions on the Incentive Mechanism". The second author wishes to acknowledge the financial assistance provided by a Global Center of Excellence (GCOE) Award made to the Graduate School of Economics and the Graduate School of Business and Commerce at Keio University for Raising Market Quality-Integrated Design of Market Infrastructure.

References

[1] H. Akabayashi, H. Toda, Prohibiting sex or prohibiting true love? An empirical assessment of effect of statutory rape law on teenage marriage in Japan, in: paper presented to the Public Economics Seminar, September 2009, Keio University, 2009.
[2] G.S. Becker, A theory of marriage: Part II, Journal of Political Economy 82 (2) (1974) S11–S26.
[3] G.S. Becker, Family economics and macro behavior, American Economic Review 64 (2) (1988) 317–319.
[4] G.S. Becker, E.M. Landes, R.T. Michael, An economic analysis of marital instability, Journal of Political Economy 85 (6) (1977) 1141–1188.
[5] M.P. Bitler, J.B. Gelbach, H.W. Hoynes, M. Zavodny, The impact of welfare reform on marriage and divorce, Demography 41 (2) (2004) 213–236.
[6] M.L. Blackburn, The effects of the welfare system on martial dissolution, Journal of Population Economics 16 (3) (2003) 477–500.
[7] S.D. Hoffman, G.J. Duncan, The effect of incomes, wages, and AFDC benefits on marital disruption, Journal of Human Resources 30 (1) (1995) 19–41.
[8] J.T. Huang, Unemployment and family behavior in Taiwan, Journal of Family and Economic Issues 24 (1) (2003) 27–47.
[9] S. Ikeda, F. Ohtake, Y. Tsutsui, Jikan waribikiritsu: keizai jikken to ankeeto ni yoru bunseki (Time discount rates: an analysis based on economic experiments and questionaire surveys), Discussion Paper No. 74, COE Discussion Paper, Osaka University, 2005 (in Japanese).

[10] A. Kato, Kekkon to rikon no kazoku jinkogaku (Family demography of marriage and divorce), in: National Institute of Population and Social Security Research (Ed.), Shoshika no Yoin Toshite no Rikon Saikon no Doko, Haikei oyobi Mitoshi ni kansuru Jinkougakuteki Kenkyu (Demographic Research of Trends, the Background and the Prospects for Divorce and Remarriage as Causes of the Low Birth Rate), National Institute of Population and Social Security Research, Tokyo, 2006, pp. 99–112 (Chapter 7) (in Japanese).
[11] H. Kato, Rikon to rodo shijyo no jikeiretsu bunseki (A time series analysis of divorce and the labour market), in: National Institute of Population and Social Security Research (Ed.), Shoshika no Yoin Toshite no Rikon Saikon no Doko, Haikei oyobi Mitoshi ni kansuru Jinkougakuteki Kenkyu (Demographic Research of Trends, the Background and the Prospects for Divorce and Remarriage as Causes of the Low Birth Rate), National Institute of Population and Social Security Research, Tokyo, 2006, pp. 85–98 (Chapter 6) (in Japanese).
[12] K. Komamura, Teishotokusha no suikei to seikatsu hogo seido (Estimation of low income households and the livelihood protection system), Mita Shougaku Kenkyu 46 (3) (2003) 107–126 (in Japanese).
[13] B.G. Link, J.C. Phelan, Conceptualizing stigma, Annual Review of Sociology 27 (1) (2001) 363–385.
[14] R.A. Moffitt, An economic model of welfare stigma, American Economic Review 73 (5) (1983) 1023–1035.
[15] R.A. Moffitt, Welfare benefits and female headship in U.S. time series, American Economic Review 90 (2) (2000) 373–377.
[16] J. Raymo, M. Iwazawa, L. Bumpass, Marital dissolution in Japan: recent trends and patterns, Demographic Research 11 (14) (2004) 395–420.
[17] K. Sakata, C.R. McKenzie, The impact of divorce precedents on the Japanese divorce rate, Mathematics and Computers in Simulation 79 (9) (2009) 2917–2926.
[18] U. Schade, K. Nemoto, Poverty and politics: evaluating public assistance in Japan, in: paper presented to the 2006 Annual Meeting of the International Studies Association, San Diego, 2006.
[19] B. Stevenson, J. Wolfers, Marriage and divorce: changes and their driving forces, Journal of Economic Perspectives 21 (2) (2007) 27–52.
[20] Y. Weiss, The formation and dissolution of families: Why marry? Who marries whom? And what happens upon divorce? in: M. Rosenzweig, O. Stark (Eds.), Handbook of Population and Family Economics, North-Holland, Amsterdam, 1997.