



Preference for sons: still a trend? Evidence from individual-level data from Finland, 1960–2015

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Abstract

Preference for sons has been shown in various ways, but is it still up to date? I investigate how sex preference has evolved during the past 50 years using population-wide data from Finland. I find that having a first-born girl increases fertility and decreases the probability of being together with the child's father in the 1960s to 1980s but not after the 1990s. Families with a first-born girl had 0.03 more children in the years 1960–1980. The effect decreases to an imprecise zero in the 1990s and to 0.007 fewer children in the 2000s. This shift occurs at the same time as the female and male employment rates approach each other. As the costs of raising a girl are not greater than those of raising a boy in Finland, the results suggest that the shift might be due to increased female bargaining power. Past literature has shown that females prefer girls over boys or are more neutral than males, who prefer having sons over daughters more often.

Keywords Child sex · Son preference · Fertility · Family structure · Marriage

JEL classification J1 · J11 · J12 · J13 · J16

1 Introduction

Preference for sons has been shown in various ways, and the sex of the child plays a large role in families—at least partly—due to sex preferences.¹ Boys are, for example, mentioned more often on social media and receive more likes (Sivak and Smirnov

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¹ The three leading explanations for why parents might treat girls and boys differently and why the sex of the child might affect family outcomes are (1) differences in production functions, (2) preferences, and (3) the costs of investing (Baker and Milligan 2016).

2019); they increase marital stability (see, e.g., Blau et al. 2020; Dahl and Moretti 2008); and fathers spend more time with them than with daughters (Lundberg 2005). Moreover, men's labor supply and wage increase more in response to the birth of sons than to the birth of daughters (Lundberg and Rose 2002), and mothers whose first child is a boy are less likely to work in a typical week and work fewer hours than women with first-born girls (Ichino et al. 2014). The literature is vast, and the aforementioned studies are only the tip of the iceberg (see, for example, Lundberg 2005; Raley and Bianchi 2006 and Bharadwaj et al. 2014 for reviews of the literature).

Most of these studies, however, reflect the preferences of individuals who became parents decades ago. Some argue that patriarchy is coming to its end (Rosin 2012) and that there is a shift toward a preference for girls (Helne 2020). In a landmark study, Dahl and Moretti (2008) found evidence consistent with son preference in the US using U.S. census data for married women for the period 1960–2000. They were followed by Blau et al.'s (2020) study showing that the son preference in fertility decisions was reversed to some extent for married natives by the 2008–13 period in the US.² Evidence for other countries and across time periods is limited. Ichino et al. (2014) find that after a first-born boy, the probability that women have more children *increases* in the UK, Italy and Sweden.³ Their sample includes all women, both married and unmarried, and they argue that in these advanced economies, the negative impact on fertility deriving from the fact that fewer pregnancies are needed to get a boy is more than compensated by the positive effect on fertility deriving from the greater stability of marriages. I suggest that the differing results might also be due to the data period used and show that the estimates might differ due to *the shift in preferences* or the fact that the preference might be outweighed by factors such as increased female bargaining power. Is there still a sex preference for boys in developed countries? Do parents who had their children in the past 20 years still have a preference for sons over daughters?

Using population-wide individual-level data for the 1950–2020 period in Finland, I study how the preference for boys has evolved over the past half-century using various approaches. First, in Section 3.1, I study the changes in preference for sons using the sex of the last child (SLC) approach, which is one of the most fundamental demographic indicators. Second, in Section 3.2.1, I use the first-born sex approach used by economists (see, for example, Dahl and Moretti 2008) to study the effects of having a first-born girl on fertility. Finally, in Section 3.2.2, using the first-born sex approach, I extend the analysis to study how the sex of the first-born affects marital stability.

This is the first study to use both extensive and recent time period and population-wide data to study how sex preferences have evolved. Using administrative instead of survey data enables a perfect identification of both birth order and sex of each child. Additionally, the paper is able to estimate son preference across more decades in a single setting than any study in the past literature. Moreover, one key contribution of the paper is that I can study whether the sex of the child has an effect on

² Blau et al.'s (2020) sample for the period 2008–13 includes all women, but for the period 1960–2000, only married women are included.

³ The data period used by Ichino et al. (2014) is 1991 for the UK, 2004–2008 for Italy, and 2004 for Sweden, while Dahl and Moretti (2008) use data from 1960–2000 and base their fertility results on data from 1960–1980.

the probability of being together, not necessarily married, with the child's father at a later age and to look at the fertility outcomes until the age of 40 years. Later, I will show evidence suggesting that the results of this paper are potentially generalizable to other similar countries, such as European countries and the US.

I find that the effect of first-born girls on fertility has changed over the decades, suggesting that the preference for sons in the 1960s to 1980s shifted toward sex neutrality in the 1990s and even to a slight preference for daughters later in the 2000s and 2010s. The results using the different approaches and outcomes follow a remarkably similar pattern. Families with a first-born girl had, on average, 0.03 more children in 1960–1980. The effect decreases to an imprecise zero in 1990 and to 0.007 *fewer* children in the 2000s. To give the numbers context, for every 100 first girls born, three additional babies were born until the 1990s. However, in the 2000s, the effect switches signs, and for every one *thousand* first-born girl, seven *fewer* babies were born. At the same time, the sex ratio of last-born children decreased from approximately 108 boys for every 100 girls in the 1960s to approximately 105 boys for every 100 girls in the 1990s and thereafter. I find that the probability of being together (either married or cohabiting) with the father of the first child is negative for mothers who had a first-born girl prior to the 2000s, after which the estimate is close to zero and imprecisely estimated.

The point estimates for the probability of having two or more children are almost identical when compared to other studies using the same empirical setting and similar years (Blau et al. 2020; Dahl and Moretti 2008; Ichino et al. 2014) but with different countries (Italy, Sweden, UK, and the US), indicating that this may be a common trend among similar countries. These earlier studies provided us with data points from different countries and time periods. The results of this study help us to map these points and provide an alternative explanation for why the estimates have differed across studies – the preference for sons might have shifted toward a preference for daughters, or son preference might have been outweighed by other factors, such as increased female bargaining power, as Blau et al. (2020) suggests.

The decrease in preference for sons and the gender gap in employment go hand-in-hand; in the 1990s, both the preference for sons, measured as the difference in total fertility rates for those with first-born girls versus boys, and the gender gap in the employment rate decreased drastically. As the costs of raising a girl are not greater than those of raising a boy in Finland, the results suggest that the shift might be due to increased female bargaining power.

2 Data and empirical specifications

2.1 Data

To analyze the evolution of sex preferences over the past 50 years, I use data from three different Finnish datasets: (1) parent-child linkages covering children born between 1949 and 2020, (2) birth register data spanning from 1988 to 2015, and (3) Finnish Longitudinal Employer-Employee Data (FLEED) for the period from 1988 to 2015. Since the parent-child register does not include information on child sex, I supplement this by linking child sex data from the FLEED. The FLEED contains information on all Finnish residents aged 15 to 70 years, regardless of their working

status, offering rich background information on the individuals, such as their education, marital status, spouse, and labor market outcomes. For younger cohorts not present in the FLEED, I link their sex information from the birth register data, which contains all births in Finland from 1988 to 2015. Therefore, individuals born before 1988 who either died before being included in the FLEED data from 1988 onwards or moved abroad lack sex information. Regarding deaths, given that males have a higher likelihood of dying young, families with first- or last-born sons may be more likely to be missing compared to those with first- or last-born daughters in the earlier years. This potential bias might result in underestimating the share of boys in earlier years.

This study is the first to utilize both an extensive time period and population-wide data to examine the evolution of sex preferences, offering several key advantages. First, by using administrative data rather than survey data (as seen in studies such as Dahl and Moretti 2008 and Blau et al. 2020), I achieve perfect identification of both birth order and the sex of each child. Second, the extensive time period allows for the estimation of son preference across more decades within a single setting than any previous study in the literature. Third, with administrative data on both maternal cohabitation status and the identity of the cohabiting partner, I am able to extend the analysis of relationship outcomes beyond marriage to include cohabitation, and ascertain whether the partner is the father of the child. Finally, I am able to track mothers' fertility outcomes up to age 40.

I limit the years of study to 1960–2015 for two reasons. First, for births occurring in the 1950s, I might be missing previous births of the mothers, as the register only has data on births from 1949 onward. To address this issue, I keep only mothers who were born in 1934 or later, and thus became 15 years old in 1949 or later. Second, I limit the sample to mothers who were born in 1980 or earlier, as I want to measure their completed fertility and argue that with high probability, it is by the age of 40. As shown by these limitations, studying sex preferences across time is very data intensive and restrictive. This is the only paper that I know that has done it using both such an extensive and recent time period and the whole sample of mothers.

In 1960 and beyond, the annual number of first births exceeds thirty thousand according to the data. Overall, there are approximately 80,000 births per year in the early sixties, which declines to approximately 60,000 or less in later decades, as shown in Appendix Fig. 8.

Column (1) in Table 1 reports the statistics for all women in the sample who had their first child between 1960 and 2015, whom I can follow until the age of 40, and for whose first child I can link data on sex. Columns (2)–(7) report the statistics separately for each decade from 1960 to 2010 by the birth decade of the first-born child. Notably, the composition of mothers (and the composition of the whole population) changes across years. Approximately one-quarter, or 24%, of first-time mothers in 1960 had completed only compulsory education, and only roughly one in every six, or 16%, had a tertiary education, meaning that they had a polytechnic or university degree. In the 2000s, 5% of the first-time mothers had only completed compulsory education, while 64% had completed tertiary education.⁴

⁴ Secondary education refers to high school or a vocational degree. Here, education refers to the highest level of education attained by the oldest age possible, according to the FLEED data for the years 1988 to 2016.

Table 1 Descriptive characteristics of first-time mothers in 1960–2015

	All	1960	1970	1980	1990	2000	2010
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Number of children	2.29	2.32	2.25	2.38	2.37	2.16	1.69
First-born girl	0.49	0.50	0.50	0.49	0.49	0.49	0.49
Last child boy	0.52	0.53	0.52	0.52	0.51	0.51	0.51
Primary educ.	0.24	0.54	0.30	0.15	0.10	0.05	0.04
Secondary educ.	0.37	0.30	0.41	0.44	0.39	0.30	0.23
Tertiary educ.	0.39	0.16	0.28	0.40	0.50	0.64	0.72
Employed (youngest)	0.79	0.84	0.83	0.73	0.75	0.80	0.84
Employed (oldest)	0.77	0.64	0.74	0.79	0.82	0.85	0.82
Age (youngest)	38.06	45.53	38.51	35.59	35.18	35.05	35.02
Age (oldest)	50.98	54.49	54.55	53.67	48.35	41.89	39.00
Mother age at first birth	25.94	22.75	24.22	25.89	27.23	29.87	34.86
First birth	1983.66	1964.92	1974.47	1984.41	1994.34	2003.94	2011.84
Not Finnish	0.03	0.03	0.02	0.02	0.04	0.04	0.03
Observations	1,303,955	255,945	305,553	268,145	261,643	176,277	36,392

The table includes all women born between 1934 and 1980 who had their first child between 1960 and 2015, and for whom I can link the sex from either FLEED data from 1988 to 2015 or birth register data from 1988 to 2015

The average age of becoming a mother or having a first child has changed significantly over time. In the 1960s, this average age was 22.75 years. However, by the 2000s, it had increased by more than seven years, reaching an average age of 29.87 years. Mothers' age at first birth in the 2010s is higher compared to previous decades, partly because I have only included women who gave birth for the first time in the 2010s and were 40 years old by 2020. This also partly explains the lower number of total children. Therefore, it's important to interpret the estimates for the 2010s with caution, as they reflect the preferences of mothers who became parents at an older age.

2.2 Empirical strategy: sex of the last child and sex of the first child

The sex of the last child (SLC), also known as the sex ratio at last birth (SRLB), stands as one of the most fundamental demographic indicators and has been a key measure in assessing sex preferences, particularly in demographic literature (see, for example, Chao et al. 2019). The underlying principle, as outlined by Dalla Zuanna and Leone (2001), is as follows: when natural fertility no longer prevails—meaning the probability of having a child is unaffected by the sex or order of children already born – and where discrimination against certain sexes, such as daughters, is prevalent, couples may opt to cease having children after the birth of a son. In such scenarios, the sex ratio at last birth may deviate from the expected ratio of 105 boys per 100 girls, even if the overall sex ratio, both globally and within each birth order, remains at approximately 105. According to this approach, if there's a preference for

sons, the sex ratio of the last-born child tends to exceed the expected ratio of 105 boys for every 100 girls. Conversely, if there's a preference for daughters, the sex ratio of the last-born child tends to fall below this ratio. Generally, the natural sex ratio at birth is around 105 boys per 100 girls, with minor fluctuations typically ranging from about 103 to 107 boys.

Economists have used other measures to assess preferences for the sex of children. Dahl and Moretti's (2008) landmark study was the first to study sex preference using the sex of the first child, and the approach has since been used by many others (such as Blau et al. 2020 and Ichino et al. 2014, among others). If families with a daughter as their first-born child are more inclined to have additional children, it implies a preference for boys. The rationale behind this, as outlined by Dahl and Moretti (2008), is as follows: Compare two families that plan to have at least two children. The other family has a first-born son, and the other has a first-born girl. After the second birth, assuming that sex-birth order does not matter, the only difference is that the other family has a 50% chance of having two boys and the other has a 50% chance of having two girls. Both families have a 50% chance of having a boy and a girl. Hence, if a family with two girls is more likely to have an additional child compared to a family with two boys, this effect will load onto the sex of the first child, which is random.

Selective abortion based on ultrasound or a noninvasive prenatal test (NIPT) might theoretically bias the results. However, I later demonstrate how the sex ratio at birth has remained stable across years in Finland, hovering around the natural sex ratio of 105 boys to every 100 girls. This stability suggests that selective abortion is not a prevalent issue. Furthermore, selective abortion is highly unlikely in Finland due to strict regulations that permit termination of pregnancy only before 12 weeks of gestation.⁵ Sex can be determined by ultrasound as early as 12 to 14 weeks of pregnancy, but it is usually done around 18 to 20 weeks. NIPT involves using a blood sample from the pregnant woman to identify fetal sex and can be performed as early as 10 weeks of pregnancy. However, obtaining results may take up to two weeks.

If selective abortion were prevalent and driven by a strong preference for sons, individuals with the strongest preference for boys might choose to abort their first-born girls, resulting in their exclusion from the data and potentially biasing the results downward. However, data indicate a decreasing trend in the number of abortions over the past 30 years, with the proportion of abortions relative to live births remaining stable, as shown in Appendix Fig. 10. Thus, while methods for detecting fetal sex have evolved, there are no indications that the number of abortions has increased in response.

Appendix Table 2 provides descriptive statistics for mothers categorized by the sex of their first-born child. The similarity in characteristics such as educational level and age at first birth among mothers of first-born boys and girls provides further evidence supporting the assumption that the sex of the first-born child is random. More formally, I use the following equation to study the effect of first-born girls on,

⁵ For a very compelling reason, an abortion may be performed after 12 weeks of pregnancy. This requires special permission issued by Valvira (National Supervisory Authority for Welfare and Health). Valvira's permission is also required if the abortion is performed due to serious illness or impairment of the fetus.

e.g., fertility outcomes:

$$Y_{id} = \delta_d D_{id} + \beta X_{id} + \epsilon_{id} \quad (1)$$

In equation (1), Y_{id} represents the total number of children for individual i who has her first child in decade d , the probability of having more than k children where k ranges from 2 to 5, or the probability of individual i being together (either married or cohabiting) with the first child's father. The variable D_{id} is of main interest, representing a dummy variable indicating whether the first child is a girl. I focus on the sex of the first child since whether the first child is a boy or a girl can be viewed as random, as argued above. Hence, the effect estimates obtained can be interpreted as causal effects. X_{id} is a vector of observable mother characteristics, including indicators for age at first birth and indicators for the first child's birth year. The results are robust to the addition of other controls, such as mothers' education.

3 Results

3.1 Sex of the last child (SLC)

In panel (a) of Fig. 1, I plot the sex ratio of last-born children to examine the preference for boys across the period 1960–2015. The dashed horizontal line represents the ratio of 105 boys to every 100 girls. If there were no preferences for either sex, the share of boys who were last born should remain close to this line. Between 1960 and 1980, the sex ratio of last-born children is between 107 and 108 boys to every 100 girls, indicating a preference for sons. However, in the 1990s, it drops to approximately 104.5. Thus, after the 1980s, there no longer appears to be such a strong preference for sons; instead, the results suggest that there might even be a slight preference for girls. According to Chao et al. (2019), the sex ratio at birth in 2010 was 104.8 for the US, 104.7 for Finland, 105.7 for Sweden, and 105.9 for Italy. China's sex ratio was still heavily skewed at 117.41 in 2010.

In panels (b) to (d), I have plotted the sex ratio at birth for all children, first-born children, and second-born children, respectively, to demonstrate that the declining share of boys among last-borns is not mirrored by a more masculine sex ratio in earlier births. The figures also indicate that there is not a skewed sex ratio, which would be an indication of selective abortions. The overall share of boys among first-borns, second-borns, and all children hovers around the natural ratio of approximately 105 boys for every 100 girls.

Hence, Fig. 1 indicates that there might have been a shift from the preference for boys. Moreover, the sex ratio at birth is close to the natural ratio, suggesting that selective abortion is not an issue in Finland. Next, I use the first-born child sex approach to see whether similar results are obtained.

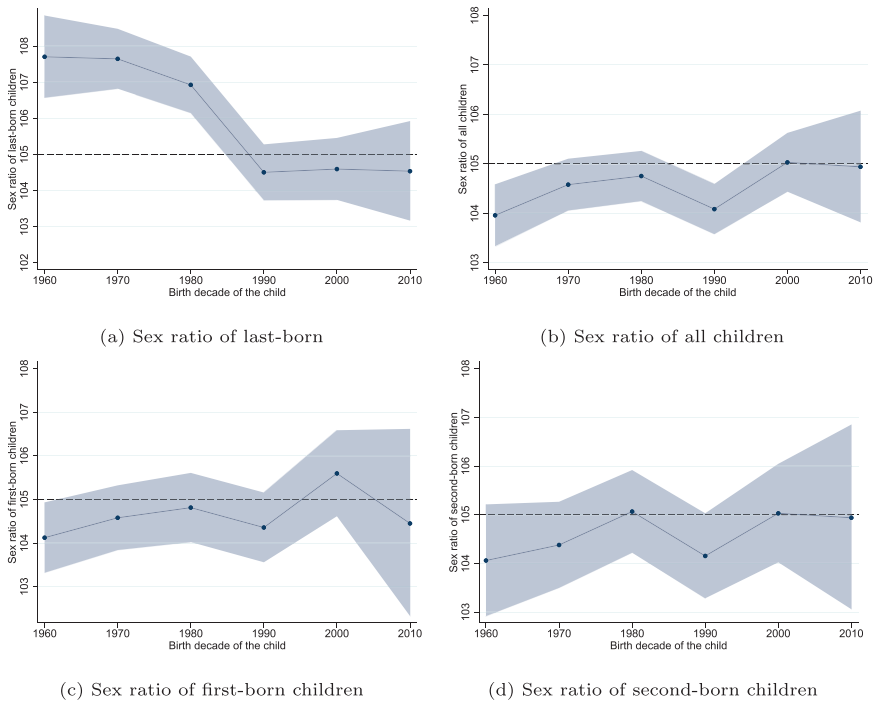


Fig. 1 Sex ratio at birth. Notes: The figure plots the sex ratio at birth, including the 95% confidence intervals. Panel (a) shows the sex ratio for last-born children, while panels (b–d) display the sex ratio for all children, first-born children, and second-born children, respectively. The sample includes all women who had their last child between 1960 and 2015 and who were born between 1934 and 1980. The dashed horizontal line represents the sex ratio of 105 boys for every 100 girls

3.2 The effects of first-born girl

3.2.1 Fertility outcomes

In Fig. 2, I plot the coefficients for δ_d , a dummy for having a first-born girl in decade d , from Eq. (1), estimated for the decades 1960 to 2010 for fertility outcomes. Panel (a) of Fig. 2 indicates that families where the first child is a girl tend to have more children than families where the first child is a boy until the 1990s. After that, the effect falls to roughly zero and then becomes negative. Families with a first-born girl have, on average, 0.03 more children in the years 1960–1980.⁶ Hence, for every 100 first girls born, three additional babies were born before the 1990s. The effect decreases to an imprecise zero in the 1990s and to 0.007 fewer children in the 2000s (imprecisely estimated). By the 2010s, families with a first-born girl have 0.019 fewer children, but this group is more selected, and the results should be interpreted with some caution. However, given the slope of the curve, the results for the 2010s

⁶ Numerical results for total fertility can be found in Appendix Table 3.

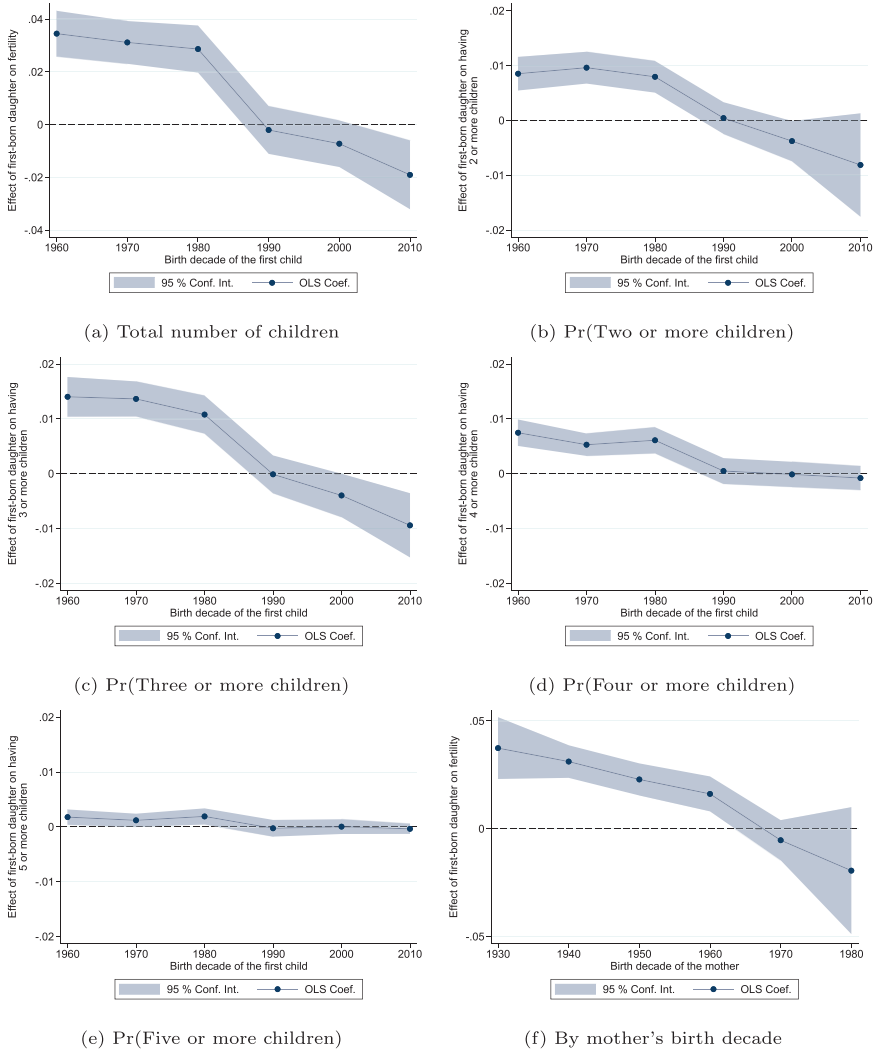


Fig. 2 Effects of having a first-born girl on fertility outcomes. Notes: The figures display the estimated impacts of having a first-born girl on fertility outcomes, including the total number of children and the probability of having 2 (3, 4, and 5) or more children (panels **a–e**), respectively). Panel **(f)** presents the estimates for the total number of children by the mother's birth year, while the other figures show the effects by the child's birth year. Each figure plots the estimates of δ_d and 95% confidence intervals obtained using Eq. (1). The sample includes all women who had their last child between 1960 and 2015 and who were born between 1934 and 1980

seem robust. The results remain robust when additional controls, such as dummies for maternal educational level (Panel E. in Table 3), are added.

Panels (b) to (e) report the estimates for a dependent variable of having two (three, four, or five, respectively) or more children following the past literature. Panel (b) indicates that the effect is strongest for having three or more children. The probability of having three or more children is 1.4 percentage points greater when the first child is

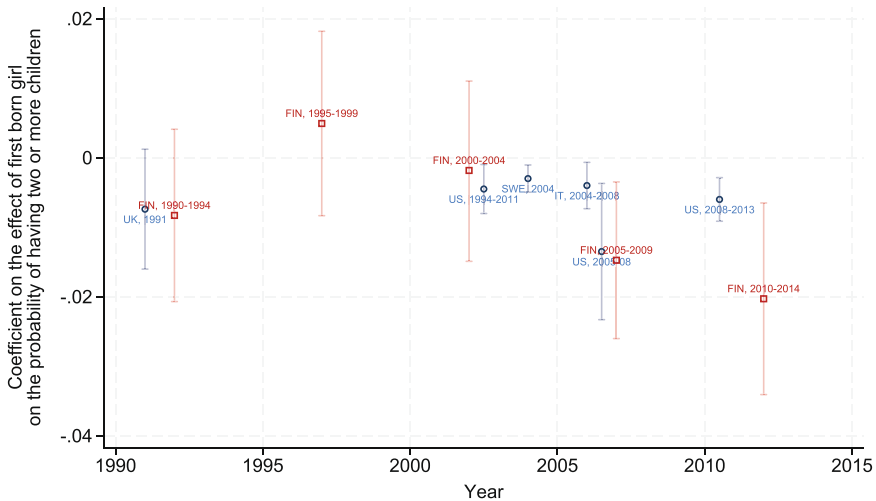


Fig. 3 Estimates of first-born girls on the probability of having two or more children compared to previous studies. Notes: This figure presents point estimates for the effect of having a first-born girl on the probability of having two or more children from studies by Blau et al. (2020) and Ichino et al. (2014), along with results from this study for the years 1990 onward, all with 95% confidence intervals. Since Ichino et al. (2014) examines the effect of first-born boys, the point estimates from their study were multiplied by -1 for comparability. If the point estimate was derived from data spanning multiple years, the year displayed on the figure represents the midpoint of the analysis period, with the years of study indicated in the figure. For results using Finnish data, the estimates are plotted according to the birth year of the first child. This may mean that the estimates from Ichino et al. (2014) and Blau et al. (2020) are ahead of time by 0–12 (or 15) years

a girl in the period 1960–1970. However, in the 2000s, the effect switches signs, and the effect on the probability of having three or more children is -0.4 percentage points. The estimates for having two or more children are very similar but slightly less pronounced. Dahl and Moretti (2008) also find the largest effect on having three or more children. Using 1960–1980 census data, they find that the probability of having three or more children is 0.31 percentage points greater when the first child is a girl for couples in their first marriage. The difference in the magnitude of the point estimates is most likely due to pooling of the years 1960–2000 and due to smaller sample sizes in the earlier years. Having only married women in the data might also affect the estimates, as Ichino et al. (2014) suggests. The estimated effects on having four (five) or more children are of smaller magnitude. However, one can observe a shift from a preference for sons toward sex neutrality.

Instead, the results of Ichino et al. (2014) are almost identical to my post-1990s results for the probability of having two or more children, as shown in Fig. 3, where I have plotted the corresponding estimates from Ichino et al. (2014) and Blau et al. (2020), along with estimates using Finnish data in five-year intervals for the years 1990 to 2014. The point estimates can also be found in Appendix Table 4. Unfortunately, there are no comparable estimates using data on all mothers for years prior to 1990.

I find point estimates of -0.18 and -1.5 percentage points for the years 2000–2004 and 2005–2009, respectively. Ichino et al. (2014) find a point estimate for having a first-born boy on the probability of having more than one child of 1.35 percentage points for the US using National Health Interview Survey (NHIS) data (2005–2008), 0.31 percentage points using US Census data for 1960–2000, and 0.45 percentage points using the Current Population Survey (CPS) data (1994–2011). They also find estimates of 0.74 percentage points for the UK using Census data for 1991, 0.3 percentage points for Sweden (2004), and 0.4 percentage points for Italy using data for 2004–2008, as depicted in Fig. 3.⁷ The estimates from Blau et al. (2020) using American Community Survey (ACS) data for 2008–13 are also of similar magnitude; they find an effect of -0.6 percentage points on the probability of having two or more children for the native sample. The point estimates are almost identical for the same years, suggesting that this might be a common trend in similar countries.⁸

The results indicate that there was a sharp decrease in the preference for sons between the 1980s and 1990s. The yearly data also show a decrease at the turn of the two decades (see Appendix Fig. 9). This implies that families⁹ who had their first child in the 1980s still had a preference for sons, but this preference was no longer present for families that had their first child in the 1990s or later. The results are strikingly similar to those found by Blau et al. (2020) regarding the timing of the shift in preferences as well. They find a positive effect on fertility for first-born girls through the 1980s, an impact consistent with son preference for married women. However, this effect decreases to roughly zero in 1990 and becomes negative thereafter, following the trend in Fig. 2.

First-time mothers were, on average, 26 years old in the 1990s, meaning that they were born in the 1970s or late 1960s. In panel (f) of Fig. 2, the estimation is performed by pooling mothers' birth decades instead of children's birth decades. The results indicate that there has been a subtle decrease in the preference for sons across mothers' birth cohorts, with the trend accelerating for the 1970s and 1980s birth cohorts.

3.2.2 Relationship outcomes

Next, I study whether the sex of the first-born has an impact on being together, either married or cohabiting, with the child's father. It is commonly assumed

⁷ They find an imprecise effect of 4.8 percentage points using the British Household Panel Survey (BHPS) data for the UK 1991. However, the number of observations is small (1174), so I do not include it in the list or in Fig. 3.

⁸ A notable difference between the studies is the age of the first child in the analysis years. For the point estimates using Finnish data, I plot the results by the birth year of the first child, while for the other studies, I plot them by the year the data were collected. Ichino et al. (2014) and Blau et al. (2020) focus on families with children aged 15 or 12 or younger, respectively. Hence, the results from those studies can be thought to be ahead of time by a maximum of 12 to 15 years, most likely by much less. Unfortunately, neither Ichino et al. (2014) nor Blau et al. (2020) report statistics for the average age of first-born children. However, as the number of children is narrowed to one or more, mothers are aged 18 to 40 years old, and there is no lower limit for the age of the first-born, the average age of the oldest child likely lies between five and ten years. This suggests that the estimates from these studies may be ahead of those from this study by approximately five to ten years.

⁹ Either couples or the mothers by themselves.

that marriages are less likely to continue following the birth of girls than following that of boys. For example, Bedard and Deschenes (2005) use the sex of the first child as an instrumental variable for divorce. I use two different measures. The first is the probability of being together with the father of the first child at the youngest age possible, but not younger than 35¹⁰. The second measure is the probability of being together with the father of the first child at the oldest age possible, but not older than 55 years. Hence, the relationship status varies from age 35 for those born in 1980 to age 55 for those born in 1934, as I need FLEED, which is available for the years 1988–2015. The first approach provides a relationship status at an average age of 38 years, while the second approach provides a relationship status at an average age of 51 years. Both approaches yield almost identical results, as shown in Fig. 4; the probability of being together with the father of the first child is negative for mothers who had a first-born girl prior to the 2000s, after which the estimate is close to zero and imprecisely estimated. The results are also robust to being married to the father (not reported here). The results for the 2010s should again be interpreted with caution, as the sample includes women who became mothers at an older age. Moreover, most mothers are relatively young and might divorce later. The results are, however, consistent with the fertility outcomes; the preference for sons has decreased.

3.2.3 Heterogeneity by maternal education and age

Finally, Dahl and Moretti (2008) show that the fertility effect of first-born daughters decreases monotonically with education, with college graduates showing essentially no fertility effect. As the composition of the whole population and mothers changes over time, it is not meaningful to study how the preference for sons by education has evolved over time. Nevertheless, I report the effect of having a first-born girl on the total number of children by both education and the birth decade of the first child in Appendix Table 3. The results differ from Dahl and Moretti (2008), as I find a preference for sons in all education groups (primary, secondary, and tertiary) until the 1990s. After the 1990s, there is a negative effect of first-born girls in all education groups except for primary education in the 2000s. The results also suggest that maternal education is not the driving force affecting the preference for sons.

To explore whether the education a mother has relative to her peers is important, in panels (a) and (b) of Appendix Fig. 6, I divide mothers into two groups based on whether they have less than or more than the median years of education compared to mothers born in the same year. In panels (c) and (d), I divide mothers by whether they were below or above the median age when giving birth for the first time. An interesting pattern arises: both older and more educated mothers react less to the sex of their first-born child starting from the 1980s (1970s for mothers above the median age). In the 1960s, there is a strong preference for sons across all groups of mothers.

¹⁰ I restrict the analysis to mothers who had their first child before the relationship status is measured.

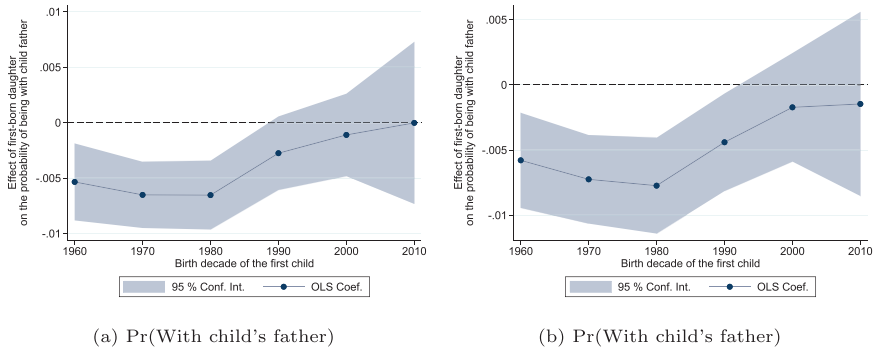


Fig. 4 Effects of having a first-born girl on marital outcomes. Notes: Figures show the estimated impacts of having a first-born girl on the probability of being together (either married or cohabiting) with the father of the first child. Panel (a) plots the estimates for being with the child's father at the youngest age possible, but not younger than 35 years. Mothers who had their first child before their relationship status was measured were excluded. Panel (b) plots the estimates for being with the child's father at the oldest age possible, but not older than 55 years. The figures plot the estimates of δ_d and 95% confidence intervals obtained using equation (1)

3.2.4 Immigrants

Preferences might still differ among different groups of people. Abrevaya (2009), for example, shows that there were 2000 “missing” Chinese and Indian girls in the United States between 1991 and 2004. He finds that mothers are significantly more likely to terminate a pregnancy and give birth to a boy when they have previously given birth only to girls. Blau et al. (2020) find that immigrant families with a female first child have significantly greater fertility and are more likely to be living without a father than native families.

Appendix Figure 7 plots the results for non-Finnish residents. The share of immigrants has traditionally been low in Finland. Moreover, the distribution of immigrants by origin has also been highly skewed. For example, only 3% of those who had their first child in the 1960s were not Finnish, and of these, 92% were originally from Afghanistan. The coefficients are more imprecise than before due to the low number of immigrants, and a shift in preferences might reflect a change in the composition of mothers by origin. Nevertheless, a similar pattern emerges in Appendix Fig. 7 as in Fig. 2. The effect of having a first-born daughter on fertility for the pre-1990s, especially for the 1980s, is larger, albeit not significantly different from the estimates after the 1990s.

Typically, India and China have had strong son preferences. Unfortunately, until the 1980s, fewer than 100 mothers who gave birth to their first child were originally from India or China. In panel (b) of Figure 7, I have plotted the estimates for mothers of Indian and Chinese origin for the period from 1980 to 2010. In the 1980s, the effect of having a first-born girl on the number of children was 0.25. In the 2000s, it decreased to 0.05, and in the 2010s, it decreased to -0.03 (both imprecisely estimated).

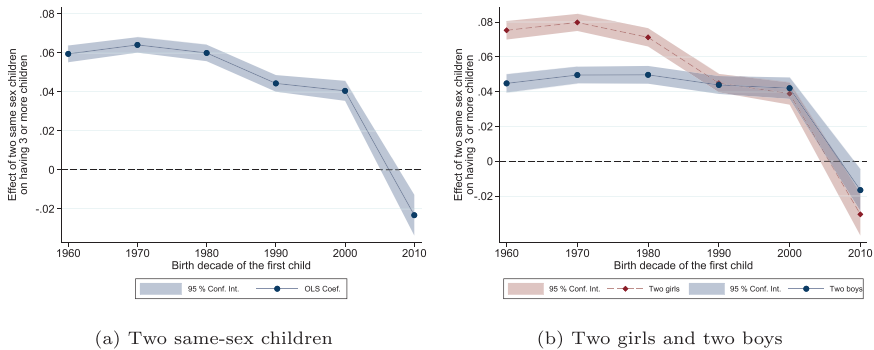


Fig. 5 Effect of having two same-sex children on fertility. Notes: The figures depict the estimated impacts of having two same-sex children on the probability of having more than two children. Panel (a) displays the coefficients for a dummy variable representing having two same-sex children. Meanwhile, Panel (b) illustrates the coefficients for two dummy variables: one for having two girls and another for having two boys

4 Supplemental analyses

4.1 Two same-sex children and fertility

The sex composition of the first two births in families with at least two children has been used to instrument for family size (see, e.g., Angrist and Evans 1998). Next, I examine how having two same-sex first births affects total fertility and whether there has been a change in the effect size over time. The specification is similar to the one used before (equation (1)), but now includes a dummy variable for having two same-sex children instead of a dummy variable for having a first-born girl. The analysis is restricted to those who have at least two children. I also conduct an analysis using two dummy variables: one for having two boys and another for having two girls. The aim of this analysis is to determine whether there has been a change in: (1) the desired number of children (total fertility would be less affected by having two same-sex children), and (2) the effects of having two boys versus two girls (an indicator of a change in sex preferences).

Panel (a) in Fig. 5 plots the coefficients for the dummy variable for having two same-sex children on the probability of having more than two children, while panel (b) plots the results for having two girls and two boys separately. Two interesting patterns emerge. First, consistent with the main results, the effect of having two girls versus boys on the probability of having more than two children is greater prior to the 1990s. In the 1960s, having two girls (boys) is associated with a 7.5 (4.5) percentage point greater probability of having more than two children, while in the 1990s, the coefficients converge; having two girls (boys) is associated with a 4.3 (4.2) percentage point greater probability of having more than two children. Second, the association between having two same-sex children and fertility remains rather stable until the 2010s, after which it becomes small and imprecisely estimated. In the 2010s, having two girls or boys is no longer associated with having more than two children. This, in turn, suggests that a family norm of two children may be emerging. The estimate for the 1980s (0.06)

is identical to that of Angrist and Evans (1998) using the Census Bureau's American Community Survey (ACS) Public Use Microdata Sample (PUMS) 1980 data for all women (both married and unmarried).

The results provide suggestive evidence that the decreasing effect of first-born daughters on fertility is not solely driven by a decrease in the number of children. This is since the effect of having two girls on the probability of having more than two children decreases prior to the overall decrease in the effect of having two same-sex children. According to various surveys conducted in Finland between 2001 and 2022, the desired number of children for individuals aged 20 to 45 with fewer than four children fluctuated between 2.45 in 2007 and 1.75 in 2018 (Sorsa et al. 2023).

4.2 Female bargaining power and the costs of raising a girl

Blau et al. (2020) suggest that son preference in fertility decisions might be outweighed by factors such as cost concerns in raising girls or increased female bargaining power. Next, I discuss these two factors in the Finnish context.

Appendix Figure 11 illustrates the employment rates for women and men separately from 1962 to 2019 for individuals aged 15 to 64 in Finland. Initially, there was a substantial gender gap of over 20 percentage points in the employment rates in the early 1960s, with approximately 60% of females and almost 90% of males employed. However, this gap gradually decreased over the years, and by the beginning of the 1990s, it had nearly disappeared. According to the Labor Force Survey, while in the mid-1960s, every fourth woman aged 15 to 74 years reported looking after their own households, caring for children, or relatives, by 2019, this was the main type of activity for just three percent of women in the same age group. Interestingly, the decrease in the preference for sons and the narrowing gender gap in employment appear to be correlated. In the 1990s, both the preference for sons, measured as the difference in total fertility rates for those with first-born girls versus boys, and the gender gap in the employment rate decreased drastically. This, in turn, provides suggestive evidence that female bargaining power might be driving the effect, at least in part. As suggested by Blau et al. (2020), women might have a greater say in fertility decisions than previously. A poll conducted by Newport (2011) found that men tend to prefer boys over girls, while women show no clear preference. Additionally, according to Lynch et al. (2018), both sexes demonstrate implicit preferences for same-sex children, with females exhibiting a stronger preference than males. Moreover, each sex shows a weak but statistically significant explicit preference for same-sex offspring.

Unfortunately, there are no data on decision making at the family level that would span the period of study. However, one indicator of female empowerment is the share of female candidates and votes cast on female candidates in parliamentary elections. As shown in Appendix Figure 12, in the 1960s, fewer than 20% of the candidates were female, and fewer than 20% of the votes were given to female candidates. Similarly, in line with trends observed in female employment, there was a rapid increase in the proportion of both female candidates and votes for females until the 1990s, after which the rate of increase slowed. In the 1991 elections, approximately 40% of the candidates were female, and slightly less than 40% of the votes were cast for female candidates.

Data on the costs of raising children, particularly separated by gender, are not available for the study period. However, according to Lehtinen and Aalto's (2018) report on living costs in Finland, the costs of raising girls and boys are similar until the age of seven. Afterward, the costs of raising boys are slightly higher due to increased food costs. Specifically, raising a 7- to 12-year-old girl costs €440 per month, while raising a 13- to 17-year-old girl costs €494 per month. In comparison, raising a boy of the same age ranges costs €465 and €530 per month, respectively. These reference budgets are computed with the input of consumers and experts from various fields.

One factor that might contribute to this shift could be a rise in the costs of raising girls, especially due to college fees, as suggested by Blau et al. (2020). However, in Finland, universities are tuition-free, and students are eligible for financial aid, including study grants and government guarantees for student loans, as well as housing allowances, regardless of their parents' income. Hence, the rising costs of raising girls might not be the driving force for the shift in preferences in Finland – at least not to the same extent as in the US.

5 Conclusions

Using population-wide individual-level data for the period 1950–2020 in Finland, I examine how the preference for boys has evolved over the past half-century. I find that the effect of first-born girls on fertility has changed over the decades, suggesting that the preference for sons in the 1960s to 1980s shifted towards sex neutrality in the 1990s and even to a slight preference for daughters in the 2000s and 2010s. The results obtained using different approaches and outcomes follow a remarkably similar pattern; the sex ratio of last-born children decreased from approximately 108 boys for every 100 girls in the 1960s to approximately 105 boys for every 100 girls in the 1990s and thereafter.

Thus, son preference appears to be either reversed or outweighed by other factors, such as higher costs of raising girls or increased female bargaining power. However, in Finland, the costs of raising girls have not increased to the same extent as in the US, given that education is free and financially supported by the government. This, in turn, suggests that the rising costs of raising girls might not be the primary cause for the shift in preferences. Instead, the decrease in son preference is coupled with an increase in the female employment rate, indicating that increased female bargaining power might play a role.

There are even signs of a slight preference for girls in the 2000s and 2010s, according to the results. This trend may also be observed in studies using different measures and cohorts born during these decades. For instance, in the 2000s, Baker and Milligan (2016) show that girls, rather than boys, receive more of certain time inputs (such as reading, storytelling, and teaching letters and numbers) from their parents across three developed countries.¹¹

In their recent overview, Doepke et al. (2023) suggest that the driving forces behind fertility decisions in advanced economies today are qualitatively different

¹¹ Baker and Milligan (2016) suggest that this effect is not solely due to a preference for a particular sex, as fathers' stated preference for sons only emerges as the child ages.

from those in earlier decades. They show how the relationship between labor market participation, education, and fertility has reversed, highlighting the compatibility of family and career as a key determinant of fertility in high-income countries. Interestingly, this change has occurred at approximately the same time as the observed shift in preferences in this study. For instance, in the 1980s, the relationship between education and fertility was negative across the entire education distribution. However, by 1990, this relationship had flattened at the upper end, and in the last two cross-sections, there has been an increase in fertility at the upper end of the education spectrum.

One might ask whether the results are generalizable to other countries. The results were almost identical to those from the UK, US, Sweden, and Italy for the 2000s, indicating that this might be a common trend in similar countries. Past literature (Blau et al. 2020; Ichino et al. 2014) also suggests that the preference for boys might have gradually shifted toward daughters. The decrease in Blau et al. (2020), as shown in Fig. 3, occurs at the same time. This paper shows how the sex of the last child and the sex of the first-born approaches show the same phenomenon. In summary, earlier studies provided us with data points from different countries and time periods. The results of this study offer an alternative explanation for why the estimates have differed across studies – the preferences might have shifted. However, it's worth noting that the results might not be generalizable to cultures or immigrant populations where strong preferences for boys are present.

How do the results then relate to conflicting polls that find that the preference for sons is the same as before, such as Newport (2011) referred to by Blau et al. (2020)? First, stated preferences might differ from revealed preferences. Likewise, the selection into parenthood might not resemble the survey sample. Finally, stated preferences might not be strong in the sense that individuals might not act on them – at least not as strongly as before. As Blau et al. (2020) suggested, women might have a greater say in fertility decisions than previously, as the poll found that men have a preference for boys over girls, while women show no preference either way.

6 Statements and declarations

- This work was supported by the Strategic Research Council at the Academy of Finland [grant numbers 345170 and 345218].
- I declare that I have no relevant or material financial interests related to the research described in this paper.
- Since the paper uses administrative data, without identifiable private information, IRB approval was not obtained for the project.

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Author contributions Krista Riukula conducted all the work.

Compliance with ethical standards

Conflict of interest The author declares no competing interests.

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7 A: Additional Tables and Figures

Tables 2, 3, 4 and Figures 6, 7, 8, 9, 10, 11, 12

Table 2 Descriptive characteristics of mothers by sex of the first-born

	First-born girl	First-born boy	<i>p</i> -value for diff.
Number of children	2.29	2.28	0.00
Last child boy	0.42	0.61	0.00
Primary educ.	0.24	0.23	0.00
Secondary educ.	0.37	0.37	0.00
Tertiary educ.	0.38	0.39	0.00
Employed (youngest)	0.78	0.80	0.00
Employed (oldest)	0.76	0.77	0.00
Age (youngest)	38.04	38.09	0.00
Age (oldest)	50.89	51.07	0.00
Mother age at first birth	25.92	25.96	0.00
First birth	1983.50	1983.81	0.00
Not Finnish	0.04	0.02	0.00
Observations	643,977	659,978	1,303,955

The table includes all women born between 1934 and 1980 who had their first child between 1960 and 2015, and for whom I can link the sex from either FLEED data from 1988 to 2015 or birth register data from 1988 to 2015

Table 3 Effect of first-born girl on total fertility

	1960	1970	1980	1990	2000	2010
<i>Panel A. Primary educated mothers</i>						
First-born girl	0.038*** (0.006)	0.045*** (0.007)	0.031** (0.013)	-0.008 (0.018)	0.022 (0.024)	-0.059 (0.038)
Mean	2.320	2.141	2.304	2.514	2.134	1.530
Per effect	1.635	2.131	1.371	-0.318	1.059	-3.774
Observations	138,438	92,492	39,639	26,509	9,667	1,284
<i>Panel B. Secondary educated mothers</i>						
First-born girl	0.024*** (0.008)	0.022*** (0.007)	0.037*** (0.007)	-0.001 (0.008)	-0.001 (0.009)	-0.040*** (0.014)
Mean	2.346	2.299	2.429	2.424	2.180	1.602
Per effect	1.041	0.960	1.530	-0.023	-0.052	-2.458
Observations	77,402	126,364	116,659	101,186	52,791	8,477
<i>Panel C. Tertiary educated mothers</i>						
First-born girl	0.042*** (0.011)	0.031*** (0.008)	0.018*** (0.006)	-0.002 (0.006)	-0.013** (0.005)	-0.010 (0.008)
Mean	2.284	2.278	2.346	2.305	2.157	1.726
Per effect	1.844	1.353	0.781	-0.098	-0.606	-0.553
Observations	39,963	85,124	108,435	130,425	112,132	26,304
<i>Panel D. All mothers</i>						
First-born girl	0.035*** (0.004)	0.031*** (0.004)	0.029*** (0.005)	-0.002 (0.005)	-0.007 (0.005)	-0.019*** (0.007)
Mean	2.323	2.246	2.378	2.372	2.160	1.688
Per effect	1.497	1.398	1.214	-0.085	-0.334	-1.121
Observations	255,945	305,553	268,145	261,643	176,277	36,392
<i>Panel E. All mothers with additional controls</i>						
First-born girl	0.035*** (0.004)	0.031*** (0.004)	0.028*** (0.005)	-0.002 (0.005)	-0.007 (0.004)	-0.018*** (0.007)
Mean	2.323	2.246	2.378	2.372	2.160	1.688
Per effect	1.508	1.383	1.206	-0.093	-0.341	-1.071
Observations	255,945	305,553	268,145	261,643	176,277	36,392

Table shows the estimates for the effect of having a first-born girl on the number of children by mother's education and for the whole sample. Controls include indicators for first child's birth year and mother's age. Additional controls in Panel E. include dummies for having a primary/secondary/tertiary education and for not being Finnish. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 Estimates of having a first-born girl on the probability of having two or more children compared to previous studies

Data	Estimate	Study
FIN, 1990-1994	-0.0083	This study
UK, Census 1991	-0.0074	Ichino et al. (2014)
US, CPS 1994–2011	-0.0045	Ichino et al. (2014)
FIN, 1995-1999	0.0049	This study
FIN, 2000–2004	-0.0018	This study
Italy, 2004–2008	-0.0040	Ichino et al. (2014)
Sweden, LISA 2004	-0.0030	Ichino et al. (2014)
FIN, 2005–2009	-0.0148	This study
US, NHIS 2005-08	-0.0135	Ichino et al. (2014)
US, ASC 2008-2013	-0.0060	Blau et al. (2020)
FIN, 2010-2014	-0.0203	This study

This table presents point estimates for the effect of first-born girl on the probability of having two or more children from Blau et al. (2020) and Ichino et al. (2014) studies and this study for the years 1990 onward that are also depicted in Fig. 3. Ichino et al. (2014) examined the effect of having a first child boy; hence, the point estimates from their study are multiplied by -1

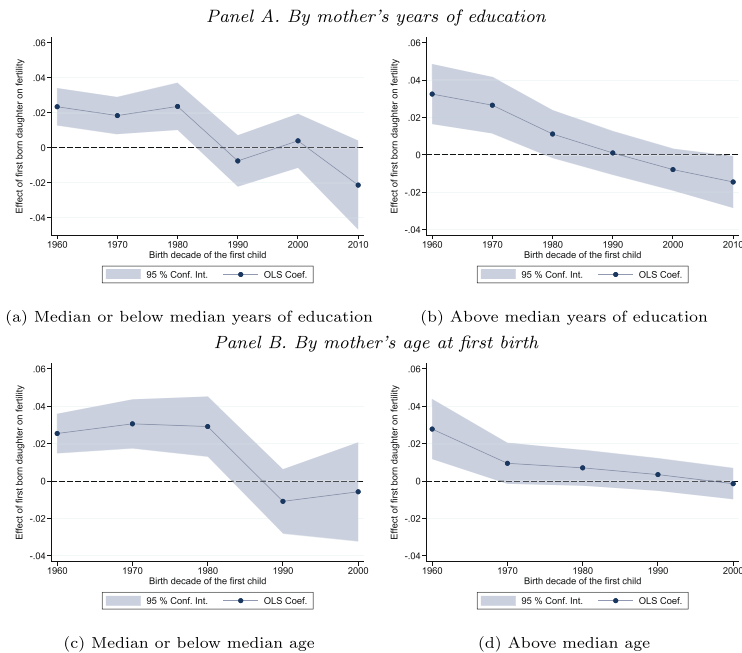
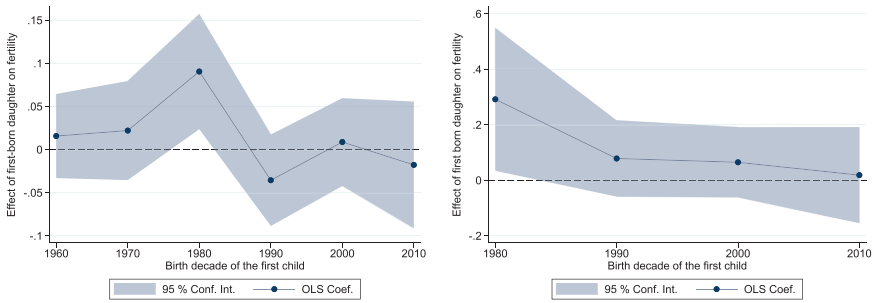


Fig. 6 Effects of having a first-born girl by mother's education and age. Figures show the estimated impacts of having a first-born girl on the total number of children for mothers with below- and above-median years of education and for mothers who gave birth for the first time when they were below or above the median age of giving birth for the first time compared to mothers born in the same birth year (panels (a–d), respectively). The figures plot the estimates of δ_d and 95% confidence intervals obtained using Eq. (1)



(a) Non-Finnish mothers

(b) Indian and Chinese mothers

Fig. 7 Effects of having a first-born girl for non-Finnish mothers. Notes: Figures show the estimated impacts of having a first-born girl on the total number of children for non-Finnish residents and for mothers of Indian and Chinese origins (panels (a), (b), respectively). The figures plot the estimates of δ_d and 95% confidence intervals obtained using Eq. (1)

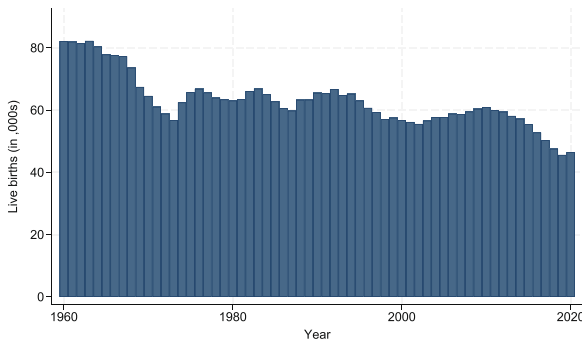
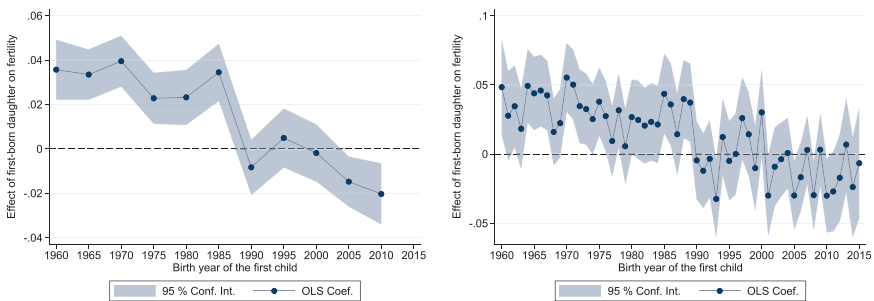


Fig. 8 Live births in Finland in 1960–2020. Notes: This figure shows the number of live births (in, 000s) in Finland in the period 1950–2020. Source: Births, Statistics Finland



(a) Total number of children

(b) Total number of children

Fig. 9 Effect of first-born girl on fertility. Notes: Figures show the estimated impacts of having a first-born girl on the total number of children. Panel (a) plots the estimates pooled every five years of data together, while panel (b) presents yearly estimates. The figures plot the estimates of δ_d and 95% confidence intervals obtained using Eq. (1)

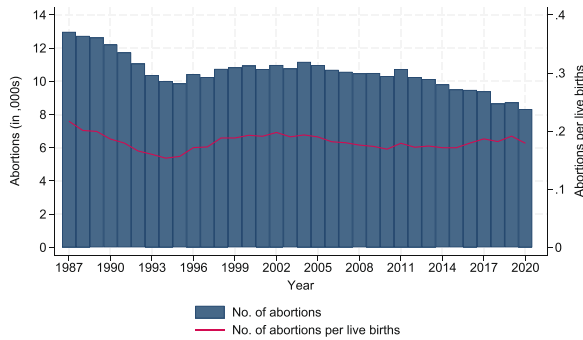


Fig. 10 Abortions in Finland in 1987–2020. Notes: This figure shows the number of abortions (in, 000s) and the number of abortions relative to the number of live births (from Fig. 8) in Finland in the period of 1987–2020. Source: Induced abortions, Official Statistics of Finland, THL (Finnish Institute for Health and Welfare)

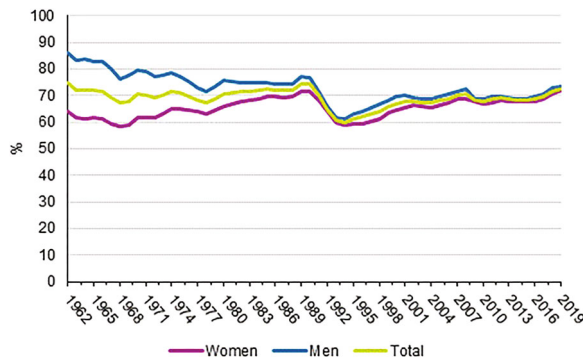


Fig. 11 Employment rates by sex in Finland in 1962–2019. Notes: This figure shows the employment rates by sex for persons aged 15–64 in Finland in the period of 1962–2019. Source: Labor Force Survey, Statistics Finland

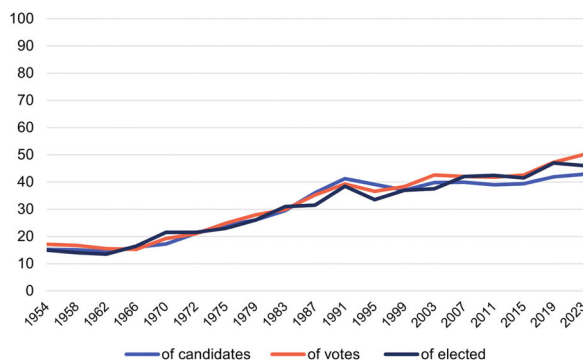


Fig. 12 Females in Parliamentary elections in Finland in 1954–2023. Notes: This figure shows the percentage of female candidates and votes cast for females and females elected in the parliamentary elections in Finland in the period of 1954–2023. Source: Statistics Finland, Election statistics

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