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All we want is a healthy baby – well, and one that is the opposite sex to what we have already[1]

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ABSTRACT

We all know families with three boys or three girls. Did they go on to have three children in the hope that the third child would be the opposite sex to the first two? Are they disappointed when they have another child of the same sex? In this paper, using two British cohort studies, we construct a sample of parents that only differ in the sex of the third born child when the first two are the same sex. Conditional on pregnancy, the sex of a child is random so it is an exogenous influence on the SWB of the parents. We show that, contrary to previous studies, having three children of the same sex negatively affects life satisfaction. This effect is entirely driven by mothers who have a third girl and lasts for ten years after birth. We conversely find that having two children of the same sex boosts SWB. We offer an explanation for this pattern of findings and discuss its implications.

1. Introduction

The effect of childbearing on the happiness of parents is an important question for economists, psychologists, demographers, and policy-makers. Despite this, our knowledge of the causal effect of having children on subjective well-being (SWB) remains limited. In this paper, we exploit the quasi-random nature of a child's sex at birth to identify the effect of getting three children of the same sex as compared to having a third child of the opposite sex to the first two. In contrast to previous findings, we find that parents who "lose" the birth lottery and have three children of the same sex are less happy than those who "win" and get a child of the opposite sex. This negative hit lasts for around a decade before parents adapt to the disappointment of yet another child of the same sex.

The effect is driven entirely by the impact on mothers who do not have a boy, which is consistent with existing literature showing that the well-being of mothers is more affected by the birth of children. This may be due to the disproportionate earning power of males, who are better able to support their parents economically. Analysis of fertility behaviours shows that parents are more likely to have a third child when the two that have come before are the same sex, indicating consistency between 'experienced utility' via self-reported happiness, and revealed preference via fertility behaviours. Parents show that they desire a third child of a different sex by increasing fertility and are happy when this goal is achieved.

We also look at the impact of having two children of the same sex on SWB, which reveals an *increase* in SWB for both parents. This effect is largely driven by having two girls, with an immediate increase for fathers and a delayed increase for mothers. These seemingly dissonant findings of increased SWB and fertility following two children of the same sex, as well as reduced SWB following three children of the same sex, warrant explanation. In the discussion section, we note that there are benefits to having multiple children of the same sex, especially when there is still a possibility of achieving sex parity with more children in the future. As the parents have more children, they near the end of their fertile lifespans, so their capacity to continue fertility and have more children declines. The costs of same sex children are therefore more likely to outweigh the benefits at three children than at two children, which explains why the former decreases SWB while the latter increases it.

Our paper contributes to the literature on the effect of life events on SWB, of which childbearing is a major component (Clark & Georgellis, 2013; Clark et al., 2008). Adaptation to life events such as childbearing over time is widely observed and is commonly estimated using panel data, though exogenous independent variables like ours remain rare in this literature (Dolan et al., 2008; Frey & Stutzer, 2018). Our paper also contributes to the demographic literature on fertility preferences (Teachman & Schollaert, 1989; Hank and Kohler, 2000; Andersson et al.,

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2006; Mills & Begall, 2010; Pollard & Morgan, 2002). Margolis and Myrskyla (2016) use birth lotteries to estimate the effect of parenthood on SWB, but they find no effect on SWB from having two children of the same sex. We contribute to this literature by additionally estimating the effect of three children of the same sex and by showing that this negatively impacts the SWB of parents.

We combine data from two British cohort studies, the 1958 National Child Development Study (NCDS) and the 1970 British Cohort Study (BCS). Each study follows approximately 17,000 individuals from childhood to late adulthood. We construct an experimental sample which compares households that differ only in the sex of the third child, for example boy-boy-girl as compared to boy-boy-boy sequences. Consistent with this expectation, we find a statistically significant and economically substantial negative effect of having three children of the same sex on SWB. This effect lasts for over a decade and is driven entirely by mothers who have had three girls in a row. This matches existing evidence showing that mothers are more affected by childhood than fathers, though to our knowledge existing studies have emphasised the benefits to mothers rather than the costs (Kohler & Mencarini, 2016; Preston & Hartnett, 2011).

We also construct a sample which compares households that have two children of the same sex to those that achieve sex parity e.g. boy-boy versus boy-girl. Consistent with existing studies, we find that parents who have two children of the same sex increase their fertility at both the extensive margin – the number of children they go on to have – and the intensive margin – the speed with which they have them. This indicates that parents desire sex parity, though further regressions show that parental SWB may increase following boy-boy or girl-girl combinations. Evidently, there are also benefits to having two children of the same sex, and we interpret these results in the discussion section.

Additional analysis splits parents by education level, showing that only parents with qualifications experience the reduction in SWB. This is contrary to existing literature, which would tend to predict a preference for sex parity among the more educated. Splitting parents instead by income level indicates that only parents with income above the median experience the reduction in SWB. This pattern is congruent with the pattern for education given the likely correlation between income and education. However, the sample size is low for this split sample analysis so results should be interpreted with caution.

The remainder of the paper is structured as follows. We first outline the relevant literature on fertility, birth lotteries, and SWB, drawing from studies across a range of disciplines. We then discuss the data and methods used to estimate the effect of birth lotteries on SWB. We present the results on the effect of the birth lottery at three children on subjective well-being (SWB), followed by the results of the birth lottery at two children on SWB and on fertility. We discuss the results in the context of the existing literature, including heterogeneities in the results, as well as consistencies and discrepancies between self-reported happiness and revealed preference through fertility. We then conclude and discuss limitations and directions for future research.

2. Literature review

As demographers have long stressed, fertility preferences have important implications for the sex composition of populations. Many East Asian countries have a strong preference for boys, which both reflects and reinforces inhumane policies aimed at reducing the population of girls and has led to the overrepresentation of boys (Margolis & Myrskyla, 2016). The preference for boys is generally because they are more likely to work and take care of parents, especially in old age, as well as due to cultural attitudes regarding gender. In contrast, substantial evidence shows that the populations of Western countries have a preference for mixed sex children (sex parity), likely owing to the expansion of pensions and gender rights (Teachman & Schollaert, 1989; Hank and Kohler, 2000; Andersson et al., 2006; Mills & Begall, 2010; Pollard & Morgan, 2002).

A classic study by Teachman and Schollaert (1989) found that women in the US who have two children of the same sex have children faster than those who achieve sex parity. This has since been replicated, with Pollard and Morgan (2002) finding that preferences for sex parity in the USA have declined slightly but remain substantial. Hank and Kohler (2000) found that 14 out of 17 European countries prefer sex parity, while Gunnar et al. (2006) found the same for all Scandinavian countries. Mills and Begall (2010) investigate cross country variation in sex parity preferences in 24 European countries and find that having two children of the same sex (for either sex) has a positive effect on future fertility, which is mediated by each country's degree of gender equality and available care in old age.

Despite widespread studies of parents' children sex composition preferences, there has been comparatively less work on the relationship of this sex composition to subjective well-being (SWB). Kohler and Mencarini (2016) comment in a special issue on the subject that "the relationship between fertility and SWB has been understudied and the mechanisms at work are not well understood." They note that the literature contains seemingly inconsistent results. To take two examples, Clark et al. (2008) found that there is a positive anticipation effect for women before having a child but a negative effect for both sexes once it arrives, which fades out as they adapt back up to their original level of happiness after a few years. Conversely, Clark and Georgellis (2013) found a contemporaneous boost for women, followed by an immediate fall back to the baseline level; they find no significant effect for men. These studies both exploit panel data to address issues of selection bias and reverse causality, though none of them estimate causal effects.

Birth lotteries have previously been used as a source of exogenous variation to estimate causal relationships in economic models of fertility. Rosenzweig and Wolpin (1980) used twins as an instrumental variable and found that exogenous increases in fertility reduce child quality in Indian data; Angrist et al. (2010) used sex composition and twins as instruments and found no evidence of a 'quality-quantity trade-off' in children using Israeli data. Angrist and Evans (1998) used U.S. data on parental preferences for mixed sex composition of their children as an instrument to investigate the effect on parents' labour supply, finding some effects for wives but no effects for husbands. Our paper instead uses birth lotteries as a source of exogenous variation to estimate the causal effect of sex composition on fertility and on subjective wellbeing (SWB).

Margolis and Myrskyla (2016) is the closest study to our own as they also used the exogenous assignment of sex to test the impact of sex parity on SWB, using German and British data. They found that SWB does not vary with the sex of the first child and find mixed results for whether SWB declines after a second child of the same sex, with weak evidence that having two boys reduces SWB. Our study differs from theirs in that we look at the SWB impact of a *third* child of the same sex, which, if parents do have preferences for mixed sex children, is presumably more likely to result in disappointment than having two children of the same sex. Indeed, Kohler and Mencarini (2016) noted that the pre-existing number of children may be one reason for the inconsistencies in the literature discussed above.

Our paper relates to the economics literature on the effect of life events on SWB, particularly the role of adaptation to major life events over time (Clark & Georgellis, 2013; Clark et al., 2008; Qari, 2014; Vendrik, 2013). Causal effects are often not possible to estimate for SWB, since happiness both affects and is affected by life outcomes (Dolan et al., 2008; Frey & Stutzer, 2018). Our results also relate to a wider literature on individual preferences and life narratives. Parents vary in their preference for the sex composition of their children, which will be related to the beliefs and narratives we inherit and tell ourselves (Bénabou & Tirole, 2016; Dolan et al., 2019; Epley & Gilanovich, 2016, ch6). Parents who have children of any sex combination may change their beliefs gradually to rationalise their current combination, which would explain our finding of the adaptation of parental SWB over time.

3. Data and methods

We combine data from the National Child Development Study (NCDS) and the British Cohort Study (BCS). Both are longitudinal cohort studies that follow subjects from birth to adulthood. The NCDS follows 17,000 children born in 1958, while another 17,000 born in 1970 are tracked in the BCS. Both cohorts have been administered survey waves at regular intervals, at least once every ten years but occasionally more frequently, with the latest waves in our sample administered at the age 50 (NCDS in 2008) and 46 (BCS in 2016). More recent waves have been administered but are not included in this study. NCDS 2013 interviews subjects at age 55 but collected no information on Subjective Well-Being (SWB). BCS re-interviewed subjects in 2020 at age 50, but the data is yet to be made publicly available at the time of writing.

The cohort studies collect information throughout a subject's lifespan, including SWB measures in adulthood. Specifically, the two samples collect information on Life Satisfaction during waves at ages 42, 46 and 50. In an earlier wave, at age 33, Life Satisfaction information was also collected, but we focus on the later waves, when subjects are nearing the end of their fertile lifespans. Subjects responded to the question *"How Satisfied are you with the way Life has Turned Out so far?"* on a 0–10 Likert Scale, which we use as our measure of SWB.

Our approach exploits the random assignment of sex to try to estimate the causal effect of unwanted sex combinations on fertility and on SWB. Although parents select into pregnancy, conditional on pregnancy the sex of the child cannot be chosen so it is exogenous to the parents. Against this background, what is the impact of the 'birth lottery' of the 3rd Child on parental outcomes (Y), across households with comparable child sex combinations? We define the quasi- experimental estimator as:

$$\begin{aligned} &\textit{Average Treatment on the Treated } (ATT) = \\ &Y[\textit{Outcome of 3rd Birth} = 1 | \textit{Three births},\ X - X \textit{ Sequence}] \\ &-Y[\textit{Outcome of 3rd Birth} = 0 | \textit{Three births},\ X - X \textit{ Sequence}] \end{aligned} \tag{1}$$

where an 'X-X' sequence refers to two children of the same sex. TX3 defines the treatment group ($TX3 = 1$) as a three-offspring sequence of identical sexes (XXX). The control group ($TX3 = 0$) is defined by a sequence with a change in sex at third parity (XXY). Both boy-boy-boy (TB3) and girl-girl-girl (TG3) sequences are included in this estimator.

TG3 and TB3 differ from TX3, by defining treatment (and control) based on a specific sex such that TG3 identifies sequence "G-G-G" as treatment and "G-G-B" as a control. TB3 treatment identifies the "B-B-B" sequence and the TB3 control identifies "B-B-G". The estimators TX2, TB2, and TB2 which are used to estimate the impact of the birth lottery on fertility at two children are defined analogously. The different groups allow us to investigate heterogeneities in how parents respond to having three boys versus three girls. Additionally, the data allow us to further distinguish between fathers and mothers to investigate how they respond differently to the different sex combinations.

Our identifying assumption is that, conditional on pregnancy, sex is assigned randomly. Establishing this causal impact of sex parity is confounded by the behavioral responses of parents faced with an offspring sex combination that does not meet their preferences. Parents could actively select the sex of their next child, either through the process of adoption or selective abortions. If the parents who are more likely to choose their child's sex through adoption or abortion are different to those who are less likely to choose their child's sex, there will be a selection bias.

Selection bias could work in either direction. If parents with lower SWB (perhaps owing to unhappiness with their existing sex combination) are more likely to choose their child's sex, the estimated impact of sex parity on SWB will be biased downwards. Conversely, if parents with higher SWB (perhaps owing to income, age, or status) are more likely to have access to facilities to choose their child's sex, the estimated impact of sex parity on SWB will be biased upwards. The decision is endogenous to the state of the parents, which will add both noise and bias to our estimates, but the direction of the bias is impossible to say *ex ante*.

As discussed by Dubuc and Coleman (2007), there is substantial evidence of sex-selection by parents in Asian countries. This may be driven by female infanticide, abortion, or underreporting of females. Engaging in these practices at any scale is virtually impossible in the UK as births are fully recorded. Sex determination in the first 24 weeks of pregnancy, when abortion is permitted, was not possible during our sample period, nor were contemporary ultrasound techniques available. The sex ratio has been stable in the UK for decades, though there is a recent uptick among Indian-born migrants – again, this is not relevant over our sample period (Dubuc & Coleman, 2007).

Another assumption, which is relevant for our interpretation rather than our identification, is that parents with two children of the same sex who have a third child desire a child of the opposite sex. It may be the case that some parents want a third child of the same sex. In this case, the observed effect of treatment cannot be considered the causal effect of having a child which is different to the parents' preferences. However, it can still be considered the causal effect of having a third child of the same sex.

Table 1 shows the treatment and control groups in the sample. There are 1361 parents in the NCDS sample and 954 parents in the BCS sample who match our conditions of having their first two children of the same sex. Crucially, all households with fourth or higher order of sex parity are included in the experimental samples, regardless of the sex of those higher order parity outcomes. Exclusion of those households would have resulted in a selected sample. Households that continue to parities higher than 3rd parity likely differ significantly from those that do not, and the differences likely correlate with whether or not they have had three children of the same sex – our treatment condition. Indeed, parents that at 3rd parity have not reached the desired sex combination are more likely to continue expanding fertility. By including higher-order parity households we avoid selection bias, but this will affect the interpretation of our estimators.

To ensure fertility is close to completion, we focus on waves from Age 42 onward. Table 2 shows descriptive statistics for the parents in the sample for selected variables. To determine whether the 'birth lottery' is truly random, we conduct a non-parametric test of whether the means are statistically different between the treatment and control groups for independent variables and find that the means are statistically indistinguishable, with one exception. The null hypothesis that the proportion who are white is different between the treatment and control groups cannot be rejected at the 5% level. We run further regressions to control for ethnicity in the analysis and find it does not alter our results.

The Average Treatment Effect on the Treated (ATT) would recover the effect on outcomes of having three children of the same sex. Continued fertility could change the sex balance and bias our estimates because parents with a strong preference for a particular sex might expand fertility beyond the 3rd child to modify their sex combination. These households are potentially 'noncompliant' to the birth lottery, so our estimate recovers the Intention to Treat on the Treated (ITT) (Duflo et al., 2007). In this context, the ITT is the effect on outcomes for individuals who have a third child which is the same sex as the first two. It may be the case that these households go on to have more children to compensate, but the fourth child could be either a different sex or yet another of the same sex. This potentially contaminates our causal estimates as the treatment group contains both those who had a third child of the same sex, and those who had more children full stop. We therefore run regressions which include a dummy for whether parents have had four children or more in our regressions, as well as a robustness check which excludes those households from the sample entirely.

Table 4 shows the average life satisfaction (SWB) in the sample, split by treatment group as well as by the sex of the parents. Results show that there is minimal variation in the sample averages by treatment group. Life satisfaction is slightly lower for both parents on average following three of the same children of any sex, but splitting the sample shows it is actually higher for fathers and lower for mothers. Average SWB is

Table 1
Treatment and Control Groups in Sample. Shows the sample sizes for individuals who are in the treatment and the control groups for both the NCDS and BCS. The control group contains the parents who have had two children of the same sex and a third child of a different sex, while the treatment group contains parents who have had three children of the same sex. The latter can be further split into parents who have had all Girls (G) and all Boys (B).

		Treatment			Total
Control BBG/GGB		BBB/GGG of which			
			GGG	BBB	
NCDS	679	682	306	376	1361
BCS	461	493	218	275	954
Total	1140	1175	524	651	2315

slightly higher for both fathers and mothers following three girls. It is slightly higher for mothers, but lower for fathers, after having three boys. Conventional tests show that none of the differences in Table 4 are statistically significant.

We test further the impact of birth lotteries on adult life satisfaction and other subjective well-being indicators using regression models. We estimate the impact of the birth lottery on SWB using the following parsimonious specification:

$$Y_{isw} = \alpha + T_s\beta + \mu_{sw} + \varepsilon_i \tag{2}$$

Whereby Y_{isw} indicates life satisfaction for individual i, in sample s and wave w; T_s indicates whether the parent has had a third child of the same sex as the ones they have already; while μ_{sw} includes sample-wave fixed effects (dummies for sample s, wave w and their interactions); and finally, ε_i denotes error terms, clustered at the individual level. The sample is restricted to when parents are ages 42 and 46 so that they are nearing the end of their fertile lifespans.

To incorporate the adaptation principle into our analysis, we augment regression (2) to include an interaction term between our Treatment indicator, T_s , and 'Age of 3rd born child' $AgeC_{iw}$. This is an indicator variable with three categories: (i) 'less than 10 years', (ii) 'between 10 and 17 years' or (iii) 'more than 18 years'. This variable can also be thought of as the years since the outcome of the 'birth lottery' was revealed.

$$Y_{isw} = \alpha + (T_s \otimes AgeC_{iw}) + \mu_{sw} + \varepsilon_i \tag{3}$$

When using Life Satisfaction as a dependent variable (Y_{isw}), two data points per individual are available. To avoid biased inferencing, we correct for inter-wave correlations by clustering standard errors at the level of individual households i (Duflo et al., 2007).

Table 3
Education and income variables. Shows the derived and harmonized qualification and income variables from the combined NCDS/BCS dataset. Note that the questions asked are different in each survey: in the NCDS the measure is net individual income (i.e. per parent) whereas in the BCS it is gross household income.

Variable	
Education level	Proportion
No qualifications	53.6%
GCSE/equivalent	19.9%
A-level/equivalent	5.10%
Degree/Equivalent	11.6%
Higher degree	1.61%
Vocational	8.19%
Income level (£)	Income Percentile
260	1%
1040	5%
1560	10%
2600	25%
3900	50%
6500	75%
11,700	>95%

Table 4
Life satisfaction values in the combined NSCD/BCS survey. TX3 is an indicator dummy equal to 1 if the parents have a third child of the same sex; or equal to 0 if they have two children of the same sex, followed by a third child of a different sex. TB3 is defined analogously but only for the case of boy-boy-boy versus boy-boy-girl combinations. TG3 is for girl-girl-girl versus girl-girl-boy combinations. The cells show average life satisfaction for the different treatment groups, stratified further by the sex of the parents. Standard deviations are in brackets.

	Life Satisfaction	
TX3	1	0
Both Parents	7.29 (1.93)	7.33 (1.89)
Mother	7.15 (2.10)	7.29 (1.97)
Father	7.45 (1.68)	7.37 (1.80)
TG3	1	0
Both Parents	7.34 (1.86)	7.31 (1.90)
Mother	7.26 (1.96)	7.23 (2.02)
Father	7.45 (1.73)	7.40 (1.77)
TB3	1	0
Both Parents	7.24 (1.97)	7.34 (1.87)
Mother	7.46 (1.66)	7.35 (1.83)
Father	7.05 (2.21)	7.34 (1.91)

Table 2
Descriptive Statistics. Descriptive statistics for the combined BCS/NCDS sample of parents ($N = 51{,}599$), shown only for individuals in the age 46 and age 50 cohorts. The fifth column shows the p-values for a nonparametric Mann-Whitney test that the means are equal for the treatment group (those who have three children of the same sex) and the control group (those who have two children of the same sex, and a third of the opposite sex).

Variable	Mean (whole sample)	Standard Deviation (whole sample)	Mean (treatment group)	Mean (control group)	p-value from Mann-Whitney
Life Satisfaction	7.32	1.87	7.29	7.33	0.80
Number of Children	1.77	1.24	3.46	3.33	0.00
Proportion White British	0.97	0.18	0.98	0.96	0.04
Proportion Male	0.52	0.50	0.46	0.47	0.43
Proportion Married	0.65	0.48	0.72	0.72	0.97
Annual Household Income (£)	4707	2991	£4373	£4535	0.23
Age	48.13	2.00	48.33	48.36	0.69
Parents' Age at 1st Child	28.03	5.82	25.37	25.56	0.35
…at 2nd Child	30.64	5.47	28.52	28.58	0.86
…at 3rd Child	32.55	5.41	32.48	32.58	0.67
Degree	0.10	0.30	0.17	0.17	0.79
London/Southeast	0.07	0.26	0.29	0.24	0.45
England	0.28	0.45	0.87	0.86	0.30
North	0.08	0.28	0.25	0.25	0.95

Table 5a
Effect of Birth Lottery on Life Satisfaction. Regressions showing the effect of having three children of the same sex on life satisfaction, including sample-wave fixed effects. Columns (1)-(3) show the baseline specification, while columns (4)-(6) include age interactions, and columns (7)-(9) show the baseline specification again, but restricted to parents who had their child within the last 10 years. For each specification the results are shown for TX3 (three children of the same sex), TB3 (three boys) and TG3 (three girls). Standard errors are in square brackets, clustered by individual. Sample is restricted to parental ages 42 and 46.

				Life Satisfaction					
Full Sample				Interaction Model			Within 10 years of Birth		
	All Parents	Fathers Only	Mothers Only	All Parents	Fathers Only	Mothers Only	All Parents	Fathers Only	Mothers Only
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment (TX3)	−0.0642	−0.0269	−0.0927	−0.2233**	−0.0381	−0.4563***	−0.2241**	−0.0330	−0.4627***
	[0.0657]	[0.0876]	[0.0962]	[0.0969]	[0.1170]	[0.1608]	[0.0967]	[0.1172]	[0.1601]
(TX3) x (Age 3rd: 10–17)				0.2812**	−0.0700	0.6342***			
				[0.1181]	[0.1556]	[0.1908]			
(TX3) x (Age 3rd: 18+)				0.1604	0.3508	0.2478			
				[0.1999]	[0.3259]	[0.2648]			
N (Observations)	4277	1978	2299	4191	1901	2290	1484	825	659
N (Clusters)	2279	1062	1217	2248	1033	1215	1106	599	507
Treatment (TG3)	−0.0422	0.0391	−0.1054	−0.2958**	0.0754	−0.7604***	−0.2921**	0.1029	−0.7625***
	[0.0945]	[0.1313]	[0.1342]	[0.1415]	[0.1639]	[0.2379]	[0.1421]	[0.1645]	[0.2379]
(TG3) x (Age 3rd: 10–17)				0.3413**	−0.1934	0.8941***			
				[0.1724]	[0.2287]	[0.2671]			
(TG3) x (Age 3rd: 18+)				0.5182*	0.2874	0.9240**			
				[0.2897]	[0.4710]	[0.3884]			
N (Observations)	1991	905	1086	1962	880	1082	661	372	289
N (Clusters)	1068	492	576	1058	482	576	495	270	225
Treatment (TB3)	−0.0745	−0.0818	−0.0747	−0.1700	−0.1446	−0.2297	−0.1793	−0.1500	−0.2576
	[0.0912]	[0.11753]	[0.1373]	[0.1330]	[0.1655]	[0.2160]	[0.1324]	[0.1656]	[0.2139]
(TB3) x (Age 3rd: 10–17)				0.2632	0.0457	0.4699*			
				[0.1631]	[0.2148]	[0.2494]			
(TB3) x (Age 3rd: 18+)				−0.1560	0.4105	−0.3129			
				[0.2741]	[0.4482]	[0.3581]			
N (Observations)	2286	1073	1213	2229	1021	1208	823	453	370
N (Clusters)	1211	570	641	1190	551	639	611	329	282

*** Indicates statistical significance at the 1% level
** significance at the 5% level
* significance at the 10% level.

4. Results

4.1. Life satisfaction

Table 5a reports our core results on Life Satisfaction impact. It reports estimates across the three outcomes of the birth lottery: TX3, TG3, and TB3. Table 5a also reports results for three types of respondents: (i) All Parents, (ii) Fathers Only, and (iii) Mothers Only. Columns (1–3) show the results from the simple specification in regression (2). Echoing the descriptive results in Table 4, the coefficients are universally insignificant at conventional levels, indicating that there is no overall life satisfaction loss from not achieving sex parity when you have your third child. Yet this result tracks individuals over their entire life spans and further analysis reveals that the average coefficients hide a period in which life satisfaction declines before adapting upwards.

In Columns (4–9), we explore the impact of adaptation in two ways. Firstly, in Columns (4-6) we report results from regression (3), where the outcome of the birth lottery is interacted with the age of the 3rd child. Secondly, in Columns (7–9) we re-estimate regression (2) only for households whose 3rd child was born less than 10 years ago. In Column (4), the interaction terms reveal that there is an initial decline in life satisfaction following a third child of the same sex, which is completely reversed by the interaction with the 'age 10–17′ dummy (moving into net positive). There is no additional effect detected when the birth of the child is interacted with the age 18+ dummy. Columns (5–6) further reveal this decline in SWB is driven entirely by mothers who have had three girls. Columns (7–9) show a similar, statistically significant effect when the regressions are re-estimated only for parents who have had their children in the past 10 years.

We now present a semi-parametric analysis which allows the data to determine the adaptation period rather than imposing it arbitrarily. Fig. 1 shows estimation of regression (2) using a kernel-weighted local polynomial estimator to explore the non-linear relation between having a third child of the same sex and the period of adaptation. Each panel in Fig. 1 represents the non-linear relation between 'Life Satisfaction' (y-axis) and 'Age of 3rd Child' (x-axis) for treated and control households. The top row depicts Fathers Only, while the bottom row depicts Mothers Only. The right column documents the impact of 'missing out on a son' (TG3), while the left column documents 'missing on a daughter' (TB3). The diagrams include 95% confidence intervals; any gap between the treatment and control confidence intervals indicates a statistically significant birth lottery impact on life satisfaction for that range of years since the 3rd child was born.

Fig. 1 shows that for mothers, the effect of having three girls is large and long-lasting. Within 10 years of Birth there is a −0.75 impact on life satisfaction (on a 0–10 scale), which is approximately 40% of a standard deviation. For all other groups – mothers having three boys, or fathers having three children of the same sex, for either sex – the treatment and control groups are statistically indistinguishable for the entire decade after the child's birth. Although noisy, point estimates for TB3 in Table 5a are generally economically substantial. For example, the point estimate for mothers who have three boys is quite large at −0.23, while the interaction the age 10–17 dummy is +0.47 and significant at the 10% level. Therefore, we cannot rule out an initial decline in SWB followed by a rise for mothers who have three boys, analogous to mothers who have three girls.

Literature on life satisfaction has found people adapt to life events like having children, so it is natural to ask if the magnitudes in our study

Table 5b

Effect of Birth Lottery on Life Satisfaction. Regressions showing the effect of having three children of the same sex on life satisfaction, including sample-wave fixed effects and covariates for education, income, and a dummy for having four children or more. Columns (1)-(3) show the baseline specification, while columns (4)-(6) include age interactions, and columns (7)-(9) show the baseline specification again but restricted to parents who had their child within the last 10 years. For each specification the results are shown for TX3 (three children of the same sex), TB3 (three boys) and TG3 (three girls). Standard errors are in square brackets, clustered by individual. Sample is restricted to parental ages 42 and 46.

	Life Satisfaction								
Full Sample				Interaction Model			Within 10 years of Birth		
	All Parents (1)	Fathers Only (2)	Mothers Only (3)	All Parents (4)	Fathers Only (5)	Mothers Only (6)	All Parents (7)	Fathers Only (8)	Mothers Only (9)
Treatment (TX3)	−0.0581	−0.0134	−0.1025	−0.2456**	−0.0639	−0.4904***	−0.2761**	−0.0644	−0.5416***
	[0.0769]	[0.1064]	[0.1102]	[0.1140]	[0.1392]	[0.1864]	[0.1124]	[0.1381]	[0.1827]
(TX3) x (Age 3rd: 10–17)				0.2906**	−0.0244	0.6136***			
				[0.1382]	[0.1849]	[0.2114]			
(TX3) x (Age 3rd: 18+)				0.2573	0.4301	0.3499			
				[0.2394]	[0.3857]	[0.3155]			
N (Observations)	3124	1405	1719	3067	1354	1713	1083	605	478
N (Clusters)	1657	753	904	1638	734	904	880	433	375
Treatment (TG3)	−0.0114	0.0814	−0.0686	−0.2996*	0.0105	−0.6591***	−0.3032*	0.0533	−0.6152**
	[0.1122]	[0.1549]	[0.1626]	[0.1601]	[0.1906]	[0.2557]	[0.1607]	[0.1901]	[0.2560]
(TG3) x (Age 3rd: 10–17)				0.4077**	0.0389	0.7979***			
				[0.1965]	[0.2711]	[0.2888]			
(TG3) x (Age 3rd: 18+)				0.5292	0.4278	0.8485*			
				[0.3489]	[0.5452]	[0.4662]			
N (Observations)	1487	647	840	1467	631	836	493	269	224
N (Clusters)	789	348	441	783	342	441	368	192	175
Treatment (TB3)	−0.1002	−0.0906	−0.1298	−0.2144	−0.1500	−0.3786	−0.2923*	−0.1637	−0.5548**
	[0.1078]	[0.1446]	[0.1575]	[0.1620]	[0.1989]	[0.2658]	[0.1584]	[0.1983]	[0.2581]
(TB3) x (Age 3rd: 10–17)				0.2234	−0.0358	0.5174*			
				[0.1930]	[0.2534]	[0.2990]			
(TB3) x (Age 3rd: 18+)				0.0187	0.4744	−0.0652			
				[0.3274]	[0.5421]	[0.4314]			
N (Observations)	1637	758	879	1600	723	877	590	336	254
N (Clusters)	868	405	463	855	392	463	440	240	200

*** Indicates statistical significance at the 1% level.
** significance at the 5% level.
* significance at the 10% level.

correspond to existing studies (Clark & Georgellis, 2013; Clark et al., 2008; Qari, 2014; Vendrik, 2013). Table 5a shows that the coefficient of −0.75, the effect on life satisfaction for mothers who have three girls, is much higher than the effect of childbirth on well-being in, for example, Clark et al. (2008). However, the average effect across all parents and both sexes is only −0.23, a raw coefficient which is strikingly similar to the difference in life satisfaction between parents with and without children from Clark et al. Nevertheless, in absence of standard deviations from their study, we cannot normalise the coefficients to make a like-for-like comparison.

To predict the exact point at which adaptation is fully achieved, we also estimate parametrically a polynomial for the age of the 3rd child:

$$Y_{isw} = \alpha + \beta[T_s] + \lambda_1[T_s * (AgeC_{iw})] + \lambda_2\left[T_s * (AgeC_{iw})^2\right] + \lambda_3\left[T_s * (AgeC_{iw})^3\right] + \mu_{sw} + \varepsilon_i \tag{4}$$

where Y_{isw} is subjective well-being (SWB), $AgeC_{iw}$ is the age of the 3rd child, T_s is a dummy variable for whether the child is the same sex as the preceding two children, μ_{sw} is a collection of dummy variables for the wave and sample, and ε_i is an error term, clustered by individual.

Results are reported in Fig. 2 and show that mothers recover fully after their third girl reaches 11 years old. The figure is shown only for mothers who had two girls and one more child. The blue line (C) shows the control group, who were able to achieve sex parity by having a boy. The red line shows the treatment group (T), who had a third girl and were unable to achieve sex parity. As Fig. 2 shows, relative to the baseline year the control group experienced a gradual decline in life satisfaction after their third child. The treatment group experienced an initial negative shock to life satisfaction but adapted over time (consistent with Table 5a and Fig. 1), before declining roughly in line with the control group after 11 years. This marks a turning point where mothers recover fully after their third girl reaches 11 years old.

4.1.1. *Further analysis*

Following the helpful suggestion of a referee, we explore some additional variables and heterogeneities in our results. As sex is randomly assigned conditional on pregnancy, the addition of covariates should not influence our results, but as discussed above the number of children may differ systematically between the treatment and control groups, confounding our estimation. Covariates such as income and education are interesting in their own right and may also reveal important heterogeneities in the results. In addition, they are a robustness check for whether our 'randomization' truly worked.

Table 5b reports regression (2) but with income, education, and number of children added as covariates. (The measures for income and education are summarized in detail in Table 3). Although the precision of some of the estimates is reduced, none of the main results are substantially altered: column (6) shows that mothers of three girls experience a SWB hit which dissipates as the child gets older. Table 5c runs the regressions with families with four or more children dropped. These are the 'noncompliers' in our experimental sample, and it is likely that they are a selected sample. Those who have more children after the outcome of the birth lottery may have been more negatively affected by having three children of the same sex. This factor does not affect our conclusions: the results in Table 5c show a similar pattern of coefficients to the main regressions in Table 5a. Unreported regressions also control for ethnicity, which Table 2 showed was not equal between the treatment and control groups, and the main results are largely unaltered.

Splitting the sample reveals some heterogeneities in the results,

Table 5c
Effect of Birth Lottery on Life Satisfaction. Regressions showing the effect of having three children of the same sex on life satisfaction, including sample-wave fixed effects, with parents with four children or more dropped from the sample. Columns (1)-(3) show the baseline specification, while columns (4)-(6) include age interactions, and columns (7)-(9) show the baseline specification again but restricted to parents who had their child within the last 10 years. For each specification the results are shown for TX3 (three children of the same sex), TB3 (three boys) and TG3 (three girls). Standard errors are in square brackets, clustered by individual. Sample is restricted to parental ages 42 and 46.

	Life Satisfaction								
Full Sample				Interaction Model			Within 10 years of Birth		
	All Parents (1)	Fathers Only (2)	Mothers Only (3)	All Parents (4)	Fathers Only (5)	Mothers Only (6)	All Parents (7)	Fathers Only (8)	Mothers Only (9)
Treatment (TX3)	−0.0556	0.01255	−0.1272	−0.1747*	0.0555	−0.4487**	−0.1775*	0.0512	−0.4477**
	[0.0734]	[0.0937]	[0.1110]	[0.1055]	[0.1210]	[0.1797]	[0.1056]	[0.1218]	[0.1795]
(TX3) x (Age 3rd: 10–17)				0.2022	−0.1059	0.5304***			
				[0.1319]	[0.1700]	[0.2067]			
(TX3) x (Age 3rd: 18+)				0.1990	0.2702	0.3397			
				[0.2392]	[0.3907]	[0.3182]			
N (Observations)	3135	1489	1646	3060	1423	1637	1233	678	555
N (Clusters)	1663	796	867	1636	771	865	907	487	420
Treatment (TG3)	−0.0662	−0.0085	−0.1233	−0.2651*	0.0672	−0.6680***	−0.2689*	0.0751	−0.6652***
	[0.1032]	[0.1405]	[0.1498]	[0.1496]	[0.1700]	[0.2543]	[0.1497]	[0.1705]	[0.2547]
(TG3) x (Age 3rd: 10–17)				0.2434	−0.2006	0.6892**			
				[0.1898]	[0.2570]	[0.2917]			
(TG3) x (Age 3rd: 18+)				0.6762	0.0191	1.232***			
				[0.3455]	[0.5527]	[0.4602]			
N (Observations)	1462	686	776	1440	668	772	569	317	252
N (Clusters)	781	370	411	774	363	411	417	1225	192
Treatment (TB3)	−0.0392	0.0469	−0.1264	−0.1020	0.0277	−0.2775	−0.1074	0.0150	−0.2844
	[0.1036]	[0.1264]	[0.1624]	[0.1485]	[0.1736]	[0.2510]	[0.1483]	[0.1741]	[0.2498]
(TB3) x (Age 3rd: 10–17)				0.1919	−0.0276	0.4312			
				[0.1842]	[0.2296]	[0.2917]			
(TB3) x (Age 3rd: 18+)				−0.1799	0.5469	−0.3711			
				[0.3259]	[0.5404]	[0.4270]			
N (Observations)	1673	803	870	1620	755	865	664	361	303
N (Clusters)	882	426	456	862	408	454	490	262	228

*** Indicates statistical significance at the 1% level.
** significance at the 5% level.
* significance at the 10% level.

though we interpret these with caution owing to low sample size. Table 5d splits the sample into those who have no qualifications and those who have at least some qualifications i.e. GCSEs/O-levels or above.[1] Results show that the effects seem to be driven largely by individuals with some qualifications. Columns (1)-(3) show that mothers with no qualifications exhibit the same coefficient pattern after having three girls as the main results, but only the interaction of TG3 and age 18+ is statistically significant, and only at the 10% level. Conversely, Columns (4)-(6) show that mothers with some qualifications display the same coefficient pattern, with all coefficients statistically significant at the 5% level.

Table 5e splits the sample into those who are below the median level of income and those who are above it. Columns (1)-(3) show that low-income parents do not seem to experience the same type of SWB pattern we have observed in the sample as a whole. Although the magnitudes of the coefficients are similar to the rest of the sample, showing an initial SWB hit followed by an increase, almost all of the coefficients are statistically insignificant. The exception is the rise in SWB for mothers who have had three girls for the period where the girl is 10–17 years of age is statistically significant at the 10% level. The pattern is therefore not robust for low-income parents, just as it was not robust for low education parents. As there is a correlation between the two groups, this congruence makes sense.

Conversely, columns (4)-(6) of Table 5e show that the high-income group exhibits roughly the same pattern of the results as the rest of the sample. The results for TX3 indicate that there is an initial decline in SWB for all parents at the birth of their third child of the same sex, followed by an adaptation back to roughly the initial level when the child reaches age 10. The results for TG3 indicate that this result is driven mostly by mothers who have three girls, once more in line with the whole sample. The results for TB3 additionally show that mothers experience the decline in SWB for three boys, but not the adaptation.

4.2. Fertility choices

As well as the impact of sex lotteries on life satisfaction, we also explore whether sex parity preferences matter sufficiently for individuals to change their subsequent behaviour. Given that our results on life satisfaction show an increase following two children of the same sex, it is worth checking whether our results on fertility are consistent with previous studies, which show parents compensate for not achieving sex parity with increased fertility (Teachman & Schollaert, 1989; Hank and Kohler, 2000; Andersson et al., 2006; Mills & Begall, 2010; Pollard & Morgan, 2002). In the context of our study, it also raises the question of whether fertility behaviour or 'revealed preference' is consistent with self-reported happiness or 'experienced utility', a long-standing debate in economics and psychology (Kahneman et al., 1997).

We analyse the extent to which fertility choices are influenced by the birth lottery outcome for the 2nd child. Once more, we classify families according to birth lottery categories, which we call TX2, TG2, and TB2. TX2 classifies households with two children of the same sex as treated ($TX2 = 1$). Similarly, TG2 (TB2) classifies households with two girls (two boys) as treated. The control group corresponds to households with one child of each sex. We estimate the impact of the birth lottery on fertility using the following specification:

[1] Although this may seem a coarse definition, recall that our sample contains individuals who were born in 1958 and 1970, times when education was far less widespread than now. As shown by Table 3, just over half the sample report having no qualifications, so the split is not far from 50/50

Table 5d
Effect of Birth Lottery on Life Satisfaction. Regressions showing the effect of having three children of the same sex on life satisfaction, including sample-wave fixed effects, split between those who report having no qualifications (Columns (1)-(3)) and those who report at least GCSEs/O-levels or above (Columns (4)-(6)). For each specification the results are shown for TX3 (three children of the same sex), TB3 (three boys) and TG3 (three girls). Standard errors are in square brackets, clustered by individual. Sample is restricted to parental ages 42 and 46.

	No Qualifications			Some Qualifications		
	All Parents	Fathers Only	Mothers Only	All Parents	Fathers Only	Mothers Only
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment (TX3)	−0.2548*	−0.1210	−0.4279	−0.2116*	0.0158	−0.5180**
	[0.1501]	[0.1946]	[0.2329]	[0.1260]	[0.1464]	[0.2144]
(TX3) x (Age 3rd: 10–17)	0.3119*	0.2882	0.3865	0.2645*	−0.2956	0.8016***
	[0.1881]	[0.2571]	[0.2746]	[0.1517]	[0.1950]	[0.2400]
(TX3) x (Age 3rd: 18+)	0.2810	0.3977	0.3357	0.0562	0.3968	0.1571
	[0.3377]	[0.5615]	[0.4378]	[0.2350]	[0.3636]	[0.3214]
N (Observations)	1571	717	854	2620	1184	1436
N (Clusters)	845	391	454	1403	642	761
Treatment (TG3)	−0.1471	−0.0143	−0.4001	−0.3867**	0.1115	−0.9341***
	[0.2367]	[0.2994]	[0.3857]	[0.1785]	[0.1917]	[0.3016]
(TG3) x (Age 3rd: 10–17)	0.3574	0.2719	0.4615	0.3292	−0.4668	0.1074***
	[0.2945]	[0.4036]	[0.4373]	[0.2132]	[0.2711]	[0.3355]
(TG3) x (Age 3rd: 18+)	0.8736*	0.6627	1.1956*	0.1543	0.2465	0.4729
	[0.4908]	[0.8507]	[0.6484]	[0.3306]	[0.5121]	[0.4524]
N (Observations)	739	340	399	1223	540	683
N (Clusters)	400	188	212	658	294	364
Treatment (TB3)	−0.3954**	−0.3541	−0.4459	−0.0806	−0.0411	−0.2079
	[0.1979]	[0.2557]	[0.3010]	[0.1757]	[0.2117]	[0.3006]
(TB3) x (Age 3rd: 10–17)	0.3510	0.3930	0.3379	0.2449	−0.1579	0.6305*
	[0.2521]	[0.3446]	[0.3680]	[0.2132]	[0.2744]	[0.3385]
(TB3) x (Age 3rd: 18+)	−0.2726	0.3537	−0.5444	0.0062	0.5455	−0.0713
	[0.4620]	[0.7407]	[0.5936]	[0.3324]	[0.5123]	[0.4537]
N (Observations)	832	377	455	1397	644	753
N (Clusters)	445	203	242	745	348	397

*** Indicates statistical significance at the 1% level.
** significance at the 5% level.
* significance at the 10% level.

Table 5e
Effect of Birth Lottery on Life Satisfaction. Regressions showing the effect of having three children of the same sex on life satisfaction, including sample-wave fixed effects, split between those who report low income – income below the median – in (Columns (1)-(3)), and those who report high income – above the median - in (Columns (4)-(6)). (See Table 3 for more details about the income variable). For each specification, the results are shown for TX3 (three children of the same sex), TB3 (three boys) and TG3 (three girls). Standard errors are in square brackets, clustered by individual. Sample is restricted to parental ages 42 and 46.

	Low Income			High Income		
	All Parents	Fathers Only	Mothers Only	All Parents	Fathers Only	Mothers Only
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment (TX3)	−0.1855	−0.1369	−0.2442	−0.3384**	−0.0753	−0.6191**
	[0.1808]	[0.2207]	[0.3061]	[0.1476]	[0.1809]	[0.2410]
(TX3) x (Age 3rd: 10–17)	0.1890	−0.2238	0.5315	0.3968**	0.2220	0.6323**
	[0.2168]	[0.2708]	[0.3550]	[0.1808]	[0.2514]	[0.2684]
(TX3) x (Age 3rd: 18+)	−0.0465	0.1842	−0.0549	0.4603	0.7364	0.5111
	[0.2938]	[0.4589]	[0.4140]	[0.3709]	[0.5944]	[0.4750]
N (Observations)	1430	658	772	1637	696	941
N (Clusters)	781	367	414	857	367	490
Treatment (TG3)	−0.3306	−0.1503	−0.6187	−0.2501	0.1145	−0.5948*
	[0.2418]	[0.2756]	[0.3855]	[0.2112]	[0.2648]	[0.3422]
(TG3) x (Age 3rd: 10–17)	0.4015	0.0399	0.8038*	−0.4094	−0.0180	0.7828**
	[0.2948]	[0.3566]	[0.4677]	[0.2661]	[0.3900]	[0.3867]
(TG3) x (Age 3rd: 18+)	0.1278	0.2131	0.2869	0.7716	0.7063	0.1003
	[0.4053]	[0.5654]	[0.5731]	[0.5130]	[0.8773]	[0.6606]
N (Observations)	661	308	353	806	323	483
N (Clusters)	357	169	188	426	173	253
Treatment (TB3)	−0.0823	−0.2456	0.1073	−0.4032**	−0.2248	−0.6298*
	[0.2632]	[0.3391]	[0.4421]	[0.2040]	[0.2460]	[0.3337]
(TB3) x (Age 3rd: 10–17)	0.0767	−0.2568	0.3032	0.3642	0.3920	0.4559
	[0.3142]	[0.4058]	[0.5052]	[0.2468]	[0.3259]	[0.3745]
(TB3) x (Age 3rd: 18+)	−0.1682	0.2499	−0.3548	−0.0049	0.9644	−0.2028
	[0.4167]	[0.7016]	[0.5801]	[0.5390]	[0.7512]	[0.7054]
N (Observations)	769	350	419	831	373	458
N (Clusters)	424	198	226	431	194	237

***Indicates statistical significance at the 1% level.
**significance at the 5% level.
* significance at the 10% level.

Table 6
Effect of Birth Lottery on Fertility. Regressions showing the effect of having two children of the same sex on three different measures of fertility: those who have at least one more child; the total number of children; and the time before the third child. All regressions include sample-wave fixed effects. For each dependent variable the results are shown for TX2 (two children of the same sex), TB2 (two boys) and TG2 (two girls). Standard errors are in square brackets, clustered by individual. Sample is restricted to the final wave (BCS=46, NCDS=50).

Panel A: Increased Fertility?	
	All Parents
	(1)
TX2	0.0749***
	[0.0089]
N	11,547
TG2	0.0655***
	[0.0111]
N	8506
TB2	0.0834***
	[0.0109]
N	8747
Panel B: Total Number of Own Children	
	All Parents
TX2	0.0976***
	[0.0155]
N	11,547
TG2	0.0864***
	[0.0196]
N	8506
TB2	0.1077***
	[0.0188]
N	8747
Panel C: Gap to 3rd Child, in Years	
	All Parents
TX2	−0.0869***
	[0.0213]
N	4053
TG2	−0.0947***
	[0.0260]
N	2845
TB2	−0.0806***
	[0.0251]
N	3000

*** Indicates statistical significance at the 1% level
**significance at the 5% level
*significance at the 10% level.

$$Y_{isw} = \omega + T_f\gamma + \mu_{sw} + E_i \quad (5)$$

Where Y_{isw} indicates fertility outcomes for individual i, in sample s and wave w; T_f indicates whether the parent has had a second child of the same sex as the one they have already; while μ_{sw} includes dummies for sample s, wave w, and their interactions; and E_i gives standard errors, clustered at the individual level. The sample is restricted to the final wave of each dataset (parents are age 46 in the BCS, and age 50 in the NCDS) to give the maximum possible time to have had more children Table 6 provides estimates of regression (5) for all three birth lottery outcomes.

As shown in Table 6, achieving sex parity after having a second child affects household's subsequent fertility both at the extensive margin – the number of children they have - and the intensive margin – the speed with which they have them. At the extensive margin, when both children have the same sex, the likelihood of having at least one more child is increased by 7 percentage points (Panel A, Column 1), while their overall number of children is increased by 0.1 (Panel B, Column 1). At the intensive margin, parents wait 0.09 fewer years between the 2nd and 3rd child when children are of the same sex (Panel C, Column 1). Though modest in magnitude, the effects remain robust and significant across both the TG2 and TB2 treatment variables.

4.3. Two children and SWB

We can also assess the impact of having two children of the same sex on life satisfaction, rerunning regressions (2) and (3), butusing TX2, TB2, and TG2. The results of these regressions are shown in Table 7. The coefficients reveal a distinct pattern to the regressions for TX3 in Tables 5a and 5b. Having two children of the same sex has a *positive* impact on SWB for both mothers and fathers. According to Column (1), this is driven by both boys and girls, and the coefficient for both parents indicates an average 0.08-point boost to SWB after the birth of a second child of the same sex. TG2 is statistically significant and positive for both mothers and fathers and indicates a 0.10-point boost to SWB from having two girls. TB2 is only statistically significant for mothers and fathers combined and indicates a 0.07-point boost from having two boys.

Columns (4)-(9) investigate the adaptation principle from regression (3). Many of the coefficients are imprecise, but the pattern seems to point to parents who have two girls experiencing an initial SWB boost but no real adaptation. Column (4) shows that parents experience a 0.097-point SWB increase following the arrival of their second child of the same sex, which is significant at the 10% level, but none of the age interactions are statistically significant. Column (5) shows this is driven by fathers experiencing an immediate 0.17-point boost to SWB on the arrival of their second girl, which is also significant at the 10% level, though none of the age interactions are significant. The coefficients for mothers are similar to those for fathers, but none of them are statistically significant. Overall, adaptation does not appear to occur when parents have two children; only a contemporaneous boost to SWB, which is driven by fathers who have two girls.

5. Discussion

Taken together, these findings indicate that parents prefer children of different sexes. After having a third child of the same sex, parents experience a decline in subjective wellbeing (SWB) that lasts for about a decade, contrary to previous studies (Margolis & Myrskyla, 2016). Additionally, after having two children of the same sex, parents are more likely to try for another child, and do so faster than those who achieve sex parity, which is consistent with previous studies (Teachman & Schollaert, 1989; Hank and Kohler, 2000; Andersson et al., 2006; Mills & Begall, 2010; Pollard & Morgan, 2002). Therefore, self-reported happiness measures are consistent with revealed preference measures in indicating that parents prefer mixed sex children, a congruence between the two measures which is not always observed (Kahneman et al., 1997).

The SWB findings are driven entirely by mothers who fail to have a boy after having two girls. It is possible that, consistent with demographic literature (Kohler & Mencarini, 2016; Preston & Hartnett, 2011), mothers are simply more affected by childbirth than fathers. Existing studies emphasise the positive effect on mothers who reported feeling "madly in love" with their children (Preston & Hartnett, 2011). In our results it seems that mothers do not want to have too many children of the same sex as them. It is possible this reflects not just an issue of children, but one of household composition, with the mother not wanting too many females in the household. One possibility would be that this reflects the superior earning power (and therefore economic security) of boys, which persists despite progress in gender equality (Mills & Begall, 2010). This would be a milder version of the preference observed for boys in developing countries (Margolis & Myrskyla, 2016).

It seems that mothers with two girls are hopeful that they can have a boy, and disappointed if this does not happen. Mothers who hope for a girl after two boys do increase their fertility to reach this aim, but their happiness does not dip if it is not fulfilled. The same applies to fathers in general, who do not suffer a dip in SWB no matter the sex of their third child, despite the increase in fertility signaling that they may desire sex parity. Therefore, it seems self-reported happiness and revealed preference are more in congruence for fathers than for mothers. Whether this

Table 7
Effect of Birth Lottery on Life Satisfaction. Regressions showing the effect of having two children of the same sex on life satisfaction, including sample-wave fixed effects. Columns (2)-(4) show the baseline specification, while Columns (5)-(7) include age interactions, and Columns (8)-(10) show the baseline specification again, but restricted to parents who had their child within the last 10 years. For each specification the results are shown for TX2 (two children of the same sex), TB2 (two boys) and TG2 (two girls). Standard errors are in square brackets, clustered by individual. Sample is restricted to parental ages 42 and 46.

	Life Satisfaction								
Full Sample					Interaction Model		Within 10 years of Birth		
	All Parents (1)	Fathers Only (2)	Mothers Only (3)	All Parents (4)	Fathers Only (5)	Mothers Only (6)	All Parents (7)	Fathers Only (8)	Mothers Only (9)
Treatment (TX2)	0.0831***	0.0859**	0.0814**	0.0970*	0.0899	0.0995	0.0961*	0.0871	1.019
	[0.0283]	[0.0390]	[0.0405]	[0.0565]	[0.0745]	[0.0856]	[0.0565]	[0.0745]	[0.0855]
(TX2) x (Age 2nd: 10–17)				−0.0064	0.0303	−0.0306			
				[0.0664]	[0.0893]	[0.0984]			
(TX2) x (Age 2nd: 18+)				−0.0365	−0.0133	−0.0501			
				[0.0664]	[0.1166]	[0.1189]			
N (Observations)	21,351	9795	11,556	16,146	7332	8814	4127	2148	1997
N (Clusters)	11,292	5203	6089	9826	4495	5331	3447	1760	1687
Treatment (TG2)	0.1007***	0.1133**	0.0903*	0.1114	0.1683*	0.0439	0.1095	0.1645*	0.1493
	[0.0349]	[0.0488]	[0.0494]	[0.0704]	[0.0951]	[0.1047]	[0.0704]	[0.0952]	[0.1051]
(TG2) x (Age 2nd: 10–17)				−0.0138	−0.0154	0.0119			
				[0.0829]	[0.1143]	[0.1206]			
(TG2) x (Age 2nd: 18+)				−0.0105	−0.0649	0.0563			
				[0.1021]	[0.1447]	[0.1438]			
N (Observations)	15,718	7171	8547	11,897	5362	6525	3022	1581	1441
N (Clusters)	8320	3817	4503	7263	3295	3968	2529	1298	1231
Treatment (TB2)	0.0669**	0.0611	0.0724	0.0834	0.0180	0.1475	0.0830	0.0189	0.142
	[0.0340]	[0.0461]	[0.0493]	[0.0659]	[0.0885]	[0.1003]	[0.0658]	[0.0855]	[0.1000]
(TB2) x (Age 2nd: 10–17)				0.0002	0.0720	−0.0675			
				[0.0776]	[0.1031]	[0.1156]			
(TB2) x (Age 2nd: 18+)				−0.0632	0.0334	−0.1514			
				[0.1004]	[0.1374]	[0.1444]			
N (Observations)	16,179	7419	8760	12,205	5545	6660	3122	1626	1496
N (Clusters)	8561	3941	4620	7421	3403	4018	2610	1329	1281

*** Indicates statistical significance at the 1% level.
** significance at the 5% level.
* significance at the 10% level.

consistency is unique to this dataset or represents a more generalised phenomenon could be a topic for future research.

Within our sample, our results showing a rise in parents' SWB following two children of the same sex warrant explanation. Firstly, they contradict the main existing study on the topic, Margolis and Myrskyla (2016), who find only weak evidence of a decline in SWB in German data after two boys and no real pattern in British data. There are numerous differences between their approach and ours. Our sample size is substantially higher than theirs: our main regression for both parents has a sample size of 8561, whereas their sample is half that at 4247. Their sample also covers the period 1991–2012, while our sample runs from 1958 to 2016, so gender attitudes may well have been different further in the past. Finally, they use the estimation strategy of separately regressing SWB measures for each year on their treatment dummies and plotting the coefficients, whereas we use one regression only to plot life satisfaction following the birth lottery.

Secondly, our results for two children must be reconciled with our own findings for three children. Margolis and Myrskyla (2016) themselves make cogent observations regarding potential positives from having children of the same sex. Parents will be able to reuse clothes and other items and will be experienced in raising a child of that sex. In addition, it is possible that having two-same sex children firms up the parents' desire to have a third child, which may yield excitement and optimism, or in Margolis and Myrskyla's words "[bind] the parents together through an unfinished agenda". This explains our results showing both increased SWB and increased fertility.

Having a third child of the same sex may not have this effect, since British families are much less likely to have four children than three. Our sample shows 20% of the sample have no children; 16.5% have one child; 40% have two children; 15.5% have three children, but only 5% have four children, and 1.5% have five. There is therefore more of a finality to having three children of the same sex as it is relatively unlikely that the parents will continue on their mission to achieve sex parity. This would explain why there is a SWB decline at three children but not at two, since two children is an earlier stage of family planning when the positives can be seen to outweigh the negatives.

Heterogeneity analysis shows that only parents who have at least some qualifications experience the dip in SWB following their third child of the same sex. As shown by Mills and Begall (2010), gender equality mediates the desire for mixed sexes. Education may reduce support for traditional gender roles and reduce the desire for males, increasing the desire for sex parity. In the present study education seems to be associated with a heightened preference for males, though. Educated mothers who have three girls have a desire for sex parity, as shown by the reduction in SWB, while educated parents who have three boys do not. The heterogeneity analysis by income reveals a similar pattern, with the dip in SWB only observed for parents with higher income. Given the correlation between income and education, these results are congruent within sample, but they represent something of a puzzle in the context of the literature.

6. Conclusion

In this paper, we have found using British cohort studies that parents who have three children of the same sex experience a substantial decline in subjective well-being (SWB) when compared to those who have a third child of the opposite sex to the first two. This effect is driven entirely by mothers who have had three girls in a row and lasts for around a decade before mothers adapt back to the previous level of SWB. There are further heterogeneities when the sample is split by qualifications or by income which point to interesting topics for future research. The sex of a child is exogenous conditional on pregnancy, which makes our effects more plausibly causal than most estimates in the SWB literature.

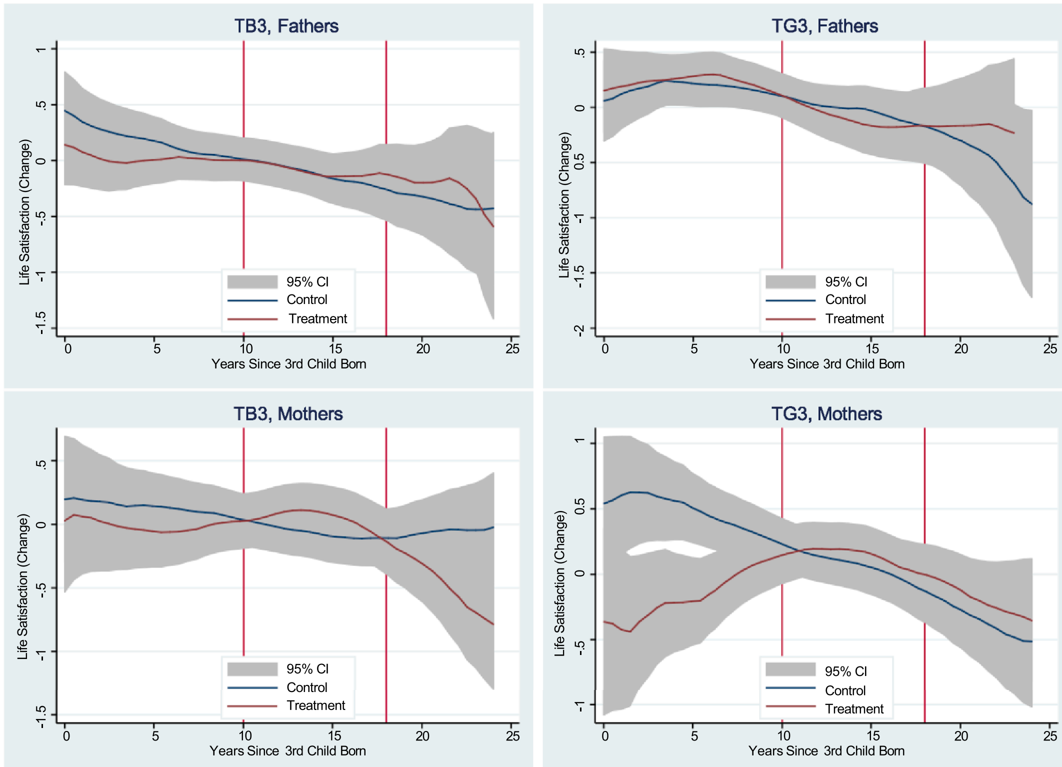

Fig. 1. Adaptation: Life Satisfaction and Age of 3rd Child, by TG3/TB3 and Sex. Shows the effects of having three children of the same sex on subjective well-being (SWB) in the years after the child was born. The vertical axes show the change in life satisfaction and the horizontal axes show the years since the child was born. The top left panel shows the effect of having three boys (TB3) on fathers, while the bottom left shows the effect of TB3 on mothers. The top right shows the effect of having three girls (TG3) on fathers, while the bottom right shows the effect of TG3 on mothers.

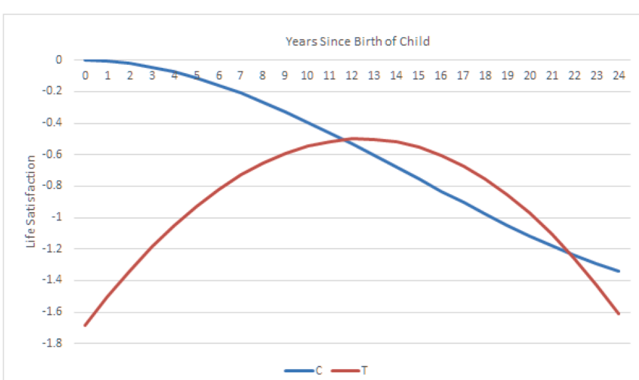

Fig. 2. Adaptation: Polynomial of Age (Mothers and TG3 Only). Shows the results of regression of subjective well-being (SWB) on a polynomial for the age of the third child, only for mothers who already have two girls. The blue line, labeled *C,* is for the Control Group who have a boy as their third child. The red line, labeled *T,* is for the Treatment Group, who have a girl as their third child. Each line shows how the SWB of a given group changes as the child gets older.

Parents who have *two* children of the same sex experience a boost to SWB which is driven mostly by fathers having two girls. In addition, they are more likely to have another child and wait for a shorter period before doing so, compared to parents who achieve sex parity. We interpret these results as showing that there are advantages to having two children of the same sex and these outweigh the costs of not achieving sex parity. Parents with two children of the same sex are likely to resolve to have a third child, a dual commitment which may boost their SWB. After having three children, parents are much less likely to continue to expand fertility, so the costs of not achieving sex parity at three children outweigh any benefits.

The SWB finding builds on the only existing (to our knowledge) previous study on the topic by Margolis and Myrskyla (2016), who found that parents who had two children of the same sex did not experience a decline in SWB. The finding on fertility is consistent with previous studies on the topic (Teachman & Schollaert, 1989; Hank and Kohler, 2000; Andersson et al., 2006; Mills & Begall, 2010; Pollard & Morgan, 2002). In addition, the finding of adaptation to a major life event is common in the literature on SWB (Clark & Georgellis, 2013; Clark et al., 2008; Qari, 2014; Vendrik, 2013), although unlike our study, these estimates do not usually harness exogenous influences on SWB (Dolan et al., 2008; Frey & Stutzer, 2018).

There are two main limitations of this analysis. Firstly, we estimate the Intention to Treat (ITT): the effect on life satisfaction for parents who have a third child of the same sex, but who may or may not go on to compensate via increased fertility later. We control for number of children, but the improper randomization may still confound our results if parents achieve a mix of sexes eventually. Secondly, we assume that parents with two children of the same sex want a child of the opposite sex, even though there may be instances where this is not the case. Despite these limitations, we still estimate of the effect of having a third child of the same consecutive sex on life satisfaction, a useful magnitude for the purposes of family planning and fertility policy. This is especially true since the ITT is generally the policy lever over which policymakers can exert control (Duflo et al., 2007).

Future research could investigate heterogeneities in sex preferences between parents: for example, how life satisfaction changes for parents who wanted a particular sex versus those who did not, as measured through stated preferences before pregnancy or other proxies derived from theory and existing data. Additionally, large sample sizes may permit researchers to look at parents with four or five children of the same sex and compare these to lower parities. Finally, researchers could look at the effect of birth lotteries on outcomes for children such as parental investment at home, schooling, and other life outcomes.

Declaration of Competing Interest

The authors declare that they have no competing interests.

Data availability

The authors do not have permission to share data.

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Appendices

A.1. Tables

A.2. Figures

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