The Impacts of the Gender Imbalance on Marriage and Birth: Evidence from World War II in Japan*

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Abstract

This study uses the unprecedented changes in the sex ratio due to the losses of men during World War II to identify the impacts of the gender imbalance on marriage market and birth outcomes in Japan. Using newly digitized census-based historical statistics, we find evidence that men had a stronger bargaining position in the marriage market and intra-household fertility decisions than women. Under relative male scarcity, while people, especially younger people, were more likely to marry and divorce, widowed women were less likely to remarry than widowed men. We also find that women's bargaining position in the marriage market might not have improved throughout the 1950s. Given the institutional changes in the abortion law after the war, marital fertility and stillbirth rates increased in the areas that suffered relative male scarcity. Our result on out-of-wedlock births indicates that the theoretical prediction of intra-household bargaining is considered to be robust in an economy in which marital fertility is dominant.

Keywords: Fertility; Gender imbalance; Marriage market; Second World War; Sex ratio;

JEL Codes: J11; J12; J13; J16; N30; N35;

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1 Introduction

War causes enormous losses of people. These losses are generally concentrated on men, who are drafted into battle, rather than women, leading to a substantial reduction in the sex ratio in an economy (i.e., the ratio of men to women in the population). Theoretically, relative male scarcity improves the bargaining position of men in the marriage market and thus their intra-household allocations (Becker 1973, 1974, 1991; Chiappori et al. 2002). A growing body of empirical research has validated this prediction, providing solid evidence that the wartime losses of men affect not only marriage market outcomes but also birth outcomes both inside and outside of marriage (Abramitzky et al. 2011; Bethmann and Kvasnicka 2012; Brainerd 2017).[1]

This study examines the impacts of relative male scarcity caused by World War II on marriage market and birth outcomes in postwar Japan. Japan's wartime losses of men led to an unprecedented decline in the sex ratio similar to in post-World War I France (Abramitzky et al. 2011), post-World War II Bavaria, Germany (Bethmann and Kvasnicka 2012), and Russia (Brainerd 2017). However, in contrast to those countries, Japan experienced rapid democratization induced by the General Headquarters of the Allied Powers. The fertility rate had declined dramatically immediately after the war, whereas the share of out-of-wedlock births had remained only a few percent. Stillbirth rates, however, substantially increased in the mid-1950s due to the enactment of the Maternal Health Act. Considering these, in this study, we contribute to the literature by investigating the consequences of the wartime losses of men on marriage market and birth outcomes in this unique context of postwar Japan.

To do so, we newly digitize census-based historical statistics and apply the difference-in-differences estimation strategy using the exogenous variations in the sex ratio from the wartime losses of men. We find that while people who faced relative male scarcity were more likely to marry and divorce, the gender differences in the estimates show men's stronger bargaining position in the marriage market. Widowed women were less likely to remarry than widowed men, who faced better outside options. While the result of our

[1]See also Acemoglu and Autor (2004) for the impacts of war-induced changes in the female labor supply on earnings inequalities. Another strand of the literature exploits different semi-experimental approaches. For example, Angrist (2002), Lafortune (2013), and Porter (2015) use exogenous changes in the sex ratio due to the inflow of immigrants and famine to analyze the impacts on pre-marital investment, marriage and labor markets, consumption behavior, and the health status of offspring. Charles and Luoh (2010) analyze the impacts of male incarceration rates on women in the marriage market. Wei and Zhang (2011) and Edlund et al. (2013) employ the culture-induced gender imbalance to investigate the impacts on saving behavior and crime rates in China, respectively.

flexible specification suggests that the relative advantage of men in the marriage market had somewhat attenuated by 1955, it also indicates that the situation of women in the marriage market did not improve throughout the 1950s, even though there were some adjustments in the marriages of widowed women at the expense of first marriages among younger women. Regarding the matching in terms of the ages of grooms and brides, we find some evidence that marriages among younger people increased in the areas that experienced the greater wartime losses of men and that a large part of this rejuvenation effect disappeared by the 1950s.

We find clearer results on birth outcomes. While marital fertility rates increased after the war in the areas that suffered relative male scarcity, this boom ended in the mid-1950s. By contrast, the stillbirth rate did not initially respond to changes in the sex ratio and only increased in the areas that faced relative male scarcity in the mid-1950s after the enactment of the Abortion Act. The wartime losses of men increased the share of out-of-wedlock births in the 1950s in Japan. These results are generally consistent with the theoretical predictions and findings of related previous studies (Becker 1991; Bethmann and Kvasnicka 2012; Brainerd 2017). Our findings thus provide suggestive evidence that the institutional context surrounding abortion can influence the fertility decision when men have a stronger bargaining position and that the initial share of out-of-wedlock births does not affect the non-marital fertility decision under relative male scarcity.

This study contributes to the literature in the following three ways. First, it is the first study to investigate the different effects of the wartime losses of men on several marriage market and birth outcomes over time using a newly digitized census-based dataset including two postwar survey points. Among previous studies, Bethmann and Kvasnicka (2012) investigate the regional heterogeneity in the war-induced shortfalls of men with respect to the share of prisoners on the non-marital fertility rate. Brainerd (2017) also finds urban–rural heterogeneity in the impacts of relative male scarcity on several demographic outcomes. However, little is known about the time-varying impacts of changes in the sex ratio due to the war. We find that shifts in the distribution of the sex ratio changed the impacts of relative male scarcity on marriage market and birth outcomes within five years and that the dynamics of the effects could vary by gender. This result indicates the importance of the dynamic relationships between the gender imbalance and demographic outcomes.

Second, this study uses a comprehensive dataset of marriage market and birth outcomes. Given the limited availability of historical statistics in the postwar period, previous

studies have collected variables on either the marriage market or demographic outcomes. Abramitzky et al. (2011) investigate the impacts of the wartime losses of men on matching in the marriage market, whereas Bethmann and Kvasnicka (2012) focus on the impacts on non-marital fertility.[2] Regarding postwar Japan, Ogasawara and Komura (2021) analyze the impacts on the fertility rate.[3] To the best of our knowledge, Brainerd (2017) is the first study to analyze the influence of an unbalanced sex ratio on marriage market and birth outcomes. Our empirical analysis builds on this approach as well as adds variables not considered by Brainerd (2017), including the proportion of single men and women, proportion of widowhoods, and average age at first marriage. In addition, to investigate the potential gender heterogeneity in the effects of the wartime losses of men, this study is the first to consider all the outcome variables by sex. Thus, our census-based dataset enables us to paint a broader picture of the marriage market and fertility decision after (and before) marriage in the aftermath of the Second World War. Specifically, the impacts of relative male scarcity on marriages among widowed women have thus far been understudied. The military pension was partly abolished in 1946 by the General Headquarters of the Allied Powers, which might have encouraged widowed women to remarry in postwar Japan. Our result on widowed women is generally consistent with that of Salisbury (2017), who finds evidence that widowed women were less likely to marry under the Civil War Pension Act of 1862 than beforehand.

Third, this study is the first to provide empirical evidence in an economy that experienced a unique trend of out-of-wedlock births. Previous studies show that relative male scarcity due to war raised the share of out-of-wedlock births in the cases of France, Bavaria, and Russia (Abramitzky et al. 2011; Bethmann and Kvasnicka 2012; Brainerd 2017). While these countries experienced an increase in the share of out-of-wedlock births, however, the share was considerably lower in postwar Japan. Despite this difference, we find a result consistent with those of previous studies, implying that the theoretical prediction of intra-household bargaining is robust in an economy in which marital fertility is dominant (Becker 1991; Willis 1999).

The remainder of this paper is organized as follows. Section 2 describes the gender imbalance, marriage market, and demographic trends after the war in Japan. Section 3

[2]While both studies examine the economies after World Wars I and II, respectively, Bitler and Schmidt (2012) investigate the impacts of the draft during a more recent war, namely, the Vietnam Conflict, on birth rates.

[3]Specifically, while Ogasawara and Komura (2021) focus on the birth rates obtained from the predicted number of people, we consider both marital and out-of-wedlock birth rates calculated using census-based statistics. We also use a different identification strategy than theirs.

illustrates the main census-based data on marriage market outcomes and identification strategy used, and Section 4 presents the main results. Section 5 provides additional analyses using census- and vital statistics-based data on matching and birth outcomes. Section 6 checks the sensitivity of the results and Section 7 concludes.

2 Japanese Population after the War

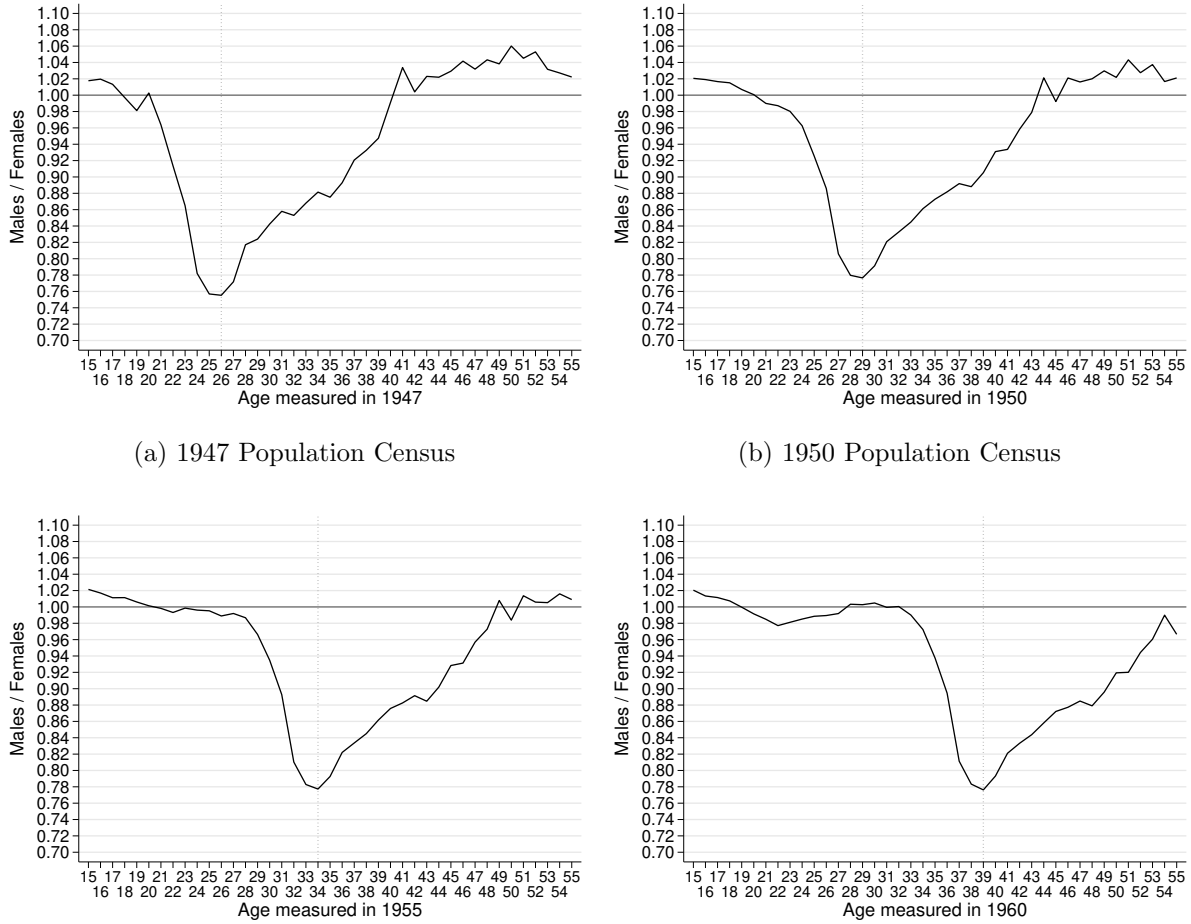
2.1 Gender Imbalance

As in many countries, Japan lost a number of men during World War II. Statistics indicate that 1,864,710 military personnel died or were missing in action during the war (Nakamura and Miyazaki 1995, p. 289).[4] A survey conducted in May 1948 shows that 323,495 homefront people died or were missing mainly due to bombing (Nakamura and Miyazaki 1995, p. 277). To understand the magnitude and persistence of the wartime losses of men, we first digitize the number of men and women using population censuses conducted after the war. Figure 1 illustrates the national average sex ratios by age in 1947, 1950, 1955, and 1960. The distributions of these sex ratios are considerably different than those in the prewar period (Figure B.1 in Online Appendix B.2 illustrates the sex ratios in 1930 and 1935). This means that the clear reductions in the sex ratios in Figure 1 were caused by the wartime losses of men. We can highlight a few important features in those figures.

First, Figure 1a indicates a clear and dramatic decline in the sex ratio soon after the war. The figures decline from age 21 and bottom out around age 26 with approximately 0.24-point $(1 - 0.76)$ losses at their maximum. These relative declines in the sex ratio are observed by age 40. Second, these declines persist until the 1950s. Figure 1b shows that the sex ratio bottoms out around age 29 with slightly more than 0.22-point $(1-0.78)$ losses at their maximum. Figures 1c and 1d confirm the roughly 0.22-point losses at age 34 in 1955 and age 39 in age 1960, respectively. Third, the impact of the growing repatriation on the sex ratio is small. As confirmed, there is slightly less than a 0.02-point rise between 1947 and 1950 (Figure 1a; 1b). While this rise implies an amount of repatriation between both years, it does not dramatically improve the sex ratios; in other words, the gender imbalance persists at that time.[5]

[4]This figure includes victims who died or were missing between 1942 and 1948. Deaths due to execution and diseases contracted on the frontline as well as those during the early stage of the Sino-Japanese war are not included (Nakamura and Miyazaki 1995, p. 289). Thus, the overall death toll was greater than the figure reported herein.

[5]This finding is consistent with the fact that most of the repatriation had finished by 1947. In the 17 months from May 1946 to September 1947, approximately 3,149,000 people (mostly men) were repatriated



(a) 1947 Population Census

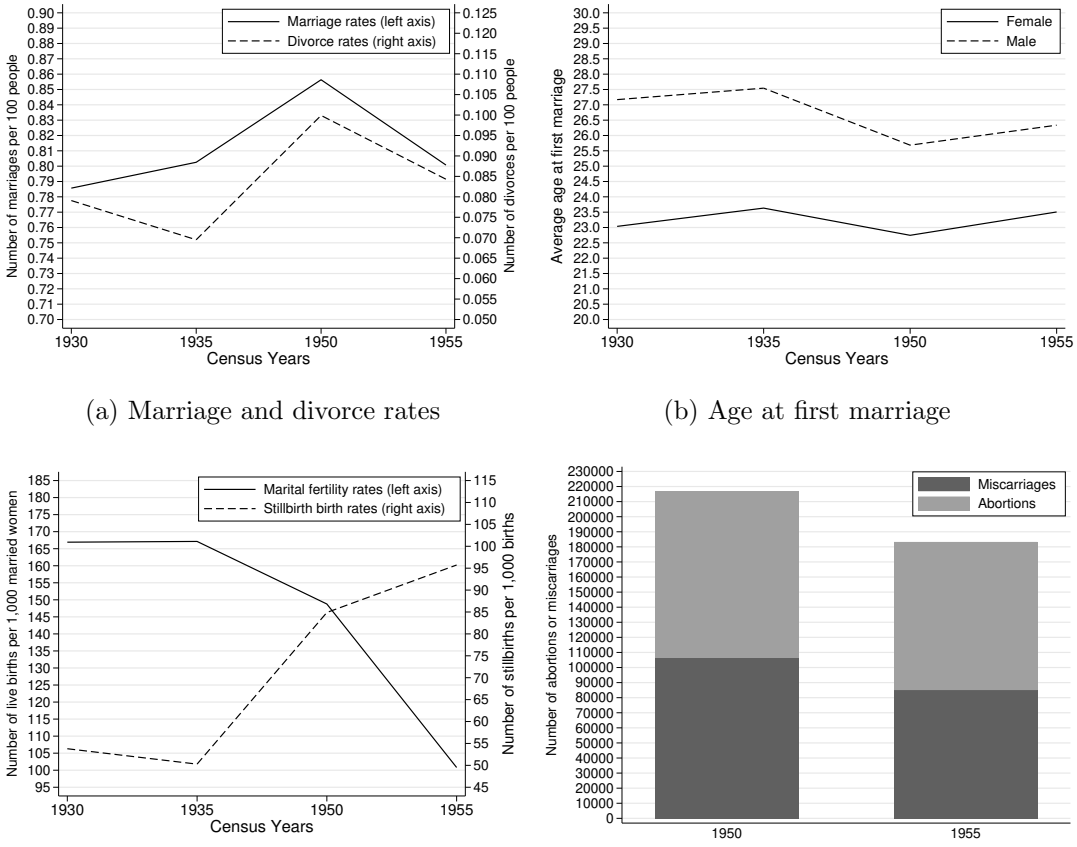
(b) 1950 Population Census

(c) 1955 Population Census

(d) 1960 Population Census

Figure 1: Sex ratios measured in the 1947, 1950, 1955, and 1960 Population Censuses

Notes: The sex ratio is defined as the number of men divided by the number of women. All the ratios are the national averages based on the 1947, 1950, 1955, and 1960 Population Censuses. The vertical dotted lines show the minimum values of the sex ratios in each census year. Source: Created by the authors using Statistics Bureau of the Prime Minister's Office (1948), Bureau of Statistics, Office of the Prime Minister (1951a), and Bureau of Statistics, Office of the Prime Minister (1956a).



(a) Marriage and divorce rates

(b) Age at first marriage

(c) Marital fertility and stillbirth rates

(d) Miscarriages and abortions

Figure 2: Marriage market and birth outcomes by census year

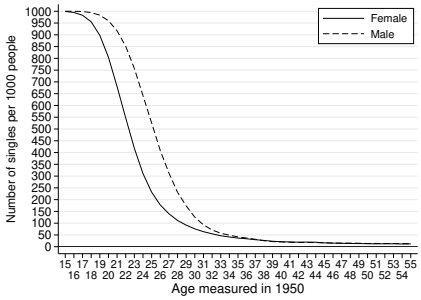
Notes: Figure 2a presents the marriage rate (number of marriages per 100 people) and divorce rate (number of divorces per 100 people). Figure 2b presents average age at first marriage by gender. Figure 2c presents the marital fertility rate (number of live births per 1,000 married women) and stillbirth rate (number of stillbirths per 1,000 births). Figure 2d presents the number of miscarriages and number of abortions. Source: Created by the authors using Statistics Bureau of the Cabinet (1935), Statistics Bureau of the Cabinet (1939b), Bureau of Statistics, Office of the Prime Minister (1951b) Bureau of Statistics, Office of the Prime Minister (1956b), Statistics Bureau of the Cabinet (1931), Statistics Bureau of the Cabinet (1936), Division of Health and Welfare Statistics, Welfare Minister's Secretraiat (1953), and Division of Health and Welfare Statistics, Welfare Minister's Secretraiat (1957).

2.2 Marriages, Divorces, and Widowhoods

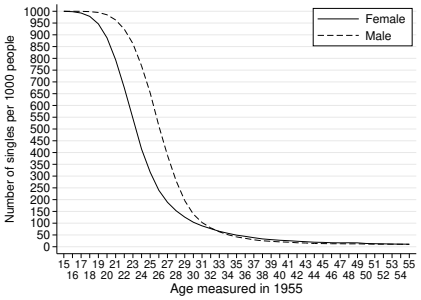
Figure 2a illustrates the marriage and divorce rates in the census years, indicating a clear hump in 1950.[6] A large number of people who could not marry during the war started to marry thereafter, creating a clear marriage boom in the early 1950s (Yuzawa 1977). Correspondingly, average age at first marriage also decreases in 1950, as shown in

to Japan (Statistics Bureau of the Prime Minister's Office 1948, p. 1).

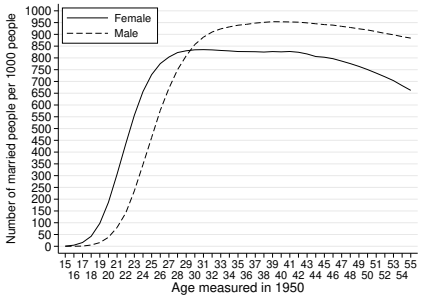
[6]This does not simply represent the decline in the population but rather the rises in the number of marriages and divorces. The numbers of marriages and divorces in 1935 are 556,730 and 48,528, respectively, whereas those are 715,081 and 83,680 in 1950 and 714,861 and 75,267 in 1955 (Division of Health and Welfare Statistics, Welfare Minister's Secretraiat 1953, 1957; Statistics Bureau of the Cabinet 1936).



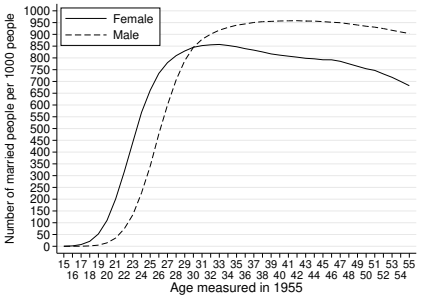
(a) Singles in 1950



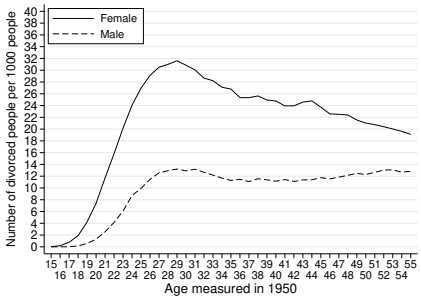
(b) Singles in 1955



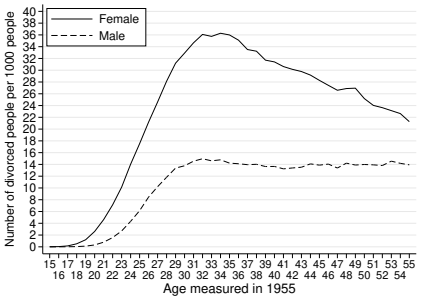
(c) Married people in 1950



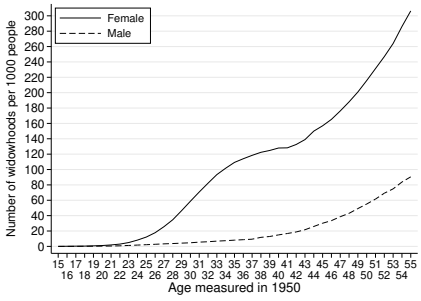
(d) Married people in 1955



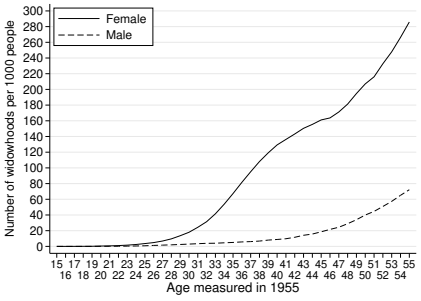
(e) Divorced people in 1950



(f) Divorced people in 1955



(g) Widowhoods in 1950



(h) Widowhoods in 1955

Figure 3: Marriage status measured in the 1950 and 1955 Population Censuses

Notes: Figures 3a and 3b present the proportion of singles per 1,000 people (women and men). Figures 3c and 3d present the proportion of married people per 1,000 people (women and men). Figures 3e and 3f present the proportion of divorced people per 1,000 people (women and men). Figures 3g and 3h present the proportion of widowhoods per 1,000 people (women and men). All those rates are the national averages based on the 1950 and 1955 Population Censuses. Source: Created by the authors using Bureau of Statistics, Office of the Prime Minister (1951a) and Bureau of Statistics, Office of the Prime Minister (1956a).

Figure 2b. Some people in their early 20s during the war married in the wartime period under the pronatalist policy, which might have led to the declines in average age at first marriage (Toshitani 1984).

Regarding divorces, Kawaguch (2003, p. 118) suggests that some couples may have divorced in the same period because of the fact that were poorly matched since they were prevented from having marriage meetings during the war.[7] An explanation of the institutional context might also be useful. The Civil Code of 1947 abolished the patriarchy family system (*ie seido*) and, correspondingly, inheritance by new heads of households was replaced by the equal distribution of inheritance.[8] The Code also allowed divorces because of the infidelity of husbands and division of properties at divorce.[9]

To see the postwar changes in the marriages and divorces, Figure 3 illustrates the proportion of singles, married people, divorced people, and widowhoods by census year and age. Figures 3a and 3b indicate that the proportion of single women starts to decline around age 18 and that most women (men) marry by age 40. Accordingly, Figures 3c and 3d show that a large proportion of women marry by age 30. Similar but slightly later trends can be found for men in the same figures.

An important trend in bargaining position in the marriage market can be observed in divorces and widowhoods. Figure 3e indicates that while there is no clear trend in the proportion of divorced men, the proportion of divorced women rises considerably between ages 25 and 37 and peaks at age 29. This trend is consistent with the wartime losses of men relative to women shown in Figure 1b. In addition, Figure 3f presents the rightward shift of the distribution, which moves the peak of the proportion of divorced women to around 34 years old. This also corresponds to the losses of men in Figure 1c. Such a trend suggests that a large proportion of divorced women remained in the marriage market, whereas men did not.

A similar trend can be seen in the proportion of widowhoods (Figures 3g and 3h).

[7]To secure human resources, the government was proactive in encouraging people to marry. Hence, a number of couples married hastily before the men were sent to the frontline, leading the poor matching (called *kakekomi kon* (hasty marriages)). Indeed, in prewar Japan, arranged marriages (*omiai-kon*) were also used, which reduces the risk of mismatch because they were preceded by documentary examination and organized meetings with the partner (Yuzawa 2005, pp. 190–192).

[8]We summarize the prewar institution and postwar reforms under the General Headquarters of the Allied Powers in Online Appendix A.1. See also Hayashi and Prescott (2008) for the economic impacts of the Old Civil Code.

[9]Under Family Laws within the Meiji Civil Code dating from 1898, although bigamy was forbidden for both husband and wife, adultery committed by a wife was recognized grounds for divorce, while adultery on the husband's part could only be a reason for divorce if he were found guilty of the crime of illicit intercourse. The new Civil Code abolished this institution and established the equality of men and women upon divorce (Online Appendix A.1).

While there is a decreasing trend in the proportion of widowhoods between 1950 and 1955, especially for widowed men, the hump for women aged in their 30s in 1950 is still obvious in 1955. This indicates that widowed women were more likely to remain in the marriage market than widowed men.

These figures suggest that relative male scarcity due to the war might strengthen men's bargaining position in the marriage market. Indeed, an article in a popular magazine titled *Ie-no-Hikari* (light of a house) at that time claimed: "You (a widowed female) are not most likely to get remarried because there are a large number of women and a small number of men in the marriage market (Kawaguch 2003, pp. 124–125). In our empirical analysis, we consider information on marriage status (single, married, divorced, and widowed) and matching (age at first marriage) to investigate the impacts of the wartime losses of men on the marriage market.

2.3 Marital and Non-marital Fertility

Figure 2c illustrates the trends of marital fertility and stillbirth rates. While the marital fertility rate shows a clear decreasing trend in the postwar period, the stillbirth rate shows the opposite trend. Note, here, that stillbirths include losses due to not only miscarriages but also artificial abortions: Figure 2d indicates that roughly half of stillbirths are from abortions. While abortion was basically forbidden in the prewar period, the establishment of the Eugenic Protection Law of 1948 started to allow artificial abortions for economic reasons. An important fact here is that out-of-wedlock births were rare in postwar Japan. The share of out-of-wedlock births to total births was only a few percent in the 1950s (Section 5.2). This means that most abortions occurred within marriage. Indeed, a survey conducted in 1964 by the Ministry of Welfare indicates that more than 40% of married women had experienced at least one abortion and roughly 80% of those women had two or more children (Nakagawa 2000, p. 282).[10] Given the poor knowledge of contraception, abortion was a frequently used means of reducing the number of births among families in the 1950s (Norgren 2008).

As discussed in Section 5, this historical context on births is different than those in countries investigated by previous studies (Abramitzky et al. 2011; Bethmann and Kvasnicka 2012; Brainerd 2017). Given this uniqueness, we consider marital fertility, stillbirth rates, and out-of-wedlock fertility to investigate the association between relative

[10]This official survey investigated 2,547 randomly sampled married women aged 20–39 in Japan. For the details, see the Ministry of Welfare's webpage on the Survey on Family Planning (https://survey.gov-online.go.jp/s39/S39-12-39-09.html [in Japanese], accessed January 25, 2021).

male scarcity and intra-household decision making after marriage.

3 Empirical Setting

3.1 Data

While statistics on the socioeconomic outcomes after the war are scarce as in other countries, the 1950 and 1955 Population Censuses document prefecture-age-level information on marriage market outcomes as well as the number of people in Japan (Bureau of Statistics, Office of the Prime Minister 1951a, 1956a).[11] We digitize those to prepare for the data on the sex ratio and several measures on marriage market outcomes in 1950 and 1955.

[11]We digitize the data using 92 (46 editions for each census year) reports of the censuses in total. To conserve space, we display those as one citation (say, Bureau of Statistics, Office of the Prime Minister (1951a) and Bureau of Statistics, Office of the Prime Minister (1956a)) for each census year throughout this paper. We cannot include Okinawa prefecture in our analytical sample because the island of Okinawa remained under the exclusive control of the American military until May 1972.

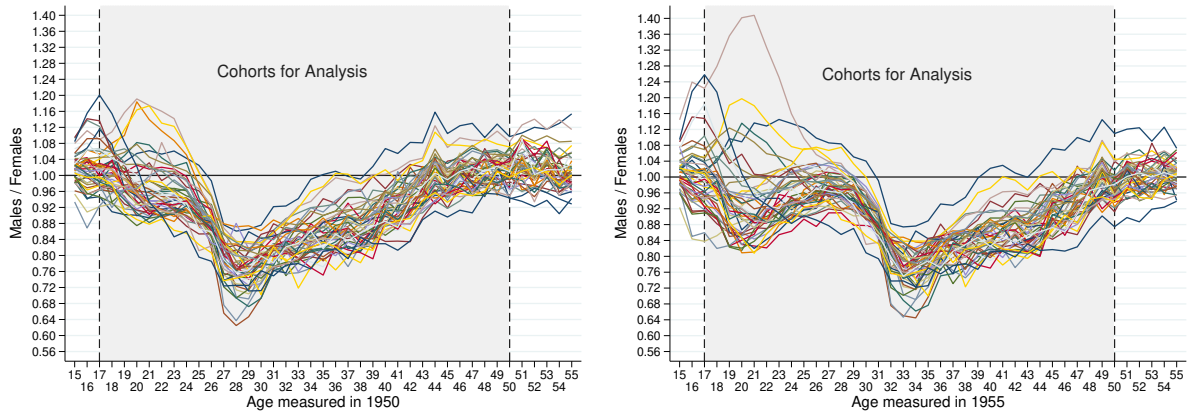
Table 1: Summary Statistics: Population Census Statistics

Panel A: Prefecture-Year-Age-Level Statistics	Unit	Observations	Mean	Std. Dev.	Minimum	Maximum
Proportion of singles (per 1,000 people)						
Women	Prefecture-Year-Age	3128	213.5	311.4	7.5	998.5
Men	Prefecture-Year-Age	3128	280.2	370.0	5.9	1000
Proportion of married people (per 1,000 people)						
Women	Prefecture-Year-Age	3128	680.7	258.9	1.5	901.5
Men	Prefecture-Year-Age	3128	698.6	358.6	0.0	977.7
Proportion of divorced people (per 1,000 people)						
Women	Prefecture-Year-Age	3128	23.4	11.1	0.0	54.2
Men	Prefecture-Year-Age	3128	10.2	5.7	0.0	26.5
Proportion of widowhoods (per 1,000 people)						
Women	Prefecture-Year-Age	3128	82.3	72.1	0.0	26.5
Men	Prefecture-Year-Age	3128	10.9	13.6	0.0	262.1
Sex ratio (Adjusted: Equation 1)	Prefecture-Year-Age	3128	0.9	0.1	0.8	81.3

Panel B: Prefecture-Year-Level Statistics	Unit	Observations	Mean	Std. Dev.	Minimum	Maximum
Average age at first marriage						
Women	Prefecture-Year	138	23.3	0.8	21.1	25.3
Men	Prefecture-Year	138	26.5	1.0	24.7	29.5
Men - Women	Prefecture-Year	138	3.2	0.6	2.0	5.0
Fertility and stillbirth rates						
Marital fertility rate (live births per 1,000 married women)	Prefecture-Year	138	140.5	34.3	74.9	219.6
Stillbirth rate (stillbirths per 1,000 birth)	Prefecture-Year	138	76.6	22.8	29.5	145.2
Sex ratio (Men 17–50/Women 15–40)	Prefecture-Year	138	1.1	0.1	1.0	1.3
Female labor force participation (workers per 100 women)	Prefecture-Year	138	35.5	5.8	20.4	47.1

Panel C: Maternal Age-Year-Level Statistics	Unit	Observations	Mean	Std. Dev.	Minimum	Maximum
Out-of-wedlock birth share (live births per 100 live births)	Maternal Age-Year	68	3.3	2.5	0.0	14.9
Out-of-wedlock birth rate (live births per 1,000 women)	Maternal Age-Year	68	1.9	1.6	0.0	4.9
Sex Ratio (Adjusted: Same as in Panel A)	Maternal Age-Year	68	0.9	0.1	0.8	1.0

Notes: Notes: Panel A reports the summary statistics for the prefecture-year-age-level population census statistics of 1950 and 1955. Panel B reports the summary statistics for the prefecture-year-level vital and population census statistics of 1935, 1950, and 1955. Panel C reports the summary statistics for the maternal age-year-level population census statistics of 1950 and 1955. The number of prefectures is 46. Measured years in Panels A and C are 1950 and 1955. Measured years in Panel B are 1935, 1950, and 1955. Age range is set to be 17–50 in Panels A and C. Sources: Data presented in Panels A and C are from Bureau of Statistics, Office of the Prime Minister (1951b); Bureau of Statistics, Office of the Prime Minister (1956b), Bureau of Statistics, Office of the Prime Minister (1951a), and Bureau of Statistics, Office of the Prime Minister (1956a). Data presented in Panel B are from Statistics Bureau of the Cabinet (1939b), Statistics Bureau of the Cabinet (1939a), Statistics Bureau of the Cabinet (1936), Bureau of Statistics, Office of the Prime Minister (1951b), Bureau of Statistics, Office of the Prime Minister (1951a), Division of Health and Welfare Statistics, Welfare Minister's Secretraiat (1953), Bureau of Statistics, Office of the Prime Minister (1956b), Bureau of Statistics, Office of the Prime Minister (1956a), and Division of Health and Welfare Statistics, Welfare Minister's Secretraiat (1957).



(a) 1950 Population Census

(b) 1955 Population Census

Figure 4: Sex Ratios by Prefecture Measured in the 1950 and 1955 Population Censuses

Notes: The sex ratio is defined as the number of men divided by the number of women. All those rates are the national averages based on the 1950 and 1955 Population Censuses. Source: Created by the authors using Bureau of Statistics, Office of the Prime Minister (1951a) and Bureau of Statistics, Office of the Prime Minister (1956a).

Marriage Status

To better understand the potential influence of the wartime losses of men on the marriage market after the war, we use several demographic variables measured in the population censuses. As discussed in Section 2.2, those include the proportion of singles, married people, divorced people, and widowhoods. Since the population census captures the people's status in October in the census years, these variables reflect marriage status at the survey points.[12] This enables us to mitigate the potential influence of internal migration because we match the data on the sex ratio to the outcome variables measured at the *same* survey points. Figure 3 illustrates the national averages of these outcome variables. Panel A of Table 1 presents the summary statistics. Online Appendix B.1 describes the sources of the documents in detail.

Sex Ratio

We aim to measure changes in the sex ratio due to the wartime losses of men as the sex ratio in each prefecture-year-age cell. Figure 4 decomposes the national average sex ratio illustrated in Figure 1 into all 46 prefectures. We focus on people aged 17–50 in each census year, meaning that those born between 1900 and 1939 are included in the

[12]In other words, the number of singles, married people, divorced people, and widowhoods measured in the population censuses are the stock rather than the flow of these measures.

analysis.[13] Figures 4a and 4b both confirm that all the prefectures experience declines in the sex ratio and that those shocks persist, as shown in Figure 1. While there are some variations in the degrees of the reductions in the sex ratios over the prefectures, unobservable factors that might be correlated with the sex ratio can be controlled for in our model presented in the next subsection. In the regression analysis, we use the adjusted sex ratio in the spirit of Brainerd (2017) to account for gender differences in age at marriage. The sex ratio in prefecture (i)-year (t)-age (a) cell is defined as follows:

$$SR_{ita} = \frac{\sum_{j=-2}^{10} MALE_{i,t,a+j}}{\sum_{j=-2}^{10} FEMALE_{i,t,a+j}} \tag{1}$$

where $MALE$ and $FEMALE$ are the number of men and women, respectively. Figure B.2 in Online Appendix B.2 illustrates the adjusted sex ratio by prefecture and age. Finally, Figure 1c shows a relatively clear boom in the late 10s and 20s in one prefecture, which indicates the influx of younger male workers to Tokyo. We confirm that our main results are robust to that potential influx in section 6.

3.2 Identification Strategy

To improve the identification, we employ a quasi-experimental design that uses changes in the sex ratio due to the substantial wartime losses of men as an exogenous shock on the marriage market after the war. We consider a bilateral-specific fixed effect model defined as follows:

$$y_{ita} = \pi + \delta SR_{ita} + \phi_{ia} + \nu_t + \epsilon_{ita}, \tag{2}$$

where i indicates the prefecture, t indicates the measured census year, and a indicates age ranges from 17 to 50. The variables y and SR are the outcome variable and sex ratio defined in equation 1 that are measured at each prefecture-year-age cell, respectively. ϕ is the prefecture-by-age fixed effect, ν is the year fixed effect, and ϵ is a random error term.

As introduced in Section 3.1, our panel data have a three-dimensional panel structure with respect to prefecture, year, and age and we assign fixed effects to the prefecture-by-age cells (ϕ_{ia}). This flexible setting of the error component enables us to control for

[13]This age range is slightly wider than that used in previous studies. For instance, Brainerd (2017) focuses on people aged 18–44 in 1959. We use a wider age range given that while the number of singles in their 40s was stable, the proportion of marriages, divorces, and widowhoods still changed in their 40s, as shown in Figure 3. We confirm that our main results are not sensitive to slight changes in the age bins in the sex ratio (Section 6).

the prefecture-varying age effects on the outcome variables.[14] Hence, the majority of the prefecture-specific trends in all the dependent variables with respect to age are controlled for using bilateral-specific fixed effects (Davis 2002). In addition, the unobservable time trends and macroeconomic shocks are captured using the year fixed effect, ν. The remaining variations used for the identification are then the within variations in each prefecture-by-age cell excluding the parallel shifts over the cells.

The key identifying assumption is that the variations in the sex ratio are exogenous to any socioeconomic conditions that might affect the outcome variables. This assumption is plausible given that the draft was conducted randomly during the war (Watanabe 2014a; 2014b) and that the losses of men were not concentrated in provincial urban areas but distributed equally over the prefectures (Ogasawara and Komura 2021). Potential threats that may be correlated with the sex ratio and marriage market outcomes in this setting are internal migration and regional economic losses (Brainerd 2017). First, although some people must have crossed prefecture borders from rural to urban regions after the war, this migration did not change the overall distributions of the sex ratios in Japan between 1950 and 1955, as shown in Figure 4. This means that internal migration only occurred in a few large prefectures such as Tokyo and Osaka, as suggested in Section 3.1, rather than in all prefectures. Indeed, Okazaki and Suda (1969, p. 54) reveal that cross-border migration over prefectures was limited throughout the 1950s.[15]

Moreover, as discussed earlier, Figure 4 indicates that these systematic flows of temporary workers from rural areas to Tokyo only comprise men in their early 20s. Since our model in equation 2 uses the within variations across years, the most important variations for the identification are the dramatic changes in the sex ratios after the late 20s.[16] This means that our results should not be influenced by such migration.[17]

[14]In other words, the age effects are allowed to vary across prefectures because we account for the interaction between the prefecture and age fixed effects. Brainerd (2017) is the first study to use a region-by-age panel in a single census year of 1959 to analyze the impacts of the wartime losses of men in Russia. The cohorts are identical to the measured ages in 1959 in her two-way region-by-age panel, which can identify the cohort effects of the losses. In this light, we expand her technique to a three-dimensional panel by controlling for age fixed effects to identify the cohort effects using prefecture-by-age fixed effects. This means that we use the within variations across years in each prefecture-by-age cell to disentangle cohort effects from age effects.

[15]The average cross-border migration rate (i.e., migration per 100 people) was less than 3% in 1955 and roughly 30% of that migration occurred from non-metropolitan to metropolitan areas (Okazaki and Suda 1969, p. 55).

[16]Comparing Figure 4a with 4b suggests this point: specifically, the model may use both the dramatic improvements in the sex ratios between, say, 26 and 31 from 1950 and 1955 and the substantial declines in the ratios between, say, 32 and around 40 from 1950 and 1955.

[17]Despite this, in Section 6, we show the robustness of our main results by including an indicator variable for observations aged less than 30 in Tokyo and the interaction term with respect to the 1955

Second, since Japan did not experience any ground battles except for the battle of Okinawa, the impacts of battles on the regional economic losses in each prefecture should be negligible. While air attacks caused devastation in some cities in 1944 and 1945, those attacks would have been less likely to disturb the gender balance, as they must have killed women as well as men. Despite this, we show that our main results are not influenced by controlling for the degree of devastation due to air attacks, including the atomic bombs dropped on Nagasaki and Hiroshima prefectures (Section 6).

For the statistical inference, we use the cluster-robust variance estimator and cluster the standard errors at the 46-prefecture level to assess the potential prefecture-specific dependence in the errors (Bertrand et al. 2004). This means that our method controls for the correlations and heteroskedasticity within clusters in the inference.

4 Main Results

Overall Effects

Panel A of Table 2 presents the results from the specification of equation 2. Columns (1)–(4) and (5)–(8) show the results for women and men, respectively. First, column (1) indicates that the sex ratio is positively associated with the proportion of single women. The estimate suggests that a one standard deviation decrease in the sex ratio decreases the number of single women by 44 per $1,000$ women. Correspondingly, the estimated coefficient on the sex ratio is negative and statistically significant (column (2)). The estimate indicates that a one standard deviation decrease in the sex ratio increases the number of married women by 38 women. The results for men are similar to those for women (columns (5) and (6)). The estimates reported in both columns indicate that a one standard deviation decrease in the sex ratio decreases the number of single (married) men by 40 (41) per $1,000$ men.

Column (3) indicates that the coefficient on the sex ratio is estimated to be -88.57 and statistically significant. This estimate suggests that a one standard deviation decrease in the sex ratio increases the proportion of divorced women by 8.9 per $1,000$ women. We find a much smaller estimate for men (column (7)). The estimated coefficient is -30.35 and statistically significant, suggesting that a one standard deviation decrease in the sex ratio increases the proportion of divorced men by 3 per $1,000$ men. We find a similar result for widowhoods. The estimate in column (4) is weakly statistically significantly positive,

dummy in our baseline specification.

whereas that in column (8) of the same panel is larger and statistically significant. These estimates suggest that a one standard deviation decrease in the sex ratio is associated with a decrease in the proportion of widowed women (men) by 2.5 (4.0) per $1,000$ women (men), respectively.

Overall, relative male scarcity due to the war has similar impacts on both genders in terms of the proportion of singles, marriages, and divorces. The women and men in prefectures with higher relative male scarcity are more likely to marry and divorce. This result may simply reflect the fact that younger people who could not marry during wartime in those prefectures started to be matched as Figure 2a indicates.[18] The greater number of marriages may have systematically induced the greater likelihood of divorce (Section 2.2). The differences in the magnitude of the estimates between women and men, however, might suggest the higher bargaining position of men in the marriage market. Indeed, the clear gender differences in the estimates for divorces (columns (3) and (7)) and widowhoods (columns (4) and (8)) suggest better outside options for men under relative male scarcity. In other words, men might be more likely to remarry than women, who faced worse outside options after the war. This finding is consistent with the lower proportion of divorced and widowed men than women (Figure 3).

It is also useful to discuss some of the differences between our results and those of related previous studies in terms of the cost of divorce. In post-World War I France, the greater wartime losses of men decreased the proportion of divorced women and men, implying that the women facing relative male scarcity were more likely to stay single and less likely to ever marry (Abramitzky et al. 2011, p. 136). Our result suggests that the opposite movement occurred in post-World War II Japan within the same mechanisms. In the case of Russia after World War II, the men in regions with greater male losses due to the war were less likely to marry. Brainerd (2017) explains that the strongly pronatalist Family Code of 1944, which led to the high cost of divorce as well as nearly costless non-marital sexual relations, decreased the probability of male marriage. In this light, Japanese men experienced a similar institutional change after the war. During the changes in the democratization policies in Japan, the Family Laws enshrined in the Civil Code were overhauled in 1947. The Civil Code allowed the divorce and division of properties at divorce, which might have increased the cost of divorce for men.[19] However,

[18] A newspaper in 1946 states: "people were encouraged to get married to fend themselves, so they held joint wedding ceremonies" (Shinbun 1946). Another article describes the tendency to hold cheaper wedding ceremonies than in the prewar period, which may have increased the number of marriages after the war (Shinbun 1949)

[19] Under the Family Laws within the Meiji Civil Code dating from 1898, although bigamy was forbidden

out-of-wedlock birth rates (as well as the birth share) were considerably lower in Japan than Russia and thus men having a relatively strong bargaining position in the marriage market might choose divorce rather than non-marital sexual relations. We investigate out-of-wedlock births in detail in Section 5.2.

for both husband and wife, adultery committed by a wife was recognized grounds for divorce, while adultery on the husband's part could only be a reason for divorce if he were found guilty of the crime of illicit intercourse. The new Civil Code abolished this institution and established the equality of men and women upon divorce. See Online Appendix A.1 for the details of this institutional background.

Table 2: Effects of the Gender Imbalance on Marriage Market Outcomes: 1950 and 1955 Population Census Data

	Women				Men			
	(1) Single	(2) Married	(3) Divorced	(4) Widowhood	(5) Single	(6) Married	(7) Divorced	(8) Widowhood
Panel A: Overall Effects								
Sex Ratio (SR)	440.59***	−376.52***	−88.57***	24.97*	404.33***	−410.97***	−30.35***	40.15***
	(45.41)	(34.37)	(6.23)	(12.40)	(70.43)	(70.96)	(1.95)	(2.85)
Panel B: Heterogeneous Effects								
Sex Ratio (SR)	480.32***	−347.76***	−93.68***	−38.84***	467.80***	−483.61***	−35.01***	54.11***
	(33.24)	(31.95)	(3.49)	(13.12)	(47.56)	(48.57)	(2.13)	(2.11)
Sex Ratio (SR) × *I(Year=1955)*	−92.50***	−66.96*	11.90*	148.55***	−141.82***	162.32***	10.40***	−31.19***
	(15.25)	(38.75)	(6.41)	(31.49)	(21.19)	(16.71)	(2.47)	(4.53)

***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors from the cluster-robust variance estimation reported in parentheses are clustered at the 46-prefecture level.

Notes: The dependent variables used in columns (1)–(4) are the proportion of single men, married men, divorced men, and widowed men per 1,000 men, respectively. The dependent variables used in columns (5)–(8) are the proportion of single women, married women, divorced women, and widowed women per 1,000 women, respectively. *I(Year=1955)* indicates an indicator variable that takes one if the year is 1955 and zero if the year is 1950, i.e., a 1955 year dummy that depends only on t. The number of observations is $3,128$ (46 prefectures × 33-age range × 2 census years) in all the regressions. All the regressions include prefecture-age-specific fixed effects and year fixed effects. All the regressions are weighted by the average number of people (women in columns (1)–(4); men in columns (5)–(8)) in each prefecture-age cell.

Heterogeneous Effects

To assess the adjustment mechanism in the marriage market, we consider a flexible specification that includes an interaction term between the sex ratio and an indicator variable that takes one for the later census year, 1955. We expect that the combination of the estimated coefficients on the sex ratio and its interaction term can be used to analyze the persistence of relative male scarcity in the marriage market.

Panel B of Table 2 presents the results from our flexible specification following the same layout as Panel A. First, we assess the results for women (columns (1)–(4)). Column (1) indicates that the impacts of the wartime losses of men on the proportion of single women decrease from 1950 to 1955. The marginal effects are estimated to be 480.32 in 1950 and 387.82 ($480.32 - 92.50$) in 1955. Column (2) indicates that the main effect of the sex ratio is statistically significantly negative and that its interaction effect is also negative and weakly statistically significant. We find a similar result for the proportion of divorced women in column (3): the interaction effect is weakly statistically significantly positive but small. Both results imply that the impacts of relative male scarcity on the proportion of married and divorced women persists in 1955. Indeed, the marginal effects in 1955 are estimated to be -414.72 in column (2) and -81.78 in column (3), which are not far from the overall effect (reported in columns (2) and (3) of Panel A).

We find an interesting change in the impacts of relative male scarcity on the proportion of widowed women. The estimates in column (4) indicate that the marginal effects of the sex ratio are -38.84 in 1950 and 109.71 ($-38.84 + 148.55$) in 1955. This implies that a one standard deviation decrease in the sex ratio is associated with an increase in the proportion of widowed women by 3.9 per $1,000$ women in 1950, but a decrease in the proportion of widowed women by 11 per $1,000$ people in 1955. Both social norms and institutional reasons may explain this result for widowed women. In the initial stage by 1950 (i.e., soon after the end of the massive repatriation), the higher male scarcity due to the wartime losses of husbands can simply reflect the greater number of widowhoods. Kawaguch (2003) explains that widowed women preferred not to remarry as a "*eirei no tsuma* (wife of spirits of war dead)." However, by the early 1950s, widowed women might have faced serious economic hardship. Indeed, the administration encouraged widowed women to remarry to cope with economic hardship, especially when the military pension was partly abolished in 1946 by the General Headquarters of the Allied Powers.[20] The

[20]A popular magazine titled *Syufu-no-Tomo* (housewife's friend) for women argued: "For widows, remarry first, and [seek] public assistance second.". This describes the clear trend that the remarriage of widowed women was regarded as a strategy to be financially independent at that time(Kawaguch 2003,

adjustment in the marriage market that began in the early 1950s moved widowed women into the marriage market, as reflected in the marginal effect in 1955. Given the attenuation in the marginal effect on the proportion of single women in column (1), this adjustment through the remarriage of widowed women might have occurred at the expense of some first marriages among younger women. Those remarriages of a massive number of widowed women may also explain the persistence of the impacts of relative male scarcity on the proportion of married and divorced women shown in columns (2) and (3).

Next, we examine the results for men (columns (5)–(8)). Column (5) indicates that the impacts of the wartime losses of men on the proportion of single men decrease from 1950 to 1955: the marginal effects are 467.80 in 1950 and 325.98 ($467.80 - 141.82$) in 1955. We find a corresponding result for the proportion of married people in column (6): the main effect of the sex ratio is statistically significantly negative and its interaction effect is statistically significantly positive. This result suggests that the impacts of relative male scarcity on the proportion of married men decreases over time. This trend is considered to be consistent with the rightward shift of the distribution of the sex ratio shown in Figure 1. Indeed, the sex ratios for 20s improve from 1950 to 1955 (Figure 1b compared with 1c), which might attenuate the better outside options in the marriage market for men (note that we fix the age bin (i.e., 17–50) in the analyses). The results for divorced and widowed men can support this interpretation. Column (7) indicates that the marginal effect of the sex ratio on the proportion of divorced men attenuated in 1955. A similar attenuation can be found in the proportion of widowed men (column (8)). The estimated marginal effects in 1955 are 24.61 ($-35.01 + 10.40$) in column (7) and 22.92 ($54.11 - 31.19$) in column (8). Both results imply that the better outside options of men decreased over time because relative male scarcity had been resolved by 1955.

To summarize, the women and men who faced relative male scarcity due to the war were more likely to marry and divorce, which may reflect a marriage boom after the war. However, there are some differences in the estimates, suggesting men enjoyed a stronger bargaining position in the marriage market. Widowed women were less likely to remarry than widowed men. The results for men thus suggest that their relative advantage in the marriage market somewhat attenuated by 1955. Despite this, the results indicate that the situation for women in the marriage market did not improve throughout the 1950s, even though there were some adjustments in the number of remarriages at the expense of first marriages among younger people.

p.116–123).

5 Additional Analyses

In this section, we investigate the impacts of the wartime losses of men on age at first marriage and birth outcomes. First, we test the influence of the age of grooms and brides, marital fertility, and stillbirths using the prefecture-year-level panel dataset obtained from both census reports and vital statistics records. Second, we analyze out-of-wedlock births using the age-year-level panel dataset from census reports.

5.1 Age at First Marriage, Marital Fertility, and Stillbirth

5.1.1 Data and Identification Strategy

Although the prefecture-year-age-level panel data on grooms and brides' ages are not available, we can obtain prefecture-year-level information on average age at first marriage from the official reports of the censuses. To prepare the difference-in-differences setting, we digitize the statistics not only from the postwar censuses of 1950 and 1955 but also from the prewar census of 1935 (Bureau of Statistics, Office of the Prime Minister 1951b, 1956b; Statistics Bureau of the Cabinet 1939b). In addition, we investigate the potential quality/quantity adjustment at birth due to the gender imbalance caused by the war. To do so, we digitize the maternal fertility and stillbirth rates using both the censuses and the vital statistics of Japan (Division of Health and Welfare Statistics, Welfare Minister's Secretraiat 1953, 1957; Statistics Bureau of the Cabinet 1936).[21] Panel B of Table 1 presents the summary statistics. Online Appendix B.3 shows the summary statistics by measured year.

For prefecture i and measured year t, we specify the regression as follows:

$$h_{it} = \omega + \gamma SR_{it} + \mu_i + \lambda_t + e_{it}, \tag{3}$$

where h is average age (and the age gap) at first marriage, the marital fertility rate, or the stillbirth rate. SR is the sex ratio modified based on equation 1, which can be simply expressed as the number of men aged 17–50 divided by the number of women aged 15–40.[22] μ is the prefecture fixed effect, λ is the year fixed effect, and e is a random

[21] We use the marital fertility rate (i.e., the number of live births per 1,000 married women) rather than the general fertility rate (i.e., the number of live births per 1,000 women aged 15—44) because out-of-wedlock births were rare in Japan at that time (Section 5.2).

[22] We modify the adjusted sex ratio of equation 1 to merge the prefecture-year-level data as $SR_{it} = \sum_{a=17}^{50} MALE_{i,t,a} / \sum_{a=15}^{40} FEMALE_{i,t,a}$, where $MALE_{i,t,a}$ and $FEMALE_{i,t,a}$ are the number of men and women in the i-t-a cell, respectively. The prefecture-year-age-level data on the number of men and women

error term. The identification assumption is similar to that for equation 2: the sex ratio is uncorrelated with any confounding factors in the error term conditional on the fixed effects. While this assumption is plausible as discussed already, we also include the female labor force participation rate as a control variable to address the potential rises in the opportunity cost of both marriage and giving birth due to relative male scarcity after the war. To address the potential heterogeneity in the treatment effects over time, we separately run regressions using the 1950 and 1955 census data, setting the 1935 census data as the reference year in the spirit of Bethmann and Kvasnicka (2012).[23]

5.1.2 Results

Age at First Marriage

First, we examine the impacts of relative male scarcity on assortative matching in terms of age. Table 3 presents the results for the age of grooms and brides and their age gap. Columns (1)–(4) show the results for the regressions using equation 3, whereas columns (5)–(8) show the results for the regressions using the same equation but including the female labor force participation rate as a control variable. Panel A presents the results for the 1935 and 1950 samples, whereas Panel B presents those for the 1935 and 1955 samples.

Column (1) of Panel A indicates that the estimated coefficient on the sex ratio is positive and statistically significant. The estimate suggests that a one standard deviation decrease in the sex ratio is associated with a decrease in the average age of brides by 0.5 years. Column (2) of Panel A shows a similar result for men. The estimate suggests that a one standard deviation decrease in the sex ratio decreases the average age of grooms by approximately 0.5 years. Consequently, the wartime losses of men do not have statistically significant impacts on the age difference between grooms and brides (column (3) of Panel A). The estimates become statistically insignificant in all the regressions in Panel B of

in 1930 and 1935 are obtained from the 46 volumes of the official reports of the 1930 and 1935 Population Censuses. This means that we use 92 volumes in total to construct the data on the prefecture-year-level adjusted sex ratio. For simplicity, however, we note the citations as Statistics Bureau of the Cabinet (1933) and Statistics Bureau of the Cabinet (1939a).

[23] Another way to address heterogeneous treatment effects over time is to use the specification including the interaction term between the sex ratio and year dummies with the pooled panel data from 1935 to 1955. However, such a specification has to assume that prefecture fixed effects do not vary between 1950 and 1955. An advantage of this specification using three census years at the same time is that it can include the prefecture-specific line time trends in the model. However, given that we are using a short panel, it considerably reduces efficiency because more than 30% of the observations are used to estimate the trends. Considering this, we use the 1950 and 1955 census data separately in this analysis.

Table 3, implying that the impacts of relative male scarcity on age at first marriage might be obvious until around 1950, but do not persist into 1955. These results are largely unchanged if we include the female labor force participation rate in columns (4)–(6). This means that the influence of changes in the opportunity cost of marriages did not matter.

In the case of post-World War I France, while average age at first marriage for men did not depend on military mortality rates in the First World War, higher military mortality rates were associated with the later marriage of women. As a result, the age gap between grooms and brides decreased in the areas that experienced greater male losses due to the war, suggesting that women who faced greater relative male scarcity might have found it more difficult to find a spouse and/or that men might have preferred to be coupled with older women than before (Abramitzky et al. 2011, p. 149). Unlike the case of France, however, our result suggests that the ages of both grooms and brides decreased under relative male scarcity. The decline in the age of grooms may be plausible because the average age of men who entered the marriage market after the war decreased as a consequence of the war (Section 2.2). This systematic decline in men's age might have induced a decline in the average age of brides by a similar magnitude. The majority of this adjustment might have ended by 1955 because of the rightward shift in the distribution of the sex ratio between 1950 and 1955 (Figure 1).

Given our finding that the impacts of relative male scarcity on the marriage market had similar impacts on women and men (Section 4), marriages among younger people might have increased in areas that experienced greater wartime losses of men, at least in 1950.

Table 3: Effects of the Gender Imbalance on Age at First Marriage: 1935, 1950, and 1955 Population Census Data

	Average age at first marriage					
	(1) Women	(2) Men	(3) Difference	(4) Women	(5) Men	(6) Difference
Panel A: 1935–1950 Census Data						
Sex Ratio (SR)	5.016**	4.830**	−0.186	4.876*	4.772**	−0.104
	(2.461)	(2.139)	(1.215)	(2.436)	(2.138)	(1.180)
Female Labor Force Participation Rate	No	No	No	Yes	Yes	Yes
Panel B: 1935–1955 Census Data						
Sex Ratio (SR)	1.154	0.928	−0.226	1.182	1.157	−0.025
	(2.064)	(1.862)	(0.643)	(2.278)	(1.944)	(0.639)
Female Labor Force Participation Rate	No	No	No	Yes	Yes	Yes

***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors from the cluster-robust variance estimation reported in parentheses are clustered at the 46-prefecture level.
Notes: The dependent variables used in columns (1) and (2) are average age at first marriage for women and men, respectively. The dependent variable used in column (3) is the difference in average age at first marriage between women and men (women minus men). All the regressions include prefecture and year fixed effects. Columns (4)–(6) include the female labor force participation rate, defined as the number of female workers per 100 women. The number of observations is 92 (46 prefectures × 2 census years) in all the regressions. All the regressions are weighted by the average number of marriages in each prefecture cell.

Marital Fertility and Stillbirth Rates

Next, we examine the impacts of relative male scarcity on birth outcomes after marriage. Table 4 presents the results for marital fertility and stillbirth rates. Columns (1) and (2) show the results for the maternal fertility rate, whereas columns (3) and (4) show those for the stillbirth rate. The regressions in columns (2) and (4) include the female labor force participation rate as a control variable. Panel A (B) presents the results for the 1935 and 1950 (1955) samples.

Column (1) of Panel A indicates that the estimated coefficient is statistically significantly negative and that this result is unchanged if we control for the potential opportunity cost of giving birth (column (2) of Panel A). The estimate in column (1) of Panel A implies that a one standard deviation decrease in the sex ratio is associated with an increase in live births by 13 per $1,000$ married women. In the case of post-World War II Russia, a lower sex ratio resulting from relative male scarcity resulted in fewer marital births, implying that men preferred fewer children than women and had a greater influence on fertility choices (Brainerd 2017, p. 237). In this light, a potential explanation for our result is that men preferring more children than women had a stronger bargaining position in the fertility decision (Ogasawara and Komura 2021). Columns (1) and (2) of Panel B suggest that this effect on marital fertility becomes statistically insignificant in 1955, implying that improvements in the gender imbalance might have attenuated the relative advantage of men.

Columns (3) and (4) of Panel A suggest that the estimated effects are positive but statistically insignificant in 1950. In columns (3) and (4) of Panel B, however, we find a negative relationship between the sex ratio and stillbirth rate in 1955. The estimate in column (3) of Panel B indicates that a one standard deviation decrease in the sex ratio increases the number of stillbirths by 7.2 per $1,000$ births. As explained before, an important fact here is that the number of stillbirths in the postwar period includes the large number of deaths before birth due to abortion (see Section 2.3). The statistically insignificant influence of relative male scarcity on marital fertility in columns (1) and (2) of Panel B can be partly explained by the rise in the number of abortions.

Overall, our result suggests that men, who had a stronger bargaining position than women, might have decided to abort, especially when the pregnancy was unexpected. As described in Section 2.3, an official survey of 1964 indicates that a large number of marred women who experienced abortions had two or more children beforehand. This is consistent with the findings of Norgren (2008) that people lacked knowledge of contraception at that

Table 4: Effects of the Gender Imbalance on Marital Fertility and Stillbirth: 1935, 1950, and 1955 Population Census and Vital Statistics (VS) Data

	Marital Fertility Rate		Stillbirth Rate	
	(1)	(2)	(3)	(4)
Panel A: 1935–1950 Census and VS Data				
Sex Ratio (SR)	−130.273**	−130.754**	21.286	20.326
	(49.288)	(49.806)	(40.259)	(41.980)
Female Labor Force Participation Rate	No	Yes	No	Yes
Panel B: 1935–1955 Census and VS Data				
Sex Ratio (SR)	−55.176	−50.067	−72.421**	−77.252**
	(53.562)	(58.115)	(29.726)	(28.960)
Female Labor Force Participation Rate	No	Yes	No	Yes

***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors from the cluster-robust variance estimation reported in parentheses are clustered at the 46-prefecture level.
Notes: The dependent variable used in columns (1) and (2) is the number of live births per 1,000 married women. The dependent variable used in columns (3) and (4) is the number of stillbirths per 1,000 births. All the regressions include prefecture and year fixed effects. Columns (3) and (4) include the female labor force participation rate, defined as the number of female workers per 100 women. The number of observations is 92 (46 prefectures × 2 census years) in all the regressions. All the regressions in columns (1) and (2) are weighted by the average number of married women in each prefecture cell. All the regressions in columns (3) and (4) are weighted by the average number of births in each prefecture cell.

time and thus relied heavily on the use of artificial abortions.

5.2 *Out-of-wedlock Births*

5.2.1 Data and Identification Strategy

Existing evidence suggests that exogenous male losses due to wars raise the share of out-of-wedlock births. In France after World War I, out-of-wedlock births were positively correlated with military mortality rates (Abramitzky et al. 2011). Bethmann and Kvasnicka (2012) reveal that the wartime losses of men increased the share of out-of-wedlock births among total births after the Second World War in Bavaria. Brainerd (2017) also finds that the decline in the sex ratio is predicted to increase the share of out-of-wedlock births in urban areas of Russia after the war. The weight of evidence thus indicates a positive causal effect of a decline in the sex ratio on the share of out-of-wedlock births, which is consistent with the theoretical implications of intra-household bargaining (Becker 1991; Willis 1999).

The current study builds on this evidence in the literature. However, we seek to add empirical evidence on Japan, a country that experienced a different trend of out-of-wedlock fertility. Indeed, while out-of-wedlock birth rates were increasing after the Second World War in Germany and Russia, those rates were *decreasing* in postwar Japan. Indeed, the

shares of out-of-wedlock births were 14.2% in 1947 in Germany (Bethmann and Kvasnicka 2012, p. 181) and 15.6% in 1959 in Russia (Brainerd 2017, p. 233), whereas the mean rate in 1950s Japan was 3.3% (Table 1).[24] Thus, this study is the first to provide empirical evidence on an economy that experienced the opposite trend of out-of-wedlock fertility.[25]

Despite the small proportion of illegitimate births at that time, the 1950 and 1955 Population Censuses do document the number of out-of-wedlock births by maternal age (Bureau of Statistics, Office of the Prime Minister 1951a, 1956a). We can then calculate two measures of the probability of having out-of-wedlock births: the share of out-of-wedlock births and out-of-wedlock birth rate. The share of out-of-wedlock births is defined as the number of out-of-wedlock live births per 100 live births and the out-of-wedlock birth rate is the number of out-of-wedlock life births per 1,000 women. Panel C of Table 1 presents the summary statistics. Figures B.3 and B.4 in Online Appendix B.3 show those rates by maternal age.

The regression specification is as follows:

$$w_{at} = \alpha + \beta SR_{at} + \theta_a + \kappa_t + u_{at}, \tag{4}$$

where a indicates the maternal age (from 17 to 50 years) and t indicates the measured census year. The variable w is either the share of out-of-wedlock births or the out-of-wedlock birth rate and SR is the adjusted sex ratio based on equation 1.[26] θ is the age fixed effect, κ is the year fixed effect, and u is a random error term. We find clear U-shaped and inverse U-shaped trends in the share of out-of-wedlock births and out-of-wedlock birth rate, respectively (Figures B.4 and B.3 in Online Appendix B.3). The age fixed effect can thus control for these systematic trends in both rates. Similarly, the year fixed effect captures the decreasing trend in both rates. As these fixed effects capture the systematic trends in both rates in terms of age and year, we use the within variation in each maternal age cell to estimate the parameter of interest, β.

[24]Specifically, 3.6% in 1950 and 3.1% in 1955. If we focus on the rates for the 20–40 age range, they were roughly 1.0–2.0% (Figure B.4 in Online Appendix B.3). Although we cannot directly compare the figures because of differences in the sample periods, the proportion of out-of-wedlock births was 7.4% in post-World War I France Abramitzky et al. (2011, p. 150).

[25]While this difference may be an interesting topic for future studies, the potential reasons for such a low share of out-of-wedlock births include the divorce law in postwar Japan, which prohibited other partners outside marriage, and the inheritance law, which was unfavorable for out-of-wedlock-born children (Ogasawara and Komura 2021).

[26]To merge the adjusted sex ratio of equation 1 into the maternal age-year-level data on the share of out-of-wedlock births, we modify equation 1 as $SR_{at} = \frac{\sum_{j=-2}^{10}\sum_{i=1}^{46} MALE_{i,t,a+j}}{\sum_{j=-2}^{10}\sum_{i=1}^{46} FEMALE_{i,t,a+j}}$.

5.2.2 Results

Table 5 presents the results. Columns (1) and (2) show the results for the share of out-of-wedlock births. Column (1) suggests that a one standard deviation decrease in the sex ratio increases out-of-wedlock births by 0.7 (0.1×6.83) per 100 live births. We also consider the specification that allows the marginal effects of the sex ratio to vary over the measured years in column (2). The estimated coefficient on the interaction term is close to zero and statistically insignificant, suggesting that the marginal effects in 1955 are similar to those in 1950. In other words, the impacts of the wartime losses of men on the share of out-of-wedlock births persisted throughout the 1950s.

Columns (3) and (4) show the results for the out-of-wedlock birth rate. Column (3) indicates that a one standard deviation decrease in the sex ratio is associated with an increase in out-of-wedlock births of 1.2 per 1,000 women in 1950. In column (4), the estimated coefficient on the interaction term is 13.28 and statistically significant, which wipes out a large part of this negative effects of the sex ratio. As a result, the marginal effect of the sex ratio is estimated to be -3.6 in 1955, showing that a one standard deviation decrease in the sex ratio increases out-of-wedlock births by 0.4 per 1,000 women. This magnitude is roughly 30% of that in 1950. The increased number of abortions in the early 1950s discussed above might have reduced out-of-wedlock births.

To summarize, the results are consistent with the theoretical predictions (Becker 1991) and findings of previous studies (Bethmann and Kvasnicka 2012; Brainerd 2017). Despite the considerably lower share of out-of-wedlock births than for the countries investigated by previous studies, we find that the wartime losses of men increased the share of out-of-wedlock births in the 1950s in Japan. While the wartime losses of men were also positively associated with the out-of-wedlock birth rate, such a relationship attenuated in 1955, presumably because of the increased number of abortions.

6 Robustness Checks

First, we test the potential influence on the influx of younger men to Tokyo in 1955. As discussed earlier, there must have been an influx of male workers aged in their 10s–20s to 1955 Tokyo. Table 6 presents the results from the specification including an indicator variable for observations aged 17–29 in 1955 Tokyo in equation 2. In this specification, we control for unobserved factors that might be correlated with changes in the sex ratio for those aged 17–29 in Tokyo from 1950 to 1955. As shown, the results are largely unchanged

Table 5: Effects of the Gender Imbalance on Out-of-Wedlock Fertility: 1950 and 1955 Population Census Data

	Share of Out-of-Wedlock Births		Out-of-Wedlock Birth Rate	
	(1)	(2)	(3)	(4)
Sex Ratio (SR)	-6.83^{***}	-7.39^{***}	-11.51^{***}	-16.88^{***}
	(0.90)	(1.35)	(1.79)	(0.90)
Sex Ratio (SR) $\times$ *I(Year=1955)*		0.91		13.28^{***}
		(1.70)		(0.96)

***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors from the cluster-robust variance estimation reported in parentheses are clustered at the 34-maternal age level.
Notes: The dependent variable used in columns (1) and (2) is the proportion of out-of-wedlock live births per 100 live births. The dependent variable used in columns (3) and (4) is the number of out-of-wedlock live births per 1,000 women. *I(Year=1955)* indicates an indicator variable that takes one if the year is 1955 and zero if the year is 1950, i.e., a 1955 year dummy that depends only on t. The number of observations is 68 (34 maternal ages $\times$ 2 census years) in all the regressions. All the regressions include age and year fixed effects. The regressions in columns (1) and (2) are weighted by the average number of live births in each age cell. The regressions in columns (3) and (4) are weighted by the average number of women in each age cell.

if we include the indicator variable for the potential influx of men into the metropolitan area.

Table 6: Robustness Checks: Effects of the Gender Imbalance on Marriage Market Outcomes Controlling for an Indicator Variable for Tokyo–1955–Aged 17–29 Cells

	Women				Men			
	(1) Single	(2) Married	(3) Divorced	(4) Widowhood	(5) Single	(6) Married	(7) Divorced	(8) Widowhood
Panel A: Overall Effects								
Sex Ratio (*SR*)	447.68***	−372.07***	−95.60***	20.52**	436.17***	−439.37***	−33.89***	40.61***
	(45.19)	(41.83)	(4.16)	(12.04)	(53.80)	(56.87)	(2.55)	(2.90)
Panel B: Heterogeneous Effects								
Sex Ratio (*SR*)	476.01***	−351.41***	−97.93***	−26.48*	476.58***	−487.32***	−36.60***	50.88***
	(40.84)	(34.38)	(3.84)	(15.62)	(47.37)	(51.58)	(2.86)	(3.66)
Sex Ratio (*SR*) × *I(Year=1955)*	−96.52***	−70.38	7.93	160.11***	−134.01***	159.01***	8.99***	−34.06***
	(20.79)	(43.33)	(5.22)	(30.82)	(21.82)	(19.35)	(1.87)	(4.28)

***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors from the cluster-robust variance estimation reported in parentheses are clustered at the 46-prefecture level. Notes: The dependent variables used in columns (1)–(4) are the proportion of single men, married men, divorced men, and widowed men per 1,000 men, respectively. The dependent variables used in columns (5)–(8) are the proportion of single women, married women, divorced women, and widowed women per 1,000 women, respectively. *I(Year=1955)* indicates an indicator variable that takes one if the year is 1955 and zero if the year is 1950, i.e., a 1955 year dummy that depends only on t. The number of observations is $3,128$ (46 prefectures × 33-age range × 2 census years) in all the regressions. All the regressions include an indicator variable that takes one for the observations aged 17–29 in 1955 Tokyo, prefecture-age-specific fixed effects, and year fixed effects. All the regressions are weighted by the average number of people (women in columns (1)–(4); men in columns (5)–(8)) in each prefecture-age cell.

The second set of analyses relate to the sensitivity of the definition in the sex ratios. Our main results from equation 2 should be *sensitive* to changes in the age window of the sex ratio. This is because it uses the within variation in each prefecture-age cell for the identification, meaning that a substantially narrow age window undercuts the useful information in the exogenous changes in the sex ratio due to the war, whereas a substantially broader age window attenuates the estimates. Note that a one age loss in the sex ratio leads to 33 age-cell losses in calculating the sex ratio in a given census year in our definition (equation 1), meaning a substantial change in the target marriage market. Indeed, we confirm that our baseline estimates tend to be sensitive to such a change if we alter the age window by ±3–5-year ranges (i.e., 99–165 age-cell losses or gains in calculating the sex ratio) from the baseline definition. Considering this, we test the baseline estimates by changing the age window by ±2 years from the baseline. Table 7 presents the results for the specification of equation 2. *Sex Ratio (Narrow)* indicates the number of men from −1 to 9 years older than a woman of a given age divided by the number of women in the same age range, whereas *Sex Ratio (Broad)* indicates the number of men from −3 to 11 years older than a woman of a given age divided by the number of women in the same age range. Table 7 indicates that our baseline results in Table 2 remain robust to these changes in the sex ratio. While the estimate in column (2) of Panel B is now weakly statistically significant, this result does not upset our main finding but rather supports the persistence of the effects of relative male scarcity on women's marriages. We conduct a similar exercise on the regressions of equation 4 in Panel C of Table 8, showing that the results are largely unchanged compared with those in Table 5. Panels A and B of Table 8 present the results from a specification based on equation 3 but using alternative definitions of the sex ratio. Since equation 3 uses the simple sex ratio (number of men aged 17–50 divided by the number of women aged 15–40), as explained in Section 5.1.1, we change the age ranges of the numerator. The sex ratio labeled "(Narrow)" ("(Broad)") indicates the number of men aged 18–49 (16–51) divided by the number of women aged 15–40. The results are similar to those reported in Tables 3 and 4.

Finally, we test the potential impacts of the physical and human damage due to the air attacks on the homefront population. If the spatial distribution of physical and human losses correlate with the sex ratio via the direct losses of men in the homefront population and influence of internal migration, our estimation could suffer from endogeneity. Considering this, we include the number of deaths and missing people in the homefront population measured in 1948 in all the specifications. The results are virtually identical to those reported in Tables 2–4, supporting the evidence that the impacts on the home-

front population do not matter in our empirical setting (Online Appendix C.1). In other words, the variations in the sex ratio used mostly come from battlefield losses outside the Japanese archipelago.

Table 7: Robustness Checks: Effects of the Gender Imbalance on Marriage Market Outcomes
Changes in the Age Windows (±2 Year Shifts from the Baseline Definition)

	Women				Men			
	(1) Single	(2) Married	(3) Divorced	(4) Widowhood	(5) Single	(6) Married	(7) Divorced	(8) Widowhood
Panel A: Overall Effects								
Sex Ratio (Narrow)	425.40***	−378.13***	−84.56***	37.78***	399.08***	−401.88***	−29.27***	35.04***
	(42.94)	(34.47)	(5.38)	(9.88)	(68.77)	(68.66)	(1.85)	(2.11)
Sex Ratio (Broad)	444.37***	−365.36***	−90.37***	11.90	390.21***	−401.46***	−31.21***	45.72***
	(48.46)	(33.32)	(7.17)	(16.22)	(74.07)	(75.50)	(2.23)	(4.00)
Panel B: Heterogeneous Effects								
Sex Ratio (Narrow)	467.59***	−352.24***	−90.10***	−25.17**	465.21***	−477.09***	−33.96***	48.94***
	(29.96)	(29.07)	(3.14)	(11.60)	(45.76)	(46.43)	(2.21)	(1.87)
Sex Ratio (Narrow) × *I(Year=1955)*	−95.60***	−58.64	12.55**	142.62***	−143.88***	163.67***	10.19***	−30.26***
	(17.17)	(40.47)	(6.17)	(30.77)	(22.68)	(17.60)	(2.33)	(4.60)
Sex Ratio (Broad)	484.16***	−335.28***	−95.60***	−53.17***	456.17***	−476.71***	−36.27***	60.22***
	(36.53)	(33.03)	(3.89)	(15.29)	(50.48)	(52.28)	(2.27)	(2.68)
Sex Ratio (Broad) × *I(Year=1955)*	−90.57***	−68.47*	11.91*	148.13***	−143.24***	163.41***	11.00***	−31.48***
	(13.08)	(35.48)	(6.95)	(31.48)	(19.17)	(15.28)	(2.63)	(4.57)

***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors from the cluster-robust variance estimation reported in parentheses are clustered at the 46-prefecture level.
Notes: Sex Ratio (Narrow) is the number of men from −1 to 9 years older than a woman of a given age divided by the number of women in the same age range. Sex Ratio (Broad) is the number of men from −3 to 11 years older than a woman of a given age divided by the number of women in the same age range. The dependent variables used in columns (1)–(4) are the proportion of single men, married men, divorced men, and widowed men per 1,000 men, respectively. The dependent variables used in columns (5)–(8) are the proportion of single women, married women, divorced women, and widowed women per 1,000 women, respectively. *I(Year=1955)* indicates an indicator variable that takes one if the year is 1955 and zero if the year is 1950, i.e., a 1955 year dummy that depends only on t. The number of observations is 3,128 (46 prefectures × 33-age range × 2 census years) in all the regressions. All the regressions include prefecture-age-specific fixed effects and year fixed effects. All the regressions are weighted by the average number of people (women in columns (1)–(4); men in columns (5)–(8)) in each prefecture-age cell.

7 Conclusion

This study used relative male scarcity due to the casualties of World War II to analyze the impacts of the gender imbalance on marriage market and birth outcomes. We found that people who faced relative male scarcity were more likely to marry and divorce. The gender difference in the estimates suggests that men had a stronger bargaining position in the marriage market than women. Indeed, widowed women were less likely to remarry than widowed men, who had better outside options. The overall situation of women in the marriage market did not improve throughout the 1950s. Regarding birth outcomes, marital fertility rates increased in the areas that suffered relative male scarcity, although this boom disappeared by 1955. Correspondingly, stillbirth rates increased substantially in the areas that faced relative male scarcity in the mid-1950s, which reflects the impact of the enactment of the Abortion Act. The wartime losses of men also increased the share of out-of-wedlock births in the 1950s.

Our evidence from post-World War II Japan is not without its limitations. While we investigate the middle-run (i.e., 10 years after the war) effects of the gender imbalance on demographic outcomes, we provide no evidence on the long-term impacts of the unbalanced sex ratio because of the unavailability of systematic data on outcomes after 1960. The unavailability of systematic data on assortative matching also made it difficult for us to analyze the impacts of the gender imbalance on assortative matching after the war. Despite these limitations, this study newly digitized a comprehensive census-based dataset that has information on marriage market and birth outcomes at two survey points and exploited the plausibly exogenous variations in the wartime losses of men. This study is thus the first to provide suggestive evidence on the dynamic relationships between the gender imbalance and demographic changes as well as the gender-based differences in its effects. Finally, our result on out-of-wedlock births indicates that the theoretical prediction of intra-household bargaining is considered to be robust in an economy in which marital fertility is dominant.

Table 8: Robustness Checks: Effects of the Gender Imbalance on Age at First Marriage, Marital Fertility, Stillbirth, and Out-of-Wedlock Fertility
Slight Changes in the Age Windows (±2 Year Shifts from the Baseline Definition)

	Average age at first marriage					
	1935–1950 Census Data			1935–1955 Census Data		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A	Women	Men	Difference	Women	Men	Difference
Sex Ratio (Narrow)	5.487**	5.321**	−0.165	1.232	0.920	−0.312
	(2.612)	(2.274)	(1.281)	(2.149)	(1.971)	(0.670)
Sex Ratio (Broad)	4.482*	4.240**	−0.242	0.565	0.395	−0.171
	(2.359)	(2.062)	(1.167)	(1.985)	(1.767)	(0.617)

	Marital Fertility & Stillbirth Rates			
	1935–1950 Census Data		1935–1955 Census Data	
	(1)	(2)	(3)	(4)
Panel B	MFR	SBR	MFR	SBR
Sex Ratio (Narrow)	−137.729**	−138.081**	−60.049	−54.613
	(52.151)	(52.575)	(55.379)	(60.567)
Sex Ratio (Broad)	−128.525***	128.946***	−47.059	−41.990
	(47.372)	(47.880)	(52.071)	(56.118)

	Out-of-Wedlock Birth Share & Out-of-Wedlock Birth Rate			
	Narrow		Broad	
	(1)	(2)	(3)	(4)
Panel C	Birth Share	Birth Rate	Birth Share	Birth Rate
Panel C-1: Overall Effects				
Sex Ratio	−5.45**	−10.35**	−8.39***	−12.71***
	(0.87)	(1.52)	(0.92)	(2.13)
Panel C-2: Heterogeneous Effects				
Sex Ratio	−6.27***	−15.37***	−8.57***	−18.48***
	(1.35)	(0.89)	(1.36)	(0.86)
Sex Ratio × *I(Year=1955)*	1.29	12.43***	0.29	14.25***
	(1.73)	(0.93)	(1.70)	(1.08)

***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors from the cluster-robust variance estimation reported in parentheses are clustered at the 46-prefecture level.
Notes: In Panels A and B, Sex Ratio (Narrow) is the number of men aged 18–49 divided by the number of women aged 15–40, whereas Sex Ratio (Broad) is the number of men aged 16–51 divided by the number of women aged 15–40. In Panel C, Sex Ratio (in the columns named "Narrow") is the number of men from −1 to 9 years older than a women of a given age divided by the number of women in the same age range, whereas Sex Ratio (in the columns named "Broad") is the number of men from −3 to 11 years older than a women of a given age divided by the number of women in the same age range.
In Panel A, the dependent variable used in columns (1) and (4) is average age at first marriage for women, whereas that in columns (2) and (5) is average age at first marriage for men. In Panel A, the dependent variable used in columns (3) and (6) is the difference in average age at first marriage between women and men (women minus men). In Panel B, the dependent variable used in columns (1) and (3) is the number of live births per 1,000 married women, whereas that in columns (2) and (4) is the number of stillbirths per 1,000 births. All the regressions in Panels A and B include prefecture and year fixed effects. In Panel C, the dependent variable used in columns (1) and (2) is the proportion of out-of-wedlock live births per 100 live births, whereas that in columns (3) and (4) is the number of out-of-wedlock live births per 1,000 women. *I(Year=1955)* indicates an indicator variable that takes one if the year is 1955 and zero if the year is 1950, i.e., a 1955 year dummy that depends only on t.
In Panels A and B, the number of observations is 92 (46 prefectures × 2 census years) in all the regressions. In Panel C, the number of observations is 68 (34 maternal ages × 2 census years) in all the regressions. In Panel A, all the regressions are weighted by the average number of marriages in each prefecture cell. In Panel B, all the regressions in columns (1) and (3) are weighted by the average number of married women in each prefecture cell, whereas all the regressions in columns (2) and (4) are weighted by the average number of births in each prefecture cell. In Panel C, the regressions in columns (1) and (3) are weighted by the average number of live births in each age cell, whereas the regressions in columns (2) and (4) are weighted by the average number of women in each age cell.

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Appendices

Appendix A Background Appendix

A.1 Institutional Background

With the fall of the Japanese Tokugawa Shogunate in 1868, a modernization policy was implemented by the new Meiji Government. Nevertheless, the position of Japanese women before World War II was still lower than that of men. Japan's postwar move toward democracy led by the General Headquarters of the Allied Powers saw women gain the right to vote in 1945 and the promulgation of a new Japanese Constitution in 1946, which led to the equality of the sexes. The transitions in Japanese civil law, civil rights, and school education from the end of the 19th century to the mid-20th century are reviewed below.

Established in 1870 and a forerunner to the Penal Code of Japan, the Outline of the New Criminal Code (*Shinritsu Kōryō*) placed the wife and mistress of a man on essentially the same legal footing. Moreover, crimes by a wife or mistress against a man were punished more severely than those against a wife or mistress committed by a man in that Code (see Wakita et al. 2011, p. 193). The Family Registration Law (*koseki-hō*) passed in 1871 sought to establish control over the nation by establishing the home (*ie*) in which one resided as the fundamental social unit. This law established the systematic domination of men over women: with the head of the family at the top of the registry, direct ancestors, direct descendants, and male family members were positioned above lineal descendants, collateral relatives, and women (The Research Society for Women's History 1990, p. 4). In 1873, Edict No. 162 of the Grand Council of State (*dajōkan*) gave wives access to courts to seek a divorce, with the condition that they be "accompanied by [a] father, brother or relative" (Wakita et al. 2011, p. 194). Nonetheless, men were not obliged to support their ex-wives, nor were women awarded custody of their children. Divorce was thus an event that disadvantaged women (Fuess 2012, p. 179).

The Family Laws (*Mibun hō*) within the Meiji Civil Code dating from 1898 similarly provided for male dominance over women within the family. The Laws instituted as legal standards rights accruing to the head of a household (*kosyu ken*), rights of succession to family headship (*katoku sōzoku*), and the family system based on the subordination of female family members (*ie seido*). Although bigamy was forbidden for both husband and wife, adultery committed by a wife was recognized grounds for divorce, while adultery on the husband's part could only be a reason for divorce if he were found guilty of the crime of illicit intercourse. The Meiji Civil Code also established the household head as the

superior authority within the family, giving him the right to determine the residence of a family member and the right to decide marriages and adoptions. Accordingly, as heads of households, husbands and fathers were legally permitted to remove members from the family register if they became married or adopted a child without their permission. Parental authority in principle rested solely with the father, only to be exercised by the mother when a father was unable to do so. When mothers carried out financial management or other legal acts related to property on behalf of a child, the agreement of a family council (*shinzoku kai*; family members selected by the court) was required (see Wakita et al. (2011, pp. 200–202); Kurushima et al. (2015, pp. 170–171)).

The family system (*ie seido*) was maintained as prescribed by the former civil code, and women did not achieve the right to vote, even in the interwar period. The rights of household heads were exceptionally strong in prewar Japan because of a family system legitimized by law. Therefore, the position of women remained low in the lead-up to World War II.

On August 14, 1945, Japan accepted the Potsdam Declaration and its defeat in World War II, after which large-scale democratization policies were set in motion by the General Headquarters of the Allied Powers. Through these policies, Japanese women achieved equal status to men under law, the right to vote, and educational opportunities equal to those of men. This section summarizes the rights gained by women as a result of Japan's democratization. On October 11, 1945, General MacArthur issued a directive to the cabinet of Kijiro Shidehara to implement the "Five Great Reforms." These pertained to (1) The liberation of women, (2) the right of workers to organize, (3) the liberalization of education, (4) the abolition of autocratic governance, and (5) the democratization of the economy. The granting of woman's suffrage received particularly strong attention and became one of the earliest rights achieved by women as a result of the reforms (Kanzaki 2009, p. 19). Indeed, a Revised General Election Law implemented in 1945 enfranchised all citizens above the age of 20. The 22nd general election for the House of Representatives held on April 10, 1946 was the first election in which women exercised their right to vote, resulting in the election of 39 women to the Diet (Wakita 2011, p. 275).[27]

The new Constitution of Japan was promulgated on November 3, 1946 and came into effect on May 3, 1947. The Constitution included provisions for the dignity of the individual (Article 13), equality under law (Article 14), the essential equality of men and women

[27]Immediately after the war, Fusae Ichikawa, who had been active in the prewar women's suffrage movement, founded the Women's Committee on Post-war Policy. With around 70 female members, the committee articulated to the government their demands for women's suffrage (see Kanzaki (2009, pp. 19–22)).

(Article 24), and equal political rights (Article 44). As the prewar Constitution contained no provisions for gender equality, the new Constitution legally established the equality of men and women for the first time.[28] Specifically, Article 14 prohibits discrimination in "political, economic or social relations because of sex." Article 24, establishing the principle of individual dignity and the essential equality of the sexes within the family, the smallest unit of society, clearly states that marriage "shall be based only on the mutual consent of both sexes and ⋯ maintained through mutual cooperation with the equal rights of husband and wife as a basis." This stands in stark contrast to the Meiji era civil code, which constrained the rights of a woman compared with her husband (see Yuzawa 2012, p. 48).

Based on the fundamental principles of the new Constitution, in December 1947, the Family Laws enshrined in Part 4 (Relatives) and Part 5 (Inheritance) of the Civil Code were completely overhauled. As a result, the old Japanese family system (*ie seido*) and the rights of householders (*kosyu ken*) were abolished, and inheritance by new heads of households was replaced in favor of the equal distribution of inheritance. Patriarchy as a family system was thus eliminated and the position of women in relation to marriage, family relations, and inheritance was raised (see Wakita et al. (2011, pp. 276–277); Kurushima et al. (2015, pp. 232–233)). Furthermore, the Fundamental Law of Education implemented in March 1947 provided for equal educational opportunity without discrimination on the basis of sex or social status and the principle of co-education. The enactment of the Labor Standards Law in April 1947 also prohibited the payment of lower wages to women than to men on the basis of their gender.[29] Thus, the revised Civil Code's

[28]Nonetheless, gender biases remaining in current laws should be noted. For instance, Article 731 of the Civil Code establishing marriageable age states that "a man who has attained 18 years of age, and a woman who has attained 16 years of age may enter into marriage." Article 733 establishing a period of prohibition of remarriage: "A woman may not remarry unless six months have passed since the day of dissolution or rescission of her previous marriage." Article 177 of the Penal Code dealing with the crime of rape states that "a person who, through assault or intimidation, forcibly commits sexual intercourse with a female of not less than 13 years of age commits the crime of rape and shall be punished by imprisonment with work for a definite term of not less than three years. The same shall apply to a person who commits sexual intercourse with a female under 13 years of age." (See Kurushima et al. (2015, pp. 232–233)).

[29]The specific articles in the Labor Standards Law that raised the position of female workers were Article 3 (Equal Treatment), Article 4 (Principle of Equal Wages for Men and Women), Article 60 (Working Hours and Days Off for Girls), Article 63 (Night Work and Restrictions on Dangerous and Harmful Jobs), Article 64 (Ban on Belowground Labor), Article 65 (Before and After Childbirth), Article 66 (Time for Child Care), Article 67 (Menstrual Leave), and Article 68 (Traveling Expenses for Returning Home). Article 4 most clearly expresses the principle of gender equality in the workplace, prohibiting the payment of lower wages to women because of their gender when employed in the same type of occupation and with the same abilities as men. For more about the Labor Standards Law, see Kanzaki (2009, pp. 71–103)

legal provisions for equality between men and women improved the position of women in Japan.

Appendix B Data Appendix

B.1 Marriage Status

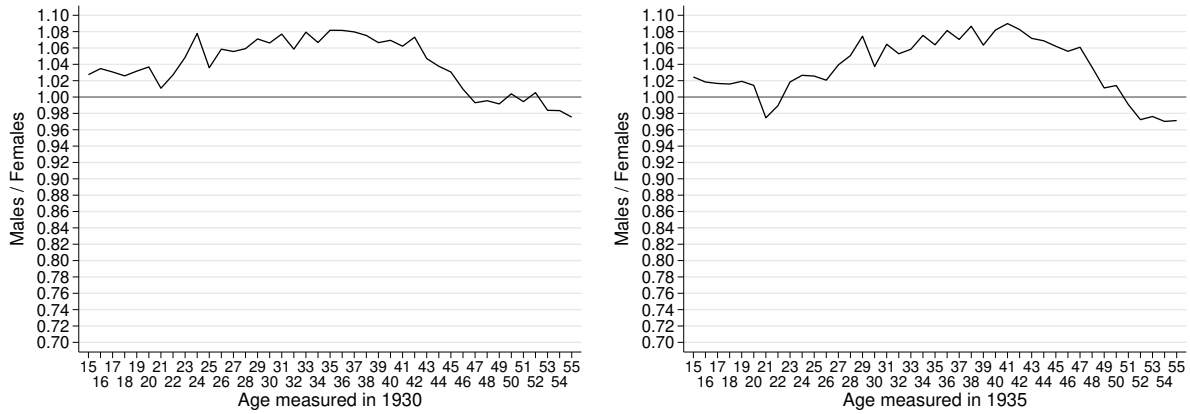
The prefecture-year-age-level data on the number of single, married, divorced, and widowed people are from the official reports of the 1950 and 1955 Population Censuses (Bureau of Statistics, Office of the Prime Minister 1951a, 1956a). For the data on the number of male divorces and widowhoods, we replace the few hyphened observations of ages less than 20 in Yamanashi with zero because they are considered to be typos. The prefecture-year-age-level data on the number of women and men (denominator of the proportion of single, married, divorced, or widowed people) are also from the 1950 and 1955 Population Censuses (Bureau of Statistics, Office of the Prime Minister 1951a, 1956a).

B.2 Sex Ratio

The prefecture-year-age-level data on the number of women and men are from the 1950 and 1955 Population Censuses (Bureau of Statistics, Office of the Prime Minister 1951a, 1956a). Figure 1 shows the sex ratio in the census years. To check the impacts of the wartime losses of men on the sex ratio, we also digitize the 1930 and 1935 Population Censuses (Statistics Bureau of the Cabinet 1933, 1939a). Figure B.1 illustrates the sex ratios in 1930 and 1935 by age, confirming that there were no dramatic declines in the sex ratio in either year. In the empirical analyses, we use the adjusted sex ratio calculated from equation 1. Figure B.2 presents the adjusted sex ratio by prefecture, year, and age.

B.3 Age at First Marriage, Marital Fertility, and Stillbirth

Prefecture-year-level data on average age at first marriage are from the official reports of the 1935, 1950, and 1955 Population Censuses (Bureau of Statistics, Office of the Prime Minister 1951b, 1956b; Statistics Bureau of the Cabinet 1939b). Prefecture-year-level data on the number of live births and stillbirths are from the official reports of 1935, 1950, and 1955 Vital Statistics of Japan (Division of Health and Welfare Statistics, Welfare Minister's Secretraiat 1953, 1957; Statistics Bureau of the Cabinet 1936). The denominator of the marital fertility rate (number of married women) is obtained from

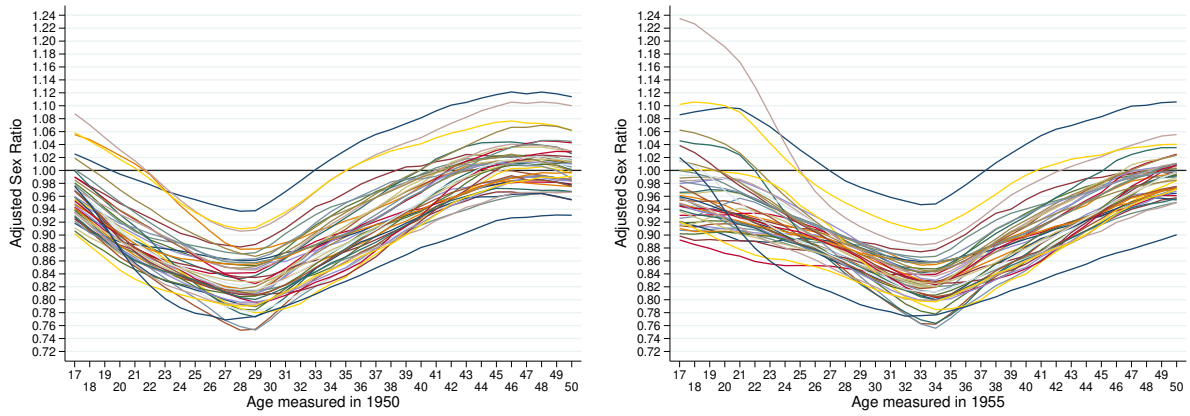


(a) 1930 Population Census

(b) 1935 Population Census

Figure B.1: Sex Ratios by Age Measured in 1930 and 1935 Population Censuses

Notes: The sex ratio is defined as the number of men divided by the number of women. All those rates are the national averages based on the 1930 and 1935 Population Censuses. Source: Created by the authors using Statistics Bureau of the Cabinet (1933) and Statistics Bureau of the Cabinet (1939a).



(a) 1950 Population Census

(b) 1955 Population Census

Figure B.2: Adjusted Sex Ratios by Prefecture Measured in the 1950 and 1955 Population Censuses

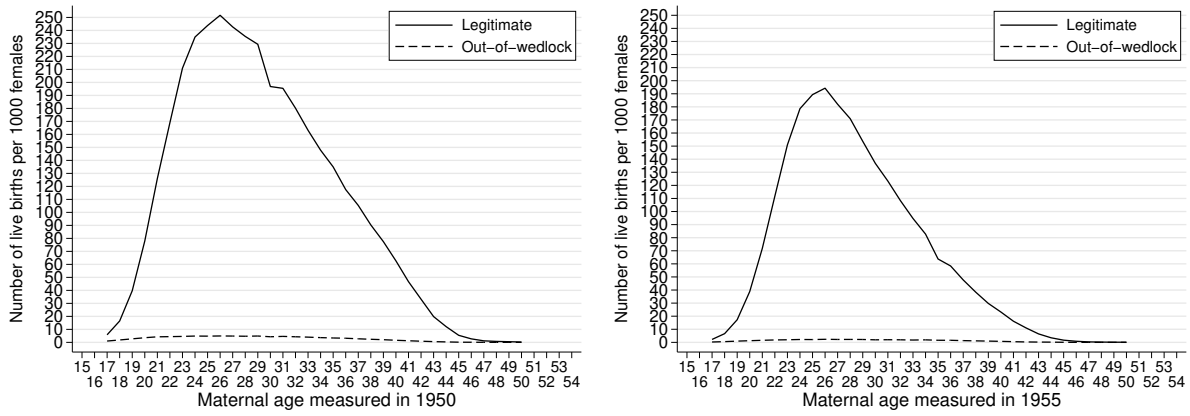
Notes: The adjusted sex ratio is defined as in equation 1. All those rates are the national averages based on the 1950 and 1955 Population Censuses. Source: Created by the authors using Bureau of Statistics, Office of the Prime Minister (1951a) and Bureau of Statistics, Office of the Prime Minister (1956a).

the 1935, 1950, and 1955 Population Censuses. The denominator of the stillbirth rate (number of births) is taken from the 1935, 1950, and 1955 Vital Statistics of Japan. Table B.1 shows the summary statistics by census year.

Table B.1: Summary Statistics: Prefecture-Year-Level Panel Dataset from the 1935, 1950, and 1955 Population Census Statistics

Panel A: Dependent Variables	Year	Observations	Mean	Std. Dev.	Minimum	Maximum
Average Age at First Marriage						
Women	1935	46	23.6	0.9	21.3	25.3
	1950	46	22.7	0.7	21.1	24.4
	1955	46	23.5	0.6	22.1	25.0
Men	1935	46	27.5	0.9	25.5	29.5
	1950	46	25.7	0.6	24.7	27.7
	1955	46	26.3	0.6	25.3	28.1
Men - Women	1935	46	3.9	0.5	2.9	5.0
	1950	46	2.9	0.4	2.2	3.9
	1955	46	2.8	0.4	2.0	3.5
Marital Fertility and Stillbirth Rates						
Marital fertility rate (live births per 1,000 married women)	1935	46	170.1	20.2	130.3	219.6
	1950	46	149.4	20.3	117.6	195.8
	1955	46	101.9	15.9	74.9	135.9
Stillbirth rate (stillbirths per 1,000 birth)	1935	46	49.2	8.2	29.5	70.4
	1950	46	85.6	11.6	70.5	126.6
	1955	46	95.1	13.8	64.2	145.2
Panel B: Intensity Variable	**Year**	**Observations**	**Mean**	**Std. Dev.**	**Minimum**	**Maximum**
Sex ratio (Men 17–50/Women 15–40)	1935	46	1.2	0.06	1.1	1.3
	1950	46	1.0	0.04	1.0	1.2
	1955	46	1.1	0.04	1.0	1.2
Panel C: Control Variable	**Year**	**Observations**	**Mean**	**Std. Dev.**	**Minimum**	**Maximum**
Female labor force participation (workers per 100 women)	1935	46	36.0	6.3	21.5	47.1
	1950	46	34.6	5.8	20.4	45.5
	1955	46	36.0	5.1	23.3	43.7

Notes: This table reports the summary statistics for the prefecture-year-level census and vital statistics of 1935, 1950, and 1955. Panels A, B, and C show the summary statistics for the dependent variables, intensity variable, and control variable, respectively.
Sources: Statistics Bureau of the Cabinet (1939b), Statistics Bureau of the Cabinet (1939a), Bureau of Statistics, Office of the Prime Minister (1951b), Bureau of Statistics, Office of the Prime Minister (1951a), Bureau of Statistics, Office of the Prime Minister (1956b), Bureau of Statistics, Office of the Prime Minister (1956a), Statistics Bureau of the Cabinet (1931), Statistics Bureau of the Cabinet (1936), Division of Health and Welfare Statistics, Welfare Minister's Secretraiat (1953), and Division of Health and Welfare Statistics, Welfare Minister's Secretraiat (1957).



(a) 1950 Population Census

(b) 1955 Population Census

Figure B.3: Legitimate and out-of-wedlock birth rates by maternal age measured in the 1950 and 1955 Population Censuses

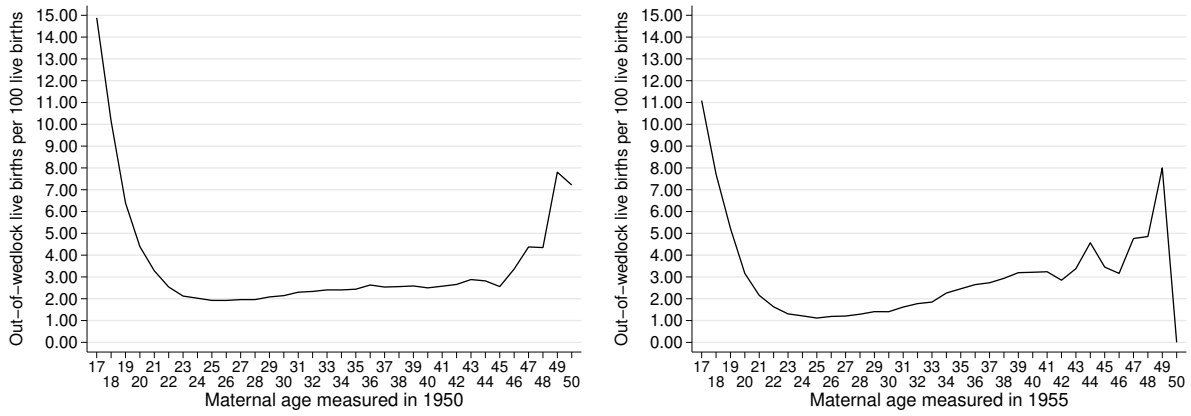
Notes: The legitimate birth rate is the number of legitimate live births per 1,000 women. The out-of-wedlock birth rate is the number of out-of-wedlock live births per 1,000 women. All the rates are the national averages based on the 1950 and 1955 Population Censuses. Prefecture-year-age-level statistics are not available for either legitimate or out-of-wedlock live birth rates. Source: Created by the authors using Bureau of Statistics, Office of the Prime Minister (1951a) and Bureau of Statistics, Office of the Prime Minister (1956a).

B.4 Out-of-Wedlock Births

The age-year-level data on the number of out-of-wedlock live births are from the 1950 and 1955 Population Censuses (Bureau of Statistics, Office of the Prime Minister 1951b, 1956b). The data on the denominator for the share of out-of-wedlock births (number of live births) and out-of-wedlock birth rate (number of women) are also from the 1950 and 1955 Population Censuses. Figure B.3 shows the legitimate birth and out-of-wedlock birth rates in the census years. Figure B.4 shows the out-of-wedlock birth share in the census years, confirming that most live births are within a marriage.

B.5 Female Labor Force Participation

The female labor force participation rate is the number of women working in any sector per 100 women. The data on the number of female workers in 1950 and 1955 are obtained from the censuses (Bureau of Statistics, Office of the Prime Minister 1951b, 1956b). The data on the number of female workers in 1935 are linearly interpolated using the 1930 and 1940 Population Censuses (Bureau of Statistics Office of the Prime Minister 1961; Statistics Bureau of the Cabinet 1935). Panel C of Table B.1 shows the summary statistics by year.



(a) 1950 Population Census

(b) 1955 Population Census

Figure B.4: Out-of-wedlock birth share by maternal age measured in the 1950 and 1955 Population Censuses

Notes: The out-of-wedlock birth share is defined as the number of out-of-wedlock live births per 100 live births. All the rates are the national averages based on the 1950 and 1955 Population Censuses. Prefecture-year-age-level statistics are not available for the out-of-wedlock live birth share. Source: Created by the authors using Bureau of Statistics, Office of the Prime Minister (1951a) and Bureau of Statistics, Office of the Prime Minister (1956a).

Table B.2: Summary Statistics: Number of Deaths and Missing Homefront People (measured in 1948)

	Year	Observations	Mean	Std. Dev.	Minimum	Maximum
Number of deaths and missing people	1948	46	7,093.7	20,976.2	16	103,065

Notes: Note: This table reports the summary statistics for the prefecture-level data on the number of deaths and missing homefront people measured in 1948. Source: Nakamura and Miyazaki (1995).

B.6 Deaths and Missing People in the Homefront Population

We digitize the statistics on the number of deaths and missing people in the homefront population as well as the number of people in 1944 using Nakamura and Miyazaki (1995, pp. 279–281). The data do not include the number of injured people. The number of deaths and missing people were concentrated in Tokyo, Hiroshima, and Nagasaki prefectures, which experienced substantial air attacks and atomic bombings. Table B.2 presents the summary statistics.

B.7 The Asahi Shimbun (Newspaper)

The Asahi Newspaper (shinbun) is one of the most popular newspapers in Japan and is read many people. Its past issues have been digitally archived and released online (https://database.asahi.com/index.shtml [in Japanese]).

Appendix C Empirical Analysis Appendix

C.1 Wartime Losses of Homefront People

Table C.1 presents the results of the specification that includes the number of deaths and missing people in the homefront population (see Online Appendix B.6) in equation 2. Since the losses of homefront people are cross-sectional data measured in 1948, we interact this variable with the indicator variable that takes one if the year is 1955 to create the within variation. Table C.2 presents the results of the specification that includes the number of deaths and missing people in the homefront population in equation 3. The wartime losses of homefront people are interacted with the 1955 dummy in a similar way. The estimates are largely unchanged if we include the female labor force participation rate in all the regressions (not reported). We could not conduct a similar exercise to the age-year-level panel data on out-of-wedlock births because the data on the wartime losses of homefront people are unavailable by age. Tables C.1 and C.2 show similar results to our main results in Tables 2, 3, and 4.

Table C.1: Robustness Checks: Effects of the Gender Imbalance on Marriage Market Outcomes: Including the Number of Deaths and Missing People in the Homefront Population

	Women				Men			
	(1) Single	(2) Married	(3) Divorced	(4) Widowhood	(5) Single	(6) Married	(7) Divorced	(8) Widowhood
Panel A: Overall Effects								
Sex Ratio (SR)	440.59***	−376.41***	−88.61***	24.98*	404.36***	−410.96***	−30.39***	40.16***
	(45.41)	(34.75)	(6.15)	(12.41)	(70.35)	(70.97)	(1.93)	(2.84)
Panel B: Heterogeneous Effects								
Sex Ratio (SR)	489.29***	−350.81***	−91.55***	−46.91***	473.80***	−492.55***	−33.61***	55.55***
	(24.81)	(29.40)	(4.77)	(15.27)	(40.54)	(38.88)	(1.95)	(2.34)
Sex Ratio (SR) × *I(Year=1955)*	−133.78***	−59.72	6.86	167.70***	−155.50***	182.72***	7.21***	−34.47***
	(33.36)	(48.07)	(4.42)	(29.07)	(35.53)	(36.36)	(1.48)	(4.20)

***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors from the cluster-robust variance estimation reported in parentheses are clustered at the 46-prefecture level. Notes: The dependent variables used in columns (1)–(4) are the proportion of single men, married men, divorced men, and widowed men per 1,000 men, respectively. The dependent variables used in columns (5)–(8) are the proportion of single women, married women, divorced women, and widowed women per 1,000 women, respectively. *I(Year=1955)* indicates an indicator variable that takes one if the year is 1955 and zero if the year is 1950, i.e., a 1955 year dummy that depends only on t. The number of observations is $3,128$ (46 prefectures × 33-age range × 2 census years) in all the regressions. All the regressions include the number of deaths and missing people in the homefront population (measured in 1948) interacted with the 1955 dummy, prefecture-age-specific fixed effects, and year fixed effects. All the regressions are weighted by the average number of people (women in columns (1)–(4); men in columns (5)–(8)) in each prefecture-age cell.

Table C.2: Robustness Checks: Effects of the Gender Imbalance on Age at First Marriage, Marital Fertility, and Stillbirths
Including the Number of Deaths and Missing People in the Homefront Population

	Average age at first marriage					
	1935–1950 Census Data			1935–1955 Census Data		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A	Women	Men	Difference	Women	Men	Difference
Sex Ratio	5.034**	4.838**	−0.196	1.318	1.271	−0.047
	(2.435)	(2.123)	(1.225)	(2.172)	(1.842)	(0.547)

	Marital Fertility & Stillbirth Rates			
	1935–1950 Census Data		1935–1955 Census Data	
	(1)	(2)	(3)	(4)
Panel B	MFR	SBR	MFR	SBR
Sex Ratio	−132.543***	−133.211**	−61.438	−56.609
	(46.768)	(46.817)	(54.547)	(57.344)

***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors from the cluster-robust variance estimation reported in parentheses are clustered at the 46-prefecture level.
Notes: The sex ratio is the number of men aged 17–50 divided by the number of women aged 15–40. In Panel A, the dependent variable used in columns (1) and (4) is average age at first marriage for women, whereas that in columns (2) and (5) is average age at first marriage for men. In Panel A, the dependent variable used in columns (3) and (6) is the difference in average age at first marriage between women and men (women minus men). In Panel B, the dependent variable used in columns (1) and (3) is the number of live births per 1,000 married women, whereas that in columns (2) and (4) is the number of stillbirths per 1,000 births. All the regressions include the number of deaths and missing people in the homefront population (measured in 1948) interacted with the 1955 dummy, prefecture fixed effects, and year fixed effects. *I(Year=1955)* indicates an indicator variable that takes one if the year is 1955 and zero if the year is 1950, i.e., a 1955 year dummy that depends only on t.
In Panels A and B, the number of observations is 92 (46 prefectures × 2 census years) in all the regressions. In Panel A, all the regressions are weighted by the average number of marriages in each prefecture cell. In Panel B, all the regressions in columns (1) and (3) are weighted by the average number of married women in each prefecture cell, whereas all the regressions in columns (2) and (4) are weighted by the average number of births in each prefecture cell. The number of observations is 92 (46 prefectures × 2 census years) in all the regressions.