Does Child Gender Affect Sibling and Family Outcomes?

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Abstract

In this paper, we empirically analyze whether child gender affects sibling and family outcomes using a very large administrative data set of the total population in Sweden. We find little evidence that child gender is of importance for a large number of sibling and family outcomes with the exception of fertility.

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1. Introduction

In this paper, we ask whether child gender affects sibling outcomes (e.g., scholastic achievements, education, labor market outcomes) and family outcomes (e.g., marital status, family structure fertility, labor market outcomes) in Sweden. The importance of child gender has received considerably attention in many fields.[1] In the literature there is however little consensus concerning the impact of child gender, both on parental behaviour and sibling outcomes.

The contribution of this paper is to use Swedish administrative data together with attractive sources of exogenous of variation in child gender. The data set used provides an accurate link between parents and all their children for all individuals born in Sweden since 1940 (in most other available data set parents cannot be linked to all their children), which implies that we can rely on a very large number of observations. We also have access to a rich information set of children and family outcomes. Moreover, we can also address the issue whether child gender affects sibling and family outcomes differently depending on the preferences for child gender by relying on the information on the country of birth.

We will use two different exogenous sources of variation of child gender since child gender could potentially have an impact on child outcomes via two independent channels, namely (i) the child gender could have a direct effect on the outcomes of siblings (ii) the child gender could affect parental behaviour which in turn could affect the outcome of the siblings.[2]

To begin with, we use the gender type of twin pairs at second birth as exogenous source of variation in child gender, that is, we restrict the population to those families who have had a twin birth at second parity and analyze the outcome for first-born sons and first-born daughters separately. We then argue that gender of the twins is as good as randomly assigned given the sex of the first-born child. For example, for a first-born boy it is an equal probability (1/3) that twin pairs are both females, both males or mixed. Consequently, we then compare the outcome for a first-born boy depending on the gender combination of twin pairs at second parity and if child gender is of importance then the child outcome of the first-born should differ depending on the gender of the twin pair. To our knowledge, this source of variation in child gender has not been used before.

The second source of variation in child gender is the gender of the first-born child since the gender of the first born should be as good as randomly assigned as discussed by

[1] See e.g., overviews by Steelman et al (2002), Lundberg (2005a), and Raley and Bianchi (2006).
[2] Several studies fail to acknowledge the endogeneity problems caused by the impact of child gender on other dimensions of family behaviour than the one being studied (see for example Lundberg 2005a).

Dahl and Moretti (2008). While Dahl and Moretti mostly analyze family outcomes this paper also looks at a number of different child outcomes.

Because twin sex composition at second birth and the gender of the first birth are exogenous, both strategies identify the total causal impacts of sibling sex composition on child as well as family outcomes. As such, estimates on child outcomes capture several causal effects, such as effects related to the sex of the siblings and indirect effects due to differential parental behaviour depending on the sex composition of their children. Thus, an estimated zero total effect of sex composition on a certain child outcome might disguise two offsetting indirect effects. For example, if brothers are detrimental for school achievement (as suggested by results in Powell and Steelman 1990), and that boys increases parental marriage stability which is good for children (as suggested by Dahl and Moretti 2007), these effects may cancel out each other. Since we in this paper estimate effects on child as well as family outcomes, such offsetting effects may be detected.

Results show very little evidence that sibling sex composition affects child and family outcomes in any significant or sizeable way. This conclusion is also valid for parents with high fertility rates, such as from parents born in Asia with strong preferences for boys. Since we find little evidence on family outcomes, it seems most likely that the total zero effects also capture zero indirect effects.

The paper is structured as follow. Section 2 describes previous work. Section 3 describes the data and the empirical framework. Section 4 provides the baseline results. Section 5 provides extension (Immigrants). Discussion and conclusion are given in Section 6.

2. Previous literature

There are two main channels through which the sex composition of the sibship can affect children. First, the sex composition can have an impact on parental behaviour in ways that affect child outcomes. If, for example, parents have preferences over child gender, the sex composition is likely to affect family size. Family size, in turn, can have an impact on child outcomes. Similarly, if the sex composition affects marital stability or parental labor supply, this may influence children both positively and negatively. Second, there may be direct effects between siblings that are affected by the sex composition of the sibship, perhaps because of how children of different gender interact and influence each other.

Both economists and sociologists have spent considerable research effort analyzing how the sex composition of children affects both parents and children in various dimensions. Basically, there are four main areas that have been studied: the effects on child educational outcomes and earnings, the effects on parental marital stability, the effects on family size, and the effects on parental labor supply or, more broadly speaking, parental time allocation between different activities. In this section we review the existing evidence on these topics in industrial economies. It should be noted that most, but not all, studies have been using US data.[3]

2.1 Effects on children's educational outcomes

The most straightforward mechanism through which the sex composition of the sibship can influence child outcomes is through parental resource allocation. Evidence of this is found in a study by Powell and Steelman (1989) who document that US college students are substantially more financially constrained when they had brothers than when they had sisters. Whether this is due to boys being more expensive, or because parents prefer to spend resources on sons is not answered in their paper. Since college funding differs substantially between the US and other countries, it is hard to generalize their finding. Since the population analyzed was already in college, it is also not clear that these financial constraints actually had an impact on educational attainment. In Powell and Steelman (1990), the same authors find that the number of brothers in the sibship reduces the GPA of students significantly more than the number of sisters, but no such effect is found on test scores. One possibility is that students with brothers tend to behave in ways that are punished by teachers when grading, but

[3] More detailed surveys of these and related topics can be found in Steelman et al (2002), Lundberg (2005a), and Raley and Bianchi (2006). Therein references to papers on developing countries can also be found. As sex biases usually are more pronounced in such economies, such evidence is less relevant here.

that actual learning is not impaired. Whether this is due to parental behaviour or child-to-child influence cannot be determined.

The result that brothers are detrimental to educational outcomes is reversed in a study by Butcher and Case (1994). Using large representative samples of the US population (the PSID and the NLSW), they find that women raised with only brothers have significantly higher educational attainment than women who have grown up with at least one sister. No such effects by the sex composition of siblings can be found among men. Further, the negative effect of growing up with a sister is much stronger among older cohorts than among younger. These findings are not easily interpreted in the light of existing theories of within household allocation of resources. Rather, Butcher and Case stress an explanation based on gender roles created within the family, and speculate that growing up with brothers improve girls' capacity of dealing with the classroom environment.

Arguing that a classroom based explanation for the effect of sex composition should be apparent already at early ages, Kaestner (1997) investigate the impact of sex composition on educational outcomes among children and teenagers, as well as more recent cohorts of adults than Butcher and Case. Using data from the NLSY, Kaestner finds no effect at any age by the sex composition of siblings for either men or women. Only among black 15-18 year olds, he finds a significant (positive) effect of having sisters in the family. Since Butcher and Case found the effects on educational attainment among adults to be declining over cohorts, the findings of the two studies are partly possible to reconcile with each other. That no effect on academic achievement was found among younger students is, however, evidence against a strong learning effect caused by the gender of siblings. It should be noted that the outcome measures for children and teenagers are standardised tests, and that classroom behaviour or grades are not observed. Therefore, these findings do not exclude the possibility that student behaviour is affected in systematic ways by the sex composition of the sibship.

The findings by Butcher and Case have further been questioned by Hauser and Kao (1998) who use three national surveys to analyze the effects of the gender composition of sibships. In line with Kaestner, they fail to find an effect by the presence of sisters (or the share of sisters) in the family on the educational outcomes for women. Conley (2000) argues that the effects of sex composition are more complex than previous researchers acknowledge. He finds that women's educational outcomes are harmed by having brothers, while men's outcomes are harmed by having sisters. As all of the above studies use US data, it is useful to note that Bauer and Gang (2001) find no effect on the sibship sex composition on educational outcomes using the German Socioeconomic Panel.

2.2 Effects on marital patterns

A different channel through which the sex composition of siblings may affect child outcomes is through its effect on marriage patterns. The literature on child gender effects on these patterns is far larger than the research body discussing the effects on educational outcomes. Sociologists such as Spanier and Glick (1981) and Morgan et al (1988) use US census and CPS data to document that the presence of a son in the family substantially lowers the probability marital disruption. Katzev et al (1994) get a similar result using a quite small sample of women from the NSFH. These findings are reconfirmed by Morgan and Pollard (2002), who on the other hand note that the relation has been substantially weakened in later time periods. To the same point, Mott (1994) reports that fathers are more likely to be present in the home when a child is male, and Lundberg and Rose (2003) find that the transition to marriage is faster after an out-of-wedlock birth of a son than of a daughter.

In the search for instruments for divorces, economists have picked up on this literature. Using large samples of US census data (PUMS), both Bedard and Deschênes (2005) and Ananat and Michaels (2004) find that having a first-born daughter rather than a first-born son, increases the probability of divorce by 3-4 percent.[4] These findings are reconfirmed in the detailed study by Dahl and Moretti (2007) who find that first-born girls are less likely than first-born sons to be living with their father. A small increase in the divorce probability is one reason behind this result, a lower probability of marriage is another, and a lower probability of paternal custody is a third. As a consequence of these patterns, girls are more likely to grow up under poor circumstances than boys. The conclusion Dahl and Moretti draw is that American families tend have a preference for sons over daughters.

While the results for the US quite consistently show that there is a relation between child gender and marital patterns, it has been difficult to find similar patterns in other countries. In a detailed large-sample study on Swedish data, Andersson and Woldemicael (2001) find that the divorce probability is somewhat lower in families where the children are of mixed gender. For mothers of only one child there is no relation between the risk of divorce, and there is no relation between child gender and marriage probability. Using smaller samples for each country, Diekmann and Schmidheiny (2004) fail to find a significant relation between the sex composition and marriage stability in any of the 18 countries investigated. However, Choi et al (2005), however, find that West-German are more likely to remain in the

[4] Both Bedard and Deschênes (2005) and Ananat and Michaels (2006) use the gender of the first born child as an instrument when estimating the effects of marital dissolution on the economic wellbeing on women and children.

same household with a male child than with a female child, thus indicating a boy preference among German families.

2.3 Effects on family size

A more direct way of analyzing gender preferences is to study family size. Simply put, if parents prefer boys over girls, families having a first born daughter will tend to have a higher probability to progress to higher parity than those having a first born son. Among most industrial countries, parents appear to have a strong bias for mixed gender sibships. In a much cited study, Angrist and Evans (1998) use these mixed gender preferences to instrument for family size when studying the effects of child bearing on family size. Pollard and Morgan (2002) reach the same conclusion but also note that US parents appear to have become increasingly indifferent to the gender of their offspring over time. Mixed gender preferences have also been found for several other countries (Hank and Kohler 2000 and Andersson et al 2006).

Regarding the question if parents have a preference for boys or girls, it is well-known that son preferences are strong in some Asian countries.[5] In other countries, the results are more mixed and the number of studies is quite small. Dahl and Moretti (2007) present quite weak evidence indicating that a first born girl increases family size, which correspond to their findings on marriage patterns. Using a similar approach Andersson et al (2006) find evidence of girl preferences in Sweden, Denmark and Norway, while the behaviour of Finnish parents indicate a boy preference. Hank and Kohler (2000) find girl preferences in the Czech Republic, Lithuania, and Portugal, while the same authors in a different study find some evidence for son preferences in Germany (Hank and Kohler 2003). Again, this last piece of evidence is consistent with the impact of child gender on marriage patterns in Germany.

2.4 Effects on parental labor supply

Another channel through which the gender composition of children may affect child outcomes is through its effect of parental labor supply, and parental time allocation in general. The labor supply decision is intimately related to marital stability as increased stability increases the payoff to specialization within the household. Given the scope of our study, we here restrict our attention to studies on the child gender effects on parental labor supply and wages.

[5] See, for example, Sen (1990) on the difference in sex ratios across different regions.

Lundberg and Rose (2002) were the first to note that male wage rates and, in particular, hours worked, increase substantially more among US males when the first born child is a boy rather than a girl. These results are somewhat at odds with the findings in Lundberg (2005b) who finds that the birth of a son tend to *reduce* the number of hours worked among US men relative to the birth of a daughter. There is considerable heterogeneity among parents, however: boys tend to decrease household specialization among college educated parents and increase it among those with less than high school education. One reason for the discrepancy between the two studies could be that the latter only studies parental behaviour during the first three years since chid birth.[6]

As the studies on fertility and marriage patterns indicate a similarity of gender preferences between US and German parents, it is interesting to note that Choi et al (2005) find an increase in the number of hours worked among German med increased substantially more after the birth of a son than of a daughter. Studies for other countries on this topic are hard to find, but a recent paper by Johansson (2007) documents that Swedish fathers are somewhat more willing to take out parental leave after the birth of a son, which of course affects their labor supply.[7] The pattern in reversed for fathers with a university degree who are more likely to stay at home after the birth of a daughter.

2.5 Summing up

It is fair to say that there is little consensus concerning the impact of child gender both on parental behaviour and sibling outcomes. At least in part, the discrepancies between studies are due to the use of different identification strategies, different time periods, and different datasets. There appears, however, to be systematic differences across societies in the sense that preferences over child gender manifest themselves similarly in fertility decisions, work life decisions, and marriage patterns.

As noted by Lundberg (2005a) several studies fail to acknowledge the endogeneity problems caused by the impact of child gender on other dimensions of family behaviour than the one being studied. In the following we attempt to address such issues by using identification strategies aimed at separating the effects of between-sibling-influence and the effects coming from parental behaviour. We will also use a rich dataset that allows us to

[6] It should also be noted that Lundberg (2005) uses the NLSY-79 and the American Time Use Survey, while Lundberg and Rose (2002) use the PSID.

[7] The Swedish parental leave system is very generous and can be divided between the parents. The government actively tries to make fathers more willing to stay at home with their children.

analyze the various channels through which child gender can affect siblings and parental behaviour in a consistent way.

3. Data and empirical framework

In this section, we describe the empirical framework and discuss the data. As discussed preciously, child gender could have an impact on child outcomes via two independent channels (i) the child gender could have a direct effect on the outcomes of siblings (ii) the child gender could affect parental behaviour which in turn could affect the outcome of the siblings. We will use two different sources of variation of child gender to investigate these channels.

The first approach uses the **gender composition of twin pairs at second parity** to look at the outcomes for first-born siblings (educational achievements, education, earnings) and the outcomes of their parents (marriage, divorce etc). This is an attractive source of variation of sibling sex compostiion since twins are as good as randomly assigned. Let Y_i be the outcome the first-born child or its family outcome in family i with twin births at 2nd parity. We can then define one indicator variables for whether the twins at second birth were all girls, G=1[Both twins are girls], and another indicator for if the twins were of opposite sex, M=1[Twins are mixed]. Then the regression of interest can expressed as

$$Y_i = a + \beta G_i + \pi M_i + v_i \quad (1)$$

where v includes all other determinants (observed or unobserved) of the outcome Y. If equation (1) is estimated on conditional on the sex of the first-born (e.g., estimating (1) separately for the samples with first-born boys and first-born girls) it may be possible to discriminate between sibling interaction and family effects. For example, if there should be no effect on parental outcomes but significant effects on first-born outcomes then the mechanism at work must be some sort of sibling interaction. Another attractive feature with this variation in sibling sex composition is that the effects are likely to be valid for a larger population since we do not analyze the outcomes for twins and twin families are likely to be comparable to other families since twin births are as good as randomly assigned.

The second approach uses the **gender of the first-born child** as exogenous source of variation in child gender which has been used by Dahl and Moretti (2007). The attractiveness of this variation is that we can use the entire universe of births and thus have very large sample sizes. However, this analysis is best suited for an examination of the whether child

gender has an effect of parental outcomes. Thus, Dahl and Moretti estimate regressions of the following form

(2) $$Y_i = a + \theta First\_born\_girl_i + r_i$$

where Y_i is some family outcome of interest (e.g., marriage , divorce, fertility), *First_born_girl* is a dummy equal to one if the first born child is female, and *v* includes all other determinants (observed or unobserved) of the outcome *Y*. They also include a vector of control variables. To investigate whether family outcomes also has an effect on the outcomes of the other siblings they also analyze whether the outcome of the 2nd born sibling is affected by the gender of the first-born, i.e.,

(3) $$Y_i = a + \pi First\_born\_girl_i + \varepsilon_i$$

where Y_i is some educational achievement of the 2nd born sibling. Thus, equation (3) does not take into account siblings interactions, i.e., that the effect of 2nd born child may be different if the first-born is a girl or a boy. Nevertheless, if equation (3) is estimated conditional on the sex of the 2nd born child (e.g., estimating equation (3) separately in the samples for second-born boys and second-born girls) then these sibling interactions effects can be estimated. However, as pointed out by Dahl and Moretti, since fertility is likely to be endogenous to the sex of the first born child, then the estimates from equation (3) will be problematic to interpret causally. In contrast, in the first approach will not be affected by this problem since the gender composition of twin pairs at second parity will not be endogenous to the outcome of the first-born child. Thus, this means that it is only possible to estimate the causal effect of the sex composition on an older siblings since the outcome of younger siblings will necessary be "post-treatment" relatively to the gender of the older sibling.

Description of the data set

We use the Multi Generation Population Register data matched with the longitudinal data base LOUISE and the Årskurs 9 registret, which includes final grades in compulsory school.[8] We will use number of years of schooling, and final grades in compulsory school for first-born individuals as the child outcomes of interests. We only have information on educational attainment for individuals born up to 1985, i.e., educational attainment is measured in 2003, and data on grades for those born between 1972 and 1988. That educational attainment is measured in 2003 means that some individuals are still in educational system. For example, the 1985 birth cohort is 18 years old in 2003. The income and labour force participation rates are also measured in 2003. All data was provided by Statistics Sweden.

[8] LOUISE is a register based data set on the total Swedish population which includes information, among other things, income and education. The Multi Generation Registers include identifiers so that we can match parents to their biological children and siblings to each other. Consequently, and quite importantly, the information on child spacing, birth order and number of children is not conditional on having found the siblings in the other parts of the data set, which otherwise is the case in most other available micro data sets, since it is directly recorded for each mother. When matching children to parents we use the mother identifier since almost all children have grown up with a mother.

4. Results

4.1 Results from gender of twin pairs

A major challenge when identifying effects of sibling sex composition on child and family outcomes is to overcome the endogeneity problem since parents can potentially choose the sex compositions through fertility decision. In the first part of our analysis we address the endogeneity issue of sibling sex composition by taking advantage of the fact the sex composition of twins at second birth is as good as random. We can therefore compare outcomes for first-born children with different sex compositions on their sibling twins. To avoid any contamination of general differences in achievement between boys and girls, we analyse first-born boys and first-born girls separately.

Since we compare families with different sex compositions of the twins at second birth, a natural question to ask is how different are families with twins at second birth compared to families with at least two children? This is the natural comparison to make since both family types have taken the decision to having an additional child at second birth.

Table 1 provides descriptive statistics for families with twins at second birth and families with more than on child, respectively. The upper panel of Table 1 shows that parent with twins at second birth are on average one year older than parents with more than one child. Child outcomes for first-born child, shown in the middle panel of Table 1, are very similar across the two family types. As regards family outcomes we expectedly find that the average family size is larger for families with twins at second birth. An interesting difference is that the divorce rate is larger for families with more than one child compared to families with twins at second birth, whereas the opposite case is true for the fraction of married. These differences could, however, be due to the fact that parents with twins at second birth are on average older. Taken together, besides the one year difference in average age, the two family types seem to be rather equal indicating that when using families with twins at second birth in the analysis, results can be fairly generalized.

Next we turn to the comparison between families with different sex composition on their twins at second birth. Table 2 show descriptive statistics for first-born boys, separate for families with twin boys, twin girls and mixed sex twins. The upper panel of Table 2 shows that parental characteristics are nearly equal across family twin types (the only difference is a somewhat higher average age in families with mixed sex twins). This supports that the sex composition of twins at second birth is exogenous.

Because twin sex composition at second birth is exogenous, estimates based on comparison between families with different sex compositions of twins identify the total causal impacts of sibling sex composition on child as well as family outcomes. As such, estimates on child outcomes capture several causal effects, such as effects related to the sex of the siblings and indirect effects due to differential parental behaviour depending on the sex composition of their children. Thus, an estimated zero total effect of sex composition on a certain child outcome might disguise two offsetting indirect effects. For example, if brothers are detrimental for school achievement (as suggested by results in Powell and Steelman 1990), and that boys increases parental marriage stability which is good for children (as suggested by Dahl and Moretti 2007), these effects may cancel out each other. Since we in this paper estimate effects on child as well as family outcomes, such offsetting effects may be detected.

The middle and the lower panel of Table 2 show differences in child outcomes and family outcomes across the three twin family types. Almost all differences between these three groups are nearly zero. One exception might be the lower percentile score for first-born boys when they have twin siblings of opposite gender. It is also the case that the divorce rate is slightly higher for boys with twin brothers and that boys with twins of opposite sex have parents who are married to a larger extent. This result contrasts the result obtained in Dahl and Moretti (2007) where boys are found to increase marriage and decrease probability of divorce.

Even though sex composition of twin birth is exogenous, controlling for parental characteristics might be relevant for two reasons. First, adding covariates might increase precision. Second, even if sex composition at twin birth is as good as random, there might still be some "random" differences in parental characteristics that might explain some of the differences in child and family outcomes. One example is the slightly higher average age for families with mixed sex twins which then to some extent might explain a higher marriage rate for parent with mixed sex twins.

For this reason we estimate equation (1) and control for parental characteristics. We control for mother's age at first birth (including age squared) and indicators for mother's education level. When father outcomes are estimated we additionally include father's age at first birth (and squared) and indicators for father's educational level. Results shown in Tables 3 and 4, for child and family outcomes respectively, show that the only significant effect of sibling composition is a lower grade if siblings are of mixed sex.

Next, we turn to an analysis based on first-born girls. Table 5 show descriptive statistics for first-born girls, separate for families twin boys, twin girls and mixed sex at second birth. Most differences in average parental characteristics, child outcomes and family

outcomes are nearly zero. One exception, consistent, with the findings for first-born boys, is that divorce rate is higher when both twins are boys and the married rate is higher when twins are of opposite sex. When controlling for parental characteristics, results show that there are m no effects on child outcomes (results are shown in Table 6). As regards family outcomes, family size is significantly higher when twin pairs are girls (see table 7). This could indicate preferences for boys, but it should be emphasized that the economic effect is rather small. Moreover, mothers' earnings are fathers' labour supply are lower when twins include at least one girl. COMMENT

Taken together, results show very little evidence that sibling sex composition affects child and family outcomes in any significant or sizeable way. As discussed previously, total zero effects can be estimated even if there are offsetting effects from pure sibling effects and from parental behaviour. Since we find little evidence on family outcomes, it seems most likely that the total zero effects also capture zero indirect effects.

3.1 Results from gender of first-born child

Next, we change identification strategy where we use the sex of the first child to estimate effects of sibling sex composition on child and family outcomes. The sex of the first child would also yield causal interpretations since a boy or a girl can arguably be viewed as random. Estimations on child outcomes are based on the second-born child and all families with at least two children are included in estimations.

Table 8 show descriptive statistics for families with first-born boys and first-born girls, respectively. The upper panel of Table 8 shows that differences in parental characteristics are nearly zero which supports the idea that the sex of the first born child is random. As regards child outcomes for second born children are nearly zero. The same conclusion holds for differences in family outcomes. For example, the difference in divorce rates between families with a first-born boy and a first-born girl is zero. This is in contrast to results obtained by Dahl and Moretti (2007) on U.S. data, where the occurrence of a girl first increases the probability of a divorce.

Table 9 show results from estimations of equation (2) on child outcomes where we control for parental characteristics in the same way as when equation (1) was estimated above. Indeed, several of the child outcomes for the second-born child turn out to be significant. If we look at the economic significance, however, the effects are very small. Since these estimations include the population of all families with at least two children there are a large number of observations used. In that sense, we have estimated zero effects very precisely.

Results on family outcomes, shown in Table 10, are all insignificant. Results on child outcomes, separate for second-born boys and girls are shown in Tables 11 and 12.

Results from the analysis using the sex of the firs-born boy in order to estimate effects of sibling sex composition on child and family outcomes are consistent with finding when we used twin sex composition at second birth as an exogenous source of variation. Results show very little evidence that sibling sex composition affects child and family outcomes.

5. Extensions

In this section we look at mothers from different country of origins since they should *a priori* have different preferences of gender of children. Table 13 shows the effects of having a first-born girl on family size, estimations based on equation (2), separately for families with mothers with different regions of birth. As shown in Table 13, family size significantly increases for families where the mother is born in non-EU European countries or Asian countries. This can be interpreted as parents having preferences for boys in these regions. This is also consistent with previous findings (see e.g., XX). We also estimate the same effects using children based on the father's region of birth. Results reported in Table 14 show a similar pattern across different regions of birth as when the division on the population was based on mothers' region of birth. We continue with the analysis based on mothers region of birth and since using fathers region of birth basically give the same results.[9]

Our hypothesis is that effects of sibling sex composition on child and family outcomes exist in families where parents have a gender bias. If parents have sex child preferences, the gender of the first-born child could then affect parents' marital status, labor supply and earnings. This in turn might have consequences for child outcomes. Table 15 and 16 show results from estimations of equation (2) using only families where the mother is born in the non-EU European countries or Asian countries. Contrary to our hypothesis, there are no effects of the sex of the first-born sibling on child outcomes. As regards, family outcomes we find no evidence that parental gender preferences also affect parental behaviour. Results on child outcomes, separate for second-born boys and girls are shown in Tables 17 and 18.

[9] Results are available from the authors.

6. Discussion and Conclusions

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Table 1. Comparison of twin pairs sample versus families with more than 1 child

	Families with twins at second birth	Families with more than one child
Parental characteristics (pre-treatment)		
Father's age at first birth	28.6	27.8
	(.04)	(.004)
Mother's age at first birth	26.1	25.2
	(.03)	(.003)
Father years of schooling	12.4	12.3
	(.02)	(.002)
Mothers years of schooling	12.8	12.7
	(.02)	(.002)
Child outcomes for first-born child		
Percentile score	51.9	51.4
	(.39)	(.004)
Years of schooling	12.7	12.7
	(.02)	(.002)
"Female" education choice	.484	.487
	(.002)	(.0002)
Log annual income	7.29	7.29
	(.01)	(.001)
Labor participation rate	.773	.776
	(.003)	(.0003)
Family outcomes		
Family size	3.33	2.60
	(.005)	(.001)
Divorce (1,0)	.078	.087
	(.002)	(.0002)
Married (1,0)	.400	.345
	(.004)	(.0004)
Mothers log earnings	7.21	7.23
	(.01)	(.001)
Fathers log earnings	7.75	7.74
	(.009)	(.001)
Mother's labor participation rate	.813	.805
	(.003)	(.0004)
Father's labor participation rate	.873	.862
	(.003)	(.0003)

Note. Standard deviations within parentheses

Table 2: Twins at 2nd parity Families with a first-born boy

Twin sex composition	Twin boys	Twin girls	Mixed sex
Parental characteristics (pre-treatment)			
Father's age at first birth	28.3	28.4	28.9
	(.08)	(.09)	(.09)
Mother's age at first birth	25.8	25.9	26.4
	(.07)	(.08)	(.07)
Father years of schooling	12.3	12.4	12.5
	(.05)	(.06)	(.06)
Mothers years of schooling	12.8	12.8	12.9
	(.05)	(.05)	(.05)
Child outcomes for first-born child			
Percentile score	46.5	46.5	45.1
	(.88)	(.89)	(.96)
Years of schooling	12.5	12.5	12.4
	(.05)	(.05)	(.05)
Employed in "female" job	.371	.374	.373
	(.003)	(.004)	(.003)
Log annual income	7.45	7.47	7.50
	(.03)	(.03)	(.02)
Labor participation rate	.775	.785	.783
	(.008)	(.008)	(.008)
Family outcomes			
Family size	3.35	3.32	3.33
	(.01)	(.01)	(0.2)
Divorce (1,0)	.085	.079	.071
	(.006)	(.005)	(.005)
Married (1,0)	.375	.376	.417
	(.010)	(.010)	(.010)
Mothers log earnings	7.23	7.21	7.22
	(.02)	(.02)	(.03)
Fathers log earnings	7.71	7.72	7.75
	(.02)	(.02)	(.02)
Mother's labor participation rate	.811	.817	.816
	(.008)	(.008)	(.008)
Father's labor participation rate	.859	.868	.871
	(.007)	(.007)	(.007)

Note. Standard deviations within parentheses

Table 3. Child outcomes for first-born boy

	Grades	Years of schooling	Female job	Log earnings	LFP
Twin pair girls	-.27	.018	-.001	-.023	.003
	(1.20)	(.077)	(.005)	(.043)	(.016)
Mixed twin pair	-2.14*	-.096	-.006	.023	.018
	(1.24)	(.079)	(.005)	(.044)	(.016)
R2	.1348	.2626	.1792	.3360	.1902
Observations	2,845	3,597	7,190	3,204	3,619

Table 4. Family outcomes: families with a first-born boy

	Family size	Divorced	Married	Log earnings mothers	Log earnings fathers	LFP mothers	LFP fathers
Twin pair girls	-.016	-.002	-.008	-.028	.007	-.0008	.0062
	(.0.17)	(.007)	(.010)	(.031)	(.033)	(.010)	(.010)
Mixed twin pair	-.020	-.004	.0006	-.012	.029	-.0025	.0022
	(.017)	(.007)	(.010)	(.032)	(.032)	(.010)	(.010)
R2	.0699	.0757	.4790	.1090	.0672	.0747	.0811
Observations	7,190	7,190	7,190	6,149	5,506	7,190	6,350

Table 5. Twins at 2nd parity. Families with a first-born girl

Twin sex composition	Twin boys	Twin girls	Mixed sex
Parental characteristics (pre-treatment)			
Father's age at first birth	28.3	28.6	28.9
	(.09)	(.09)	(.09)
Mother's age at first birth	26.0	25.9	26.4
	(.08)	(.08)	(.008)
Father years of schooling	12.4	12.4	12.6
	(.06)	(.06)	(.06)
Mothers years of schooling	12.8	12.8	12.9
	(.05)	(.05)	(.05)
Child outcomes for first-born child			
Percentile score	57.3	58.5	58.5
	(.94)	(.93)	(.97)
Years of schooling	12.9	13.0	12.9
	(.05)	(.05)	(.05)
Employed in "female" job	.603	.603	.599
	(.003)	(.003)	(.003)
Log annual income	7.08	7.07	7.14
	(.03)	(.03)	(.02)
Labor participation rate	.765	.767	.760
	(.008)	(.008)	(.009)
Family outcomes			
Family size	3.32	3.37	3.31
	(.01)	(.01)	(.01)
Divorce (1,0)	.080	.074	.079
	(.006)	(.005)	(.006)
Married (1,0)	.401	.403	.438
	(.001)	(.01)	(.010)
Mothers log earnings	7.25	7.19	7.16
	(.02)	(.03)	(.03)
Fathers log earnings	7.75	7.75	7.81
	(.02)	(.02)	(.02)
Mother's labor participation rate	.804	.817	.813
	(.008)	(.008)	(.008)
Father's labor participation rate	.894	.870	.878
	(007)	(.007)	(.007)

Note. Standard deviations within parentheses

Table 6. Child outcomes for first-born girl

	Grades	Years of schooling	Female job	Log earnings	LFP
Twin pair girls	2.02	.051	-.0007	.018	.013
	(1.24)	(.081)	(.0043)	(.052)	(.018)
Mixed twin pair	.90	-0.09	-.0050	.036	-.006
	(1.28)	(.085)	(.0042)	(.055)	(.019)
R2	.1544	.3068	.2358	.1643	.1107
Observations	2,563	3,269	6,740	2,953	3,282

Table 7. Family outcomes: families with a first-born girl

	Family size	Divorced	Married	Log earnings mothers	Log earnings fathers	LFP mothers	LFP fathers
Twin pair girls	.044**	-.0047	.0097	-.060*	.007	.016	-.022**
	(.019)	(.0076)	(.010)	(.033)	(.032)	(.011)	(.010)
Mixed twin pair	-.030*	.0048	.0059	-.075**	.020	.004	-.023**
	(.017)	(.0076)	(.0.10)	(.035)	(.032)	(.011)	(.010)
R2	.0862	.0904	.4952	.1193	.0829	.0909	.0874
Observations	6,740	6,740	6,740	5,785	5,174	6,740	5,968

Table 8 . Comparison of families with a first born boy versus a first-born girl

	First-born boy	First-born girl
Parental characteristics (pre-treatment)		
Father's age at first birth	29.1	29.1
	(.005)	(.005)
Mother's age at first birth	26.4	26.4
	(.004)	(.005)
Father years of schooling	12.3	12.3
	(.003)	(.003)
Mothers years of schooling	12.6	12.6
	(.003)	(.003)
Child outcomes for second-born child		
Percentile score	48.9	49.2
	(.05)	(.05)
Years of schooling	12.6	12.6
	(.003)	(.003)
Employed in "female" job	.489	.485
	(.0002)	(.0002)
Log annual income	7.27	7.27
	(.001)	(.002)
Labor participation rate	.784	.786
	(.0005)	(.0005)
Family outcomes		
Family size	2.10	2.10
	(.0008)	(.0009)
Divorce (1,0)	.092	.092
	(.0003)	(.0003)
Married (1,0)	.395	.396
	(.0005)	(.0005)
Mothers log earnings	7.19	7.19
	(.001)	(.001)
Fathers log earnings	7.71	7.71
	(.001)	(.001)
Mother's labor participation rate	.789	.789
	(.0004)	(.0004)
Father's labor participation rate	.854	.854
	(.0004)	(.0004)

Note. Standard deviations within parentheses

Table 9. Child outcomes for second born

	Grades	Years of schooling	Female job	Log earnings	LFP
First-born girl	.33***	.0012	-.0029***	.0088***	.0037***
	(.070)	(.0047)	(.0003)	(.0030)	(.0010)
R2	.1295	.2717	.0020	.2367	.1390
Observations	547,258	636,015	1,268,181	566,716	639,822

Table 10. Family outcomes

	Family size	Divorced	Married	Log earnings mothers	Log earnings fathers	LFP mothers	LFP fathers
First-born girl	-.00076	.00070*	-.00030	-0.0009	-0.00015	.00021	.00010
	(.0013)	(.00042)	(.00054)	(.0018)	(.0017)	(.00060)	(.00056)
R2	.1699	.0672	.4745	.0955	.0552	.0732	.0590
Observations	1,704,446	1,704,442	1,704,446	1,433,451	1,224,021	1,704,446	1,422,954

Table 11. Child outcomes for second-born boy

	Grades	Years of schooling	Female job	Log earnings	LFP
First-born girl	.067	.0018	-0.0052***	.014***	.0025*
	(.096)	(.0065)	(.00043)	(.003)	(.0014)
R2	.1379	.2612	.1638	.3239	.1771
Observations	280,680	327,289	652,081	290,722	329,489

Table 12. Child outcomes for second-born girl

	Grades	Years of schooling	Female job	Log earnings	LFP
First-born girl	.63***	.0007	-0.00022	.0038	.0050***
	(.10)	(.0068)	(.00035)	(.0044)	(.0016)
R2	.1342	.2887	.2394	.1728	.1084
Observations	266,578	308,726	616,100	275,994	310,333

Table 13. Gender and fertility across regions of mother's country birth

	Sweden	Nordic	EU-15	Other European	North America	South America	Africa	Asia
First-born girl =1	-0.035**	.014*	-0.009	0.059***	-0.066	-.0045	.023	.095***
	(.0014)	(.008)	(.0.017)	(.011)	(.045)	(.032)	(.045)	(.017)
R2	.1791	.0928	.1064	.0831	.1520	.2009	.2174	.3405
Observations	1,560,687	74,535	12,154	25,048	2,000	7,098	2,778	19,145

Table 14. Gender and fertility across regions of father's country birth

	Sweden	Nordic	EU-15	Other European	North America	South America	Africa	Asia
First-born girl =1	-0.006	0.03*	0.031	0.077***	0.0184	-0.0137	0.050	0.129***
	(0.0015)	(0.0100)	(0.0154)	(0.0134)	(0.0461)	(0.0279)	(0.0390)	(0.0194)
R2	0.020	0.12	0.11	0.10	0.16	0.24	0.15	0.34
Observations	1,359,217	46,811	16,042	18,161	1,924	5,552	4,107	15,223

Table 15. Child outcomes for second born

	Grades	Years of schooling	Female job	Log earnings	LFP
First-born girl	.61	.030	-0.0009	-.0015	.0045
	(.42)	(.030)	(.002)	(.02)	(.007)
R2	.0972	.2503	0.0022	.2348	.1184
Observations	16,975	17,475	31,330	13,735	17,701

Table 16. Family outcomes

	Family size	Divorced	Married	Log earnings mothers	Log earnings fathers	LFP mothers	LFP fathers
First-born girl	.078***	-.0021	-0.0031	-.0055	-.021	.0078*	.0026
	(.010)	(.0033)	(.0027)	(.015)	(.015)	(.0044)	(.0051)
R2	.1776	.0439	.4674	.0788	.0728	.1338	.1086
Observations	44,193	44,193	44,193	27,619	20,150	44,193	29,578

Table 17. Child outcomes for second born-boy

	Grades	Years of schooling	Female job	Log earnings	LFP
First-born girl	.61	.0032	-.0080***	-.015	-0.001
	(.57)	(.041)	(.007)	(.030)	(.009)
R2	.0946	.2438	.0955	.2745	.1430
Observations	8,883	9,133	16,247	7,085	9.281

Table 18. Child outcomes for second-born girl

	Grades	Years of schooling	Female job	Log earnings	LFP
First-born girl	.36	0.057	.0039*	.016	.011
	(.61)	(.042)	(.0022)	(.031)	(.010)
R2	.1087	.2662	.1727	.2015	.0977
Observations	8,092	8,324	15,083	6,650	8,420