Curriculum and Gender Norms:

The Effect of Co-Education of Home Economics[*]

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Abstract

This study examines the causal effect of educational policy on people's attitudes toward traditional gender roles through the study of a 1989 national educational reform in Japan in which home economics became a co-educational subject, having previously been taken only by girls. Using a regression discontinuity design and microdata from a Japanese time-use survey, we examined whether co-educational classes in home economics have increased husbands' participation in domestic production. We found a sharp increase in both the amount and the share of the typical husband's household production at the cutoff point (the cohort born in the 1977 academic year), indicating that husbands who had studied home economics for six years in junior and senior high school later contributed more to household production than those who did not. This implies that by providing both men and women with a more equitable view of gender role divisions, co-education can lead to increased male participation in activities previously seen as gendered. The study also validates the role of education in reshaping social norms.

Keywords: gender norms, educational reform, co-education, gender gaps in household production and the labor market
JEL classification: J22, J24, I2

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1 Introduction

Although gender equality has become a worldwide concern, many countries continue to exhibit a gender gap in the labor market. Labor economists have been trying to explore its cause: some have focused on the supply side, such as the gender difference in the human capital and the child penalty,[1] and the others the demand side, that is, the labor market discrimination and the issues inherent in the labor market system.[2] Furthermore, recently, some studies focusing on the effect of the social norm have been published.

While differences in labor incentives may explain some of this imbalance in home production, economists recently have begun to draw upon ideas about identity from the sociology and social psychology literatures to examine how social norms can also play an important role in people's decision making (Akerlof and Kranton [2000] and Akerlof and Kranton [2010]). As Bertrand et al. [2015] note, "They [Akerlof and Kranton] define identity as a sense of belonging to a social category, coupled with a view on how people in that category should behave. They propose that identity influences economic outcomes because deviating from the prescribed behavior is inherently costly." Bertrand et al. [2015] apply this model to gender identity, with men and women as the social categories, and they focus on the traditional behavioral prescription that "a man should earn more than his wife." They show empirically that even in couples where the wife's potential income is likely to exceed her husband's, the wife is less likely to be in the labor force and, moreover, she also earns less than her potential if she does work. Additionally, even in couples where the wife earns more than the husband, the wife spends more time on household chores. As these results contradict the theoretical expectation (Becker [1985], Becker [1965]), this suggests that gender identity does play an important role in household behavior.[3]

In Japan, although the average wages of men and women have been gradually converging,

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[1]Bertrand et al. [2010].

[2]Cortés and Pan [2018], Gicheva [2013], and Goldin [2014].

[3]See Fortin [2005].

with the female-male ratio of average monthly scheduled wages of full-time workers rising from 59.7% in 1990 to 72.2% in 2014,[4] this trend has stabilized in recent years. In 2014, Japan's gender wage gap remained third highest among OECD countries after Korea and Estonia.[5] [6] With such an imbalance in labor incentives, it should not be surprising that Japanese men spend relatively little time in unpaid home production. At around one hour per day, it is the second lowest among developed countries after Korea.[7]

As is well known, Japan is one of the countries which have well-defined social norms in which the husband has traditionally worked outside the home while the wife has specialized in domestic production, and this is one of the reasons why the Japanese women are less likely to work at the market intensively and the Japanese husband's share of housework is relatively small.[8] Further, Rodríguez-Planas and Tanaka [2018] show that gendered social norms affect Japanese women's decision to work, which implies that the observed gender imbalance in the labor market in Japan is caused by social norms that affect the behavior of both Japanese men and women. It is thus possible that a change in the social norm might trigger a change in behavior of men as well as women. Conversely, we might also say that a change behavior might require a change in social norms, and we suggest that education policy might be one means of achieving this.

Turning to the Japanese education system, the government guidelines for education (GGE) are the legally binding standard for the education curriculum throughout the nation, not by region, and have undergone periodic revision since they were first instituted at the end of World War II. If the GGE are revised, all Japaneses schools have to change their curriculum according to them.

Home economics, the field of study to acquire skills and knowledge related to home

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[4]Japanese Ministry of Health, Labour, and Welfare *Basic Survey on Wage Structure*.

[5]OECD database.

[6]Hara [2018], Kawaguchi [2005], Kawaguchi [2015], and Chiang and Ohtake [2014] study the gender wage gap in Japan.

[7]The Statistics Bureau of Japan.

[8]Porterfield and Winkler [2007] show that among teenagers in the US, time spent on housework by girls is longer than for boys, suggesting that these social norms exist at an early age.

production such as cooking, sewing, housing and family studies, is currently a required subject for both boys and girls, however, it was a required subject *only for girls* in junior high and senior high school for an extended period after World War II, thus inculcating through education policy the social norm that men do not need to do housework because that is a woman's domain.[9] In addition, most classes in Japan occur in the homeroom class, with teachers moving around the school and students staying in one place; however, some classes such as science, music, art, and home economics take place in a special subject classroom, such as the science room. Home economics was highlighted not only as a special subject since it was held in the home economics classroom, but also a gender segregated one, for while girls were studying home economics, boys were also outside their homeroom studying another subject in a different specialized classroom. In this manner, by creating home economics as a geographically separate knowledge domain hidden from boys, the social norm that home production was applicable only to girls was actively promoted through both educational policy and practice.[10]

However, the 1989 revision of GGE stipulated that both boys and girls born after the beginning of the 1977 school year (FY1977) on April 2, 1977[11] would be required to study home economics in junior and senior high school. We can infer that this shift in educational policy to six years of home economics, taken co-educationally, might have contributed to a substantial change in male attitudes about traditional gender roles and social norms regarding gender roles. Accordingly, in this study, we use the difference in the education of home economics for boys born before FY1976 (the pre-1977 cohort) and after FY1977 (the post-1977 cohort) to examine the effect of education on men's participation in home production, using a regression discontinuity design and micro data from a Japanese time use survey

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[9]In elementary school, it is a required subject for both boys and girls even now and then.

[10]This began to change with the 1978 revision of the GGE, which determined that junior high school boys would also take home economics. However, the required number of credits for boys was much smaller than that for girls, and home economics classes were gender segregated, with boys and girls taught separately in different classrooms.

[11]The school year in Japan begins in April and is thus different from the calendar year. To clarify, we define school year T (FYT) to include the cohort born between April 2nd in T and April 1st in $T+1$.

(JTUS).[12]

Of its several contributions to the field, first and most importantly, this study shows that education plays an important role in changing/shaping social norms about gender roles. While previous studies have shown that social norms affect decision to work (Rodríguez-Planas and Tanaka [2018]) and even allow people to deviate from economically rational behavior (Bertrand et al. [2015]), this is the first study to date that investigates factors that might be effective in weakening these social norms. Other contributions include our use of JTUS microdata that provides detailed information on time use (explained in detail in Section 4.1) and a natural experiment framework that exploits the discrete change in Japanese national educational policy which together provide a precise yet comprehensive examination of the effect of education on social norms.

The main result of this study is that men of the post-1977 cohort are more likely to participate in home production than those of the pre-1977 cohort, suggesting that co-education in home economics changed the attitudes of both men and women about gender roles. This implies that education is quite important in both forming and changing social norms.

The structure of this paper is as follows: We review previous literatures in Section 2. Section 3 explains the change in educational policy on home economics in Japan, and Section 4 describes the data used in this study as well as the identification strategy for the analysis. The estimation results are reported in Section 6, and Section 7 concludes the paper.

2 Literature Survey

There are a number of existing studies on determinants of gender role division. Roughly speaking, it is shown that 1) economic development, medical improvements, and technological change (e.g., Doepke and Tertilt [2009], and Albanesi and Olivetti [2016]),[13] 2) the production

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[12]The formal name of JTUS is the *Survey on Time Use and Leisure Activities* conducted by the Statistics Bureau of Japan.

[13]Doepke and Tertilt [2009] show that increase in the importance of human capital by technological change improves in the legal rights of married women, and Albanesi and Olivetti [2016] do that medical progress is essential for the joint rise in women's labor force participation and fertility.

structure of the economy and incentive problems in the labor market (e.g., Olivetti and Petrongolo [2016] and Albanesi and Olivetti [2009]),[14] 3) demographic factor (the sex ratio) (Cardoso and Morin [2018]),[15] and 4) beliefs and norms about the appropriate role of women in society are main factors. Thus, the gender norm, the fourth one, is considered to be one of the most important factors determining the gender role.

Some studies, including both ones using survey data and ones using experimental framework, show the effect of gender norm on people's decision making. For example, Fernandez and Fogli [2009] and Bertrand et al. [2015] show empirically that the social norms/the culture are significant in explaining women's hours of work and domestic production, and fertility outcomes, using survey data like the General Social Survey. Additionally, using the experimental framework, Bursztyn et al. [2018] and Bursztyn et al. [2017] also find it.

Now, how do people form/transmit believes and values on the gender role? From a long-term/historical perspective, Alesina et al. [2013] provide an answer on the origin of gender norm, that is, differences in traditional farming practices ("plough use") have shaped the evolution of norms and beliefs about the gender role in society.

Then, in the modern society, what form/transmit the gender norm? There might be some factors; from parents to children, from peer to peer, from third parties such as media, experts, the state, and schools. This study explores determinants of the gender norm, focusing on the role of education. To our knowledge, this is the first study to examine the effect of education on the form of gender norm.[16]

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[14]Olivetti and Petrongolo [2016] provide the evidence on the interplay between the rise of the service economy and the growth in female hours of work. Albanesi and Olivetti [2009] show that the fraction of performance pay in total compensation is inversely related to home hours.

[15]Cardoso and Morin [2018] find that as the ratio of men in the society declines, female labor force participation increases, women enter traditionally male-dominated occupations and industries.

[16]In terms of the political attitude, it is shown that the curriculum change could affect it (Cantoni et al. [2017] and Chen et al. [2016]).

3 Home Economics Education in Japan

3.1 Japanese Education System

Japan has a *national* education system, with the two main laws regulating Japanese schooling being the *Basic Act on Education* and the *School Education Law*. The former is the fundamental law concerning school education in Japan, while the latter determines the school system. In addition, a school's curriculum is also regulated by various other laws, government ordinances, regulations, and notifications. Among them, the most important are the *Government Guidelines for Education* (GGE),[17] which are determined based on the School Education Law.

The GGE, which are determined separately for elementary, junior high, senior high, schools for the blind, schools for the deaf, and schools for the disabled, provide the legally binding national curriculum standards for each type of school. As each school must adhere to these guidelines on curriculum organization and course content, the GGE plays the most important role in how education is practiced within the Japanese school system.

3.2 Home Economics Education before the 1989 Policy Change

In Japan, under the GGE, home economics has been studied in elementary, junior high and senior high schools since the end of World War II, with the focus on learning content and skills related to home production such as cooking, sewing, housing and nursing, as well as understanding family, community and societal relationships.[18] In elementary school, it has been a required subject for both boys and girls throughout the post-war period, however, it was not co-educational in junior high and senior high school before the policy change in 1989, shown in Table 1.

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[17]Compulsory education in Japan begins at age six and consists of six years of elementary school and three years of junior high school. While not compulsory, most Japanese continue on to the three years of high school. The high school enrollment rate has been greater than 95% since 1992, and in 2017, it was 96.4% (Ministry of Education, Culture, Sports, Science and Technology *School Basic Survey*).

[18]Yokoyama [1996] was referred to for this subsection.

In junior high school, the subject was originally in 1958 called "technology education and home economics (*gijutu-kateika*)." Although treated officially as a single subject, in practice, the content was divided by gender, with technology education for boys and home economics for girls, and studied separately in different rooms. In Japan, most subjects such as math, social studies and languages are held co-educationally in the students' homeroom, while subjects such as science that have special equipment needs require boys and girls to go together to the science room for instruction. In contrast to this, for technology education and home economics instruction, boys moved to the school workshop to study technology while girls moved to the home economics room to study home economics.

This gendered implementation of the course began to change somewhat with the 1978 revision of the GGE which determined that junior high school boys would also take home economics and girls would take technology. However, the required number of home economics credits was substantially smaller for boys than for girls (and similarly for girls with respect to technology), so the content coverage remained different according to gender.[19] Additionally, as boys and girls continued to study only with their own gender and not co-educationally, the 1978 revision maintained the course as content differentiated and physically segregated by gender.

3.3 Home Economics Education after the 1989 Policy Change

Although the gender segregation and content differentiation in the teaching of home economics and technology had been a topic of discussion for some time in Japan from the perspective of equality of educational opportunities for men and women, the 1989 policy change was triggered by international pressure rather than by grass-roots movements based on domestic public opinion.

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[19]Technology education consisted of nine areas: wood-processing I and II, metal-processing I and II, machinery I and II, electricity I and II, and cultivation, while home economics consisted of eight areas: clothing I, II, and III; food I, II, and III; housing; and nursing. Junior high schools were then required to choose five areas from technology education and one area from home economics for male students, and one area from technology education and five areas from home economics for female students.

Table 1: Home Economics Education before Policy Change (–1989)

school	subject name	contents
junior high school (period of enrollment: 3 yrs, 13–15 yrs old)	technology education and home economics	divided by gender • boys: mainly took technology (large required # of technology credits & small # of home economics credits) • girls: mainly took home economics (large required # of home economics credits & small # of technology credits)
senior high school (period of enrollment: 3 yrs, 16–18 yrs old)	home economics	• boys: not a required subject (no boys who took it) • girls: a required subject

In December 1979, after six years of deliberation, the 34th General Assembly of the United Nations adopted the *Convention on the Elimination of All forms of Discrimination against Women* (CEDAW). In order to ratify the agreement, Japan needed to overcome some gender inequality hurdles in three areas: nationality, employment, and education. With respect to education, CEDAW required that all signatory states "shall take all appropriate measures to eliminate discrimination against women in order to ensure to them equal rights with men in the field of education," including the same conditions for vocational training at all levels of schooling, access to the same teaching staff and standard of curriculum quality, and the elimination of stereotyped concepts of gender roles by revising textbooks, adapting teaching methods, and promoting co-educational training (Article 10, (a) (b) (c)). Equal access to vocational training was also required under the measures to eliminate discrimination against women in the workplace (Article 11 (c)). While Japan desired to ratify CEDAW as a member of the international community of developed nations, the home economics curriculum did not satisfy these requirements, with gender-segregated and differentiated content in junior high school and single-sex education for girls only in senior high school.

The discussion to revise the Government Guidelines for Education (GGE) thus began in the Ministry of Education in 1984, and revisions for both junior and senior high schools

were published in March 1989 (hereafter, the 1989 GGE), eliminating the aforementioned gender differences in home economics education in both junior and senior high school. At that time, it was also decided that the new 1989 GGE would be adopted by junior high schools in FY1993, but to ensure a smooth transition from the existing 1978 GGE to the new 1989 GGE, a *transition period* was established between FY1989–1992 (the years that cohorts born in 1976–1979 were enrolled in junior high school) that allowed schools flexibility in deciding which year they would choose to adopt the new guidelines. In terms of home economics education, special exceptions were set for the cohorts born in 1977–1979 (the 1977–79 cohorts), but not for the 1976-cohort,[20] meaning that the gendered difference in learning areas in junior high school was still accepted for the 1976 cohort but were not permitted for the 1977–1979 cohorts regardless of which GGE, 1977 or 1989, was in place at that school at that time.[21]

Most importantly for our research, each junior high was not permitted to set any difference between boys and girls by the 1989 GGE.[22] Consequently, even though there may have been slight differences in the content areas across junior high schools and the year in which each school implemented the new 1989 GGE, for the post-1977 cohort, boys and girls in junior high school studied the same content in the same classroom in a co-educational manner. For this reason, the 1977 cohort is the cutoff of the regression discontinuity design in this study.

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[20]When the 1976 cohort enrolled junior high schools, the 1977 GGE remained in place but junior high schools were required to consider the principle of the new 1989 GGE within the 1977 GGE framework. In practice, this meant that the gender differences in the learning areas for technology and home economics continued to be permitted.

[21]Looking in more detail at how the curriculum was changed by the 1989 GGE, in junior high school, technology education and home economics now covered eleven content areas: wood processing, metal processing, electricity, machinery, cultivation, basic information, family life, food, clothing, housing, and nursing. Of these, wood-processing, electricity, family life, and food were required topics in every school, and to these were added at least three other areas from the list based on regional characteristics and the needs of each school and its students.

[22]The change in *senior high schools* is beyond the scope of this study. The co-education of home economics in in senior high schools was stipulated by the new 1989 GGE too, and it was enacted in FY1994. However, regional differences existed in high school home economics education. For example, from FY1973, public senior high schools in Kyoto prefecture began co-education of home economics for boys and girls. This was abolished in FY1985 as an institution, however, as a matter of fact, many senior high schools continued it until FY1994 (**?**).

4 Econometric Framework

4.1 Data

This study utilizes micro data from the Japanese time use survey (JTUS) conducted by the Statistics Bureau of Japan (SBJ).[23] The JTUS is the pre-eminent government statistical database providing the most comprehensive and reliable data on daily patterns of time allocation and on leisure activities in the country. The main topics covered are: 1) time use over a single day, 2) participation in leisure activities during the past year, and 3) frequency of participation in leisure activities during the past year. [24] The survey has been conducted every five years in October since 1976, and the most recent 2016 survey is the ninth. We have received permission from the SBJ to use the database for this study and, to examine the effect of making home economics compulsory for boys, we utilized the most recent 2016 data.

The JTUS adopts a two-stage stratified sampling method, with the primary sampling unit being the enemuration district (ED) of the *Population Census of Japan*, [25] and the secondary sampling unit being the household. [26] All persons aged 10 and over in the sample households are asked to respond to the survey, and foreigners living in Japan are included. [27] The JTUS is conducted by enumerators who proceed door-to-door, though an online response also became possible for the 2016 survey. The enumerators deliver the questionnaires to each

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[23]The formal name of the JTUS is the *Survey on Time Use and Leisure Activities* (*syakai-seikatsu-kihon-chosa* in Japanese).

[24]For time use during a single day, two questionnaires are used. Questionnaire A adopts a pre-coding method while Questionnaire B adopts an after-coding method designed to elucidate time use in more detail.

[25]The *Census* has been conducted every five years since 1920, with the most recent held in 2015.

[26]First, the entire country is divided into the 47 prefectural regions and sample EDs are selected in each region. Within each selected ED, households are selected from lists of households compiled by enumerators before the survey begins. For the 2016 survey, a total of about 7,300 sample EDs and 88,000 households within those EDs were selected. Within each sample household, all people aged 10 and over are asked to respond to the survey. In 2016, this amounted to about 200,000 people.

[27]There are several groups of people who are explicitly excluded from the survey samples: 1) foreign diplomatic and consular corps (including their families and other members of their party), 2) foreign military personnel and civilian employees (including their families), 3) the Self-Defense Force personnel living in barracks or vessels, 4) sentenced prisoners or persons in reformatories, 5) persons living in social welfare facilities, 6) inpatients of hospitals or clinics, and 7) persons living on the water.

surveyed household, collect the completed questionnaires, and interview the households as necessary.

The JTUS dataset has several advantages, one being that it surveys time use over a single day in nominal terms, not by categories or ranges. This allows us to obtain the exact amounts. Additionally the survey design creates a dataset that represents well the households in Japan. The JTUS is a large-sample dataset with more than 80,000 household samples every survey year (e.g. 88,000 in 2016) and for this study, we used the sample weights to weight back the data to create an analysis sample representative of the target population.

4.2   Analysis Sample

In this section, we describe how the analysis sample of this study was constructed. Focusing on those who were born 10 years before and after the cutoff point of FY1977 (that is, from FY1967 to FY1987), the analysis sample was restricted to married individuals because home production activities differ between those who are married and unmarried. For one, responsibilities about family life are more crucial for those who are married (See subsection 5.1 for detail).

Our concern is whether there might be manipulation in the forcing variable. Checking to ensure that there was no discontinuity in the marriage rate for males at the cutoff point, we see in Figure 1 which shows the marriage rate for males by birth year that although there was no sharp decrease at FY1977, the marriage rate did decline after FY1977, becoming more pronounced toward FY1987. However, when we compare this with the *2015 Japanese National Census*, we see that while the level is different, there is no difference in the trend in the JTUS and CPS. This indicates that the decline in the marriage rate after FY1977 is not a discontinuity but merely reflects the lower marriage rate among younger men and implies that there is no selection manipulation in the analysis sample.

Figure 2 shows the distribution of the forcing variable: the school (fiscal) year in which the husband was born. We can see that while there is a slightly larger gap between FY1977

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Figure 1: Marriage Rate for Males by Birth Year
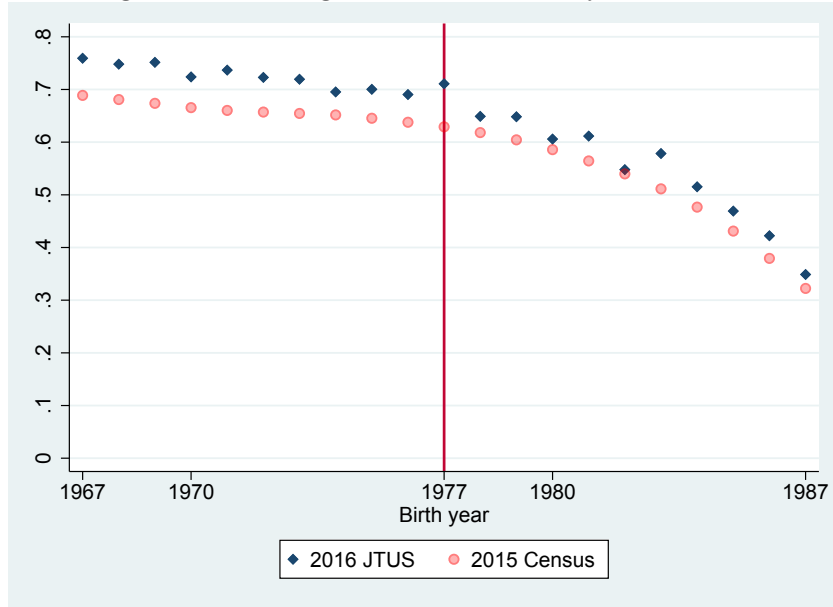
Source: *2016 JTUS* and *2015 Census.*

and FY1978, no discontinuity is observed at FY1977. Intuitively, this is a reasonable finding, for in order for manipulation of our forcing variable to occur, it would require a couple to change the timing of a pregnancy to accommodate an educational policy change some 13 years or more in the future. Moreover, as it would have been incredible to expect in 1976 or 1977 the policy change that would occur in 1989, we do not need to be concerned about manipulation of the forcing variable in this study.

The descriptive statistics are summarized in Table 2, and we present both the totals and the statistics for those born in a three year window before and after the cutoff date (1974–1976 and 1977–1980) in order to see if there is a difference between the two groups. We can see that there are some differences in individual characteristics such as age, number of household members older or younger than age 10 and working style. There are also some differences in the wife's characteristics. However, as these differences might depend on age, we conducted an RD estimation for each covariate to ensure that they did not occur discontinuously. [28]

[28]We used the following equation for each covariate (X): $X_i = birthyear_i + \beta Post1977_i + \epsilon_i$. The notations

Table 2: Descriptive Statistics by Birth Year

	Husband's birth year			Total
	1974–1976	1977–1980		Total
Husband				
age	40.64	37.24	***	38.95
	(0.94)	(1.24)		(2.02)
years of education	13.91	13.97		13.94
	(2.24)	(2.28)		(2.26)
work hour	49.13	49.21		49.17
	(9.38)	(9.21)		(9.29)
annual income	507.10	471.10	***	489.10
(million JPY)	(230.20)	(207.20)		(219.70)
child (yes/no)	0.62	0.77	***	0.70
	(0.49)	(0.42)		(0.46)
no of children	0.95	1.31	***	1.13
	(0.90)	(0.94)		(0.94)
working style				
regular workers	0.83	0.85		0.84
	(0.37)	(0.36)		(0.37)
non-regular workers	0.03	0.03		0.03
	(0.16)	(0.18)		(0.17)
self employed	0.14	0.12	**	0.13
	(0.35)	(0.32)		(0.33)
not working	0.01	0.01		0.01
	(0.10)	(0.08)		(0.09)
His wife				
age	39.46	36.49	***	37.98
	(3.69)	(3.76)		(4.01)
years of education	13.78	13.83		13.80
	(1.77)	(1.86)		(1.82)
work hour	32.75	32.98		32.86
	(12.98)	(13.59)		(13.28)
annual income	193.20	192.30		192.70
(million JPY)	(160.30)	(152.70)		(156.60)
working style				
regular workers	0.26	0.28		0.27
	(0.44)	(0.45)		(0.45)
non-regular workers	0.43	0.38	***	0.40
	(0.50)	(0.48)		(0.49)
self employed	0.06	0.06		0.06
	(0.25)	(0.23)		(0.24)
not working	0.25	0.29	***	0.27
	(0.43)	(0.45)		(0.44)

Source: Statistics Bureau of Japan *2016 Survey on Time Use and Leisure Activities.*
Note: Standard deviation is in parenthesis. *** and ** indicates that t-test rejects the null hypothesis (which both values are the same) with 1% or 5% statistical significance respectively.

Figure 2: Distribution of the Forcing Variable

Note: Sample size of 2015 Census is 10,014,777, and that of 2016 JTUS is 28,076.
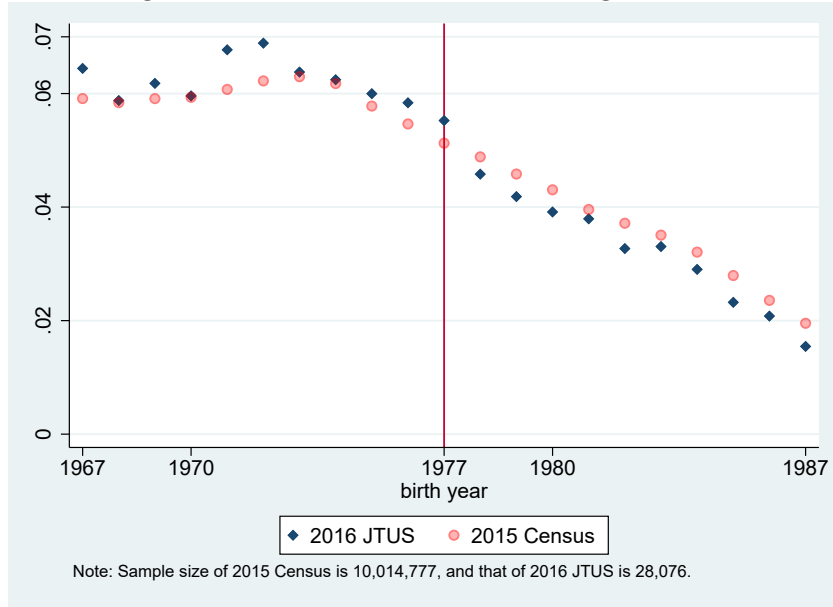
Source: *2016 JTUS* and *2015 Census*.

Table 3 shows the results. All covariates except for the number of household members below 10 years old show with statistical significance that there is no difference at the cut off point (See Figure A1), which implies that any difference in the individual characteristics by age is the result of a continuous change. We can thus say that no covariate affects our RD estimate of the share of home production within a couple.

4.3 Identification Strategy

The JTUS requires respondents to answer the length of time they spend in each of twenty activities [29] in units of fifteen minutes. In other words, responses are provided only for activities on which the husband spent at least 15 minutes. For this study, we focused on activities related to home production such as housework and childcare and so, for our purposes, the

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are the same as those in Eq. (2).

[29]These include sleep, personal up-keep, meals, commuting to and from school or work, work, school, housework, caregiving, childcare, shopping, transportation (excluding commuting to and from school to work), TV, radio, newspaper, magazine, rest and relaxation, educational training, hobby, sports, volunteer activity and social services, association, health care, and other.

Table 3: RD Estimates for Covariates ($\hat{\beta}$)

Panel A. Husband

	(1) age	(2) years of education	(3) regular worker	(4) non-regular worker	(5) self-employed	(6) not working	(7) work hour	(8) annual income
$Post1977_i$	-0.008	0.039	-0.016	0.002	0.020	-0.006	-0.330	-3.583
	(0.019)	(0.089)	(0.015)	(0.007)	(0.013)	(0.003)	(0.383)	(8.728)
N	10,187	10,073	10,162	10,162	10,162	10,185	9,437	10,032

Panel B. Husband's wife

	(1) age	(2) years of education	(3) regular worker	(4) non-regular worker	(5) self-employed	(6) not working	(7) work hour	(8) annual income
$Post1977_i$	0.085	0.044	0.003	-0.015	-0.002	0.015	0.53	10.611
	(0.142)	(0.072)	(0.017)	(0.019)	(0.009)	(0.017)	(0.632)	(7.223)
N	10,187	10,087	10,181	10,181	10,181	10,187	7,042	7,428

Source: Statistics Bureau of Japan *2016 Survey on Time Use and Leisure Activities.*
Note: The estimation equation is $X_i = birthyear_i + \beta Post1977_i + \epsilon_i$, therefore, all equations are controlled for $birthyear_i$. Standard error is in parenthesis.

time allocated to home production thus includes the amount of time spent on housework, caregiving to household members, childcare, shopping, and transportation.

The husband's share of each activity is calculated as follows:

$$Share_i^j = \frac{a\ husband\ time\ spent\ on\ activity\ j}{[a\ husband's\ time\ spent\ on\ activity\ j] + [a\ wife's\ time\ spent\ on\ activity\ j]}. \quad (1)$$

Our identification strategy is an RD design, and the basic estimation equation is a standard RD model as follows:

$$Share_i^j = birthyear_i + \beta Post1977_i + X_i'\gamma + \epsilon_i, \quad (2)$$

where $Share_i$ indicates the husband's share of household production within a couple, $birthyear_i$ is the fiscal year when the husband was born, $Post1977$ is a dummy variable that takes the value one if individual i was born after April 1977 (otherwise zero), and X_i is a set of individual covariates. Our coefficient of interest is $\hat{\beta}$.

5 Graphical Results

Before moving to our estimation results, in this section we first discuss the results of a graphical analysis of the effects of the home economics policy change by applying the method provided by Calonico et al. [2015] [30] to data from the FY1967–1987 cohorts, which is 10 years before and after the cutoff point (FY1977).

5.1 Home Production Time

We begin by observing the results of the graphical analysis of home production time, which we have defined as the the amount of time for housework, caregiving to household members, childcare, grocery shopping, and transportation related to home production. Figure 4 shows the actual and fitted profiles of home production time per day by weekday and weekend according to the *husband's* birth year (a unit is a minute).

Panel A shows the total home production time of a couple on weekdays and weekends, and we can see that the total home production time increases over time as the husband's birth year approaches FY1987, but there are no discontinuous jumps at the cutoff point. We can thus infer that co-education in home economics does not greatly affect the total home production time of a couple. Next, looking at the results of the graphical analysis for husbands and wives separately, we can see in Panel C that there is no effect on the wife's home production time but in Panel B we observe a sharp positive jump of about 20 minutes in home production time for husbands on the weekend.

These results imply that the post-1977 cohort of husbands who studied home economics in junior high school spend more time than the pre-1977 cohort on home production on the weekend, but not on weekdays. This suggests that studying home economics seems to

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[30]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. The lines are polynomial regression curves estimated to flexibly approximate the population conditional mean functions for the control and treated units over a restricted support of the running variable. For more detail, see Calonico et al. [2014].

have a positive influence on men's participation in home production, but as there is little opportunity for most Japanese men to increase the time they spend on home production on weekdays because of their long work hours, we observe this effect only on the weekend.

Next, we investigated whether there might be a difference in time devoted to the various home production activities. For this analysis, we decomposed home production into its individual activities but focused on housework and childcare because time devoted to the other activities was quite small. Figure 4 shows only the weekend results because that is the condition in which a jump in home production time was observed. The forcing variable is again the husband's birth year. In Panel A, which shows the results for a couple, we see a negative jump in housework time at the cutoff point but a positive jump in childcare time. As these two activities had opposite effects, this might explain why no jump was observed above with respect to a couple's total home production time.

Looking at husbands and wives individually (Panels B and C), we see no jump in housework but a sharp jump in childcare that is especially noticeable for husbands but also salient for wives as well. One possible interpretation is that because couples often participate in childcare together on the weekend, if the husband increases the time he devotes to childcare, his wife does as well.

To check this hypothesis, we conducted the same analysis using the wife's birth year as the forcing variable. Figure 5 shows the results, and we see that if we use the wife's birth year as the forcing variable, we do not observe a jump in childcare time but a continuous increase instead. This implies that while co-education in home economics does not directly affect the behavior of wives, the time they devote to it increases as an indirect consequence of their husband's increased participation.

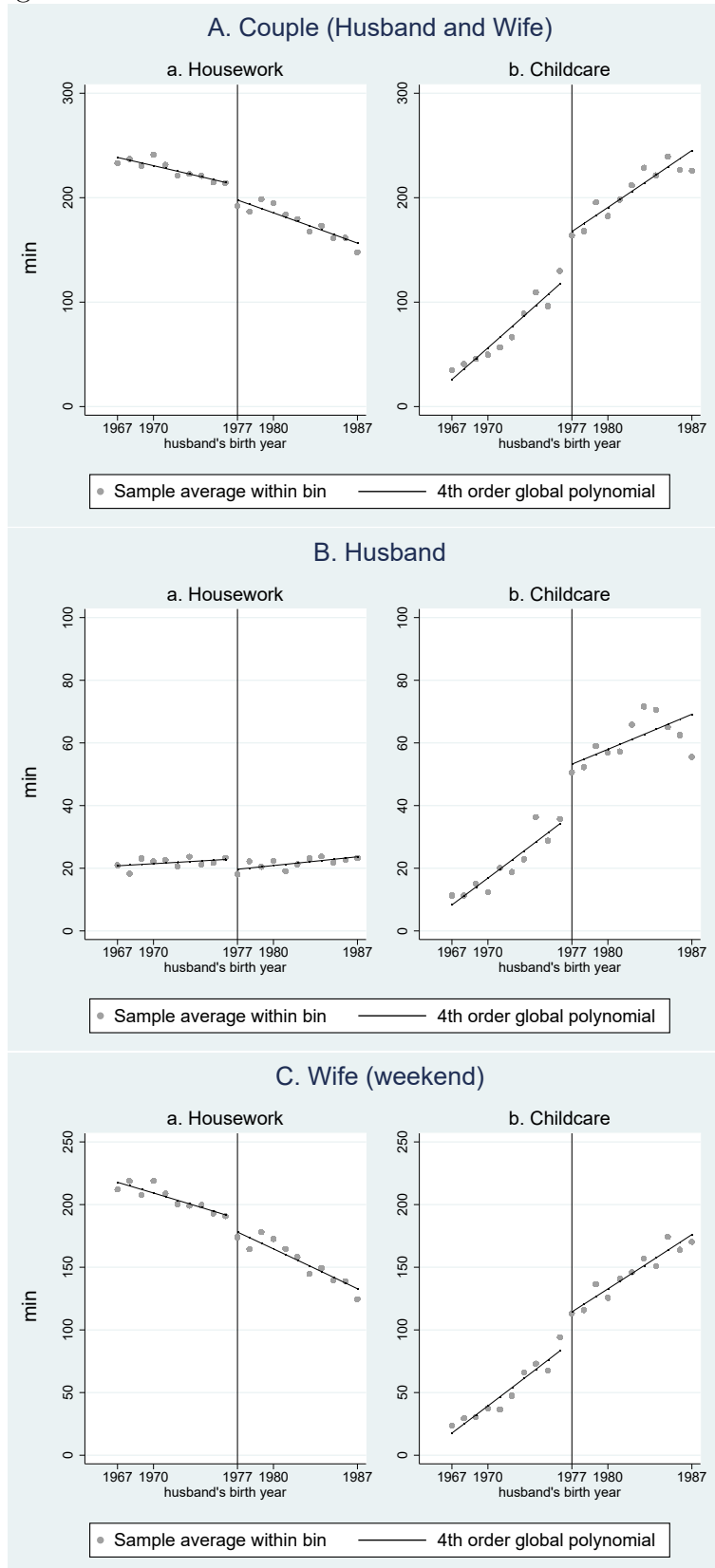## 5.2   Husband and Wife Share of Home Production

Next, we observe the effects of co-education in home economics on the husband/wife share of home production among couples. Here, because the total time allocated to home production
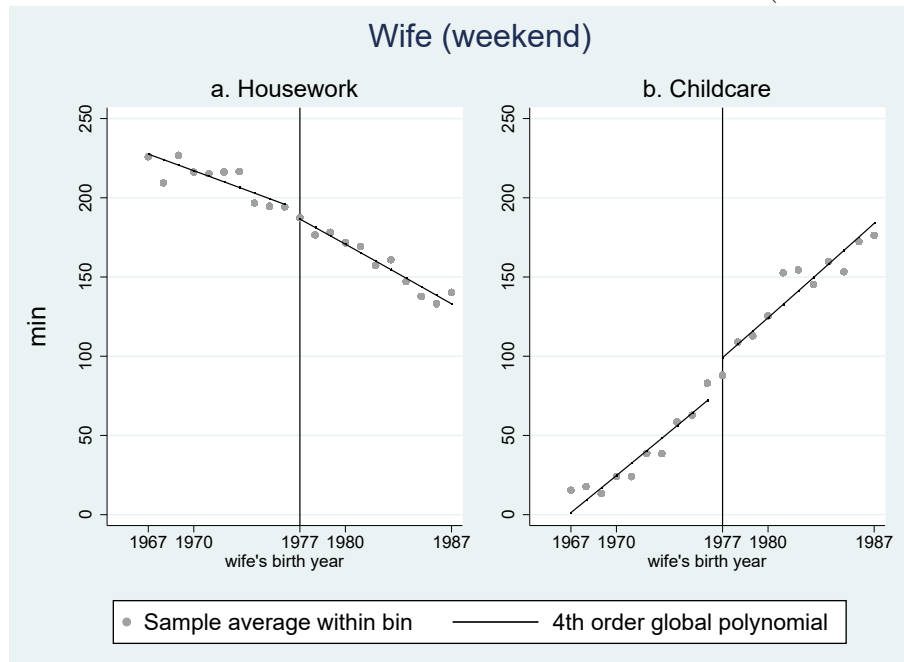
Figure 3: Home Production Time
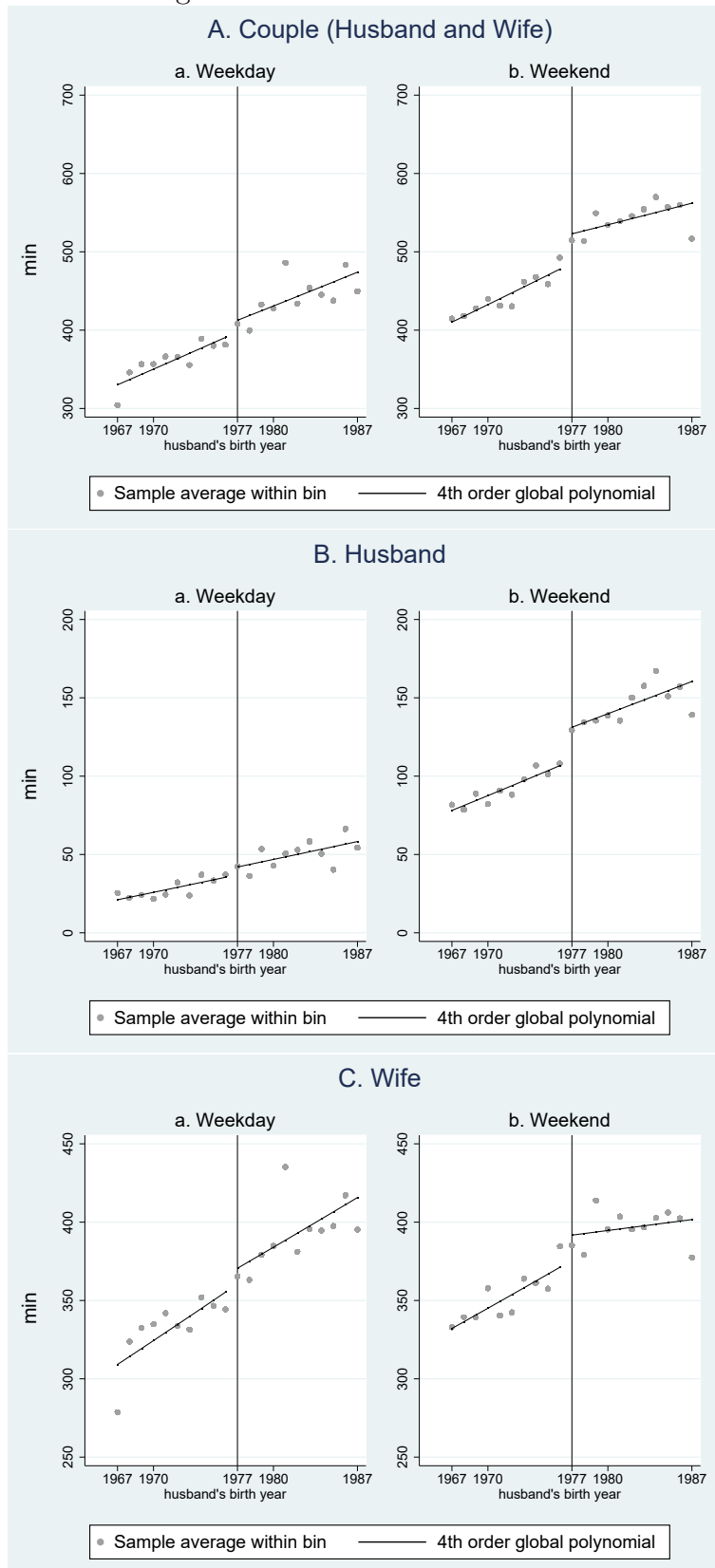
Source: *2016 JTUS.*

Figure 4: Housework and Childcare Time on the Weekend

Source: *2016 JTUS*.

Figure 5: Wife's Housework and Childcare Time on the Weekend (fv=wife's birth year)

might differ among couples, an analysis of absolute time devoted to it is inadequate. Instead, we took the total time devoted to home production for each couple and examined how the husband's role in the household might have changed by investigating his $Share_i^j$ as defined in Eq. (1).

Figure 6 shows the actual and fitted husband share of home production time, with the sample for this analysis being all couples. The dots in the figure represent the average share of home production time according to the husband's birth year, while the lines, as before, represent fitted regressions from models with a quadratic birth year profile. While a jump at the cutoff point can be observed for weekdays (Panel A), an even more pronounced jump of around three points can be seen in the results for weekends (Panel B).

Finally, we checked to see whether there were any differences according to the type of couple: worker-worker, employee-employee (which excludes self-employed workers), and worker-housewife. Figure 7 reports the results, and from Panel A, we find that when both husband

Figure 6: Husband's Share of Home Production within a Couple (All couples)
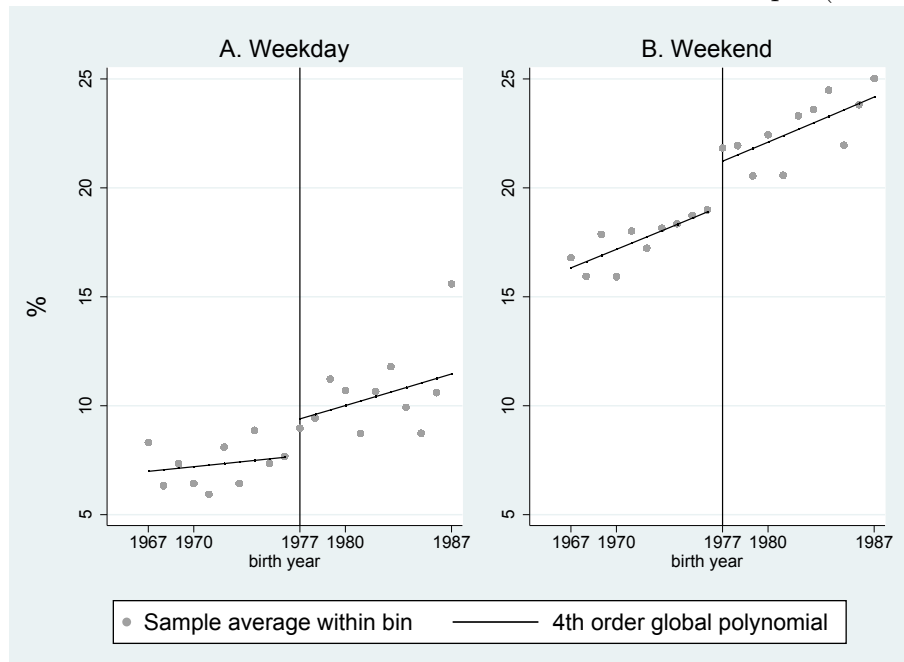
Source: Statistics Bureau of Japan *2016 JTUS*.

and wife are workers, a sharp jump can be observed on the weekend and a smaller jump on weekdays. In Panel B, however, which excludes self-employment, we can see sharp jumps for both weekdays and weekends, while in Panel C, which shows the results for a husband worker/housewife couple, no jumps are observed either for weekdays or weekends. Taking these results together, the effect of co-education in home economics is observed most clearly in couples that face strict time constraints. Further analysis of each of these categories is an issue for future study.

Figure 7: Husband's Share of Home Production within a Couple by Couple Type

A. Worker-worker couple

a. Weekday — b. Weekend

Sample average within bin — 4th order global polynomial

B. Employee-employee couple

a. Weekday — b. Weekend

Sample average within bin — 4th order global polynomial

C. Worker-housewife couple

a. Weekday — b. Weekend

Sample average within bin — 4th order global polynomial
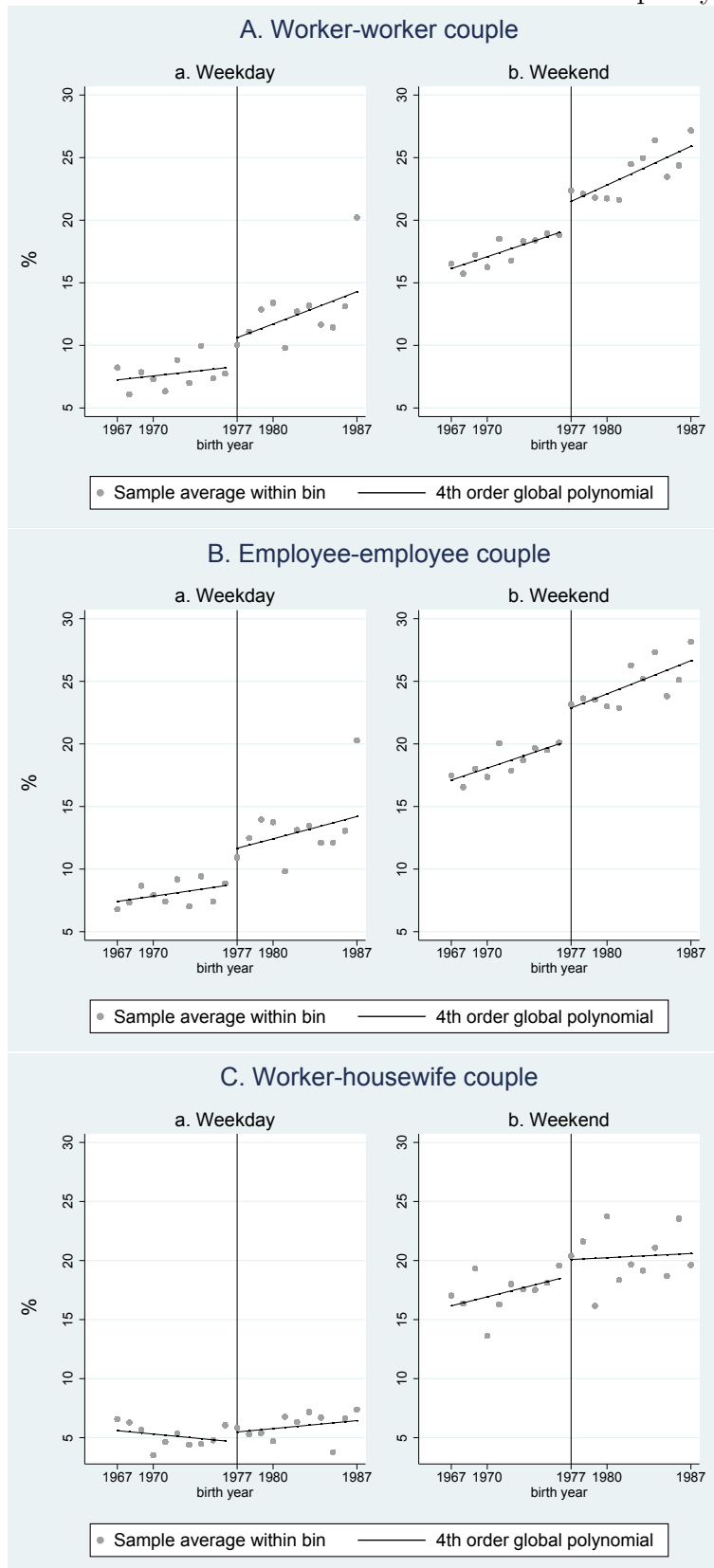
Source: Statistics Bureau of Japan *2016 JTUS*.

6   Estimation Results

Having gained intuition from the graphical analysis, in this section we present and discuss the estimation results of the RD regression of Equation (2) discussed in section 4.3.

Table 4 shows the estimation results for the home production time of a husband. For this analysis, we began with a sample of all couples and then restricted the analysis to cohorts with 5, 3, 2 and 1-year windows around the cutoff point in order to check robustness of the results. Panel A shows the results of the weekdays and we cannot see any statistically significant results, so we focus here on Panel B which shows the results of the weekends. Column (6) reports our baseline estimation for the 1967–87 birth cohort, comprising a ten-year window around the cutoff point of FY1977. We can see that the husband's home production time for the post-1977 cohort is 21.468 minutes larger than for the pre-1977 cohort at a 1% level of statistical significance. As we can also see the same results for the estimation with 5, 3, and 2-year windows around cutoff point (Columns (7), (8), and (9)), our estimation results are therefore considered to be robust. This indicates that men who had studied home economics in junior high school devoted more time to home production, particularly on the weekends, than those who had not.

Next, Table 5 shows the estimation results for the share (%) of home production time within a couple and reports the results of cohorts with ten (baseline), 5, 3, 2 and 1-year windows around the cutoff point. Looking at the effect according to the days of the week (Panel A), we see that there is a statistically significant difference on only the result with ten year windows. However, if we see the results of the weekends (Panel B), the husband's share of home production for the post-1977 cohort is 2.046 points larger than for the pre-1977 cohort at a 1% level of statistical significance. The estimation results using shorter five, three and two year windows around the cutoff point, respectively, are statistically significant, and the coefficients are not different from that of Column (6). Due to the similarity in the value of the coefficients for these three estimations, we can conclude that the results appear to be

Table 4: RD Estimate of Home Production Time ($\hat{\beta}$ (coefficient of *Post*1977), Husband)

Panel A. Weekdays (mins)

	(1)	(2)	(3)	(4)	(5)
	1967–1987	1972–1982	1974–1980	1975–1979	1976–1978
	10 yrs	5 yrs	3 yrs	2 yrs	1 yr
Post1977	4.082	-0.116	2.285	-2.612	11.755
	(3.561)	(5.086)	(6.611)	(8.150)	(10.235)
N	9,215	5,268	3,395	2,430	1,511

Panel B. Weekends (mins)

	(6)	(7)	(8)	(9)	(10)
	1967–1987	1972–1982	1974–1980	1975–1979	1976–1978
	10 yrs	5 yrs	3 yrs	2 yrs	1 yr
Post1977	21.468***	18.018***	22.774***	21.217**	16.462
	(4.843)	(6.786)	(8.683)	(10.340)	(14.060)
N	16,784	9,417	6,019	4,345	2,613

Source: Statistics Bureau of Japan *2016 JTUS*.
Note: Standard error is in parenthesis. ** and * indicates 5% and 10% statistical significance respectively.

reliable.

7 Conclusion

This study examined whether co-education in home economics, which has been compulsory for both boys and girls in Japanese junior high schools since FY1989, has reduced the traditional gender gap in household production in Japan associated with long-standing social norms. For the analysis, we used a regression discontinuity (RD) design and micro data from a Japanese time use survey, and found a sharp increase at the cutoff point in the time husbands devoted to home production, particularly to childcare. We also found a sharp increase in the husband's share of household production at the cutoff point, indicating that those men who studied home economics during junior and senior high school later contributed a larger share of household production compared to those who did not. This implies that co-education in home economics might provide boys with a more equitable view of gender role

Table 5: RD Estimate of Home Production Share ($\hat{\beta}$ (coefficient of $Post1977$), Husband)

Panel A. Weekdays (%points)

	(1)	(2)	(3)	(4)	(5)
	1967–1987	1972–1982	1974–1980	1975–1979	1976–1978
	10 yrs	5 yrs	3 yrs	2 yrs	1 yr
Post1977	1.713**	1.594	1.114	0.051	0.825
	(0.723)	(0.972)	(1.258)	(1.474)	(1.903)
N	8,894	5,083	3,289	2,348	1,463

Panel B. Weekends (%points)

	(6)	(7)	(8)	(9)	(10)
	1967–1987	1972–1982	1974–1980	1975–1979	1976–1978
	10 yrs	5 yrs	3 yrs	2 yrs	1 yr
Post1977	2.046***	2.147**	2.594**	3.585**	2.730
	(0.727)	(0.992)	(1.247)	(1.489)	(2.017)
N	16,079	9,015	5,764	4,155	2,503

Source: Statistics Bureau of Japan *2016 JTUS*.
Note: Standard error is in parenthesis. ** and * indicates 5% and 10% statistical significance respectively.

divisions, which might encourage them to participate more actively in home production as adults.

A limitation of the study is that we cannot identify the specific path that might lead to this change in attitudes towards home production. 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 men's participation in home production might have changed due to skill accumulation rather than changes in attitudes. In other words, we cannot yet identify precisely whether the effect of human capital development or changing social norms is stronger. However, we do note that we observed larger effects for childcare than for housework, and because most of the skills related to childcare are considered to be acquired through actual "on-the-job training" rather than school education, this might comprise supplementary evidence that co-education could change men's attitudes and, eventually, the social norms associated with gender roles. Although further study is required, the results of this study show that education is crucial for changing social norms associated with traditional

household gender roles.

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Appendix 1: Appendix Figures

Figure A1: Average Ratio of Husbands with Children under 10 Years Old and Average Number of Children under 10 Years Old by Husbands' Birth Year
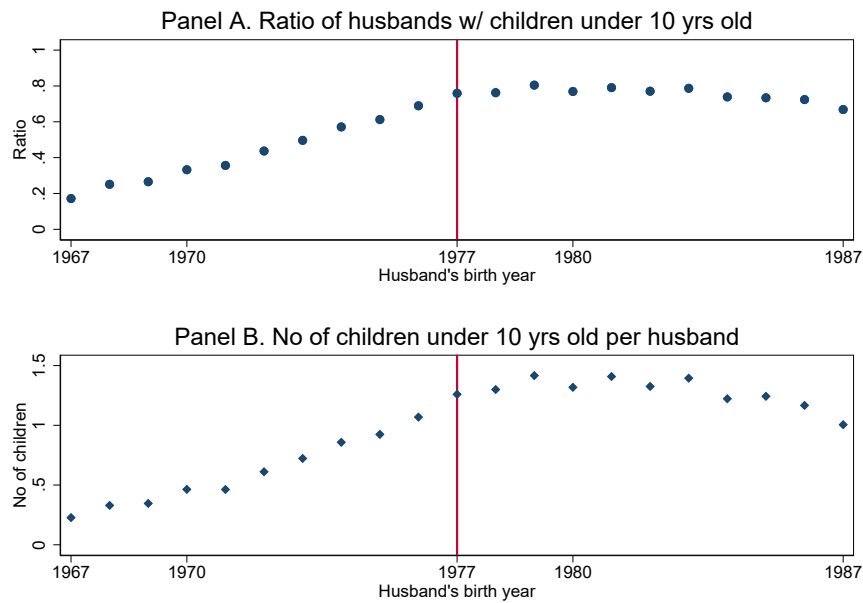
Source: Statistics Bureau of Japan *2016 JTUS*.

Table A1: Estimation Results (Coefficient of treatment dummy: β)

	(1) 1967–87 10 yrs	(2) 1972–82 5 yrs	(3) 1974–80 3 yrs	(4) 1975–79 2 yrs	(5) 1976–78 1 yr
Dependent variable					
A. Child dummy	-0.004	0.009	-0.048	0.055	0
(=1 if having children under 10 yrs old)	(0.017)	(0.027)	(0.051)	(0.034)	(.)
B. No of children under 10 yrs old	0.047	0.087	-0.044	0.141	0
	(0.031)	(0.054)	(0.104)	(0.070)	(.)
N	26,291	14,746	9,393	6,734	4,103

Notes:

1. SE is in parenthesis.

2. $Y_i = \beta Post1977_i + \gamma_1 forcing_i + \gamma_2 forcing_i^2 + \gamma_3 Post1977_i forcing_i + \gamma_4 Post1977_i forcing_i^2 + \epsilon_i$, $forcing_i$ indicates distance from the cutoff point. The coefficient of our interest is β.

Table A2: Results of Housework Time on Weekend ($\hat{\beta}$)

Panel A. Husband

	(1)	(2)	(3)	(4)	(5)
	1967–1987	1972–1982	1974–1980	1975–1979	1976–1978
	10 yrs	5 yrs	3 yrs	2 yrs	1 yr
Post1977	14.986	5.087	-1.217	-14.06	9.676
	(6.565)	(9.083)	(11.472)	(13.871)	(18.798)
N	17,730	9,973	6,380	4,604	2,772

Panel B. Wife

	(6)	(7)	(8)	(9)	(10)
	1967–1987	1972–1982	1974–1980	1975–1979	1976–1978
	10 yrs	5 yrs	3 yrs	2 yrs	1 yr
Post1977	-10.963**	-14.995**	-20.215**	-21.252	-11.177
	(4.187)	(5.623)	(7.090)	(8.480)	(11.343)
N	17,730	9,973	6,380	4,604	2,772

Source: Statistics Bureau of Japan *2016 JTUS*.

Note: $Share_i^j = \alpha + \beta Post1977_i + \gamma birthyear_i + \epsilon_i$. Standard error is in parenthesis. ** and * indicates 5% and 10% statistical significance respectively.

Table A3: Results of Childcare Time on Weekend ($\hat{\beta}$)

Panel A. Husband

	(1)	(2)	(3)	(4)	(5)
	1967–1987	1972–1982	1974–1980	1975–1979	1976–1978
	10 yrs	5 yrs	3 yrs	2 yrs	1 yr
Post1977	14.522***	10.919**	15.027**	10.031	11.319
	(2.881)	(4.167)	(5.478)	(6.447)	(8.801)
N	17,730	9,973	6,380	4,604	2,772

Panel B. Wife

	(6)	(7)	(8)	(9)	(10)
	1967–1987	1972–1982	1974–1980	1975–1979	1976–1978
	10 yrs	5 yrs	3 yrs	2 yrs	1 yr
Post1977	23.326***	18.377**	20.897*	10.435	20.656
	(4.460)	(6.484)	(8.335)	(10.125)	(14.123)
N	17,730	9,973	6,380	4,604	2,772

Source: Statistics Bureau of Japan *2016 JTUS*.

Note: $Share_i^j = \alpha + \beta Post1977_i + \gamma birthyear_i + \epsilon_i$. Standard error is in parenthesis. *** and ** indicates 1% and 5% statistical significance respectively.