Preferences for a mixed-sex composition of offspring: A multigenerational approach

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Abstract

Parents with two boys or two girls are more likely to have a third child than those with a 'sex mix'. However, little is known on whether these 'mixed-sex preferences' extend beyond the nuclear family. This study leverages the random variation in sex at birth to assess whether the sex of nieces and nephews, in combination with own children, matters for fertility choices. Using three-generational data from the US Panel Study of Income Dynamics (PSID), I show that extended families (including grandparents, their children, and their grandchildren) are collectively more likely to have three or more grandchildren when lacking sex mix, whether the first two grandchildren are siblings or cousins. I explore the pathways for these offspring sex preferences, finding support for a preference for an uninterrupted line of male descendants. This multigenerational approach also contributes a new estimation strategy that causally estimates the effects of family sizes on outcomes beyond fertility.

Keywords: fertility; sex preferences; causal; balanced family; intergenerational transmission; peer effects; parents; siblings; gender; symbolic capital

Introduction

The preference for having at least one boy and one girl is well documented among nuclear families in the United States (US). This preference for a 'sex mix' among offspring is inferred from the higher observed propensity to have a third child if the first two are the same sex (Ben-Porath and Welch 1976; Angrist and Evans 1998; Lundberg 2005). It is, however, unclear whether the manifestation of this 'mixed-sex preference' pertains exclusively to the childbearing couple or is part of a wider web of preferences and fertility behaviours within the extended family (comprising grandparents, their adult children, and their grandchildren).

Other family members' fertility behaviours may increase in saliency as overall fertility decreases and third births within the same household become increasingly rare (De Boca et al. 2005). Moreover, several researchers have found that family members share preferences and fertility behaviours in addition to sharing characteristics due to genetic endowments, family culture, and socio-economic environment, thus making the extended family a reasonable place for the manifestation of preferences for mixed-sex offspring (Axinn et al. 1994; Barber 2000; Bernardi 2003; Murphy 2013; Cools and Hart 2017; Dahlberg and Kolk 2018; Beaujouan and Solaz 2019).

This study proposes a novel methodological approach to this issue by leveraging the random variation in sex at birth of grandchildren and the preference for mixed-sex offspring (Ben-Porath and Welch 1976; Angrist and Evans 1998; Andersson et al. 2006) to test the hypothesis that mixed-sex preferences also manifest within multigenerational families. More specifically, I explore whether there is a causal effect of the sex composition not only of own children (as has been previously established) but also of the combination of their own children with the sexes of their nieces/nephews. I then explore some possible pathways, looking at drivers of mixed-sex preferences in nuclear families, for example symbolic capital and cultural values (Nugent 2013), as well as factors relevant to fertility peer effects, such as age similarity, being sisters, and geographical proximity (Kuziemko 2006).

I use three-generational data from the US Panel Study of Income Dynamics (PSID; 1968–2015) to construct extended families, defined to include grandparents, adult children in the middle generation (siblings), and grandchildren. I show that if the first two grandchildren are the same sex, then the overall extended family is more likely to have three or more grandchildren than if a sex mix is attained within the first two grandchildren. Crucially, this holds true not only for siblings as expected, but also for cousins, showing that fertility decisions are impacted not only by the sex composition of parents' own offspring but by that of their siblings as well.

The finding that mixed-sex preferences do not manifest exclusively within the nuclear family contributes to our understanding of their emergence and actualization in fertility behaviour. For example, the limited number of studies conducted to uncover the reasons behind persistent mixed-sex preferences have pointed to socio-cultural explanations related to symbolic capital and cultural values; these are also applicable to multigenerational families (Hank and Kohler 2000; Mills and Begall 2010; Nugent 2013). Parents may value interactions with cousins of a different sex for their offspring's developmental growth. They may also be affected by social learning differently according to the sex composition of their nieces and nephews (Raley and Bianchi 2006; Lois and Arránz Becker 2013; Baker and Milligan 2016). This study also provides new evidence supporting the importance of transmitting the family name through an intergenerational line of male descendants and not only in the father–son dyad.

Conditional on the availability of three-generational data, this new approach of looking at the sex composition of grandchildren (rather than at natural variations within the nuclear family) also contributes a new method that opens new avenues of research beyond family demography. Indeed, it can identify effects beyond the marginal effect of the third child and is less subject to threats to the exclusion restriction when used in an instrumental variable framework for other outcomes of interest, such as grandparents' early retirement and labour force participation.

Background

Sex preferences for offspring

Extensive demographic research has documented a preference for mixed-sex offspring in the US and Europe. The existence of a preference for at least a son and a daughter relies on the empirical evidence that parents with two boys or two girls are more likely to have a third child than are parents with a boy and a girl (Ben-Porath and Welch 1976; Angrist and Evans 1998; Hank and Kohler 2000; Conley and Glauber 2006; Mills and Begall 2010). This continues to be documented regardless of whether boys are favoured over girls or a girl preference has emerged: when there are two children in a family, a sex mix is always preferred (Lundberg 2005; Andersson et al. 2006; Dahl and Moretti 2008). Moreover, the strength of this mixed-sex preference has not diminished over time, despite a weakening in the 1980s (Pollard and Morgan 2002; Tian and Morgan 2015).

The continuation of childbearing to achieve a preferred sex composition of offspring is often described as the pursuit of a 'balanced family' within a nuclear household (Lundberg 2005; Nugent 2013; Larsen and Thomas 2019). This characterization is a pervasive narrative in many arenas, from online forums to US fertility clinics marketing their sex-selection services (Nugent 2013). However, there is no a priori reason why balancing the sex composition of a family needs to occur solely within the nuclear family. Indeed, the emergence of low fertility reduces the proportion of women in a population with at least two children, and transitions to third births are becoming increasingly rare (Del Boca et al. 2005). This puts limitations on the actualization of mixed-sex preferences within the nuclear family, as highlighted by the fact that using sibling sex composition as an instrumental variable for fertility replicates better in Mexico and Argentina than in a low-fertility context such as Greece (Angrist and Evans 1998; Cruces and Galiani 2007; Daouli et al. 2009). Realizing mixed-sex preferences in the extended family rather than in the nuclear family would afford greater flexibility in the method of achieving a balanced family within the larger pool of grandchildren.

The manifestation of a mixed-sex preference across multiple nuclear families within the same extended family presupposes that family members can and do influence each other's fertility behaviours. This would be in line with previous studies showing that fertility decisions are influenced not only by individual characteristics, but also by the fertility behaviours of other individuals in their sphere of social influence (Coale and Watkins 1986; Bernardi and Klärner 2014). Family members share genetic, environmental, socio-economic, and cultural traits, and they are likely to have high social proximity and considerable length and depth of interactions. These factors make the extended family—comprising grandparents, adult siblings, and grandchildren—a possible locus of the manifestation of family influences on fertility driven by mixed-sex preferences (Axinn et al. 1994; Barber 2000; Kuziemko 2006; Lyngstad and Prskawetz 2010; Kotte and Ludwig 2011; Aassve et al. 2012; Buyukkececi et al. 2020).

Extended family fertility influences

Family members are densely connected in a complex web of influences that may facilitate the realization of mixed-sex preferences, keeping in mind the overall sex distribution of children within the family. Participants in qualitative studies have implicitly or explicitly acknowledged that their decisions to form a family and have children reflect what other members of the extended family expect and do (Bernardi 2003; Keim et al. 2013). Some recent quantitative studies have also lent support to the relevance of more than one source of family influences on fertility, indicating complex extended family influences, including preferences and behaviour from prospective parents' parents and adult siblings, and the presence of nieces and nephews (Balbo and Mills 2011; Kotte and Ludwig 2011; Aassve et al. 2012; Dahlberg and Kolk 2018; Buyukkececi et al. 2020). However, only a limited number of studies have used plausibly causal instrumental variable approaches based on sex composition (Cools and Hart 2017; Hart and Cools 2019; Buyukkececi et al. 2020).

Against the backdrop of multifaceted family influences, the two most studied sources have been the vertical influence, from parents to their adult children, and the horizontal peer effects of siblings. First, offspring tend to replicate their parents' family size, an empirical pattern known as intergenerational transmission of fertility (Murphy 2013; Beaujouan and Solaz 2019). Empirical evidence has shown how the family of origin influences family size preferences, childbearing intentions, and fertility behaviour (Axinn et al. 1994; Barber 2000; Kotte and Ludwig 2011; Cools and Hart 2017; Dahlberg and Kolk 2018). Second, adult siblings have a positive effect on each other's fertility, but with significant heterogeneous effects based on parity, sex, and proxies for strength of social ties (Kuziemko 2006; Lyngstad and Prskawetz 2010; Hart and Cools 2019; Buyukkececi et al. 2020). While it is unclear whether cross-sibling influences increase the total number of children or are limited to timing, they tend to be stronger for first births and also when the siblings are sisters, are close in age, or live in the same state (Kuziemko 2006; Lyngstad and Prskawetz 2010; Balbo and Mills 2011).

Extended family mixed-sex preferences

Despite the demonstrated mixed-sex preference, there are only a few studies that have explored the reasons behind it (Hank and Kohler 2000; Mills and Begall 2010; Nugent 2013). They mostly point to socio-cultural factors that can, in large part, be applicable to extended families as well as nuclear families. For example, older generations, in this case the grandparents, may hold stronger preferences for boys and may exercise social pressure on members of the middle generation differently, according to this preference (Nugent 2013; Bernardi and Klärner 2014). A cultural explanation that gains strength in multigenerational families is the preference for an uninterrupted line of male descendants (Nugent 2013; Larsen and Thomas 2019). The 'family name' is traditionally transmitted through men, and therefore a grandson born to a male child may bear higher importance for the extended family. If this is the case, the presence of a grandson who carries the grandfather's last name could reduce the likelihood of additional grandchildren because the need for an 'heir' is already satisfied.

Another possible explanation for desiring a boy and a girl is the symbolic capital associated with a balanced family (Nugent 2013). The saliency of a diverse sex composition may increase if it is not achieved within one generation. For example, if there are two brothers in the middle generation and the first two grandchildren are boys, there may be an additional desire for a third grandchild in the hope of having at least one girl in the family. In this case, (grand)parents with boys only could have an additional interest in helping to raise a girl, as it would involve a different set of perceived interests, traits, and skills (Jacobsen et al. 1999; Nugent 2013; Larsen and Thomas 2019), while reducing social opportunity costs for the parents who could benefit from additional help from the grandparents (Aassve et al. 2012).

Mixed-sex preferences in the extended family mean that not only does the sex distribution of parents' own children matter but also that of their nieces and nephews. First, parents may desire that their offspring interact with other children of a different sex, be they siblings or cousins, as part of their developmental growth (Kuziemko 2006; Halpern 2011). This would represent a behavioural response to the specific sex composition of children born to siblings in addition to just their number (Hart and Cools 2019). Second, social learning is an important channel for fertility peer effects on first-time parents. Observing a sibling raising two boys or two girls, with the related economies of scale and joint benefits from sex-specific time investments, may positively influence the likelihood of childbearing compared with observing a sibling with one boy and one girl (Raley and Bianchi 2006; Lois and Arránz Becker 2013; Baker and Milligan 2016; Buyukkececi et al. 2020). Belonging to an emotionally loaded set of relationships within the extended family, with frequent contacts or geographical proximity, enhances the saliency of other family members' fertility behaviours, although this is hard to quantify precisely (Bernardi 2003; Kuziemko 2006; Lyngstad and Prskawetz 2010; Hart and Cools 2019).

Data

I use the nationally representative sample of US households provided by the PSID, which has been conducted since 1968. The key advantage of this data set is that adult children of the initial respondents are invited to join the survey once they form their own economically independent households. This allows researchers to identify siblings and cousins nested within three generations (PSID 2018). The offspring of the original PSID respondents are now on average older than the mean age at first birth in the US, although not all will have completed their fertility (NCHS

2018; Lundberg 2020). Following the PSID's own terminology, I use 'dynasty' to indicate a multigenerational family that comprises at least grandparents, a middle generation, and one or more grandchildren, and I use 'family' to indicate a nuclear family within a dynasty.

Using the 1986–2015 family and individual files, I match three-generational dynasties where the original 1968 respondents are the grandparents. Figure 1 details the sample selection process. Following previous studies addressing sibling influences (Lyngstad and Prskawetz 2010; Cools and Hart 2019; Buyukkececi et al. 2020), the analyses include only dynasties with exactly two siblings in the middle generation. This restriction significantly simplifies data construction and modelling but reduces the external validity of the study. Conversely, comparing dynasties with only two people in the middle generation increases internal validity because the analyses include only individuals of at least childbearing age who grew up in families of the same size. Dynasties with half-siblings or adopted children and those with incomplete information on the sex and year of birth of all members in the middle and youngest generations are not included in the analyses. The resulting analytic sample consists of 906 dynasties with at least two grandchildren.

<Figure 1 about here>

Figure 2 provides a schematic representation of the types of dynasties and nuclear families within them in the analytical sample. Panels (a)–(d) represent four possible types of dynasties with different family structures. The grandparents (GP) constitute the original respondent household sampled in 1968, while their two children constitute the middle generation and are siblings to each other (hence S1, S2). The youngest generation (grandchildren, GC) is a combination of grandsons (M) and granddaughters (F), and they can be either siblings or cousins, depending on whether they were born to the same parents. The number of (grand)children can differ between nuclear families and dynasties. For example, in panel (a) the dynasty has two grandchildren in S1's family, while S2's family is childless.

<Figure 2 about here>

A major limitation of using the PSID is that, by construction, it contains only the descendants of the original respondents. This means that subsequent analyses include the complete universe of grandchildren for the grandparents originally observed in the PSID, but the adult siblings in the middle generation may have additional nieces and nephews through their spouses. I use the available information on these in-laws, such as the existence, number, and sex distribution of the spouses' siblings, to check that they do not differ significantly across observed dynasties with or without a sex mix, but unfortunately the crucial information on the sex distribution of in-laws' nieces and nephews is unavailable. As I discuss in the next section, this leads to attenuation bias.

Table 1 presents the distribution of grandchildren's sex at birth within dynasties with at least two grandchildren, as well as the prevalence of different dynasty structures. The sex distribution of the grandchildren is slightly in favour of boys, especially for the first birth. One-quarter of the dynasties have only girls and about a third only boys as their first two grandchildren, while the reminder achieve a sex mix within the first two grandchildren, as expected. Family structures are unevenly represented, with 67 per cent of the dynasties having the first two grandchildren born within the same nuclear family (i.e. the first two grandchildren are siblings rather than cousins; see panels (a) and (b) in Figure 2).

<Table 1 about here>

Table 2 provides additional characteristics for each generation by the sex distribution of the first two grandchildren. In the grandparents' generation, the matriarch of the dynasty was born on average at the very end of the 1940s. The grandchildren's sex distribution and the within-family prevalence of cousins mirror those just presented in Table 1. In the middle generation, the sex distribution of the adult siblings is what randomness of sex at birth would predict, with a quarter being two brothers, a quarter being two sisters, and the remaining half being a brother and a sister. The first sibling in the middle generation was born in the late 1960s to early 1970s on average, while the second was born on average three years later. While at least 60 per cent of the adult siblings are ever married, the first sibling is more likely to be ever married than the second. Although information on the families of siblings' spouses is limited (most notably lacking the number and sex of the couple's other potential nieces and nephews), the available information suggests that, in the case of adult siblings who are married, almost all the spouses have siblings, and they have two siblings on average.

<Table 2 about here>

Methods

This work identifies mixed-sex preferences as manifested in the overall number of grandchildren descended from a set of grandparents by using the sex composition of the first two grandchildren pooled across nuclear families. Because this sex composition is randomly assigned, the estimation strategy is straightforward. I use an indicator for whether the first two grandchildren born within a dynasty are the same sex to predict whether the pool of grandchildren will contain three or more grandchildren. This can be estimated by OLS regression as follows:

$$Y_i = \beta_0 + \beta_1 S_i + \beta_2 F_i + \varepsilon_i \qquad (1)$$

where the subscript i indicates that the measures are at the dynasty level; Y_i is a dummy variable equal to '1' if a dynasty has three or more grandchildren; S_i is a dummy variable equal to '1' if the first two grandchildren born into a dynasty are the same sex; and F_i is an indicator of whether the first two grandchildren are siblings rather than cousins. Note that this method mirrors the first stage of an instrumental variable approach, but the outcome of interest is fertility itself and therefore there is no second stage nor are there any concerns about an exclusion restriction. Given the randomness of the sex composition within the first two grandchildren, I do not include additional control variables in the main model. This approach tests the expression of mixed-sex preferences in the extended family through additional transitions to three or more grandchildren in dynasties with no sex mix. Including family structure accounts for differences between previously identified within-nuclear-family effects (Ben-Porath and Welch 1976; Angrist and Evans 1998) and those that manifest across the entire pool of grandchildren in the observed dynasty.

The key assumption underlying this causal estimation is the randomness with which dynasties either achieve a grandchild sex mix with the first two grandchildren or have grandchildren of the same sex. This holds if sex at birth is random, it is not correlated across siblings, and parents cannot influence the sex of their offspring. These are theoretically reasonable assumptions in developed countries where there is no evidence of severe malnutrition or sex-selective abortion (Almond and Edlund 2008). To corroborate these assumptions empirically, Table 2 compares observable characteristics by generation for dynasties with and without a sex mix. The t-statistics show that there are no statistically significant differences across sex composition for observable characteristics at the grandparental level, grandchild characteristics, middle-generation characteristics, or family structure (including in-laws). Therefore, dynasties in the sample are similar with regard to observable characteristics and, thanks to the randomness of sex at birth, plausibly also on unobservables.

The fact that dynasties with and without a sex mix in the first two grandchildren display statistically indistinguishable characteristics on average supports the assumptions behind this method. However, it does not solve the problem of the lack of information on additional nieces and nephews born to the siblings of the observed adult siblings' spouses. Table 2 shows that couples with and without a sex mix do not marry in families of different sizes on average, but the data do not contain information on whether the in-laws have children and whether they have achieved a sex mix within their side of the family. The unobserved in-laws can be seen as a case of non-compliance with (the lack of) sex mix as some of them may indeed have a boy and a girl. This leads to an attenuation bias towards zero, so the finding of an effect is a harder test of the existence of extended family mixed-sex preference than it would be if the in-laws were also observed.

Family structure plays a key role in shaping fertility behaviours within extended families. Pooling across all grandchildren born in the same grandparental line poses the unique challenge of accounting for different transition rates by parity. In this set-up, a third grandchild could be born within the same nuclear family as the first two, could be a firstborn child with two cousins, or could be a second child with a cousin. Bringing this back to the schematic representation in Figure 2, grandchildren born in dynasties represented in panels (a) and (b) will be either a third birth for sibling 1 or a firstborn for sibling 2. These transition rates will be different from those of families nested in dynasties (c) and (d), where the third grandchild will be a second-born child, regardless of which family experiences the birth. Therefore, it is important to test the role of family structure by separately controlling for an indicator capturing whether the first two grandchildren are siblings or are born to different parents (i.e. they are cousins). The established mixed-sex preference within a nuclear family would manifest in the case of a third sibling, but evidence that more grandchildren are born in dynasties with cousins of the same sex than in mixed-sex cousins would point to the manifestation of extended family mixed-sex preferences and influences.

In addition to identifying an extended family mixed-sex effect on fertility beyond previous studies within nuclear families, the three-generational set-up allows me to test possible explanations for it. For example, I test whether there are grandson-specific preferences driven by more strongly held preferences in the older generation. Given the cultural importance of the transmission of the family name, I look at whether the grandfather (who was an original PSID respondent) has an uninterrupted line of male descendants, through a son and a grandson. I also test the role of the symbolic capital associated with a sex-balanced, three-generational dynasty by looking at the effects of lacking descendant heterogeneity (i.e. two brothers in the middle generation with only boys or two sisters with only girls). In the last set of analyses, I introduce characteristics of the middle generation, such as siblings' closeness in age and being sisters (rather than brothers or mixed composition), which previous literature on fertility peer effects has identified as facilitating social learning. However, it must be noted that this exercise is exploratory, and including these additional covariates may introduce endogeneity; thus these last results should be interpreted with caution.

Results

Table 3 presents the main results of estimating the probability of having three or more grandchildren in a dynasty, based on the sex composition of the first two grandchildren. As expected, if the first two grandchildren are the same sex, there is a positive and significant effect on dynasty fertility overall (column (1)), meaning that the mixed-sex preference also manifests in the extended family. At the same time, family structure plays an important role, as dynasties in which the first two grandchildren come from the same nuclear family are less likely to have three or more grandchildren (column (2)). This indicates that the combined transitions to first and third births are less frequent than transitions to second births, in line with previous demographic evidence.

<Table 3 about here>

What is most noteworthy is that the positive effect of the lack of sex mix on fertility remains significant and unchanged in sign and magnitude when family structure is controlled for (Table 3, column (3)), indicating a separate effect of this exogenous component. The introduction of an interaction between the indicators for family structure and sex composition in column (4) covers all the schematic possibilities presented in Figure 2. The presence of the interaction term does not change the magnitude of the other coefficients and the model remains jointly significant. However, including the interaction term reduces the statistical power due to a reduction in the degrees of freedom, and the interaction is not itself significant. This means that there is no evidence that the main effect of family influences on fertility via the sex composition is driven by a specific nuclear family structure.

The fact that there is no interaction effect between grandchildren being born to the same parents and being of the same sex is relevant because it relates to the central question of whether there is evidence of mixed-sex preference that goes beyond cases where offspring come from the same nuclear family. Table 4 shows the results from the same models but conducted separately on subsamples of dynasties according to whether the first two grandchildren are siblings or cousins and which adult sibling in the middle generation has the third grandchild, if any, in the dynasty. Although separating dynasty structures means that sample sizes for these models are smaller and the estimates are therefore not statistically significant, this exercise is useful in illuminating how mixed-sex preferences and family influences manifest. Table 4, column (1), reports results for mixed-sex preferences within the same nuclear family, as in this dynasty all the grandchildren are born to only one of the siblings in the middle generation. The effect size is comparable to those found in previous studies looking at the propensity of having a third child if the first two are the same sex, confirming the presence of mixed-sex preferences within a nuclear family. Columns (2) and (3) use the dynasty structure of the data to estimate mixed-sex preferences across cousins, separating between-sibling peer effects on a first birth (column (2)) from overall preference for sex mix among cousins (column (3)). Always keeping in consideration the uncertainty around these point estimates, the ordering of the size of effects is in line with theoretical expectation, as within-nuclear-family mixed-sex preferences are stronger than mixed-sex preferences among cousins and fertility peer effects. The results for cousins also support the main finding of mixed-sex preference manifestation at the extended family level as, without coordinated family preferences and influences, there is no reason why both observed families are more likely to have a child when two cousins are the same sex than if the two cousins are both boys or both girls.

<Table 4 about here>

Table 5 explores the role of family structure in more detail by reporting the distribution of grandchildren for dynasties that go on to have at least three grandchildren, according to their family structure and the sex of the first two grandchildren. Column (1) describes the various birth order possibilities for a third grandchild, given different combinations of which sibling has the first two grandchildren. Column (2) represents the family structure types described in the first column as events: event ‘1’ is realized if sibling 1 has a birth and, conversely, event ‘2’ if the birth occurs to sibling 2. This representation highlights that symmetrical family structures (i.e.

sibling 1 has all three grandchildren or sibling 2 has all three) are grouped together. In line with the descriptive statistics presented in Table 1, the third grandchild is a third birth within a nuclear family in about 40 per cent of cases, making these family structures the most prevalent in the sample. However, comparing the prevalence of third births within family structures but across sex composition of the first two grandchildren (columns (3) and (4)) confirms that dynasties with no sex mix have a larger share of third grandchildren for all family structures.

<Table 5 about here>

Motivations for mixed-sex preferences: Sex composition across generations

Table 6 explores possible sources of mixed-sex preferences in extended families, with a focus on three aspects of the intergenerational dimension: grandson preferences, symbolic capital in descendant heterogeneity, and the cultural value of an uninterrupted line of male descendants. The first possible manifestation of intergenerational preferences is through a preference for grandsons driving the results. Indeed, older generations may maintain stronger preferences for boys and may exercise social pressure differentially according to this preference. Substituting the 'same sex' indicator with one in which the first two grandchildren are boys halves the original coefficient, suggesting that there is no preference for grandsons or granddaughters but instead a preference for a sex mix. Concurrently, it is possible that preferences for a sex mix in the pool of grandchildren undergo cohort changes, but a proxy (the grandmother's year of birth) was precisely estimated to be zero, suggesting a limited role of changes in mixed-sex preferences over time. However, the spread of ages in the grandparental generation may not be wide enough to capture changes in preferences that are slow to change (results available on request).

<Table 6 about here>

Second, it is possible that there is a broader intergenerational preference for diversity in the sex composition of descendants overall rather than in just one generation, following the hypothesis that there is symbolic capital associated with a sex-balanced family. Therefore, Table 6 includes a 'no descendant heterogeneity' term to reflect a possible cross-generation interaction in terms of sex composition between the middle generation and the grandchildren. There is no descendant heterogeneity when the middle generation and the grandchildren are all male or all female, and this should increase overall fertility of the dynasty if intergenerational diversity is preferred. Examples of dynasties with no descendant heterogeneity are those with two brothers in the middle generation and grandsons in the youngest generation or those comprising two sisters with granddaughters. The rationale is that in the absence of sex mix in the middle generation, seeking children of a different sex in the youngest generation might be even more salient than in a dynasty with a middle generation comprising a sister and a brother or in a dynasty where the first grandchild is a different sex from their respondent parent. Results in Table 6, columns (3) and (4), do not support the existence of intergenerational mixed-sex preferences, as the combination of sexes in the middle and youngest generations is insignificant across all models. However, it is not possible to fully dismiss this hypothesis because of the aforementioned attenuation bias.

Lastly, a cultural explanation combines conceivable preferences for grandsons and the intergenerational dimension to support a preference for an uninterrupted line of male descendants. The family name is traditionally transmitted through men and therefore a grandson born to a male member of the middle generation might bear higher importance for the extended family. Coefficients in Table 6, columns (5) and (6), are negative and significant, meaning that the presence of a grandson who carries the observed grandfather's last name reduces the likelihood of having additional grandchildren because the need for an heir is already satisfied. It is worth noting that this is the only case where the magnitude of the effect changes when controlling for family structure (column (6)). This is due to the de facto restriction to dynasties with at least a brother in the middle generation, which increases the collinearity between the variables denoting the line of male descendants and family structure. Therefore, this result should be interpreted with caution, taking into consideration that men tend to have children later in life than women (see also Rupert and Zanella 2018).

Fertility peer effects: Characteristics within the middle generation

Table 7 reports results from models including characteristics of the middle generation; these characteristics are expected to shape fertility based on fertility peer effects, as adult siblings in the middle generations are the ones making the childbearing decisions. Although these characteristics can be informative for exploring the mechanisms of mixed-sex preference manifestation, it is important to note that including them may introduce bias if they are influenced by offspring sex composition. Therefore, these results do not necessarily have a causal interpretation. The main takeaway from the table remains that the primary result—the lack of sex mix in the first two grandchildren positively affecting the number of grandchildren in the overall dynasty—remains unchanged.

<Table 7 about here>

Table 7, column (1), shows that the two siblings in the middle both being men is negatively associated with the dynasty having three or more grandchildren. This is in line with the fact that men tend to have children later, thus influencing the timing of their parents becoming grandparents (Rupert and Zanella 2018). It is therefore possible that compared with dynasties with daughters or a mixed-sex sibling composition, having two sons in the middle generation reduces the probability of having three or more grandchildren because the childbearing time window extends to later ages for men and they may not have completed their fertility. Moreover, we would expect sisters more often to influence each other's childbearing positively (Kumzienko 2006; Lyngstad and Prskawetz 2010), but Table 7, column (2), shows that this is not the case.

Following a similar reasoning, Table 7, column (3), also includes a dummy for whether siblings are less than four years apart in age, but this variable does not seem to play a role in the overall fertility of the dynasty, contrary to the expectation that social learning occurs more for siblings who are closer in age (Kumzienko 2006). Conversely, as we would expect from positive correlations between fertility and marriage in this sample, the coefficient on siblings in the middle generation being ever married is positive and significant. The PSID does not include measurements of cohabitation throughout the period, so whether an individual has ever been married is used as a rough proxy for the middle generation being in a union during their childbearing years. This finding is thus in line with the demographic intuition that being in a union increases the likelihood of childbearing.

Extended family ties

The higher propensity to have a third grandchild in dynasties where the first two are the same sex indicates a preference for sex mix, but it does not identify the sources of such preferences. Previous studies have suggested that both the middle and older generations play a role in shaping fertility. Disentangling the two is beyond the scope of this paper, but I did conduct some data exploration on the availability of grandparents and their geographical proximity to contextualize my findings.

First, having living grandparents can diminish the social opportunity costs of having an additional child, but not enough grandparental deaths occurred between the births of different grandchildren to identify discernible patterns between dynasties in which the grandparents were alive and those where they were not. However, it is not theoretically clear whether the death of a grandparent makes some theoretical mechanisms, such as the cultural desire for a male heir, more or less salient.

Second, family members who live geographically closer could exert more influence on each other. Members of the observed extended family (excluding in-laws, for whom this information is not available) tend to live in the same geographical area. At the last survey, in 2015, slightly more than 7 per cent of older siblings in this analytic sample did not live in the same US state as their mothers and the corresponding figure for younger siblings was slightly below 7 per cent. At the same time, 11.4 per cent of siblings did not live in the same state as each other, indicating some overlap within these two groups. This geographical proximity of the majority of the sample suggests that family members had the opportunity to be connected with each other, although the PSID does not contain any measures of frequency and depth of contact that could be used to quantify the relationships.

Lastly, Table A2 in the Appendix shows that the sex of the first grandchild alone does not predict additional grandchildren, confirming a mixed-sex preference rather than a preference for a specific sex, as previously shown. This addresses the concern that a preference for sons might lead families with a firstborn daughter to have more children overall (Dahl and Moretti 2008). The main results are also robust to alternative specifications of the sample, such as including only dynasties where there are no missing father IDs (Table A3 in the Appendix) or excluding cases where cousins were born within a year of each other and therefore the two siblings may have been trying to conceive at around the same time. Unfortunately, limited availability of information on the children born to spouses' siblings does not allow the inclusion of nieces and nephews born to in-laws; it allows us to follow only the descendants of the original respondents for which the full pool of grandchildren is observed.

Discussion and conclusion

This paper builds on the well-known preference for mixed-sex offspring and suggests that it manifests also in the pool of grandchildren descending from common grandparents. By constructing three-generational dynasties including the original PSID respondents, their children, and their grandchildren, I show that dynasties with no sex mix in the two oldest grandchildren are more likely to have three or more grandchildren than dynasties in which the first two grandchildren are different sexes, even if the two types of dynasties are otherwise similar on average. A main contribution of this paper is to look at mixed-sex preferences, in cases where the first two grandchildren are born to the same parents vs where they are cousins, and also by the distribution of grandchildren across adult siblings' nuclear families.

The estimates of the likelihood that a dynasty has three or more grandchildren are remarkably similar for dynasties where the first two grandchildren are siblings and for those where they are cousins. These estimates are comparable to results from previous studies that have estimated the propensity to have a third child within the same nuclear family to be about 6 percentage points higher when the first- and second-born children are the same sex than when they are different sexes.

There are several factors that could be contributing to this finding. The first is that progression to an additional birth depends on family structure and parity. While we would expect parents to place more emphasis on the sex composition of their own children than that of their nieces and nephews, dynasties where the first two grandchildren are cousins by definition contain two adult siblings who have proven to be able and willing to have children. Transitions to a second birth within a nuclear family are easier to achieve than a third birth within the same nuclear family, especially in a context of lower fertility compared with that of the generations studied for the initial identification of mixed-sex preferences (Ben-Porath and Welch 1976).

Yet, transitions to a third grandchild occur disproportionally in dynasties with no sex mix in the first two grandchildren in all family structures, highlighting the manifestation of mixed-sex preferences despite different parity progression ratios. For example, in dynasties where all three grandchildren come from one nuclear family, more than 60 per cent do not achieve a sex mix within the first two. This 40:60 split between those with two grandchildren of mixed sex vs the same sex is similar to those dynasties where the third grandchild is born to the previously childless adult sibling. Therefore, while nuclear family structures within dynasties affect the probability of having three or more grandchildren, there is no specific distribution of grandchildren driving the results.

The second factor explaining the similarity of the cousin and sibling estimates is extended family influences per se. Family influences are a complex web, coming both from parents and from adult siblings, and they are not empirically distinguishable by source but, rather, interact and reinforce each other (Bernardi 2003; Aassve et al. 2013). For example, it is not necessary to assume that grandparents exercise a strong social pressure to impose their mixed-sex preference for them to play a role. Indeed, they could be acting as facilitators of family interactions between nuclear families (from shared meals and events to joint babysitting), thus increasing the saliency of the sex composition of their nieces and nephews for their childbearing-aged children. The higher fertility in dynasties with no sex mix in the first two grandchildren can then suggest a desire for interaction with children of different sexes, be they siblings or cousins, as part of the formative process, consistent with the view that siblings adopt behaviours that support sharing common experiences for themselves and for similarly aged cousins (Kumzienko 2006). Common measures from the peer effects literature, such as similarity in age or having two sisters in the middle generation, do not play a role in sustaining mixed-sex preferences in the dynasty, but it is possible that more detailed data on geographical proximity and frequency of contacts could illuminate this pathway.

There is, instead, support for mechanisms linked to why mixed-sex preferences arise. The psychological and sociological origins of offspring sex preferences are still being studied, but I test the cultural explanation based on patrilinear family name inheritance and the symbolic capital deriving from a balanced family because they may be especially relevant in a multigenerational setting. I find no support for the symbolic capital of a balanced extended family, but my results support the existence of a preference for an uninterrupted line of men from the grandfather to the grandson; those dynasties where this is fulfilled within the first two grandchildren are less likely to have additional grandchildren than those where there is no male heir. The two caveats to this result are that men tend to have children later (Rupert and Zanella 2018) and that women in the middle generation may be facing similar pressure from their husband's family if the in-laws do not have a male heir, but these are not observable with these data.

Third, it is difficult to produce exact point estimates and quantify the difference between sibling and cousin estimates because of the small sample size and the attenuation bias due to the lack of information on in-laws. Indeed, using three generations comes with some limitations. The most evident is the constraint on data choice, the PSID being one of the very few data sets containing three generations, especially in the US context. The PSID follows descendants of the original respondents, so little is known about the other side of the extended family. While access to data of this type would constitute an important addition to the present study, concerns are mitigated by the fact that the non-surveyed side of the extended family is comparable across the sex distribution of the observed grandchildren to the observable in-laws' characteristics, such as the number and sex of the partner's siblings, and there is no theoretical reason why the in-laws should be systematically different by the observed sex composition of grandchildren. Moreover, the incomplete compliance due to the unobserved sex composition of nieces and nephews in the children of a spouse's siblings leads to attenuation bias. Therefore, my significant finding of mixed-sex preferences in the observed dynasty is, if anything, a lower bound for an even stronger effect.

Another data-related limitation is that once attrition and childlessness are taken into account, the sample size does not allow for additional stratifications besides the ones shown without coming across the problem of small cell sizes. This is particularly evident for the geographical distribution of the extended family members, as most live close to their family of origin. Therefore, separating those adult siblings who live close to their parents, those who live close to each other, and those who live far from both does not yield enough variation. Similarly, grandparental death occurring between the first two grandchildren or after the first two but before the third grandchild each amounts to less than 1 per cent of grandmothers. The low prevalence of grandparental death around the time of childbirth does not make it possible to investigate the role of exogenous reduction of grandparents' availability to support the middle generation.

Finally, the restriction to dynasties in which the middle generation comprises two (and only two) siblings reduces the external validity of this study. There are reasons to believe that as the number of adult siblings in the middle generation increases, so does the probability that dynasties will have three or more grandchildren: first, because of the larger number of people who could experience childbearing and, second, because third births increasingly occur primarily among individuals coming from larger families (Beaujouan and Solaz 2019). However, the case of only children in the middle generation is less clear-cut and could go either way, depending on the strength with which mixed-sex preferences are held and on the sources of the family influences on fertility.

In light of these data limitations, future research should make use of registry data from other contexts and with larger sample sizes, where it is increasingly possible to link three generations and different sides of the extended family. The increased power from more observations would allow for stratification beyond the results presented in this study. For example, such data could help to isolate the effects of grandparents and adult siblings in cases when their influence on fertility choices is lower, through either geographical distance or death. Moreover, it could be possible to ascertain the role of socio-economic status and whether there is a dominant side of the extended family when it comes to offspring preferences. This could also contribute to the under-studied field of why mixed-sex preferences exist in the first place.

Lastly, this paper also makes an important methodological contribution that can be used to study outcomes other than fertility. Using a natural experiment originally used only within the nuclear family, it extends the applicability of this method in several ways. The method is more applicable to low-fertility contexts, where higher parity births are becoming less common (Del Boca et al. 2005; Daouli et al. 2009) but there is no clear prevailing norm on the number of grandchildren. Indeed, previous studies using the sex composition of own children as an instrumental variable for additional fertility have been able to identify the marginal effect of a third child only in a nuclear family but not in the case when the third birth is a cousin.

This empirical approach with multigenerational data also opens new estimation avenues for investments in children's human capital, parental employment, and labour force participation in the grandparents' generation, an area of growing interest due to population ageing. A natural extension would be to use the results obtained so far as the basis for an intergenerational instrumental variable. By limiting the analyses to nuclear families, it is possible that sex-specific returns to scale could make having two children of the same sex directly affect parents' outcomes, thus threatening the exclusion restriction. By locating the treatment at the level of the extended family rather than the nuclear family, the causal framework proposed in this work can be used as an instrument that is less subject to such issues. The models presented here pass the heuristic test for a non-weak instrument when family structure is accounted for and therefore lend themselves to studying, for example, the effect of more grandchildren on grandparents' early retirement or participation in the labour force using an alternative instrument that is less subject to exclusion restriction threats.

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Appendix

Table A1 Descriptive statistics for sex distribution, age, and marital status of family members by number of grandchildren present in the dynasty, United States

	(1) Dynasties with two or less grandchildren		(2) Dynasties with three or more grandchildren		
	Mean	SD	Mean	SD	t-stat
Grandmother's birth year	1956.3***	10.57	1948.1	12.29	14.492
Middle generation					
Sibling 1 birth year	1980.1***	11.32	1968.3	13.22	21.066
Sibling 2 birth year	1982.7***	11.39	1971.6	12.93	19.692
Sibling 1 ever married	0.264***	0.441	0.794	0.405	−25.932
Sibling 2 ever married	0.177***	0.382	0.726	0.446	−29.010
Brothers	0.269***	0.444	0.188	0.391	3.989
Sisters	0.214**	0.410	0.267	0.443	−2.677
Mixed-sex	0.516	0.500	0.545	0.498	−1.191
Sibling age difference	2.554***	4.462	3.358	4.996	−3.680
N	1,681		606		2,287

*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Notes: First and third columns of data show mean coefficients; second and fourth columns show standard deviations (SD); and last column shows t-statistics. This table reports observable characteristics for dynasties based on the number of grandchildren. As would be expected, members of dynasties with three or more grandchildren are, on average, older (in both the oldest and middle generations) than members of dynasties that do not meet the inclusion criteria because they have two grandchildren or less. Both siblings are also more likely to be ever married in dynasties with three or more grandchildren. In half of the dynasties the middle generation is composed of a brother and a sister regardless of the number of children.

Source: Panel Study of Income Dynamics, United States, 1968–2015.

Table A2 Effect of the sex of the first grandchild on having additional grandchildren, United States

	Dependent variable: More than one grandchild		
	(1)	(2)	(3)
Grandson	−0.0264 (0.0251)	–	–
No descendant heterogeneity	–	−0.0368 (0.0280)	–
Line of male descendants	–	–	−0.0437 (0.0278)
Constant	0.765*** (0.188)	0.760*** (0.0146)	0.762*** (0.0146)
Observations	1,213	1,213	1,213
R-squared	0.001	0.001	0.002

*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Notes: Differently from all other results, this table focuses on the sex of the first grandchild only, therefore the sample consists of dynasties with at least one grandchild. 'No descendant heterogeneity' is equal to '1' if the middle generation and the grandchild are all of the same sex: for example, brothers with a grandson or sisters with a granddaughter. 'Line of male descendants' is equal to '1' if the oldest grandchild is a boy and is born to a man in the middle generation (i.e. he shares the original PSID respondent's last name). Standard errors in parentheses.

Source: As for Table A1.

Table A3 Effect of no sex mix in pool of grandchildren on dynasty fertility, for subsample of dynasties with no missing father IDs, United States

	Dependent variable: Dynasty has three or more grandchildren			
Two oldest GC are same sex	0.0926**	–	0.0835**	0.0949
	(0.0362)		(0.0357)	(0.0622)
Two oldest GC have same parent	–	−0.188***	−0.183***	−0.173***
		(0.0376)	(0.0375)	(0.0578)
Interaction: same parent × same sex	–	–	–	−0.0170
				(0.0760)
Constant	0.611***	0.788***	0.738***	0.731***
	(0.0272)	(0.0306)	(0.0372)	(0.0481)
Observations	686	686	686	686
R-squared	0.009	0.035	0.043	0.043

*** p<0.01, ** p<0.05, * p<0.10.

Notes: GC stands for grandchildren. Standard errors in parentheses.

Source: As for Table A1.

References

Aassve, Arnstein, Elena Meroni, and Chiara Pronzato. 2012. Grandparenting and Childbearing in the Extended Family, *European Journal of Population / Revue Européenne de Démographie* 28 (4): 499–518. https://doi.org/10.1007/s10680-012-9273-2.

Almond, Douglas, and Lena Edlund. 2008. Son-Biased Sex Ratios in the 2000 United States Census, *PNAS* 105 (15): 5681–82.

Andersson, Gunnar, Karsten Hank, Marit Ronsen, and Andres Vikat. 2006. Gendering Family Composition: Sex Preferences for Children and Childbearing Behavior in the Nordic Countries, *Demography* 43 (2): 255–67. https://doi.org/10.1353/dem.2006.0010.

Angrist, Joshua, and William Evans. 1998. Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size, *The American Economic Review* 88 (3): 450–77. https://doi.org/10.3386/w5778.

Axinn, William G., Marin E. Clarkberg, and Arland Thornton. 1994. Family Influences on Family Size Preferences, *Demography* 31 (1): 65. https://doi.org/10.2307/2061908.

Baker, Michael, and Kevin Milligan. 2016. Boy-Girl Differences in Parental Time Investments: Evidence from Three Countries, *Journal of Human Capital* 10 (4): 399–441. https://doi.org/10.1086/688899.

Balbo, Nicoletta, and Melinda Mills. 2011. The Influence of the Family Network on the Realisation of Fertility Intentions, *Vienna Yearbook of Population Research* 9: 179–205.

Barber, Jennifer S. 2000. Intergenerational Influences on the Entry into Parenthood: Mothers' Preferences for Family and Nonfamily Behaviors, *Social Forces* 79 (1): 319–48.

Beaujouan, Eva, and Anne Solaz. 2019. Is the Family Size of Parents and Children Still Related? Revisiting the Cross-Generational Relationship Over the Last Century, *Demography* 56 (2): 595–619. https://doi.org/10.1007/s13524-019-00767-5.

Ben-Porath, Yoram, and Finis Welch. 1976. Do Sex Preferences Really Matter?*, *The Quarterly Journal of Economics* 90 (2): 285–307. https://doi.org/10.2307/1884631.

Bernardi, Laura. 2003. Channels of Social Influence on Reproduction, *Population Research and Policy Review* 22 (5/6): 427–555. https://doi.org/10.1023/B:POPU.0000020892.15221.44.

Bernardi, Laura, and Andreas Klärner. 2014. Social Networks and Fertility, *Demographic Research* S16 (22): 641–70. https://doi.org/10.4054/DemRes.2014.30.22.

Buyukkececi, Zafer, Thomas Leopold, Ruben van Gaalen, and Henriette Engelhardt. 2020. Family, Firms, and Fertility: A Study of Social Interaction Effects, *Demography* 57 (1): 243–66. https://doi.org/10.1007/s13524-019-00841-y.

Coale, Ansley, and Susan Watkins. 1986. Chapter 11 ("Conclusions"), In *The Decline of Fertility in Europe*, 420–49. Princeton University Press.

Conley, Dalton, and Rebecca Glauber. 2006. Parental Educational Investment and Children's Academic Risk: Estimates of the Impact of Sibship Size and Birth Order from Exogenous Variation in Fertility, *Journal of Human Resources* XLI (4): 722–37. https://doi.org/10.3368/jhr.XLI.4.722.

Cools, Sara, and Rannveig Kaldager Hart. 2017. The Effect of Childhood Family Size on Fertility in Adulthood: New Evidence From IV Estimation, *Demography* 54 (1): 23–44. https://doi.org/10.1007/s13524-016-0537-z.

Cruces, Guillermo, and Sebastian Galiani. 2007. Fertility and Female Labor Supply in Latin America: New Causal Evidence, *Labour Economics* 14 (3): 565–73. https://doi.org/10.1016/j.labeco.2005.10.006.

Dahl, Gordon B., and Enrico Moretti. 2008. The Demand for Sons, *Review of Economic Studies* 75 (4): 1085–1120. https://doi.org/10.1111/j.1467-937X.2008.00514.x.

Dahlberg, Johan, and Martin Kolk. 2018. Explaining Swedish Sibling Similarity in Fertility: Parental Fertility Behavior vs. Social Background, *Demographic Research* 39 (32): 883–96. https://doi.org/10.4054/DemRes.2018.39.32.

Daouli, Joan, Michael Demoussis, and Nicholas Giannakopoulos. 2009. Sibling-Sex Composition and Its Effects on Fertility and Labor Supply of Greek Mothers, *Economics Letters* 102 (3): 189–91. https://doi.org/10.1016/j.econlet.2009.01.002.

Del Boca, Daniela, Silvia Pasqua, and Chiara Pronzato. 2005. Fertility and Employment in Italy, France, and the UK, *Labour* 19 (s1): 51–77. https://doi.org/10.1111/j.1467-9914.2005.00323.x.

Halpern, Diane F. 2011. *Sex Differences in Cognitive Abilities*. 4th ed. New York: Psychology Press. https://doi.org/10.4324/9781410605290.

Hank, Karsten, and Hans-Peter Kohler. 2000. Gender Preferences for Children in Europe: Empirical Results from 17 FFS Countries, *Demographic Research* 2. https://www.jstor.org/stable/26347999.

Hart, Rannveig, and Sara Cools. 2019. Identifying Interaction Effects Using Random Fertility Shocks, *Demographic Research* 40 (January): 261–78. https://doi.org/10.4054/DemRes.2019.40.10.

Jacobsen, Rune, Henrik Møller, and Gerda Engholm. 1999. Fertility Rates in Denmark in Relation to the Sexes of Preceding Children in the Family, *Human Reproduction* 14 (4): 1127–30. https://doi.org/10.1093/humrep/14.4.1127.

Keim, Sylvia, Andreas Klärner, and Laura Bernardi. 2013. Tie Strength and Family Formation: Which Personal Relationships Are Influential?, *Personal Relationships* 20 (3): 462–78. https://doi.org/10.1111/j.1475-6811.2012.01418.x.

Kotte, Markus, and Volker Ludwig. 2011. Intergenerational Transmission of Fertility Intentions and Behaviour in Germany: The Role of Contagion, *Vienna Yearbook of Population Research* 9: 207–26.

Kuziemko, Ilyana. 2006. Is Having Babies Contagious? Estimating Fertility Peer Effects Between Siblings, *Unpublished Manuscript*, *New Jersey*.

Larsen, Gibby, Ashley Larsen, and Kevin J. A. Thomas. 2019. Adoption: A Strategy to Fulfill Sex Preferences of U.S. Parents, *Journal of Marriage and Family* 81 (2): 531–41. https://doi.org/10.1111/jomf.12541.

Lois, Daniel, and Oliver Arránz Becker. 2014. Is Fertility Contagious? Using Panel Data to Disentangle Mechanisms of Social Network Influences on Fertility Decisions, *Advances in Life Course Research* 21 (September): 123–34. https://doi.org/10.1016/j.alcr.2013.10.001.

Lundberg, Ian. 2020. Does Opportunity Skip Generations? Reassessing Evidence From Sibling and Cousin Correlations, *Demography* 57 (4): 1193-1213. https://doi.org/10.1007/s13524-020-00880-w.

Lundberg, Shelly. 2005. Sons, Daughters, and Parental Behaviour, *Oxford Review of Economic Policy* 21 (3): 340–56. https://doi.org/10.1093/oxrep/gri020.

Lyngstad, Torkild Hovde, and Alexia Prskawetz. 2010. Do Siblings' Fertility Decisions Influence Each Other?, *Demography* 47 (4): 923–34. https://doi.org/10.1007/BF03213733.

Mills, Melinda, and Katia Begall. 2010. Preferences for the Sex-Composition of Children in Europe: A Multilevel Examination of Its Effect on Progression to a Third Child, *Population Studies* 64 (1): 77–95. https://doi.org/10.1080/00324720903497081.

Murphy, Michael. 2013. Cross-National Patterns of Intergenerational Continuities in Childbearing in Developed Countries, *Biodemography and Social Biology* 59 (2): 101–26. https://doi.org/10.1080/19485565.2013.833779.

National Center for Health and Statistics. (2018). Martin, J. A., & Hamilton B.E., & Osterman, M. J. K., & Driscoll, A. K., & Drake, P. Births: Final data for 2017, *National Vital Statistics Reports* 67(8). Hyattsville, MD.

Nugent, Colleen N. 2013. Wanting Mixed-Sex Children: Separate Spheres, Rational Choice, and Symbolic Capital Motivations, *Journal of Marriage and Family* 75 (4): 886–902. https://doi.org/10.1111/jomf.12046.

Pollard, Michael S., and S. Philip Morgan. 2002. Emerging Parental Gender Indifference? Sex Composition of Children and the Third Birth, *American Sociological Review* 67 (4): 600–613.

Panel Study of Income Dynamics. (2018). Public use dataset. Produced and distributed by the Survey Research Center, Institute for Social Research, University of Michigan, Ann Arbor, MI.

Raley, Sara, and Suzanne Bianchi. 2006. Sons, Daughters, and Family Processes: Does Gender of Children Matter?, *Annual Review of Sociology* 32 (1): 401–21. https://doi.org/10.1146/annurev.soc.32.061604.123106.

Rupert, Peter, and Giulio Zanella. 2018. Grandchildren and Their Grandparents' Labor Supply, *Journal of Public Economics* 159 (March): 89–103. https://doi.org/10.1016/j.jpubeco.2017.12.013.

Tian, Felicia F., and S. Philip Morgan. 2015. Gender Composition of Children and the Third Birth in the United States, *Journal of Marriage and Family* 77 (5): 1157–65. https://doi.org/10.1111/jomf.12218.

Table 1 Descriptive statistics for three-generational dynasties with at least two grandchildren: sex distribution of grandchildren and their distribution across nuclear families, United States

	Mean	SD	*N*
First GC is a girl	0.44	0.496	1,213
Second GC is a girl	0.49	0.500	906
Granddaughters: Two oldest GC are girls	0.25	0.435	906
Grandsons: Two oldest GC are boys	0.32	0.465	906
Two oldest GC are same sex	0.57	0.495	906
Two oldest GC are siblings	0.67	0.471	906

Notes: GC refers to grandchildren. The three data columns show mean coefficients, standard deviations (SD), and sample sizes, respectively. Overall, there are 2,287 dynasties with two siblings of childbearing age in the middle generation. Of these, 1,213 (53 per cent) have at least one grandchild, 906 (40 per cent) have two or more grandchildren, and 606 (27 per cent) have three or more grandchildren. Among all the dynasties with two siblings in the middle generation, the mean number of grandchildren is 1.52. Table A1 in the Appendix reports characteristics of dynasties by number of grandchildren, comparing dynasties with three or more grandchildren with dynasties that are not eligible because they have no grandchildren or only one grandchild.

Source: Panel Study of Income Dynamics, United States, 1968–2015.

Table 2 Balancing tests comparing observable characteristics of dynasties with at least two grandchildren: first two grandchildren of the same sex vs first two grandchildren of different sexes, United States

	(1) First two GC are the same sex		(2) First two GC are different sexes		
	Mean	SD	Mean	SD	t-stat
Oldest and youngest generations					
Grandmother's birth year	1949.3	12.57	1949.0	11.80	−0.308
First GC is a girl	0.44	0.498	0.45	0.498	0.166
Two oldest GC are siblings	0.65	0.477	0.70	0.463	1.220
Middle generation					
Brothers	0.24	0.427	0.20	0.399	−1.471
Sisters	0.25	0.433	0.26	0.440	0.394
Mixed-sex	0.51	0.500	0.54	0.499	0.877
Sibling 1's birth year	1969.5	13.64	1970.3	12.78	0.941
Sibling 2's birth year	1972.9	13.58	1973.4	12.86	0.567
Sibling age difference	3.42	5.22	3.09	4.618	−0.999
Sibling 1 ever married	0.74	0.441	0.79	0.410	1.768
Sibling 2 ever married	0.64	0.479	0.61	0.497	−0.865
N	516		390		906
In-laws					
Sibling 1's spouse has siblings	0.95	0.215	0.95	0.223	−0.184
Sibling 2's spouse has siblings	0.96	0.206	0.96	0.201	0.120
Sibling 1's spouse: number of siblings	2.03	1.742	2.13	1.945	0.522

Sibling 2's spouse: number of siblings	1.95	2.194	2.19	2.096	0.988
N	306		258		564

*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Notes: GC refers to grandchildren. First and third columns show means and proportions; second and fourth columns show standard deviations; and last column shows t-statistics.

Source: As for Table 1.

Table 3 Effect of no sex mix in pool of grandchildren on dynasty fertility, United States

	Dependent Variable: Dynasty has three or more grandchildren			
	(1)	(2)	(3)	(4)
Two oldest GC are same sex	0.069**	–	0.062**	0.065
	(0.0317)		(0.0312)	(0.0546)
Two oldest GC have same parent (are siblings)	–	−0.192***	−0.190***	−0.187***
		(0.0328)	(0.0328)	(0.0508)
Interaction: same parent × same sex	–	–	–	−0.005
				(0.0665)
Observations	906	906	906	906
R-squared	0.005	0.037	0.041	0.041

*** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Notes: GC stands for grandchildren. Standard errors in parentheses. The sample size is reported as number of dynasties rather than individuals within the dynasties.

Source: As for Table 1.

Table 4 Effect of no sex mix in pool of grandchildren on dynasty fertility, separating mixed-sex preferences within the same nuclear family and across cousins, indicating parity of the third grandchild, United States

Dependent variable: Dynasty has three or more grandchildren			
	(1) Two oldest GC are siblings: Third GC born into same nuclear family (parity 3)	(2) Two oldest GC are siblings: Third GC is a cousin (parity 1)	(3) Two oldest GC are cousins (parity 2)
Two oldest GC are same sex	0.067 (0.0473)	0.058 (0.0492)	0.065 (0.0478)
Constant	0.421*** (0.0351)	0.350*** (0.0362)	0.752*** (0.0370)
Observations	448	393	301
R-squared	0.004	0.004	0.006

*** *p*<0.01, ** *p*<0.05, * *p*<0.10.

Notes: GC stands for grandchildren. Standard errors in parentheses. Column (1) includes dynasties where the first three grandchildren are all born within the same nuclear family, indicating mixed-sex preferences within the same family. Column (2) includes dynasties where the first two grandchildren are siblings, but the third one is a cousin born by the previously childless adult sibling in the middle generation, indicating potential for between-sibling peer effects. Column (3) includes dynasties where the first two grandchildren are cousins, and therefore the preference for sex mix among cousins is manifested with a child of parity two for either one of the adult siblings in the middle generation.

Source: As for Table 1.

Table 5 Distribution of grandchildren by sex composition and family structure, for dynasties with at least three grandchildren, United States

(1) Family structure of third births	(2) Distribution of who has GC	(3) Two oldest GC are different sex (row %)	(4) Two oldest GC are same sex (row %)	(5) Total (column %)
Third GC is a third birth	{1,1,1}, {2,2,2}	95 (38.5)	152 (61.5)	247 (41.4)
Third GC is a first birth	{1,1,2}, {2,2,1}	64 (38.1)	104 (61.9)	168 (28.2)
Third GC is a second birth	{1,2,1}, {2,1,2} {1,2,2}, {2,1,1}	83 (45.8)	98 (54.1)	181 (30.4)
Totals		242 (40.6)	354 (59.4)	596 (100.0)

Notes: GC stands for grandchildren. Column (1) describes the family structure for the first three grandchildren; in the first and second rows the first two grandchildren are siblings (i.e. born to the same parents). Dynasties where the first two children are cousins are in the third row. Column (2) shows all eight possible family structures for the first three grandchildren. ‘1’ indicates that the birth occurred to sibling 1, and ‘2’ indicates a birth to sibling 2. For example, {1,1,2} means that sibling 1 has the first two grandchildren and sibling 2 has the third grandchild.

Source: As for Table 1.

Table 6 Effects on dynasty fertility of sex composition across generations, United States

	Dependent variable: Dynasty has three or more grandchildren					
	(1)	(2)	(3)	(4)	(5)	(6)
Grandsons	0.039 (0.0338)	0.027 (0.0333)	–	–	–	–
No descendant heterogeneity	–	–	−0.054 (0.0424)	−0.051 (0.0416)	–	–
Line of male descendants	–	–	–	–	−0.068** (0.0327)	−0.088*** (0.0322)
Two oldest GC born to same parent	–	−0.191*** (0.0328)	–	−0.192*** (0.0328)	–	−0.202*** (0.0328)
Constant	0.650*** (0.0190)	0.781*** (0.0293)	0.671*** (0.0172)	0.799*** (0.0276)	0.687*** (0.0196)	0.829*** (0.0301)
Observations	906	906	906	906	906	906
R-squared	0.001	0.037	0.002	0.038	0.005	0.045

*** p<0.01, ** p<0.05, * p<0.10.

Notes: GC stands for grandchildren. 'Grandsons' is equal to '1' if the first two grandchildren are both boys. 'No descendant heterogeneity' is equal to '1' if the middle generation and the grandchildren are all of the same sex, for example, two brothers with only grandsons or sisters with only granddaughters. 'Line of male descendants' is equal to '1' if there is at least one grandson (in the first two) who is born to a man in the middle generation (i.e. he shares the original PSID respondent's last name). Standard errors in parentheses.

Source: As for Table 1.

Table 7 Effects on dynasty fertility of including characteristics of the middle generation, United States

	Dependent variable: Dynasty has three or more grandchildren				
	(1)	(2)	(3)	(4)	(5)
Two oldest grandchildren are same sex	0.067** (0.0310)	0.062** (0.0312)	0.062** (0.0312)	0.060** (0.0300)	0.066** (0.0299)
Two oldest grandchildren born to same parent	−0.187*** (0.0326)	−0.188*** (0.0328)	−0.188*** (0.0330)	−0.142*** (0.0320)	−0.140*** (0.0319)
Two men in middle generation (brothers)	−0.125*** (0.0370)	–	–	–	−0.133*** (0.0356)
Two women in middle generation (sisters)	–	0.045 (0.0354)	–	–	–
Siblings close in age (less than four years apart)	–	–	0.012 (0.0325)	–	−0.003 (0.0311)
Sibling 1 ever married	–	–	–	0.080** (0.0354)	0.085** (0.0352)
Sibling 2 ever married	–	–	–	0.248*** (0.0317)	0.249*** (0.0315)
Constant	0.777*** (0.0331)	0.741*** (0.0341)	0.745*** (0.0406)	0.506*** (0.0465)	0.527*** (0.0512)
Observations	906	906	906	906	906
R-squared	0.053	0.043	0.041	0.115	0.128

*** p<0.01, ** p<0.05, * p<0.10.

Notes: Standard errors in parentheses.

Source: As for Table 1.

Figures

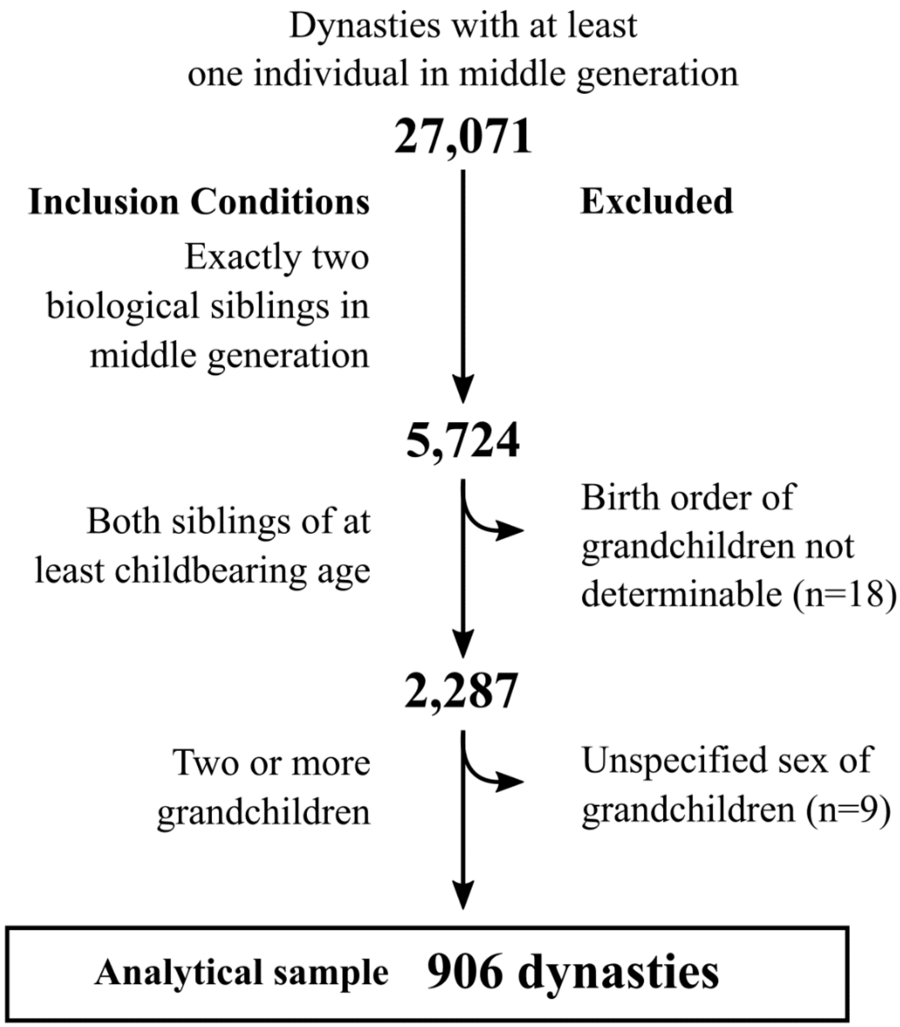

Figure 1 Sample selection

Notes: Starting with dynasties with at least one individual in the middle generation linked to original respondents, the left column describes the conditions for being included in the analytical sample while the right column indicates the number of dynasties excluded because of missing information. The siblings in the middle generation need to both be of childbearing age (≥15 years) in order to have at least the theoretical possibility of childbearing. While not all sibling pairs have completed their fertility, the median and mean ages for younger and older siblings are in the late 30s to early 40s, well above the mean age at first birth in the US, which was 26.6 at the time of last data collection (NCHS 2018). The characteristics of the resulting sample are reported in Table 1 and Table 2.

Source: Panel Study of Income Dynamics, United States, 1968–2015.

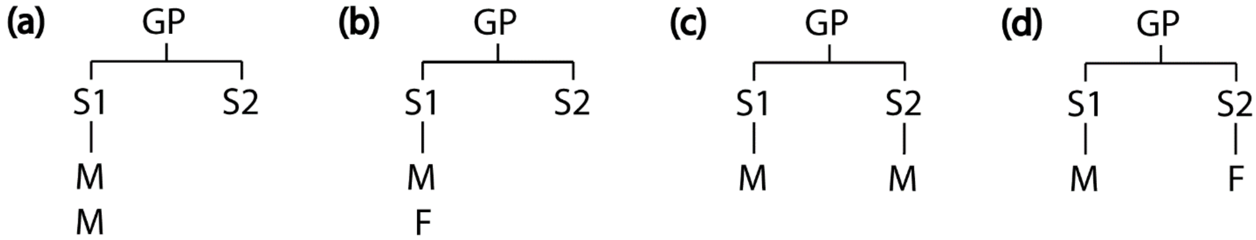

Figure 2 Schematic representations of families within dynasties by distribution of first two grandchildren

Notes: GP refers to grandparents; S1 and S2 refer to a sibling pair; F refers to granddaughters and M to grandsons. This is a schematic representation of possible family and dynasty structures; variations are possible in where grandchildren are distributed within the nuclear families and in the sexes of grandchildren and adult siblings in the middle generation.

Source: Author's representation.