The Heterogeneous Effects of Uncertainty on Divorces

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Abstract

Existing work shows that uncertainty created by a lack of information about the other partner before marriage leads to more divorces. In this paper, I use the different timing of the adoption of anti-discrimination legislation in Japan, which bans the identification of the Burakumins, to examine the effect of uncertainty on divorces with a difference-in-differences approach. I show that an increase in such uncertainty has heterogeneous effects on divorces. I find that an increase in uncertainty increases divorces in places where the information is less important and decreases divorces when that information is more important.

1 Introduction

It is said that transparency is crucial to a stable marriage. Naturally, knowing more about the other partner introduces less uncertainty into the marriage and results in better matches being formed. As demonstrated by Becker et al. (1977), more uncertainty leads to more divorces. Existing empirical work, such as Charles and Stephens (2004) and Booth and Edwards (1985), confirm that result. In this paper, I present new empirical evidence using data from

Japan and a difference-in-differences approach to show that an increase in uncertainty can lead to both a decrease and an increase in divorces.

In addition to reporting new findings on the effects of uncertainty, this paper also examines discrimination in the marriage market. It is hard to determine what qualities an individual values in a potential partner. Cerroni-Long (1985) proposes an exchange theory that suggests some look for higher income, while others prefer a higher social status. Gordon (1964) explains in detail how third-party preferences for certain values play an important role in marriages. Lastly, the availability of potential candidates may also affect individuals' preferences. The inability to ascertain what singles value when they search for marriage candidates makes it hard to determine what factors should be controlled for to obtain unbiased results of discrimination in the marriage market.

The case of the Burakumins in Japan presents an opportunity to study the effect of uncertainty on divorces and discrimination in the marriage market. As a minority group with identical phenotypes to the average Japanese, they have been discriminated against by the Japanese for centuries. Even after the emancipation during the Meiji Restoration, the non-Burakumin Japanese still want to identify the Burakumins to avoid marrying or hiring them. Many rely on private investigators to determine if their future spouse or in-laws are Burakumins.

Starting with the Osaka Prefecture in 1985, four other prefectures have adopted ordinances that make it more costly to identify the Burakumins using private investigators. Governments in those prefectures ban background checks aimed at discriminating the Burakumins. In addition to suspension of business, perpetrators can face months of imprisonment and thousands of dollars of fines. The exogenous decrease in the information that partners have about each other in those five prefectures allows me to conduct a diff-in-diff analysis on marriages and divorces. With the prefecture-level panel data compiled by the Statistics Bureau of Japan and the distribution of Burakumins from a government study, I can also conduct a triple diff-in-diff analysis in this paper.

I introduce a simple model to illustrate the mechanism involved. When the cost of marrying a Burakumin is high enough, interracial marriages that accidentally occur because of a lack of information will dissolve. In regions with only a small percentage of Burakumins, it is those new interracial marriages that drive up the overall divorce rates. On the other hand, partners in non-Burakumin marriages will be discouraged from divorce in regions with a large proportion of Burakumins. This is because they will have a higher chance of matching with a Burakumin after divorce, which lowers their remarriage value. It is this unwillingness to divorce among partners in non-Burakumin marriages that brings down the overall divorce rate.

I start with the standard difference-in-differences (DID) model and find no significant changes in either marriages or divorces. I then conduct a triple difference-in-differences analysis to determine if the effect of the policy on marriages and divorces depends on the percentage of Burakumins in each prefecture. While the ordinances have no effects on the number of marriages per thousand, I find an increase in divorces per thousand in places where Burakumins account for a smaller percentage of the total population and a decrease in the measure when there are relatively more Burakumins. The results suggest that an increase in uncertainty can have heterogeneous effects on divorces. Recent literature has shown that when treatment occurs at different time periods, the estimates obtained by staggered DID models may be biased. To alleviate such concern, I employ a new method called the two-stage difference-in-differences to confirm the results along with the synthetic control method.

2 Background

2.1 Related Literature

Becker et al. (1977) finds that uncertainty in a marriage will result in more divorces. Empirical works, such as Charles and Stephens (2004) and Booth and Edwards (1985), provide evidence for that result. Partners with less in-

formation about each other can also have more uncertainty in their marriage. In this paper, I set out to study how this type of uncertainty affects marriage.

On the other hand, this paper also touches on discrimination in the marriage market. Pager and Shepherd (2008) reviews the issue of racial inequality in many social domains and finds that little work is done on the issue in marriage markets. Hitsch et al. (2010) shows that racial preference exists in dating using micro-level data from online dating websites. And that both men and women exhibit same-race preference. Fisman et al. (2008) employs a speed dating experiment to study subjects' revealed preferences. The author also finds a same-race preference in matching. It is the women who tend to have a stronger same-race preference than men.

More recent works, such as Fryer Jr (2007) and Qian and Lichter (2011), focus on documenting the trend in interracial marriages and seeking to explain those trends. Another strand of literature studies divorces among interracial marriages. Bratter and King (2008) shows that interracial couples are more prone to divorce, while Zhang and Van Hook (2009) draws the opposite conclusion. To sum up, existing literature finds uncertainty has a homogeneous effect on divorces. And there is a paucity of empirical literature on discrimination in the marriage market.

2.2 The Burakumins

For centuries, the group of people known as the Burakumins were shunned by their fellow Japanese because of their low caste status during the Tokugawa Period. The discrimination against members of the group did not disappear with the abolishment of the caste system in the late 19th Century. Many were still impoverished and had to live in their segregated and dilapidated neighborhoods known as Burakus.

From 1965 to 2002, the Japanese government implemented the Dowa Project to improve the living conditions of those Burakus. However, the additional investment in education, infrastructure, and payments of subsidies did little to curb the discrimination. On the contrary, it made it easier to

identify those neighborhoods and gave the general public the impression that the Burakumins lived off handouts (Ramseyer and Rasmusen, 2018).

Although the situation has improved since the 1960s, Burakumins still face discrimination in the areas of employment and marriage. However, the fact that they are identical in phenotype to the average Japanese makes it hard to discriminate against them. With stricter control of access to the Koseki (Household Registry), it becomes increasingly hard to identify the Burakumins. While certain Burakumins have specific Kanjis in their last names, many can be identified by their addresses. In 1975, a list of burakus was found by the police. Based on the 1936 survey, the list contained the location of Buraku communities. Just like how major corporations would check their prospective employees' backgrounds, parents would also look into their future in-laws' family origin to screen out the Burakumins. Many turned to private investigators for such background investigations since addresses and last names can be deceiving.

As a result of the severe discrimination, many Burakumins fared poorly in marriage and labor markets. Burakumins tend to marry within their neighborhood and divorce easily for the lack of a quality partner (Gordon, 2006). Being denied opportunities to work in big companies, many either worked in small family businesses or joined the Yakuza. It is estimated that about 60% of the members in Yakuza are Burakumins. In the Yamaguchi-Gumi, the largest organized crime syndicate in Japan, Burakumins account for 70% of the members (Kaplan and Dubro, 1986).

2.3 The Anti-Discrimination Ordinances

In 1985, the Osaka Prefecture adopted an ordinance that outlawed the investigation into individuals' backgrounds. Four other prefectures adopted similar ordinances shortly after. Kumamoto followed suit in 1995. A year later, Fukuoka and Kagawa adopted the ordinance. Tokushima passed the same law in 1997. In Figure 1, the proportions of Burakumins as a percentage of the total population in every prefecture are shown.

The ordinances punish transgressors by possible suspension of business, fines, criminal penalties, and public denunciation. Private investigators who continue to provide the services may be forced to suspend their businesses. Perpetrators in Osaka can face up to 3 months of imprisonment and 1000 dollars worth of fines. For instance, a business consulting firm and its investigating arm in Osaka were charged by the Osaka District Public Prosecutor for doing such background checks in 1999 (Buraku Liberation and Human Rights Research Institute, 1999).

On the other hand, public denunciation is a very effective measure often used by the Burakumin Liberation League (BLL), a Burakumin human rights activist group. The BLL is said to have used the threat of public denunciation to extort businesses for economic and political gains. The implementation of the policy raised the cost of such background research. Combined with the identical phenotype, the Burakumins can exit their neighborhoods and marry members of the majority when the conditions are favorable.

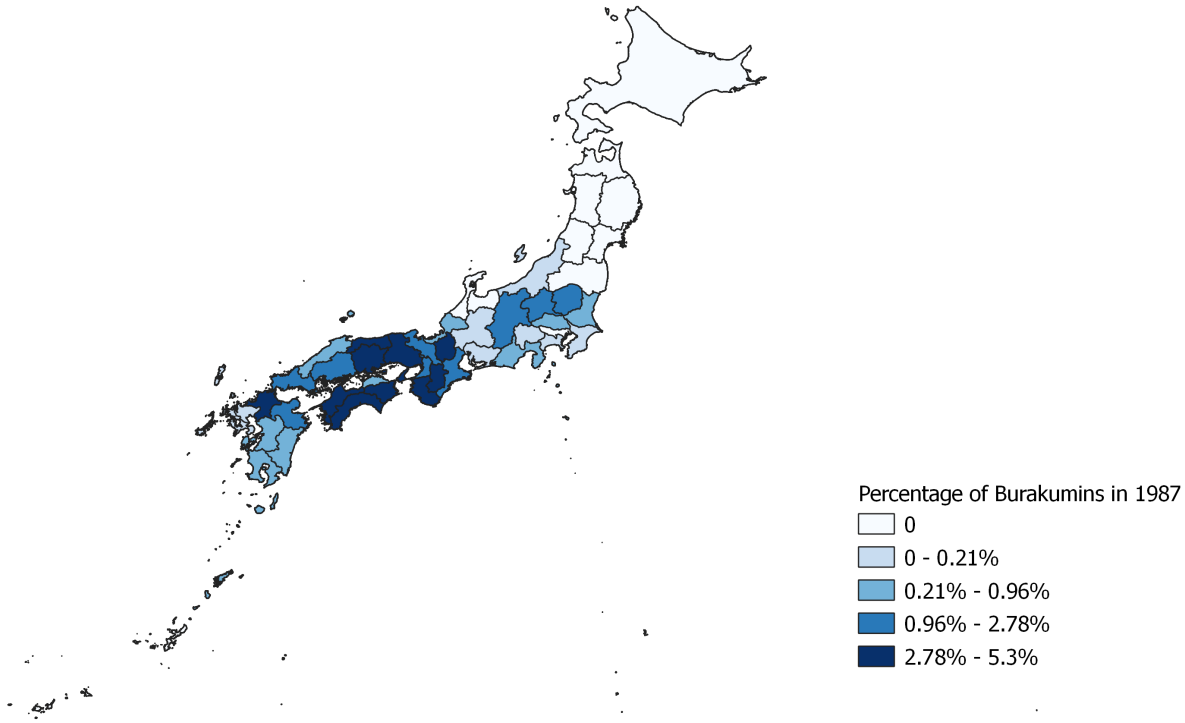


Figure 1: The Distribution of Burakumins

2.4 Theoretical Framework

This model is based on Browning et al. (2014). I extend the model by allowing different distributions of marriage quality for different ethnic groups and introducing a cost for interracial marriages. In this model, there are two groups of people-the majorities and the Burakumins. Each group has an equal number of men and women. And they live for two periods. Each

consumes his or her income Y when they are single. If they get married, each spouse consumes $2Y$. Marriage also entails a non-monetary return θ that both partners share. This marriage quality is randomly distributed. Different couples will draw different values of θ when they get married. And it is not known until after the marriage at the end of the period. Let $F(\theta)$ and $G(\theta)$ be the CDFs of θ when a marriage is between two majorities and when one of the partners is a Burakumin, respectively. Assume further that the mean of θ is zero for both distributions. Additionally, if individuals choose to divorce, then they will have to draw another θ when they remarry.

The meetings occur randomly. An individual meets a person of the opposite sex at the beginning of the period. Assume further that the Burakumins account for R proportion of the population. While it is costless to marry within one's group, intermarriage will lower the consumption of a majority by C. A majority will only find out whether their partner is a Burakumin or not at the end of the period. A marriage lasts for at least 1 period. Divorce can occur at the end of the first period. However, remarriage is only possible with unattached individuals who are either never married or divorced. An individual will meet a mate in the first period with certainty. In the second period, the probability of meeting an eligible partner is equal to the proportion of the population that is unattached to the opposite sex.

At the end of the first period, the quality of the match and the identity of one's partner are revealed. Everyone will get married in the first period as consumption is always higher when married and the commitment is only for one period. Before the policy is implemented, the background check is rather cheap and everyone purchases the service before marriage. This implies segregation in the marriage market. The following should occur in both groups. Let α be the remarriage rate. So the value of being unattached at the beginning of the second period is

$$V(\alpha) = Y + \alpha Y \tag{1}$$

At the end of the first period, a person will choose to divorce if

$$2Y + \theta < Y + \alpha Y \tag{2}$$

At the end of the first period, when

$$\theta < \alpha Y - Y \tag{3}$$

divorces occur. An equilibrium is reached when the expected remarriage rate is equal to the actual divorce rate. We have,

$$\alpha_M^* = F[\alpha^* Y - Y] \;\; \alpha_B^* = G[\alpha^* Y - Y] \tag{4}$$

The Burakumins have a higher rate of divorce. To capture this feature in the model, I assume that θ is uniformly distributed with a support of $[-b_M, b_M]$ if the marriage is between two majorities. And if either one of the partners is a Burakumin, then θ will be uniformly distributed with a support of $[-b_B, b_B]$. Furthermore, b_B is greater than b_M. So the equilibrium divorce rate is the weighted average of the two divorce rates.

$$\alpha^* = (1 - R)\frac{b_M - Y}{2b_M - Y} + R\frac{b_B - Y}{2b_M - Y} \tag{5}$$

After the anti-discrimination ordinance is implemented, the service will be too expensive to purchase. As a result, there are three types of marriages: Burakumin within-race marriages, majority within-race marriages, and inter-racial marriages. The expected value of being unattached for a Burakumin at the beginning of the second period is different from that of a majority. Let π be the proportion of Burakumins among divorcees. See Appendix A for the detailed derivation of the model.

In equilibrium, the expected remarriage rate is equal to the actual divorce rate, this gives,

$$\alpha = R^2 G[\alpha Y - Y] + 2R(1-R)G[\alpha Y - Y + (1 - \alpha\pi)C] + (1-R)^2 F[\alpha Y - Y - \alpha\pi C] \tag{6}$$

The proportion of divorcees who are Burakumins at the beginning of the second period can be represented by the following equation,

$$\alpha\pi = R^2 G[\alpha Y - Y] + R(1-R)G[\alpha Y - Y + (1-\alpha\pi)C] \tag{7}$$

Solving for both α and π analytically is rather difficult, so I simulate the model. A higher percentage of Burakumins implies a higher chance of meeting a Burakumin in the second period. And that will discourage a majority from exiting a majority-majority marriage. On the other hand, an increase in the proportion of the Burakumin population will also increase the proportion of marriages that are prone to dissolve[1] (i.e. Burakumin-Burakumin and interracial marriages).

[1] $\alpha Y - Y - \alpha\pi C < \alpha Y - Y < \alpha Y - Y + (1-\alpha\pi)C$

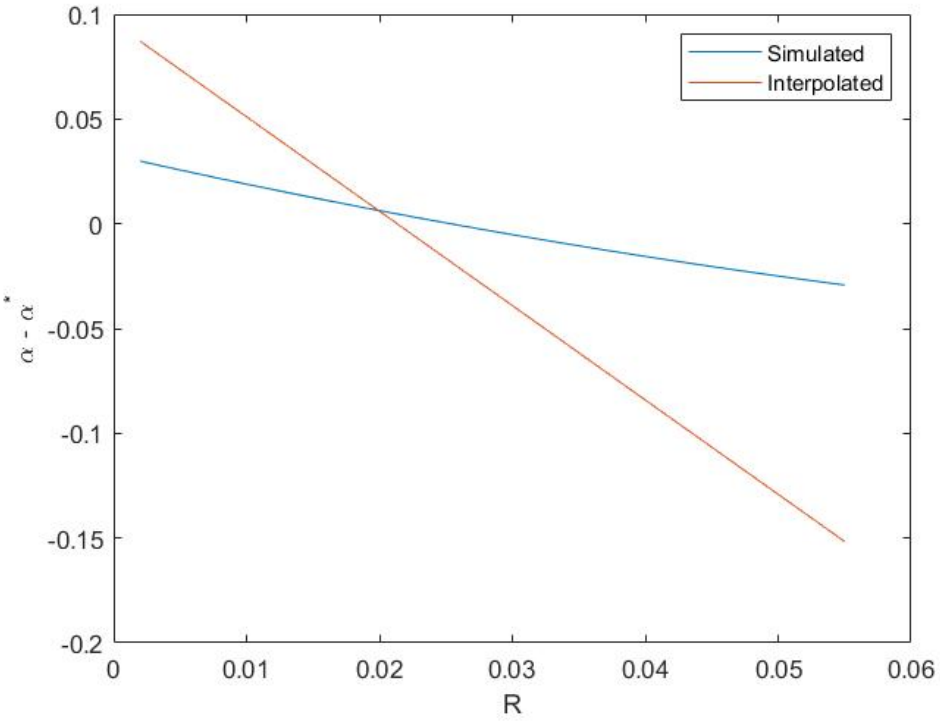


Figure 2: Relative Burakumin Presence and the Effect of the Policy

Note: the red line is derived using linear interpolation with the results in Table 2. The blue line is generated by simulation.

When the cost of marrying a Burakumin is high enough, all interracial marriages will result in divorce. The divorce rate of Burakumin-Burakumin marriages remains constant. When the Burakumins account for only a small proportion of the total population, it is the interracial marriages that drive up the total divorces. Partners in majority-majority marriages are discouraged from divorce when the Burakumins account for a higher proportion of the population, which lowers the overall divorce rate. As shown in Figure 2, the simulated changes in the divorce rate match the results generated by linear interpolation with data qualitatively.

3 Methodology

3.1 Data

For the empirical analysis, I use prefecture-level data from the Statistics Bureau of Japan. The Statistics Bureau of Japan is a government organization operating under the Ministry of Internal Affairs and Communications. The Bureau compiles administrative and survey data from various sources including population census to create the aggregate data at municipal, prefecture, regional, and national levels. The panel dataset contains data on the number of divorces and marriages, prefecture-level population, education, crime, local economy, and other relevant control variables from 1975 to 2018 (Statistics Bureau of Japan, 2019).

The data on the distribution of Burakumin comes from Smith (1995). According to the author, the data was originally collected by the Japanese government. With the household registration records and the population census, the government of Japan conducts studies specifically targeting the Burakumins from time to time.

3.2 Empirical Strategy

Although Japan has 47 prefectures in total, I only keep the prefectures that have non-zero percentages of Burakumins (36 prefectures). That is because all the treated prefectures have Burakumins and I am concerned that prefectures with no Burakumins may be fundamentally different from the treated prefectures. I drop the highest and lowest 1% of the data based on the outcome variables to avoid outliers driving the results.

The dependent variables are divorces per thousand and marriages per thousand. The list of covariates includes the unemployment rate, crimes per thousand, log GDP, percentage enrolled in universities and colleges, percentage of net immigration, percentage of land cultivated, and the labor force participation rate. Due to the fact that the data for covariates comes from the census, I use the nearest neighborhood extrapolation to fill in the

gaps.

The standard difference-in-difference and the triple diff-in-diff approaches are chosen to study the effect of the policy. While the standard diff-in-diff setup is simple, the triple diff-in-diff involves interacting the diff-in-diff interaction term with the percentage of the Burakumin population.

For each dependent variable, I use a few types of models. The standard diff-in-diff model at the prefecture level is as follows

$$Y_{pt} = \alpha + \delta(T_t \times P_p) + \eta R + \beta X_{pt} + \gamma_p + \sigma_t + \epsilon_{pt} \tag{8}$$

Y_{pt} is the dependent variable and X_{pt} refers to the list of covariates mentioned earlier. γ_p and σ_t are the prefecture and year fixed effects, respectively. α is a constant. ϵ_{pt} is the error term. Subscripts p and t represent the prefecture and year, respectively. T_t is equal to one in the years after the policy is implemented. And P_p is equal to one in a treated prefecture. This means $(T_t \times P_p)$ is the interaction term and δ captures the effect of the policy. The first triple diff-in-diff model used is given as

$$Y_{pt} = \alpha + \delta D_{pt} + \lambda D_{pt} \times R + \eta R + \beta X_{pt} + \gamma_p + \sigma_t + \epsilon_{pt} \tag{9}$$

In this model, I interact the relative presence R with the diff-in-diff interaction term D_{pt}. So the total effect on a treated prefecture is $\delta + \lambda R$. I also interact R with the years of treatment T_t and the treated prefecture P_p, separately. Everything else stays the same as before. For a clearer interpretation, I convert R into a dummy: large Burakumin presence. It is equal to 1 if the R is greater than its median in the sample. So we have the following model

$$Y_{pt} = \alpha + \delta D_{pt} + \lambda D_{pt} \times LBP + \eta LBP + \beta X_{pt} + \gamma_p + \sigma_t + \epsilon_{pt} \tag{10}$$

LBP is equal to one if the region has a large Burakumin presence. So in regions with a small proportion of Burakumins, δ captures the effect of the policy. And $\delta + \lambda$ gives the effect of the policy in places with a large Burakumin presence. To further confirm my results and address the potential

bias that recent literature has found in staggered OLS DID models, I will implement a two-stage DID and the synthetic control method.

Table 1: Summary Statistics

Variables (Mean)	No ordinance	Ordinance passed	Sample
Marriages per thousand	5.657	5.487	5.645
Divorces per thousand	1.508	1.992	1.547
Percentage of Burakumins (%)	1.56	1.94	1.59
Unemployment rate(%)	3.85	5.90	4.00
Crimes per thousand	1.18	1.59	1.21
Log GDP	15.754	16.096	15.781
Percentage enrolled in Uni/Coll (%)	2.13	2.81	2.18
Percentage of net immigration (%)	-2.14	1.41	-1.86
Percentage of arable land (%)	13.4	13.2	13.3
Labor force participation rate (%)	50.7	49.4	50.6
Observations	1,427	121	1,584

Table 1 holds the summary statistics for all the outcome variables and the covariates. The sample includes only the prefectures that have non-zero Burakumins. I then divide the sample by whether the prefectures passed the ordinance. Except for the amount of immigration, prefectures with and without the ordinance appear to be somewhat similar in other aspects.

4 Results

4.1 Main Results

As shown in Table 2, I evaluate the effect of the policy with two different models and two different samples. Columns 1 and 3 report the results of model 8. Columns 2 and 4 analyze the data using model 9. For all columns, the sample includes prefectures with non-zero Burakumins with the highest and lowest 1% of the data dropped as mentioned earlier. Since I have to interpolate some of the data by prefecture to fill in the gaps, the errors may be correlated at the prefecture level. That is why I also cluster the errors by

prefectures to make the results more robust in every column. The sample that I use for the analysis contains 36 prefectures, which is not an extremely small number of clusters. In the robustness checks, I will use the full sample which contains 47 prefectures to show that the small sample bias is not a concern.

Table 2: Effects of the Policy on Marriage and Divorce Rates

	Marriages per thousand		Divorces per thousand	
Variables	(1)	(2)	(3)	(4)
Ordinance implemented	0.083	0.242	0.005	0.096***
	(0.092)	(0.199)	(0.036)	(0.032)
Ordinance implemented × Burakumins (%)		-7.237		-4.505**
		(6.246)		(2.143)
Burakumins (%)	1,706.4	1,492	-502.3	-667.8
	(1,107.5)	(1,139.2)	(593.6)	(591.1)
Observations	1,489	1,489	1,480	1,480
R-squared	0.946	0.947	0.973	0.974

Note: Ordinance implemented is the diff-in-diff interaction term. It is equal to 1 if it is in a treated prefecture after the policy is implemented. All models include prefecture and year fixed effects, prefecture Burakumin presence interaction, and year Burakumin interaction. Covariates include the unemployment rate, crimes per thousand, log GDP, percentage enrolled in universities and colleges, percentage of net immigration, percentage of land cultivated, and the labor force participation rate. Errors are clustered by prefecture.
*** p<0.01, ** p<0.05, * p<0.1

The interaction term in the standard diff-in-diff regression is not significantly different from zero in the first column. The coefficients of the interaction terms in the second column are both insignificant. Moving on to

column 3, the standard diff-in-diff model gives no significant results even when the divorce rate is the dependent variable. In column 4, the coefficient on the interaction term is positive and significant while the coefficient on the triple diff-in-diff interaction term is negative and significant. In all, the policy appears to have no effect on the marriage rate. However, it is clear that the policy increases the divorce rate in areas with a small Burakumin presence and lowers the number of divorces when Burakumins account for a larger percentage of the population. As mentioned earlier, with model 9, the effect on each treated prefecture can be calculated as $0.096 - 4.505 \times R$, where R is the proportion of Burakumins in a prefecture. The policy increases divorces per thousand in Kagawa, Kumamoto, and Osaka by 0.059, 0.065, and 0.022, respectively. In Fukuoka and Tokushima, the policy lowers divorces per thousand by 0.033 and 0.083, respectively.

4.2 Robustness Checks

In this section, I check the robustness of the baseline results by including no covariates, using the full sample, clustering the errors by both year and prefecture, and using the binary measure of relative Burakumin presence, respectively. In Table 3, I use a set of different specifications to confirm the policy's effect on marriage per thousand. Columns 1 to 4 report the results using model 9, while the last column uses model 10 for the analysis. Additionally, all columns use the sample as that of the main results, except for column 3 which uses the full sample. Errors are clustered by prefecture in columns 1, 2, 3, and 5. In column 4, two-way clustering by prefecture and year is used.

I start by reporting the baseline result in column 1. This column obviously has no significant results. In column 2, I include no covariates or prefecture-fixed effects. There are still no significant results. Even with the full sample in column 3, the results are insignificant as well. The two-way clustering model in column 4 also finds no significant effects. In the last column, model 10 continues to find insignificant results. Similar to the main results, I find

the policy has no significant effects on the marriage rate. The main results for marriages are robust to different specifications.

Table 3: Robustness Checks for the Effect on Marriages

Dependent variable: Marriages per thousand					
Variables	(1) Baseline Results	(2) No covariates	(3) Full sample	(4) Two-way clustering	(5) Large Burakumin presence
Ordinance implemented	0.242	0.377	0.207	0.242	0.158
	(0.199)	(0.279)	(0.152)	(0.195)	(0.171)
Ordinance implemented × Burakumins (%)	-7.237	-7.697	-9.000*	-7.237	
	(6.246)	(9.287)	(4.689)	(6.021)	
Burakumins (%)	1,492.1	-3.3	784.9		
	(1,139.2)	(3.4)	(1,058.0)		
Ordinance implemented × Burakumin (LBP)					-0.119
					(0.195)
Burakumin (LBP)					-1.613*
					(0.926)
Observations	1,489	1,517	1,974	1,489	1,489
R-squared	0.947	0.681	0.949	0.947	0.946

Note: Ordinance implemented is the diff-in-diff interaction term. It is equal to 1 if it is in a treated prefecture after the policy is implemented. Large Burakumin presence (LBP) is equal to 1 if the proportion of Burakumins is greater than its median. Column 2 contains no covariates or prefecture-fixed effects. Models in columns 1, 3, 4, and 5 include prefecture and year fixed effects, prefecture Burakumin presence interaction, and year Burakumin interaction. Covariates in columns 1, 3, 4, and 5 include the unemployment rate, crimes per thousand, log GDP, percentage enrolled in universities and colleges, percentage of net immigration, percentage of land cultivated, and the labor force participation rate. Errors are clustered by prefecture in columns 1, 2, 3, and 5. Errors are clustered by prefecture and year in column 4.
*** p<0.01, ** p<0.05, * p<0.1

Next, I use the same specifications from the previous table to check the effect of the policy on divorces per thousand and report the results in Table 4.

In all columns, I find positive effects on the diff-in-diff interaction terms and negative effects on the triple interaction terms. All results are quantitatively similar and significant. The main results for the divorce rate are also robust to different specifications.

Table 4: Robustness Checks for the Effect on Divorces

Dependent variable: Divorces per thousand					
Variables	(1) Baseline Results	(2) No covariates	(3) Full sample	(4) Two-way clustering	(5) Large Burakumin presence
Ordinance implemented	0.096***	0.140**	0.101***	0.096***	0.082***
	(0.032)	(0.067)	(0.035)	(0.032)	(0.021)
Ordinance implemented × Burakumins (%)	-4.505**	-4.457*	-5.091**	-4.505**	
	(2.143)	(2.306)	(2.513)	(2.108)	
Burakumins (%)	-667.8	3.3	-747.0		
	(591.1)	(2.6)	(539.7)		
Ordinance implemented × Burakumin (LBP)					-0.129***
					(0.043)
Burakumin (LBP)					0.679
					(0.529)
Observations	1,480	1,516	1,974	1,480	1,480
R-squared	0.974	0.789	0.970	0.974	0.974

Note: Ordinance implemented is the diff-in-diff interaction term. It is equal to 1 if it is in a treated prefecture after the policy is implemented. Large Burakumin presence (LBP) is equal to 1 if the proportion of Burakumins is greater than its median. Column 2 contains no covariates or prefecture-fixed effects. Models in columns 1, 3, 4, and 5 include prefecture and year fixed effects, prefecture Burakumin presence interaction, and year Burakumin interaction. Covariates in columns 1, 3, 4, and 5 include the unemployment rate, crimes per thousand, log GDP, percentage enrolled in universities and colleges, percentage of net immigration, percentage of land cultivated, and the labor force participation rate. Errors are clustered by prefecture in columns 1, 2, 3, and 5. Errors are clustered by prefecture and year in column 4.
*** p<0.01, ** p<0.05, * p<0.1

4.3 Alternative DID Methods

Recent work, such as Baker et al. (2022) and Callaway and Sant'Anna (2021), show that the staggered OLS difference-in-differences (DID) estimators can produce biased results. The result of a staggered DID analysis is essentially a weighted average of the treatment effects from various treated groups. With a staggered OLS DID setup, early-treated groups are used as the control group for late-treated groups. Effects estimated from such comparison will be given negative weights. Therefore, the estimates from such analysis may be smaller in magnitude than the actual effects or even have the wrong sign. The cause of this problem lies in the fact that a staggered OLS DID assumes the treatment effects are the same across groups and periods.

To deal with the potential bias, I implement a new method developed by Gardner (2022), known as the two-stage difference-in-differences. Borusyak et al. (2021) complete the mathematical derivation of the model. As one of the very few models that allows a triple difference-in-differences setup, the two-stage DID model allows me to check the robustness of the main results. This method computes the heterogeneous treatment effects across groups and periods to estimate the overall effect. To that end, group and period effects are identified in the first stage from the sample of untreated observations, and average treatment effects are identified in the second stage by comparing treated and untreated outcomes, after removing the group and period effects.

Table 5: Two-Stage Difference-in-Differences

	Marriages per thousand		Divorces per thousand	
Variables	(1)	(2)	(3)	(4)
Ordinance implemented	0.117	0.285	0.006	0.087***
	(0.088)	(0.178)	(0.034)	(0.033)
Ordinance implemented × Burakumins (%)		-8.635		-4.170**
		(5.706)		(2.072)
Observations	1,489	1,489	1,480	1,480

Note: Results in this table are generated using the two-stage DID estimator developed by Gardner (2022). Ordinance implemented is the diff-in-diff interaction term. It is equal to 1 if it is in a treated prefecture after the policy is implemented. In the first stage, prefecture and year fixed effects are included, and covariates in all columns are the unemployment rate, crimes per thousand, log GDP, percentage enrolled in universities and colleges, percentage of net immigration, percentage of land cultivated, and the labor force participation rate. Errors are clustered by prefecture.
*** p<0.01, ** p<0.05, * p<0.1

As shown in Table 5, I estimate the effect of the policy on the marriage and divorce rates again with the two-stage DID method. The covariates and sample remain the same as those of the main results. The results in all columns are roughly the same as before. I still find the policy has no impact on marriages, and the heterogeneous effects of the policy on divorces can be observed. As shown in model 9, the effect of the policy on each treated prefecture can be computed as $\delta + \lambda R$. I can compute the effect of the policy on each prefecture using the coefficients of the interaction and the triple interaction terms estimated in both DID methods along with the percentage of Burakumins in each treated prefecture. Table 6 has the effects of the policy on each treated prefecture's divorce rate using the coefficients estimated by

the two different estimators. The results are quantitatively similar.

Table 6: Impact on Divorces per Thousand by Prefecture

Prefecture	(1) Percentage of Burakumins	(2) OLS DID	(3) Two-Stage DID
Kagawa	0.008	0.059	0.052
Kumamoto	0.007	0.065	0.058
Osaka	0.016	0.022	0.019
Fukuoka	0.029	-0.033	-0.033
Tokushima	0.040	-0.083	-0.079

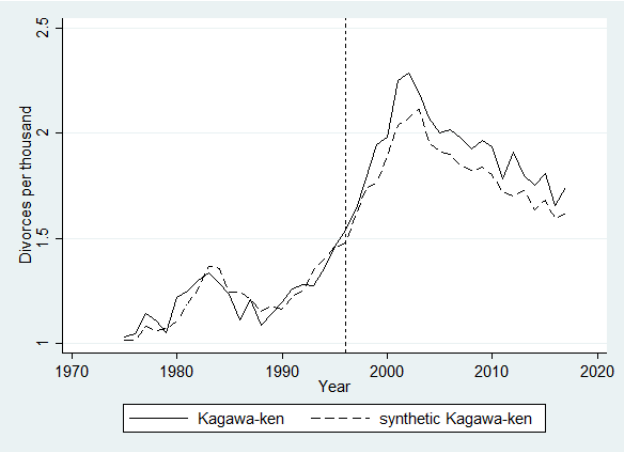
Note: Results in the table are computed using the interaction and the triple terms estimated by each estimator, and the percentage of Burakumins. R is the percentage of Burakumin in each prefecture. The effects of the policy in column 2 are equal to $0.096 - 4.505 \times R$. The results in column 3 are equal to $0.087 - 4.170 \times R$.

Estimates obtained from the DID approaches that have only one treatment period can still be trusted. As an alternative approach to further ascertain the effect of the policy on divorces, I keep only one treated prefecture in each sample and generate synthetic control graphs for each of the treated prefectures with divorces per thousand as the dependent variable. To synthesize the control group in all graphs, I use the following covariates: the unemployment rate, crimes per thousand, log GDP, percentage enrolled in universities and colleges, percentage of net immigration, percentage of land cultivated, the labor force participation rate, and the percentage of Burakumins.[2] I use the full sample for each graph and keep only one treated prefecture in each sample. Figures 3 and 4 explore the impact of the policy on the divorce rate in the five treated prefectures.

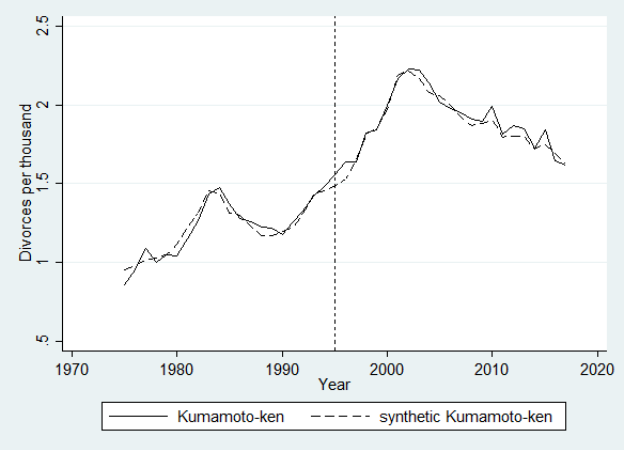
Results for prefectures with a small relative presence of Burakumins can be found in Figure 3, and Figure 4 has the results for prefectures with a large Burakumin presence. In Figures 3 (a) and 3 (c), delayed positive effects can be seen in Kagawa and Osaka. However, no effects of the policy

[2]The nested and allopt options in Stata are selected to generate robust results.

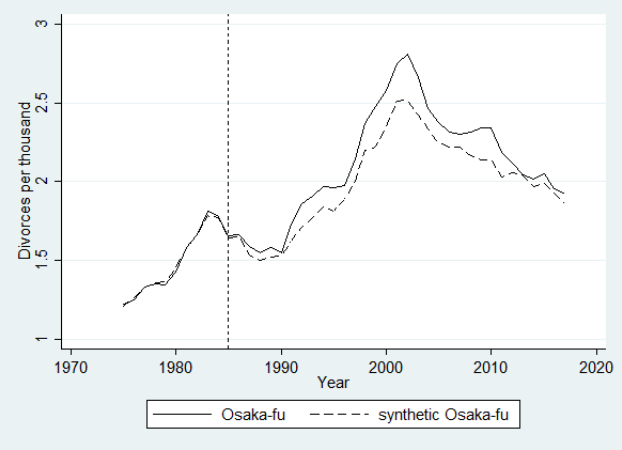
can be observed in Figure 3 (b) for Kumamoto. In Figures 4 (a) and 4 (b), I observe delayed negative effects in Fukuoka and Tokushima, respectively. The delayed effects are plausible because it takes time for the effects to occur in the marriage market. With the exception of Kumamoto in Figure 3, which shows no effect from the policy, other prefectures in the figure with a small Burakumin presence see an increase in their divorce rate. On the other hand, all prefectures experience a decrease in divorces when Burakumins account for a large proportion of the population in Figure 4. Results in the graphs for most prefectures qualitatively match that of the main results. While it is possible that the ordinance may be somewhat ceremonial in Kumamoto, the results here confirm that uncertainty created by the policy has heterogeneous effects on divorces.



(a) Synthetic Control for Kagawa

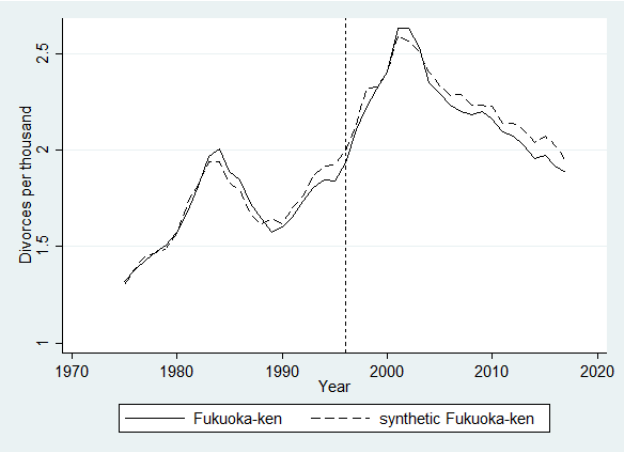


(b) Synthetic Control for Kumamoto

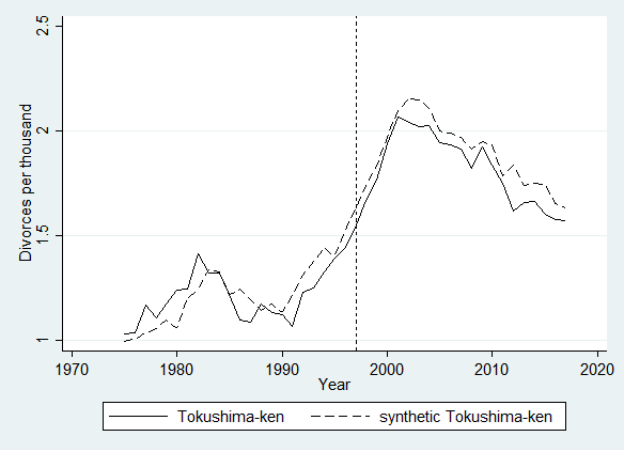


(c) Synthetic Control for Osaka

Figure 3: Small Burakumin Presence



(a) Synthetic Control for Fukuoka



(b) Synthetic Control for Tokushima

Figure 4: Large Burakumin Presence

4.4 Impact on Employment

A major concern is that the changes in the divorce rate may be driven by changes in people's employment status. The policy also bans firms from such background checks against Burakumins. And if they become more involved in the formal labor market, their marriage quality may change as a result of better employment opportunities. However, in all the previous analyses, I included the unemployment rate and the labor participation rate as controls. Therefore, it is unlikely that the effects of the policy on divorces are driven

by changes in labor market outcomes.

Although changes in divorces are not related to changes in labor market outcomes, the policy can still have a separate effect on the Burakumins' labor market outcomes. The Burakumins can now work outside of their small family businesses as corporations can no longer screen out the Burakumins with background checks. As shown in Table 7, I use the same setup as Table 2 to examine the policy's effect on the unemployment rate and the labor force participation rate. Columns 1 and 3 report the results of model 8. Columns 2 and 4 analyze the data using model 9. The policy has no significant effect on labor outcomes. The insignificant results here also confirm that changes in the divorce rate are not driven by changes in labor market outcomes.

Table 7: Effects of the Policy on Labor Outcomes

	Unemployment rate		Labor force participation rate	
Variables	(1)	(2)	(3)	(4)
Ordinance implemented	-0.000	-0.001	-0.006	-0.005
	(0.002)	(0.002)	(0.004)	(0.007)
Ordinance implemented × Burakumins (%)		0.028		0.004
		(0.099)		(0.269)
Burakumins (%)	37.7*	38.9**	-85.9*	-82.5*
	(20.2)	(19.0)	(50.2)	(46.5)
Observations	1,475	1,475	1,480	1,480
R-squared	0.962	0.963	0.881	0.885

Note: Ordinance implemented is the diff-in-diff interaction term. It is equal to 1 if it is in a treated prefecture after the policy is implemented. All models include prefecture and year fixed effects, prefecture Burakumin presence interaction, and year Burakumin interaction. Covariates include crimes per thousand, log GDP, percentage enrolled in universities and colleges, percentage of net immigration, and percentage of land cultivated. Errors are clustered by prefecture.
*** p<0.01, ** p<0.05, * p<0.1

5 Conclusion

I examine the effect of uncertainty on divorce in this paper. By exploiting the prefecture ordinances that prevent the identification of a group of heavily discriminated people known as the Burakumins in Japan, I am able to show with a triple diff-in-diff approach that uncertainty has heterogeneous effects on divorces. In regions with a small percentage of Burakumins where the information is less important, introducing uncertainty increases the divorce rate. When the information is more important in places where Burakumins

account for a larger share of the population, uncertainty decreases the total number of divorces.

This paper offers a possible explanation for the heterogeneous effects. In regions where the information is less relevant, many new interracial marriages occur and dissolve, which drives up the overall divorce rate. When the information is more important, the low remarriage value discourages non-Burakumin marriages from dissolving. And that lowers the overall divorce rate. The evidence provided by this paper shows that uncertainty can both increase and decrease marriage dissolution depending on the importance of the information. In addition, the paper also touches on discrimination in the marriage market. Unlike discrimination in the labor market, the aversion to particular ethnic groups in the marriage market is hardly seen as discrimination. The unique traits of the Burakumins offer us a glimpse into discrimination in the marriage market.

Governments across the globe may at a certain point decide to restrict access to certain information to protect vulnerable groups. While existing literature argues that such action will no doubt increase the number of divorces, my findings suggest it will depend on how important and relevant the information is. Perhaps the price to pay for equality is not as high as officials originally thought. Lastly, individuals who desire a stable marriage obviously should disclose important and relevant information to their partners.

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Appendix A Model Derivation

For a majority, the value of being unattached at the beginning of the second period is,

$$V_M(\alpha, \pi) = Y + \alpha(Y - \pi C) \tag{11}$$

While for a Burakumin [3], the value is,

$$V_B(\alpha) = Y + \alpha Y \tag{12}$$

At the end of the first period, a majority-majority marriage will dissolve if,

$$2Y + \theta < V_M \Rightarrow \theta < \alpha Y - Y - \alpha\pi C \tag{13}$$

A Burakumin-Burakumin marriage will dissolve if,

$$2Y + \theta < V_B \Rightarrow \theta < \alpha Y - Y \tag{14}$$

For intermarriages, the Burakumin partner will wish to divorce if,

$$2Y + \theta < V_B \Rightarrow \theta < \alpha Y - Y \tag{15}$$

the majority partner will find out about their partner's identity and wish to divorce if,

$$2Y + \theta - C < V_M \Rightarrow \theta < \alpha Y - Y + (1 - \alpha\pi)C \tag{16}$$

Since

$$\alpha Y - Y < \alpha Y - Y + (1 - \alpha\pi)C \tag{17}$$

[3] Recall that the interracial marriage is only costly for the majority partner

when

$$\theta < \alpha Y - Y \tag{18}$$

both partners will want to divorce. If

$$\theta > \alpha Y - Y + (1 - \alpha\pi)C \tag{19}$$

then no partner will wish to divorce.

The majority partners wish to divorce if

$$\alpha Y - Y < \theta < \alpha Y - Y + (1 - \alpha\pi)C \tag{20}$$

And thus, when

$$\theta < \alpha Y - Y + (1 - \alpha\pi)C \tag{21}$$

intermarriages will dissolve as the majority dominates in this case.