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ABSTRACT

Long-Term Consequences of Teaching Gender Roles: Evidence from Desegregating Industrial Arts and Home Economics in Japan*

We explore whether a 1990 Japanese educational reform that eliminated gender-segregated and gender-stereotyped industrial arts and home economics classes in junior high schools led to behavioral changes among these students some two decades later when they were married and in their early forties. Using a Regression Discontinuity (RD) design and Japanese time-use data from 2016, we find that the reform had a direct impact on Japanese women's attachment to the labor force, which seems to have changed the distribution of gender roles within the household, as we observe both a direct effect of the reform on women spending more time in traditionally male tasks during the weekend and an indirect effect on their husbands, who spend more time in traditionally female tasks. We present suggestive evidence that women's stronger attachment to the labor force may have been driven by changes in beliefs regarding men' and women's gender roles. As for men, the reform only had a direct impact on their weekend home production if they were younger than their wives and had small children. In such relationships, the reform also had the indirect effect of reducing their wives' time spent in weekend home production without increasing their labor-market attachment. Interestingly, the reform increased fertility only when it decreased wives' childcare. Otherwise, the reform delayed fertility.

JEL Classification: J22, J24, I2

Keywords: junior high school, coeducation of industrial arts and home economics, gender gaps, time-use data, employment and labor income, and fertility

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1. Introduction

Despite the great convergence in the lives of men and women, especially in the labor market (Goldin 2014), women continue to shoulder a disproportionate burden at home. On the one hand, gender disparities in the division of domestic work hold back women's professional careers. On the other hand, wives' greater involvement in household chores and childcare may also affect the hiring and promotion decisions of employers regarding women, stalling gender convergence in the labor market. While more than 70% of Japanese women aged 15 to 64 worked in 2018, only 44% did so on a full-time permanent basis.[1] The majority either worked part-time and/or on a fixed-term contract, reinforcing a large pay gap between men and women.

At the same time, Japan has one of the highest disparities in the division of domestic work, with Japanese husbands with children under six years old spending only 1 hour and 23 minutes per day on housework and childcare, the shortest time among the developed countries.[2] These disparities are likely reinforced by well-defined Japanese social norms regarding traditional gender roles and society's demanding domestic expectations for wives. Despite a significant decrease in the share of Japanese who agree with the statement "married women should stay at home", still 37% of the population agreed with it in 2018.[3] Furthermore, over 83% of Japanese agreed with the statement "if a woman earns more money than her husband, it is almost certain to cause problems," the highest share among World Value Survey participating countries (wave 6, 2010-2014).

In this paper, we analyze the causal effect of an early 1990s Japanese junior high school[4] educational reform on subsequent behavioral changes among adult married males and females within and outside the household. More specifically, we study the long-term consequences of an educational reform that ended over 30 years of gender segregation and stereotyping in *industrial arts* and *home economics* (IA-HE hereafter) classes in Japanese junior high schools and instead began offering boys and girls the same IA-HE curriculum, taught coeducationally.

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[1] Statistics Bureau of Japan, *Labor Force Survey 2018*.

[2] Statistics Bureau of Japan, *Survey on Time Use and Leisure Activities 2016.* In contrast, American men spend an average of 2 hours and 21 minutes per day on housework and childcare (American Time Use Survey 2016), and European men over 2 and a half hours (Eurostat 2004).

[3] NHK Broadcasting Culture Research Institute, *The Japanese Value Orientations Survey 2018* (*Nihonjin no ishiki chosa* in Japanese).

[4] Japanese junior high schools cover grades 7 to 9.

Beyond teaching students to become independent in their daily lives by cooking, washing clothes and cleaning rooms, the curriculum in home economics in Japanese schools is "carefully designed to get children to value cooperation in the home and examine their own roles as contributing members of a family. It encourages them to think about what kind of life, and what kind of household, they should have as adults" (The Japan Times, November 16, 2001). As Kawamura (2016) explains, home economics "may provide a good opportunity for all students to discover new things and widen their cultural perceptions. Some students have already experienced something in their home, but experiences with their friends and teacher in *katei-ka* (home economics) classes could widen their viewpoints even more. In other words, *katei-ka* can encourage students in their daily lives and promote them to be more conscious in their lives."

Since the reform was implemented at the beginning of the 1990 school year, the first cohort to receive coeducational home economics and industrial arts during the three years of junior high school is the cohort born between April in 1977 and March in 1978, referred hereafter as the 1977 cohort. Using a Regression Discontinuity design and Japanese 2016 time-use data,[5] we analyze whether the junior high school education reform introduced on April 1st 1990 *caused* a behavioral change among these students more than two decades later, when they were married men and women in their late thirties/early forties. Among the behavioral changes we study are: time spent in home production by men and women during weekdays and weekends, labor market preferences (measured by hours worked, type of employment, and labor income), and preferences for children (measured by total number of children born by 2016 when the youngest cohort was 37 years old). The analysis is done separately for men and women.

Our findings suggest that this educational reform, which mainly eliminated gender-segregated and gender-stereotyped IA-HE courses in junior high school, was successful in modifying treated individuals' long-term behavior. The reform closed the gender gaps in weekend home-production and weekend job-related activities by increasing men's engagement in traditionally female activities (home-production) and decreasing their engagement in traditionally male activities (time spent in job-related activities), and the opposite for women. More specifically, we find that men affected by the reform increased their weekend home-production time by 20 minutes per day (18%) and their share of the couple's weekend home-production time by 2.3 percentage points, or 13%. At the same time, the reform reduced women's home-production weekend time by 16 minutes (5%) and their share of the couple's weekend home-production time by 1.3 percentage points, or 1.6%. Lastly, the reform also reduced the gender gap in weekend time spent in job-related activities, as treated men reduced their weekend time in job-related activities by 30

[5] The formal name of the Japanese time-use data is the *Survey on Time Use and Leisure Activities* (*Syakai-Seikatsu-Kihon-Chosa* in Japanese) conducted by the Statistics Bureau of Japan.

minutes while women increased it by 13 minutes. We also find that the reform increased women's regular employment by 5 percentage points (or 20%) and wages by 5%, with no effect on male employment outcomes, hence reducing the gender gap in both regular employment and annual labor income.

To disentangle the channels through which this reform may have operated, we analyze the direct effect of the reform on men and women versus the indirect effect on their wives and husbands according to whether the spouse was also treated or not. We find that the reform had a direct impact on Japanese women's attachment to the labor force, which seems to have changed the distribution of gender roles within the household, as we observe both a direct effect of the reform on treated women and an indirect effect on their husbands. Specifically, women spend more time in traditionally male tasks within the household during the weekend and less time in traditionally female household tasks. Conversely, their husbands spend more time in traditionally female household tasks and less time on traditionally male tasks. Interestingly, this indirect effect of the reform on husbands' higher home-production time holds and remains statistically significant (albeit smaller in size) even if there are no small children in the household. As for the mechanism causing women's stronger attachment to the labor force, we present suggestive evidence that it may have been driven by changes in their social norms. As for men, the reform only had a direct impact on their weekend home production if they were younger than their wives and had small children. In such relationships, the reform also had the indirect effect of reducing their wives' time spent in weekend home production without affecting their labor-market attachment. A final interesting result is that the reform increased fertility only when it decreased wives' childcare. Otherwise, the reform delayed fertility. The above findings are robust to a battery of sensitivity checks and placebo tests.

While our work contributes to a recent but growing literature on how individuals allocate time between market and non-market activities,[6] this research is most directly related to the following two studies. First, it speaks to recent work by Dahl, Kotsadam, and Rooth (2020) on whether working side-by-side with women in a traditionally male-dominated setting has an impact on attitudes about productivity and gender roles. In that study, the authors analyze a field experiment whereby females are recruited to some Norwegian military squads but not others during an 8-week boot camp to see if men adopt more egalitarian attitudes. They find an increase in the share of men who think mixed-gender teams perform as well or better than same-gender teams and who think household work should be shared equally. Second, this paper relates

[6] Several authors have analyzed how individuals modify their time between market and non-market activities as a response to temporary changes (Hamermesh 2002; Burda and Hamermesh 2010) or permanent changes (Lee, Hamermesh and Kawaguchi 2012; Stancanelli and van Soest 2012; Kawaguchi, Lee, Hamermesh 2013; Goux et al. 2014) in the time available for market work, or to shocks to market childcare prices (Cortés and Tessada 2010; Amuedo-Dorantes and Sevilla 2014).

to an evaluation of a randomized school-based program that engaged grade 7-10 students in India in classroom discussions about gender equality (Dhar, Jain and Jayachandran 2018). That study finds that the intervention caused gender attitudes to become more progressive and produced more gender-equal behavior, especially among boys who reported doing more household chores. While these two related studies focus on the short-run effects of these interventions on reshaping (mostly) gender attitudes, our work focuses instead on whether the Japanese educational reform generated more gender-equal behavior within and outside the household in the long run.

The structure of this paper is as follows. Section 2 explains the institutional background and the reform. Section 3 explains the regression discontinuity design, while Section 4 presents the data and validates the identification strategy. Section 5 presents the main findings and the robustness analysis, including placebo tests. Section 6 disentangles the direct versus indirect effects of the reform, while Section 7 presents the results on fertility and gender norms. Section 8 concludes the paper.

2. The Japanese Education System and the Reform

Japanese Education System Prior to the Reform

Compulsory schooling in Japan begins at age six and consists of six years of primary school and three years of junior high school, after which most students proceed to high school. Compulsory schooling is mostly public and coeducational,[7] with students not separated into ability groups or gifted classes. Importantly for our analysis, students remain in their age cohorts and are not advanced a grade if they are perceived to be exceptionally able, nor are they held back if they are having difficulty (OECD 2010). Hence, individuals enter first grade the year in which they are six years old on April 1, which is when the academic school year begins in Japan, and they continue with the same cohort until they graduate.

The Japanese education system is regulated at the national level, including the setting of national curriculum standards that define the content to be taught by grade and subject. To guarantee faithful implementation of this curriculum across the country, the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT), with advice from the Central Council for Education and the assistance of university professors and ministry staff, publishes detailed curriculum guidelines in the *Government*

[7] Private school and same-sex education in junior high school is uncommon in Japan. The percentage of private junior high schools was 5.4% in 1990 and 7.6% in 2018 (*The School Basic Survey* by MEXT). Based on our calculations using data from *The School Basic Survey*, we estimate that the percentage of single-sex junior high schools was less than 3% during the 2017-18 academic year.

Guidelines for Education (GGE). In addition, MEXT funds each of the 47 prefectures (the government jurisdiction between the county and national level roughly corresponding to a state or province which implements national policy at the local level) and provides them with detailed explanatory booklets for each subject and grade level so that instruction is based on the national curriculum standards throughout the country.

Japan is recognized by the OECD (2010) as having very little flexibility to adapt or modify the national curriculum, which requires students to take five core subjects (Japanese, social studies, mathematics, science, and foreign language), music, arts, physical education, and industrial arts-home economics (*gijutsu-katei,* IA-HE), which covers a wide range of skills from cooking, baby and child caring, meal planning, grocery shopping and sewing to building electronic circuits and constructing wooden furniture. Home economics was first introduced in 1947 as one of six areas[8] covered in a new compulsory course offered to all children from 5th grade to high school. According to Yokoyama (1996), soon thereafter, this course was restructured into two courses, occupation and home economics, with boys specializing in the former and girls in the latter. In 1958, Japan's desire to promote science and technology education prompted another revision of the GGE by which this course was renamed IA-HE, with industrial arts (wood shop, machinery, and electronics) offered to boys and home economics (cooking, family, clothing, and homemaking) to girls. Importantly, boys and girls were taught IA-HE during the same period but in physically segregated rooms—the school shop and the home economics room— instilling and perpetuating gender stereotypes during adolescence. This was in stark contrast with the core subjects, which were taught coeducationally in the students' homeroom.

In 1978, another GGE revision divided industrial arts into nine areas (wood-shop I and II, metal-shop I and II, machinery I and II, electronics I and II, and horticulture), and home economics into eight areas (clothing I, II, and III; food I, II, and III; housing; and nursing). It also required junior high school boys to choose five areas from industrial arts and one from home economics, and junior high school girls to choose one area from industrial arts and five areas from home economics. Hence, most of the content (83%) of IA-HE education continued to be differentiated by gender and, crucially, gender segregation also persisted, as boys and girls continued to be taught in physically segregated classrooms. It was not until the 1990 reform that gender-segregated and gender-stereotyped IA-HE junior high-school education was completely abolished.

[8] The six subject areas included agriculture, industry, business, fisheries, vocational guidance, and home economics.

The Reform: Coeducation in 1990

In 1980, concerns about Japan's international reputation prompted the Japanese government to sign the United Nations *Convention on the Elimination of all Forms of Discrimination against Women* (CEDAW). However, in order to ratify CEDAW, Japan needed to overcome several gender inequality hurdles in three areas: nationality, employment, and education.[9] With respect to education, concerns were raised that in Japan, the IA-HE junior high-school course segregated boys and girls both physically and in content taught. After pressure from the Ministry of Foreign Affairs, the Ministry of Education agreed to revise the IA-HE education in March 1984 with the creation of the Panel on Home Economics Education whose objective was to draft new regulations that would eliminate gender discrimination within junior high school IA-HE.

In March 1989, the Ministry of Education published new guidelines prohibiting any differential treatment between boys and girls in IA-HE junior high-school education. The new regulations required IA-HE to be taught coeducationally in the same physical room. In addition, it restructured its content into eleven subject areas: wood-shop, electronics, family life, food, metal-shop, machinery, horticulture, information technology, clothing, housing, and nursing, and made the first four subject areas compulsory for both boys and girls. Moreover, it allowed schools to choose three additional subject areas among the other seven (to be taught to both boys and girls) based on the characteristics of both the schools' region and student population. Among the eleven subject areas, two (family life and information technology) were newly created to respond to the progress of computerization and changes in family functions. Family life covered family care and relationships, as well as division of roles among family members. This GGE reform implemented in the 1990 school year brought an end to over 30 years of gender segregation in IA-HE junior high school education. As the normative changes (namely the two new subject areas) occurred at the same time as the desegregation of home economics, and as we have no information on the specific home economics courses individuals took in junior high school in the 1990s, we are unable to disentangle their role in explaining our results.

Currently, students attend two classes of IA-HE per week and each class lasts 50 minutes. Before the reform, students were required to take 245 classes of IA-HE over the three years of junior high school, of which boys took between 20 and 35 classes in home economics and the rest in industrial arts, while girls

[9] In terms of nationality, Japanese women married to foreign nationals could not give Japanese nationality to their children (while Japanese men married to foreign nationals could). The ratification of CEDAW led to the elimination of this gender asymmetry. In the labor market, men and women were also treated differently, and the Equal Employment Opportunity Act for Men and Women enacted in 1986 addressed the gender-differentiated treatment in this domain. To the extent that these changes affected all cohorts equally, they are not a threat to our identification strategy.

took between 210 and 225 classes in home economics and the rest in industrial arts. After the reform, the total number of classes of IA-HE required over the three years of junior high school ranged from 210 to 245 classes, with both boys and girls required to take a minimum of 70 classes in both subjects (industrial arts and home economics). For the other 70 to 105 classes, schools had discretion on which combination of industrial arts and home economics classes to offer as long as this combination was the same for both boys and girls and taught coeducationally.

Since the reform was implemented at the beginning of the 1990 school year, the first cohort to receive three full years of coeducational junior high school IA-HE is the cohort born after April 1977; hereafter, the 1977 cohort (See Appendix Figure A1). While the majority of the entering 7th grade students began coeducational IA-HE during the 1990 school year, most 8th and 9th grade students continued with gender-segregated IA-HE education because of the limited availability of IA-HE teachers and facilities (Yasuno 1991). Indeed, according to Yasuno (1991), during that year, 88% of junior high schools in Hyogo prefecture introduced coeducational IA-HE courses in the 7th grade compared to only 41% in 8th grade and 16% in 9th grade.[10] Even though some students from the 1975 and 1976 cohorts may have been taught IA-HE coeducationally, this was for only one or two years as opposed to the full three years of junior high school, and only after they had already experienced gender-segregated IA-HE for at least one year. It is therefore likely that gender stereotypes would have already been formed, making it difficult for one or two additional years of coeducation in IA-HE to reverse them. However, as both the 1975 and 1976 cohorts are included in our pre-reform group, our estimates are thus the lower bounds of the effect of the reform to the extent that these two cohorts may have been partially impacted by one or two years of coeducational home economics in junior high school.

3. Econometric Framework

Our aim is to explore whether the introduction of coeducational IA-HE courses in junior high schools in Japan in 1990 caused a behavioral change among those students several decades later when they were married and in their late thirties or early forties. Among the behavioral changes we study are the total daily minutes of home production, leisure, life-support activities, and market work during both weekdays and weekends,[11] other labor market outcomes (regular versus non-regular job, self-employment, non-

[10] Hyogo prefecture is a commercial center located in the western part of Japan.

[11] The analysis distinguishes between weekdays and weekends because they each have distinct patterns of time use.

employment, occupation and annual earnings) and fertility. The analysis is conducted separately for married men and women.

We take advantage of a sharp discontinuity across cohorts in the coeducational nature of the IA-HE curriculum and pedagogy during junior high school—from some (one to three full years of) gender-segregated and gender-stereotyped education to three years of coeducation—that took place beginning April 1, 1990, when the Japanese government implemented the reform. Our model implements a regression discontinuity (RD) design in which treatment status (receiving three years of coeducational IA-HE during junior high school) is a deterministic and discontinuous function of time. Academic year of birth (D_i) is the running variable[12] that determines whether individual i is exposed to full treatment or not and it is normalized to 0 at the cut-off, which is April 1977. The empirical specification is:

$$Y_i = \alpha + \beta Post_{1977} + \delta X_i + \sum_{k=2}^{47} \mu_k(\pi_j) + \sum_{m=2}^{7} \eta_m(Q_m) + [(1 - Post_{1977}) \times f_0(D_i)] + [Post_{1977} \times f_1(D_i)] + \varepsilon_i \quad (1)$$

where Y_i is the outcome variable for individual i. $Post_{1977}$ is a dummy variable taking a value of one for all individuals who were born after April 1977 and hence began junior high school after the implementation of the reform, and zero otherwise. The vector X_i contains variables that control for individual i's socio-demographic characteristics such as their highest educational attainment or whether they live in a three-generation household. As these controls may be endogenous, they are not included in our preferred specification, but instead are used as robustness checks. In some specifications, X_i will also control for the number of children and the presence of children under ten years old in the household. In addition to prefecture j fixed effects, $\{\pi_j\}_{j=2}^{47}$, which capture institutional and structural differences across prefectures, we also include controls for the day of the week the time-use survey took place, $\{Q_m\}_{m=2}^{7}$.[13] We allow for a different trend $f_j(D_i)$ before ($j = 0$) and after ($j = 1$) the reform implementation date. In our baseline specification, $f_j(D_i)$ is a linear function, but in the sensitivity analysis in Section 5, we present alternative specifications with different windows around the threshold (from 3 to 10 years), as well as different orders of the polynomial in the running variable. Standard errors are clustered at the level of the running variable,

[12] Using the month and year of birth from the Japanese Time-Use Survey (JTUS), we assigned individuals to their academic year.

[13] Monday through Friday dummy variables represent weekdays, and Saturday and Sunday dummy variables represent weekends.

which in our case is the year of birth.

The coefficient of interest, β, captures the causal effect of the junior high school reform on the outcomes of married individuals such as their daily time use in 2016. Note that at the cutoff point, individuals were born in April 1977, so $f_j(0) = 0$ for $j = 0, 1$. Hence, any causal effect associated with the implementation of the reform will be absorbed by our coefficient of interest, β. For example, a positive and statistically significant β would provide evidence that the junior high school reform increased students' daily time use within their marital household decades later.

Identification comes from assuming that the underlying potentially endogenous relationship between ε_i and the year and month of birth is eliminated by the flexible functions $f_0(D_i)$ and $f_1(D_i)$ that absorb any smooth relationship between the birth year and month and ε_i. To put it differently, the polynomial cohort trend, $f_j(D_i)$, controls for any variation in an individual's outcome variable that would have occurred in the absence of the reform, picking up smooth changes in that outcome variable caused by other policies that take effect slowly over time. Crucially, these flexible linear cohort trends control for potential variation arising from observations further and further away from the threshold. We also allow these trends to differ on either side of the implementation date to increase flexibility in our specification.

Our identifying assumption is that having begun junior high school (attended 7th grade) during the 1990 school year is as good as random. If this assumption holds, we expect to observe no bunching in the number of births around the cut-off date, and balanced socio-demographic characteristics around the threshold, on average. We test for these implications in the next section.

4. Data

This study utilizes microdata from the nationally representative *Japanese Time-Use Survey* (JTUS). By conducting this survey every five years since 1976, the Statistics Bureau of Japan collects the most comprehensive and reliable data on daily time-allocation patterns, including total daily minutes of childcare, housework, market work, and any other use of time. Because we are interested in analyzing how a junior high school education reform in 1990 affected the long-run time-use distribution of home production within households, it is important that we observe these individuals several years after they have formed their families.[14] Hence, we focus our analysis on the 2016 JTUS because, by that time, cohorts that had begun

[14] The average age of first marriage was 31.1 years old for men and 29.4 years old for women in 2016 (MHLW, *Vital Statistics*).

junior high school three years before and after the 1990 academic year when the reform was implemented were now between 37 and 42 years old.[15]

JTUS adopts a two-stage stratified sampling method in which enumeration districts (ED) from each of the 47 prefectures are selected in the first stage and, within each selected ED, households are selected in the second stage. Within the selected households, all individuals 10 years old or older are asked to respond to the survey. In 2016, the JTUS collected time-use information on 176,285 individuals (83,670 of whom were men) from 76,553 households. This information was collected during two consecutive days within the nine-day period from October 15-23, 2016. For each of these two days, the individual was asked to provide information on time use via a pre-coding questionnaire,[16] which divides the 24 hours in a given day into 96 time segments of 15 minutes each[17] and offers 20 possible activities.[18] For each 15-minute time segment, the respondent selects the most appropriate of the twenty pre-printed activities, with individuals engaged in more than one activity at the same time instructed to report the primary activity. Our analysis focuses on home-production time, defined as daily time spent (in minutes) by the husband (or the wife) in any of the following five activities: housework,[19] childcare, caregiving to sick children or the elderly, grocery shopping, and travel time for home production (which excludes commuting time to and from school or work). In addition, we also estimate the share of time the husband (or the wife) spends on the couple's total daily time spent in home production. Furthermore, we present a heterogeneity analysis by classifying home-production time into the

[15] The cohort that began junior high school on April 1, 1987 was born between April 2, 1974 and April 1, 1975. Similarly, the cohort that began junior high school on April 1, 1993 was born between April 2, 1980 and April 1, 1981.

[16] In contrast with the after-coding method whereby the respondent details his or her time use over a single day in nominal terms (that is, not following categories or time ranges) that is commonly used in other countries such as the US, the simplicity and efficiency of the pre-coding method allows for considerably larger samples. For example, the 2016 JTUS interviews 76,553 households whereas the American Time Survey interviews 26,400 households.

[17] Such as 0:00-0:15, 0:15-0:30, … 23:45-24:00.

[18] The twenty activity categories are: 1) sleep, 2) personal up-keep, 3) meals, 4) commuting to and from school or work, 5) work, 6) school, 7) housework, 8) caregiving to the elderly or sick children, 9) childcare, 10) shopping, 11) transportation (excluding commuting to and from school to work), 12) TV, radio, newspaper, and magazine, 13) rest and relaxation, 14) job training, 15) hobby, 16) sports, 17) volunteering and social services, 18) associations, 19) healthcare, and 20) other.

[19] Housework includes many chores: cooking, washing dishes, cleaning, taking out the trash, doing laundry, ironing, sewing, bed making, folding clothes, doing household accounts, managing the household's assets, weeding, doing banking or errands at city hall, car care, and furniture repair.

following three categories: housework, childcare, and "other" activities (with "other" an aggregation of the remaining three categories of the original five because time devoted to these was relatively small).[20]

As of October 20, 2016, JTUS also collects socio-demographic individual characteristics for every household member over 10 years old. These include information on age, sex, marital status, number of children, relationship to household head, education, employment and self-employment status, usual weekly work hours, full-time versus part-time status, regular versus non-regular work, and annual income. While regular jobs allow workers to progress within the firm, have salary promotions, job benefits, and job security until retirement, non-regular jobs are temporary or part-time jobs with low salaries and no benefits. The annual income is taxable labor income from the previous year (from October 20, 2015 to October 19, 2016 for the 2016 JTUS).

Sample Restrictions

We restrict our analysis to married individuals who filled the time-use diary for at least one of the two days.[21] We focus on married individuals, as we are mostly interested in observing whether the 1990 implementation of the junior high school educational reform had an impact in the long run on those students' home production time within the household.[22] Given our identification strategy, we further restrict our sample to couples in which at least one of the spouses was born within the window of three years before or after April 1977. In other words, we include all individuals born between academic years 1974 and 1979, regardless of whether their spouse was born within those same cohorts.

The 2016 JTUS has information on 350,744 days, 166,429 of which were reported by men (62,895 weekdays and 103,534 weekends). Restricting the sample to men born between school years 1974 and 1979 leaves us with 5,981 weekdays and 10,001 weekends. Further restricting the sample to those who are married and whose information on home production time is not missing leaves us with 3,564 weekdays and

[20] The majority of time spent in "other activities" is grocery shopping—74.1% for men and 59.6% for women.

[21] All respondents are required to answer the time-use diary for two consecutive days. However, some people only responded for one day, showing only a single-day diary. The number of individuals who provided a one-day response is small: 306 men (4.8%) in the weekend sample (6,371), and 88 women (1.1%) in the weekend sample (7,712). Overall, there are no large differences between one- and two-day respondents.

[22] In Japan, a household usually consists of a married man and woman because cohabitation outside of marriage is uncommon, ranging from less than 1% of respondents in 1987 to close to 2% in 2005 based on the *Japanese National Fertility Survey* conducted by the National Institute of Population and Social Security Research.

6,371 weekends. A similar exercise leaves us with 4,589 weekdays and 7,712 weekends reported by women.[23] These are the samples used for the time-use analysis.

To analyze labor market outcomes and fertility, we use the 2016 JTUS information at the individual level. Restricting the sample to individuals born between academic years 1974 and 1979 leaves us with 8,037 men and 8,399 women. Further restricting the sample to married individual with non-missing labor market outcomes leaves us with 5,393 men and 6,251 women.

Descriptive Statistics

Table 1 presents the descriptive statistics of the time Japanese married men and women spent on home production on weekdays and weekends in 2016. Estimates are shown separately for the 1974 to 1976 (pre-reform) and the 1977 to 1979 (post-reform) cohorts. We observe a large gender disparity in home production, as Japanese women in the pre-reform cohorts spent on average close to six hours per day in home production during weekdays, close to ten times more than the amount spent by their male counterparts (37 minutes per day). While this gender gap is reduced during weekends, women still spent 3.4 times more on home production than men—5 hours and 54 minutes versus 1 hour and 46 minutes.

Comparing the change in home-production time across pre- and post-reform cohorts, the 25 percent increase observed among men over the weekend is about four times larger than the 8 percent increase observed among women, suggesting a differentiated change in growth rates across genders after the reform. We also observe a 16 percent increase in men's share of home production on weekends but only a slight 2 percent decrease in women's.

Next, a similar gender disparity is observed in the amount of time spent on work-related activities including working, commuting to and from work, and job training, with pre-reform men spending on average about 10 hours (610 minutes) per day during weekdays, double the amount spent by women on weekdays (301.7 minutes), as shown in Appendix Table A1. On weekends, men spent, on average, about 4 hours per day working, 2.5 times the amount spent by women. Similarly, Table 2 underscores significant gender differences in labor market characteristics across Japanese married men and women. While most pre-reform men (82%) work in regular jobs, pre-reform women are more likely to work in non-regular jobs (45%) followed by regular jobs (25%) or not employed (23%). Not surprisingly, the gender gap in annual

[23] Of the 184,315 days reported by women in the 2016 JTUS, 69,697 are weekdays and 114,618 weekends. Restricting the sample to those born between school years 1974 and 1979 leaves us with 6,272 weekdays and 10,454 weekends.

employment income is large, with women earning 62% lower annual labor earnings than men.[24] Comparing the change in women's regular and non-regular jobs across pre- and post-reform cohorts, we observe a two percentage point increase in regular jobs, and a seven percentage point decrease in non-regular jobs.

Finally, Table 2 also shows that 89% of pre-reform married men and 87% of pre-reform married women have children, 2.5 and 2.6 children on average, with 57% of men and 51% of women having young children under 10 years old. Children of post-reform cohorts are fewer and younger.

Manipulation of Running Variable Test

It is important for our identification assumption that the assignment to treatment around the threshold is random and that the density of the running variable does not jump around the cutoff. *A priori* manipulation of the running variable (time of birth) is very unlikely because these individuals were born between 1974 and 1979, more than a decade before the policy change was announced in 1989. Indeed, the distribution of the running variable using the 2015 *Japanese National Census* reveals no discontinuity whatsoever at 1977 for either males or females born between 1972 and 1982 (shown in Appendix Figure A2).[25] Moreover, since advancing or holding back students a grade is extremely rare in Japan as explained in Section 2.1 above, we do not need to worry about parents strategically placing their children in different grades.

Even though there is no manipulation of the running variable, a related concern would be a jump in the density of the running variable in our sample of respondents. Figure 1 shows the distribution of the running variable separately for the respondents in our samples of (1) weekday and (2) weekend time-use and (3) labor market outcomes by gender. Among all three samples for women and the weekday sample for men, there is little indication of a discontinuity near the cut-off point. Indeed, the density appears generally quite smooth around the threshold, suggesting that individuals (or their parents) did not manipulate their date of entry into junior high school. While this may be less clear for the weekend time-use and labor market outcome samples for men, the 95% confidence interval of the Cattaneo, Jansson, and Ma (2019) manipulation test of the running variable does not indicate a discontinuity at the cut-off point. Moreover, as we could not reject the null hypothesis that the density of units is continuous near the cut-off point in either of the data subsets, it is safe to assume that assignment to treatment near the threshold is essentially randomized.

[24] Based on annual male and female earnings in Table 2, we estimate the gender gap to be 63% = (509.8-191.3)/509.8*100.

[25] *The Japanese National Census* only has information on the calendar year, not the school year. We observe a declining fertility rate over time, but no jump at or around 1977.

Because we focus on married individuals, another potential concern is that there may be a discontinuity in the marriage rate at the 1977 cut-off point. Appendix Figure A3 shows the marriage rate by birth cohort separately for men and women in our sample using both the Census data and our JTUS sample. Appendix Figure A3 shows a similar declining trend in the marriage rate across both datasets, with younger cohorts less likely to be married than older ones. Importantly, we do not observe a discontinuity in the marriage rate at the 1977 cut-off point among men or women. Moreover, we also do not observe any statistically significant discontinuity at the 1977 cut-off point when estimating a 3-year bandwidth RD model with prefecture and day of the week dummy variables and a marriage status indicator as the left-hand-side variable for the sample of all men and women in the 2016 JTUS data set.[26] The lack of discontinuity in the marriage rate around the cut-off point indicates that the junior high school reform did not have an impact on the marriage rate of men and women.

Endogenous Sorting Test

The validity of the RD design also depends on the non-existence of any endogenous sorting. To explore the validity of this assumption, we examine whether individuals' socio-demographic characteristics are balanced (meaning they have equal conditional expectations) around the cut-off point. Evidence of no discontinuity among observable covariates around the cutoff would suggest that discontinuity among unobservable characteristics is less likely. These tests (shown in Table 3) reveal that, for men, two of our six coefficients are statistically significantly different from zero at the 10% level, which is more than what we would expect by chance, but none are statistically significantly different from zero at the 5% level, which is the standard criterion for significance. For women, none of our coefficients are statistically significantly different from zero.

Table 3 also shows the means for the different socio-demographic characteristics of pre-reform men and women. On average, these individuals are close to 41 years old, have almost 14 years of education (with men slightly more educated than women), and live in 4-person households. In addition, three fifths of these individuals live in high minimum wage prefectures.[27] Women in our sample are married to men who are, on average, 2.5 years older than them, and men are married to women who are one year younger than them.

[26] The coefficient β is 0.011 (standard error is 0.012).

[27] Each Japanese prefecture sets its own minimum wage (MW). We classified prefectures with high MW as those 23 prefectures whose MW were above the median. These include Tokyo and Osaka.

5. Main Findings

Home-Production Time

Figure 2A plots the evolution of weekday and weekend home-production time spent by men (Panel a) and women (Panel b) from cohorts 1974 to 1980 with its 95% confidential interval following the procedure of Calonico, Cattaneo, and Titiunik (2015, 2014).[28] The horizontal axis shows the running variable (time), centered on April 1977 which is highlighted by a vertical line. After this date, which is normalized at zero, cohorts were treated with three years of coeducational industrial arts and home economics (IA-HE) instruction during junior high school. To gauge the importance of the discontinuity, the solid line is a linear regression estimated to approximate the population conditional mean functions for the control and treated units. This linear specification is the same as our baseline estimation in the RD regression model.

Figure 2A reveals a sharp upturn (of 20 minutes) in the time treated men spend in home production on the weekend, but no effect on weekdays. The jump is less clear among women but, if anything, indicates a decrease in weekend home production after the reform. This is preliminary evidence that the junior high school reform may have had an effect on weekend home production among men at the cut-off point. Figure 2B plots the evolution of men's share of the couples' weekday and weekend home production. Consistent with Figure 2A, it shows a jump in the treated men's share of household home production during the weekends relative to the pre-reform male cohort, suggesting that the reform affected the intra-household distribution of home-production time.

To explore whether the educational reform has modified Japanese married couples' distribution of home-production time, Table 4 presents estimates of our RD model described in Section 3 using different specifications. Panel A presents results for males and panel B presents results for females. In the first two rows of each panel in Table 4, we use as left-hand-side (LHS) variables the weekday time spent in home production in minutes and as a share of the couple's total time spent in home production, respectively. The next two rows present similar estimates using weekend home-production time and share as LHS variables.

Column 1 in Table 4 presents estimates from our baseline and preferred RD model that controls only for prefecture and day-of-week fixed effects with a linear specification. Among men, we observe that the coefficient of interest, $\hat{\beta}$, which captures the causal effect of the junior high school reform on the outcome variable of married individuals is positive and statistically significant at the 5% level or higher for: (1) the share of the couples' weekday time spent in home production, (2) weekend home-production

[28] The dots represent the local sample means over non-overlapping bins under evenly spaced partitions. The number of bins is selected according to the mimicking variance method which is explicitly tailored to approximate the underlying variability of the raw data and is thereby useful in depicting the data in a disciplined and objective way.

time, and (3) the share of the couples' weekend time spent in home production. In contrast, $\hat{\beta}$ is negative and statistically significant at the 5% level for women's weekend time and the share of the couples' weekend time spent in home production, suggesting that the educational reform reduced the weekend home production gender gap.

The economic interpretation of the estimates is that the junior high school educational reform increased the weekend home production of males by 20 minutes per day (the equivalent of an 18% increase from the pre-reform average of 1 hour and 47 minutes) and the male share of the couple's weekend home production by 2.4 percentage points, or a 13% increase from the pre-reform average of 18.7%. At the same time, the reform reduced the time women spent in home production by 16 minutes (a 5% decrease from the pre-reform average) and their share of the couple's weekend home production by 1.3 percentage points (or 1.6%).

Column 2 adds to the column 1 specification controls for an individual's years of education and whether he or she lives in a three-generation household, characteristics which are potentially endogenous.[29] Importantly, adding them does not change the main finding for men. For women, only the reduction in the share of the couples' weekend home production remains statistically significant at the 1 percent level. Potential concerns that our findings may be driven by a higher presence of young children in the household are addressed in column 3, which adds to the specification in column 2 the number of young children in the household and number of children under ten years old. While adding these controls changes slightly the size of some of the $\hat{\beta}$ coefficients, overall, the main results hold, suggesting that they are not driven by the presence or number of young children in the household.

Weekend Home-Production Time Use by Type

To disentangle what type of activity is driving men's increase in weekend home production, Figure 3 plots the evolution of men's weekend home-production time by type of activity. It reveals that the upturn is driven by time spent on childcare and other housework, which includes grocery shopping, caregiving to sick children and the elderly, and travel time for home production. For the sake of completeness, Appendix Figure A4 shows the evolution of women's weekend home-production time by type of activity.

[29] Ichino and Sanz de Galdeano (2005) argue that the presence of grandparents in the household plays an important role in determining how much time parents spend with their children in childcare. In our sample, 15% and 17% of our pre-reform men and women live in a three-generation household, respectively. These averages are statistically significantly higher by 1.8 and 3.2 percentage points for post-reform men and women.

Panel A of Table 5 presents estimates of our baseline specification using as LHS variables time spent in different types of weekend home-production activities by treated males (row 1) and treated females (row 3). Rows 2 and 4 show a similar analysis with the wives of treated males (row 2) and the husbands of treated females (row 4). Note that in this case, we use as the running variable the husbands' date of birth in row 2 and the wives' date of birth in row 4. These two rows capture the indirect effect of the reform on the spouses of treated individuals. The different types of home production are housework (column 1), childcare (column 2) and other (column 3).

Focusing on men first, we observe that those affected by the reform increased their weekend time spent taking care of children by 14 minutes and doing other activities by 12 minutes and reduced their time on housework by 6 minutes. Meanwhile, their wives decreased their weekend time spent on housework by 14 minutes and other home-production activities by 8 minutes (shown in row 2). All these estimates are statistically significant at least at the 5% level. At the same time, row 3 shows that the reform reduced by 5 minutes the weekend time treated women spent doing other home-production activities at the expense of their husbands, who increased such time by 15 minutes (shown in row 4). Hence, perhaps not surprisingly, we observe that an externality of the reform was to also impact the weekend home-production time of the spouses, independently of whether they themselves were directly affected by the reform or not.[30] Section 6 below will analyze the direct and indirect effects of the reform distinguishing by whether the spouse was treated or not.

Weekend Non-Home-Production Activities

Table 4 revealed that the junior high school reform had a long-term impact on the household distribution of time during the weekends, as men increased their home-production time by 20 minutes and women decreased it by 16 minutes. Similarly, Panel A of Table 5 revealed that the husbands of treated women increased their weekend home-production time by 18 minutes while the wives of treated men decreased their home-production time by 8 minutes. Consequently, one may wonder what weekend activities were crowded out by the increase in men's home-production time. Conversely, one may also ask what weekend activities expanded as women reduced their home-production time.

To address these questions, Panel B of Table 5 shows the effect of the educational reform on weekend time spent in activities other than home-production, namely leisure (column 4), life support

[30] Rows 2 and 4 estimate the effect of the reform on the spouses, regardless of whether or not they were directly affected by the reform.

(column 5) and (paid) work-related activities (column 6). Leisure activities include watching TV, listening to the radio, reading the newspaper or magazines, resting and relaxing, doing hobbies or sports, volunteering and participating in social services or associations. Life-support activities include activities involving personal care, eating and sleeping, and work-related activities include working, commuting to and from work, and job training. As in Panel A, the estimates are obtained using our baseline specification and are shown for treated males and females (rows 1 and 3) and their spouses (rows 2 and 4).

We find that the reform reduced the gender gap in time spent in work-related activities on the weekend. This is illustrated by Figure 4, which plots the evolution of weekend time in work-related activities for men and women. For more detail, the plots for weekend time spent in the different types of non-home-production activities are shown in Appendix Figures A5 and A6. As the junior high school reform reduced treated men's weekend time in work-related activities by 30 minutes and increased women's weekend time in work-related activities by 13 minutes, this gender gap was reduced by 43 minutes. Interestingly, treated women also reduced their weekend time spent in leisure activities by 7 minutes. Both treated men and women increased their time in life-support activities by 9 minutes.

Labor Market Outcomes

The evidence thus far indicates that the implementation of the junior high school reform reduced the gender gaps in weekend home production and in (paid) work-related activities by increasing men's engagement in traditionally female activities (home production) and decreasing men's engagement in traditionally male activities (work-related activities), and the opposite for women. We also observe a small effect of the reform on the gender gap in the weekday share of home production, as the reform increased the male share but had no effect on female home-production time. We now proceed to analyze the impact of the reform on the labor market outcomes of married women. To explore this, Figure 5 plots the evolution of different labor market outcomes for Japanese married women such as the share of women who are working in regular and non-regular jobs, self-employed or out of work, who are working in high-wage occupations[31], and their annual wage and salary income. At the cut-off point, we observe a discontinuity in the share of regular and non-regular work and in annual wage and salary income. Appendix Figure A7 shows similar plots as in Figure 5 for married men. To gauge the causal effect of the reform on these outcomes, Table 6 presents estimates of our baseline specification using married women's labor market outcomes as LHS variables;

[31] A high-wage occupation dummy variable takes a value of 1 if the average occupation wage is higher than the overall average and 0 otherwise. High-wage occupations include managers, professionals and engineers, clerical workers, security workers, manufacturing workers, transportation and machine operation workers, and workers in construction and mining. Low-wage occupations include sales, services, agriculture, forestry and fishery, cleaning and packaging.

namely, time spent working on weekdays, the likelihood of working in a regular job or a non-regular job, being self-employed and not working, and annual employment income.[32] The analysis is performed separately for treated males and females (rows 1 and 2). Focusing first on treated women, we observe that the reform increased women's likelihood of working in a regular job by 5 percentage points (a 19% increase) and decreased their likelihood of working in a non-regular job by 6 percentage points (or 12%). The reform also increased women's annual earnings by 12%, given average earnings of 1.91 million yen ($17,879, $1=107 yen) for the pre-reform cohorts. As no effect is found on the likelihood of working in high-occupation jobs or at the intensive or extensive margin, this income effect is driven by the higher access to well-paying jobs with benefits (i.e. regular jobs rather than non-regular jobs). It is interesting to observe that the reform had a negligible impact on male labor market outcomes.[33] It is noteworthy that the reform only reduced men's work time during the weekdays by a non-statistically significant 5 minutes, despite pre-reform cohorts working, on average, 10 hours and 10 minutes daily. This lack of effect on the long daily work hours would limit the capacity of the reform to increase men's weekday home production, especially if social norms in the labor market are such that men are expected to stay long hours in their job.

Sensitivity Analysis, Potential Confounders, and Placebo Tests

Table 7 presents robustness checks for our main outcome variables; namely, weekend home-production time for men, and the likelihood of working in a regular job, a non-regular job, and annual employment income for women. Column 1 presents our baseline estimates for comparison purposes. Columns 2 and 3 present estimates using one-year smaller and larger bandwidths, respectively. Columns 4 to 8 present estimates using 5- or 10-year bandwidths and different functional polynomial forms. While we do observe some changes in the size and precision of a few estimates, overall, the findings tell a consistent story; that is, the reform reduced the gender gaps in weekend home production and in regular and non-regular employment and annual income.

We follow the advice of Lee and Card (2008) to cluster standard errors at the level of the running variable in an RD model with a discrete running variable, which in our case is the year of birth. Concerns that our confidence intervals may be downward biased because of the small number of clusters (see Cameron, Gelbach, and Miller, 2008) are addressed by following the advice of Kolesár and Rothe (2018) and using White robust standard errors for inference instead. Appendix Table A2 presents estimates of our

[32] A respondent is required to select an income range such as less than 500,000 yen, 500,000-999,999 yen, and so on. We used the median of each category. If a respondent does not work, we set the income to 0.

[33] The finding that family policies have a negligible impact on men's labor market outcomes is not uncommon (Farré and González 2019).

key outcomes without clustering the standard errors (column 1), clustering the standard errors at the year-of-birth level, and using White robust standard errors. All the home production and labor market coefficients remain statistically significant with White robust standard errors, albeit some may be less precisely estimated.

Following an inflating asset price bubble in the late 1980s, Japan experienced a severe collapse in asset prices in the early 1990s from which it has still not fully recovered, as measured by the Nikkei 225 or TOPIX stock indices. During the collapse of the asset price bubble in 1991, our pre-reform cohorts were between 15 and 17 years old, while our post-reform cohorts were between 11 and 14 years old. During the Asian financial crisis (1997-98), our pre-reform cohorts were between 22 and 24 years old while our post-reform cohorts were between 18 and 21 years old. To the extent that there are lasting scarring effects of graduating during a recession (Genda, Kondo, and Ohta 2010; Hashimoto and Kondo 2012; Oreopoulos, Von Wachter, and Heisz 2012; Raymo and Shibata 2017; Fernández-Kranz and Rodríguez-Planas 2018), our pre- and post-reform cohorts may have been impacted differentially by the subsequent slack labor market and high unemployment rates. In both cases, older cohorts may have been more directly impacted, as their high-school or college graduation was closer in time to the peak of the crisis. To the extent that pre-reform cohorts would have had a harder time finding (good) jobs than post-reform cohorts, one may be concerned that our results might be confounded, with these crises differentially impacting the pre- and post-reform cohorts in our analysis. However, because we find zero effects of the reform on men's labor market outcomes (shown in Table 6), it is very unlikely that our findings simply reflect worse labor markets at graduation for the pre-reform than the post-reform cohorts unless the crises only affected women, which would contradict our knowledge of the context and the findings in Genda, Kondo, and Ohta (2010). Similarly, it is unclear how such crises would differentially impact men's and women's home-production distribution. However, note that if these crises hit younger cohorts harder than older ones, our labor-market estimates would be lower bound estimates.

Because we cannot test selection on unobserved variables around the discontinuity, Figure 6 shows the effect of *fictitious* reforms 3, 2 and 1 year before 1990 and 1, 2 and 3 years after 1990. The estimate shown at "0" is the coefficient of the actual reform in 1990. For each placebo estimate, we also display its 95% confidential interval. We find that the placebo estimates are either not statistically significantly different from zero or have the wrong sign, so the placebo results from Figure 6 suggest that our results are not due to uncaptured systematic differences between younger and older cohorts.

Subgroup Analysis

Table 8 presents subgroup analysis by education level (distinguishing between with a university degree or higher and with only two years of college or less), whether the individual lives in a three- or two-generation

household, and whether they live in a high-wage prefecture (that is, Tokyo, Kanagawa, Aichi, Osaka) or a low-wage prefecture (the rest of Japan).

Subgroup analysis by highest educational attainment allows us to address any potential concern that our findings may be confounded with a Japanese labor market reform, the 1997 Revision of the 1986 Equal Employment Opportunity Law between Genders (EEOL), which introduced new prohibitions against gender discrimination in job posting, hiring, and promotion, and was implemented in 1999. As the implementation of the revised EEOL coincides with the year the 1977 cohort would have graduated from university and, hence, entered the labor market, one may be concerned that we might be unable to disentangle the effects from both reforms for university graduates. To address this, Columns 1 and 2 of Table 8 show the effect of the reform separately according to whether or not individuals have a 4-year university degree. If our results were driven by the EEOL reform, we would not find any effect on the non-university educated subgroup (column 1). However, as the educational reform had a widespread impact in both the home-production and labor-market outcomes of non-university female graduates, it is unlikely that our findings are driven by this later reform. Furthermore, as less than one third of the 1977 female cohort attended university (32.1%), it is the non-college group that is most salient in this cohort.

Further, we would expect the effect of the reform to be stronger among those living in more traditional communities, and subgroup analysis according to whether the individual lives in a three- versus two-generation household explores this. The effect of the reform on women's labor market and men's home production activity is stronger among those living in three-generation households than those living in nuclear families. The only exception is women's home production time, which increases in traditional households (albeit it is not statistically significantly different from zero). An alternative way to explore this is to classify prefectures by whether they are high- or low-wage prefectures, as the ones in the high-wage group (Tokyo, Kanagawa, Aichi, Osaka) are centers of economic activity in Japan and also have a higher population density, as they are the largest metropolitan areas. While the effect of the reform on both male and female home production is widespread across the two types of prefectures, we observe that the effect on women's employment is largely driven by women living in low-wage prefectures; that is, rural prefectures (shown in columns 5 and 6).

6. Direct and Indirect Effects of the Reform by whether or not Spouse was also Treated

To disentangle the potential mechanisms at work, in Tables 9 and 10 we present the direct and indirect effects of the reform by whether or not the spouse was also treated. The direct effect of the reform is the effect on the individual who was actually treated, while the indirect effect is the effect of the reform on an

individual whose spouse was treated. The direct effects are estimated using equation (1) separately for whether or not the spouse was treated, and these are shown highlighted in yellow in Tables 9 and 10. Similarly, the indirect effects are also estimated separately by whether or not the spouse was treated, but, in this case, the running variable for equation (1) is the spouse's date of birth instead of the treated person's date of birth.

Focusing first on the impact of the reform on women's labor market outcomes, Table 9 shows that the labor market convergence is solely driven by the direct effect of the reform on women and that this effect is stronger if the husband was also treated. When both spouses were treated (column 1), the reform directly increased treated women's likelihood of regular employment by 18 percentage points, or 72%, and directly decreased their likelihood of non-regular employment by 18 percentage points (-43%) and of self-employment by 6 percentage points (-100%). As a result, the reform also increased their annual earnings by 384,610JPY (or $3,594, given $1=107 yen, an increase of 29%). Perhaps not surprisingly, the reform had smaller (but far from negligible) labor market impacts for women whose husbands were not treated (column 2): it increased their likelihood of regular employment by 6 percentage points (24%) and annual earnings by 232,270JPY (approximately $2,127, an increase of 16%).[34] The aforementioned coefficients are statistically significant at the 5% level or better. In contrast, Panel B of Table 9 reveals that the reform did not have any indirect effect on the labor market attachment or earnings of the wives of treated men, as the coefficients on regular employment are close to zero and negative, and those on income are also small and not statistically significant.

Moving to the impacts of the reform on the distribution of home production within the household, Panel C in Table 10 presents the direct impact of the reform on women's home-production time (highlighted in yellow), and Panel A presents the indirect effect on their husbands' outcomes; whereas Panel B presents the direct impact of the reform on men's home-production time (highlighted in yellow), and Panel D presents the indirect effect on their wives.[35] Focusing on the direct impact of the reform on women (Panel C), the reform had a large impact on those with treated husbands (shown in column 1) as it decreased their weekend childcare time by 48 minutes and increased their (paid) work-related time by 56 minutes (albeit only marginally statistically significant at the 10% level). We also observe a reduction in other home production activities, though smaller, for women whose husbands were not treated: a 14-minute decrease in weekend time spent on other home-production activities and an 18-minute increase in job-related

[34] The pre-reform means for these groups are available in Appendix Tables A.3 and A.4.

[35] Panels A and C in Table 10 use as the running variable the wives' date of birth, whereas Panels B and D use as the running variable the husbands' date of birth.

weekend activities. Subgroup analysis according to whether the couple has children younger than 10 years old reveals that the direct effect of the reform on women whose husbands were also treated is larger if there are small children in the household: a statistically significant reduction of 34 and 51 minutes in housework and childcare, respectively, for mothers of small children versus a decrease of 13 and 14 minutes for those without small children.[36] The reduction for those with small children is statistically significant at the 5% level or lower. The reduction for those without children lacks precision because the sample size is small.

Interestingly, the reform had a large indirect effect on the weekend home production time of the husbands of treated women, and the effect is (not surprisingly) larger if the husband was himself also treated, though the aggregated effect (shown in column 1, row 1 of Panel A) lacks precision. When both spouses were treated, the indirect effect of the reform is to increase men's housework by 12 minutes and other home-production activities by 25 minutes (column 1 of Panel A). When only the wife was treated, the indirect effect of the reform is to increase men's childcare by 21 minutes and other home-production activities by 14 minutes (column 2 of Panel A). Subgroup analysis according to whether the couple have children younger than 10 years old reveals that the indirect effect on husbands' home-production time is the same regardless of the presence of young children if both the husband and wife are treated, and smaller for couples without young children if the husband is untreated. At the same time, there are non-negligible indirect effects of the reform on husbands' time spent on job-related activities over the weekend, with a reduction of 31 minutes (albeit not statistically significant) if the husbands were themselves treated (column 1 of Panel A) and 22 minutes if they were not (column 2 of Panel A). These findings suggest that males' greater engagement in home production is, at least partially, channeled through the impact of the reform on their wives.

In contrast, the direct effect of the reform on men's weekend home-production time depends on whether or not the wife was also treated. Column 4 of Panel B shows that if the wife was *not* treated (and hence older than him), the reform increased men's weekend time in childcare (28 minutes) and leisure (27 minutes) at the expense of time on job-related activities (a 45-minute decrease). Not surprisingly, subgroup analysis according to whether the couple has children younger than 10 years old reveals that the fathers' higher childcare involvement is driven solely by those with young children in the household, with an increase of 46 minutes over the weekend. This estimate is statistically significant at the 1 percent level. However, column 3 of Panel B shows that if both spouses were treated, the reform did *not* directly increase men's weekend home-production time.[37] Instead, it increased men's weekend time on life-support activities

[36] Estimates for the presence of small children in the household are available from the authors upon request.

[37] It actually decreased men's time in housework by an average of 6 minutes.

(21 minutes) and work-related activities (24 minutes) at the expense of their leisure (a 42-minute decrease)—shown in column 3 of Panel B. In summary, the impact of this reform on men's' higher involvement in weekend home production seems to be driven indirectly through their wives. The reform only had a direct impact on men's' home-production for those married with older wives and with young children.

The indirect effect of the reform on the wives of treated men is a 14-minute reduction in other home-production activities if the wife was untreated (and hence, older)—shown in column 4 of Panel D). If both spouses were treated (column 3 of Panel D), the indirect effects of the reform on wives' home production cancel out, as the decrease in housework (29 minutes) by wives is neutralized by an increase in childcare (27 minutes). This is solely driven by those with small children in the household.

In summary, the reform had a direct impact on the attachment of Japanese women to the labor force, which seems to have changed the distribution of gender roles within the household, as we observe both a direct effect of the reform on treated women and an indirect effect on their husbands. Specifically, women spend more time in traditionally male tasks within the household during the weekend and less time in traditionally female household tasks. Conversely, their husbands spend more time in traditionally female household tasks and less time on traditionally male tasks. Interestingly, this indirect effect of the reform on husbands' increased home-production time holds and remains statistically significant (albeit smaller in size) even if there are no small children in the household. As for men, the reform only had a positive direct impact on their home production if they are younger than their wives and have small children. In such relationships, the reform also indirectly impacted their wives by reducing their weekend time spent in home production. However, the reform did not indirectly impact the labor-market attachment of treated men's wives more generally.

7. Fertility and Social Norms

Fertility

The evidence thus far indicates that the junior high school reform that abolished gender segregation and gender-differentiated content in IA-HE instruction reduced the gender gaps both in weekend intra-household home production and in the labor market. With the stronger labor market attachment of wives and the change in the allocation of childcare duties between spouses, with fathers increasing their involvement in childcare, it is conceivable that the reform might also have affected the desired number of children and fertility outcomes. Indeed, Feyrer et al. (2008), Doepke and Kindermann (2016) and Farré and González (2019) find that the distribution of the childcare burden between mothers and fathers is an

important determinant of fertility. Stronger female labor attachment may have increased the opportunity costs of having children, and higher father involvement in childcare and housework more generally may have increased their awareness of the full costs of having children, potentially shifting their preferences in favor of quality of child upbringing rather than quantity of children.

Figure 7 and columns 1 and 4 of Table 11 analyze the effect of the junior high school reform on fertility by using two different outcomes: the total number of children and of young children (under 10 years old) and the presence of them at the time of the survey. Interestingly, we observe that men treated by the reform have fewer children overall by 2016 but more young children, suggesting that they delayed fertility, which is consistent with Farré and González (2019). However, as we did not find that the reform increased labor market attachment of their wives (indirectly through the husband's treatment), the delay in fertility among treated men must be the result of their increased awareness of the full costs of having children or a change in their preferences in favor of quality of child upbringing. While columns 5 and 6 show that the delay in fertility seems to take place regardless of whether or not the wife was treated, this effect is larger in those couples in which the wife was untreated, which is the group where we observe the husband increasing childcare by 28 minutes during the weekends (shown in column 4 of Panel B of Table 10).[38]

In contrast, the lack of average effects of the reform on the fertility of treated women hides a differential impact according to whether or not their husband was also treated. When both spouses were treated, we observe an increase in fertility, with a 7% higher likelihood of having children relative to the pre-reform mean and a 20% higher number of children on average. Note that among this group, women decreased childcare time during the weekends by 48 minutes (shown in column 1, Panel C of Table 10). In contrast, when only the wife was treated, the reform delayed fertility, and women did not decrease childcare time during the weekends (shown in column 2, Panel C of Table 10), but their husbands increased it by 21 minutes (column 2, Panel A of Table 10). Only when the reform decreased wives' childcare, do we observe higher fertility outcomes

Robustness Checks

Table 12 presents a battery of robustness checks for our main outcome variables; namely, men's and women's weekend home-production time and women's likelihood of working in a regular job, annual employment income, and fertility. Columns 1, 2, 4 and 5 present estimates using different year bandwidths

[38] When both husband and wife were treated, we only observe the wife increasing childcare time by 29 minutes (column 3 of Panel D), while the husband reduces childcare by a non-statistically significant 9 minutes (column 3 of Panel B).

and functional polynomial forms. While we do observe some changes in the size and precision of a few estimates, overall, the robustness checks tell a story consistent with the findings presented above. Importantly, columns 3 and 6 re-estimate the baseline model using month of birth as the running variable but, again, the results are very consistent with those of our main estimates using year of birth instead.

Social Norms

One potential mechanism of the reform is that it affected men's and women's views of traditional gender roles. As the JTUS does not have information on social norms or beliefs, we conducted our own survey through the survey company, Rakuten Insight, Inc. Between July 22 and July 27 in 2019 the survey was fielded where we asked respondents about their socio-demographic characteristics and attitudes toward traditional gender roles. The survey was targeted to married men and women born between April 1973 and March 1982 (that is, from the same birth cohorts as in our main analysis) from among Rakuten Insight's registered respondents, who are a representative sample of the Japanese population. The target recovery number was set at 1,750 individuals for each cohort and gender. The survey continued until the target number was recovered; hence, we received responses from 31,500 people (=1,750 x 9 annual cohorts x 2 genders). However, to be consistent with our other regressions, for this analysis, we only used 7 years of data, resulting in a total sample of 24,500. The final sample size was further reduced to 22,376 because of missing values. We implemented this survey method to guarantee sufficiently large gender-cohort sample sizes to maximize precision. We asked individuals whether they agreed or disagreed with statements on gender roles, as described below.

Figure 8 and Table 13 explore whether the reform altered the share of married men and women who disagree with either of these two statements: "the husband should work outside and the wife should protect the family at home" or "if the husband has enough income, the wife should not have a job."[39] The gender norm variable takes 1 if the respondent disagrees or somewhat disagrees with either statement above, and 0 otherwise. While there is no evidence of an effect on married men's beliefs on gender roles, Figure 8 and Table 12 reveal that the reform increased the likelihood that married women disagree with traditional gender roles, suggesting that for women a potential mechanism of this educational reform is through changes in their views of traditional gender norms. This is consistent with Rodríguez-Planas and Tanaka (2021) who find a direct relationship between gender norms in Japan and women's decision to work. The fact that we find no effect of the reform on male gender norms, even though the reform increased their

[39] Unfortunately, we did not ask about the spouse's year of birth, preventing us from performing the analysis according to whether or not the spouse was also treated.

weekend home-production time, provides further corroborating evidence that the mechanism for men may well be through their wives' stronger labor market attachment.

7. Conclusion

Using Regression Discontinuity design and Japanese time-use data from 2016, we analyze whether the introduction of the junior high school education reform on April 1990 caused a behavioral change among treated students more than two decades later, when they were married and in their late thirties/early forties. Among the behavioral changes we study are: time spent by men and women in home production during weekdays and weekends, their preferences for children (measured by number of children born by 2016), and their labor market outcomes measured by time spent on work-related activity, type of employment and labor income. The analysis is done separately for men and women, and evidence of behavioral change among married men and women in their late thirties/early forties suggest that this educational reform, which mainly eliminated segregated and gender-stereotyped industrial arts and home economics (IA-HE) instruction in junior high school, was successful in modifying treated individuals' long-term behavior.

We find robust evidence that the implementation of the junior high school reform reduced the gender gaps in weekend home-production time and weekend time spent in work-related activities by increasing men's engagement in traditionally female activities (home-production) and decreasing men's engagement in traditionally male activities (time spent on work-related activities), and the opposite for women. We also find that the reform reduced the gender gap in regular employment and annual labor earnings, with effects on women driving these results.

By exploring the direct and indirect effects of the reform, we have also disentangled some of the mechanisms underlying these findings. For instance, we find that the reform had a direct impact on women's labor-market attachment by increasing their odds of working in a regular job and their annual earnings. This was channeled solely through the direct effect of the reform on treated women, not indirectly through the effect of the reform on their husbands. At the same time, the reform reduced women's home-production time and also had an indirect positive effect on their husbands' home-production time. Thus, women's stronger labor-market attachment seems to have been accompanied by a convergence of gender roles within those households, suggesting that men married to women treated by the reform modified their attitudes towards home production, regardless of whether they were treated themselves. We provide evidence that the reform also changed women's beliefs on their gender roles in society more generally.

While we find stronger direct effects of the reform on women's home-production time and labor-market outcomes when the husband is also treated (and hence younger) than when the husband is not treated, we do not see similar direct effects of the reform on men's outcomes. Instead, the reform has a greater impact on men's home-production time when the wife is untreated, and hence older than him, and there are children younger than 10 years old in the household. Of course, the spouse's age relative to one's own is unlikely to be random. So perhaps it is unsurprising that there is a greater direct impact of the reform on men in marriages in which they are, atypically for Japan, younger than their wives. Interestingly, it is in such marriages where we find the only evidence of an indirect effect of the reform on the wives of treated men. This finding is consistent with Hwang et al. (2019), who find that among couples in South Korea, women married to husbands with modern gender attitudes spend about 3 hours less in housework time per week than those married to husband with traditional gender attitudes. However, we find no evidence of any indirect impact of the reform on women's attachment to the labor market through their husbands. We also find no evidence that the reform impacted men's gender norms.

Among men, the reform delayed fertility regardless of whether or not the wife was treated by the junior high school reform. However, the lack of average effects of the reform on the fertility of treated women hides a differential impact according to whether or not their husband was also treated, revealing an increase in fertility when the husband was also treated. In such case, the reform also decreased women's childcare.

Finally, as home economics classes teach not only content that might raise students' awareness about gender roles but also skills in home production, it is possible that the direct effect of the reform on men's participation in home production might have changed due to skill accumulation rather than changes in attitudes, which would be consistent with our lack of findings of the reform on men's gender norms. A related issue is the social expectation of long work hours for Japanese in regular jobs, which may well constrain the impact of the educational reform on adult men's behavioral changes (especially during the weekday). This would suggest that educational reforms aiming to modify gender norms ought to go hand in hand with labor-market reforms that make possible a better work-life balance for both genders.

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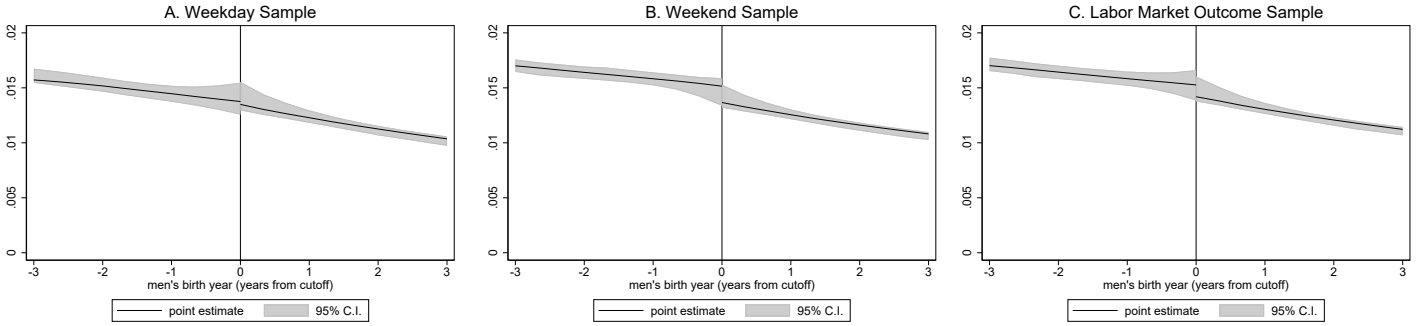
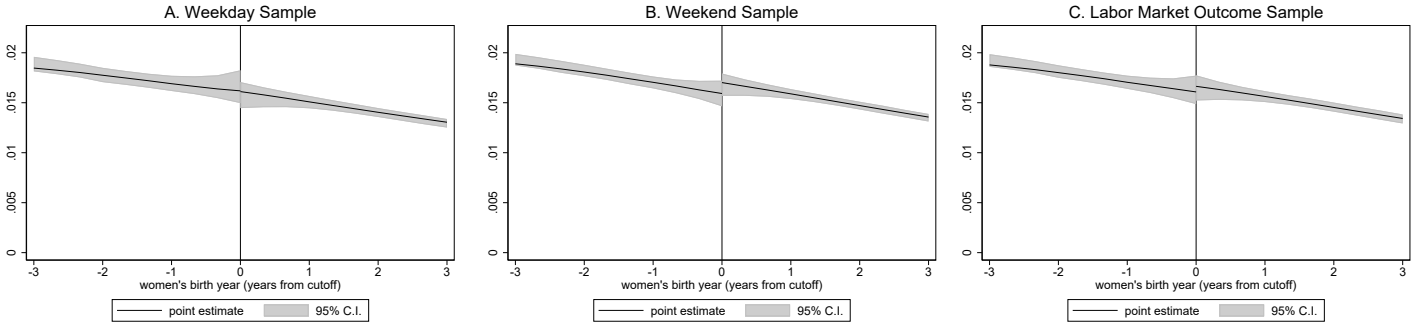
Figure 1: Density of the Forcing Variable by Birth Year across Three Analysis Samples

(a) Men



(b) Women

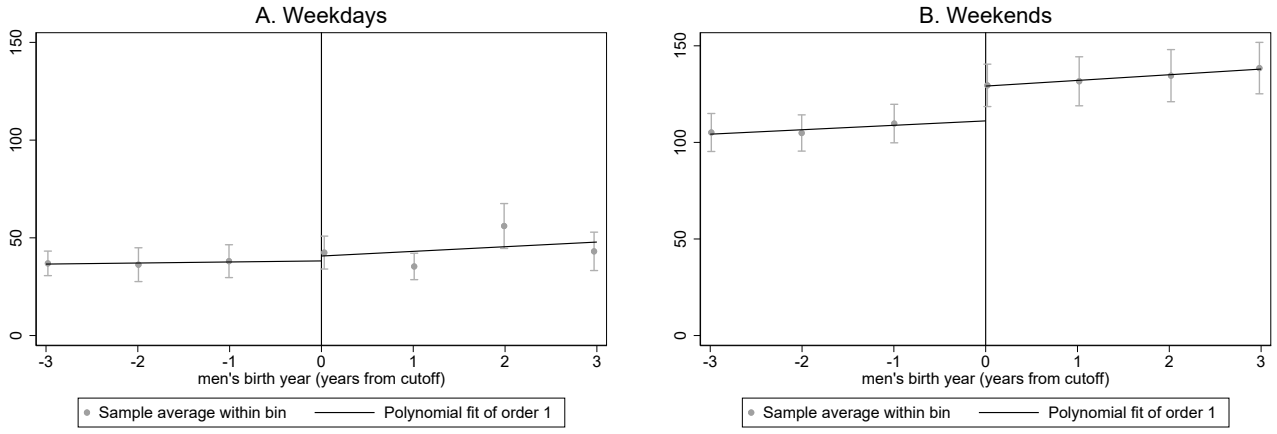


Source: 2016 JTUS.

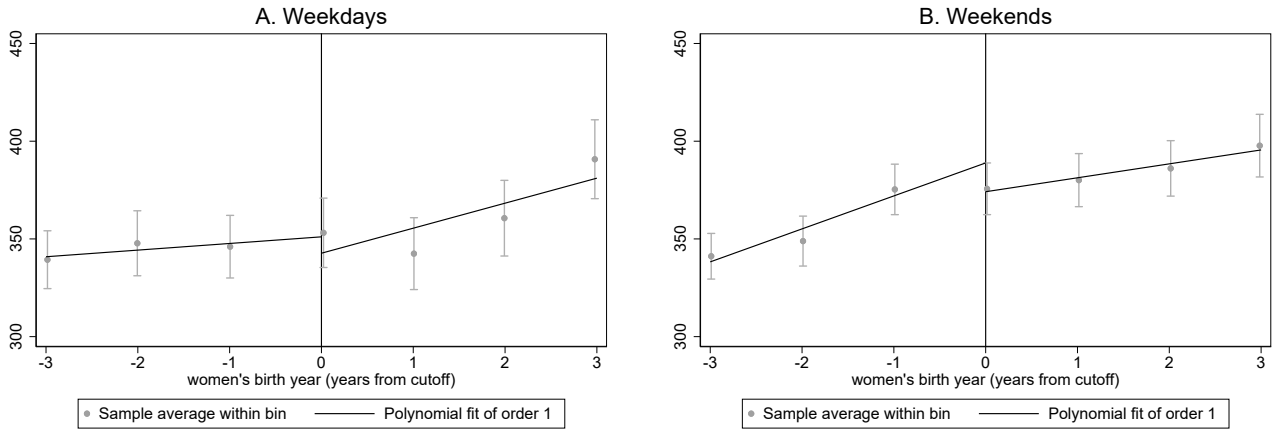
Notes: The graphs show the results of the manipulation test of the forcing variable proposed by Cattaneo, Jansson, and Ma (2019). The analysis sample consists of 1974-1980 cohorts. The vertical line is at the threshold year, which is normalized to zero, so that -3, 0, and 3 indicate 1974, 1977, and 1980, respectively. For all figures, the order of the local polynomials used to construct the point estimator and bias-corrected density point estimator is two and three, respectively, and the kernel function is triangular. The gray zone shows a 95% confidence interval.

Figure 2A: Home Production Time, by Gender

(a) Men



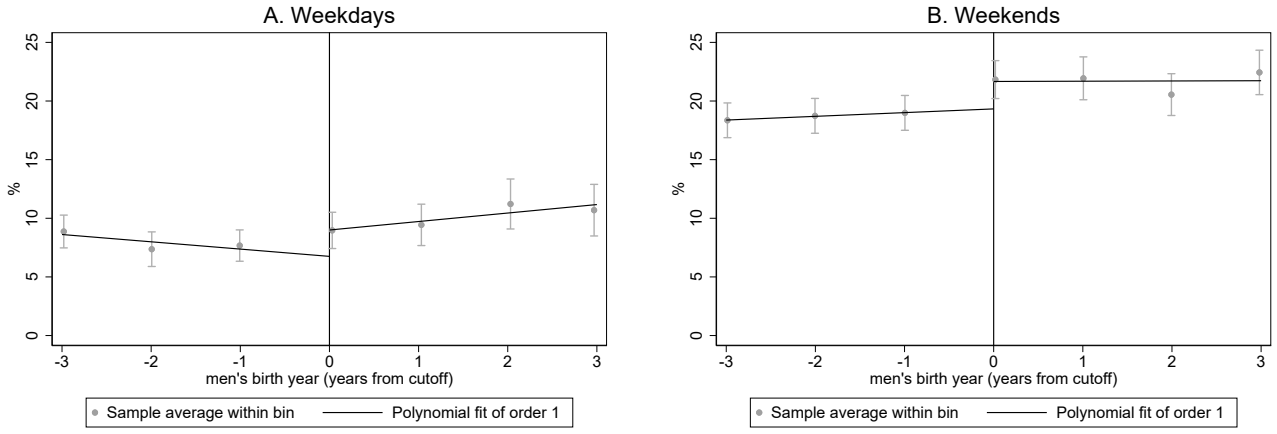
(b) Women



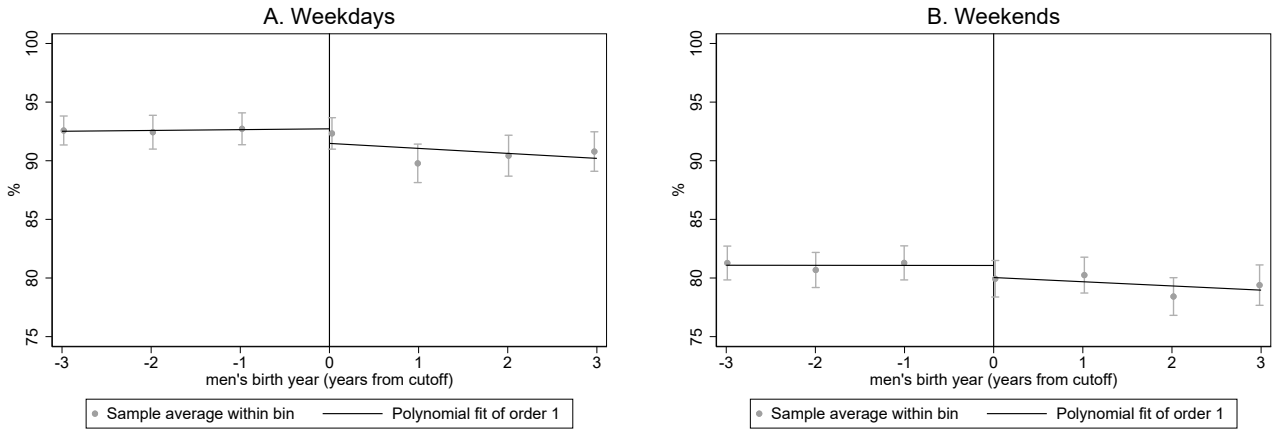
Source: 2016 JTUS.
Notes: The analysis sample consists of 1974-1980 cohorts. The vertical line is at the threshold year, which is normalized to zero, so that -3, 0, and 3 indicate 1974, 1977, and 1980, respectively. The dots in the figure are the within-bin sample means and the vertical bars show the 95% confidence intervals.

Figure 2B: Share of Home Production within A Couple, by Gender (Couple Sample)

(a) Men

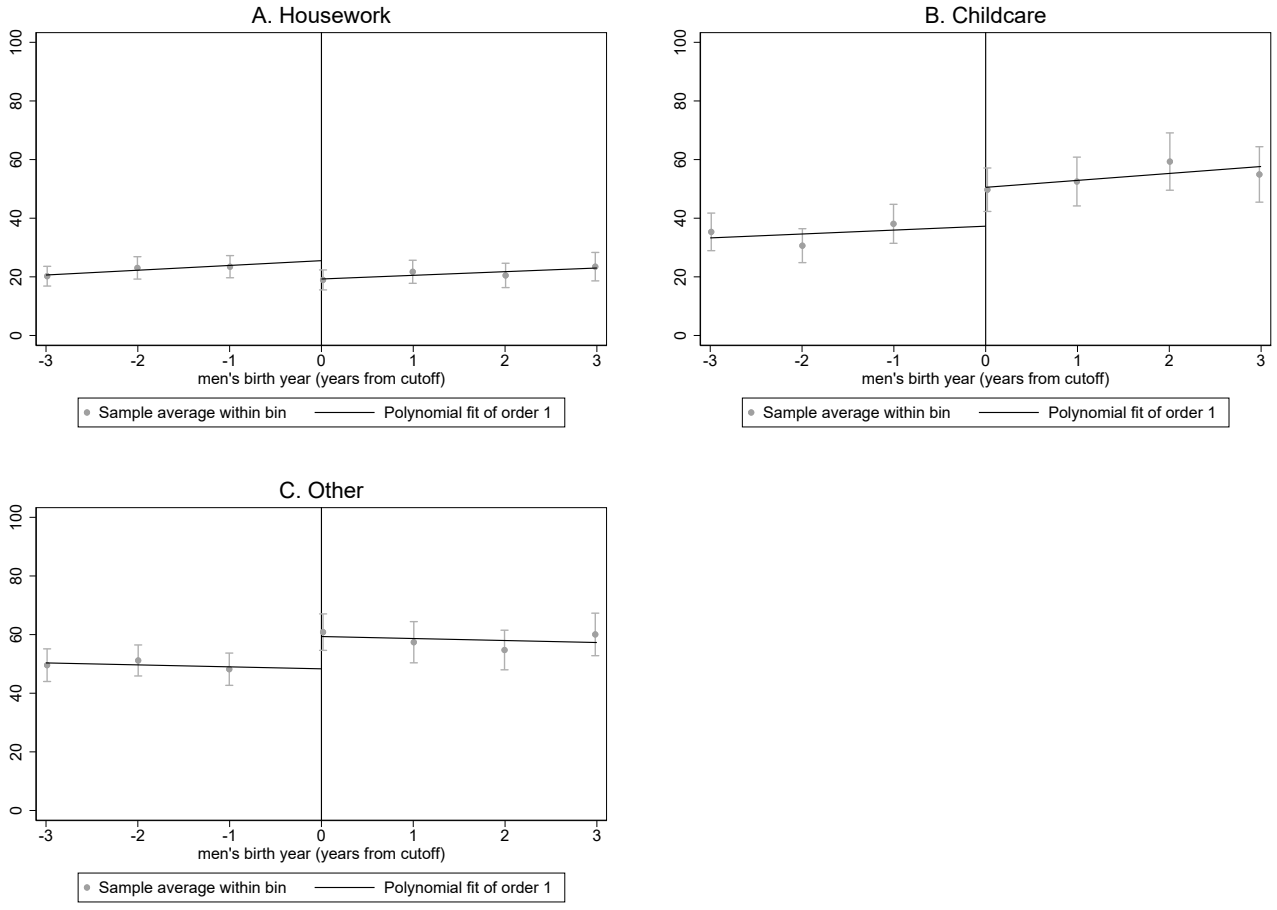


(b) Women



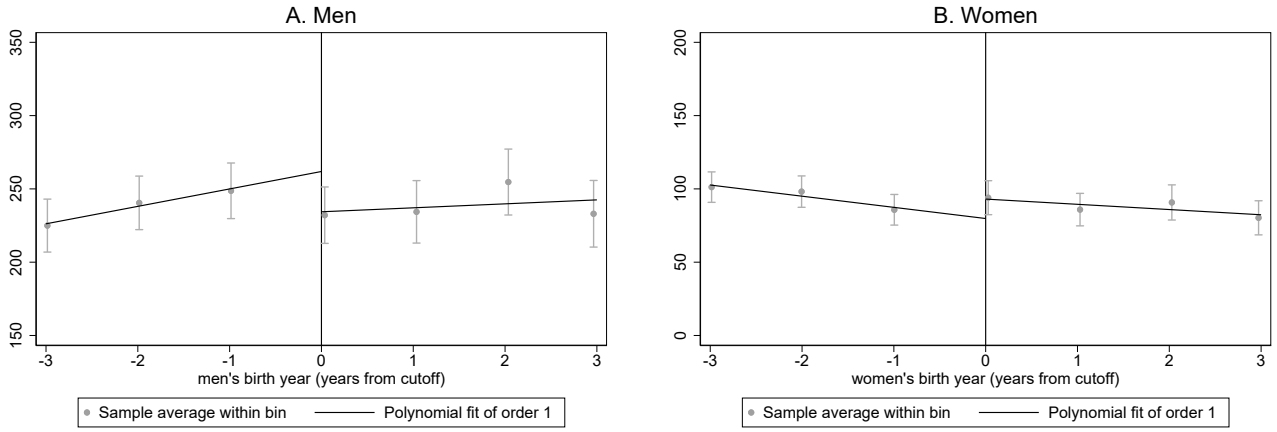
Source: 2016 JTUS.
Notes: The analysis sample consists of 1974-1980 cohorts, for which we observe the spouse. The vertical line is at the threshold year, which is normalized to zero, so that -3, 0, and 3 indicate 1974, 1977, and 1980, respectively. The dots in the figure are the within-bin sample means and the vertical bars show the 95% confidence intervals.

Figure 3: Men's Weekend Home Production by Activity Type



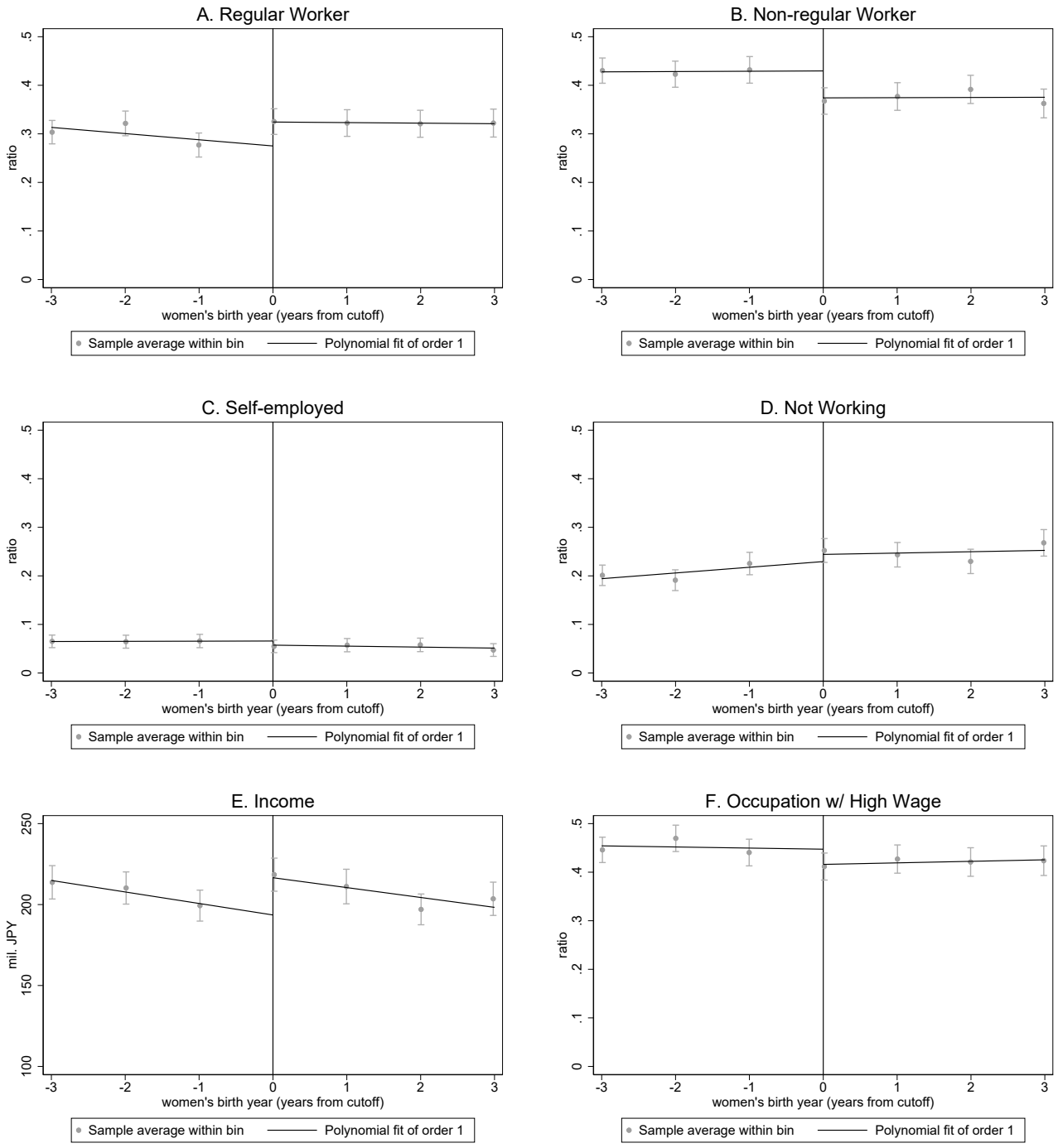
Source: 2016 JTUS.
Notes: The analysis sample consists of 1974-1980 cohorts. The vertical line is at the threshold year, which is normalized to zero, so that -3, 0, and 3 indicate 1974, 1977, and 1980, respectively. The dots in the figure are the within-bin sample means and the vertical bars show the 95% confidence intervals.

Figure 4: Weekend Work-Related Activity



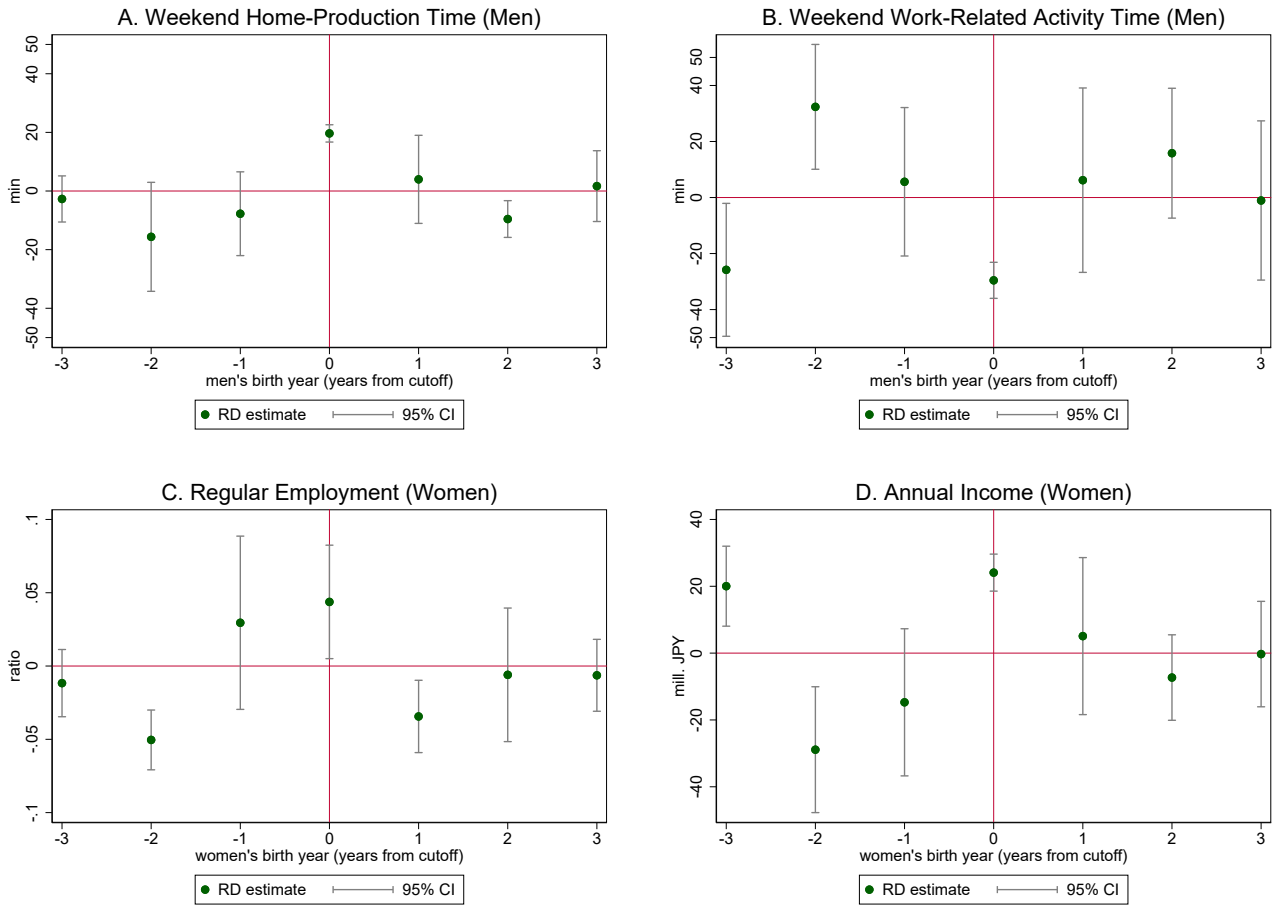
Source: 2016 JTUS.
Notes: The analysis sample consists of 1974-1980 cohorts. The vertical line is at the threshold year, which is normalized to zero, so that -3, 0, and 3 indicate 1974, 1977, and 1980, respectively. The dots in the figure are the within-bin sample means and the vertical bars show the 95% confidence intervals.

Figure 5: Labor Market Outcome, Women



Source: 2016 JTUS.
Notes: The analysis sample consists of 1974-1980 cohorts. The vertical line is at the threshold year, which is normalized to zero, so that -3, 0, and 3 indicate 1974, 1977, and 1980, respectively. Information at the individual level is used. The dots in the figure are the within-bin sample means and the vertical bars show the 95% confidence intervals.

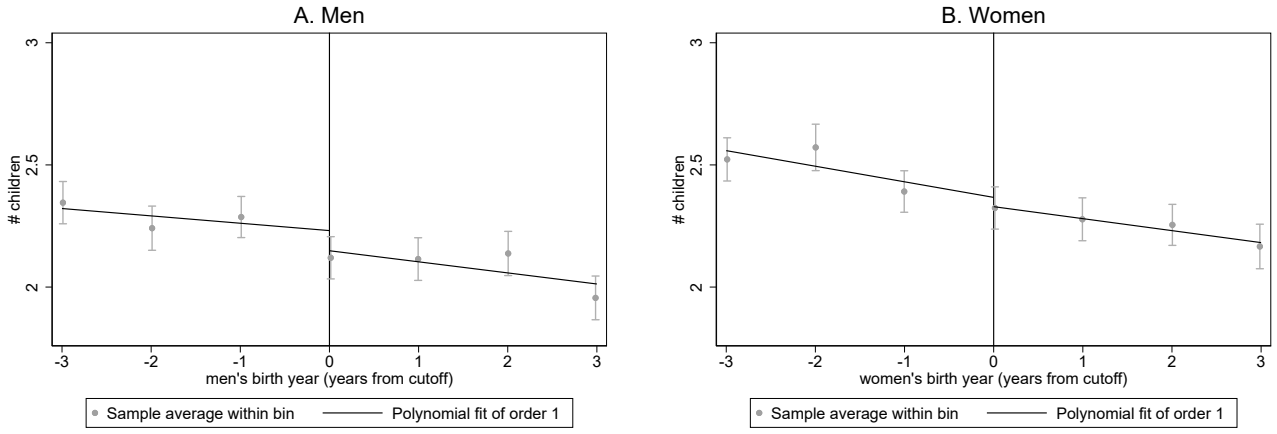
Figure 6: Results of Placebo Test



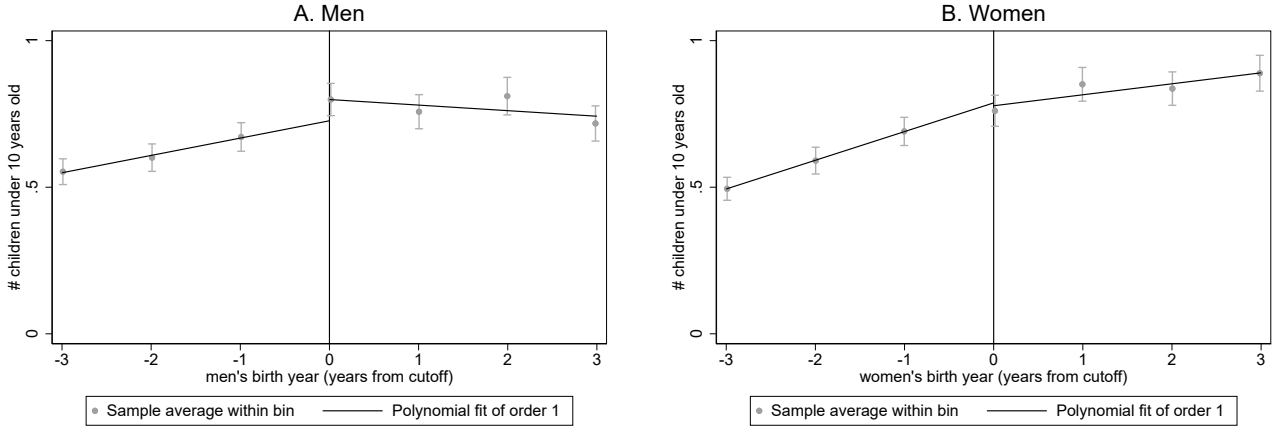
Source: 2016 JTUS.
Notes: The figures above show the effect of fictitious reforms 3, 2 and 1 year before 1990 and 1, 2 and 3 years after 1990. The estimate shown at "0" is the coefficient of the actual reform in 1990. Information at the time level is used for Panels A and B, and Information at the individual level is used for Panels C and D. The dots in the figure are the within-bin sample means and the vertical bars show the 95% confidence intervals.

Figure 7: Total Number of Children and Total Number of Children Under 10 Years Old, by Gender

(a) Total Number of Children



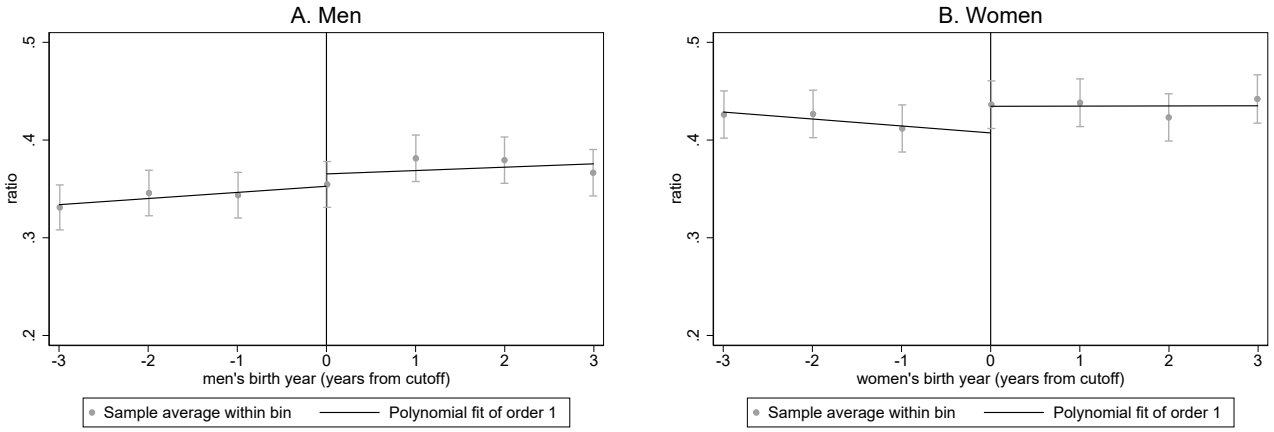
(b) Number of Children under 10 Years Old



Source: 2016 JTUS

Notes: The analysis sample consists of 1974-1980 cohorts. The vertical line is at the threshold year, which is normalized to zero, so that -3, 0, and 3 indicate 1974, 1977, and 1980, respectively. The dots in the figure are the within-bin sample means and the vertical bars show the 95% confidence intervals. Information at the individual level is used.

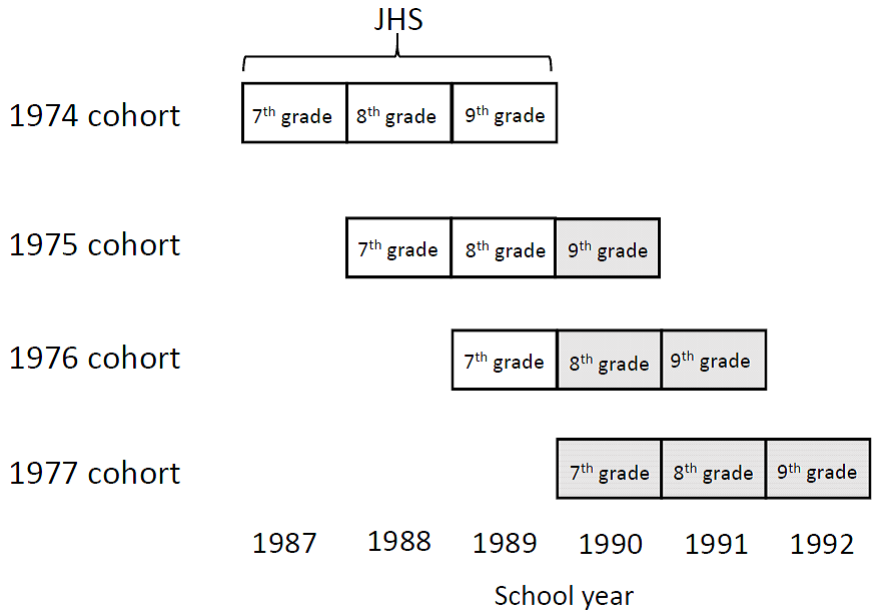
Figure 8: Disagrees with Traditional Attitudes, by Gender



Source: Authors' original survey.
Notes: The analysis sample consists of the 1974-1980 cohorts, who were in coeducational classes in junior high school. The vertical line is at the threshold year, which is normalized to zero, so that -3, 0, and 3 indicate 1974, 1977, and 1980, respectively. The dots in the figure are the within-bin sample means and the vertical bars show the 95% confidence intervals. "Disagrees with traditional attitudes" indicates that the respondent disagrees or somewhat disagrees to either "the husband should work outside and the wife should protect the family" or "if the husband has enough income, the wife should not have a job."

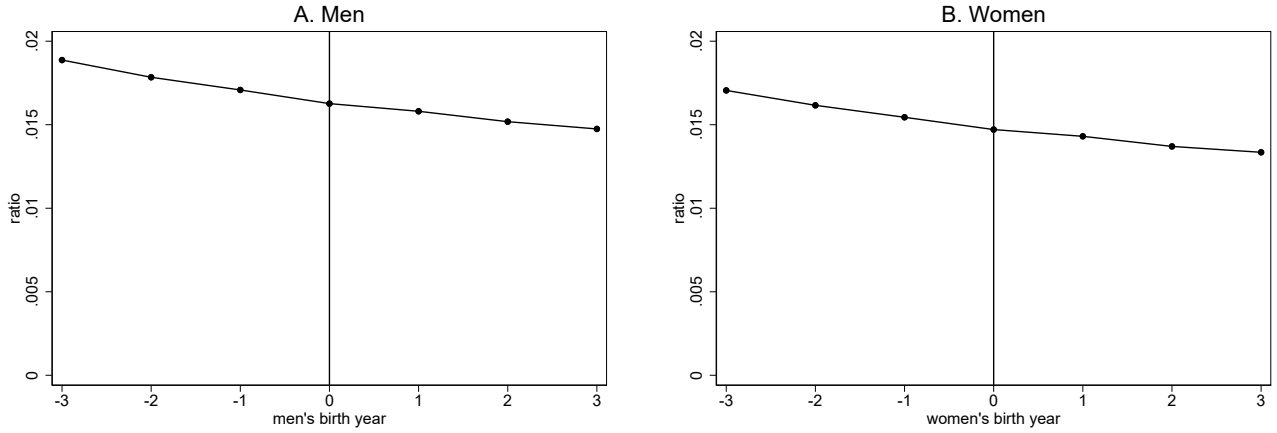
Appendix A

Figure A1: Coeducation of IA-HE by Cohort



Notes: The gray cells indicate coeducation. "JHS" indicates junior high school, and 7th to 9th grade students are Japanese junior high school students. All years are school years (April 1 - March 31), not calendar years.

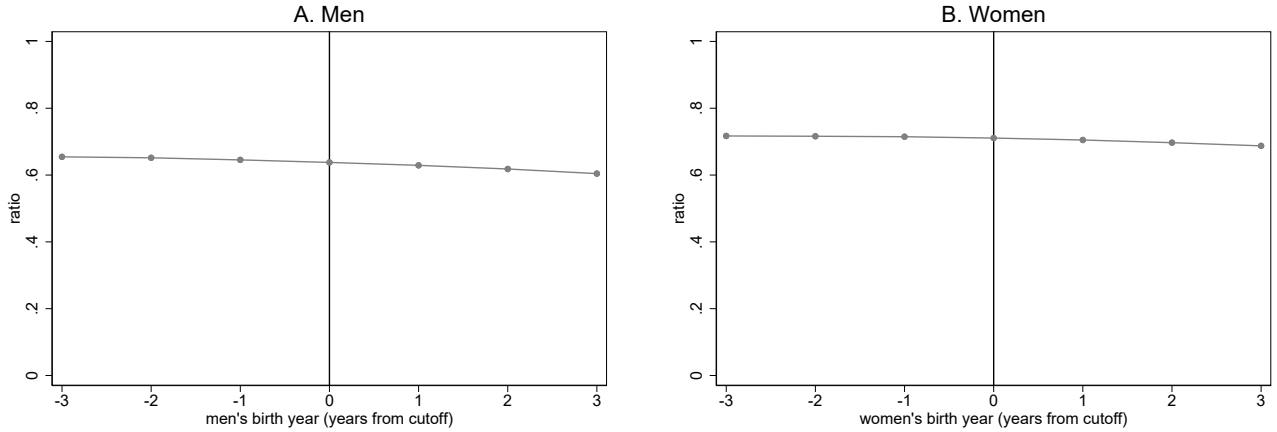
Figure A2: Distribution of the Running Variable using National Census Data



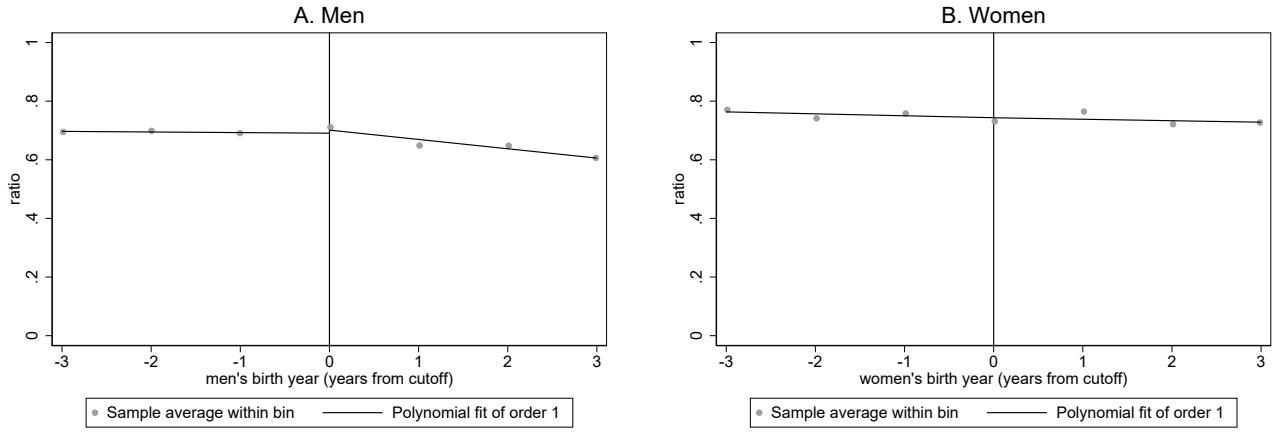
Source: 2015 National Census.
Notes: The Y axis indicates the ratio of each of the 1974-1980 cohorts among the whole Japanese population over 15 years old. The vertical line is at the threshold year, which is normalized to zero, so that -3, 0, and 3 indicate 1974, 1977, and 1980, respectively. Note that the birth year is represented by the calendar year, not the school year.

Figure A3: Marriage Rate by Birth School Year, by Gender

(a) National Census

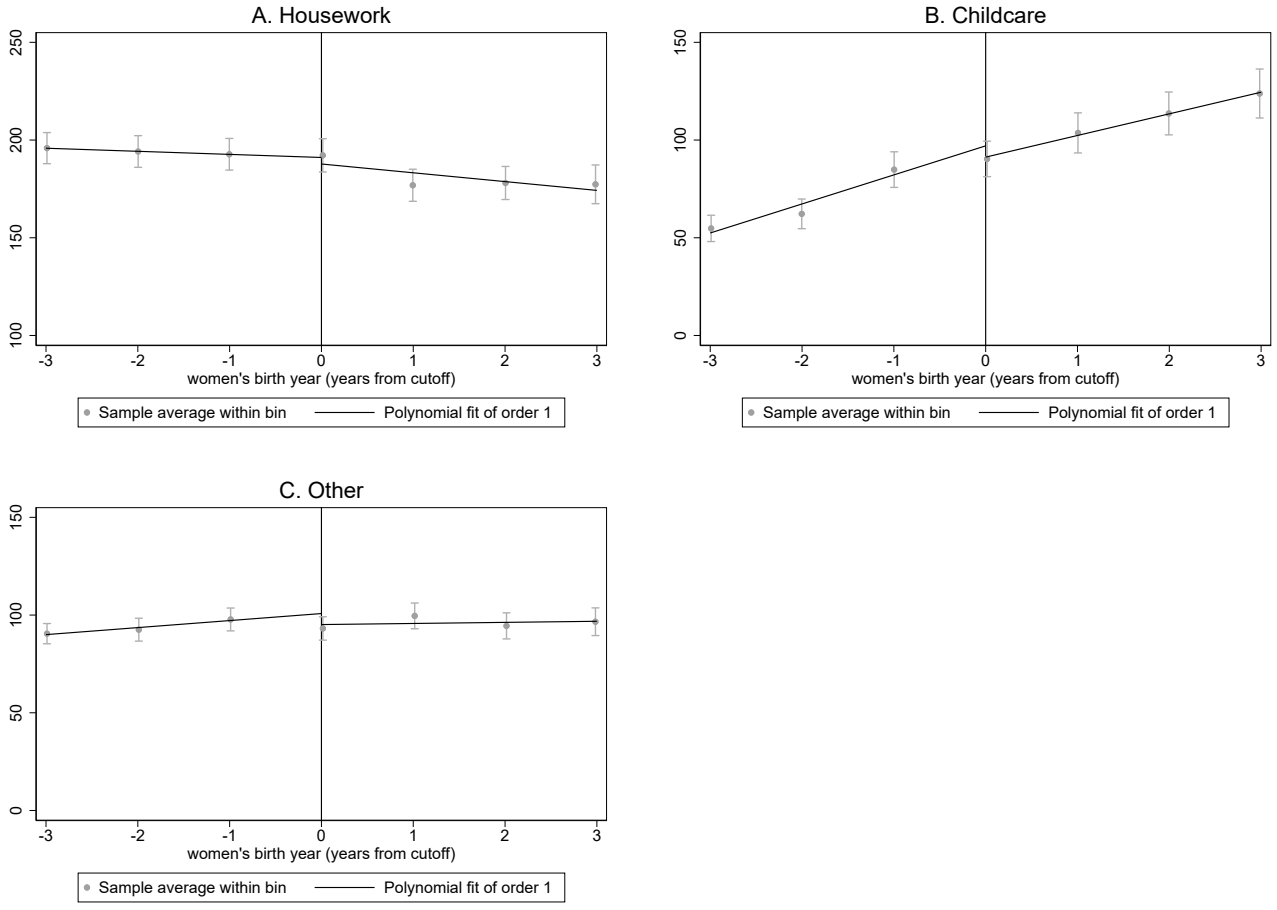


(b) JTUS



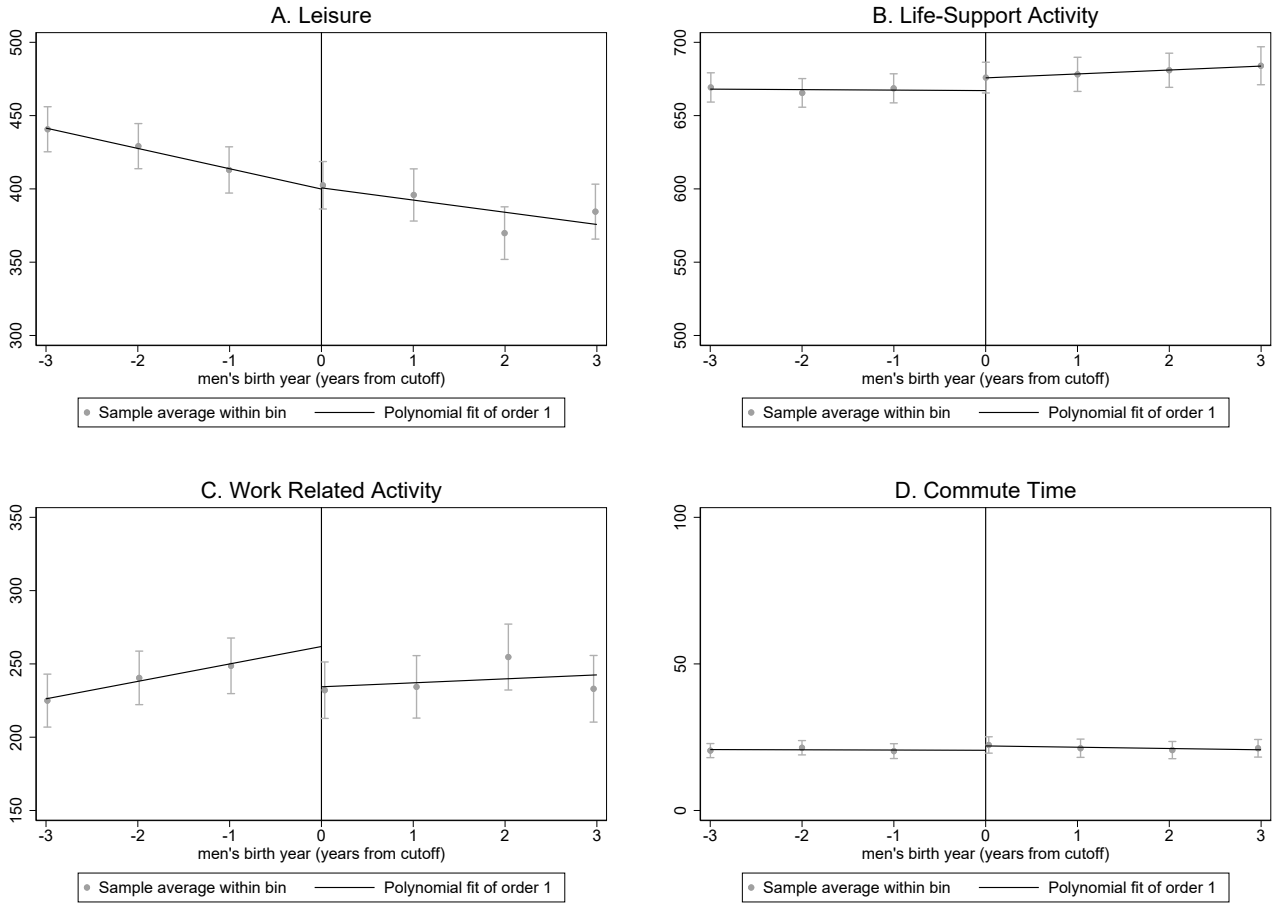
Source: 2016 JTUS, and 2015 National Census.
Notes: The analysis sample consists of the 1974-1980 cohorts. The vertical line is at the threshold year, which is normalized to zero, so that -3, 0, and 3 indicate 1974, 1977, and 1980, respectively. Panel (a) shows connected plots of average marriage rate by birth year, using the published value of the 2015 National Census by the Japanese Statistics Bureau. Panel (b) shows plots of average marriage rate by birth year, and polynomial fitted lines, using 2016 JTUS data.

Figure A4: Women's Weekend Home-Production by Activity Type



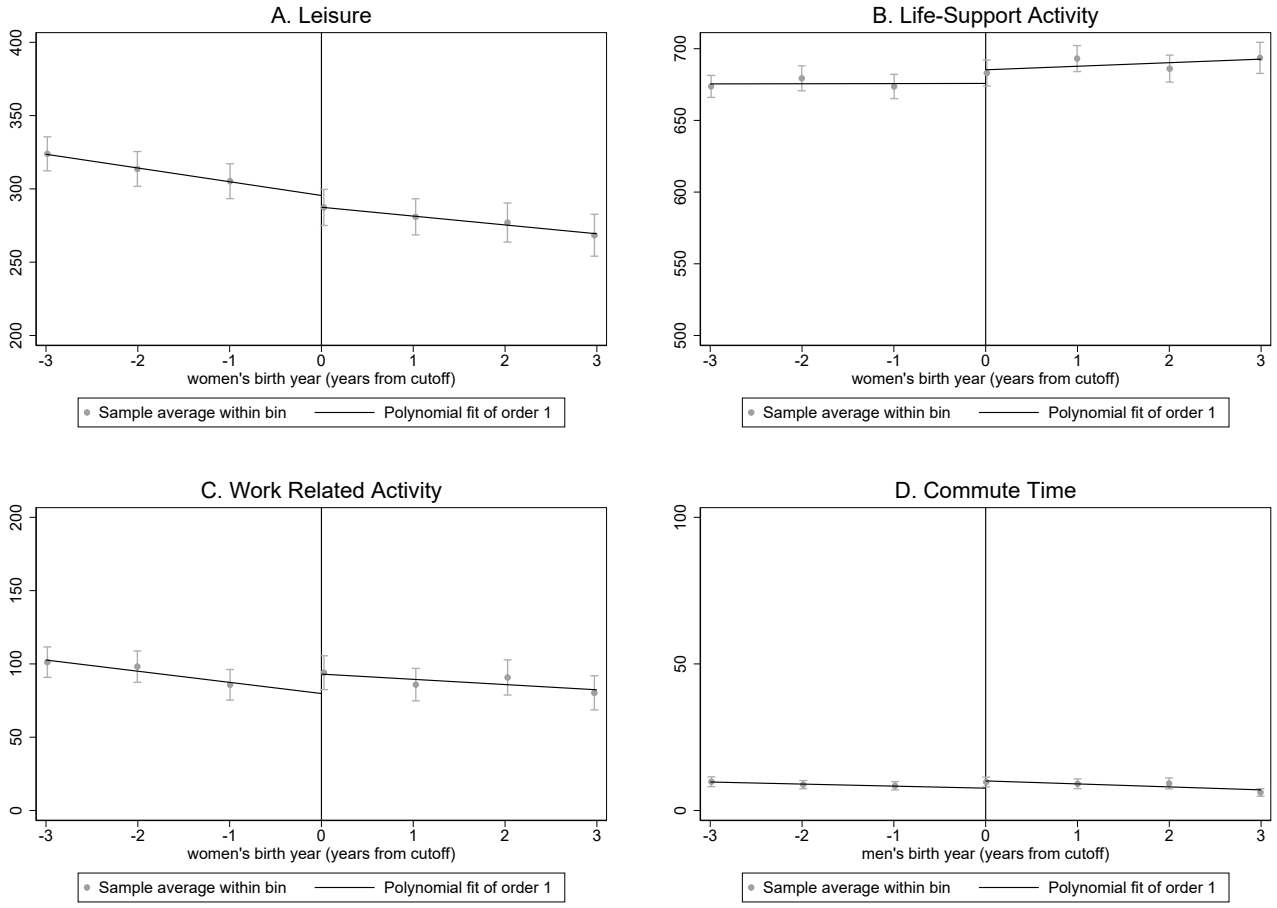
Source: 2016 JTUS.
Notes: The analysis sample consists of the 1974-1980 cohorts. The vertical line is at the threshold year, which is normalized to zero, so that -3, 0, and 3 indicate 1974, 1977, and 1980, respectively. The dots in the figure are the within-bin sample means and the vertical bars show the 95% confidence intervals.

Figure A5: Weekend Non-Home-Production Activity Type, Men



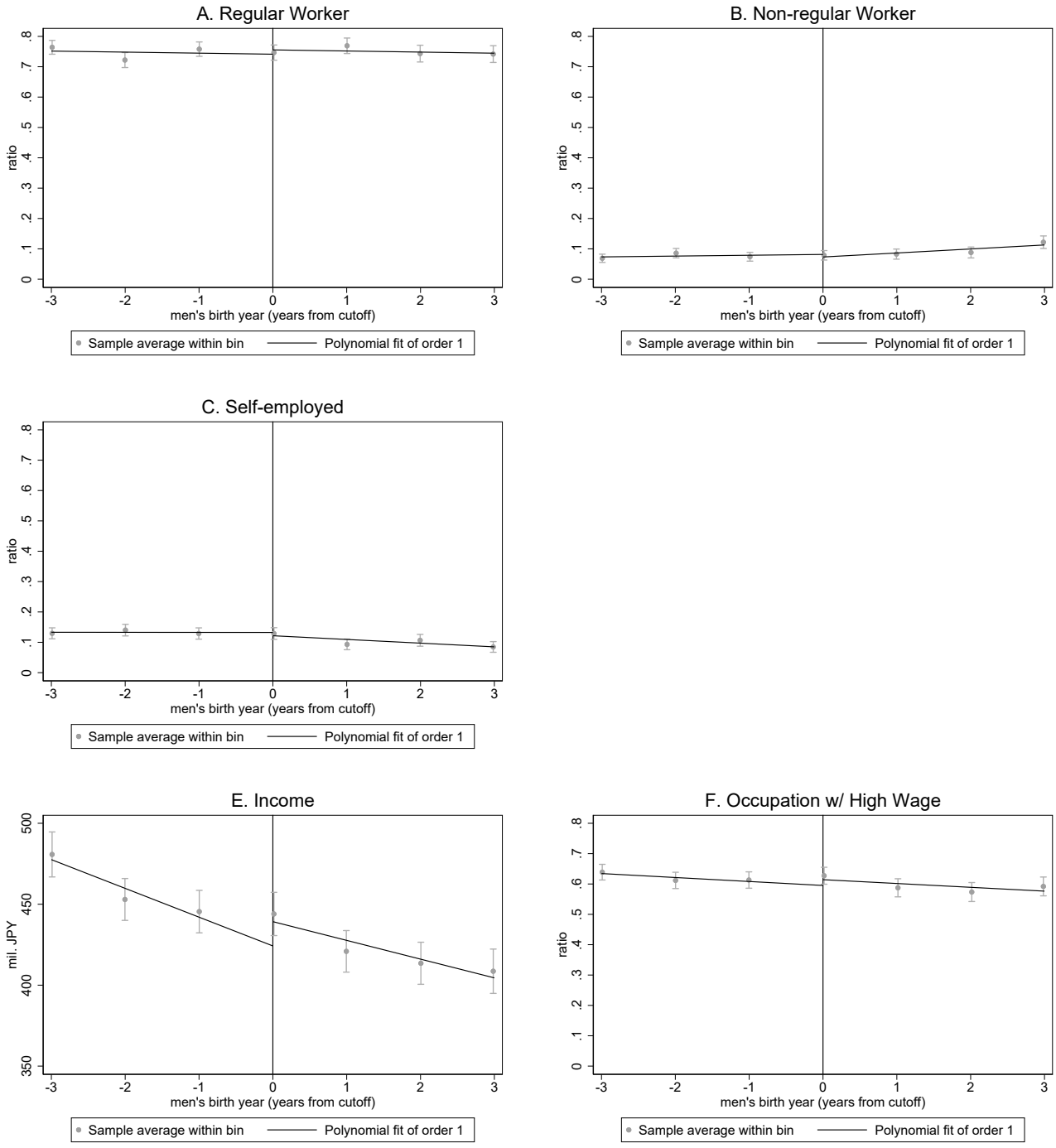
Source: 2016 JTUS.
Notes: The analysis sample consists of the 1974-1980 cohorts. The vertical line is at the threshold year, which is normalized to zero, so that -3, 0, and 3 indicate 1974, 1977, and 1980, respectively. The dots in the figure are the within-bin sample means and the vertical bars show the 95% confidence intervals. Panel C is the same as Figure 4.

Figure A6: Weekend Non-Home-Production Activity Type, Women



Source: 2016 JTUS.
Notes: The analysis sample consists of the 1974-1980 cohorts. The vertical line is at the threshold year, which is normalized to zero, so that -3, 0, and 3 indicate 1974, 1977, and 1980, respectively. The dots in the figure are the within-bin sample means and the vertical bars show the 95% confidence intervals. Panel C is the same as Figure 4.

Figure A7: Labor Market Outcomes, Men



Source: 2016 JTUS.
Notes: The analysis sample consists of the 1974-1980 cohorts. The vertical line is at the threshold year, which is normalized to zero, so that -3, 0, and 3 indicate 1974, 1977, and 1980, respectively. The dots in the figure are the within-bin sample means and the vertical bars show the 95% confidence intervals. The figure for non-work is not reported here because we could not estimate it, as the sample of non-working married men was negligible.

Table 1: Descriptive Statistics for Home Production (Averages per Cohort)

	Pre-Reform 1974 to 1976 cohorts	Post-Reform 1977 to 1980 cohorts	Diff		Diff
	Mean (Sd)	Mean (Sd)	Absolute		% change
Men					
Home Production					
Weekdays					
Time (min)	37.09 (95.40)	43.87 (98.16)	+6.8	**	+18%
Share relative to spouse (%)	8.03 (16.7)	9.96(19.4)	+1.9	***	+24%
Weekends					
Time (min)	106.50 (162.20)	133.20 (171.1)	+26.7	***	+25%
Share relative to spouse (%)	18.7 (23.6)	21.7 (24.1)	+3.0	***	+16%
Each Activity on Weekends (min)***:***					
Housework	22.24 (61.07)	20.98 (57.64)	-1.3		-6%
Childcare	34.60 (104.70)	53.77 (123.60)	+19.2	***	+55%
Other	49.68 (90.95)	58.42 (97.08)	+8.7	***	+18%
Women					
Home Production					
Weekdays					
Time (min)	344.20 (234.80)	361.1 (227.0)	+16.9	**	+5%
Share relative to spouse (%)	92.58 (16.70)	90.87 (17.9)	-1.7	***	-2%
Weekends					
Time (min)	354.30 (222.40)	384.20 (229.30)	+29.9	***	+8%
Share relative to spouse (%)	81.08 (24.2)	79.5 (23.7)	-1.6	***	-2%
Each Activity on Weekends (min)***:***					
Housework	194.30 (143.90)	181.40 (141.40)	-12.9	***	-7%
Childcare	66.59 (139.20)	106.90 (172.20)	+40.3	***	+61%
Other	93.41 (100.20)	95.93 (106.00)	+2.5		+3%

Notes: The size of the weekday and weekend time-use samples for men are 3,564 and 6,371, respectively. For women, they are 4,589 and 7,712. Share relative to spouse is estimated using a sample which includes his/her own spouse; therefore, sample sizes are 3,289 for men and 3,739 for women on weekdays, and 5,764 for men and 6,546 for women on weekends. The table presents the mean values, with standard deviations in parentheses. The symbols ***, **, and * indicate that the pre/postreform differences are statistically significant at the 1%, 5%, and 10% level, respectively.

Table 2: Descriptive Statistics for Number of Children and Labor Market Outcomes (Averages per Cohort)

	Before 1977 Cohorts 1974 to 1976	After 1977 Cohorts 1977 to 1980	Diff		Diff
	Mean (Sd)	Mean (Sd)	Absolute		% change
Men					
Has children	0.89 (0.32)	0.88 (0.33)	-0.01		-1%
Total number of children	2.50 (1.61)	2.11 (1.41)	-0.39	***	-15%
Has children < 10 years old	0.57 (0.50)	0.69 (0.46)	+0.12	***	+7%
Number of children < 10 years old	0.87 (0.90)	1.17(0.80)	+0.30	***	+34%
Labor Market Outcomes					
Regular worker	0.82 (0.38)	0.84 (0.37)	+0.02		+2%
Non-regular worker	0.03 (0.17)	0.04 (0.19)	+0.01		+24%
Self-employment	0.14 (0.35)	0.12 (0.32)	-0.02	**	-15%
Non-work	0.01 (0.09)	0.01 (0.08)	+0.00		-14%
Annual income (in 10,000 Yen)	509.80 (234.30)	470.60 (222.40)	-39.20	***	-8%
High-wage occupation	0.66 (0.47)	0.65 (0.48)	-0.01		-1%
Women					
Has children	0.87 (0.33)	0.89 (0.32)	+0.01		+1%
Total number of children	2.60 (1.71)	2.25 (1.47)	-0.35	***	-13%
Has children < 10 years old	0.51 (0.50)	0.66 (0.48)	+0.15	***	+29%
Number of children < 10 years old	0.75 (0.87)	1.10 (0.98)	+0.35	***	+46%
Labor Market Outcomes					
Regular worker	0.25 (0.43)	0.27 (0.44)	+0.02	**	+9%
Non-regular worker	0.45 (0.50)	0.38 (0.49)	-0.07	***	-16%
Self-employment	0.07 (0.25)	0.06 (0.24)	-0.01		-14%
Non-work	0.23 (0.42)	0.29 (0.45)	+0.06	***	+26%
Annual income (in 10,000 Yen)	191.30 (165.00)	192.60 (157.10)	+1.30		+1%
High-wage occupation	0.432 (0.495)	0.399 (0.490)	-0.03	***	-8%

Notes: The sample size for fertility and labor market outcomes is 5,393 for men (5,311 for annual income) and 6,251 for women (4,582 for annual income). The unit for annual income is 10,000 Japanese yen ($1 = 107JPY).
The table presents the mean values, with standard deviations in parentheses. The symbols ***, **, and * indicate that the pre/post-reform differences are statistically significant at the 1%, 5%, and 10% level, respectively.

Table 3. Balance Tests (Weekend Sample)

	Own age	Own years of education	Household members	Spouse's age	Spouse's years of education	Lives in prefecture with high MW
Panel A. Men (Forcing variable: Men's date of birth)						
	-0.041*	-0.098	-0.002	-0.029	-0.069*	-0.011
	(0.019)	(0.104)	(0.031)	(0.196)	(0.030)	(0.010)
Means for pre-reform cohort	40.62	13.91	4.08	39.47	13.78	0.59
Sample sizes	6,371	6,296	6,371	5,764	5,722	6,371
Panel B. Women (Forcing variable: Women's date of birth)						
	0.002	0.001	0.052	-0.048	-0.147	0.002
	(0.027)	(0.052)	(0.049)	(0.161)	(0.089)	(0.007)
Means for pre-reform cohort	40.65	13.73	4.07	43.18	13.94	0.592
Sample sizes	7,712	7,631	7,712	6,546	6,480	7,712

Notes: Each column in the first row of each panel represents the coefficient of $Post_{1977}$ ($\hat{\beta}$) from a regression using a 3-year bandwidth RD model with dummy variables for prefecture and day of the week with standard deviations in parentheses. The outcome variables are indicated by the column labels. When the outcome is "lives in prefecture with high minimum wage (MW)," no prefecture dummies are included in the model. Robust standard errors are clustered at year of birth level. Spouse's age and education are calculated with a sample which has his/her spouse, so sample sizes are smaller. Each Japanese prefecture sets its own minimum wage. We classified prefectures with high MW as those 23 prefectures whose MW were above the median. These include Tokyo and Osaka.

Table 4. Home-Production Time

	Spec 1	Spec 2	Spec 3
		Panel A: Men	
Weekdays			
Time (min)	0.437	0.477	-2.271
	(2.727)	(2.809)	(3.210)
Share relative to spouse (%)	1.950**	1.536**	1.382**
	(0.603)	(0.551)	(0.557)
Weekends			
Time (min)	19.653***	24.129***	20.481***
	(1.205)	(3.462)	(2.522)
Share relative to spouse (%)	2.389***	2.362***	2.012***
	(0.298)	(0.233)	(0.259)
		Panel B: Women	
Weekdays			
Time (min)	-10.238	-9.310	-17.852
	(11.609)	(13.193)	(12.900)
Share relative to spouse (%)	-0.831	-0.999	-0.943
	(0.850)	(0.793)	(0.814)
Weekends			
Time (min)	-15.942**	-9.773	-7.226
	(5.426)	(5.973)	(5.861)
Share relative to spouse (%)	-1.293**	-1.319***	-1.003**
	(0.481)	(0.318)	(0.385)
Years of education		X	X
Three-generation household		X	X
Total number of children			X
Number of children under 10			X

Notes: Estimates are from a 3-year bandwidth RD model with dummy variables for prefecture and day of the week and additional covariates when indicated in the bottom rows of the table. Robust standard errors are clustered at the year of birth level. Sample sizes of time are 3,564 for men and 4,589 for women on weekdays and 6,371 for men and 7,712 for women on weekends. Share relative to spouse are estimated using a sample that includes his/her own spouse; therefore, sample sizes are 3,289 for men and 3,739 for women on weekdays, and 5,764 for men and 6,546 for women on weekends. The symbols ***, **, and * indicate that the pre/post-reform differences are statistically significant at the 1%, 5%, and 10% level, respectively.

Table 5. Weekend Time Use by Type of Activity (in Minutes)

Panel A: Home Production			*Panel B: Not-Home Production*		
(1)	(2)	(3)	(4)	(5)	(6)
Housework	Childcare	Other	Leisure	Life-Support Activity	Work-Related Activity
Men (Running variable: Men's date of birth)					
-6.058***	13.767***	11.945***	0.592	9.312***	-29.557***
(0.986)	(3.679)	(2.175)	(1.717)	(1.544)	(2.630)
Treated Men's Wives (Running variable: Husbands' date of birth)					
-13.647***	13.392	-8.273**	-3.803	2.423	9.907
(3.222)	(10.167)	(2.542)	(3.611)	(1.881)	(12.608)
Women (Running variable: Women's date of birth)					
-3.581	-7.107	-5.255**	-6.647***	9.352*	13.237***
(5.000)	(4.494)	(1.918)	(1.559)	(4.552)	(3.359)
Treated Women's Husbands (Running variable: Wives' date of birth)					
0.202	2.813	15.081***	-11.223	4.518*	-7.790
(2.562)	(10.114)	(3.942)	(6.924)	(2.162)	(6.834)

Notes: Estimates are from a 3-year bandwidth RD model with dummy variables for prefecture and day of the week. Robust standard errors are clustered at the year of birth level. Sample sizes of time are 6,371 for men and 7,712 for women. Other home production in column 3 includes caregiving for sick children and the elderly, grocery shopping, and travel time for home production (excluding commuting time to and from school or work). Life-support activities in column 5 include personal care, eating and sleeping. The symbols ***, **, and * indicate that the pre/ post-reform differences are statistically significant at the 1%, 5%, and 10% level, respectively.

Table 6. Labor Market Outcomes

Regular employment	Non-regular employment	Self-employed	Not working	Annual income	High-wage occupation	Weekday time spent working (in minutes)
Men						
-0.006	0.012	-0.001	-0.004	-0.951	0.013	-4.737
(0.011)	(0.008)	(0.008)	(0.004)	(11.875)	(0.015)	(7.570)
Women						
0.047**	-0.056***	-0.015*	0.024	23.641***	-0.025	6.999
(0.017)	(0.009)	(0.007)	(0.023)	(2.237)	(0.018)	(16.808)

Notes: Estimates are from a 3-year bandwidth RD model with dummy variables for prefecture and day of the week. Robust standard errors are clustered at the year of birth level. The sample for labor market outcomes is 5,393 for men (5,311 for annual income) and 6,251 for women (4,582 for annual income). The unit for annual income is 10,000 Japanese yen ($1 = 107JPY). Sample sizes of work-related time on weekdays are 3,564 for men and 4,589 for women. The symbols ***, **, and * indicate that the pre/ post-reform differences are statistically significant at the 1%, 5%, and 10% level, respectively.

Table 7. Sensitivity Analysis of Main Findings to Alternative Specifications

	Baseline	Bandwidth = 2 years	Bandwidth = 4 years	Bandwidth = 5 years		Bandwidth = 10 years		
	Linear	*Linear*	*Linear*	*Linear*	*2nd polynomial*	*Linear*	*2nd polynomial*	*3rd polynomial*
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Men's weekend home production (min)	19.653**	17.959***	16.944***	12.145***	23.573***	19.340*	9.266**	18.371***
	(1.205)	(0.731)	(2.754)	(2.754)	(2.548)	(2.813)	(4.254)	(3.812)
Women's regular employment	0.047**	0.079***	0.034	0.027	0.062***	0.020*	0.026	0.044**
	(0.017)	(0.008)	(0.020)	(0.017)	(0.018)	(0.011)	(0.019)	(0.021)
Women's non-regular employment	-0.056***	-0.084***	-0.047***	-0.069***	-0.034	-0.065***	-0.051***	-0.060***
	(0.009)	(0.004)	(0.012)	(0.013)	(0.022)	(0.011)	(0.016)	(0.019)
Women's annual income	23.641**	20.998**	16.414***	14.297**	23.433***	6.035	16.149***	21.661***
	(2.237)	(3.592)	(3.570)	(5.389)	(6.102)	(6.126)	(5.250)	(6.322)

Notes: Column 1 presents our baseline estimates for comparison purposes. Columns 2 and 3 present estimates using one-year smaller and larger bandwidths, respectively. Columns 4 to 8 present estimates using 5- or 10-year bandwidths and different functional polynomial forms. The unit for annual income is 10,000 Japanese yen ($1 = 107JPY).
The symbols ***, **, and * indicate that the pre- post-reform differences are statistically significant at the 1%, 5%, and 10% level, respectively.

Table 8. Subgroup Analysis

	Non-university educated	University educated	Three-generation households	Two-generation households	High-Wage prefectures	Low-Wage prefectures
	1	*2*	*3*	*4*	*5*	*6*
Men's weekend home production (min)	29.901***	3.310	47.850	23.750***	26.103**	18.482***
	(7.337)	(14.020)	(27.051)	(1.255)	(7.778)	(1.058)
Women's weekend home production (min)	-21.764**	2.479	25.371	-13.770	-24.109	-14.868***
	(7.079)	(4.337)	(22.246)	(9.365)	(24.414)	(3.919)
Women's regular employment	0.056**	0.001	0.123*	0.029*	-0.0004	0.051**
	(0.019)	(0.031)	(0.059)	(0.015)	(0.027)	(0.016)
Women's non-regular employment	-0.077***	-0.001	-0.196**	-0.031***	-0.049	-0.055***
	(0.019)	(0.032)	(0.078)	(0.006)	(0.029)	(0.012)
Women's annual income	21.783***	35.199*	39.620***	21.548***	18.381***	23.295***
	(3.871)	(15.288)	(9.621)	(3.959)	(3.216)	(2.651)

Notes: Estimates are from a 3-year bandwidth RD model with dummy variables for prefecture and day of the week. Robust standard errors are clustered at the year of birth level. Non-college educated includes individuals whose highest educational attainment is junior high school, high school, vocational training school, or 2-year college, whereas college educated includes individuals with a university degree or higher. High-wage prefectures include Tokyo, Kanagawa, Aichi, and Osaka. The unit for annual income is 10,000 Japanese yen ($1 = 107JPY). The symbols ***, **, and * indicate that the pre-/post-reform differences are statistically significant at the 1%, 5%, and 10% level, respectively.

Table 9. Women's Labor-Market Outcomes Within a Couple

	Women's Treatment Running Variable: Women's Date of Birth		**Men's Treatment** Running Variable: Men's Date of Birth	
	(1)	(2)	(3)	(4)
	Panel A ***Direct Effect on Women Themselves***		**Panel B** ***Indirect Effect on their Wife***	
Sub-sample	Husband also treated	Husband untreated	Wife also treated	Wife untreated
Regular employment	0.178***	0.061**	-0.017	-0.03
	(0.025)	(0.009)	(0.44)	(0.031)
Non-regular employment	-0.184***	-0.054***	0.044	-0.049
	(0.039)	(0.013)	(0.30)	(0.026)
Self-employed	-0.058***	-0.014	-0.011	0.030**
	(0.009)	(0.007)	(0.013)	(0.011)
Not working	0.064	0.007	-0.016	0.049
	(0.061)	(0.008)	(0.016)	(0.041)
Annual income (unit: 10,000 JPY)	38.461***	23.227**	11.653	-5.773
	(5.889)	(6.299)	(9.300)	(6.348)
High-wage Occupation	0.048	0.001	-0.005	-0.106***
	(26.53)	(0.009)	(0.025)	(0.018)
Number of observations	1,682	1,886	2,121	1,447

Source: 2016 JTUS.

Notes: Estimates are from a 3-year bandwidth RD model with dummy variables for prefecture and day of the week. Robust standard errors are clustered at the year of birth level. Only a sample which includes his/her own spouse is used. The forcing variable for both husbands and wives is restricted to (fv>= -3 & fv<= 3), meaning that all samples were born between 1974 and 1980. Sample sizes of weekday time spent working are 1,097 and 1,204 for treated women with treated husband and untreated husband, respectively, and are 1,366 and 935 for their wives with treated wife and untreated wife, respectively. The symbols ***, **, and * indicate that the pre/post-reform differences are statistically significant at the 1%, 5%, and 10% level, respectively.

Table 10. Weekend Home-Production Time Within a Couple (in minutes)

	Women's Treatment Running Variable: Women's Date of Birth		**Men's Treatment** Running Variable: Men's Date of Birth	
	(1)	(2)	(3)	(4)
	Panel A ***Indirect Effect on their Husband***		**Panel B** ***Direct Effect on Men Themselves***	
Sub-sample	Husband also treated	Husband untreated	Wife also treated	Wife untreated
Home Prod.	45.23	32.32***	-3.55	27.99***
	(23.85)	(6.59)	(5.96)	(6.01)
Housework	11.63***	-2.34	-5.76**	-4.55
	(2.56)	(5.96)	(1.78)	(4.18)
Childcare	8.79	20.61***	-9.43	28.38***
	(19.17)	(3.632)	(5.15)	(6.38)
Other	24.81*	14.05***	11.64	4.15
	(7.20)	(2.601)	(9.97)	(3.55)
Leisure	18.52*	-15.02*	-41.53**	26.53*
	(9.18)	(7.21)	(11.94)	(13.03)
Life-Support	-32.51***	5.08	21.26*	-9.94
	(8.25)	(3.57)	(8.77)	(10.40)
Work-Related	-31.24	-22.39**	23.81**	-44.57***
	(18.87)	(6.20)	(8.29)	(10.97)
	Panel C ***Direct Effect on Women Themselves***		**Panel D** ***Indirect Effect on Their Wives***	
Sub-sample	Husband also treated	Husband untreated	Wife also treated	Wife untreated
Home Prod.	-58.77	-18.28	-2.88	-19.79
	(32.39)	(10.08)	(14.61)	(28.90)
Housework	-18.57	0.13	-28.88***	-11.07
	(14.14)	(8.13)	(7.21)	(7.78)
Childcare	-48.16**	-4.77	26.88***	5.29
	(13.17)	(5.34)	(2.40)	(26.17)
Other	7.96	-13.64**	-0.87	-14.01***
	(6.69)	(4.13)	(8.33)	(3.38)
Leisure	2.17	0.538	-14.52	-2.20
	(15.83)	(8.73)	(14.99)	(16.89)
Life-Support	0.67	0.123	-2.49	1.625
	(15.83)	(4.54)	(4.71)	(13.23)
Work-Related	55.93*	17.62***	19.89*	20.36
	(26.53)	(2.29)	(8.32)	(25.71)
Number of observations	1,844	2,171	2,368	1,647

Notes: Estimates are from a 3-year bandwidth RD model with dummy variables for prefecture and day of the week. Robust standard errors are clustered at the year of birth level. Only a sample which includes his/her own spouse is used. The forcing variable for both husbands and wives is restricted to (fv>= -3 & fv<= 3), meaning that all samples were born between 1974 and 1980. The symbols ***, **, and * indicate that the pre-/post-reform differences are statistically significant at the 1%, 5%, and 10% level, respectively.

Table 11. Fertility

	Women's Treatment Running Variable: Women's Date of Birth			**Men's Treatment** Running Variable: Men's Date of Birth		
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Husband also treated	Husband untreated	All	Wife also treated	Wife untreated
All children						
Has children	-0.001	0.063***	-0.025*	0.002	0.008	-0.045*
	(0.006)	(0.012)	(0.12)	(0.006)	(0.007)	(0.021)
Total number	-0.119	0.449**	-0.329***	-0.105**	-0.096**	-0.268*
	(0.066)	(0.132)	(0.061)	(0.032)	(0.028)	(0.115)
Children < 10						
Has children	-0.010	-0.027	0.007	0.051**	0.025	0.054***
	(0.013)	(0.027)	(0.008)	(0.014)	(0.030)	(0.011)
Total number	0.024	-0.163	0.074***	0.197***	0.118*	0.226***
	(0.023)	(0.096)	(0.015)	(0.037)	(0.050)	(0.040)
Number of observations	3,581	1,685	1,896	3,581	2,129	1,452

Source: 2016 JTUS.

Notes: Estimates are from a 3-year bandwidth RD model with dummy variables for prefecture and day of the week. Robust standard errors are clustered at the year of birth level. Only a sample which includes his/her own spouse is used. The forcing variable for both husbands and wives is restricted to (fv>= -3 & fv<= 3), meaning that all samples were born between 1974 and 1980. The symbols ***, **, and * indicate that the pre/post-reform differences are statistically significant at the 1%, 5%, and 10% level, respectively.

Table 12. Sensitivity Analysis of Direct and Indirect Effects, by Whether or not Spouse was Treated

	Bandwidth = 4 years	Bandwidth = 5 years	Bandwidth = 36 months	Bandwidth = 4 years	Bandwidth = 5 years	Bandwidth = 36 months
	linear	*2nd polynomial*	*linear*	*linear*	*2nd polynomial*	*linear*
	1	*2*	*3*	*4*	*5*	*6*
Panel A: Women's Treatment (Running Variable: Women's Date of Birth)						
	Husband also treated			***Husband untreated***		
Men's home production (min)	40.81***	41.57**	26.05*	4.37	20.14	35.66**
	(8.25)	(17.12)	(15.54)	(13.27)	(11.43)	(15.25)
Women's home production (min)	-49.62**	-125.53***	-63.96***	-13.53	-27.83***	-13.45
	(20.43)	(29.48)	(21.81)	(9.41)	(4.81)	(19.98)
Women's regular employment	0.069	0.213**	0.145***	0.070***	0.091***	0.051
	(0.058)	(0.045)	(0.048)	(0.007)	(0.025)	(0.039)
Women's annual income	19.281**	33.859***	38.355**	17.699***	27.711***	17.344
	(7.23)	(9.555)	(17.971)	(3.543)	(3.604)	(12.160)
Number of children	0.359**	0.488***	0.379***	-0.344***	-0.281**	-0.361***
	(0.125)	(0.089)	(0.136)	(0.096)	(0.099)	(0.117)
Number of children <10	-0.170*	-0.153	-0.058	0.068**	0.021	0.097
	(0.088)	(0.127)	(0.107)	(0.027)	(0.020)	(0.066)
Panel B: Men's Treatment (Running Variable: Men's Date of Birth)						
	Wife also treated			***Wife untreated***		
Men's home production (min)	-0.01	-15.24**	5.88	20.364***	43.18***	19.69
	(3.52)	(5.39)	(21.59)	(5.23)	(12.18)	(18.38)
Women's home production (min)	-0.87	-16.03	1.59	-7.31	-24.29	-15.63
	(7.98)	(10.16)	(24.96)	(22.45)	(21.92)	(28.72)
Women's regular employment	-0.12	-0.016	0.002	-0.038	-0.060***	-0.003
	(0.024)	(0.055)	(0.035)	(0.030)	(0.017)	(0.045)
Women's annual income	8.228	24.664	12.800	-12.427	-6.867	-7.442
	(5.348)	(15.371)	(10.895)	(7.668)	(7.047)	(13.914)
Number of children	-0.102**	-0.282***	-0.013	-0.380**	-0.382**	-0.254
	(0.031)	(0.047)	(9.166)	(0.124)	(0.124)	(0.230)
Number of children <10	0.086	-0.076*	0.115**	0.120***	0.127***	0.231**
	(0.049)	(0.034)	(0.062)	(0.034)	(0.037)	(0.104)

Source: 2016 JTUS.

Notes: Estimates are from a 3-year bandwidth RD model with dummy variables for prefecture and day of the week. Robust standard errors are clustered at the year of birth level. Only a sample which includes his/her own spouse is used. The forcing variable for both husbands and wives is restricted to (fv>= -3 & fv<= 3), meaning that all samples were born between 1974 and 1980. Columns 1 and 4 present estimates using four-year bandwidths. Columns 2 and 5 present estimates using 5-year bandwidths and different functional polynomial forms. Columns 3 and 6 re-estimate the baseline model using months as a running variable. The unit for annual income is 10,000 Japanese yen ($1 = 107JPY). The statistics presented here reflect the mean values, with standard deviations in parentheses. The symbols ***, **, and * indicate that the pre-/post-reform differences are statistically significant at the 1%, 5%, and 10% level, respectively.

Table 13. Gender Norms, by Gender

	Disagrees with Traditional Norms
Men	0.013
	(0.011)
Sample size	11,215
Women	0.031***
	(0.006)
Sample size	11,161

Source: Authors' survey.

Notes: Estimates are from a 3-year bandwidth RD model with dummy variables for prefecture and day of the week dummies. Robust standard errors are clustered at the year of birth level. The symbols *** indicate that the pre-/post-reform differences are statistically significant at the 1% level.

Appendix Table A1: Descriptive Statistics for Time Use (Averages per Cohort, in Minutes)

	Before 1977 Cohorts 1974 to 1976 Mean (Sd)	After 1977 Cohorts 1977 to 1980 Mean (Sd)	Diff (Post 1977-Pre 1977)		Diff % change
Men					
Weekdays					
Work	610.00 (221.90)	609.60 (232.90)	-0.44		0%
Of which commuting time is	61.83 (56.01)	58.35 (52.01)	-3.49	*	-6%
Leisure	210.30 (167.4)	208.20 (164.50)	-2.08		-1%
Home production	37.09 (95.40)	43.87 (98.16)	+6.79	**	+18%
Sleep and eat	582.60 (122.50)	578.40 (126.40)	-4.27		
Weekends					
Work	237.90 (307.50)	239.10 (307.50)	+0.17		0%
Of which commuting time is	20.71 (41.01)	21.43 (41.01)	+0.72		+3%
Leisure	427.80 (258.90)	389.30 (251.90)	-38.48	***	-9%
Home production	106.50 (162.20)	133.20 (171.10)	+26.64	***	+25%
Sleep and eat	667.70 (165.00)	679.40 (165.90)	+11.66	***	+2%
Women					
Weekdays					
Work	301.70 (254.40)	281.40 (260.10)	-20.27	***	-7%
Of which commuting time is	31.98 (41.60)	30.76 (41.46)	-1.22		-4%
Leisure	190.80 (154.70)	178.90 (153.00)	-11.92	***	-6%
Home production	344.20 (218.10)	361.10 (227.00)	+16.91	**	+5%
Sleep and eat	603.30 (125.60)	618.60 (130.10)	+15.28	***	+3%
Weekends					
Work	95.40 (188.00)	88.01 (187.50)	-7.39	*	-8%
Of which commuting time is	9.05 (26.95)	8.65 (26.84)	-0.40		-4%
Leisure	314.70 (210.60)	279.00 (210.40)	-35.76	***	-11%
Home production	354.30 (222.40)	384.20 (229.30)	+29.92	***	+8%
Sleep and eat	675.60 (147.60)	688.80 (154.30)	+13.24	***	+2%

Source: 2016 JTUS.

Notes: The size of the weekday and weekday time-use sample for men is 3,564 and 6,371, respectively. For women, it is 4,589 and 7,712. The statistics presented are the mean values, with standard deviations in parenthesis. The symbols ***, **, and * indicate that the pre-/post-reform differences are statistically significant at the 1%, 5%, and 10% level, respectively. Work time includes time commuting to work.

Appendix Table A.2. Sensitivity Analysis of Main Findings to Robust Standard Errors

	Not clustered	Clustered at the year of birth	Kolesár and Rothe (2018)
	1	*2*	*3*
Men's weekend home production (min)	18.019*	18.02***	18.02**
	(9.37)	(1.62)	(9.13)
Women's regular employment	0.050**	0.050**	0.050**
	(0.025)	(0.020)	(0.024)
Women's non-regular employment	-0.057***	-0.057***	-0.057**
	(0.028)	(0.011)	(0.028)
Women's annual income	23.411**	23.411***	23.411**
	(10.342)	(2.574)	(10.400)
Number of children (among men)	-0.164*	-0.164***	-0.164*
	(0.090)	(0.027)	(0.092)
Number of children < 10 y.o. (among men)	0.079	0.079***	0.079
	(0.056)	(0.020)	(0.055)

Source: 2016 JTUS.

Notes: Column 1 presents a specification with no covariates, yearly data and bandwidth of 3 years before and after the threshold. Column 2 clusters the standard errors at the year of birth level. Column 3 presents estimates using White robust standard errors for inference in RDDs with a discrete running variable, as per Kolesár and Rothe (2018), using the R code "RDHonest".

Appendix Table A.3. Pre-reform Control Means (Women's Labor-Market Outcomes Within a Couple and Fertility)

	Panel A Pre-reform women's control means Running Variable: Women's Date of Birth		**Panel B** Pre-reform men's wives' control means Running Variable: Men's Date of Birth	
Sub-sample	***Husband also treated***	***Husband untreated***	***Wife also treated***	***Wife untreated***
Women's Labor Market				
Regular employment	0.25	0.25	0.28	0.25
	(0.43)	(0.43)	(0.45)	(0.43)
Non-regular employment	0.42	0.47	0.39	0.47
	(0.49)	(0.50)	(0.49)	(0.50)
Self-employed	0.06	0.07	0.07	0.07
	(0.24)	(0.25)	(0.25)	(0.25)
Not working	0.27	0.22	0.26	0.22
	(0.45)	(0.41)	(0.44)	(0.41)
Annual income (unit: 10,000 yen)	133.70	147.60	142.60	147.60
	(158.20)	(162.70)	(153.00)	(162.70)
High-wage occupation	0.38	0.45	0.42	0.45
	(0.49)	(0.50)	(0.49)	(0.50)
Number of observations	293	1,154	732	1,154
	Panel C Pre-reform women's control means Running Variable: Women's Date of Birth		**Panel D** Pre-reform men's control means Running Variable: Men's Date of Birth	
	Husband also treated	***Husband untreated***	***Wife also treated***	***Wife untreated***
Fertility				
Has children	0.850	0.911	0.886	0.911
	(0.358)	(0.285)	(0.318)	(0.285)
Total number	2.297	2.934	2.434	2.934
	(1.735)	(1.674)	(1.621)	(1.674)
Has children under 10 years old	0.765	0.610	0.745	0.610
	(0.425)	(0.488)	(0.436)	(0.488)
Total number under 10 years old	1.259	0.897	1.202	0.897
	(0.922)	(0.868)	(0.920)	(0.868)
Number of observations (total # children)	737	1,159	293	1,159

Source: 2016 JTUS.

Notes: This table shows pre-reform control means of Tables 9 and 11. Only a sample which includes his/her spouse is used. Husband's sample in Panel A and wife's sample in Panel B are restricted to (fv>= -3 & fv<= 3), meaning that they were born between 1974 and 1980.

Appendix Table A.4. Pre-reform Control Means (Weekend Home-Production Time Within a Couple (in minutes))

	Panel A: Pre-reform women's husbands' control means Running Variable: Women's Date of Birth		**Panel B: Pre-reform men's control means** Running Variable: Men's Date of Birth	
Sub-sample	***Husband also treated***	***Husband untreated***	***Wife also treated***	***Wife untreated***
Men's time use				
Home Production	112.30	103.70	118.90	103.70
	(164.40)	(155.60)	(167.40)	(155.60)
Housework	14.64	22.44	25.09	22.44
	(40.35)	(61.64)	(66.35)	(61.64)
Childcare	42.81	31.37	40.29	31.37
	(110.40)	(97.72)	(107.60)	(97.72)
Other	54.81	49.91	53.51	49.91
	(94.20)	(91.80)	(90.15)	(91.80)
Leisure	412.50	440.10	404.10	440.10
	(254.90)	(253.50)	(254.00)	(253.50)
Life-Support	670.80	669.80	674.40	669.80
	(154.70)	(162.80)	(158.70)	(162.80)
Work-Related	244.40	226.40	242.50	226.40
	(303.90)	(302.80)	(307.20)	(302.80)
Number of Obs.	329	1,318	853	1,318
	Panel C: Pre-reform women's control means Running Variable: Women's Date of Birth		**Panel D: Pre-reform men's wives' control means** Running Variable: Men's Date of Birth	
Sub-sample	***Husband also treated***	***Husband untreated***	***Wife also treated***	***Wife untreated***
Women's time				
Home Production	399.10	376.70	387.50	376.70
	(222.80)	(213.50)	(215.70)	(213.50)
Housework	197.50	204.90	202.30	204.90
	(136.60)	(139.60)	(140.80)	(139.60)
Childcare	101.10	72.17	89.05	72.17
	(165.10)	(144.20)	(150.90)	(144.20)
Other	100.50	99.69	96.18	99.69
	(101.80)	(100.80)	(94.97)	(100.80)
Leisure	273.10	305.60	278.70	305.60
	(192.90)	(196.40)	(206.20)	(196.40)
Life-Support	682.60	672.60	683.30	672.60
	(141.50)	(142.70)	(145.50)	(142.70)
Work-Related	85.21	85.07	90.46	85.07
	(185.70)	(174.40)	(192.90)	(174.40)
Number of Obs.	329	1,318	853	1,318

Source: 2016 JTUS.

Notes: This table shows pre-reform control means of Table 10. Only a sample which include his/her own spouse is used. Husband's sample in Panel A and wife's sample in Panel B are restricted to (fv>= -3 & fv<= 3), meaning that they were born between 1974 and 1980.