Toward Better Informed Decision-Making: the Impacts of a Mass Media Campaign on Women's Outcomes in Occupied Japan

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Abstract

This paper provides causal evidence that a mass media campaign targeting women can affect women's behavior and increase their participation in decision-making. Specifically, I examine women's radio programs aired in Japan under the US-lead occupation (1945-1952). Employing the instrumental variable of radio signal quality, I identify and estimate the causal impacts of exposure to women's radio programs on female political participation, labor market participation, marriage, and fertility decisions. I find that, in the area where women were more exposed to women's radio programs, women turned out more and female candidates gained more votes in the first election after World War II. Moreover, information provision through women's radio programs significantly contributes to the fertility decline. Since I find that female labor force participation and marriage remain the same, the declining fertility suggests that time a mother spends at home per child would potentially increase. The results are not driven by pre-existing correlation between signal quality and women's behavior before the US occupation. My results provide evidence that information can change women's behavior. They also lend support to the contemporary initiatives by the UN, NGOs and NPOs to use mass media to reach out to women who have limited access to information.

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1 Introduction

Can we use a targeted mass media campaign to lead women toward better-informed decisions? Evidence suggests that women are often more disadvantaged in information acquisition compared to men [1]. Because such gender informational inequality can be a root of gender inequality in behaviors, policy makers have been viewing targeted information provisions toward women as potent policy levers to address gender inequality. However, no paper has yet to fully examine the causal impact of targeted mass media intervention on women's outcomes. This is what I shed light on.

In this paper, I leverage nationwide women's radio programs aired in Occupied Japan (1945-1952), and examine the causal impacts of the women's radio programs on women's decision-making, specifically on particular political participation, labor market participation, and family formation. Occupied Japan, or Japan during the US-led occupation, provides us a unique opportunity to examine the causal impacts of targeted a mass media campaign toward women for at least two reasons. First, women's radio programs in Occupied Japan are quasi-experimental in nature: Japanese women were exposed to new information that occupying authorities brought externally. In contrast, women's radio programs in other countries often emerge hand in hand with women's rights movement and thereby it would be more challenging to elicit the causal impact of the radio campaign separately from the overarching women's rights movement[2]. Second, importantly for my empirical analysis, I find rich

[1] For example, Beaman and Dillon (2018 [6]) conducts an experiment to provide information on a new agricultural technology to a central node of a social network, and shows that women are socially less connected and therefore receive less information, which results in gender inequality in agricultural outputs

[2] We can trace the idea of women's radio programs to the heyday of radio: for example, BBC Radio 4' s Woman's Hour in the UK (from October 7,1946 to the present), Radio Donna by Radio CittäFutura in Rome (from March 1976 to the present), Womankind by Pacifica Radio in New York (1969), and Hemmafru byter yrke (the Housewife switches jobs) by Swedish Radio P1 in Sweden (from October 7,

archival resources on the contents of women's radio programs, the geographical reach of radio, as well as women's outcomes. These records exist because women's legal and social status was considered a barometer for the success of the American occupation and thereby documented in great detail.

From the beginning of the occupation, the authorities aired daily women's radio programs in order to better inform Japanese women. As my archival study together with historians' accounts reveal, the women's programs were multifaceted. The programs covered a wide range of topics, including politics, gender equality, marriage, labor law, birth spacing, and health, providing a whole package of new information to Japanese women. Moreover, a series of listers surveys reveal that women's radio programs received high listenership and the majority of female listeners found that women's radio programs were informative. Thereby I ask how the differential exposure to women's radio programs affected women's decision-making on electoral turnout, labor market participation, annual marriage rate, and fertility.

To carry out my empirical analysis, I digitize various historical records and construct a unique district-level panel dataset. A primary challenge is to hand-collect data on some women's outcomes, such as electoral turnout, marriage, and birth rate, by going through local newspapers and local governments' yearbooks. Although the resulting sample does not cover the entire nation, I document that the districts in my sample are comparable with districts outside of my sample in terms of observable characteristics.

My main analysis utilize district-level variation in the radio listenership to investigate whether differential exposure to women's radio programs causally affect a districts female

1965 to December 9, 1965).

turnout and labor market participation as well as marriage and fertility. I proxy listenership by the radio subscription rate at the district level. The key empirical challenge to identify the causal effect is that the radio subscription rate is likely endogenous to women's outcomes. To address this endogeneity concern, I exploit quasi-random variation in radio reception quality during the daytime hours, measured by the ground wave field strength. The field strength, in short, varies due to geographical conditions even after controlling for distance to the nearest transmitter and transmitter fixed effects while it increases the likelihood of subscribing to radio.

Using the conditional field strength as an instrumental variable, I find that greater exposure to women's programs significantly increases women's political participation in the first election in which women could vote, both as voters and representatives: a standard deviation increase in exposure to women's radio programs increases women's electoral turnout by 2.5 percentage points, closing the gender gap in turnout by 35 percent. The same increase in exposure also raises female candidate's vote share by 1.3 percentage points, a figure that is much greater than the median win loss margin of 0.23. Moreover, radio exposure contributes to the birthrate decline between 1949 and 1960: a one standard deviation increase in radio exposure contributes to the annual birthrate decline by 1.84 per 1,000 population off of a prewar baseline birthrate of 30.8 per 1,000 population. On the other hand, I do not find any significant impacts on women's labor market participation nor marriage. My findings on labor market participation, marriage, and fertility together suggest that the time a mother would spend at home per child would increase. Therefore, the impacts of women's radio programs are not limited to women themselves but potentially extended to the next generation.

I argue that my findings are not driven by a direct association between the conditional field strength and outcome variables. In theory, one might be worried that, for example, the soil type happens to be correlated with other local factors that influence human fertility. Such a direct association between the field strength and my outcomes of study would undermine the exclusivity of the instrumental variable. I argue, however, that such concern is unlikely because I find no correlation between the instrumental variable and pre-intervention outcomes.

What are potential mechanisms through which women's radio programs substantially affect women's political participation in 1946 and fertility rate from 1949 to 1955? I suggest that the impact on political participation arises primarily through an informational channel. Women's radio programs provide information on how elections work to women, who otherwise would not have been exposed to such information. As a result, better-informed women turned out more. On the other hand, the multifaceted nature of women's radio programs can affect fertility through multiple channels: first, women's radio programs provide information on the health benefit of birth spacing and thus affect fertility through an informational channel. Second, women's programs provide information on child bearing and therefore they may change women's preference over quality of children. Third, earlier impacts of women's radio programs on women's political participation may change the socioeconomic environment, and further affect fertility decisions. Although it is beyond the scope of my study to disentangle different channels, my findings open up a new avenue of future research.

My findings contribute to four strands of literature. First, a growing body of economic literature has examined the impacts of public policies targeting women and shown

that targeted policies can deliver better outcomes for women as well as children, and can even lead economic growth (Doepke, Le Tertilt, and Voena (2012 [14]); Duflo (2012 [15]) for review). Such policies take various forms, including legal rights (land ownership (Field (2003 [19])) and voting rights (Lott and Kenny (1999 [29]), Miller (2008 [33])), targeted provision of financial means (conditional cash transfer (Benhassine, Devoto, Duflo, Dupas, and Pouliquen (2015 [8]), Lundberg, Pollak, and Wales (1997 [30]), and agricultural investment (Udry (1996 [47])), reserving leadership positions (gender quota in politics (Beaman, Chattopadhyay, Duflo, Pande, and Topalova (2009 [5]), Duflo and Chattopadhyay (2004 [16])) and corporate board (Bertrand, Black, Jensen, and Lleras-Muney (2019 [9])), and access to contraception (Ashraf, Field, and Lee (2014 [4])). My paper is the first one to provide causal evidence that targeted mass media intervention toward women can also have substantial effects on women's outcomes. Second, a rich body of literature has examined the causal impact of mass media on electoral turnout and election outcomes. As DellaVigna and Gentzkow (2010 [13]) as well as Strömberg (2015 [42]) review, mass media can increase electoral turnout while it can decrease turnout if it substitutes for other information sources that are more relevant to electoral turnout. My study strengthens their case by showing a substantial positive impact of radio on women's electoral turnout in a setting with a scarcity of other media outlets (TV or newspapers). Third, existing literature has shown that entertainment content on TV can decrease fertility in a context in which fertility decline is desired to alleviate poverty and improve children's well-being (Jensen and Oster (2009 [24]) on cable TV introduced in rural India, La Ferrara, Chong, and Duryea (2012 [28]) on TV novela in Brazil, and Kearney and Levine (2015 [25]) on the MTV show *16 and Pregnant*). My paper complements the existing literature by examining a different type of mass media from commercial, entertainment TV content: state-sponsored, educational radio programs.

Despite such differences in media outlet types, I find that women's radio programs also contribute to fertility decline, highlighting the role of information dissemination on fertility change. Last but not least, my paper contributes to a growing body of literature examining the impacts of radio broadcasting on various socioeconomic outcomes, such as political knowledge (Strömberg (2004 [41])), price convergence (Svensson and Yanagizawa-Drott (2008 [43])), mass-killing (Yanagizawa-Drott (2014 [49])), emergence of a dictatorial regime (Adena, Enikolopov, Petrova, Santarosa, and Ekaterina (2015 [2])) registance (Gagliarducci, Onorato, Sobbrio, and Tabellini (2017 [20])), and immigrants' assimilation (Russo (2019)).

While results should be extrapolated with caution, my historical analysis carries important implications in contemporary efforts to provide women with more information. I call for caution in drawing direct policy implication from my findings because Japan under the Allied Occupation was unique in at least two dimensions: first, the Allies started women's radio programs in their broader effort to emancipate Japanese women. The other policies, many of which were nationwide legal reforms, would not interfere the internal validity of my findings. However such legal changes need to be taken into account when generalizing my results outside of Occupied Japan. Second, in the aftermath of World War II, Japanese citizens may have questioned their prewar values and beliefs, and thus they were more ready to embrace new information. With these caveats in mind, my results provide evidence that information can change women's behavior and lend support to the contemporary initiatives by UN, NGOs and NPOs to use mass media to reach out to women who have limited access to information.

The remainder of the paper is organized as follows. Section 2 provides a brief back-

ground of the women's radio programs in Occupied Japan to highlight some key features that are critical to my empirical analysis. Section 3 explains the model, identification, and estimation strategy. Since the data collection and digitization are also the key stepping stones of this project, Section 4 discusses them in detail. Then Section 5 discusses the results and addresses potential threats to my identification strategy. Section 6 concludes.

2 Contextual background: women's radio program in Occupied Japan

This section provides three pieces of historical background that are essential for my study. Section 2.1 highlights the fact that women's radio programs were one of the first things that the Allies did in their effort to emancipate Japanese women. Section 2.2 explains preexisting radio broadcasting infrastructure, which speaks to my identification strategy. Section 2.3 summarizes the content of women's radio program, which in turn leads me to examine women's political participation, labor market participation, and family formation as relevant behaviors.

2.1 Women's emancipation in Occupied Japan

After World War II, Japan was occupied by the Allied Powers from September 2, 1945 to April 28, 1952. Although officially called "Allied Occupation," it was mostly an American undertaking with contributions from Australia, India, New Zealand, and the

United Kingdom, and therefore often called the "American Occupation". General Douglas MacArthur oversaw the occupation as the Supreme Commander for the Allied Powers. The acronym SCAP was soon used to refer not only the commander himself, but to the offices of occupation set up under him to guide Japan to demilitarize and democratize the nation.

When General MacArthur set up five major reforms on October 11, 1945, later known as the Five Major Reform Directives, one of them turned out to be the emancipation of Japanese women [3]. The idea behind it was that SCAP arguably attributed the prewar militant political system to the patriarchal Japanese social system (Kobayashi [26]). The emancipation of Japanese women was placed at the core of the occupation policies as a major pathway for peacebuidling. Thereby Japanese women gained several legal rights, including rights to vote, run for office,and go to college under the Allied Occupation[4].

Women's emancipation under the Allied Occupation was considered not only radical in relation to the status quo in Japanese society in 1945, but also more liberal compared to Western society. This is mainly due to the fact that the postwar Japanese Constitution, enacted in 1947, guarantee the equal rights of men and women not only in the public domain but also in marriage and family life. In fact, in the new Japanese Constitution, Article 14 reads "All people are equal under the law and there shall be no discrimination in political, economic or social relations because of race, creed, sex, social status or family origin" while Article 24 states that "marriage shall be based on the mutual consent of both sexes and it shall be maintained through mutual co-operation with the equal rights of husband and wife as a

[3]The other four reforms were to abolish the secret police, to encourage the formation of labor unions, to liberalize education system, and to democratize the economy. Source: Diplomatic Records A' 1.0.0.2-3-4 "Conference Abstracts and Memoranda between the Supreme Commander for the Allied Powers and his Staff and the Prime Minister and other ministers of Japan" <GAI-1, Reel No. A'-0055>

[4]Uemura [48] provides a detailed historical analysis of women's emancipation during the Allied Occupation

basis; With regard to choice of spouse, property rights, inheritance, choice of domicile and other matters pertaining to marriage and the family, laws shall be enacted from the standpoint of individual dignity and the essential equality of the sexes." As Pharr [38] argues, there were no other countries except for Communist countries such as the USSR and Poland that guaranteed equal rights between sexes in domestic life. Pharr [38] calls it "the US experiment with women's rights in Japan."

In the significant effort to emancipate Japanese women, one of the first things that the Allied Forces did was to start women's radio programs [5]. In fact, as early as October 1, 1945, just one month after the Allies started to occupy Japan, the government-sponsored radio station began to air educational programs targeting women. The women's programs aimed "to raise political, social, and cultural standards of ordinary women and the breaking away from feudalism", and "in order to select qualified female leaders, [the women's radio programs introduced] not only anti-militarists who remained silent during the war but also many unknown progressive, young women." (Japan Broadcasting Corporation Yearbook (1947); translated by the author).

The important takeaway from this subsection is that women's radio programs started in the unique context of the Allies' broader efforts to emancipate women. Thereby I call for caution in generalizing my findings that I present in Section 5. As I explain in Section 3, however, my analysis relies on cross-sectional variation in exposure to women's radio programs but not the timing. Leveraging cross-sectional variation allows me to ensure the internal validity of my results. Otherwise, different timing may also reflect different legal

[5] Table 5 in Appendix A provides more detailed time line of SCAP's policy toward emancipation Japanese women.

environment that women were facing.

2.2 Radio reception and use in Occupied Japan

Next, I explain the preexisting radio broadcasting infrastructure that existed before the Allies' arrival, which allowed GHQ/SCAP to introduce women's radio programs in the very early stage of the occupation period. Not only was the program on air, but it was also well received by female listeners, as I uncover from listeners' surveys.

On the onset of the Allied occupation, there were 53 radio transmitters and 39 amplifiers across the nation, all of which were connected and operated by a single state-sponsored radio station, Japan Broadcasting Corporation or JBC for short. The JBC has a primary channel, channel 1 (*daiichi hoso* in Japanese) which aired various programs throughout the day, and a secondary channel, channel 2 (*daini hoso*) which was utilized only for part of the day. Until 1952, there was no private radio broadcasting. In effect, a radio holder faced a binary choice: either to listen to JBC's programs, or not to listen any programs at all. Such a binary choice set turns out to be critical for my empirical analysis: I do not need to consider the listener's selection into different radio stations at the same time window.

Importantly for my analysis, the JBC kept records on the number of households subscribing to radio as well as the total number of households in all municipalities. This is because the JBC mandated all radio holders to register and pay subscription fees. I should note that fee was not expensive and thus I do not worry that the fee may have excluded low-

income families from acquiring radio. In fact, the mandated annual fee in 1950 was 35 yen, which was 2.5 times of the price of Japanese staples, Soba noodles [6]. I digitize the JBC record to calculate the radio subscription rate, which I later use as an independent variable in my empirical analysis.

During the Allied occupation, the JBC operated under the close supervision of the GHQ/SCAP Civil Information and Education Section Radio Unit (later also called Radio Branch and hereafter the Radio Unit). Radio broadcast content was censored in advance by the Radio Unit [7]. The Radio Unit also conducted modern listeners surveys (Mayo 1988 [32], Luther and Boyd 1997 [31], Smulyan 2002 [40]). In effect, the Radio Unit had a large say over what kind of contents were on air and therefore played a key role in disseminating information to meet the GHQ's purposes.

JBC started airing the flagship women's program "Women's Hour (*Fujin no jikan*)" as early as October 1st in 1945, just about a month after the Allies started occupying Japan. The program was carefully designed to draw as much of women's attention as possible: a time slot allotted to the women's program was the lunch break when women used to listen to war-time women's program during World War II; a director of the production team, as well as moderators, were women to be friendly to female listeners; music was played here and there for a pause so that listeners could maintain concentration (JBC 1947 [21], 1950 [23]).

As JBC's listener's survey reveals, women's programs were indeed well received. In

[6] See Table 7 in Appendix A on annual radio subscription fee from 1925 to 1955. Data are drawn from Okabe 2018 [36]

[7] The head of the production team for women's programs, Fuji Egami recalls "All women's programs, including introductory announcements, were to be submitted to the Civil Information and Education Section ten days before the broadcast. Translators kept typing all the time. All dramas, stories, lectures, interviews, debates and even round tables were stenographed, rewritten into Japanese, then translated into English. It took more than two weeks to broadcast programs after they were recorded. It was impossible to deliver timely information" (Egami, 1955 [18], translated in English by the author.)

1947 survey, more than 70 percent of women with a radio subscription said that they currently listen to or used to listen to the women's program. Not only did they listen to the women's program, but more than 60 percent of them answered that they had gained new knowledge through the program. This survey provides evidence that reassures that women's programs conveyed new information to women as GHQ/SCAP intended.

As time went by and the JBC's production capacity increased, JBC added more time slots for women's programs. By the end of 1950, the weekly airtime that JBC allocated to women's program had quadrupled compared to its onset in October 1945 [8]. This fact underscores the fact that GHQ/SCAP maintained and strengthened their efforts on women's emancipation throughout the occupation. As the airtime expands, the content covered by the women's programs expanded as I will show in detail in the next subsection.

Before diving into the radio content analysis, I should also note that my analysis primarily focuses on the occupation period (1945-1952) although JBC continued airing women's program until 1963. I restrict my attention mainly to the occupation period because, at the end of the occupation period, private radio broadcasting, as well as TV broadcasting started, giving more choices to potential listeners. Competition among different mass media outlets may have fundamentally changed the nature of media content as well as complicated the listeners' decision process on which information they acquire and why. Though this transition in the broadcasting market opens up a new avenue of research, it's beyond the scope of my current analysis.

[8] See Figure A.7 in Appendix A. NHK Yearbook (1947 [21], 1949 [22]) and GHQ/SCAP CIE Weekly Report (Radio Education Branch, 1946 - 1950).

2.3 Contents of women's programs

What kind of information did the women's programs try to disseminate? Answering this question is key to determine which women's outcome I should look at. Therefore I turn to the Weekly Radio Reports (from January 1946 to December 1950), which document daily radio content. I classify them into topics, and see how the composition of topics changed over the course of the Allied occupation.

The Weekly Radio Report was reported every week, with one section dedicated to the featured programs of the week. The following are examples of content descriptions.

> Women's Hour (26 July 1947, from 13:00 to 14:00)
> "Marriage and Pregnancy", a straightforward talk on the importance of honest information on sex for adolescent boys and girls and young married people, was presented with simple good taste by Dr. Fusao Hori"

> Women's Hour (11 November 1948, from 13:00 to 14:00)
> "Mrs. Ohara, interviewer for the Tokyo Domestic Court, Prof. Kawashima of Tokyo University, and Mrs. Fujioka, editor of "Consumer's Co-Op Magazine", discussed the problem of inheritance of all property by the eldest son as it was formerly observed before the Civil Code was revised. Even though the law now provides that the wife and younger children will share an inheritance equally with the first son, many people cling to the old way of doing things"

Two things should be noted in the above examples: first, academics, policymakers, and corporate leaders spoke on the show to provide specialized knowledge. Second, as we notice from honorifics, both men and women are invited as speakers. In fact, by counting the number of honorifics "Mrs", "Ms" and "Mr" that appeared in the Weekly Report from January 1946 to December 1950, I find that the share of female speakers was 49.9 percent: women's radio programs provided an equal playing field for men and women on air.

To further understand, to understand the topic composition of the women's radio programs in a more systematic manner, I classify the daily contents of women's programs using Latent Dirichlet allocation, and show the year-by-year topic composition[9] (Figure 1). I find that, women's programs were primarily about politics and elections in 1946, which is consistent with what Okahara (2007 [37]) uncovers in her case study. Interestingly, the content covered by the women's programs became more diverse over the years: they covered women's organizations, content catered to young women and girls' interests, child development, new labor and welfare laws, and information on food and health.

The fact that program content became diverse overtime motivates me to explore whether the exposure to women's radio programs can affect not only political behaviors but also other women's outcomes, particularly labor market participation, marriage rate, and fertility rate. Based on the words and phrases that appear in the radio content, I hypothesize the following[10]: first, women's electoral turnout increases in response to larger exposure to the women's radio, which "urged" women to vote in the 1946 general election. Second, women's labor market participation increases in response to greater exposure to women's radio, which

[9] For a detailed explanation, see Appendix A Figure A.8

[10] Table 8 in Appendix A summarizes the association between topics within the women's radio programs and women's outcomes that I examine in this paper.

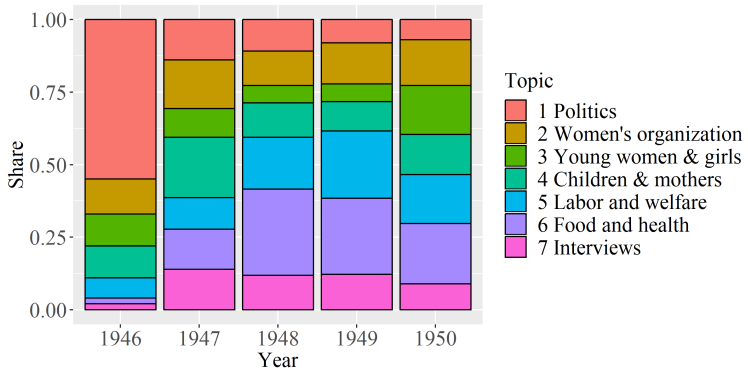


Figure 1: Topic compositions of women's radio over the course of the Allied Occupation. Contents descriptions are drawn from GHQ/SCAP CIE Weekly Report (Radio Education Branch, 1946 - 1950) and classified using Latent Dirichlet allocation.

talked about women's careers and labor laws that protect women's rights in the work place. Third, the annual marriage rate decreases, at least in the short run, in response to larger exposure to the women's radio programs, which emphasized women's freedom to choose their own marriage partners. Fourth, the annual birth rate decreases in response to greater exposure to women's radio programs, which discussed the benefit of birth spacing for women's health. Table 8 summarizes the association between topics within the women's radio programs and women's outcomes that I examine in this paper.

3 Model, identification, and estimation

Based on the content analysis, I hypothesize and test that exposure to women's radio programs can affect women's decision-making on political participation, labor market participation, marriage, and fertility. To identify the causal effects of radio exposure, I instrument for the exposure to the radio using quasi-random variation in AM radio reception induced by

geographical conditions and perform an IV analysis.

3.1 Model

I assume a linear causal model between the exposure to women's radio program and the outcomes of interests. What I wish to identify here is a causal parameter β_1 below, which captures the impact of the exposure on each outcome.

$$\text{Outcome}_{j,t} = \beta_0 + \beta_1 \text{radio exposure}_{j,1946} + \gamma x'_{j,t} + u_{j,t} \tag{1}$$

where j indicates a district. $x_{j,t}$ is a vector of district characteristics, which I explain in detain in the next subsection.

Though I describe how I measure each variable in detail in Section 4, I forewarn that I proxy radio exposure by the district-level radio subscription rate, defined as the share of households subscribing to radio, which has both advantages and shortcomings. On the one hand, the subscription rate captures the actual listener rate better than signal strength or cable introduction, which potentially overstate the radio listenership but are nonetheless used as a main explanatory variable by most of the existing papers on mass media. To this end, I take advantage of the radio receiver license system in Japan, which provides me with data on district-level radio subscription rates. Having the actual radio subscription turns out to be especially critical in my study because the average radio subscription rate is 36.7 percent, being far from 100 percent, while the radio signal covers almost the entire nation however weak it is. On the other hand, one may worry that the radio subscription captures the impact

of radio listenership in general but not necessarily the exposure to women's programs. To address this concern, I draw evidence that men's and women's ratings were statistically indistinguishable for all programs but women's programs (Figure A.9 in Appendix A). Moreover whenever possible, I perform regressions for both men and women separately and compare their impacts. Under the assumptions that (i) there is no gender difference in the impact of radio exposure and (ii) men's and women's ratings are the same across districts, the gender-differential impact of the radio subscription rate captures the impact of women's radio programs on women's outcomes. However, we could instead assume that women react more to new information than men, due to preexisting gender informational inequality. Under this alternative assumption, the impact of the radio subscription rate can indeed confound women's radio programs and other radio programs. I still argue that the primary impact most likely comes from the women's radio programs because women's programs but not other programs provide relevant information on female election candidates, labor laws relevant to women, freedom of choosing marriage partner, the health benefit of birth spacing, and so forth. It's beyond the scope of my research to ask how impacts would change if such information were conveyed within general programs that are not specifically targeting women. It is an interesting open question how the effects of information vary when conveyed in and out of gendered spaces.

3.2 Identification strategy

The key empirical challenge to identifying the causal effect β_1 is that radio exposure, proxied by the radio subscription rate as above, might be endogenous to women's outcomes

through women's unobserved characteristics. Such a concern arises when radio subscriptions are correlated with subscribers' unobserved characteristics such as attitude toward the American occupation, openness to new ideas, and willingness to acquire new information. For example, women with greater interests in politics may subscribe to radio to obtain information on politics. Such a positive correlation between the subscription and unobserved characteristics overstates the causal effect β_1.

To address the endogeneity issue, I leverage quasi-random variation in radio reception quality during the daytime hours, which is as good as random to potential subscribers but increases their likelihood of radio subscription. The metric of the radio reception I use is the ground wave field strength (hereafter field strength), which depends on the horizontal distance from a nearby transmitter, output power of the transmitter, the wave length, and the ground conductivity between the transmitter and the receiver. The ground conductivity measures how fast the AM radio wave can propagate through a given soil type and depends on the moisture and salt contents of the soil. The key idea is as follows: on the one hand, the distance to nearby transmitter, output power, or wavelength may be based on strategic considerations[11], the ground conductivity is as good as random to potential subscribers. Therefore, the local variation in the field strength after controlling for the distance and transmitter fixed effects can serve as an instrumental variable for the radio subscription rate[12].

[11] For example, radio transmitters may have been strategically placed in the area with higher political aspirations, higher aspiration for freedom of marriage, higher demand for birth control, higher potential supply of female labor force, and so forth. Although such a concern might be unwarranted given the historical background of radio, as I described in Section 2, these unobserved characteristics of women may indirectly relate to transmitter locations through urbanness, and therefore it is still important to control for the distance.

[12] Formally, our conditional exogeneity condition and the relevance conditions take the form

$$E[\text{Field strength} \times u | \text{transmitter fe}, \text{distance}, \mathbf{x}] = 0$$

$$E[\text{Field strength} \times \text{Radio exposure} | \text{transmitter fe}, \text{distance}, \mathbf{x}] \neq 0$$

Furthermore, I also control for other district characteristics: I include industry composition, measured by the labor share in 10 industries (agriculture, forestry, fishery, mining, construction, manufacturing, whole sale and retail, finance and real estate, information and transportation, and service; the omitted category is public service), in order to address the concern that the soil may reflect how fertile the land is and correlate with the economic potentials of a given area. I also include the number of households, the number of households per square km, and a city indicator to control for the urbanness. Moreover, I control for the fact that a district was subject to bombing during World War II to take into account that bombings may have affected citizens' attitudes toward the American Occupation and their radio programs. Finally, prefecture fixed effects control for any inter-prefectural public policy differences. Figure 2 shows the residualized field strength after controlling for the distance, transmitter fixed effects, and all the other control variables. Notice that areas with high residualized field strength, in dark blue, and areas with low residualized field strength, in dark red, are adjacent to each other. It is reassuring that there is no systematic pattern.

With the IV in hand, I estimate the causal impact of radio exposure on each outcome of interest via two-stage least squares and compute robust standard errors[13].

4 Data

I hand-collect data on election turnout, labor market participation, marriage, and fertility, as well as the geographical reach of the radio from various historical resources. All

[13] In Appendix B, I also discuss another specification where instrumental variables are discretized into decline bins

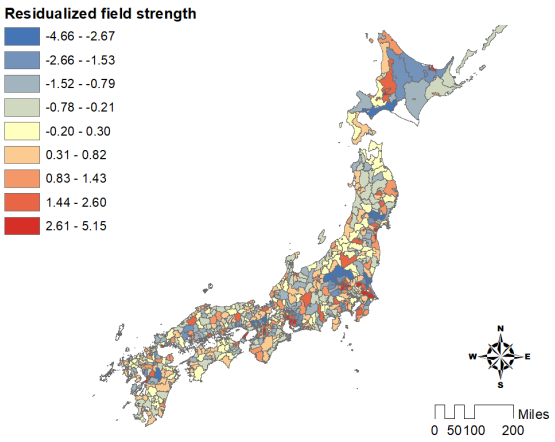


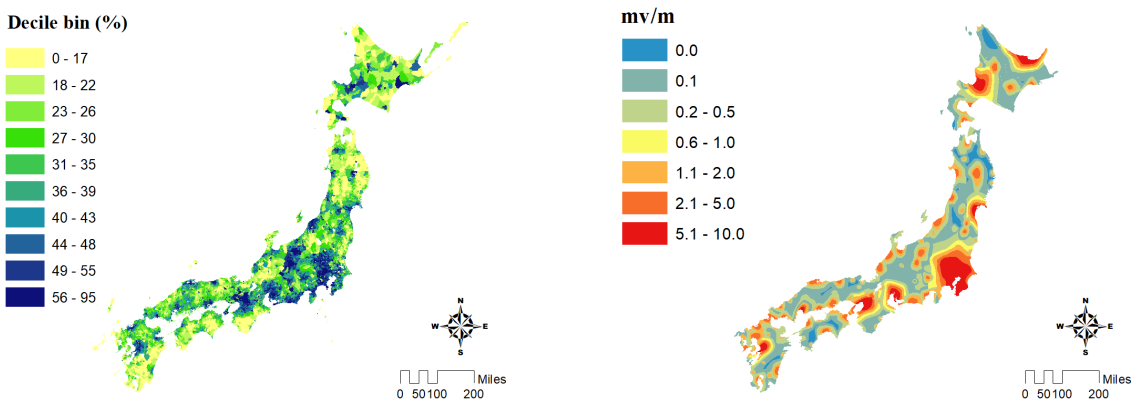
Figure 2: Residualized field strength

variables are observed at the district (*shi* and gun) level[14] unless stated otherwise. Using these variables, I construct a unique, district level panel dataset. Table 6 in Appendix A summarizes all the data sources for the reader's convenience.

4.1 Radio exposure, field strength, and distance to a nearby transmitter

As I have mentioned in Section 3.1, I proxy the degree of exposure to women's radio programs by the radio subscription rate, which is defined as the share of households subscribing to radio in 1946. I draw the radio subscription rate from the 1946 yearbook published by the Japan Broadcasting Corporation, which recorded the number of households subscribing radio as well as the total number of households at the village level in order to collect subscription fees. In 1946, the village level subscription rate ranges from less than 10 percent to over 80 percent, with an average of 37.7 percent. Figure 3a shows how radio

[14]There are around 700 districts in the late 1940's. The average population size is 54,000 in 1950.



(a) Radio subscription rates in 1946

(b) Digitized map of the Radio 1 field strength

Figure 3

subscription varies in the nation. The map is colored based on the decile bins: from areas with low subscription rate in yellow to areas with high subscription rate in dark blue.

I draw data on the AM wave field strength, which serves as the instrumental variable for radio exposure, from the map that the Japan Broadcasting Corporation published in 1949. As far as the I know, this is the oldest map of the field strength published after World War II. I digitize the map (Figure 3b) and compute the district level average field strength to construct the instrumental variable.

Finally, I compute the distance from each district to the nearest radio transmitter by utilizing the information on latitude and longitude of radio transmitters taken from the Japan Broadcasting Service 1947 yearbook as well as data on administrative boundaries[15].

[15] I use shape files on administrative boundaries provided by Maruyama Lab, Tsukuba University, Japan.

4.2 Election turnout

I draw data on electoral turnout by sex in the 22nd House of Representative Election held on April 10th 1945, the first election after women's suffrage. I collected them from local editions of three national news papers as well as prefectural news papers, that reported district level turnout by sex between April 12 and April 14,1945[16]. My final dataset covers 26 prefectures, which covers 56.7 percent of all the eligible voters across the nation in 1946 election, across the nation.

Although turnout is available for only a subset of the nation, the average turnout in my sample is statistically indistinguishable from the nationally aggregated turnout by sex[17]: In my sample, women's average turnout rate is 0.64 with a standard deviation of 0.08 while the national average is 0.67. One the other hand, men's average turnout rate is 0.76 with a standard deviation of 0.09 in my sample, while the national average is 0.78. The gender difference of 0.13 is statistically significant. Moreover in Table 9 in Appendix A, I show that districts in my sample and out of my sample are observably similar.

Additionally, I digitize votes that female candidates obtained by district as well as total votes cast in each district to compute the vote share of female candidates. In the 1946 general election, 79 females ran for office, accounting for 3 percent of all candidates. The average vote share is 0.08 with a minimum of 0 and a maximum of 0.58.

[16] The three national news papers are Yomiuri, Asahi, and Mainichi.

[17] Tabulated statistics on electoral turnouts by sex are drawn from Japan Ministry of Internal Affairs and Communications and complied by the National Women's Education Center [12]

4.3 Labor market participation

I compute women's labor force participation at the district level by using the 1950 Population Census: I divide the number of women aged 14 or above who participate in the labor force by the total number of women who are in the respective age group[18]. Using the same data source, I also compute women's labor force participation at district level by excluding women in family business, most of whom are farmers' wives at the time. Moreover, 1950 Population Census also provides labor share of industries which I use as control variables.

For sensitivity tests, I also compute women's labor force participation at the district level by using the 1940 Population Census: because age breakdown of population is not available at the district level, I divide the number of women in the labor force by the total number of females [19].

4.4 Annual marriage rate and birth rate

I draw the annual marriage rate, defined as the number of marriages per 1,000 population, and the annual birth rate, defined similarly as the number of births per 1,000 population, from prefecture yearbooks between 1949 and 1960 in five prefectures (Iwate, Chiba, Mie, Nara, and Tokushima prefectures), which are the only five prefectures that provide the necessary information to my best knowledge. I digitize these prefecture yearbooks and spatially

[18]The total number of women in the work force is drawn from Table 8 and the total number of women is drawn from Table 4 of the 1950 Japan Population Census digitized by Kishimoto Lab [45]

[19]The total number of women in the work force is drawn from Table 2-1 and the total number of women is drawn from Table 1-1 of the 1930 Japan Population Census digitized by Kishimoto Lab, Tsukuba University, Japan.

merge them across years using municipality boundaries. I also digitize the 1935 vital statistics to obtain prewar annual marriage and birth rates. As Figure A.11 in Appendix A shows, the average annual marriage and birth rates in my sample resembles the national averages. Moreover in Table 10 in Appendix A, I show that districts in my sample and out of my sample are similar in terms of prewar birth and marriage rates, as well as residualized field strength and the share of agricultural labor. Districts in my sample are less densely populated and has a slightly different industrial composition than those out of sample. Therefore it calls for a caution to extrapolate my findings to the entire nation.

4.5 World War II damage

In order to proxy the degree of war damage, I draw data on district-level total casualties during World War II from *Overall Report of Damage Sustained by the Nation During the Pacific War* published by Economic Stabilization Agency, Planning Department, the Office of the Secretary General (1949 [17]) and digitized by Japan Air Raid Org. Casualties, which were estimated in May 1948, includes casualty due to air raid bombings (in many places such as Tokyo and Yokohama) , atomic bombings (in Hiroshima and Nagasaki) and naval artillery (in some coastal cities such as Kamaishi, Muroran and Hamamatsu). Since the report presents district-level casualties only for cities with significant number of casualty, I further create a dummy variable which takes one if the war casualties are above median.

5 Findings

This section presents the main result that exposure to women's radio program causes changes in women's decision-making on political participation (section 5.1), labor market participation (section 5.2), and family formation (section 5.3).

5.1 Political participation

First, I find that exposure to women's radio programs yields positive impacts on women's political participation. Table 1 shows results from regressions of the form of equation 1 with three different outcomes: women's turnout (Columns 1, 2, and 3), men's turnout (Columns 4 and 5), and the female share out of those who cast ballots (Column 6). For each outcome, I present OLS and TSLS estimates. The key independent variable (the radio subscription rate) is in standard deviation units. Looking at OLS estimates first, the radio subscription has a strong positive association with women's turnout (Column 1) but not with men's turnout (Column 4). These associations turn out to be causal: Column 2 demonstrates that a one standard deviation increase in radio subscriptions increases women's electoral turnout by 2.45 percentage points. The magnitude of the TSLS estimate is slightly smaller than the OLS estimate (Column 1), suggesting a small positive bias in the OLS estimate. In other words, there would possibly be a positive association between women's unobserved characteristics and their radio subscription. Compared to Column 2, Column 3 includes additional control variables: city indicator and industrial compositions in 1950. Notice that these control variables do not affect the causal effect of women's radio programs. Since these

variables are measured in 1950 which is later than the electoral turnouts were observed and moreover they are irrelevant, I prefer the specification as in Column 2 than Column 3. One the other hand, Column 5 presents the TSLS estimate regressing men's turnout on the radio subscription. Similar to the OLS estimate, TSLS estimate is not statistically distinguishable from zero. The difference between women's turnout (Column 2) and men's turnout (Column 5) suggests that the radio subscription has impacts only on women through the provision of women's radio programs. In addition, Column 6 shows the impact on the female share among voters, defined by the share of women out of men and women who cast ballots, and confirms that the radio exposure shifted the female share by 1.6 percentage point. Later in this section, I further ask if the increase in the female share among voters induced by radio increases female candidate's vote share.

The magnitude is not only statistically significant but also socio-economically significant: it accounts for 30 percent of the standard deviation of women's turnout. A back-of-the-envelop calculation, assuming that the impact is homogenous at any level of radio subscription rate, suggests that the radio exposure overall reduced the gender disparity in turnouts by 4.8 percentage point [20]. This accounts for almost one-third of the gender gap. Moreover, the persuasion rate based on Dellavigna and Gentzkow (2010 [13]) is 46.4 percent, larger than other papers on voter persuasions[21].

[20] To calculate the overall impact, I assume that the impact of radio subscription is homogenous at any level of radio subscription rate. By setting the radio subscription to be zero, I compute the level of women's turnout that would have occurred in the absence of radio in each district and then aggregate them to the national level. I compare such counter-factual turnout with the observed turnout of 0.64 to get at the overall impact.

[21] There are at least two potential reasons why the persuasion rate here is larger than what we have seen in the past literature. First, recall that the 1946 general election was the first election after women gained their right to vote. They had never voted before. Thus the estimated effect may capture both persuasion effect and educational effect. Radio would have been primary mean to inform women about voting. Second, to compute the persuasion rate, we need to assume homogeneous impacts of radio. But the impact of radio exposure may be heterogeneous and it may be larger for inframarginal voters. If this is the case, the persuasion rate that I computed may overstate the true persuasive effect.

A question that follows is if women's greater turnout in the election translates into greater women's representation at the Diet. To see this, Table 2 presents the impacts of the radio exposure (Column 2) as well as the female turnout share (Column 4) on the female candidate's vote share, each of which is instrumented by the field strength. As Column 2 shows that the greater radio exposure increases a female candidate's vote share by 1.3 percentage points. The direct impact of female turnout is also positive although the estimate is noisier (Column 4): A one percentage point increase in female turnout share increases female candidate's vote share by 1.29 percentage point.

Was the impact large enough to push female candidates to win? I calculated a win-loss margin, defined as the difference in vote shares of the lowest-ranked winner and the runner up in each electoral district. It turned out that the 1946 election was quite competitive: the minimum win-loss margin was 0.005 percentage point, the median win-loss margin was 0.23 percentage points, and the maximum win-loss margin was 2.19 percentage points [22]. Therefore, I conclude that the impact of a one standard deviation increase in radio exposure on the female vote share, 1.3 percentage point, is above the median win-loss margin and thus sizable.

Taken all together, I conclude that the women's radio programs successfully amplified women's voices in the political sphere: the women's programs effectively induce more women to vote, which in turn translates into a greater vote share for female candidates. The findings also echo what the GHQ/SCAP Radio Unit wrote in their weekly radio report: the

[22] In order to calculate the win-loss margin, I draw the total number of men and women who cast ballots from the government's official report. Moreover, I draw data on vote counts of winners and runner-ups from *The Mainichi*, one of the major newspapers, published on April 13, 1946. Because the vote counts were not finalized in five electoral districts (Hokkaido 2nd district, Tokyo 2nd district, Chiba, Nagasaki, and Kagoshima), I calculated win-loss margins with and without these five districts. The distribution of win-loss margin is robust.

Table 1: OLS and TSLS results
The impact of the radio subscription in 1946 on turnout in the first postwar election

	Women's turnout Mean 0.66 Std.dev. 0.08			Men's turnout Mean 0.79 Std.dev. 0.06		Turnout female share Mean 0.37 Std.dev. 0.06
	(1) OLS	(2) TSLS	(3) TSLS	(4) OLS	(5) TSLS	(6) TSLS
Radio subscription in std.dev. unit	0.0289***	0.0245**	0.0248*	0.00231	0.0106	0.0157**
	(0.00519)	(0.00999)	(0.0142)	(0.00482)	(0.00769)	(0.00612)
R^2	0.707	0.707	0.740	0.620	0.615	0.726
Distance control	decile bins	decile bins	decile bins	decile bins	decile bins	decile bins
N.of HH, HH density	✓	✓	✓	✓	✓	✓
Transmitter FE	✓	✓	✓	✓	✓	✓
Prefecture FE	✓	✓	✓	✓	✓	✓
City indicator			✓			
Industrial composition			✓			
Male to female ratio						✓
Observations	346	346	346	336	336	288

[1] Standard errors are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[2] In Columns (4) and (5), the sample size is reduced in men's regression because only women's (but not men's) turnout was reported in one prefecture (Miyazaki prefecture).

[3] In Column (6), the sample size further decreases because data on the number of qualified eligible voters are available for districts with at least one female candidate. In Saitama, Aichi 2nd, and Yamaguchi prefectures did not have any female candidate.

women's programs "undoubtedly contributed in a large measure to the fact that 65 percent of the eligible women voters went to the polls" [23].

[23] Weekly radio report, SCAP Civil Information and Education Section

Table 2: OLS and TSLS results
The impact of greater exposure to women's radio on the vote share of a female candidate

	Female vote share Mean .077 Std.dev. .08			
	(1) OLS	(2) TSLS	(3) OLS	(4) TSLS
Radio subscription (std.dev)	0.00308 (0.00193)	0.0133** (0.00655)		
Female share turnout (p.p.)			0.00143** (0.000670)	0.0129 (0.00887)
R^2	0.538	0.531	0.622	0.415
Control variables	✓	✓	✓	✓
Observations	958	958	465	465

[1] Standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The sample size is larger than the dataset on women's turnout analysis because (i) I have data on all female candidates (whereas the data on turnout had missing values) and (ii) some electoral districts had multiple female candidates.

5.2 Labor market participation

If radio exposure effectively encourages women to participate in politics, what about labor market participation? I examine the causal impact of radio subscription on women's labor force participation, by adding two control variables to the main Equation (1);

$$
\begin{aligned}
\text{Women's LFP}_{j,1950} = {} & \beta_0 + \beta_1 \text{radio exposure}_{j,1946} + \iota_t \\
& + \gamma_1 \text{Women's LFP}_{j,1930} + \gamma_2 \text{Male-to-female ratio}_{j,1950} \\
& + f(\text{distance to a nearby transmitter}_{j,1946}) + \nu_{\text{transmitter(j)}} \\
& + \boldsymbol{\kappa_t} \textbf{industries}'_{j,1950} + \pi_{h1} \text{N of HH}_j + \pi_{h2} \frac{\text{N of HH}_j}{\text{SqKM}_j} + \delta_{\text{prefecture(j)}} \\
& + I_{j=\text{city}} + \psi_{\text{bombed(j)}} + u_{j,t}
\end{aligned} \tag{2}
$$

The additional variables are "Women's LFP$_{j,1930}$" and "Male-to-female ratio$_{j,1950}$". Women's LFP$_{j,1930}$ indicates women's labor force participation in 1930, controlling for pre-existing across-district variation in women's labor force participation. Male-to-female ratio$_{j,1950}$ measures the sex ratio, defined by the number of men per one woman at working age. The idea of the sex ratio determining women's labor force participation is motivated by the existing literature that examines the impact of wartime male casualties on women's labor market participation after the war (Rose (2018 [39]) on the US after World War II and Boenke and Gay (2018 [10]) on France after World War I.

Table 3 presents results from regressions of the form of equation 2 with three different outcomes: female labor force participation rate (Columns 1 for OLS and Column 2 for TSLS), the female labor force participation rate excluding family employees (Column 3), and the women's share out of all the labor force (Column 4). I exclude family employees

Table 3: The impact of the radio subscription in 1946 on labor force participation

	(1) Women's LFP Mean 0.521 Std.dev. 0.134	(2) Women's LFP excld. family emp Mean 0.283,Std.dev. 0.06	(3) Female share in LF mean: 0.398 sd. 0.065
Radio subscription in std.dev. unit	-0.00923	-0.00994	-0.00263
	(0.00736)	(0.00708)	(0.00357)
Women's LFP in 1930	0.373***	0.206***	0.170***
	(0.0293)	(0.0282)	(0.0142)
Male to female ratio	-0.297***	-0.572***	-0.433***
	(0.0385)	(0.0371)	(0.0187)
Distance control	decile bins	decile bins	decile bins
N.of HH, HH density	✓	✓	✓
Transmitter FE	✓	✓	✓
Prefecture FE	✓	✓	✓
Prewar LF participation	✓	✓	✓
Industrial composition	✓	✓	✓
Observations	674	674	674

[1] Standard errors are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
[2] LFP stands for labor force participation. LF stands for labor force.
[3] 1930 Population Census provides the data on latest women's labor force participation in the prewar period.

from the definition of women's labor participation in Column 3 in order to isolate the impact of radio on salaried employees. The women's share out of all the labor force in Column 4 highlights the composition of labor force rather than the level of labor force. The radio subscription rate is in standard deviation units. In no case is the impact of the radio subscription distinguishable from zero.

5.3 Family formation

Lastly, I turn to the impact of exposure to the women's radio programs on decision-making on family formation, namely marriage and fertility. Because marriage and childbirth

are infrequent decisions, I use a panel dataset of 10 years to capture any lagged impact. Accordingly, I modify the main model (1) as follows

$$\begin{aligned}
\text{Crude rate}_{j,t} = \beta_0 &+ \beta_{1t}\text{radio exposure}_{j,1946} + \iota_t \\
&+ \gamma_1\text{Crude rate}_{j,1935} + \gamma_2\text{Male-to-female ratio}_{j,1950} \\
&+ f(\text{distance to a nearby transmitter}_{j,1946}) + \nu_{\text{transmitter(j)}} \\
&+ \boldsymbol{\kappa_t}\textbf{industries}'_{j,1950} + \pi_{h1}\text{N of HH}_j + \pi_{h2}\frac{\text{N of HH}_j}{\text{SqKM}_j} + \delta_{\text{prefecture(j)}} \\
&+ I_{j=\text{city}} + \psi_{\text{bombed(j)}} + u_{j,t}
\end{aligned} \tag{3}$$

where crude rate refers to either the number of marriages or births per 1,000 population in a specified year. I allow the impact of the radio exposure (β_{1t}) to vary across time. I add four control variables to the main model (1): first, Crude rate$_{j,1935}$ controls for the baseline marriage or birth rate prior to the US occupation to make sure that any preexisting marriage and fertility patterns do not drive my results. Keeping the baseline rate constant is important also because, as the baseline rate is higher, there is more room to decline (or vice versa). Second, I also include the postwar male to female radio (Male-to-female ratio$_{j,1950}$) as a determinant of marriage and fertility rate. The idea of the sex ratio determining marriage-market outcomes dates back to Becker (1973 [7]), and a growing body of empirical literature exploits the war-induced variation in the male to female ratio and shows its causal impacts on marriage and fertility[24]. Third, year fixed effect ι_t takes into account the nationwide trend in

[24] Abramitzky, Delavande, and Vasconcelos 2011 [1] in the post World War I France, Bethmann and Kvasnicka 2013 [27] in the German

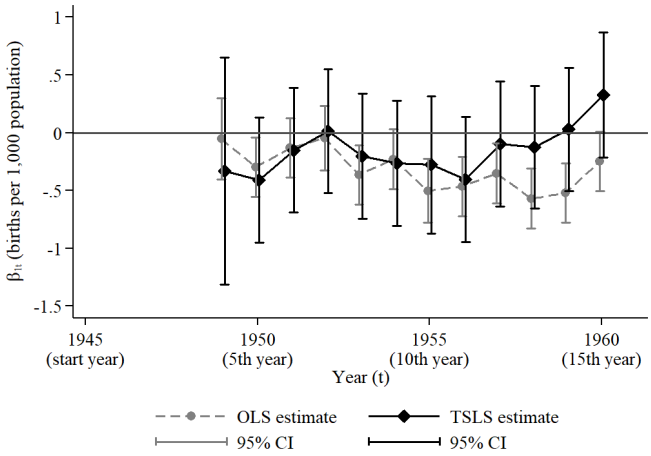


Figure 4: The impact on the annual marriage rate

marriage and fertility rate. Last but not least, I allow coefficients on the industrial composition (**industries**$'_{j,1950}$, a vector of labor share of 10 out of 11 industries in 1950) to vary across time to capture industry-specific time trends. Industry-specific time trends accommodate the fact that postwar birth-control first emerged among wives of coal miners and factory workers (Tama 2006 [46], Ogino 2008 [35], Takagi 2012 [44]). Other control variables remain the same as the main model (1).

Figure 4 plots the TSLS coefficients ($\hat{\beta}_{1t}$) for marriage rate from regressions of the form of equation 3. I do not find any significant effect of the radio intervention on marriage rates. On the other hand, Figure 5 plots the TSLS coefficients ($\hat{\beta}_{1t}$) for birth rate. I find negative impacts up until the 10th year (1955) from the onset of the women's radio programs, and then the impact starts to fade out over time. In other words, in areas where women are more exposed to the women's radio programs, they decrease their fertility around 1.84 per

state of Bavaria during and after World War II, Brainerd 2017 [11] in the post World War II Soviet Union and Ogasawara and Komura 2018 [34] in the post World War II Japan.

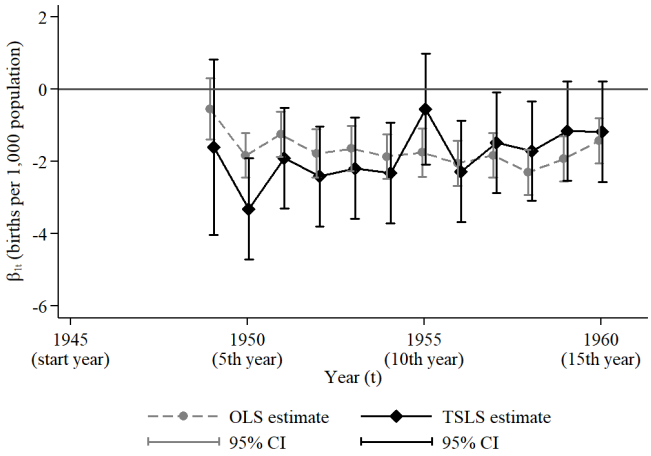


Figure 5: The impact on the annual crude birth rate

1,000 on average. Note that changes are not driven by changes in marital behavior. Putting the result into context, the time period that I study saw a substantial decline in birth rate as Appendix A Figure A.14 shows. The back-of-the-envelope calculation shows that the radio intervention contributes of 4.5 per 1,000 population out of an overall decline 13.5 per 1,000 from prewar to 1960 [25].

How can the impact be so substantial? I examine two possibilities: first, the high baseline birthrate prior to the US occupation may leave large room for change. In fact, prior to the US occupation, the annual birthrate remained the level of around 30 per 1,000 population, or 4.8 children per a married woman (Appendix A Figure A.13). To test this hypothesis, I split my sample into two groups, districts with the baseline birthrate higher or lower than the median of 32.77 per 1,000 population in 1935, rerun the regression (3), and see if the

[25] I draw data from the National Institute of Population and Social Security Research. The prewar average birth rate is 30.8 per 1,000 population annually, which is the average between 1932 and 1937 (plus and minus two years of the base year 1935). The average birthrate at the end of the sample period is 17.3 per 1,000 population, which is the average between 1957 and 1962 (plus and minus two years of 1960).

impact of the exposure to women's radio programs is higher in the high birth-rate districts. The difference is, however, statistically indistinguishable (Appendix A Figure A.15) and not in favor of my first hypothesis.

Thus I propose an alternative interpretation: the multifaceted nature of women's radio programs caused the large impact through multiple channels. By the multifaceted nature, I mean that the women's radio programs covered various topics, including politics, marriage, children, health and labor market. As I summarize in a diagram (Figure 6), there are at least three ways through which the women's programs can cause the fertility decline: first, women can update their belief on the health benefit of birth spacing and consequently change their fertility decisions. Second, women can change their preference over the quality of children against the quantity of children in response to new information on childrearing. Third, recall my earlier finding that the radio exposure increases women's political participation in Section 5.1. Past literature has also shown that greater women's political participation can lead to more public spending on women's and children's issues [26] and therefore can cause changes in the socioeconomic environment surrounding childrearing. Taken all together, the multifaceted nature of women's radio programs can cause a larger impact on fertility compared to a situation where an information campaign focuses only on the health benefit of the birth spacing. Decomposing these channels is beyond the scope of my paper although it would be an interesting avenue of future research.

[26] Duflo and Chattopadhyay 2004 [16], Lott and Kenny 1999 [29], Miller 2008 [33], Aidt and Dallal 2008 [3]

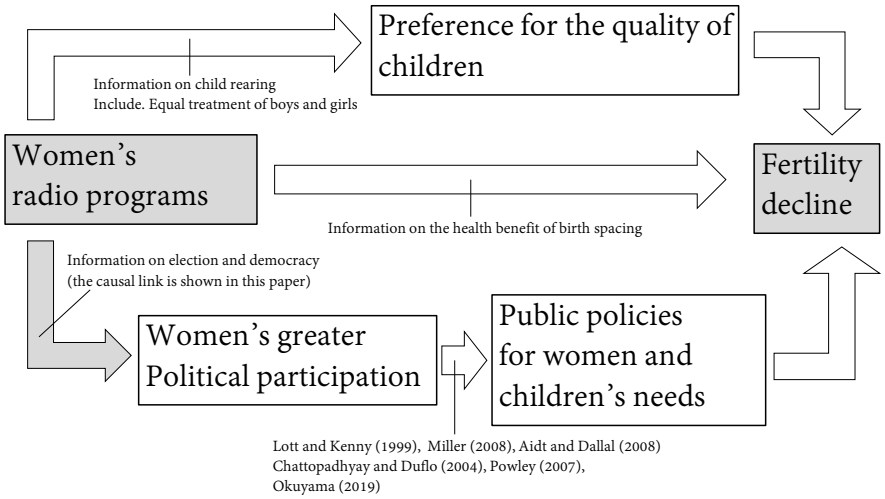


Figure 6: Potential channels through which the women's radio programs can contribute to the birth rate decline.

5.4 Addressing potential threats for the instrumental variable

In this section, I discuss potential mechanisms through which my instrumental variable may violate the conditional exogeneity assumption. Then I provide a series of tests to show that they are not first-order concerns in this context.

One may be concerned that the soil type, which provides local variation in the field strength, directly determines the outcomes that I am interested in. Such concern arises if soil types happen to indicate agricultural productivity, which then directly determines the optimal labor input. For another example, suppose the soil type happen to capture environmental factor for human fertility, which then directly determines the birth rate. In either case, the direct association between the outcomes and the field strength would undermine the exclusion restriction of the IV.

Table 4

	(1)	(2)	(3)	(4)
	Birth rate 1935	Marriage rate 1935	LFP 1940 (men and women)	LFP 1940 (women)
	Mean 32.70 Std.dev. 4.28	Mean 8.50 Std.dev. 1.30	Mean 0.45 Std.dev. 0.05	Mean 0.37 Std.dev. 0.10
Field strength in std.dev.	-0.293	-0.0321	0.000218	-0.00509
	(0.180)	(0.0846)	(0.00220)	(0.00384)
R^2	0.848	0.634	0.854	0.902
Distance control	decile bins	decile bins	decile bins	decile bins
N.of HH, HH density	✓	✓	✓	✓
Transmitter FE	✓	✓	✓	✓
Prefecture FE	✓	✓	✓	✓
City indicator	✓	✓	✓	✓
Industrial composition	✓	✓	✓	✓
Male to female ratio	✓	✓	✓	✓
Observations	771	771	651	651

Standard errors are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

[1] In column 1, the birth rate is defined as the annual number of birth in 1935 per 1,000 population. Similarly in column 2, the marriage rate is the annual number of birth in 1935 per 1,000 population. I draw the number of births and marriages from the 1935 vital statistics (*Shi-cho-son betsu zinko dotai tokei: showa 10 nen*), which I have digitized for this project.

[2] In columns 3 and 4, LFP stands for the labor force participation rate, which is a share of respective population who work out of all the population (but not the working-age population). I draw the number of men and women working from Table 2-1 of the Japan Population Census 1940 while I draw the number of total population from Table 1-1 of the same census.

[3] I spatially merge data in different years using year-by-year municipality boundaries, in order to take into account municipality mergers. The match rate was lower for the year of 1935, which results in a smaller sample size in columns 1 and 2.

To address the above concerns, I regress the pre-intervention outcomes on the field strength and full set of control variables. As Table 4 shows, the outcome variables are not associated with filed strength, in the absence of the radio intervention[27].

[27] Figure A.16 graphically shows that there is no association between the field strength and marriage or fertility rate.

6 Conclusion

This paper examines the impact of women's radio programs on women's outcomes, namely electoral turnout, labor force participation, marriage, and fertility in Occupied Japan (from 1945 to 1952). I find that greater exposure to women's programs significantly increases women's political participation, both as voters and representatives: a standard deviation increase in exposure to women's radio programs increases women's electoral turnout by 2.5 percentage points, closing the gender gap in turnout by 35 percent. The same increase in exposure also raises female candidate's vote share by 1.3 percentage points, a figure that is much greater than the median win loss margin of 0.23. Moreover, radio exposure contributes to the birthrate decline: a one standard deviation increase in radio exposure contributes to the annual birthrate decline by 1.84 per 1,000 population off of a prewar baseline birthrate of 30.8 per 1,000 population. On the other hand, I do not find any significant impacts on women's labor market participation nor marriage.

I suggest that the impact on political participation arises primarily through the informational channel. Women's radio programs provide information on how elections work to women, who otherwise would not have been exposed to such information. As a result, better-informed women turned out more. One the other hand, the multifaceted nature of women's radio programs can affect fertility through multiple channels: first, women's radio programs provide information on the health benefit of birth spacing and thus affect fertility through informational channel. Second, women's programs provide information on child bearing and therefore they may change women's preference over quality of children. Third, earlier impacts of women's radio programs on women's political participation may change

the socioeconomic environment, and further affect fertility decisions. Although it is beyond the scope of my study to disentangle different channels, it would be an interesting avenue of future research.

My findings open new avenues of economic research. First, it is still an open question if the intervention during the American occupation has had a long-term effect and triggered a virtuous cycle toward gender equality in Japanese society. Second, Occupied Japan's case limits my ability to investigate what would have happened if both men and women, or only men, were exposed to women's radio contents. This limitation, however, may motivate us to design field experiments to understand the nature of targeted information interventions further. Third, my findings also call for a theoretical framework, which incorporates gender disparity in information access and gender disparity in behavioral outcomes.

Nonetheless, my results provide evidence that information can change women's behavior and lend support to the contemporary initiatives by UN, NGOs and NPOs to use mass media to reach out to women who have limited access to information.

References

[1] Ran Abramitzky, Adeline Delavande, and Luis Vasconcelos. American Economic Association Marrying Up: The Role of Sex Ratio in Assortative Matching. *American Economic Journal: Applied Economics*, 3(3):124–157, 2011.

[2] Maja Adena, Ruben Enikolopov, Maria Petrova, Veronica Santarosa, and Ekaterina Zhuravskaya. RADIO AND THE RISE OF THE NAZIS IN PREWAR GERMANY*. *The Quarterly Journal of Economics*, pages 1885–1939, 2015.

[3] Toke S Aidt and Bianca Dallal. Female voting power: the contribution of women's suffrage to the growth of social spending in Western Europe (1869-1960). *Public Choice*, pages 391–408, 2008.

[4] Nava Ashraf, Erica Field, and Jean Lee. Household Bargaining and Excess Fertility: An Experimental Study in Zambia âĂă. *American Economic Review*, 104(7):2210–2237, 2014.

[5] Lori Beaman, Raghabendra Chattopadhyay, Esther Duflo, Rohini Pande, and Petia Topalova. Powerful Women: Does Exposure Reduce Bias? [*]. *Quarterly Journal of Economics*, 124(4):1497–1540, nov 2009.

[6] Lori Beaman and Andrew Dillon. Diffusion of agricultural information within social networks: Evidence on gender inequalities from Mali. *Journal of Development Economics*, 133:147–161, jul 2018.

[7] Gary S Becker. A Theory of Marriage : Part I. *Journal of Political Economy*, 81(4):813–846, 1973.

[8] Najy Benhassine, Florencia Devoto, Esther Duflo, Pascaline Dupas, and Victor Pouliquen. Turning a Shove into a Nudge? A "Labeled Cash Transfer" for Education. *American Economic Journal: Economic Policy*, 7(3):86–125, 2015.

[9] Marianne Bertrand, Sandra E Black, Sissel Jensen, and Adriana Lleras-Muney. Breaking the Glass Ceiling? The Effect of Board Quotas on Female Labour Market Outcomes in Norway and ADRIANA LLERAS-MUNEY UCLA and NBER 192 REVIEW OF ECONOMIC STUDIES. *Review of Economic Studies*, 2019.

[10] Jorn Boenke and Victor Gay. The missing men. 2018.

[11] Elizabeth Brainerd. THE LASTING EFFECT OF SEX RATIO IMBALANCE ON MARRIAGE AND FAMILY: EVIDENCE FROM WORLD WAR II IN RUSSIA. *The review of Economics and Statistics*, 2017.

[12] National Women's Education Center. Gender statistics database.

[13] Stefano Dellavigna and Matthew Gentzkow. Persuasion: Empirical Evidence. *Annual Review of Economics*, 2010.

[14] Matthias Doepke, Michè Le Tertilt, and Alessandra Voena. The Economics and Politics of Women's Rights. 2012.

[15] Esther Duflo. Women Empowerment and Economic Development. *Journal of Economic Literature*, 50(4):1051–1079, 2012.

[16] Esther Duflo and Raghabendra Chattopadhyay. Women as Policy Makers : Evidence from a Randomized Policy Experiment in India. *Econometrica*, 72(5):1409–1443, 2004.

[17] Office of the Secretary General Economic Stabilization Agency, Planning Department. Overall Report of Damage Sustained by the Nation During the Pacific War. Technical report, 1949.

[18] Fuji Egami. Fujin no Jikan no Ju Nen (Ten Years of Women's Hour). *Fujin Koron*, pages p.164–165, aug 1955.

[19] Erica Field. Fertility Responses to Urban Land Titling Programs: The Roles of Ownership Security and the Distribution of Household Assets. 2003.

[20] Stefano Gagliarducci, Massimiliano Gaetano Onorato, Francesco Sobbrio, and Guido Tabellini. War of the Waves: Radio and Resistance During World War II. *Ssrn*, 12746, 2017.

[21] Japan Broadcasting Corporation (NHK). Radio Yearbook (Radio Nen Kan). Technical report, Tokyo, 1947.

[22] Japan Broadcasting Corporation (NHK). Radio Yearbook (Radio Nen Kan). Technical report, Tokyo, 1949.

[23] Japan Broadcasting Corporation (NHK). Radio Yearbook (Radio Nen Kan). Technical report, Tokyo, 1950.

[24] Robert Jensen and Emily Oster. The Power of TV: Cable Television and Women's Status in India. Technical Report 3, 2009.

[25] Melissa S Kearney and Phillip B Levine. Media Influences on Social Outcomes: The Impact of MTV's 16 and Pregnant on Teen Childbearing. *American Economic Review*, 105(12):3597–3632, 2015.

[26] Yoshie Kobayashi. *A Path Toward Gender Equality: State Feminism in Japan*. Routledge, 2004.

[27] Michael Kvasnicka and Dirk Bethmann. World War II, Missing Men, and Out-of-Wedlock Childbearing. *The Economic Journal*, 123(567):162–194, 2012.

[28] Eliana La Ferrara, Alberto Chong, and Suzanne Duryea. Soap Operas and Fertility: Evidence from Brazil. *American Economic Journal: Applied Economics*, 2012(4):1–31, 2012.

[29] John R Lott and Lawrence W Kenny. Did Women's Suffrage Change the Size and Scope of Government? *Journal of Political Economy*, 107(6), 1999.

[30] Shelly J Lundberg, Robert A Pollak, and Terence J Wales. Do Husbands and Wives Pool Their Resources? Evidence from the United Kingdom Child Benefit. *The Journal of Human Resources*, 1997.

[31] Catherine A. Luther and Douglas A. Boyd. American Occupation Control over Broadcasting in Japan, from 1945 to 1952. *Journal of Communication*, 47(2):39–59, 1997.

[32] J. Marlene Mayo. The War of Words Continues: American Radio Guidance in Occupied Japan. In *The Occupation of Japan: Arts and Culture*. Norfolk, VA, 1988.

[33] Grant Miller. WOMEN'S SUFFRAGE, POLITICAL RESPONSIVENESS, AND CHILD SURVIVAL IN AMERICAN HISTORY*. *The Quarterly Journal of Economics*, 2008.

[34] Kota Ogasawara and Mizuki Komura. Consequences of War: Japan's Demographic Transition and the Marriage Market. 2018.

[35] Miho Ogino. *Kazoku Keikaku e no Michi: Kindai Nihon no Seishoku o Meguru Seiji*. Iwanami Shoten, 2008.

[36] Tadanobu Okabe. *The 50 years of Japanese Radio 1925-75*. Japan Radio Museum, Matsumoto, Japan, 2018.

[37] Miyako Okahara. *America senryoki no minshuka seisaku*. 2007.

[38] Susan Pharr. The Politics of Women's Rights. In *Policy and Planning During the Allied Occupation of Japan*, chapter 8. University Press of Hawaii, 1987.

[39] Evan K Rose. The Rise and Fall of Female Labor Force Participation During World War II in the United States. *The Journal of Economic History*, 2018.

[40] Susan Smulyan. Now It Can Be Told: the Influence of the United States Occupation on Japanese Radio. In *Radio Reader: Essays in the Cultural History of Radio*, chapter 14. Routledge, 2002.

[41] David Stroemberg. Radio's Impact on Public Spending. *Quarterly Journal of Economics*, 119(1):189–221, 2004.

[42] David Strömberg. Media Coverage and Political Accountability. In *Handbook of Media Economics*, pages 595–622. 2015.

[43] Jakob Svensson and David Yanagizawa. Getting prices right: The impact of the market information service in Uganda. *Journal of the European Economic Association*, 7(2-3):435–445, 2009.

[44] Masahi Takagi. Sengo Shoki Nihon ni okeru Jutai Chosetsu Shido. *Fukuoka University Review of Literature & Humanities*, 44, 2012.

[45] D. Takita, Y. Ogasawara, and K. Kishimoto. Kokusei Chousa (1950 Nen) Shikuchousonbetsu Deeta Beesu Sakusei ni Tsuite. Technical report, Tsukuba University, 2012.

[46] Yasuko Tama. *Kindai Kazoku to Body Politics*. Sekai Shiso Sha, 2006.

[47] Christopher Udry. Gender, Agricultural Production, and the Theory of the. Technical Report 5, 1996.

[48] Chikako Uemura. *Josei kaiho o meguru senryo seisaku*. Sosho jenda bunseki, Tokyo, 2007.

[49] David Yanagizawa-Drott. Propaganda and Conflict: Evidence from the Rwandan Genocide. 2014.

A Supplemental figures and tables

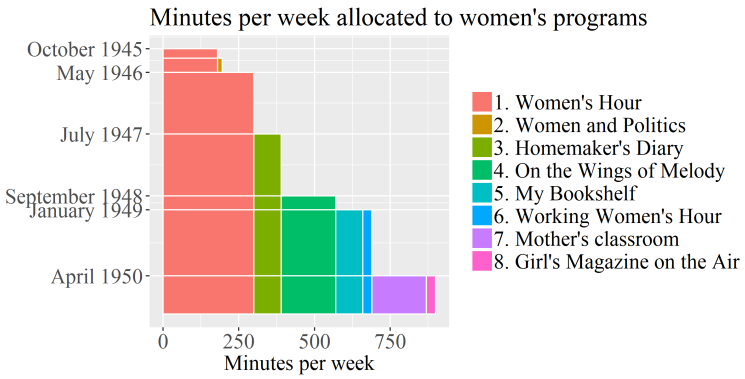


Figure A.7: Airtime allocated to women's programs. Above programs were categorized as "Women's program" by the Japan Broadcasting Corporation. Source: NHK Yearbook (1947, 1949) and GHQ/SCAP CIE Weekly Report (Radio Education Branch, 1946 - 1950).

Table 5: Time line for women's emancipation under Allied Occupation

October 1, 1945	The flagship women's radio program "Women's Hour" was on air for the first time
December 17, 1945	Women were granted voting rights in national elections.
April 10, 1946	House of Representative General Election. Women voted for the first time.
November 3, 1946	New Japanese Constitution was enacted.
1947	Women's and Minor's Bureau was established withing the Ministry of Labor.
1948	Women were allowed to go to college.

Table 6: Data sources

Data source	**Variable**
Japan Broadcasting Corporation Statistic Report 1946	Post-war radio subscription rate N. of households in 1946
A map on medium wave field strength 1949	Field strength
Latitudes and longitudes of transmitters obtained from Japan Broadcasting Corporation Yearbook 1947 District boundaries year by year provided by Maruyama Lab, Tsukuba University	Distance to a nearby transmitter
Prefecture Annual Statistics Book (annually from 1949 to 1960)	Postwar crude birth rate
The Annual Vital Statistics Report in 1935	Prewar marriage rate and birth rate
Population Census 1940	Prewar labor force participation
Population Census 1950	Postwar labor force participation Industrial composition
News papers	Turnout in the 1946 election by sex
The 22nd House of Representatives election results A list of female candidates provided by Ito (2008)	Female candidate's vote share
Overall Report of Damage Sustained by the Nation During the Pacific War	District-level total casualty during the World War II

Table 7: Radio subscription fees

	Radio subscription fee (monthly)	TV subscription fee (monthly)	Starting teacher salaries (monthly)	Japanese soba noodle unit price
1925	1.00		45.00	0.10
1930	0.75		45.00	0.10
1933	0.75		55.00	0.10
1937	0.50		55.00	0.13
1941	0.50		55.00	0.16
1946	2.50		400.00	-
1948	35.00		2000.00	-
1950	35.00		5000.00	15.00
1954	67.00	300.00	7800.00	30.00
1955	67.00	300.00	7800.00	30.00

Source: Okabe (2018 [36]) *"The 50 Years of Japanese Radio 1925-1975"* The Japan Radio Museum.
In real terms radio subscription fees had been declining before the World War II. Table 7 shows the monthly radio subscription fee (in Japanese Yen) from 1925 to 1955 along with the monthly salary for first-year teachers and a unit price for Japanese soba noodles. While inflation accelerated, the Japan Broadcasting Service decreased the monthly fee and made radio more accessible for a wide income-range of Japanese: the fee was 1 Japanese yen compared to 45 yen of starting teacher salaries in 1925. in 1941, however, the fee halved while the teacher salaries moderately grew. After the World War II, the inflation outpaced the increase in nominal subscription fee, and thus the subscription fee further drops in real terms. Therefore, we would less worry that subscription fees deterred low income Japanese from listening to the radio.

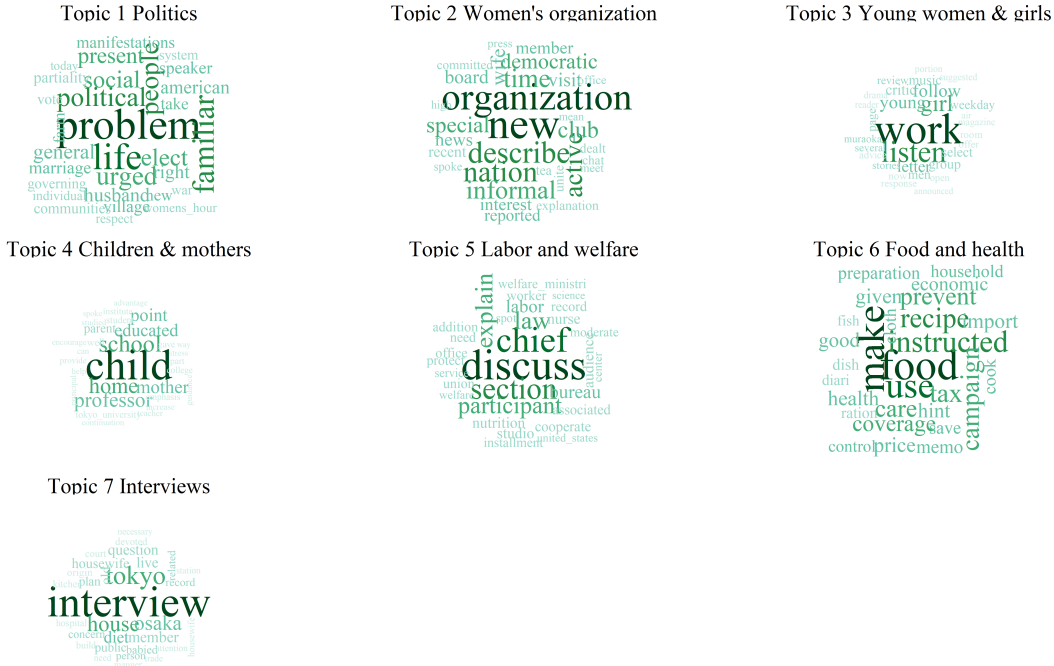


Figure A.8: Word clouds characterizing each of seven topics in women's radio programs.

Latent Dirichlet Allocation (LDA) is an unsupervised machine learning technique for topic modeling. It considers each document as a predetermined number of topics in a certain proportion, and each topic as a collection of keywords in a certain proportion. A goal of LDA is to estimate a word distribution within each topic, then a topic distribution within each document by maximum likelihood. In other words, LDA tries to find a topic model which fits best to the corpus within a collection of documents that we are analyzing. In my study, a document corresponds to a daily content of women's radio programs, two of which I have quoted earlier. On the one hand, each topic gets a probability distribution over words. Figure A.8 in Appendix A shows word clouds for each of nice topics: each word cloud shows the top-30 most frequently used words in each topic. The relative size of a word corresponds to its assigned probability, i.e., a larger words gets higher weight within the topic. Based on the word clouds, I assign labels to the topics: politics, women's organization, young women & girls, children & mothers, labor & welfare, food & health, and interviews. On the other hand, each document (i.e., a daily content description) gets a probability distribution over seven topics as in Figure 1. Then, for further simplicity, I assign each document one topic with the highest probability. Thereby I obtain a mapping from a collection of documents to seven topics.The choice of seven groups was made as follows: in a model with a larger number of topics than seven, some topics appear to be too specific. On the other hand, in a model with a smaller number of topics than seven, some topics turn out to be too general and need to be split in order to be interpretable. My main takeaways are, however, robust to the number of topics.

Table 8: Topics within the women's radio programs, associated phrases, and women's outcomes

Topics	Outcomes to examine	Key words and expected impact
Politics Women's organization	Turnout in the 1946 general election	+ "urge to vote"
Children and mothers	Fertility (1949-1960)	- "birth control" "[birth] spacing"
Young women and girls	Marriage (1949-1960)	- "seeking marriage by their own choice" "marriage vs. career"
Labor and welfare	Labor force participation (1950)	+ "new labor law" "interesting careers"

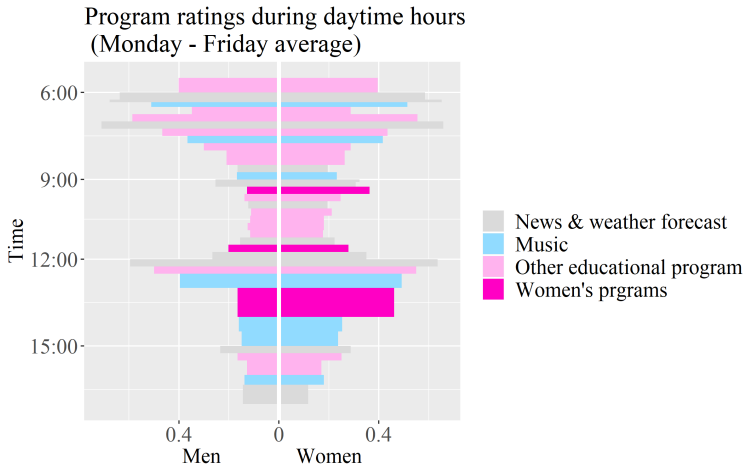
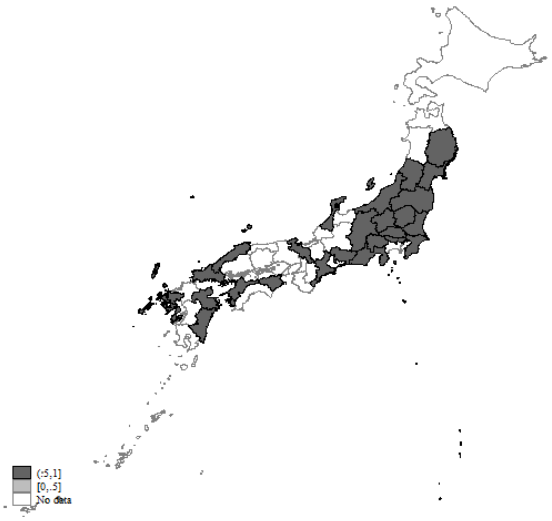
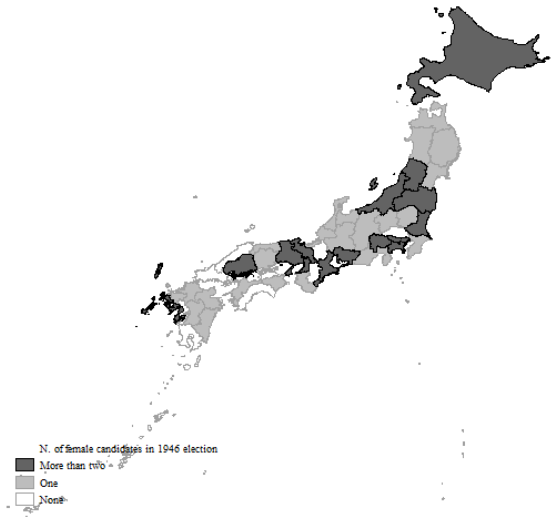


Figure A.9: Channel 1 program ratings during the daytime hours. Rating is defined as a percentage of male and female radio holders who actively listened to the radio in a given time slot. The figure shows the average rating from Monday to Friday in survey week. Dark pink represents times slots allocated to women's programs, which were aired daily. One the other hand, grey, pale blue, and pale pink indicate news & weather forecast, music, and educational programs respectively. Men's rating is no larger than women's rating for any time slot. Women's rating is especially higher than men's for women's programs: gender rating gap is 23.6 percentage points from 9:15 to 9:30, and 29.6 percentage points from 1 pm to 2 pm. Source: Radio Listeners Survey - Report of the 3rd Regular Survey, Part 1-4 (November 1948))

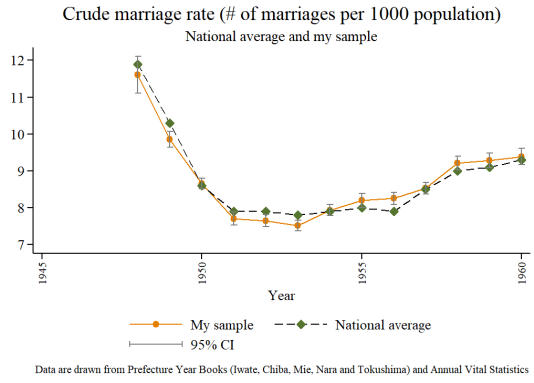


(a) Prefectures for which data on 1946 turnout available. Data on electoral turnouts by sex in each district are available for 26 prefectures.

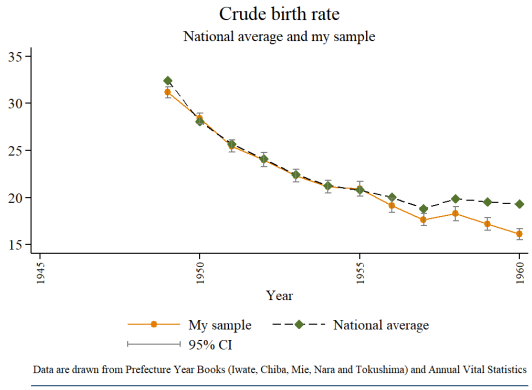


(b) A map of prefectures where at least one female candidate run for office

Figure A.10



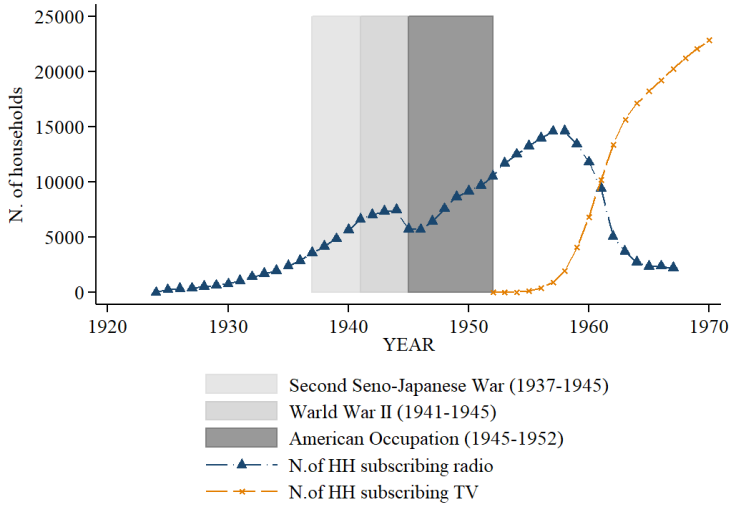
(a) The annual marriage rate



(b) The annual birth rate

Figure A.11: Annual marriage and birth: comparing the national average and the average in my sample

Figure A.12: Radio and TV subscriptions



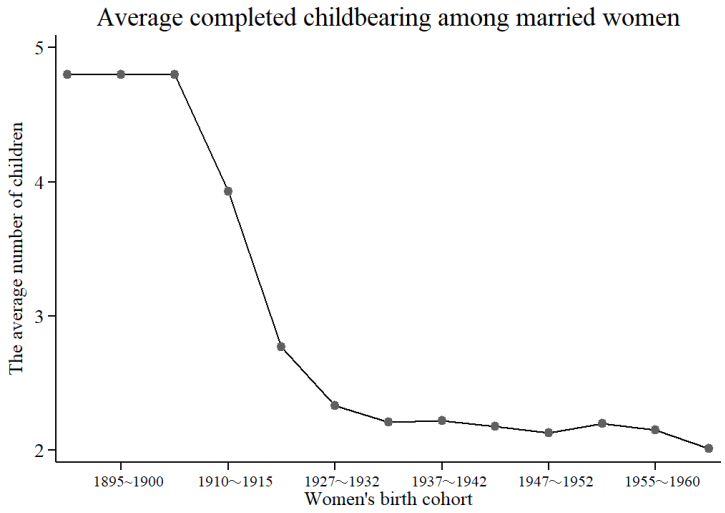


Figure A.13: Average number of children per married woman. Data are drawn from Census and Vital Statistics and complied by the National Insutitute of Population and Social Security Research. Okinawa prefecture is not included during 1947-1970. Female population include foreign citizens who were living in Japan until 1940 but only Japanese citizens in 1941 and onward.

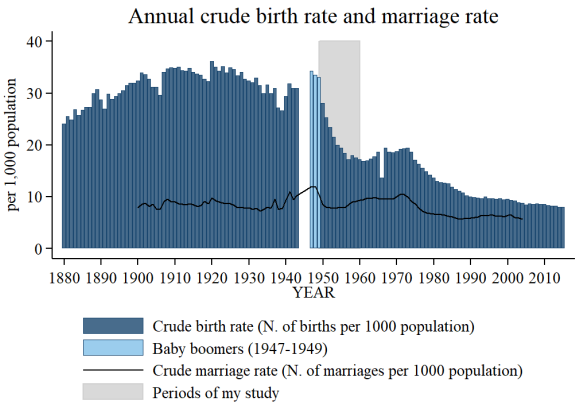


Figure A.14: The number of births per 1,000 population in Japan from 1880 to 2015

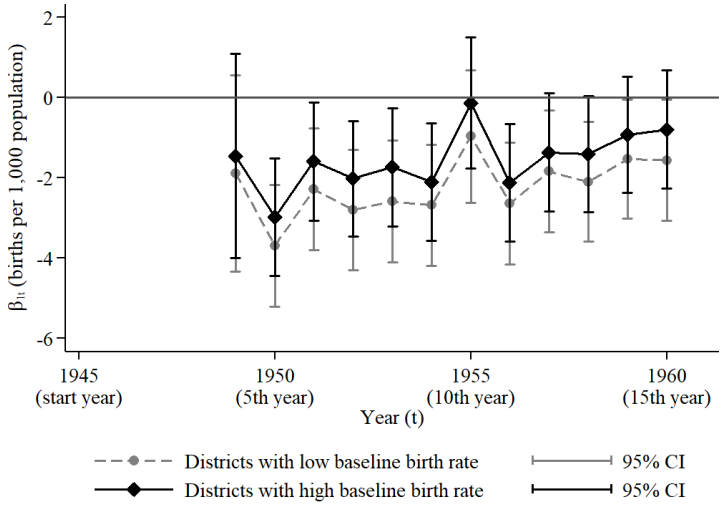
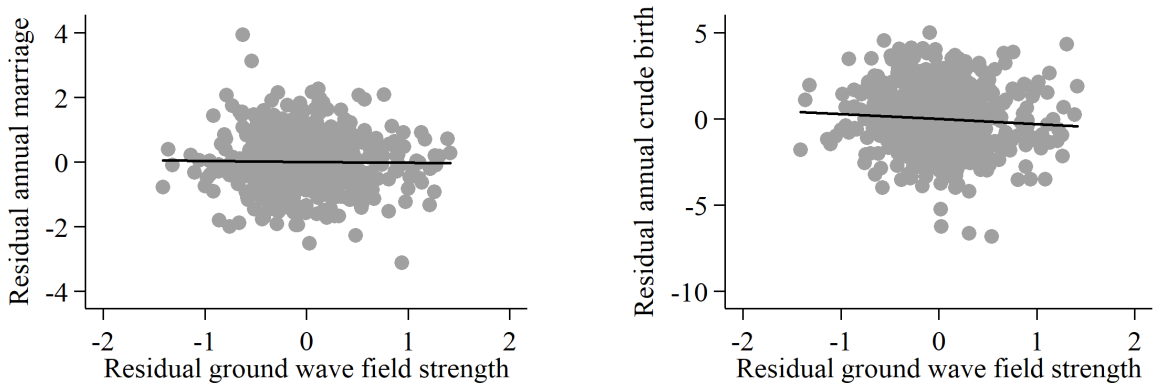


Figure A.15: Heterogenous impacts of the radio exposure on birth rates. The radio exposure is in standard deviation unit. Regressions include the full set of control variables presented in the equation (3). The sample is split into two groups, based on the baseline birth rate compared to its median.



(a) The annual marriage rate in 1935

(b) The annual birth rate in 1935

Figure A.16: Association between the residualized field strength and residualized annual marriage and birth

Table 9: Observable characteristics of my sample to examine electoral turnout

	(1) All mean/[std.dev.]	(2) My sample mean/[std.dev.]	(3) Out of my sample mean/[std.dev.]	(4) Diff. diff/(std.err.)
Radio subscription rate	0.378	0.383	0.373	0.010
	[0.126]	[0.121]	[0.130]	(0.01)
Residualized field strength	-0.000	-0.018	0.018	-0.036
	[1.226]	[1.249]	[1.205]	(0.09)
Distance from a nearby transmitter (km)	32.606	33.326	31.938	1.388
	[21.667]	[22.947]	[20.418]	(1.61)
N. of households (in 1,000)	1.929	2.025	1.846	0.179
	[1.981]	[1.928]	[2.025]	(0.14)
N. of hh (in 1000) per SqKM	88.763	121.094	57.249	63.845***
	[254.356]	[326.421]	[148.554]	(19.21)
Labor share: Agriculture	0.369	0.394	0.351	0.043***
	[0.225]	[0.222]	[0.225]	(0.02)
Labor share: Forestry	0.017	0.015	0.019	-0.003*
	[0.026]	[0.024]	[0.027]	(0.00)
Labor share: Fishery	0.024	0.023	0.025	-0.002
	[0.045]	[0.041]	[0.048]	(0.00)
Labor share: Mining	0.019	0.015	0.023	-0.008*
	[0.072]	[0.045]	[0.087]	(0.00)
Labor share: Construction	0.057	0.057	0.056	0.001
	[0.020]	[0.020]	[0.020]	(0.00)
Labor share: Manufacturing	0.170	0.159	0.178	-0.020***
	[0.110]	[0.102]	[0.115]	(0.01)
Labor share: Whole sale and retail	0.129	0.129	0.129	-0.000
	[0.071]	[0.068]	[0.073]	(0.00)
Labor share: Finance	0.011	0.011	0.011	-0.000
	[0.010]	[0.010]	[0.010]	(0.00)
Labor share: Transportation	0.066	0.059	0.070	-0.011***
	[0.035]	[0.027]	[0.040]	(0.00)
Labor share: Service	0.091	0.092	0.090	0.001
	[0.034]	[0.036]	[0.032]	(0.00)
Heavy damage in WWII	1.214	1.286	1.162	0.124***
	[0.411]	[0.453]	[0.369]	(0.03)
Observations	873	367	506	873

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard deviations are in square brackets. Standard errors are in parentheses.

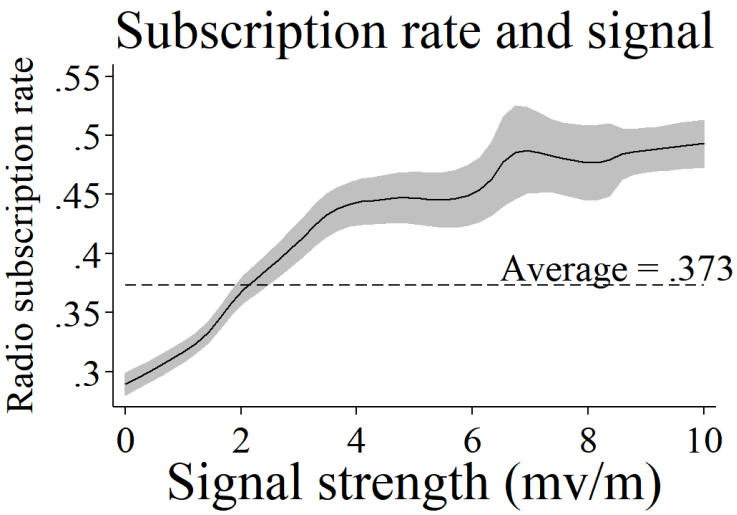
Table 10: Observable characteristics of my sample to examine marriage and fertility

	(1) All mean/[std.dev.]	(2) My sample mean/[std.dev.]	(3) Out of my sample mean/[std.dev.]	(4) Diff. diff/(std.err.)
Radio subscription rate	0.350	0.329	0.353	-0.023***
	[0.158]	[0.135]	[0.161]	(0.01)
Residualized field strength	0.000	-0.000	0.000	-0.000
	[1.495]	[1.552]	[1.489]	(0.09)
Male to female ratio				
at reproductive age in 1950	0.924	0.916	0.925	-0.008**
	[0.087]	[0.069]	[0.089]	(0.00)
N. birth per 1000 population				
in 1935	34.353	34.379	34.350	0.029
	[4.916]	[4.919]	[4.916]	(0.29)
N. marriage per 1000 population				
in 1935	8.881	8.789	8.892	-0.103
	[1.693]	[1.634]	[1.699]	(0.10)
Distance from a nearby transmitter (km)	28.991	42.090	27.442	14.648***
	[16.468]	[21.764]	[14.989]	(1.23)
N. of households (in 1,000)	0.388	0.353	0.393	-0.039
	[0.619]	[0.425]	[0.638]	(0.03)
N. of hh (in 1000) per SqKM	38.354	29.415	39.411	-9.996***
	[103.302]	[43.061]	[108.189]	(3.12)
Labor share: Agriculture	0.526	0.530	0.526	0.004
	[0.186]	[0.188]	[0.186]	(0.01)
Labor share: Forestry	0.033	0.036	0.033	0.003
	[0.061]	[0.073]	[0.059]	(0.00)
Labor share: Fishery	0.023	0.037	0.021	0.015***
	[0.063]	[0.078]	[0.061]	(0.00)
Labor share: Mining	0.021	0.009	0.023	-0.014***
	[0.090]	[0.049]	[0.094]	(0.00)
Labor share: Construction	0.047	0.043	0.047	-0.004***
	[0.023]	[0.019]	[0.024]	(0.00)
Labor share: Manufacturing	0.106	0.101	0.106	-0.006
	[0.083]	[0.075]	[0.084]	(0.00)
Labor share: Whole sale and retail	0.085	0.089	0.084	0.005*
	[0.045]	[0.047]	[0.045]	(0.00)
Labor share: Finance	0.006	0.005	0.006	-0.001**
	[0.005]	[0.005]	[0.005]	(0.00)
Labor share: Transportation	0.048	0.047	0.048	-0.001
	[0.031]	[0.027]	[0.032]	(0.00)
Labor share: Service	0.070	0.071	0.070	0.000
	[0.026]	[0.023]	[0.027]	(0.00)
Observations	3148	333	2815	3148

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard deviations are in square brackets. Standard errors are in parentheses.

B Binned IV

Figure B.17: Plotting the radio subscription rate against the field strength



Motivated by a non-linear relationship between the radio subscription and the field strength (B.17), this section presents results from IV regressions with binned instrumental variables. By binned instrumental variable, I mean that I create indicator variables for each decline bin of the field strength, and use them as instrumental variables.

Table 11, Table 12, and Table 13 show results for electoral turnout, female candidates' vote share, and labor force participation respectively. Figure B.18a and Figure B.18b present results for marriage rate and fertility rates. Results are similar to what the main specification (1) yields. There are, however, two exceptions: first, the impact of women's turnout on the female candidate's vote share is now statistically significantly positive (Column 4 of Table 12). This is likely because flexibly fitting instrumental variable yields a stronger first stage. Second, the impacts on the birth rate (Figure B.18b) has become more persistent.

Table 11

	Women's turnout Mean 0.66 Std.dev. 0.08			Men's turnout Mean 0.79 Std.dev. 0.06		Turnout female share Mean 0.37 Std.dev. 0.06
	(1) OLS	(2) TSLS	(3) TSLS	(4) OLS	(5) TSLS	(6) TSLS
Radio subscription in std.dev. unit	0.0289*** (0.00519)	0.0247*** (0.00861)	0.0248** (0.0111)	0.00231 (0.00482)	0.0114 (0.00791)	0.0136** (0.00581)
R^2	0.707	0.707	0.740	0.620	0.613	0.727
Distance control	decile bins	decile bins	decile bins	decile bins	decile bins	decile bins
N.of HH, HH density	✓	✓	✓	✓	✓	✓
Transmitter FE	✓	✓	✓	✓	✓	✓
Prefecture FE	✓	✓	✓	✓	✓	✓
City indicator	✓		✓			
Industrial composition	✓		✓			
Male to female ratio						✓
Observations	346	346	346	336	336	288

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard deviations are in square brackets. Standard errors are in parentheses.

Table 12

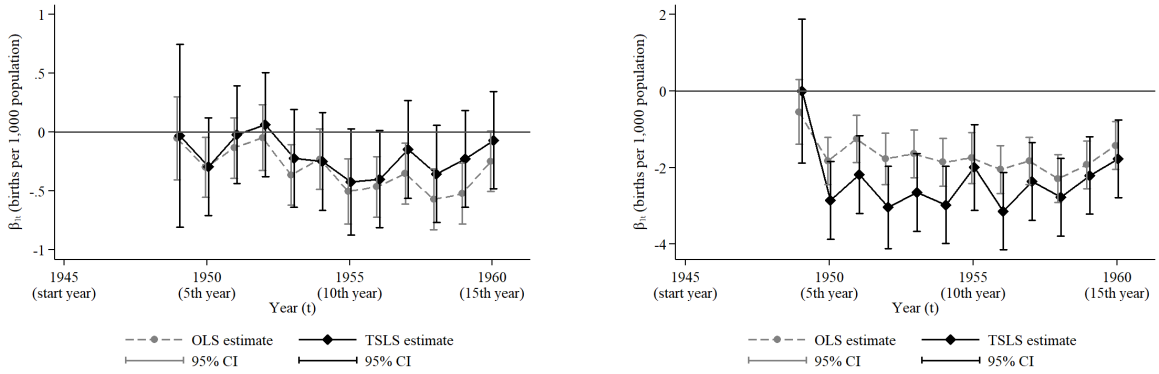
	Female vote share Mean .077 Std.dev. .08			
	(1) OLS	(2) TSLS	(3) OLS	(4) TSLS
Radio subscription (std.dev)	0.00308 (0.00193)	0.0114* (0.00591)		
Female share turnout (p.p.)			0.00143** (0.000670)	0.00890** (0.00380)
R^2	0.538	0.533	0.622	0.534
Distance control	decile bins	decile bins	decile bins	decile bins
Electoral district FE	✓	✓	✓	✓
Electoral disrict controls	✓	✓	✓	✓
Transmitter FE	✓	✓	✓	✓
N.of HH and HH density	✓	✓	✓	✓
War casualty	✓	✓	✓	✓
Candidate controls	✓	✓	✓	✓
Candidate FE				
Std.error clustered	Yes	Yes	Yes	Yes
Observations	958	958	465	465

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard deviations are in square brackets. Standard errors are in parentheses.

Table 13

	(1) Women's LFP Mean 0.521 Std.dev. 0.134	(2) Women's LFP excld. family emp Mean 0.283,Std.dev. 0.06	(3) Female share in LF mean: 0.398 sd. 0.065
Radio subscription			
in std.dev. unit	-0.00987	-0.00479	-0.00143
	(0.00617)	(0.00591)	(0.00300)
Women's LFP in 1930	0.374***	0.205***	0.169***
	(0.0291)	(0.0279)	(0.0141)
Male to female ratio	-0.293***	-0.579***	-0.433***
	(0.0379)	(0.0363)	(0.0184)
Distance control	decile bins	decile bins	decile bins
N.of HH, HH density	✓	✓	✓
Transmitter FE	✓	✓	✓
Prefecture FE	✓	✓	✓
Prewar LF participation	✓	✓	✓
Industrial composition	✓	✓	✓
Observations	678	678	678

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard deviations are in square brackets. Standard errors are in parentheses.



(a) The annual marriage rate

(b) The annual birth rate

Figure B.18: Annual marriage and birth: comparing the national average and the average in my sample