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 study examines the impact of women's radio programs that the US-led occupying force aired in Japan (1945-1952) to dismantle the prewar patriarchal norms. Using local variation in radio signal strength driven by soil conditions as an instrumental variable, I provide causal evidence that greater exposure to women's radio programs increases women's electoral turnout, which further translates into a greater vote share for female candidates. This positive effect contributes to women's greater representation in the national legislature: had there not been women's radio programs in place, the number of female winners would have been halved. Moreover, exposure to women's radio programs contributes to a decline in fertility and therefore had an important implication for the nation's demographic landscape. The declining fertility is due neither to an increase in women's career aspirations nor to a decline in marriages. My results are not driven by a preexisting correlation between radio signal strength and women's behavior before the US occupation. Although research shows that gender norms have historical roots and move slowly, my findings provide evidence that public policy can cut against them to promote equal participation in decision-making.

Key words: mass media, gender norm, equal representation, fertility

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1 Introduction

Is altering norms an effective way of changing socioeconomic behavior? Norms, by which I mean societally coordinated beliefs, have gained renewed attention in economics as critical determinants of economic behaviors, economic growth, and the efficacy of public policies.[1] Gender norms are no exception. They are shown to drive gender-related outcomes such as the gender wage gap, women's underrepresentation in political and corporate decision-making, the incidence of intimate partner violence, and marriage, divorce, and fertility patterns.[2] Moreover, gender norms are shown to have deep, historical roots in relation to factors such as different types of agricultural practices,[3] grammatical gender,[4] the practice of matrilineality,[5] and the bride price and dowry traditions.[6] However, as Giuliano (2020) highlights, this line of literature has mostly been focused on the historical persistence of norms. Far less understood is how gender norms evolve and, in particular, how policies can cut against gender norms that hold women back from equal participation in decision-making. This is what the present study sheds light on.

In this study, I examine the impact of a norm-based intervention in the form of a mass media campaign promoting gender equity. I leverage one of the world's oldest examples of

[1] See, for example, Akerlof and Kranton (2000), Benabou and Tirole (2013), and Acemoglu and Jackson (2016).

[2] For example, Fernandez and Fogli (2009) study the second-generation American women and show that culture, which includes gender norms and is transmitted from parents to children, explains women's labor market participation and fertility decisions. Bertrand, Kamenica and Pan (2015) document that the distribution of wives' earned income share drops sharply to the right of 1/2 and argue that gender identity norms best explain this stark discontinuity. Other studies document a similar pattern in Germany (Wieber and Holst 2015), Finland (Zinovyeva and Tverdostup 2018), and Sweden (Hederos and Stenberg 2019) while the cause of the sharp drop is still debated. In the context of developing countries, Jayachandran (2020) reviews the literature showing that gender norms hinder women's employment.

[3] See, for example, Alesina, Giuliano and Nunn (2013), and Alesina, Giuliano and Nunn (2018)

[4] See, for example, Gay, Santacreu-Vasut and Shoham (2013), and Galor, Ömer and Sarid (2020).

[5] The literature comparing matrinieal and patriarchal kinship systems highlights that gender differences in psychological attributes may be influenced by social structures. See, for example, Gneezy, Leonard and List (2009), Hoffman, Gneezy and List (2011), Gong and Yang (2012), Gong, Yan and Yang (2015), Robinson and Gottlieb (2019), and Lowes (2020).

[6] See, for example, Ashraf, Bau, Nunn and Voena (2020).

a mass media campaign targeting women: women's radio programs in Occupied Japan, that is, Japan during the US-led occupation (1945–1952). Women's issue was one of the core occupation policies. In fact, as Pharr (1987) wrote, the U.S. occupying force "chose to make Japan a laboratory for one of the world's most radical experiments with women's rights" at the time. Notably, just one month after the occupation started, they began airing women's radio programs in order to dismantle the prewar, patriarchal norms. Occupied Japan provides an ideal experimental setting because women's radio programs were externally brought without anticipation upon Japan's defeat in World War II. While the idea of empowering women through radio programs is not uncommon across the world, it usually emerges hand-in-hand with women's rights movements. It would, therefore, be more challenging in other contexts to separate the causal impact of the radio campaign from that of the overarching women's rights movement.[7]

Specifically, I investigate how differential exposure to women's radio programs affects women's decision-making in terms of electoral turnout, labor market participation, marriage, and fertility. I focus on these outcomes based on the program content. As revealed through my study of archives and historians' accounts, women's radio programs covered a wide range of topics: they were initially dedicated to women's political participation, but then gradually diversified to cover topics including marriage, labor law, birth spacing, and health. Even though the content was quite radical with respect to contemporary gender norms, many female listeners tuned in. In fact, a series of listener surveys revealed that women's radio programs drew a high listenership[8] with more than 60 percent of female listeners finding the

[7]Women's radio programs were widespread feature of the heyday of radio: for example, BBC Radio 4's Woman's Hour in the UK (from October 7,1946), Radio Donna by Radio Città Futura in Rome, Italy (from March 1976 onwards), Womankind by Pacifica Radio in New York (1969), Hemmafru byter yrke (The Housewife Switches Jobs) by Swedish Radio P1 in Sweden (from October 7, 1965 to December 9, 1965), and RadiOrakel in Oslo, Norway (from October 16, 1982)

[8]In the listener's survey conducted between July 14th and 17th in 1949, more than 70 percent of women with a radio subscription said

show to be informative (Japan Broadcasting Corporation (NHK) (1949b)).

I draw data from various archival resources and construct a unique district-level panel dataset that includes both the prewar and postwar periods. It is particularly challenging to collect data specific to women for some outcomes, such as electoral turnout, marriage, and birth rates: I hand-collect these data from prefectural newspapers and prefectural governments' yearbooks. Since the resulting sample does not cover all prefectures,[9] my analyses rely on within-prefecture, across-district variation but not across-prefecture variation.

Exposure to women's radio programs, which is my main independent variable, comes from district-level variation in radio listenership. Listenership is proxied by the district-level radio subscription rate, the statistics that originates from the state-owned radio licensing system at the time. Across the nation, listenership varied from below 10 percent to above 70 percent with the average of 37 percent, providing cross-sectional variation in women's exposure to the gender-egalitarian norms on air.

I address endogeneity in radio listenership using AM radio signal quality, measured by field strength, that varies locally based on soil conditions. While AM radio signal quality depends not only on soil conditions but also on the distance to a nearby transmitter, transmission power, and frequency, I control for these three factors and use the residual variation in field strength to instrument for radio listenership. I do so to eliminate any concern that the location of a transmitter correlates with women's outcomes. Essentially, the identifying

that they currently listened to or had listened to "Women's Hour," the flagship programs among women's programs (Japan Broadcasting Corporation (NHK) (1949a)).

[9] A prefecture is the first level of jurisdiction and administrative division in Japan and is overseen by an elected governor, legislature and administrative bureaucracy. Each prefecture consists of multiple districts.

variation comes from districts equidistant from the same transmitter but nonetheless receiving different signal strength due to different soil qualities. I show that the first stage is strong. Field strength positively predicts radio subscriptions, even after controlling for distance to the nearest radio transmitter and transmitter fixed effects. I also provide support for my identification by finding no correlation between the instrumental variable and preintervention outcomes.

Using conditional field strength as an instrumental variable, I find that greater exposure to women's programs significantly increases women's political participation, both as voters and representatives, in the first election in which women could vote. Indeed, a one standard deviation increase in exposure to women's radio programs increases women's electoral turnout by 2.6 percentage points. The same increase in exposure also raises a female candidate's vote share by 1.3 percentage points. This positive effect contributes to women's increasing representation in the national legislature: had there not been women's radio programs in place, then women's share among winners would have been only 4.2 percent, almost the half of the actual representation of 8.2 percent.

The above impact appears to be heterogeneous based on a district's male-to-female ratio. Exposure to women's radio programs had greater effect in areas where men are more scarce due to the high military mortality rate. This heterogeneity arises probably because the cost of deviating from traditional gender norms would be smaller where there were fewer men, who may retaliate against the new norms.

Moreover, the radio impact extends to decision-making within the household. I find that radio exposure contributes to a decline in the birthrate between 1949 and 1960; a one standard deviation increase in radio exposure contributes to the annual birthrate declining by 1.71 per 1,000 population, compared to the prewar baseline birthrate of 30.8 per 1,000 population. On the other hand, I do not find any significant impacts on either women's labor market participation or marriage. My findings on labor market participation, marriage, and fertility together suggest that declining fertility is due to neither an increase in women's career aspirations nor a decline in marriages.

My findings contribute to four strands of literature. First, this study provides new evidence that public policy can actively alter preexisting gender norms and close the gender gap in socioeconomic outcomes. As Giuliano (2020) states in her review, the current literature on gender norms has been devoted to showing their historical roots, while less is known about how public policies could change them. A recent exception is Bursztyn, González and Yanagizawa-Drott (2020). They provide survey evidence that men underestimate the extent to which other men approve of their wives working in the market and show in experimental results that after receiving correct information about others, men increase their willingness to support their wives' working. While Bursztyn et al. (2020) design a lab experiment that corrects men's misperception of gender norms, my research studies historical policy intervention targeting women who have internalized patriarchal norms. With this difference in mind, our works together open avenues for future research on how public policies may change the gender norms that cause gender inequality.

Second and related, this study adds additional causal evidence that changing norms play a critical role in the fertility transition, a topic that has gained renewed interest in economics in the last decade. The idea of norms influencing fertility decisions dates back to Coale (1973) and what later became known as "ready, willing, and able" model (van de Kaa 2004). While economists have long focused on analyzing the costs and benefits that give incentives to reduce fertility (see Guinnane 2011 for a review), there is now growing evidence that norms and cultural change also play a critical role in the fertility transition across the globe (see Silva and Tenreyro 2017 for review). For example, Jensen and Oster (2009) show that the introduction of cable television contributed to decreasing fertility in rural India. La Ferrara, Chong and Duryea (2012) provide evidence that Globo, the Brazilian soap opera, has disseminated the smaller family size norm and thus contributed to the rapid fertility decline in Brazil. Kearney and Levine (2015) identify that the American TV show 16 and Pregnant contributed to reducing the teenage birth rate by spurring interest in contraceptives among teens.[10] Beach and Hanlon (2019) show that greater exposure to the Bradlaugh and Besant trial contributed to the fertility decline in England and Wales starting in 1877, by disseminating a positive image of family planning. My study is complementary to these studies, which underscore the importance of integrating norms and cultural factors to better understand the fertility change in economic literature.

Third, a rich body of literature has examined the causal impact of mass media on electoral turnout and election outcomes. As Della Vigna and Gentzkow (2010) as well as Strömberg (2015) note in their reviews, mass media can increase electoral turnout; however, it can also decrease turnout if it substitutes for other information sources that are more relevant to electoral turnout. My study strengthens the case of these authors by showing a substantial positive impact of radio on women's electoral turnout in a setting with few other media outlets

[10] As an instrument variable for the viewership of 16 and Pregnant, Kearney and Levine (2015) use MTV viewership in a year before the show started. Jaeger, Joyce and Kaestner (2020) raise a concern that such an IV may violate the exclusion restriction because demographic characteristics determining MTV viewership may directory affect teenage pregnancy.

(TV or newspapers).

Fourth, my study contributes to a growing body of literature examining the impacts of radio broadcasting on various socioeconomic outcomes, such as political knowledge (Strömberg 2004), participation in social groups and trust (Olken 2009), price convergence (Svensson and Yanagizawa-Drott, 2009), the self-reported number of household decisions that women have final says and children's primary school attendance (Cheung 2012), mass-killing (Yanagizawa-Drott 2014), animosity between ethnic groups (Della Vigna, Enikolopov, Mironova, Petrova and Zhuravskaya 2014), emergence of a dictatorial regime (Adena, Enikolopov, Petrova, Santarosa and Zhuravskaya 2015), resistance (Gagliarducci, Onorato, Sobbrio and Tabellini 2020), immigrants' assimilation (Russo 2019), and populist persuasion (Wang 2020). In terms of its identification strategy, my study is closest to that of Strömberg (2004) which also exploits features of AM radio wave propagation.

While the results should be extrapolated with caution, they provide evidence that public policy can cut against gender norms that hold women from as equally participating in decision-making as men do. Thereby my findings also lend support to contemporary initiatives to use mass media to address gender inequality.

The remainder of the paper is organized as follows. Section 2 provides a brief background of women's radio programs in Occupied Japan and highlights key features that are critical for my empirical analysis. Section 3 explains the model, identification, and estimation strategy. Since data collection and digitization are also key steps in this project, Section 4 discusses them in detail. Section 5 discusses the results and addresses potential threats to the identification strategy. Section 6 mentions the remaining points that my present study does not address. Finally, Section 7 concludes.

2 Historical background: women's radio programs in Occupied Japan

This section provides three pieces of historical background that are essential for my study. Subsection 2.1 highlights the fact that women's radio programs were one of the first efforts of the Allies to raise women's social status. Subsection 2.2 explains the preexisting radio broadcasting infrastructure, which informs my identification strategy. Subsection 2.3 summarizes the content of women's radio program, and presents an examination of women's political participation, labor market participation, and family formation as relevant behavior.

2.1 The Allies' efforts to raise women's status 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 the "Allied Occupation," it was mostly an undertaking of the United States, with contributions from Australia, India, New Zealand, and the United Kingdom, and therefore it was often called the "American Occupation." General Douglas MacArthur oversaw the occupation as the Supreme Commander for the Allied Powers (SCAP). The acronym SCAP was soon used to refer not only to the commander himself, but also 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 raising the legal and social status of Japanese women.[11] The idea behind it was that SCAP arguably attributed the prewar militant political system to the patriarchal Japanese social system (Kobayashi 2004). The idea of raising women's status was placed at the core of the occupation policies as a major pathway for peacebuilding. In this way, Japanese women gained several legal rights during the Allied Occupation, including rights to vote and run for office (in December 1945 for the national election, and in September 1946 for the local election) and to attend college (1948).[12]

The U.S. occupying force "chose to make Japan a laboratory for one of the world's most radical experiments with women's rights" (Pharr 1987). Women-related policies under the Allied Occupation are considered not only radical in relation to the status quo in Japanese society in 1945, but also more liberal than the situation in Western societies at the time.[13]

In a significant effort to raise women's status, the first initiative of the Allied Forces was to start women's radio programs.[14] In fact, as early as October 1, 1945, just one month after the Allies started to occupy Japan, the government-sponsored radio station, the Japan Broadcasting Corporation, began to air educational programs targeting women. The women's

[11] The other four reforms were to abolish the secret police, to encourage the formation of labor unions, liberalize education system, and 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>

[12] Uemura (2007)'s pioneering work uncovers the role of the Occupation regime in raising Japanese women's status and, in particular, analyzes the relationships between occupier and occupied.

[13] For example, the postwar Japanese Constitution, enacted in 1947, guarantees 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 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 (1987) 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.

[14] Table C.6 provides more detailed time line of SCAP's policy toward emancipation Japanese women.

programs aimed "to raise political, social, and cultural standards of ordinary women and 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 raise women's legal and social status. As explained in Section 3, however, the 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 the results. Otherwise, different timing may also reflect a different legal environment that women were facing.

2.2 Radio reception and use in Occupied Japan

In this subsection, I explain the preexisting radio broadcasting infrastructure that existed before the Allies' arrival, which allowed the General Headquarters (GHQ)/SCAP to introduce women's radio programs in the very early stage of the occupation period. Not only were the programs on air, but they were also well received by female listeners, as I uncover from listeners' surveys.

At 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, the Japan Broadcasting Corporation (JBC). 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 used for only part of the day and mainly for rebroadcasting. Until 1952, there was no private radio broadcasting. In effect, a radio holder had only two choices: either to listen to the JBC's programs, or not to listen to 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. The fee was not expensive and thus, I do not worry that it 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 the price of one serving of Soba noodles, Japanese staples.[15] 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 the Radio Branch and hereafter referred to as the Radio Unit). Radio broadcast content was censored in advance by the Radio Unit.[16] The Radio Unit also conducted modern listener surveys (Mayo

[15]See Table C.7 on annual radio subscription fee from 1925 to 1955. Data are drawn from Okabe (2018).

[16]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 10 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, translated in English by the author.)

1988, Luther and Boyd 1997, Smulyan 2002). In effect, the Radio Unit had a large say over what kind of content was on air and therefore played a key role in disseminating information to meet the GHQ's purposes.

The JBC started airing the flagship women's program "Women's Hour (*Fujin no jikan*)" on October 1, 1945, just about a month after the Allies started occupying Japan. The program was designed to draw as many women as possible. A time slot allotted to the women's program was the lunch break when women used to listen to a war-time women's program during World War II; women were appointed as the director of the production team, as well as moderators, in order to be friendly to female listeners; music was played occasionally for a pause so that listeners could maintain concentration (Japan Broadcasting Corporation (NHK), 1947, 1950)

As the JBC's Listener survey reveals, women's programs were indeed well received. In the 1947 survey, more than 70 percent of women with a radio subscription said that they currently listened 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 reassures me that women's programs conveyed new information to women as GHQ/SCAP intended.

As time went by and the JBC's production capacity increased, the JBC added more time slots for women's programs. By the end of 1950, the weekly airtime that the JBC allocated to women's programs had quadrupled from its onset in October 1945.[17] This under-

[17]See Figure C.2 NHK Yearbook (Japan Broadcasting Corporation (NHK) 1947, 1949) and GHQ/SCAP CIE Weekly Report (Radio Education Branch, 1946 - 1950).

scores the fact that GHQ/SCAP maintained and strengthened efforts to raise women's status throughout the occupation. As the airtime expanded, the content covered by the women's programs grew too, as I show in detail in the next subsection.

Before diving into the radio content analysis, I note that the analysis primarily focuses on the occupation period (1945-1952) although the JBC continued to air women's programs 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 about which information they acquire and why. Although this transition in the broadcasting market opens up a new avenue of research, it is beyond the scope of my current analysis.

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 this study should consider. Therefore I turn to the Weekly Radio Reports (from January 1946 to December 1950), which document daily radio content. I classify them into several topics, and see how the composition of topics changed over the course of the Allied occupation.

The Weekly Radio Report[18] was reported every week, with one section dedicated to

[18]Weekly Radio Report GHQ/SCAP CIE Box No. 5318 Folder 9.

the featured programs of the week. The following are examples of content descriptions.

> Women's Hour March 12, 1946
>
> "While it may be praiseworthy for a wife to bow to her husband's will in many cases, the forthcoming general election demands that she make her own decision, entirely independent of others"

> Women's Hour December 7, 1950
>
> "Birth control was the subject of a discussion among three prominent guests: Mrs. Kato [Kato Sizue], disciple of Margaret Sanger; Mrs. Yamamoto, physician and Mr. Mochizuki, member of the purity education committee of the ministry of education. While Mrs. Kato and Mrs. Yamamoto stressed the need for birth control in Japan's rapidly expanding population, Mr. Mochizuki turned his attention to a discussion on specific related problems in a married life"

Both of the above examples appear to challenge the prewar gender norms. In the first example, the program demands that women make their own choices of whom to vote. This goes against the conventional view that a woman obeys her father, her husband, and her son. In the second example, Shizue Kato airs her support for birth control. This highlights a significant shift in norms around birth control. The wartime militaristic government had the "births for the nation (Umeyo Fuyaseyo)" policy, and oppressed birth control as the " dangerous thoughts." In fact, Shizue Kato, who had pioneered the birth control movement since the 1920s, was arrested in December 1937 (Tipton 1997). With this background, airing her voice in the public women's radio programs would shift the public discourse around birth

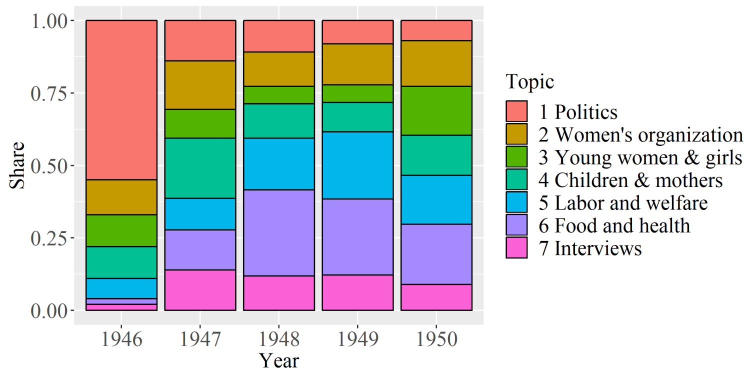


Figure 1: Topic compositions of women's radio over the course of the Allied Occupation. Contents descriptions are drawn from GHQ/SCAP CIE Weekly Report (Radio Education Branch, 1946 - 1950) and classified using Latent Dirichlet allocation.

control.

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 (Figure 1).[19] I find that, women's programs were primarily about politics and elections in 1946, which is consistent with what Okahara (2007) uncovers in her case study.[20] Interestingly, the content covered by women's programs became more diverse over the years to cover women's organizations, the interests of 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 over time motivates me to explore whether exposure to women's radio programs can affect not only political behavior but also other women's outcomes, particularly labor market participation, marriage rate, and fertility

[19]For a detailed explanation, see Appendix D.
[20]Toyoda (2012) reviews Okahara (2007) in English.

rate. Based on the words and phrases that appear in the radio content, I hypothesize the following.[21] First, women's electoral turnout increases in response to larger exposure to women's radio programs, 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, whose content included women's careers and to labor laws that protect women's rights in the workplace. 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 C.8 summarizes the association between topics within the women's radio programs and the women's outcomes that I examine in this study.

3 Empirical model and identification strategy

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 quality induced by soil conditions and perform an instrumental variable (IV) analysis.

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

3.1 Empirical model

I assume a linear causal model between exposure to women's radio programs and the outcomes of interests. Here I aim to identify 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, explained in detail in the next subsection.

I describe in detail in Section 4 how each variable is measured, but note here that radio exposure is proxied by the district-level radio subscription rate, defined as the share of households subscribing to radio; this proxy 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 existing studies on mass media. To this end, I take advantage of the radio receiver license system in Japan, which provides data on district-level radio subscription rates. Having the actual radio subscription turns out to be especially critical for scaling in this study, because the average radio subscription rate is only 36.7 percent, while the radio signal covers almost the entire nation, however weak it is.

Meanwhile, 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 on evidence that men's and women's ratings were statistically indistinguishable for all programs except women's programs (Figure C.3). 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 norms than men do, owing to preexisting gender 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 content on female election candidates, labor laws relevant to women, freedom of choosing marriage partner, the health benefit of birth spacing, and so forth. It is beyond the scope of my research to ask how impacts would change if such contents were conveyed within general programs that do not specifically target women. An interesting open question remains about how the effects of information vary when conveyed in and out of gendered spaces.

3.2 Identification strategy

The key empirical challenge to identify the causal effect β_1 is that radio exposure, proxied by the radio subscription rate, may 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, willingness to acquire new information, potential for local economic growth, local culture, or religion. For example, women with greater interest 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 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, wavelength, and ground conductivity between the transmitter and 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,[22] and the ground conductivity is as good as random to potential subscribers. Therefore, after controlling for distance and transmitter fixed effects, the local variation in the field strength can serve as an instrumental variable for the radio subscription rate.[23]

Furthermore, I control for other district characteristics: industry composition, mea-

[22]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 may be unwarranted given the historical background of radio, as 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.

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

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

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

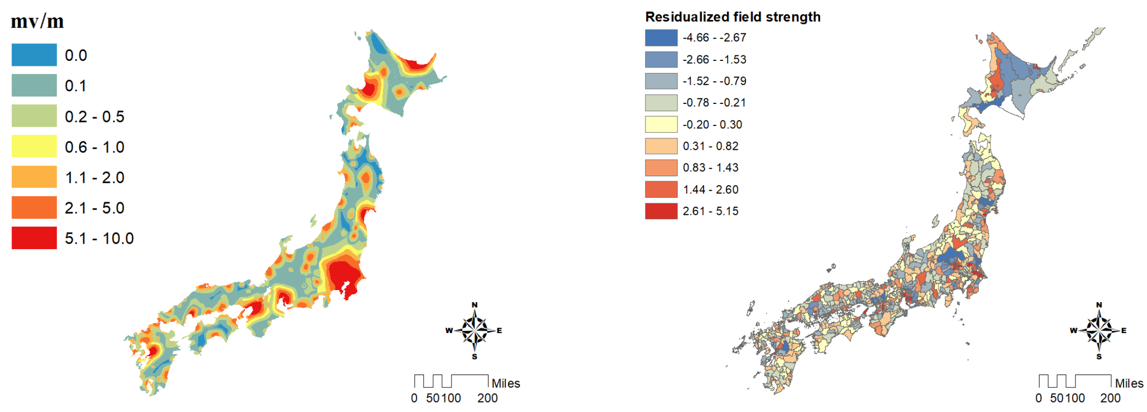
sured by the labor share in major three industries (agriculture, forestry, and mining). Doing so addresses the concern that the soil may reflect how fertile the land is and correlate with the economic potentials of a given area. I also include the number of households, number of households per square km, and a city indicator to control for urbanness. Moreover, I control for the fact that a district was subject to bombing during World War II to take into account that bombings might have affected citizens' attitudes toward the American Occupation and their radio programs. Finally, prefecture fixed effects control for any inter-prefectural public policy differences[24]. 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 instrumental variable in hand, I estimate the causal impact of radio exposure on each outcome of interest via two-stage least squares (TSLS) and compute robust standard errors.[25]

To conclude this section, I discuss potential mechanisms through which my instrumental variable may violate the conditional exogeneity assumption. There may be concern that soil type, which provides local variation in the field strength, directly determines the outcomes that I am interested in. Such concern arises if the soil type happens to indicate agricultural productivity, which then directly determines the optimal labor input. Alternatively, the soil type may capture an environmental factor for human fertility, which then directly de-

[24] A prefecture is the first level of jurisdiction and administrative division in Japan and is overseen by an elected governor, legislature and administrative bureaucracy.

[25] In Appendix F, I also discuss another specification where instrumental variables are discretized into decile bins to address a potentially non-linear relationship between field strength and radio subscription. The main results are robust.



(a) Digitized map of the Radio 1 field strength

(b) Residualized field strength

Figure 2: Field strength and residualized field strength. Panel (a) shows the AM wave field strength, which serves as the instrumental variable for radio exposure. I digitized the map that the JBC published in 1949. Panel (b) shows the spatial distribution of residualized field strength. The residualized field strength is obtained by regressing field strength on the distance to a nearby transmitter, transmitter fixed effects, and all the other district characteristics variables such as population density and industrial composition.

termines the birth rate. In either case, the direct association between the outcomes and field strength would undermine the exclusion restriction of the instrumental variable.

To address these concerns, I regress the pre-intervention outcomes on the field strength and full set of control variables. Pre-intervention variables are available for the annual marriage rate (1935), the birth rate (1935), and the labor force participation rate (both men and women in 1940). For a political outcome, I use men's turnout in the 1942 general election, which was the last national election before the American occupation, to proxy for the district-specific political aspiration.[26,27] As Table 1 shows, the outcome variables are not associated with field strength, in the absence of the radio intervention.[28]

[26]In 1942, all men above the age of 25 had the right to vote whereas women did not.
[27]Data sources are explained in the next section in details.
[28]Figure C.12 graphically shows that there is no association between field strength and marriage or fertility rate in 1935.

Table 1: The association between field strength and prewar outcomes

	(1) Turnout 1942 (men) Mean 0.85 Std.dev. 0.04	(2) Birth rate 1935 Mean 32.70 Std.dev. 4.28	(3) Marriage rate 1935 Mean 8.50 Std.dev. 1.30	(4) LFP 1940 (women) Mean 0.37 Std.dev. 0.10
Field strength in std.dev.	0.00184 (0.00348)	-0.288 (0.186)	-0.0459 (0.0828)	-0.00619 (0.00387)
R^2	0.695	0.822	0.621	0.899
Control variables	✓	✓	✓	✓
Observations	356	771	771	651

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: In Column 1, men's turnout is defined as the number of eligible voters who casted ballots divided by the number of eligible voters. I draw data from *"Dai 21 kai Shugi-in so senkyo ichiran"* (The 21st (1942) House of Representatives election voting record). The sample is restricted to districts for which I have data on women's turnout in 1946. Methods of data collection is described in detail in Section 4. In Column 2, the birth rate is defined as the annual number of births in 1935 per 1,000 population. Similarly, in column 3, the marriage rate is the annual number of births 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 digitize for this project. In Columns 4, LFP stands for the labor force participation rate, which is a share of the respective population working 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. I spatially merge data in different years using year-by-year municipality boundaries, to take into account municipality mergers. The match rate was lower for 1935, which results in a smaller sample size in Column 4 as compared to Columns 2 and 3.

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 variables are observed at the district (*shi* and *gun*) level[29] unless stated otherwise. Using these variables, I construct a unique, district-level panel dataset, which covers both the prewar and postwar periods. Appendix A describes all the data sources in detail, and Table A.2 and A.3 show summary statistics.

Here I highlight challenges to collect data for three outcomes, electoral turnout, marriage and birth rate. I draw data on electoral turnout by sex in the 22nd House of Representatives Election held on April 10, 1946, the first election after women's suffrage. The data are from local editions of three national newspapers as well as prefectural newspapers, which reported district level turnout by sex between April 12 and April 14,1946.[30] My final dataset contains 26 prefectures, covering 56.7 percent of eligible voters[31] in Japan in the 1946 election.

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[32]: 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. Meanwhile, 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

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

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

[31] In the 1946 election, men and women aged 20 years or above were eligible to vote. Eligible voters were automatically registered.

[32] 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

0.13 is statistically significant. Moreover, Table A.2 shows that districts in my sample and out of my sample are observably similar.

Meanwhile 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). These are the only five prefectures that provide the necessary information to the best of my knowledge. I digitize these prefecture yearbooks and spatially merge them across years using municipality boundaries.[33] I also digitize the 1935 vital statistics to obtain prewar annual marriage and birth rates. As Figure C.7 in shows, the average annual marriage and birth rates in my sample resemble the national averages. Moreover, Table A.3 shows that districts in my sample are similar in terms of prewar birth and marriage rates, as well as residualized field strength and share of agricultural labor. Districts in the sample are less densely populated and have a slightly different industrial composition than those out of the sample. Therefore, caution is required in extrapolating these findings to the entire nation.

5 Findings

This section presents the main results concerning the effects of exposure to women's radio programs on political participation (Subsection 5.1), labor market participation (Sub-

[33] When analyzing marriage and birth rates, I use a municipality as a unit of observation instead of using a district, which is a collection of municipalities. I do so to deal with major municipality mergers and consolidations, which make it difficult to maintain the same district boundaries over the period of my study. In fact, the number of municipality significantly declined from 9,868 (in October 1953) to 3,975 (in September 1956) due to municipality mergers and consolidations (`http://www.soumu.go.jp/gapei/gapei2.html`). Therefore, I apply municipality boundaries in 1960 to data in 1935 as well as in years between 1949 and 1960, and merge all of them to create a municipality-level panel dataset. This procedure requires me excluding municipalities that were split although such cases are very rare.

section 5.2), and family formation (Subsection 5.3).

5.1 Political participation

Table 2 shows results from the regressions of equation (1). Column 1 reports the first stage estimate with the minimal set of covariates: after controlling for the transmitter fixed effect and distance to a nearby transmitter, a one standard deviation of field strength increases radio subscription by 0.47 standard unit. Column 2 reports the first stage estimate with the complete set of covariates. A one standard deviation of field strength increases radio subscription by 0.51 standard unit.

I find that exposure to women's radio programs yields positive impacts on women's political participation. Table 2 shows results from the regressions of equation (1) with three different outcomes: women's turnout (Columns 3, 4 and 5), men's turnout (Columns 6 and 7), and women's share of those who cast ballots (Column 8). For each outcome, I present ordinary least squares (OLS) and TSLS estimates. The key independent variable (radio subscription rate at district level) is in standard deviation units. Analyzing the OLS estimates first, radio subscription has a strong positive association with women's turnout (Column 3) but not men's turnout (Column 6).

These associations turn out to be causal: Column 3 demonstrates that a one standard deviation increase in radio subscriptions increases women's electoral turnout by 2.6 percentage points. The magnitude of the TSLS estimate is slightly larger than the OLS estimate (Column 3). To see the role that some control variables play, Column 4 exclude city indicator and industrial compositions. Notice that these control variables do not affect the estimate of the causal effect of women's radio programs. Column 7 presents the TSLS estimate regressing men's turnout on the radio subscription. Similar to the OLS estimate, the TSLS estimate is not statistically distinguishable from zero at the five percent level. The positive gap between women's turnout (Column 5) and men's turnout (Column 7) suggests that the radio subscription has impacts only on women through the provision of women's radio programs.

In addition, Column 8 shows the impact on the women's share among voters, defined by the share of women out of men and women who cast ballots, and confirms that the radio exposure increases the women's share by 1.6 percentage points. Later in this section, I further ask if the increase in the women's share among voters induced by radio increases a female candidate's vote share.

The magnitude of 2.6 in Column 5 is not only statistically significant at the five percent level, but also substantially important: it accounts for 31 percent of the standard deviation of women's turnout. A back-of-the-envelope 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 3.0 percentage point.[34] Moreover, the persuasion rate based on Della Vigna and Gentzkow (2010) is 46.4 percent, larger than other papers on voter persuasions.[35]

[34]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.

[35]There are at least two possible reasons for the persuasion rate being larger than that shown 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 the persuasion effect and an 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 marginal voters. If this is the case, the persuasion rate that I compute may overstate the true persuasive effect.

Table 2: 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 0.80 Std.dev. 0.06		Turnout female share Mean 0.38 Std.dev. 0.06
	(1) First stage	(2) First stage	(3) OLS	(4) TSLS	(5) TSLS	(6) OLS	(7) TSLS	(8) TSLS
Field strength in std.dev. unit	0.474	0.514						
	(0.0368)	(0.0755)						
Radio subscription in std.dev. unit			0.0242	0.0245	0.0261	0.00221	0.0106	0.0165
			(0.00553)	(0.00898)	(0.0113)	(0.00442)	(0.00847)	(0.00881)
Observations	356	356	356	356	356	346	346	277
First stage F-stat				62.63	46.37		41.42	26.11
Distance control	decile bins	decile bins	decile bins	decile bins	decile bins	decile bins	decile bins	decile bins
Transmitter FE	✓	✓	✓	✓	✓	✓	✓	✓
Men's turnout in 1942		✓	✓	✓	✓	✓	✓	✓
N.of HH, HH density		✓	✓	✓	✓	✓	✓	✓
WWII heavy damage		✓	✓	✓	✓	✓	✓	✓
Prefecture FE		✓	✓	✓	✓	✓	✓	✓
City indicator		✓	✓		✓	✓	✓	✓
Industrial composition		✓	✓		✓	✓	✓	✓
Male to female ratio								✓
R-squared	0.29	0.80	0.75	0.73	0.75	0.72	0.72	0.75
2-step GMM estimate				0.0247	0.0260		0.0071	0.0177
(Spatial s.e.)				(0.0078)	(0.0104)		(0.0088)	(0.0082)

Standard errors in parentheses

Note: 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). 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. Saitama, Aichi 2nd, and Yamaguchi prefectures did not have any female candidates. The male-to-female ratio is defined as the number of eligible male voters per female voters. At the bottom of the table, I also present two-step GMM estimates. The two-step GMM estimators and standard errors are calculated using Conley (1999). Conley (1999) proposes the way to allow for spatial correlation as a function of an economic distance between units by using a weighting function that is a product of one kernel in each dimension of the the Cartesian plane (north/south and east/west). In each dimension, the kernel starts at one and decreases linearly until zero at a cutoff distance, and remains zero for larger distances. I measure an economic distance by a physical distance, and use the cutoff of 38.84 miles, which is the maximum value of the distance to the first nearest district. A distance between two districts is measured by a distance between their centroids, and the average is 9.54 miles.

Additionally, I explore the possibility of heterogeneous impact based on the male to female ratio. Due to military casualties, the male to female ratio varies substantially with the mean of 0.92 and the standard deviation of 0.06. Asai and Kambayashi (2020) document that such across-district variation comes from *home regiments*: each regiment consisted of men from the same prefecture and it was as if home away from home. Moreover by chance, some regiments were heavily damaged. This is because the allies employed the leapfrogging strategy, i.e., bypassing heavily fortified islands instead of capturing every island in sequence. Therefore, variation in the male-to-female ratio in the aftermath of WWII is as-good-as-random, and provides the opportunity to test the heterogeneous effect of radio exposure.

$$\begin{aligned}\text{Turnout}_{j,1946} = \beta_0 + \beta_1 \text{radio exposure}_{j,1946} + \beta_2 \text{radio exposure}_{j,1946} \times \text{male to female ratio}_j \\ + \beta_3 \text{male to female ratio}_j + \text{radio exposure}_{j,1946} + \gamma x'_{j,1946} + u_{j,1946}\end{aligned} \tag{2}$$

Different theories would predict the heterogeneous impacts in a opposite direction. On the one hand, the critical mass theory or male backlash theory predict that female scarcity would yield negative coefficient β_2. The idea is that women would be less likely to act on new norms if women have a smaller mass to avoid backlash. On the other hand, the marriage bargaining theory predicts that female scarcity would yield positive coefficient β_2. The idea is that female scarcity would increase their bargaining power, and therefore would amplify the effect of radio exposure. It is an empirical question which would be the case.

Table 3: The heterogeneous impact of greater exposure to women's radio on turnout based on male-to-female ratio

	Outcome: Women's turn out in 1946	
	(1) Women's turnout Mean 0.66 Std.dev. 0.08	(2) Women's turnout Mean 0.66 Std.dev. 0.08
Radio subscription in std.dev. unit	0.0261 (0.0113)	0.278 (0.110)
Male to female ratio (std.dev.) $\times$ Radio subscription (std.dev.)		-0.0163 (0.00714)
Male to female ratio in std.dev.		0.0426 (0.0222)
R^2	0.752	0.744
Control variables	✓	✓
First stage F-stat	46.37	22.79
Observations	356	356

Standard errors in parentheses

The male to female ratio is defined as the number of men per a woman. The smaller male to female ratio means that men are more scarce. Data on the male to female ratio are drawn from Table 2, 3 and 5 of the 1950 Census. All regressions include the common set of control variables: distance decile bins, transmitter fixed effect, prefecture fixed effect, industrial composition, the number of households, the number of households per square km, city indicator, bombing indicator.

Column 2 of Table 3 shows results from the regression of equation 2. A one standard deviation increase in the male to female ratio decreases the impact of radio exposure by 1.63 percentage points. In other words, radio exposure has a greater impact on women's turnout if men are relatively scarce. This result is in favor of the critical mass theory rather than the marriage bargaining theory.

Does women's greater turnout matter in the end? Does it translate into greater women's representation at the Diet?[36] To observe this, Table 4 presents the impacts of radio

[36]In the 1946 general election, 2770 candidates run for office and 79 (2.8 %) were women. Of 46 prefectures, 40 prefectures had at least one female candidate and the share of female candidates ranged from 0.01 to 0.09 with the median of 0.03. As Figure C.6 shows, there is no systematic relationship between the radio subscription rate and the female candidacy.

Table 4: The impact of greater exposure to women's radio on the vote share of a female candidate

	Vote share of female candidate Mean 0.08 Std.dev. 0.08			
	(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

Standard errors in parentheses

Note: Standard errors are clustered at the level of electoral districts and shown in parentheses. In the 1946 general election, there were 52 multi-member districts, whose boundaries align with prefecture boundaries except for Hokkaido, Tokyo, Niigata, Aichi, Osaka, Hyogo, and Fukuoka prefectures, each of which was split into two. Appendix E explains in detail how the electoral system worked in the 1946 election. 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 has missing values) and (ii) some electoral districts had multiple female candidates. I compute the dependent variable, the vote share of a female candidate, by dividing the number of votes a female candidate received by the number of voters who cast votes in the district. All columns include dummies for the deciles of the distance to the nearest transmitter, transmitter fixed effects, number of households, number of households per square km, an indicator for whether a district was bombed during World War II, and the male to female ratio defined as the number of eligible male voters per one eligible female voter. In all columns, I also control for the candidate's characteristics (party dummies, the age of a candidate, an indicator for whether a candidate was a women's suffrage activist, and an indicator for whether a candidate worked before running for office) and electoral district characteristics (total number of candidates, dummies for the number of female candidates, number of seats, and number of votes per voter).

exposure (Column 2) as well as women's turnout share (Column 4) on a female candidate's vote share, each of which is instrumented by field strength. Column 2 shows that greater radio exposure increases a female candidate's vote share by 1.33 percentage points. The direct impact of female turnout is also positive although the estimate is noisier (Column 4): a one percentage point increase in women's turnout share increases a female candidate's vote share by 1.3 percentage points.

Was the impact large enough to push a female candidate to win? To put the 1.33

percentage points into perspective, I compute the counterfactual election outcome by setting radio exposure to be zero in every district. Had there not been women's radio programs in place, the female share among winners would have been only 4.2 percent, almost the half of the actual representation of 8.2 percent.[37,38] Therefore, I conclude that women's radio programs plays a critical role in increasing women's representation at the Diet.

Overall, women's radio programs successfully amplified women's voices in the political sphere in Japan: the women's programs effectively induced more women to vote, which in turn resulted in closing the gender representation gap. The findings echo what the GHQ/SCAP Radio Unit wrote in a weekly radio report: the women's programs "undoubtedly contributed in a large measure to the fact that 65 percent of the eligible women voters went to the polls." [39]

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;

[37]One should note that the 1946 election was quite competitive. The minimum win-loss margin, by which I mean the vote share difference between the last winner and the runner up, 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.

[38]In this counterfactual exercise, I assume that female candidates' gain in the vote share entirely comes from the female voters who would have abstained in the absence of women's radio programs.

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

$$\begin{aligned}
\text{Women's LFP}_{j,1950} = {} & \beta_0 + \beta_1 \text{radio exposure}_{j,1946} + \iota_t \\
& + \gamma_1 \text{Women's LFP}_{j,1930} + \gamma_2 \text{Male-to-female ratio}_{j,1950} \\
& + f(\text{distance to a nearby transmitter}_{j,1946}) + \nu_{\text{transmitter(j)}} \\
& + \boldsymbol{\kappa_t} \textbf{industries}'_{j,1950} + \pi_{h1} \text{N of HH}_j + \pi_{h2} \frac{\text{N of HH}_j}{\text{SqKM}_j} + \delta_{\text{prefecture(j)}} \\
& + I_{j=\text{city}} + \psi_{\text{bombed(j)}} + u_{j,t} \qquad (3)
\end{aligned}$$

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 aged 15 years and above. The inclusion of the sex ratio as a determinant of women's labor force participation is motivated by the existing literature on the impact of wartime male casualties on women's labor market participation after the war (Rose 2018 on the United States after World War II and Boenke and Gay 2019 on France after World War I).

Regardless of how I define the female labor force participation rate, I find no significant impact of radio subscription. Table 5 presents the first stage (Column 1) and TSLS results from regressions of the form of equation 3 with three different outcomes: female labor force participation rate (Columns 2), female labor force participation rate excluding family

Table 5: The impact of the radio subscription in 1946 on labor force participation

	First stage	TSLS		
	(1)	(2)	(3)	(4)
	Radio subscription in std.dev. unit	Women's LFP Mean 0.521 Std.dev. 0.134	Women's LFP excld. family emp Mean 0.283,Std.dev. 0.06	Female share in LF mean: 0.398 sd. 0.065
Field strength in std.dev. unit	0.460			
	(0.0535)			
Radio subscription in std.dev. unit		-0.00951	-0.0100	-0.00285
		(0.00701)	(0.00683)	(0.00358)
Distance control	decile bins	decile bins	decile bins	decile bins
N.of HH, HH density	✓	✓	✓	✓
Transmitter FE	✓	✓	✓	✓
Prefecture FE	✓	✓	✓	✓
Prewar LF participation	✓	✓	✓	✓
Industrial composition	✓	✓	✓	✓
Prewar Women's LFP	✓	✓	✓	✓
Male to female ratio	✓	✓	✓	✓
Observations	678	678	678	678

Standard errors in parentheses

Note: Standard errors are clustered at an electoral district. LFP stands for labor force participation. LF stands for labor force. The male to female ratio is defined as the number of women aged 15 and above per man in the same age group. The 1930 Population Census provides the latest data on women's labor force participation in the prewar period.

employees (Column 3), and women's share in the labor force (Column 4). I exclude family employees from the definition of women's labor participation in Column 3 in order to isolate the impact of radio on salaried employees. Women's share in the labor force in Column 4 highlights the composition of the labor force rather than the level of the labor force. The radio subscription rate is in standard deviation units. In no case is the impact of the radio subscription distinguishable from zero or economically significant.

5.3 Family formation

Last, I turn to the impact of exposure to 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

$$\begin{aligned}\text{Crude rate}_{j,t} &= \beta_0 + \beta_{1t}\text{radio exposure}_{j,1946} + \iota_t \\ &+ \gamma_1\text{Crude rate}_{j,1935} + \gamma_2\text{Male-to-female ratio}_{j,1950} \\ &+ f(\text{distance to a nearby transmitter}_{j,1946}) + \nu_{\text{transmitter(j)}} \\ &+ \boldsymbol{\kappa_t}\textbf{industries}'_{j,1950} + \pi_{h1}\text{N of HH}_j + \pi_{h2}\frac{\text{N of HH}_j}{\text{SqKM}_j} + \delta_{\text{prefecture(j)}} \\ &+ I_{j=\text{city}} + \psi_{\text{bombed(j)}} + u_{j,t} \qquad (4)\end{aligned}$$

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 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 for a decline (or vice versa). Second, I also include the postwar male to female ratio (Male-to-female ratio$_{j,1950}$) as a deter-

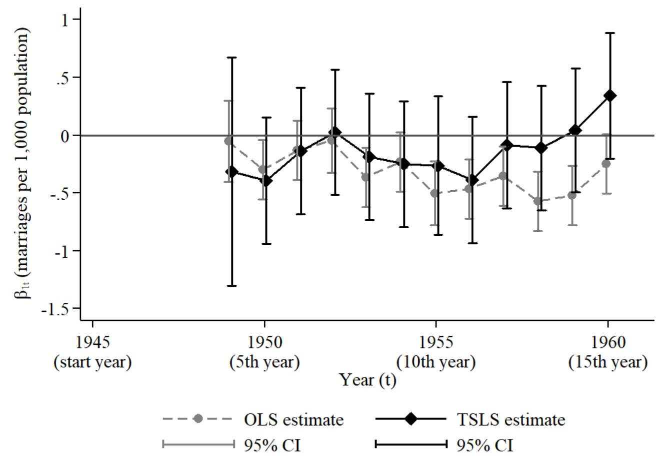


Figure 3: The impact of radio exposure on the annual marriage rate. Gray circles show the OLS coefficients for the crude marriage rate in equation 4. The crude marriage rate is defined as the annual number of marriages per 1,000 population. A vertical bar around each circle shows the 95 percent confidence interval. Similarly, black diamonds show the TSLS coefficients with the confidence intervals.

minant of marriage and fertility rate. The idea of the sex ratio determining marriage-market outcomes dates back to Becker (1973). 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.[40] Third, year fixed effect ι_t takes into account the nationwide trend in marriage and fertility rate. Last but not least, I allow coefficients on the industrial composition ($\mathbf{industries}'_{j,1950}$, a vector of labor shares in industry j in 1950) to vary across time to capture industry-specific time trends. Industry-specific time trends accommodate the fact that post-war birth-control first emerged among wives of coal miners and factory workers (Tama 2006, Ogino 2008, Takagi 2012. Okubo (2011) reviews Ogino in English.). Other control variables remain the same as the main model (1).

[40]For examples, refer to Abramitzky, Delavande and Vasconcelos (2011) in post World War I France, Kvasnicka and Bethmann (2012) in the German state of Bavaria during and after World War II, Brainerd (2017) in post World War II Soviet Union and Ogasawara and Komura (2018) in post World War II Japan.

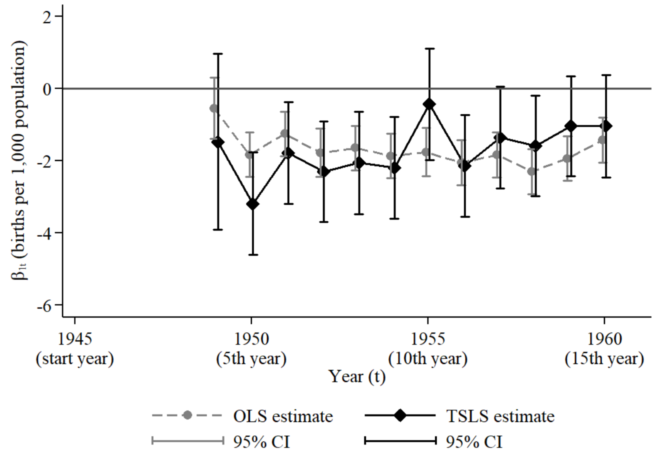


Figure 4: The impact of radio exposure on the annual birth rate. Gray circles show the OLS coefficients for the crude birth rate in equation 4. The crude birth rate is defined as the annual number of marriages per 1,000 population. A vertical bar around each circle shows the 95 percent confidence interval. Similarly, black diamonds show the TSLS coefficients with the confidence intervals.

On the one hand, Figure 3 plots the TSLS coefficients ($\hat{\beta}_{1t}$) for the marriage rate from regressions of the form of equation 4. I find no significant effect of radio intervention on marriage rates.[41]

On the other hand, Figure 4 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, after which the impact starts to fade over time. In other words, in areas in which women are more exposed to women's radio programs, their fertility declines by around 1.71 per 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 Figure C.10 shows. The back-of-the-envelope calculation shows that the radio intervention contributes of

[41]The mean coefficient is -1.72 with a standard error of 2.11 and therefore the coefficient is statistically indistinguishable from 0. The mean coefficient in the first half of the period of my study, from 1949 to 1954, is -1.26 with a standard error of 1.17 and therefore the impact is not significant

4.2 per 1,000 population out of an overall decline of 13.5 per 1,000 from prewar to 1960.[42]

How can the impact be so substantial? I examine two possibilities. First, the high baseline birthrate prior to the US occupation may have left large room for change. Prior to the US occupation, the annual birthrate was at a level of around 30 per 1,000 population, or 4.8 children per married woman (Figure C.9). 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, and rerun regression (4) to observe whether the impact of the exposure to women's radio programs is higher in the high birth-rate districts. The difference is, however, statistically indistinguishable (Figure C.11) and not in favor of my first hypothesis.

I also consider an alternative interpretation: women's radio programs would have changed the norms around fertility from one polar opposite to the other. As I document in Section 2.3, the wartime government had the "births for the nation" policy. Having more children was praiseworthy, and the concept of birth control was a "dangerous thought." With this background, airing the benefit of birth control would have been a substantial paradigm shift for women. This can yield a bigger impact on fertility than it would have been without the "births for the nation" policy in the preintervention period.

[42] 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 per year, which is the average between 1957 and 1962 (plus and minus two years of 1960).

6 Discussion

Overall my findings provide evidence that greater exposure to women's radio programs improve women's outcomes at the political sphere and within the household during the Allied Occupation and shortly after. Before I conclude, I discuss the remaining three aspects that go beyond this study.

First, one may ask whether women's radio programs provided women with new knowledge instead of changing gender norms. While I acknowledge such a possibility, it is not straightforward to disentangle *a shock to norms* from *knowledge*. Could one intervene in existing norms without providing any knowledge? Probably not. By intervening in existing gender norms, women are provided with the knowledge that they were constrained by norms and there could be another way to live. Conceptually distinguishing between shocks to norms and knowledge, if any, would be interesting but would go beyond this study. As I document in Subsection 2.3, the women's radio programs appear to challenge the existing norms, and therefore I interpret the effects as norm effects.

Second, it is still an open question of whether radio exposure has a long-term effect. Examining the long-term effect requires contemporary individual-level data with detailed geographical information during their childhood, which are not found at this moment. In the context of postwar Japan, it is critical to trace individuals to elicit the long-term effect. Looking at district-level contemporary data would likely confound regional migration effects because Japan experienced rapid urbanization during the period of fast economic growth in the1960s. Had there been individual-level data available, they would enable me to further examine the impact of radio on the marriage timing, marriage matching, complete fertility, birth spacing, and moreover women's regional migration pattern. I leave these aspects in future research in other contexts.

Third, Occupied Japan's unique environment needs to be considered when extending my results to other contexts. In the aftermath of World War II, Japanese citizens may have questioned their prewar values and beliefs, and thus may have been more ready to embrace new norms. Such a societal environment may facilitate a larger impact of radio programs than it would have been in other contexts. Better understanding psychological mechanisms through which mass media interventions work would be invaluable for policy discussion.

7 Conclusion

This study examines the impact of women's radio programs that the US-led occupying force aired in Japan (1945-1952) to dismantle the prewar patriarchal norms. Exploiting local variation in radio signal strength driven by soil conditions as an instrumental variable, I provide causal evidence that greater exposure to women's radio programs increased women's electoral turnout. A one standard deviation increase in exposure to women's radio programs increases women's electoral turnout by 2.6 percentage points. This further translated into a greater vote share for female candidates and mattered for women's representation: had there not been women's radio programs in place, the number of female winners would have been halved. Moreover, I show that greater exposure to women's radio programs contributed to a decline in fertility. A one standard deviation increase in radio exposure contributes to the annual birthrate decline by 1.71 per 1,000 population from a prewar baseline birthrate of 30.8

per 1,000 population.The declining fertility is due neither to an increase in women's career aspiration nor to a decline in marriages. My results are not driven by a preexisting correlation between radio signal strength and women's behavior before the US occupation.

While there is much work to be done, my results provide evidence that, using mass media, public policy can alter gender norms to address gender issues. Thereby they lend support to the contemporary initiatives to use mass media to reach out to women and promote gender equity.

My findings open new avenues of economic research. First, it is still an open question as to whether the intervention during the Allied Occupation has had a long-term effect and triggered a virtuous cycle toward gender equality in Japanese society. Second, the case of Occupied Japan limits my ability to investigate what would have happened if both men and women, or only men, had been exposed to women's radio contents. This limitation, however, provide motivation for field experiments to understand the nature of targeted information interventions further. Third, women who are exposed to new gender norms may have passed them onto their children even if they themselves did not change their behavior. Such an inter-generational transmission of the impact of norm-based interventions would be an interesting avenue of future research.

References

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

Acemoglu, Daron and Matthew O Jackson, "Social Norms and the Enforcement," 2016, *15* (April 2017), 245–295.

Adena, Maja, Ruben Enikolopov, Maria Petrova, Veronica Santarosa, and Ekaterina Zhuravskaya, "Radio and the Rise of the Nazis in Prewar Germany," *The Quarterly Journal of Economics*, 2015, pp. 1885–1939.

Akerlof, George A and Rachel E Kranton, "Economics and Identity," *Quarterly Journal of Economics*, 2000.

Alesina, Alberto, Paola Giuliano, and Nathan Nunn, "On the Origin of Gender Roles: Women and the Plough," *The Quarterly Journal of Economics*, 2013, pp. 469–530.

____ , ____ , and ____ , "Traditional agricultural practices and the sex ratio today," *PLoS ONE*, 2018, *13* (1), 1–14.

Asai, Kentaro and Ryo Kambayashi, "Consequence of Hometown Regiment," 2020.

Ashraf, Nava, Natalie Bau, Nathan Nunn, and Alessandra Voena, "Bride Price and Female Education Nava," *Journal of Political Economy*, 2020.

Beach, Brian and Walker Hanlon, "Censorship, Family Planning, and the Historical Fertility Transition," 2019.

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

Benabou, Roland and Jean Tirole, "Laws and Norms," 2013.

Bertrand, Marianne, Emir Kamenica, and Jessica Pan, "Gender Identity and Relative Income Within Households," *The Quarterly Journal of Economics*, 2015.

Boenke, Jorn and Victor Gay, "The missing men," *Retrieved from SSRN (April 2019)*, 2019, pp. 79–102.

Brainerd, Elizabeth, "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.

Bursztyn, Leonardo, Alessandra L González, and David Yanagizawa-Drott, "Misperceived Social Norms: Women Working Outside the Home in Saudi Arabia," *American Economic Review*, 2020, (Forthcoming).

Cheung, Maria, "Edutainment Radio, Women's Status and Primary School Participation: Evidence from Cambodia," 2012.

Coale, Ansley, "The demographic transition reconsidered," in "International Population Conference, Leige 1973 vol.1," International Union for the Scientific Study of Population, 1973.

Conley, T. G., "GMM estimation with cross sectional dependence," *Journal of Econometrics*, 1999, *92* (1), 1–45.

Della Vigna, Stefano, Ruben Enikolopov, Vera Mironova, Maria Petrova, and Ekaterina Zhuravskaya, "Cross-border media and nationalism: Evidence from serbian radio in croatia," *American Economic Journal: Applied Economics*, 2014, *6* (3), 103–132.

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

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

Fernandez, Raquel and Alessandra Fogli, "Culture: An empirical investigation of beliefs, work, and fertility," *American Economic Journal: Macroeconomics*, 2009, *1* (1), 146–177.

Gagliarducci, Stefano, Massimiliano Gaetano Onorato, Francesco Sobbrio, and Guido Tabellini, "War of the Waves: Radio and Resistance During World War II," *American Economic Journal: Applied Economics*, 2020.

Galor, Oded, Özak Ömer, and Assaf Sarid, "Linguistic Traits and Human Capital Formation," 2020.

Gay, Victor, Estefania Santacreu-Vasut, and Amir Shoham, "The Grammatical Origins of Gender Roles," 2013.

Giuliano, Paola, "Gender and Culture," 2020.

Gneezy, Uri, Kenneth L. Leonard, and John A. List, "Gender Differences in Competition: Evidence From a Matrilineal and a Patriarchal Society," *Econometrica*, 2009, *77* (5), 1637–1664.

Gong, Binglin and Chun Lei Yang, "Gender differences in risk attitudes: Field experiments on the matrilineal Mosuo and the patriarchal Yi," *Journal of Economic Behavior and Organization*, 2012, *83* (1), 59–65.

____ , Huibin Yan, and Chun Lei Yang, "Gender differences in the dictator experiment: evidence from the matrilineal Mosuo and the patriarchal Yi," *Experimental Economics*, 2015, *18* (2), 302–313.

Guinnane, Timothy W, "The Historical Fertility Transition: A Guide for Economists," *Journal of Economic Literature*, 2011, *493*, 589–614.

Hederos, Karin and Anders Stenberg, "Gender Identity and Relative Income Within Households - Evidence from Sweden," 2019.

Hoffman, Moshe, Uri Gneezy, and John A. List, "Erratum: Nurture affects gender differences in spatial abilities," *Proceedings of the National Academy of Sciences of the United States of America*, 2011, *108* (43), 17856.

Ito, Yasuko, *Kusa no ne no fujin sanseiken undoshi [A History of the Grassroots Women's Suffrage Movement]*, Yoshikawa Kobunkan, 2008.

Jaeger, David A, Theodore Joyce, and Robert Kaestner, "Journal of Business and Economic Statistics: Comment," *Journal of Business and Economic Statistics*, 2020.

Japan Broadcasting Corporation (NHK), "Radio Yearbook (Radio Nen Kan)," Technical Report, Tokyo 1947.

____ , "Hoso Bangumi Yoron Chosa [The 11th Listener's Survey]," Technical Report 1949.

——, “Radio and Women’s Life,” Technical Report 1949.

Jayachandran, Seema, “Social Norms as a Barrier to Women’s Employment in Developing Countries,” 2020.

Jensen, Robert and Emily Oster, “The Power of TV: Cable Television and Women’s Status in India,” Technical Report 3 2009.

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

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

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

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

Lowes, Sara, “Matrilineal Kinship and Spousal Cooperation: Evidence from the Matrilineal Belt,” 2020.

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

Mayo, J. Marlene, “The War of Words Continues: American Radio Guidance in Occupied Japan,” in “The Occupation of Japan: Arts and Culture” 1988.

National Women’s Education Center, “Gender Statistics Database.”

Ogasawara, Kota and Mizuki Komura, “Consequences of War: Japan’s Demographic Transition and the Marriage Market,” 2018.

Ogino, Miho, *Kazoku Keikaku e no Michi: Kindai Nihon no Seishoku o Meguru Seiji [The Road to "Family Planning": Politics over Reproduction in Modern Japan]*, Iwanami Shoten, 2008.

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

Okahara, Miyako, *Amerika Senryoki no Minshuka Seisaku: Rajio Hoso ni yoru Nihon Josei Saikyoiku Puroguramu [Democratization Policies During the US Occupation Period: Radio Broadcasting Programs for the Re-education of Japanese Women]* 2007.

Okubo, Sumiko, “Book review: “Kazoku Keikaku” e no michi: Kindai Nihon no seishoku o meguru seiji,” *East Asian Science, Technology and Society: An International Journal*, 2011.

Olken, Benjamin A., “Do television and radio destroy social capital? Evidence from indonesian villages,” *American Economic Journal: Applied Economics*, 2009, *1* (4), 1–33.

Pharr, Susan, “The Politics of Women’s Rights,” in “Policy and Planning During the Allied Occupation of Japan,” University Press of Hawaii, 1987, chapter 8.

Robinson, Amanda Lea and Jessica Gottlieb, “How to Close the Gender Gap in Political Participation: Lessons from Matrilineal Societies in Africa,” *British Journal of Political Science*, 2019.

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

Russo, Gianluca, “Mass Media and Cultural Homogenization: Broadcasting the American Dream on the Radio,” 2019.

Silva, Tiloka De and Silvana Tenreyro, “Population Control Policies and Fertility Convergence,” *Journal of Economic Perspective*, 2017.

Smulyan, Susan, “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,” Routledge, 2002, chapter 14.

Strömberg, David, “Radio’s Impact on Public Spending,” *Quarterly Journal of Economics*, 2004, *119* (1), 189–221.

Strömberg, David, “Media Coverage and Political Accountability,” in “Handbook of Media Economics” 2015, pp. 595–622.

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

Takagi, Masahi, “Sengo Shoki Nihon ni okeru Jutai Chosetsu Shido [Birth Control Guidance in Early Postwar Japan],” *Fukuoka University Review of Literature & Humanities*, 2012, *44.*

Takita, D., Y. Ogasawara, and K. Kishimoto, “Kokusei Chousa (1950 Nen) Shikuchousonbetsu Deeta Beesu Sakusei ni Tsuite [The 1950 Population Census Database by City, Town, and Village],” Technical Report, Tsukuba University 2012.

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

Tipton, Elise K., “Ishimoto Shizue: The Margaret Sanger of Japan,” *Women’s History Review*, 1997, *6* (3), 337–355.

Toyoda, Maho, “Information, Re-education and Re-orientation Policies in the US Occupation of Japan,” *Social Science Japan Journal*, 2012, *15* (2), 255–260.

Uemura, Chikako, *Josei kaiho o meguru senryo seisaku [Occupation Policies on Women’s Liberation]*, Tokyo: Sosho jenda bunseki, 2007.

van de Kaa, Dirk J, “"Ready, Willing, and Able”: Ansley J. Coale, 1917-2002",” *Journal of Interdiciplinary History*, 2004.

Vigna, Stefano Della and Matthew Gentzkow, “Persuasion: Empirical Evidence,” *Annual Review of Economics*, 2010.

Wang, Tianyi, “Media, Pulpit, and Populist Persuasion: Evidence from Father Coughlin,” 2020.

Wieber, Anna and Elke Holst, “Gender Identity and Womens’ Supply of Labor and Non-Market Work: Panel Data Evidence for Germany,” 2015.

Yanagizawa-Drott, David, “Propaganda and Conflict: Evidence from the Rwandan Genocide,” 2014.

Zinovyeva, Natalia and Maryna Tverdostup, “Gender Identity, Co-Working Spouses and Relative Income within Households,” *IZA Discussion Papers*, 2018, (11757).

A Data source

Table A.1: 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

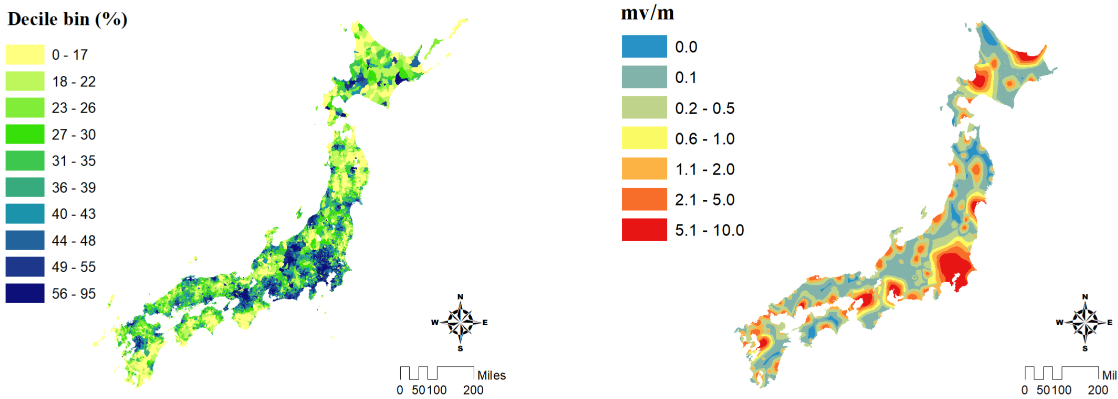
A.1 Radio exposure, field strength, and distance to a nearby transmitter

As mentioned in Subsection 3.1, the degree of exposure to women's radio programs is proxied 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 JBC, which recorded the number of households subscribing to radio as well as the total number of households at the village level. 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 A.1a shows how radio subscription varies across Japan. 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 JBC published in 1949. To the best of my knowledge, this is the first map of the field strength published after World War II. I digitize the map (Figure A.1b) 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 JBC 1947 yearbook as well as data on administrative boundaries.[43]

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



(a) Radio subscription rates in 1946

(b) Digitized map of the Radio 1 field strength

Figure A.1: Regional variation in radio subscription and field strength. On the panel (a), I draw the radio subscription rate from the 1946 yearbook published by the Japan Broadcasting Corporation, which recorded the number of households subscribing to radio as well as the total number of households at the village level. Panel (b) shows the AM wave field strength, which serves as the instrumental variable for radio exposure. I digitized the map that the JBC published in 1949.

A.2 Election turnout and outcomes

As I described in Section 4, I draw data on electoral turnout by sex in the 22nd House of Representatives Election held on April 10, 1946, the first election after women's suffrage. The data are from local editions of three national newspapers as well as prefectural newspapers, which reported district level turnout by sex between April 12 and April 14,1946.[44] My final dataset contains 26 prefectures, covering 56.7 percent of eligible voters[45] in Japan in the 1946 election.

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[46]: 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. Meanwhile, 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, Table A.2 shows that districts in my sample and out of my sample are observably similar.

Data on the election result comes from "Dai 22 kai Shugi-in so senkyo ichiran" (The 22nd (1946) House of Representatives election voting record). In addition, I collect characteristics of female candidates

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

[45]In the 1946 election, men and women aged 20 years or above were eligible to vote. Eligible voters were automatically registered.

[46]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

from Ito (2008).[47]

Furthermore, I digitize turnout in three other general elections. One is men's turnout in the 1942 election, which has been shown not to be correlated with the radio signal in Section 3.2. The other two are men's and women's turnout in the 1949 and 1952 general elections and used to analyze the long-run impact of exposure to women's radio programs.[48]

A.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 years or above who participate in the labor force by the total number of women who are in the respective age group.[49] Using the same data source, I compute women's labor force participation at district level by excluding women in family business, most of whom were farmers' wives at the time. Moreover, the 1950 Population Census also provides the labor share of industries, which I use as a control variable.

For sensitivity tests, I compute women's labor force participation at the district level by using the 1940 Population Census: because the age breakdown of the population is not available at the district level, I cannot use the number of women in the age most relevant to the labor force, and therefore, I divide the number of women in the labor force by the total number of women.[50]

A.4 Annual marriage rate and birth rate

As I describe in Section 4, 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). These are the only five prefectures that provide the necessary information to the best of my knowledge. I digitize these prefecture yearbooks and spatially merge them across years using municipality boundaries.[51]

[47] 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.

[48] I digitized two election records, "Dai 24 kai Shugi-in so senkyo ichiran" (The 24th (1949) House of Representatives election voting record) and "Dai 25 kai Shugi-in so senkyo ichiran" (The 25th (1952) House of Representatives election voting record). These records includes the number of eligible voters, number of votes cast, number of invalid votes, and number of abstentions in the 1949 and 1952 general elections. The unique feature of these records is that they include breakdowns of the above variables by gender, and covers all administrative districts in Japan. Unfortunately, however, such a gender breakdown is not available for the 23rd (1947) general election.

[49] 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 (Takita, Ogasawara and Kishimoto 2012)

[50] 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.

[51] When analyzing marriage and birth rates, I use a municipality as a unit of observation instead of using a district, which is a collection of municipalities. I do so to deal with major municipality mergers and consolidations, which make it difficult to maintain the same

I also digitize the 1935 vital statistics to obtain prewar annual marriage and birth rates. As Figure C.7 in shows, the average annual marriage and birth rates in my sample resemble the national averages. Moreover, Table A.3 shows that districts in my sample are similar in terms of prewar birth and marriage rates, as well as residualized field strength and share of agricultural labor. Districts in the sample are less densely populated and have a slightly different industrial composition than those out of the sample. Therefore, caution is required in extrapolating these findings to the entire nation.

A.5 World War II damage

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

district boundaries over the period of my study. In fact, the number of municipality significantly declined from 9,868 (in October 1953) to 3,975 (in September 1956) due to municipality mergers and consolidations (`http://www.soumu.go.jp/gapei/gapei2.html`). Therefore, I apply municipality boundaries in 1960 to data in 1935 as well as in years between 1949 and 1960, and merge all of them to create a municipality-level panel dataset. This procedure requires me excluding municipalities that were split although such cases are very rare.

Table A.2: 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 [0.126]	0.383 [0.120]	0.374 [0.131]	0.010 (0.01)
Residualized field strength	0.000 [1.246]	-0.019 [1.245]	0.019 [1.249]	-0.038 (0.09)
Distance from a nearby transmitter (km)	32.606 [21.667]	33.223 [22.837]	31.991 [20.451]	1.233 (1.60)
No. of households (in 1,000)	1.928 [1.975]	1.995 [1.906]	1.867 [2.038]	0.127 (0.14)
No. of hh (in 1,000) per km2	88.348 [253.695]	118.198 [321.967]	57.728 [149.570]	60.469** (18.81)
Labor share: Agriculture	0.369 [0.225]	0.396 [0.220]	0.348 [0.227]	0.048** (0.02)
Labor share: Forestry	0.017 [0.026]	0.016 [0.025]	0.018 [0.026]	-0.001 (0.00)
Labor share: Fishery	0.024 [0.045]	0.023 [0.041]	0.025 [0.048]	-0.002 (0.00)
Labor share: Mining	0.019 [0.072]	0.015 [0.045]	0.023 [0.088]	-0.008 (0.00)
Labor share: Construction	0.057 [0.020]	0.058 [0.020]	0.056 [0.020]	0.002 (0.00)
Labor share: Manufacturing	0.170 [0.110]	0.156 [0.101]	0.180 [0.116]	-0.024** (0.01)
Labor share: Whole sale and retail	0.129 [0.071]	0.127 [0.067]	0.130 [0.073]	-0.003 (0.00)
Labor share: Finance	0.011 [0.010]	0.011 [0.010]	0.011 [0.010]	-0.001 (0.00)
Labor share: Transportation	0.066 [0.035]	0.059 [0.027]	0.071 [0.040]	-0.011*** (0.00)
Labor share: Service	0.091 [0.034]	0.092 [0.036]	0.090 [0.032]	0.001 (0.00)
Heavy damage in WWII	1.214 [0.411]	1.276 [0.448]	1.166 [0.373]	0.110*** (0.03)
Observations	873	380	493	873

Standard deviations are in square brackets. Standard errors are in parentheses.

Table A.3: 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)
No. births 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)
No. of households (in 1,000)	0.388	0.353	0.393	-0.039
	[0.619]	[0.425]	[0.638]	(0.03)
No. of hh (in 1000) per km2	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

Standard deviations are in square brackets. Standard errors are in parentheses.

B Regression results

Table B.4: The impact of the radio subscription in 1946 on the marriage rate

	(1)	(2)
1949 ×		
Radio subscription (std.dev.)	-0.0534	-0.316
	(0.180)	(0.504)
1950 ×		
Radio subscription (std.dev.)	-0.298	-0.394
	(0.131)	(0.279)
1951 ×		
Radio subscription (std.dev.)	-0.134	-0.136
	(0.131)	(0.278)
1952 ×		
Radio subscription (std.dev.)	-0.0469	0.0267
	(0.142)	(0.276)
1953 ×		
Radio subscription (std.dev.)	-0.363	-0.188
	(0.131)	(0.279)
1954 ×		
Radio subscription (std.dev.)	-0.229	-0.250
	(0.131)	(0.278)
1955 ×		
Radio subscription (std.dev.)	-0.503	-0.263
	(0.141)	(0.306)
1956 ×		
Radio subscription (std.dev.)	-0.466	-0.388
	(0.131)	(0.279)
1957 ×		
Radio subscription (std.dev.)	-0.352	-0.0839
	(0.131)	(0.279)
1958 ×		
Radio subscription (std.dev.)	-0.571	-0.111
	(0.132)	(0.275)
1959 ×		
Radio subscription (std.dev.)	-0.523	0.0430
	(0.132)	(0.274)
1960 ×		
Radio subscription (std.dev.)	-0.249	0.342
	(0.131)	(0.278)
N	3690	3690

Standard errors in parentheses

Note: The crude marriage rate is defined as the annual number of births per 1,000 population. Regressions include the common set of control variables: distance decile bins, transmitter fixed effect, prefecture fixed effect, industrial composition, the number of households, the number of households per square km, city indicator, bombing indicator, the baseline marriage rate prior to the US occupation, the postwar male to female radio, year fixed effect, and industry-specific time trends.

Table B.5: The impact of the radio subscription in 1946 on the birth rate

	(1)	(2)
1949 ×		
Radio subscription (std.dev.)	-0.546	-1.467
	(0.433)	(1.245)
1950 ×		
Radio subscription (std.dev.)	-1.830	-3.185
	(0.315)	(0.722)
1951 ×		
Radio subscription (std.dev.)	-1.248	-1.778
	(0.316)	(0.721)
1952 ×		
Radio subscription (std.dev.)	-1.772	-2.292
	(0.343)	(0.711)
1953 ×		
Radio subscription (std.dev.)	-1.642	-2.055
	(0.317)	(0.722)
1954 ×		
Radio subscription (std.dev.)	-1.862	-2.187
	(0.317)	(0.719)
1955 ×		
Radio subscription (std.dev.)	-1.754	-0.424
	(0.341)	(0.790)
1956 ×		
Radio subscription (std.dev.)	-2.053	-2.145
	(0.317)	(0.720)
1957 ×		
Radio subscription (std.dev.)	-1.829	-1.354
	(0.317)	(0.721)
1958 ×		
Radio subscription (std.dev.)	-2.296	-1.587
	(0.319)	(0.710)
1959 ×		
Radio subscription (std.dev.)	-1.932	-1.032
	(0.318)	(0.707)
1960 ×		
Radio subscription (std.dev.)	-1.425	-1.038
	(0.317)	(0.720)
N	3681	3681

Standard errors in parentheses

Note: The crude birth rate is defined as the annual number of births per 1,000 population. Regressions include the common set of control variables: distance decile bins, transmitter fixed effect, prefecture fixed effect, industrial composition, the number of households, the number of households per square km, city indicator, bombing indicator, the baseline birth rate prior to the US occupation, the postwar male to female radio, year fixed effect, and industry-specific time trends.

C For Online Publication: Supplemental figures and tables

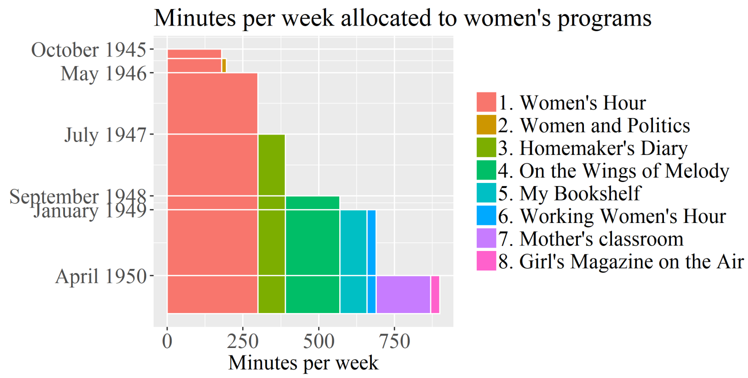


Figure C.2: Airtime allocated to women's programs. The programs were categorized as "Women's program" by the JBC. Source: NHK Yearbook (1947, 1949) and GHQ/SCAP CIE Weekly Report (Radio Education Branch, 1946 - 1950).

Table C.6: Time line for policies aimed at raising women's status under the 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 within the Ministry of Labor.
1948	Women were allowed to attend college.

Table C.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) *"The 50 Years of Japanese Radio 1925-1975"* The Japan Radio Museum.

In real terms radio subscription fees had been declining before World War II. Table C.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 JBC 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 teachers' starting salaries in 1925. In 1941, however, the fee halved while teacher salaries moderately grew. After World War II, the inflation outpaced the increase in nominal subscription fee, and thus the subscription fee further drops in real terms. Therefore, I am less concerned that subscription fees deterred low income Japanese from listening to the radio.

Table C.8: Topics within 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"

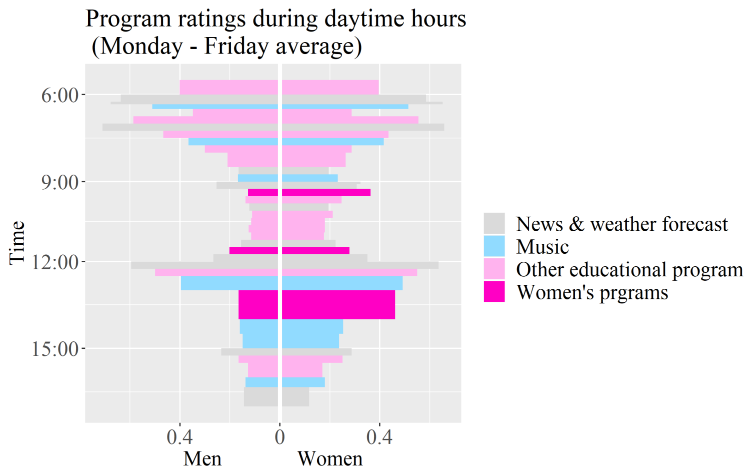


Figure C.3: Channel 1 program ratings during daytime hours. Rating is defined as a percentage of male and female radio holders who actively listened to the radio in a given time slot. The figure shows the average rating from Monday to Friday in the survey week. Dark pink represents times slots allocated to women's programs, which were aired daily. Grey, pale blue, and pale pink indicate news and weather forecasts, 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: the 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))

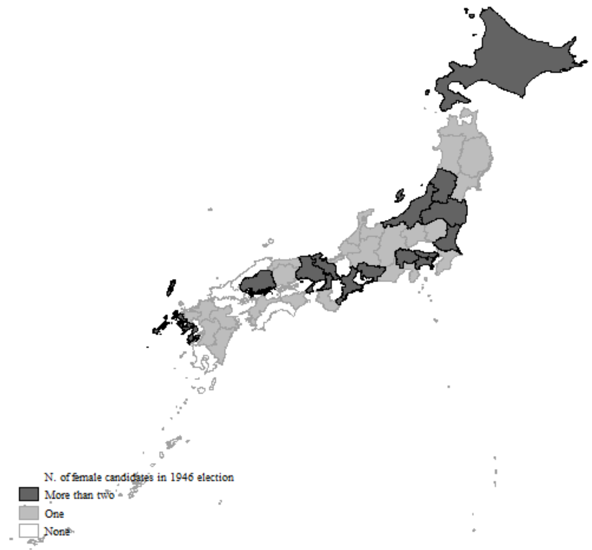


Figure C.5: A map of prefectures where at least one female candidate ran for office

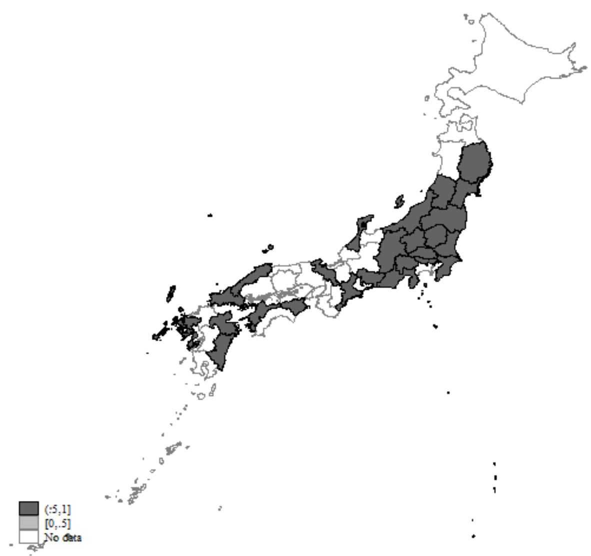
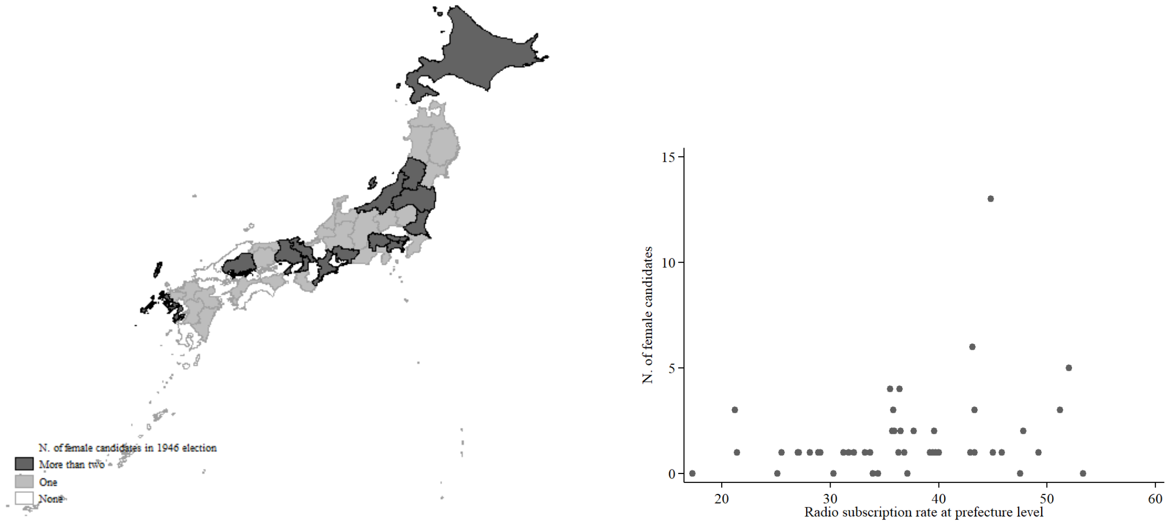
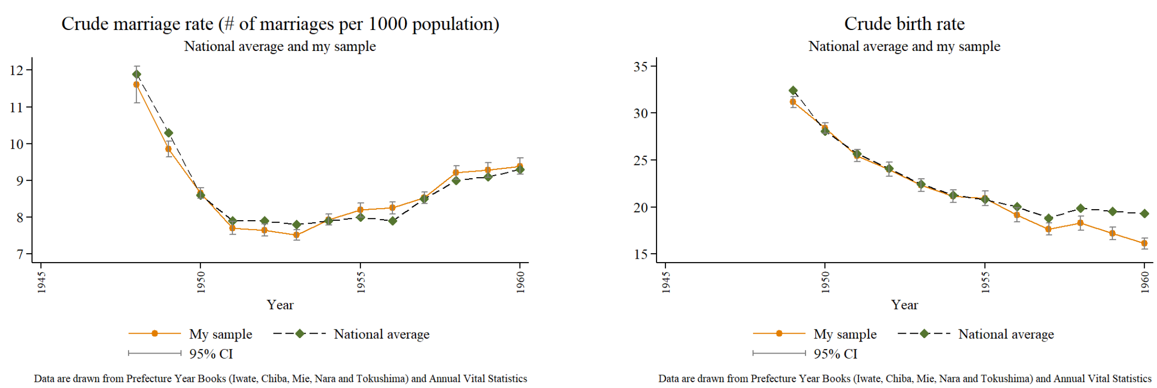


Figure C.4: Prefectures for which data on 1946 turnout are available. Data on electoral turnouts by sex in each district are available for 26 prefectures.



(a) (b)

Figure C.6: (a) Geographical variation in the number of female candidates in the 1946 general election . (b) Relationship between the radio subscription rate and the number of female candidates running for office in the 1946 general election. Each dot represents a prefecture. Five prefectures (Saitama, Shiga, Nara, Shimane, Yamaguchi, and Kagoshima) had no female candidates and therefore are omitted in from the figure. Conditional on having at least female candidate, there is no significant relationship between female candidacy and the radio subscription rate.



(a) Annual marriage rate (b) Annual birth rate

Figure C.7: Annual marriage and birth: comparing the national average and the average in my sample

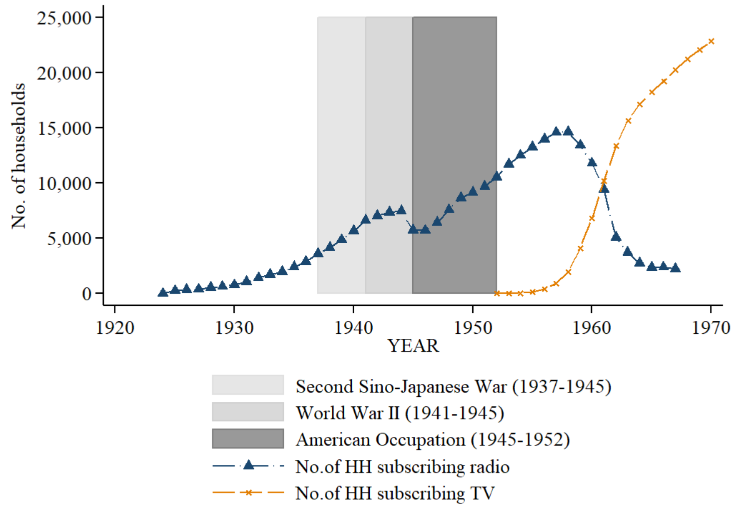


Figure C.8: Radio and TV subscriptions

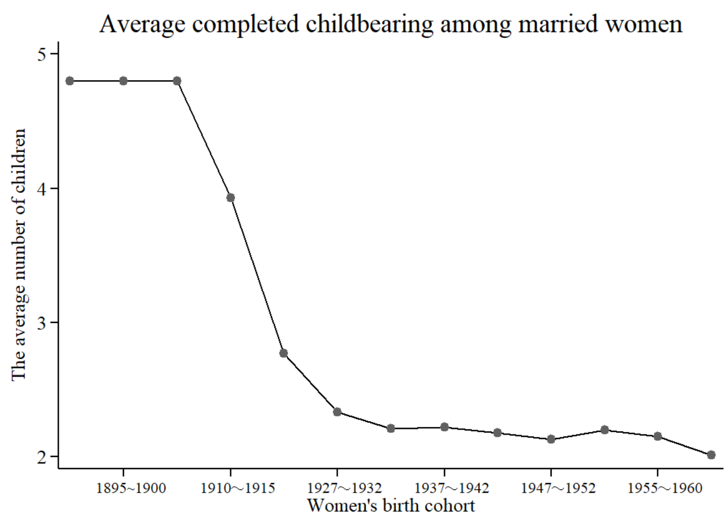


Figure C.9: Average number of children per married woman. Data are from the Census and Vital Statistics and complied by the National Institute of Population and Social Security Research. Okinawa prefecture is not included during 1947-1970. The female population includes foreign citizens who were living in Japan until 1940 but only Japanese citizens from 1941.

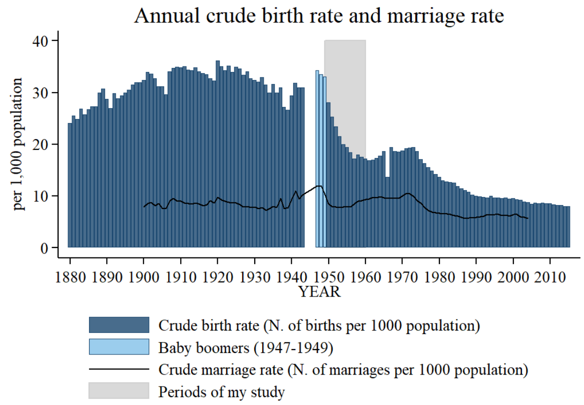


Figure C.10: The number of births per 1,000 population in Japan from 1880 to 2015

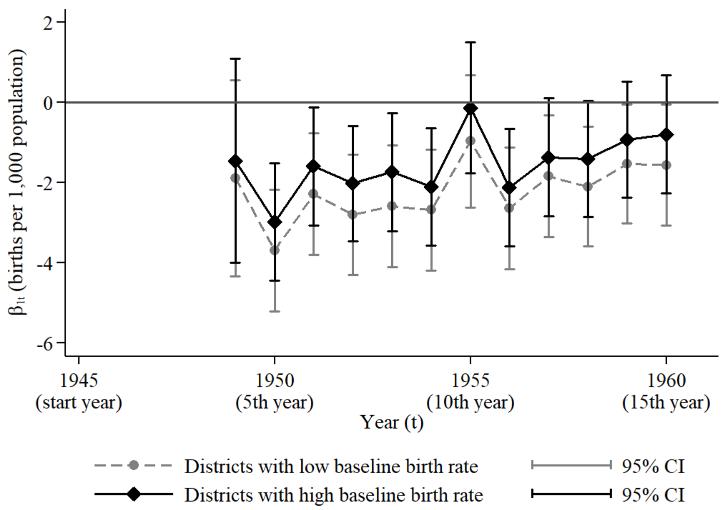
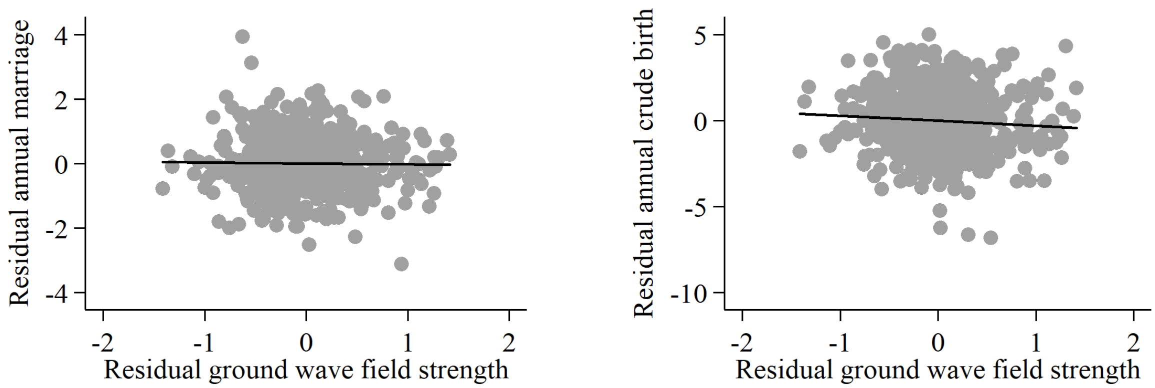


Figure C.11: Heterogeneous impacts of the radio exposure on birth rates. Radio exposure is in standard deviations. Regressions include the full set of control variables presented in equation (4). The sample is split into two groups, based on the baseline birth rate and its median.



(a) Annual marriage rate in 1935

(b) Annual birth rate in 1935

Figure C.12: Association between residualized field strength and residualized annual marriage and birth

D For Online Publication: Analyzing radio content

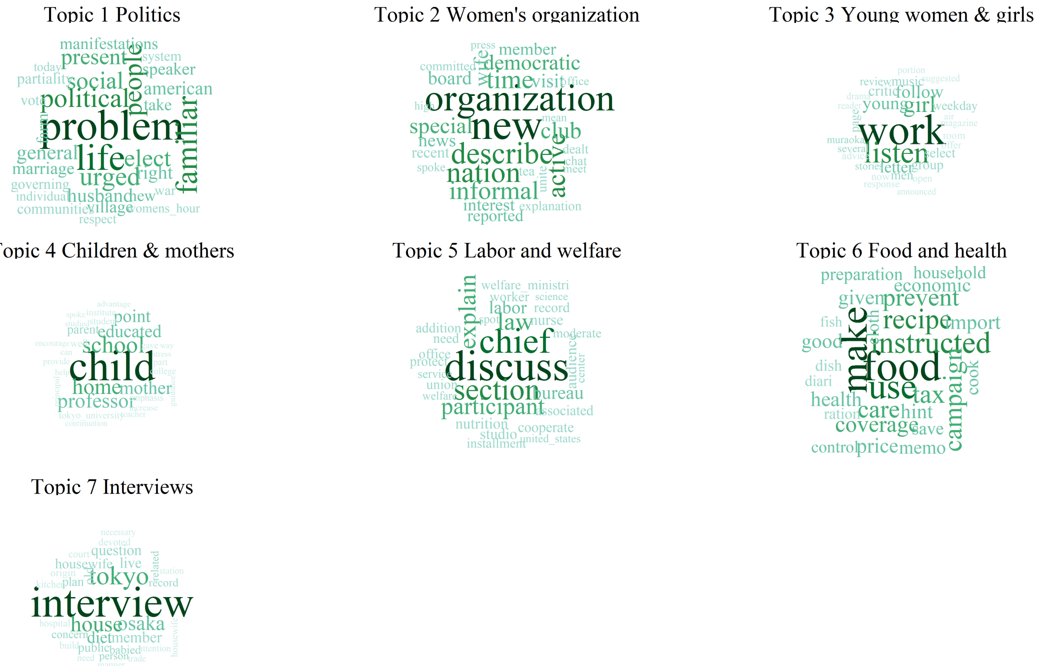


Figure D.13: Word clouds characterizing each of seven topics in women's radio programs.

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 that fits best to the corpus within a collection of documents under analysis. In my study, a document corresponds to a daily content of women's radio programs, two of which are quoted in Subsection 2.3. On the one hand, each topic obtains a probability distribution over words. Figure D.13 shows word clouds for each of seven 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, that is, larger words are weighted higher within the topic. Based on the word clouds, I assign labels to the topics: politics, women's organization, young women and girls, children and mothers, labor and welfare, food and health, and interviews. Each document (i.e., a daily content description) obtains a probability distribution over the seven topics as in Figure 1. Then, for further simplicity, I assign each document one topic with the highest probability, and obtain a mapping from a collection of documents to the seven topics.The choice of seven groups was made as follows. One the one hand, 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 to be interpretable. However, my main takeaways are robust to the number of topics.

E For Online Publication: Background on the 1946 general election

This section explains in details how the electoral system worked in the 1946 general election. The limited voting, as it is called, resembles multi-seat plurality voting because it also uses multi-seat districts. A key difference between the limited voting and the multi-seat plurality voting is that, in the limited voting, a voter casts multiple ballots, but the number of ballots per voter is *limited* strictly to less than the number of seats. In Japan's 1946 general election in Japan, in particular, a voter casted two ballots in a district with less than or equal 10 seats whereas they voted three ballots in a district with more than 10 seats.

Although the limited voting system is less common compared to multi-seat plurality voting, and less understood theoretically, it is often advocated as a way to better reflect the voices of both majority and minority groups. In fact, the limited voting was considered a desirable electoral system as the very first election that Japanese women participated in. However the status-quo majority (right-wing male politicians) was less favor of the limited voting and, in 1947, the Diet agreed to reform the electoral system again and employ multi-seat plurality. Therefore, the 1946 general election was the first and last to employ limited voting. In fact, in 1946, as many as 39 women were elected with winning probability of 49.4 percent, which was much higher than that of men (15.8 percent). The initial success of a female candidate, however, was followed by a long stagnation, and 39 remained the record high for more than five decades until 2009.

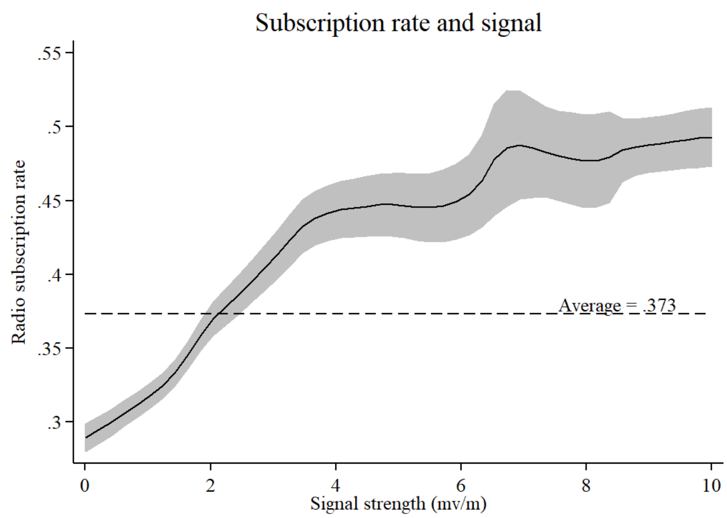
I construct a dataset of 958 female candidate and district pairs and run the following regression. To identify the parameter of interest, β_1, I instrument the radio subscription by the ground wave field strength. Table 4 column (2) presents the result.

$$
\begin{aligned}
s_{i(p),j(d)} = \beta_0 + \beta_1 \text{radio subscription}_{d(j)} \\
& + \underbrace{\phi_d}_{\text{electoral district FE}} + \underbrace{\gamma x'_d}_{\text{electoral district characteristics}} \\
& + \underbrace{\iota c_{i(p)}}_{\text{candidate characteristics}} \\
& + f(\text{distance to a nearby transmitter}_{j,1946}) + \nu_{\text{transmitter(j)}} \\
& + \pi_{h1} \text{N of HH}_j + \pi_{h2} \frac{\text{N of HH}_j}{\text{SqKM}_j} + \psi_{\text{bombed(j)}} + u_{i(p),j(d)}
\end{aligned}
$$

where $s_{i(p),j(d)}$ is candidate i's vote share in administrative district j which belongs to an electoral district d. The exposure to the women's radio programs is again measured by the radio subscription rate, which is the share of households subscribing to radio in district j. The set of electoral district characteristics is meant to control for competitiveness in each district and include the number of seats, number of candidates, female candidates, number of votes per voter (two or three), and male-to-female ratio of eligible voters. The set of candidate characteristics include age, partisanship, whether or not she was employed before the election, and whether or not she was engaged in the women's suffrage movement in the prewar period. Unlike the regression of women's turnout, I do not include prefecture fixed effects, because they are highly collinear with electoral district fixed effects. In fact, in the 1946 general election in Japan, there were 52 multi-member districts, whose boundaries align with prefecture boundaries except for Hokkaido, Tokyo, Niigata, Aichi, Osaka, Hyogo and Fukuoka prefectures, each of which was split into two. Finally, standard errors are clustered at an electoral district level.

F For Online Publication: Binned Instrumental Variable

Figure F.14: Plotting the radio subscription rate against the field strength



Motivated by a non-linear relationship between radio subscription and field strength (Figure F.14), this section presents results from regressions with binned instrumental variables. By binned instrumental variable, I create indicator variables for each decline bin of the field strength, and use them as instrumental variables.

Table F.9, Table F.10, and Table F.11 show results for electoral turnout, a female candidate' vote share, and labor force participation respectively. Figure F.15a and Figure F.15b present results for marriage rate and fertility rates. The results are similar to those of the main specification (1). 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 F.10). This is likely because flexibly fitting the instrumental variable yields a stronger first stage. Second, the impacts on the birth rate (Figure F.15b) has become more persistent.

Table F.9: The impact of radio exposure on electoral turnout

	Women's turnout Mean 0.66 Std.dev. 0.08			Men's turnout Mean 0.80 Std.dev. 0.06		Turnout female share Mean 0.38 Std.dev. 0.06
	(1) OLS	(2) TSLS	(3) TSLS	(4) OLS	(5) TSLS	(6) TSLS
Radio subscription in std.dev. unit	0.0288 (0.00513)	0.0211 (0.00840)	0.0237 (0.0103)	0.00221 (0.00442)	0.00747 (0.00836)	0.0125 (0.00751)
R^2	0.717	0.725	0.752	0.723	0.721	0.754
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						✓
Men's turnout in 1942		✓	✓	✓	✓	✓
Observations	357	356	356	346	346	287

Standard errors in parentheses

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

Table F.10: The impact of radio exposure 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)	0.0114 (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

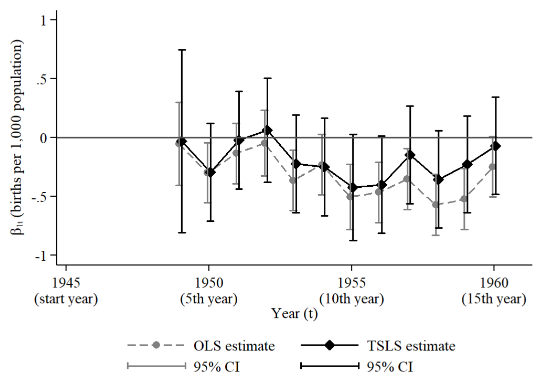
Standard errors in parentheses

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

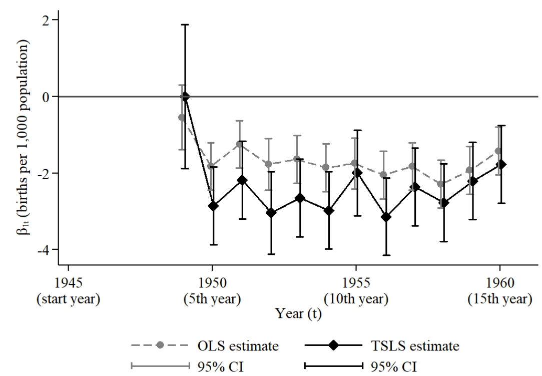
Table F.11: The impact of radio exposure on labor force participation

	(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	-0.00987 (0.00617)	-0.00479 (0.00591)	-0.00143 (0.00300)
Women's LFP in 1930	0.374 (0.0291)	0.205 (0.0279)	0.169 (0.0141)
Male to female ratio	-0.293 (0.0379)	-0.579 (0.0363)	-0.433 (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) Annual marriage rate



(b) Annual birth rate

Figure F.15: The impact of radio exposure on the annual marriage and birth rate