Parental sex preference for children and parity progression in Japan: new preference for daughters?

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Abstract

It is well known that under the strong parental sex preference, the sex composition of previous children has a pronatalist effect. To understand the change in the third birth fertility in Japan – one of the lowest-fertility and relatively gender-segregated developed countries - I examine the role of parental sex preference for children to the parity progression. Using the birth history data from the Japanese National Fertility Surveys, the period parity progression ratios to third birth from the 1930s to the 2000s are calculated by the sex composition of previous two children. To explore the related factors to the change in the sex-of-previous-children effect, I also estimate multivariate survival model (Complementary log-log model) for third birth risk as a function of sex composition of children and socio-demographic predictor variables, assuming that relative risk of two-girl families to mixed-sex families reflects son preference and that of two-boy families reflects daughter preference.

I found that the positive effect of the same sex children on the third birth progression still exists, but the pattern of the contribution of the sex of children has changed over times. While son preference effect seems to be unchanged or even declining, daughter preference effect became evident after the 1960s and finally exceeds son preference effect after the 1990s. Declining trends in son preference is partially explained by the declining share of farming households or wives having their own brothers. Husband of an eldest son is positively associated with the third birth risk and the interaction term with two-girl family is significant. On the other hand, wives who don't have their own sisters contribute higher risk of having third birth among two-boy families (versus mixed sex). While wife's traditional gender role attitude does not show any effect for son preference, it negatively associated with the relative risk of the third birth among two-boy families. This means that wives who have gender convergence perception have more desire to have a daughter than those with traditional attitude when they have only two boys.

These results suggested that (1)sons in Japan are still expected to keep paternal lineage, (2)a daughter may be considered by their mothers a substitute for their own sisters, and (3) even if perceptions of gender role wanes, sons seem not be considered a substitute for daughters.

Introduction

As many scholars suggested, determinants of childbearing vary with birth order, and it is well-known that sex preference plays an important role to the decision making to have a third birth (Yamaguchi and Ferguson 1995). That is, when the first and the second children are the same sex, the probability to have additional childbirth is significantly higher than other cases (Morgan and Hagewen 2005). In recent time, this phenomenon is discussed from the perspective of the change in sociatal gender system (Pollard and Morgan 2002, Hank and Andersson 2002, Andersson et al.

2006).

In this paper, I focus on Japan, whose fertility level is one of the lowest levels and where relatively traditional gender role prevails, and demonstrate how parental sex preference affect parental fertility behaviour. I calculate period parity progression ratio from the second to the third by the sex composition of the previous birth over a couple of decades since the mid-20th century. Actually in the first fertility transition and the second fertility transition in Japan, the change in the third birth fertility rate hugely contributed to overall fertility decline. Using multivariate survival models, I explain how the household occupation, the presence of siblings of parents, and gender role attitude of wives affect son preference and daughter preference.

Backgrounds

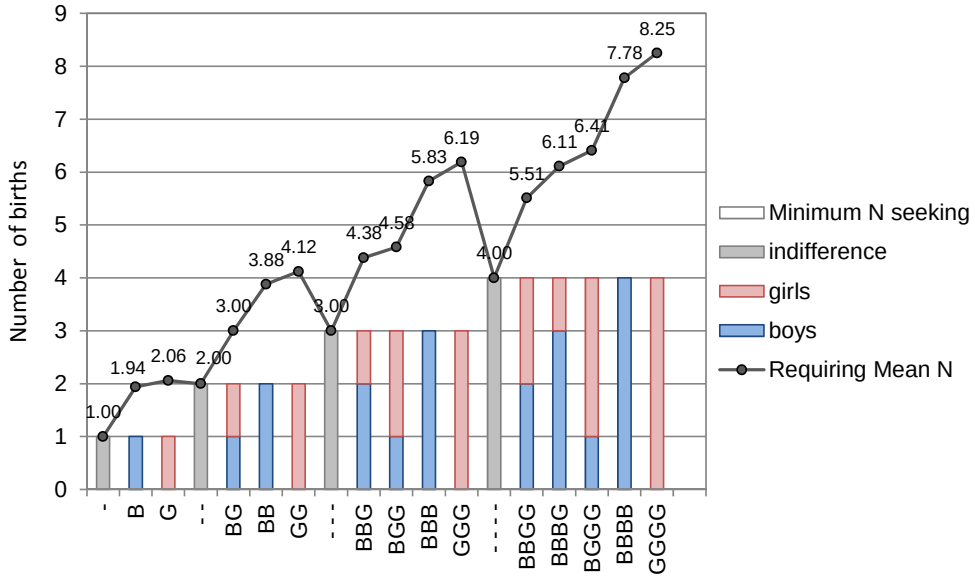
(1)Gender preference and the higher-order birth fertility rate

Although there are a lot of determinants of an additional childbirth, determinants are different between birth orders. It is often said that the first birth is desired for the couple, the second birth is desired for the first child to have sibling, and the third and higher births are desired to have a child of different sex from the children already the couple have, otherwise mistakes.

In Western Society, as modern industrial society had developed, gender-balanced family - it consists of father, mother and (at least two) children with different sex - had been recognized as a perfect family (Gillis 1992). In the society where such preference for a balance of daughters and sons (a desire to have at least one child of each sex) is strong, having only the same sex children was an important factor to have additional fertility intention. In Eastern Asian counties where Confucianism affects various social systems including family system, traditionally son preference is relatively strong. Overall we expect that as gender role is strong in the society, the progression ratio to the third birth become larger.

In post-transitional phase of fertility, the decision to have another child should become more important to overall fertility level. Most of parents in developed countries have their own desirable number of children. At the same time, not a few couples also have a desire to have children of a certain sex. In that case, if parents fail to achieve the desired sex ratio among their children by the time they reach their desirable number of children, some of them would revise the desirable number upward. Figure 1 from Bongaarts and Potter (1983) shows that how many children parents will have on average if they seek a minimum number of boys and girls shown in the x axis label. If parents want to have at least one boy and one girl, they have to have three children on average. Also if they continue to have children by the time they reach at least two boys, they will have 3.88 children on average.

Figure 1: Mean number of children when seeking a minimum number of boys and girls in x axis



Source: Bongaarts and Potter (1983)

(2)Gender role and fertility decline

It is also suggested that fertility decline in developed society is largely caused by change in the gender role system in society. Changes in gender role, however, emerged in the various areas of social system and individual behavior and attitude, and the ways of affecting fertility are not simple. In general, educational improvement and rising earing power among women contributes to lower fertility, especially in fertility transition from high to low (replacement) level. However, as McDonald stated, when gender equity in individual-oriented institutions is not accompanied by gender equity in family-oriented institutions, the further movement to very low fertility is observed in many countries including Japan (McDonald 2004). Increasing gender equality should also affect gender preference of parents, and whether a shift toward gender equality occurs in only individual institutions such as education and market employment or in domestic institution as well would have different impact on the changing pattern of gender preference of childbearing. This change in gender preference may influence to fertility through the probability of additional childbearing.

Distinguishing types of gender equality can be applied not only in individual-oriented institutions and in family-oriented institutions. It can be applied to difference in generation: mothers' generation and daughters' generation. In the process of a shift toward gender equality, society often experienced that older generation faces strong gender-oriented roles, while younger generations live in more gender symmetry society. In transition phase, specific pattern may be observed in gender preference.

(3)Parental sex preference for children in Japan

There are various patterns in Gender preferences in the world, but most common ones are a son preference and balanced preference (a desire to have at least one child of each sex). In a band of countries from North Africa through the Middle East and South Asia to East Asia, son preference is strong (Arnold 2003). On the other hand, in European countries a balanced preference is relatively common (Hank and Kohler 2000, Mills and Begall 2010) and Pollard and Morgan (2002) suggested that weakening of gender preference as a shift toward gender equality in the United States. However, Andersson et al. (2006) suggested that even in the fairly gender equal Swedish society, a clear preference for one child of each sex has continued to exist, and the relationship between gender role equality and gender preference is still an open question.

Japan is an East Asian country and share a lot of cultural aspect with Korea and China, but today son preference is not so strong compared with these countries (Moriizumi 2008). Rather according to the sex composition of aggregated ideal number of children among married women, since the late 1980s, more girls are desired than boys (the ratio for girls is 53.5% and that for boys is 46.5% in the 2010 survey) (NIPSSR 2012)(Table 1). Japanese General Social surveys also showed the shift from son preference to daughter preference (Iwai and Sato 2002). As for the association between gender role attitudes and gender preference, Fuse (2013) and Moriizumi (2008) found that daughter preference of women links to strong gender role attitudes or expectation of care by children in their old age.

Table 1: Percentages of couples by ideal combination of boys and girls, by survey and ideal number of children

Ideal combination of boys and girls		8th Survey (1982)	9th Survey (1987)	10th Survey (1992)	11th Survey (1997)	12th Survey (2002)	13th Survey (2005)	14th Survey (2010)	
1 child	1 boy/0 girls	51.5 %	37.1	24.3	25.0	27.3	22.2	31.3	N=83
	0 boys/1 girl	48.5	62.9	75.7	75.0	72.7	77.8	68.7	
2 children	2 boys/0 girls	8.8 %	4.1	2.7	2.1	1.9	2.2	1.9	
	1 boy/1 girl	82.4	85.5	84.0	84.9	85.9	86.0	87.9	N=1,988
	0 boys/2 girls	8.9	10.4	13.3	13.0	12.2	11.8	10.2	
3 children	3 boys/0 girls	0.7 %	0.5	0.3	0.4	0.6	1.1	0.9	
	2 boys/1 girl	62.4	52.3	45.1	38.4	41.6	38.5	40.7	N=1,470
	1 boy/2 girls	36.2	46.2	52.9	58.9	55.4	58.3	55.4	
	0 boys/3 girls	0.7	0.7	1.6	2.3	2.4	2.1	3.1	
Sex ratio in ideal number of children 100 x (ideal number of boys/ideal number of girls)		105	99	91	85	87	86	87	

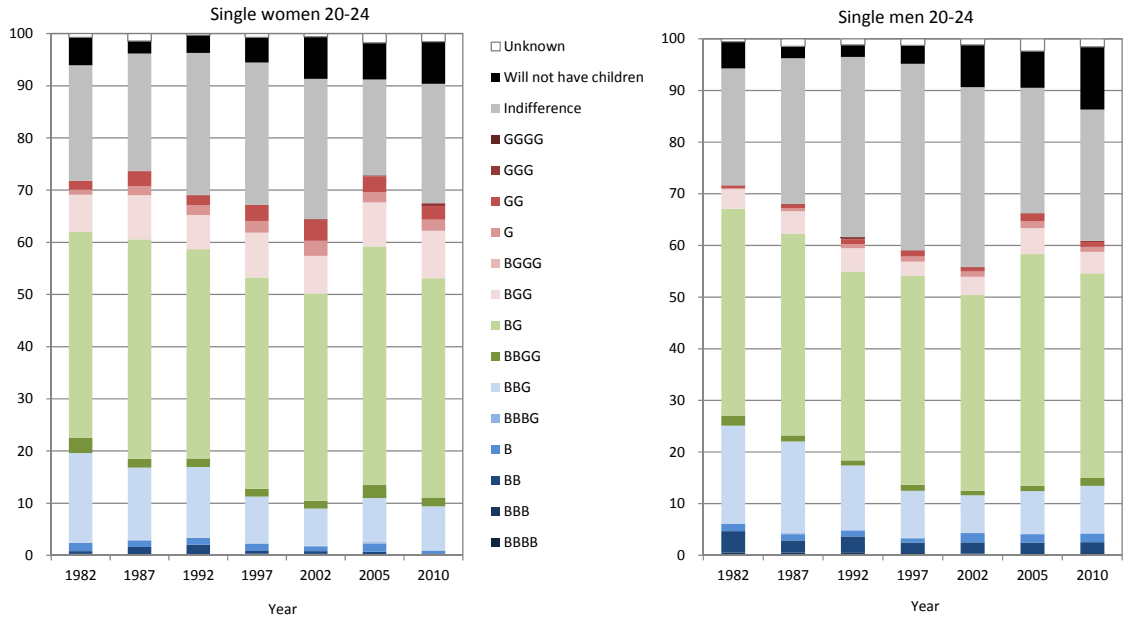
Source: Japanese National Fertility Surveys (NIPSSR 2011).

Gender preference in Japan has played an important role to fertility. Sakai (1994) examined that the number of planed additional fertility is on average higher among married women who have gender preference for children. He also found that the risk of induced abortion is also influenced by the composition of sex of children ever born (Sakai 1992). Moriizumi (2008)

demonstrates using more recent data that fertility intention for the third birth is the highest among couples with two boys. This means that desire to have at least one daughter is stronger than the desire to have a boy.

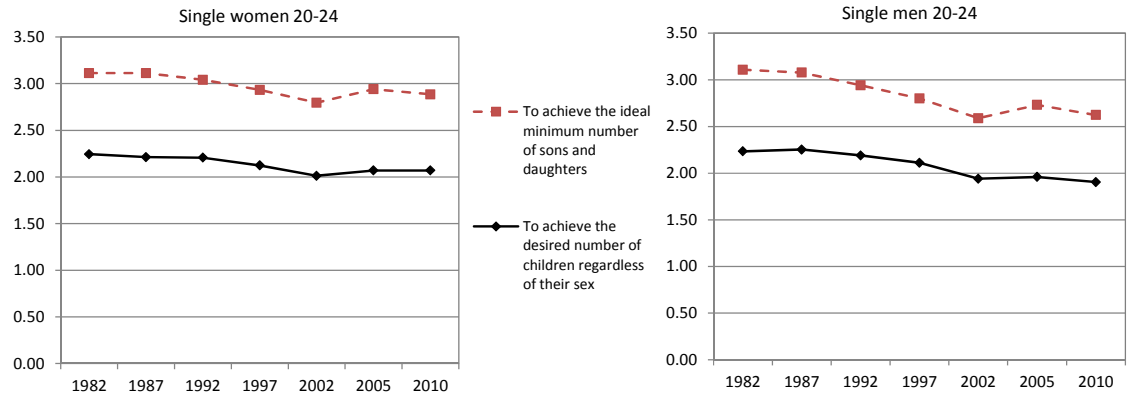
The parental gender preference should become more important in societies with very low fertility such as Japan. In recent years, the desired number of children for most Japanese is two or three. On the other hand, not a few people have an ideal combination of sex of children they have. In Figure 2, I show the distribution of children that single men and women aged 20 to 24 would like to have by sex of the children. In the 2010 survey, while 23% of women and 25% of men have no desire on sex composition, 42% of women and 40% of men want one son and one daughter, 9% and 4% want one son and two daughters, and 8% and 9% want two sons and one daughter. If people continue to have additional birth until they reach to have their minimum number of sons and daughters they want to have, how many children they will have eventually? Using the mean number of children in Figure 1 as a weight, I estimated the mean number of children based on their ideal number of sons and daughters shown in Figure 2. The results are shown in Figure 3. In 2010, the desired number of children is 2.07 for single women and 1.90 for single men aged 20-24. If people prioritize the number of sons and daughters over the total number of desired children, the ultimate number will rise to 2.9 and 2.6, respectively. The potential growth due to parental gender preference would be 0.82 for women and 0.72 for men.

Figure 2: Desired number of children and the ideal sex composition among single women and men aged 20-24.



Data: The 8th to 14th Japanese National Fertility Surveys.
G or B and the number of character represent the number of daughters or sons they want to have in the future.

Figure 3: Mean number of children singles desire to have and mean number of children they will have when seeking a minimum number of sons and daughters



Note: For the number required if they achieve the ideal minimum number of sons and daughters

These previous studies and simulation tell us that Japanese people still have gender preference and daughter preference may boost up fertility recently. However, we know little about the relationship between parental gender preference and fertility for the long term. In this paper, using birth history data of large sample surveys conducted every five years since the 1970s, I calculate period parity progression ratios by sex composition of children ever born and examine how gender preference contribute to decision making of additional childbirth.

Data

I use the Japanese National Fertility Survey data conducted by the National Institute of Population and Social Security Research in 1977, 1982, 1987, 1992, 1997, 2002, 2005 and 2010. Each survey includes around 6000 first married couples and response rates are around 90 percent. From the 1982 through 2010 survey, age of married women is from 18 to 49. The 1977 survey includes married women aged between 18 and 86. Data covers third birth events from the 1930s to the 2000s.

The birth history includes the date of child birth by birth order and sex of each child. The births include multiple births. I found that the results were not changed much when I calculated the PPPR to the exclusion of multiple births. In this study I show the results including all women having at least two children. I constructed person-month (or person-three-month) data from the date of the second birth to the date of the third birth or the date of survey. I obtain risk population and event cases by year from 1918 to 2010. To use enough sample to reproduce a period schedule of parity progression ratio, I limited observation period from 1935 to 2009.

Analytical strategy and methods

(1) Period parity progression ratios

To capture the magnitude and trends in the third birth occurrence by the sex composition of children, I calculate period parity progression ratio by the composition of sex of children and compare boy-boy case or girl-girl cases with mixed sex cases. Given that sex pre-selection is very rare, among couples who have two children, the composition of sex of children should be determined randomly. If the relative risk of the parity progression among parents having only two boys is higher than other cases, this is considered that difference would reflect the expectation to have a daughter or some interaction effect between structural variables and the sex composition.

The period parity progression ratio from the second to the third birth can be calculated from birth history data from survey data (Feeney 1986). Let ${r_E}^i(y)$ denotes the proportion of women having an *i*th birth in year *y* who have an (*i*+1)th birth in the same year, and let ${r_x}^i(y)$ denotes the proportion of parity *i* women with *x* completed years duration in parity at the beginning of year y who have an (*i*+1)st birth during year y. The cohort parity progression ratio ${P^c}_i(y)$, which is the proportion of women having an *i*th birth in year y who ever have an (*i*+1)th birth, is expressed as below.

$$ {P^c}_i(y) = 1 - [1 - {r_E}^i(y)] \prod_{x=0} [1 - {r_x}^i(y + x)]. $$

The period parity progression ratio ${P^p}_i(y)$ (PPPR), which is the ratio that would be observed in a hypothetical cohort that experiences the parity progression rates of year y, can be defined by

$$ {P^p}_i(y) = 1 - [1 - {r_E}^i(y)] \prod_{x=0} [1 - {r_x}^i(y)]. $$

I calculate the PPPR by the sex composition (and order) of previous births: a boy and a boy, a girl and a girl, and mixed sex.

(2) Complimentary log-log model with covariates

In the second part, I explore the related social change that may affect the change in the sex preferences for children. Using multivariate discrete-duration survival model for the transition from the parity 2 to the parity 3, I estimate relative risk of parity progression by calendar year from the late 1930s through the late 2000s and the sex composition of two children. Controlling for other predictor variables, I observe the change in the relative risk of parity progression and demonstrate which factor is relevant to the trends in sex preference in Japan. In this study, I use the complementary log-log (CLL) model because this model can be viewed as a multivariate life table (Retherford et al 2010). Coefficients of predictor variables in the CLL model mean that a one-unit increase in a predictor variable multiplies the underlying continuous-time hazard by exp(*b*), where *b* is the coefficient of the predictor variable and exp(*b*) is the relative risk.

I focus on two types of temporal effects, two types of socio-demographic condition of couples and one value aspect as predictor variables.

Temporal factors

Since our goal of this paper is to determine long term trends in sex preference, it is desirable that temporal factors should be eliminated. Fertility intention is often affected by temporal social situation. Most famous phenomenon in Japan for a half century is fertility drop in *Hinoeuma* (Fire Horse) year (1966) (Sakai 1987). In Japan, there is a superstition that girls born in this specific astrological year are not happy. As a result, many couples avoided having children in this year. This may also affect the relative risk of the third birth by the sex composition of children.

I include Fire Horse year dummy variable in the model and also interaction with the sex composition of children (Fire horse year dummy x two girls and Fire horse year dummy x two boys).

Husband's occupation

Male offspring is often essential when a couple runs family business, so it is plausible that there is a positive relationship between the prevalence of family business and the strong son preference in society. Actually, according to Andersson et al.(2006), in Finland, where traditional agricultural thinking is prevalent, higher excess birth risks among mothers of two girls are observed. In Japan, farming business or family-operated business is usually taken over by the male offspring of that family. I expect that couples whose husband's occupation is farming or self-employment have higher risk of the transition to the third birth, and in particular, families with two daughters are more likely to have another child, expecting it is son. If it is true, since the proportion of farming households and self-employment has been declining, we can expect that a part of decline in the relative risk of the third birth for two-girls-family is accounted for by husband's occupation. I include farming and self-employment dummy variables to control for husband's occupation and interaction term between husband's occupation and the sex composition.

Presence of siblings

To continuity the family lineage (name) is considered as important in most countries and in Japan and the eldest son is expected to take such a role. I expect that if a husband is an eldest son, son preference should be much higher than other cases. I include the dummy variables that indicate husband is an eldest son.

Family of orientation of adults affects various aspects of their reproductive attitude and behavior. I focus on the effect of the presence of sibling. When women have brothers, they may feel it necessary to have a boy. In contrast, women who have sisters may have a desire to have a daughter at least. The presence of sisters or brothers for wives is added in the model and the interaction between the sister dummy and two-boy family and that between the brother dummy and two-daughter family included as well will assess the sibling effect on the risk of the transition to third birth.

Gender role attitude

In recent literature on sex preference in developed countries, the relationship with society's gender systems has become a central issue. While Pollard and Morgan (2002) suggested that changes in the society's gender system have led to a decreasing effect of children's sex on parent's fertility decision based on the US data, Andersson et al. (2006) found that new sex preferences (in favor of girls) has evolved in countries with a high level of gender equality, such as Denmark, Norway, and Sweden. For Japan, Fuse (2013) examined the relationship between single's gender preference of children and gender role attitudes. She found that, while daughter preference is associated with nontraditional gender role attitudes for men, daughter preference is associated with traditional attitudes for women. Although our definition of gender preference is not the same as Fuse's study using ideal gender ratios of children, if women's traditional gender attitudes contributes to daughter preference, this relationship is the case with married. By controlling for traditional attitudes, the relative risk of third birth among mothers with two boys would decline. As gender role attitude, I use indicator representing mothers agree or disagree with the statement: men should work outside and women should take care of the home after marriage. I create a traditional (agree with statement) attitude dummy variable.

To estimate the CLL model, I set up person-three-month observations from the original person sample. If P is a predicted probability of failure in three months, our base CLL model is

Model 0: Log[-log(1-P)]=Intercept + DUR0+ DUR1+ DUR3+ DUR4+ DUR5(ref.=DUR2)
+[Calendar year terms (in three) from 1935-1939 to 2005-2009](ref.=1985-1989)
+BB(two boys dummy)+GG(two girls dummy)(ref.=Mixed(one boy and one girl))
+Interaction (Calendar Year x BB) + Interaction (Calendar Year x GG)

where DURs represent one-year piecewise constant variable from the 9th month after the second childbearing. A temporal factor is included in Model 1, and it is expressed as

Model 1: log[-log(1-P)]= Model 0
+Fire horse year
+ Interaction (Fire horse year x GG) + Interaction (Fire horse year x BB)

Husband's occupation is controlled for in Model 2.

Model 2: log[-log(1-P)]= Model 1

+Farming /Self-employment
+ Interaction (Farming/ Self-employment x GG)
+ Interaction (Farming/ Self-employment x BB)

Then, husband's sibling position and the presence of sisters or brothers of wife are included in Model 3.

Model 3: log[-log(1-P)]= Model 2
+ Husband is an eldest son + Wife has brothers + Wife has sisters
+ Interaction (Husband is an eldest son x GG) + Interaction (Husband is an eldest son x BB)
+ Interaction (Wife has bros. x GG) + Interaction (Wife has sisters x BB)

Finally, traditional gender role attitude is included in Model 4.

Model 4: log[-log(1-P)]= Model 3
+ Traditional gender role attitude
+ Interaction (Traditional attitude x GG) + Interaction (Traditional attitude x BB)

I observe relative risks for calendar year and its change after controlling for socio-demographic factors by the sex composition of two children (one boy and one girl (as a reference), two girls, and two boys).

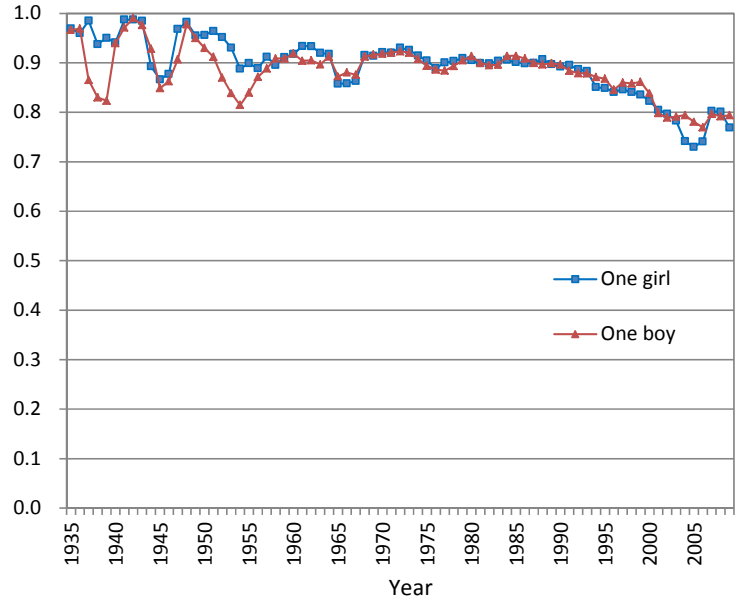
Results

(1) Period parity progression ratios

The period parity progression ratios(PPPRs) can be calculated by birth order. Figure 4 shows the PPPRs from the first to second birth by the sex of the first birth. The progression ratio by the sex of a first child seems almost identical with the exception of the period before and after the World War II and the early 2000s. Figure 5 shows the trends in the PPPRs from the second to the third birth. I can see that the PPPRs for couples with the same sex children are much higher than those with mixed-sex children. Since the overall PPPRs have been declined dramatically during the 1950s and the 1960s and after 1990s, the progression ratio shows the declining trend. To focus on the effect of gender preference, I show the difference in the PPPR of the same sex children from the mixed children as a base line. We don't see any attenuation of the same sex children effect which is suggested in Pollard and Morgan paper for the US (Pollard and Morgan 2002). Furthermore, contributing factor has changed apparently. In the late 1950s and the early 1970s, the PPPR for only daughters was much higher than only sons. That is, desire to have at least one son would be much

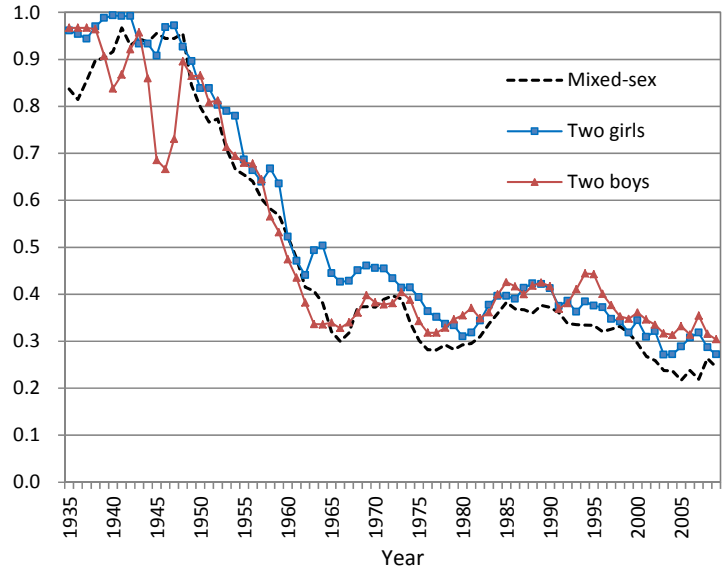
stronger than having at least one daughter. In the late 1970s, although the effect of the same sex children still exists, the difference between daughter-only families and son-only families seemed disappeared. After the 1990s, another phase began. The PPPR for the only sons became much higher than that for the only daughters, which means that having at least one daughter is much more desired than having one son.

Figure 4: Period parity progression ratios (PPPRs) from the first to the second birth by the sex of previous child



Note: Figures are based on Three-year moving average.

Figure 5: Period parity progression ratios (PPPRs) from the second to the third birth by the sex composition of previous children



Note: Figures are based on Three-year moving average.

(2) Relative risks from the CLL models

Figure 6 shows the relative third birth risk among couples having one boy and one girl using coefficients of the calendar year dummy in year from the CLL model. The figure for each year represents the relative magnitude of hazard to that in 1985. The trend looks very similar to that for mixed-sex category shown in figure 5.

Figure 7 shows the relative risks of having a third birth by the sex composition of children from the estimation of model 0(not shown in Table 2). We can observe whether the sex-of-previous-children effect persists, rises or attenuates over multiple decades. The level of 1.0 represents relative risk among mixed sex composition. The blue line graph represents a relative risk among two-girl families who should expect to have a son. So we can consider it as an indication of son preference. On the other hand, the red line represents a relative risk among two boys families who should expect to have a daughter. We think it is an indication of daughter preference. Looking at the trends in both risks, directions seem to be different. If the previous children were both girls, the risks of third birth are always higher than that for mixed-sex family and trends seem to be relatively stable. The risks among two-boy families show different trends. From the late 1930 to the 1960s, the risks are around 1.0, that means no difference between two-boy families and mixed-sex families in terms of third birth progression. Since the 1970s, however, the risks among two-boy families have been increasing and exceed the level of two-girl families. This result suggests that as in some of Nordic countries, daughter preference has been developed since the 1970s in Japan as well.

Figure 6: Relative risk of third birth (relative to year 1985) among couples with one boy and one girl from the CLL model by calendar year in year

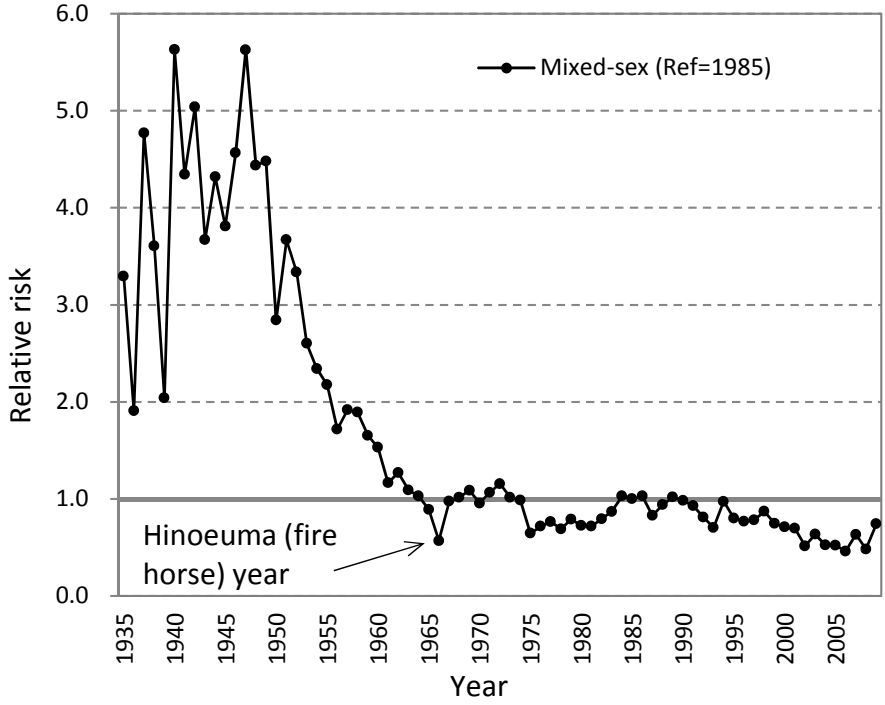


Figure 7: Relative risk of third birth (relative to mixed sex) among couples with two children from the CLL model by calendar year

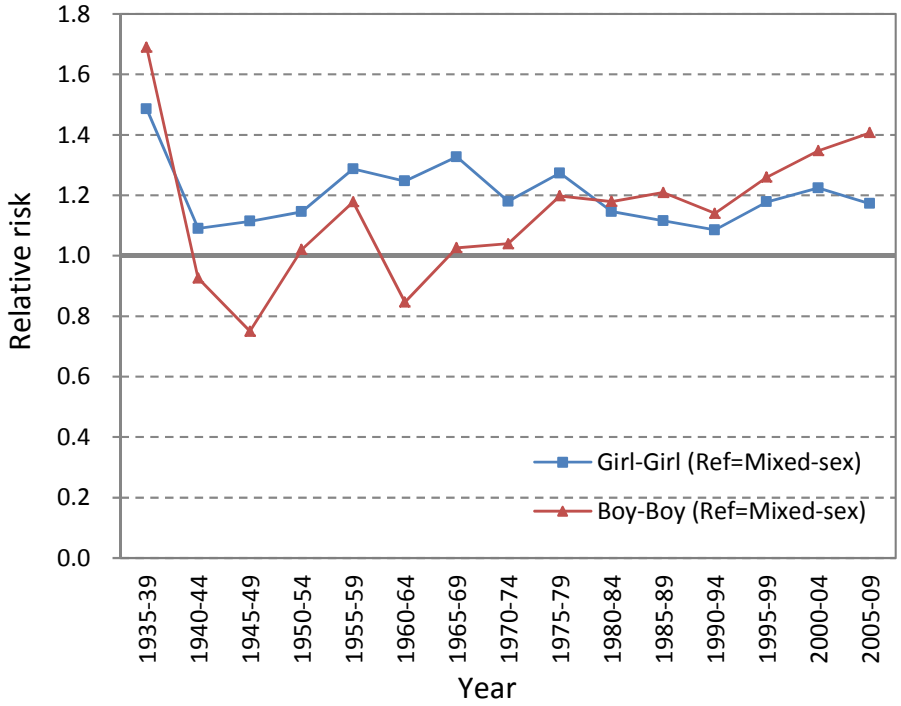


Table 2: Relative risk of third birth from the complementary log-log model among couples with two children

Covariates			Model 1 Base+period effect model exp(β)	95% CI		Model 2 +Husband's occupation exp(β)	95% CI		Model 3 +Siblings exp(β)	95% CI		Model 4 +Gender role attitude exp(β)	95% CI	
Duration from the 9th month after 2nd birth	[2-<3 yr.]													
	0-<1 yr.		0.39	(0.37 -	0.42) **	0.39	(0.37 -	0.42) **	0.42	(0.39 -	0.45) **	0.39	(0.36 -	0.43) **
	1-<2 yr.		1.14	(1.09 -	1.19) **	1.14	(1.08 -	1.19) **	1.17	(1.11 -	1.23) **	1.18	(1.11 -	1.26) **
	3-<4 yr.		0.69	(0.65 -	0.73) **	0.69	(0.65 -	0.73) **	0.68	(0.64 -	0.73) **	0.69	(0.63 -	0.75) **
	4-<5 yr.		0.46	(0.43 -	0.49) **	0.46	(0.43 -	0.49) **	0.47	(0.44 -	0.51) **	0.49	(0.45 -	0.54) **
	5+ yrs.		0.09	(0.09 -	0.10) **	0.09	(0.09 -	0.10) **	0.09	(0.09 -	0.10) **	0.10	(0.09 -	0.11) **
Year (in five-year)	[1985-89]													
	1935-39		3.21	(2.51 -	4.11) **	2.99	(2.34 -	3.83) **						
	1940-44		4.70	(3.92 -	5.64) **	4.24	(3.53 -	5.09) **						
	1945-49		4.72	(4.01 -	5.55) **	4.30	(3.65 -	5.06) **						
	1950-54		3.03	(2.63 -	3.49) **	2.73	(2.37 -	3.15) **						
	1955-59		1.93	(1.66 -	2.23) **	1.78	(1.53 -	2.06) **						
	1960-64		1.23	(1.07 -	1.41) **	1.14	(1.00 -	1.31) #	1.38	(1.12 -	1.70) **			
	1965-69		1.04	(0.92 -	1.17)	0.98	(0.87 -	1.11)	1.19	(1.03 -	1.38) *			
	1970-74		1.07	(0.98 -	1.18)	1.02	(0.93 -	1.13)	1.05	(0.94 -	1.18)	1.23	(1.01 -	1.49) *
	1975-79		0.75	(0.68 -	0.82) **	0.72	(0.66 -	0.80) **	0.77	(0.69 -	0.85) **	0.76	(0.66 -	0.88) **
	1980-84		0.85	(0.77 -	0.93) **	0.83	(0.76 -	0.92) **	0.84	(0.76 -	0.92) **	0.87	(0.78 -	0.98) *
	1990-94		0.92	(0.83 -	1.02)	0.93	(0.84 -	1.03)	0.92	(0.83 -	1.02)	0.90	(0.81 -	1.00) *
	1995-99		0.82	(0.73 -	0.92) **	0.84	(0.75 -	0.94) **	0.83	(0.74 -	0.93) **	0.79	(0.71 -	0.89) **
	2000-04		0.65	(0.57 -	0.74) **	0.66	(0.58 -	0.75) **	0.65	(0.57 -	0.74) **	0.63	(0.55 -	0.72) **
	2005-09		0.58	(0.49 -	0.70) **	0.60	(0.50 -	0.72) **	0.59	(0.49 -	0.71) **	0.58	(0.48 -	0.69) **
Sex composition of children	[Mixed-sex]													
	Two girls (GG)		1.12	(0.99 -	1.25) #	1.10	(0.98 -	1.24)	0.99	(0.85 -	1.15)	1.02	(0.86 -	1.22)
	Two boys (BB)		1.21	(1.08 -	1.35) **	1.21	(1.08 -	1.35) **	1.35	(1.17 -	1.55) **	1.40	(1.19 -	1.65) **
Interaction with sex composition		1935-39 x GG	1.33	(0.88 -	2.02)	1.23	(0.81 -	1.87)						
		1940-44 x GG	0.98	(0.70 -	1.36)	0.96	(0.69 -	1.34)						
		1945-49 x GG	1.00	(0.76 -	1.32)	0.97	(0.74 -	1.28)						
		1950-54 x GG	1.03	(0.80 -	1.32)	1.01	(0.78 -	1.30)						
		1955-59 x GG	1.15	(0.90 -	1.47)	1.13	(0.89 -	1.45)						
		1960-64 x GG	1.12	(0.89 -	1.41)	1.10	(0.87 -	1.39)	0.93	(0.65 -	1.34)			
		1965-69 x GG	1.13	(0.92 -	1.39)	1.11	(0.90 -	1.37)	1.04	(0.81 -	1.33)			
		1970-74 x GG	1.06	(0.90 -	1.25)	1.05	(0.89 -	1.24)	1.04	(0.86 -	1.26)	0.97	(0.69 -	1.37)
		1975-79 x GG	1.14	(0.97 -	1.35)	1.13	(0.96 -	1.34)	1.09	(0.92 -	1.30)	1.15	(0.91 -	1.47)
		1980-84 x GG	1.03	(0.87 -	1.21)	1.03	(0.87 -	1.22)	1.03	(0.87 -	1.21)	1.04	(0.86 -	1.27)
		1990-94 x GG	0.97	(0.81 -	1.16)	0.98	(0.82 -	1.17)	0.97	(0.82 -	1.16)	0.94	(0.78 -	1.13)
		1995-99 x GG	1.06	(0.87 -	1.28)	1.06	(0.88 -	1.29)	1.06	(0.87 -	1.28)	1.00	(0.81 -	1.22)
		2000-04 x GG	1.10	(0.88 -	1.36)	1.11	(0.89 -	1.38)	1.10	(0.88 -	1.37)	1.06	(0.84 -	1.33)
		2005-09 x GG	1.05	(0.77 -	1.43)	1.06	(0.78 -	1.44)	1.04	(0.76 -	1.42)	1.00	(0.73 -	1.37)
		1935-39 x BB	1.40	(0.92 -	2.13)	1.30	(0.85 -	1.99)						
		1940-44 x BB	0.77	(0.55 -	1.06)	0.77	(0.55 -	1.07)						
		1945-49 x BB	0.62	(0.47 -	0.82) **	0.63	(0.47 -	0.83) **						
		1950-54 x BB	0.84	(0.67 -	1.07)	0.87	(0.68 -	1.10)						
		1955-59 x BB	0.97	(0.76 -	1.24)	0.99	(0.77 -	1.27)						
		1960-64 x BB	0.70	(0.55 -	0.89) **	0.71	(0.56 -	0.90) **	0.67	(0.46 -	0.98) *			
		1965-69 x BB	0.77	(0.62 -	0.95) *	0.77	(0.63 -	0.95) *	0.72	(0.56 -	0.94) *			
		1970-74 x BB	0.86	(0.73 -	1.01) #	0.87	(0.74 -	1.02) #	0.92	(0.77 -	1.10)	0.86	(0.61 -	1.22)
		1975-79 x BB	0.99	(0.84 -	1.16)	0.99	(0.84 -	1.16)	1.01	(0.86 -	1.20)	1.06	(0.83 -	1.34)
		1980-84 x BB	0.98	(0.83 -	1.14)	0.98	(0.84 -	1.15)	0.99	(0.84 -	1.15)	0.94	(0.77 -	1.13)
		1990-94 x BB	0.94	(0.80 -	1.12)	0.95	(0.80 -	1.12)	0.94	(0.79 -	1.11)	0.93	(0.78 -	1.11)
		1995-99 x BB	1.04	(0.87 -	1.25)	1.04	(0.87 -	1.25)	1.02	(0.85 -	1.23)	1.03	(0.85 -	1.25)
		2000-04 x BB	1.11	(0.91 -	1.37)	1.12	(0.91 -	1.38)	1.10	(0.90 -	1.36)	1.11	(0.89 -	1.37)
		2005-09 x BB	1.16	(0.88 -	1.54)	1.17	(0.88 -	1.56)	1.14	(0.86 -	1.52)	1.15	(0.86 -	1.53)

Table 2: Relative risk of third birth from the complementary log-log model among couples with two children (Continued)

Covariates		Model 1 Base+period effect model exp(β) 95% CI	Model 2 +Husband's occupation exp(β) 95% CI	Model 3 +Siblings exp(β) 95% CI	Model 4 +Gender role attitude exp(β) 95% CI
Fire horse year (1966)	[Not Fire horse]				
	Fire horse	0.57 (0.42 - 0.76) **	0.56 (0.41 - 0.75) **	0.58 (0.40 - 0.86) **	
Interaction with sex composition	Fire horse x GG	1.45 (0.91 - 2.30)	1.44 (0.91 - 2.28)	1.64 (0.92 - 2.90) #	
	Fire horse x BB	1.94 (1.24 - 3.04) **	1.95 (1.24 - 3.05) **	1.58 (0.85 - 2.94)	
Husband's occupation	[Non Farming/Self-employment]				
	Farming/Self-employment		1.39 (1.31 - 1.47) **	1.46 (1.36 - 1.57) **	1.36 (1.23 - 1.51) **
Interaction with sex composition	Farming/Self-employment*GG		1.11 (1.01 - 1.23) *	1.08 (0.96 - 1.22)	1.06 (0.89 - 1.27)
	Farming/Self-employment*BB		0.99 (0.90 - 1.10)	0.94 (0.83 - 1.06)	0.94 (0.79 - 1.12)
Presence of siblings	Husband is a non-eldest son・Wife has no bros./sisters]				
	Husband is an eldest son			1.18 (1.12 - 1.25) **	1.18 (1.10 - 1.27) **
	Wife has brothers			0.96 (0.91 - 1.01)	1.02 (0.96 - 1.08)
	Wife has sisters			1.03 (0.98 - 1.09)	1.07 (1.00 - 1.13) *
Interaction with sex composition	Husband is an eldest son x GG			1.09 (0.99 - 1.21) #	1.11 (0.98 - 1.26) #
	Husband is an eldest son x BB			0.98 (0.89 - 1.08)	0.94 (0.84 - 1.06)
	Wife has brothers x GG			1.09 (0.99 - 1.21) #	1.04 (0.92 - 1.17)
	Wife has sisters x BB			0.88 (0.80 - 0.97) **	0.90 (0.81 - 1.01) #
Attitude for gender role	[Non traditional gender role attitude]				
	Traditional gender role attitude				1.08 (1.00 - 1.16) *
Interaction with sex composition	Traditional gender role attitude x GG				1.05 (0.93 - 1.19)
	Traditional gender role attitude x BB				0.87 (0.77 - 0.98) *
Data		7th-14th JNFS	7th-14th JNFS	8th-14th JNFS	10th-14th JNFS
Survey year		1977-2010	1977-2010	1982-2010	1992-2010
Size of observation		1,211,797	1,211,797	1,011,993	686,490
# of event		13,491	13,491	10,232	6,611
AIC		134,093	133,827	104,903	68,057

#p ≤ .1; *p ≤ .05; **p ≤ .01

Person-three-month data. For the magnitude of interaction effect between year and sex composition of children is shown in Figure 6 and Figure 7.

How can we explain the change in the relative risks as an indication of sex preference and the different pattern of trends between son and daughter preference? To explore the reason for these, I added control variables and interaction term with sex composition of children to the CLL base model. The estimated coefficients of control variables are shown in Table 2. Using these models, I show the changes in the relative risks of two-girl family and two-boy family (vs. mixed-sex family) from pre- to post-controlling for covariates.

After controlling for period effect, farming and self-employment households (reference is husbands work as an employee), presence of siblings (reference is husbands of non-eldest son and wives with no brothers), and traditional gender attitude (reference is wives who disagree with traditional gender role), we see that relative risks of third birth among two-girl family (indication of son preference) moved downward staying around 1.0 level (indifference with mixed-sex families)(Figure 8). In the 1940s and the 1950s, son preference seems to be partially explained by the large share of farming or self-employment households. After the 1960s, we see that husband's position of siblings or the presence of wife's brothers may affect son preference.

The results for two-boy families, daughter preference, look different from those for son preference. Control for farming and self-employment does not alter the relative risks of third birth (vs. mixed-sex). The interaction term between wives having sister and two-boy family shows strong negative effect in Model 3. In fact, when I eliminate the effect of wives who have sisters, the risks moved upward (Figure 9). Furthermore, traditional attitude toward gender role of wives is negatively associated with the risk of third birth. That means non-traditional wives seem to have a higher demand for daughter than traditional wives do. The relative risks after controlling for traditional gender role attitude are higher than that of Model 3.

Figure 8: Change in relative third birth risk (relative to mixed-sex) among couples with two girls (son preference) from the CLL model by calendar year after controlling for covariates

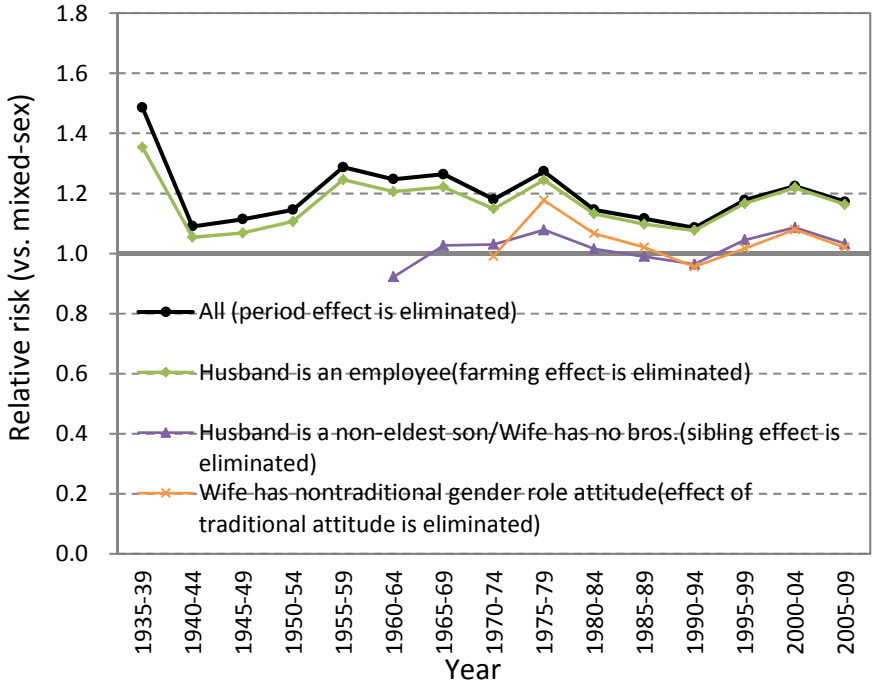
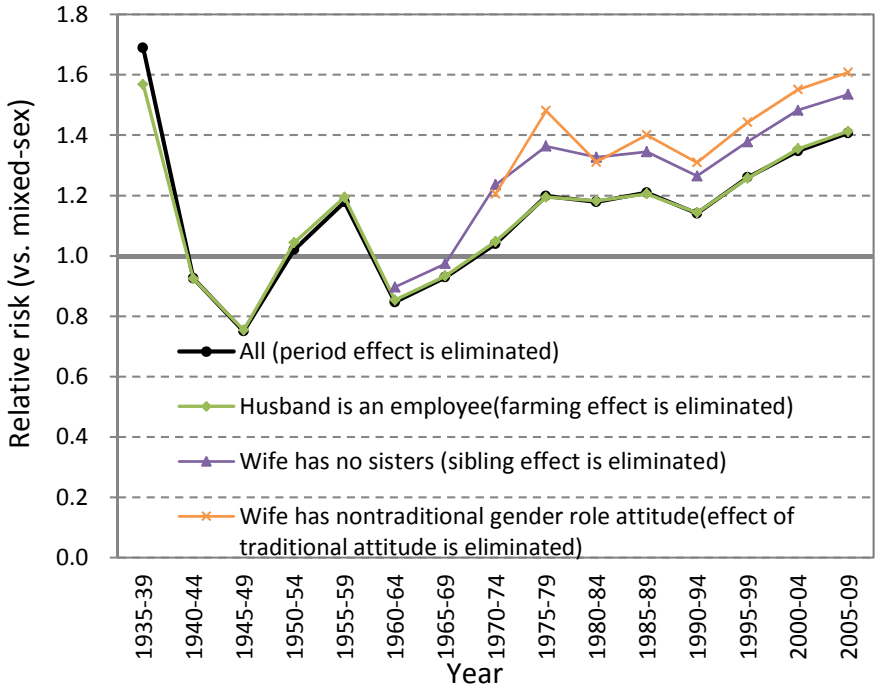


Figure 9: Change in elative third birth risk (relative to mixed-sex) among couples with two boys (daughter preference) from the CLL model by calendar year after controlling for covariates



Conclusions and discussions

Parental sex preference often has a pronatalist effect on parity progression. In industrialized countries, especially with very low fertility countries, trends in the effect of the sex of preceding children on fertility behaviour has become more important in terms of fertility trends. At the same time, observed patterns in parental gender preference vary across developed countries and a fully satisfying theoretical explanation is still not at hand (Hank 2006). In this paper, I focus on Japan where one of developed countries with very low fertility and although the state is changing, more traditional gender role attitudes prevail compared with other Western societies. I described long-term trends in Japanese parental gender preference focusing on the relative risks of transition to the third birth by children's sex composition. Also using multivariate discrete-duration survival models which can be viewed as a multivariate life table, I tried to show the extent to which the pattern in gender preference of children can be explained by covariates such as husband's occupation, position in siblings, and wife's traditional gender role attitudes.

Parental gender preference for children has become much stronger since the 1960s. Most importantly, after fertility transition in the 1950s, superiority in gender preference is reversed. In the late 1950s to the earlier 1970s, son preference was relatively strong. After the 1980s, daughter preference effect has exceeded. This emerging daughter preference in the transition to the third birth is consistent with previous research for Japan that focuses on ideal gender composition of children or fertility intention by the sex composition of children already they have (Sakai 1989, Moriizumi 2008).

Utilizing multivariate CLL model estimations, I found that declining trends in son preference is partially explained by the declining share of farming households or wives having their own brothers. Husband of an eldest son is positively associated with the third birth risk and the risk increases more when the couple has only two girls. On the other hand, wives who don't have their own sisters contribute higher risk of having third birth among two-boy families (versus mixed sex). While wife's traditional gender role attitude does not show any effect in son preference, it negatively associated with the relative risk of the third birth among two-boy families. This means that wives who disagree with traditional gender role have more desire to have a daughter than those with traditional attitude when they have only two boys. It may be similar line to Nordic countries, emergence of "new" daughter preference. Women with gender convergence perception may expect self-expansion through reproduction. Also we should keep in mind that fertile women with gender convergence perception would be selective.

These results suggested that sons in Japan are still expected to keep paternal lineage. Since the percentage of eldest son is expected to increase because of decline in the number of children couples have, two-girl effect on the third birth probability should contribute to inflate third birth fertility for a while. The positive relationship between women with no sisters and daughter

preference suggested that today a daughter may be a substitute for their mother's sisters. According to previous studies for gender-symmetry in Western countries, increasing gender equality do not necessarily bring about parental gender indifference (Hank 2007). In Japan as well, higher risk of having third birth among women having two boys with nontraditional gender role attitude suggested that even if perceptions of gender role wanes, sons do not seem to be considered a substitute for daughters. Even after controlling for these covariates, increasing trend in desire to have at least one daughter clearly exists. This remaining demand for female offspring in the age of shrinking desired family size may reflect that parents may attribute more values in emotional aspects or providing old-age assistance, which are traditionally seen as beneficial function of daughters, to their children. Although surveys among single men indicate that Japanese men still prefer sons over daughters, this is not reflected in the observed pattern of parity progression. This suggested that wife dominant decision making on next birth may prevails recently.

References

Andersson, G., Hank, K., Rønsen, M., and Vikat, A. (2006) "Gendering family composition: Sex preferences for children and childbearing behavior in the Nordic countries." *Demography*, 43(2): 255-267.

Andersson, Gunnar, Karsten Hank, and Andres Vikat. (2006) "Understanding parental gender preferences in advanced societies: Lessons from Sweden and Finland." MPIDR WORKING PAPER WP 2006-019

Banks, Joseph, A. (1954) *Prosperity and Parenthood: A Study of Family Planning among the Victorian Middle Classes*. London: Routledge and Kegan Patul.

Bongaarts, John, and Robert G Potter. (1983) *Fertility, Biology, and Behavior: An Analysis of the Proximate Determinants*, New York: Academic Press.

Campbell, Ruth, and Elaine M. Brody (1985) "Women's changing roles and help to the elderly: Attitudes of women in the United States and Japan." *The Gerontologist* 25(6):584-92.

Feeney, G. (1986) *Period parity progression measures of fertility in Japan*. NUPRI Research paper series No.35: Nihon University, Population Research Institute.

Fuse, Kana (2010) "Variations in attitudinal gender preferences for children across 50 less-developed countries." *Demographic Research*, 23(36):1031-48.

Fuse, Kana. (2013) "Daughter preference in Japan: A reflection of gender role attitudes?" *Demographic Research* 28(36):1021-52.

Gillis, John R, Louise A Tilly, and David Levine (1992) *The European Experience of Declining Fertility, 1850-1970: the Quiet Revolution*. Oxford, Blackwell.

Gray, E., Duckworth, D. and Nakajima, Y. (1980) "The human sex ratio and factors influencing family size in Japan." *Journal of Heredity*, 71: 411–415.

Hank, Karsten. (2007) "Parental gender preferences and reproductive behaviour: A review of the recent literature."

Journal of Biosocial Science, 39(05): 759-67. doi:10.1017/S0021932006001787.

Hank, Karsten, and Gunnar Andersson (2002) *Parental gender indifference or persistent sex preferences for children at the turn to the 21st century? A reflection on Pollard and Morgan (2002) with reference to the Swedish case*. No. WP-2002-049. Max Planck Institute for Demographic Research, Rostock, Germany, 2002.

Hank, Karsten. and H.-P. Hans-Peter Kohler (2000) "Gender preferences for children in Europe: Empirical results from 17 FFS countries. " *Demographic Research*, 2(1).

Hank, Karsten. and H.-P. Hans-Peter Kohler (2003) "Sex preferences for children revisited: New evidence from Germany. " *Population (English ed.) ,* 58(1):133–44.

Iwai, N. and Sato, H. (2002). *Japanese values and behavioral patterns seen in the Japanese General Social Survey*. Tokyo, Japan: Yuhikaku. (In Japanese).

McClelland, Gary H. (1979) "Determining the impact of sex preferences on fertility: A consideration of parity progression ratio, dominance, and stopping rule measures." *Demography*,16(3):377-88.

McDonald, Peter (2004) "Gender equity in theories of fertility transition." *Population and Development Review* 26(3):427-39.

Mills, Melinda and Begall, Katia (2010) "Preferences for the sex-composition of children in Europe: A multilevel examination of its effect on progression to a third child," *Population Studies*, 64(1):77-95, DOI: 10.1080/00324720903497081

Moriizumi, Rie. (2008). "An empirical study of sex preferences for children in Japan." *Jinko Mondai Kenkyu (Journal of Population Problems)*, 64(1):1-20 (In Japanese)

National Institute of Population and Social Security Research (2011) *Marriage Process and Fertility of Japanese Married Couples Highlights of the Survey Results on Married Couples.*

Nishioka, Hachiro (1994) "Effects of the Family Formation Norms on Demographic Behaviors: Case of Okinawa in Japan." *Jinko Mondai Kenkyu (Journal of Population Problems)*, 50(2):52-60

Pollard, Michael S. and S. Philip Morgan (2002) "Emerging parental gender indifference? Sex composition of children and the third birth." *American Sociological Review* 67: 600-613.

Sakai, Hiromichi (1987) "Todofuken betsuni mita Nihon no syussyo seihi (Sex ratios at birth in Japan by prefectures)." *Jinko Mondai Kenkyu (Journal of Population Problems)*, No.184: 78-83. (In Japanese)

Sakai, Hiromichi (1989) "Kodomo no seibetsu ga syussyo ni ataeru eikyo ni tsuite (Child-sex effects on further births)." *Jinko Mondai Kenkyu (Journal of Population Problems)*, No.189: 18-30. (In Japanese)

Sakai, Hiromichi (1992) "Kinnen ni okeru kodomo no seibetsu senko no doko to sono syakaikeizaiteki sai (Recent trend in sex preferences for children among Japanese couples and their socio-economic differences)." *Shakai Shinrigaku Kenkyu (Japanese Journal of Social Psychology)*, 7(2): 75-84. (In Japanese)

Sloane, Douglas M. and Che-Fu Lee (1983) "Sex of previous children and intentions for further births in the United States, 1965-1976." *Demography* 20: 353-367.

Yamaguchi, Kazuo, and Linda R Ferguson. (1995) "The stopping and spacing of childbirths and their birth-history predictors: rational-choice theory and event-history analysis," *American Sociological Review*, 60:272-98.