

# **The Sex of Children and the Probability and Timing of Subsequent Births: Comparative Analysis for European Countries<sup>1</sup>**

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### **1. Introduction**

The sex of children one has can affect further fertility because individuals may have certain preferences for having a child of a particular sex. From the theoretical point of view there exist reasons that speak in favor of having both the preference for girls and for boys. Existing research, however, suggests that the preference for having children of a particular sex may depend on the institutional setting, and particularly the stage of country's economic development, related state support for the elderly, women's labor market participation, gender equality and the prevailing gender norms. Yet, up to date empirical literature on the sex preferences among Western societies is rather modest and mostly relates to North America (e.g. Blau et al., 2020; Yamaguchi & Ferguson, 1995) and selected European countries (e.g. Andersson et al., 2006; Hank & Kohler, 2000; Mills & Begall, 2010; Myck et al., 2021).

With this paper we add to the existing research on the topic in several respects. First, we examine how having children of certain sex affects the fertility, meaning that we focus on births rather than on fertility intentions and declared preferences towards children's sex. Second, we provide a comparative analysis for 11 European countries using consistent methodology and harmonized data coming from Harmonized Histories dataset. Third, in contrast to the existing studies for Europe we focus not only on the sex composition of the two first children but also on the sex of the first child, which in European context of low fertility is an important distinction. We also disentangle between young and old cohorts to investigate whether there was a change in the preference for children's sex. Finally, by applying mixture cure models that allow us to distinguish between the impact of the sex of children on the probability of having a next child and its timing, we are able to infer how sex preferences affect one's fertility in terms of the parity progression and in terms of the speed at which this progression takes place.

### **2. Theoretical considerations and literature review**

Existing literature provides several explanations for the preference of having children of a particular sex. According to Hank & Kohler (2000) children of a particular sex are expected to provide certain utilities that fulfill different needs of their parents in their old ages. Having a son is considered useful in an economic sense because boys are perceived as being more able than girls to financially support their parents once they get older. The other reason for a boy preference is that boys continue the family line and carry the family name (Mills & Begall, 2010). Additionally, especially in the case of the dowry systems, daughters could be perceived as an economic burden because after they get married, they are expected to take care of their parents in-law, not their biological parents (Mills & Begall, 2010).

On the other hand, daughters are believed to play an important role in care-connected activities, including taking care of their younger siblings and providing care to their parents when they get old (Mills & Begall, 2010; Myck et al., 2021). Mills & Begall (2010) thus argue that in more developed societies parents should not have preferences for having a son that are driven by an increased future financial support because of the state support system for elderly that is present in these countries. In addition, in developed economies women are becoming more active in the labor market which indicates that daughters are able to provide not only emotional care for their older parents but also the financial support, which is considered especially

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highly valued (Andersson et al., 2006). This becomes even more important if we take into account the fact that on average women have longer life expectancy than men (Blau et al., 2020).

Apart from the described preference for having either a boy or a girl, there is an extensive literature that finds a significant preference for having a mixed-sex offspring. According to Mills & Begall (2010) by having both a son and a daughter parents reduce their uncertainty in old ages because they secure economic, physical and emotional care. Parents may also treat children as their self-actualization, which may explain the preference of having a child of their own sex. Other explanation for a mixed-sex preference refers to homophily hypothesis, which states that people tend to search for and bond with similar others. Thus heterosexual parents will prefer to have a child of their own sex, resulting in a preference of having children of both sexes.

Empirical findings tend to confirm the theoretical considerations and show that a boy preference occurs in less developed countries while in some developed countries this preference has disappeared or even transformed into a girl preference (Adsera & Ferrer, 2020; Blau et al., 2020; Hank & Kohler, 2000; Mills & Begall, 2010). For example, Blau et al. (2020) look at preferences for child's sex among the US natives and immigrants to find out that among individuals coming to the US from countries with relatively low gender equity there is a strong preference towards boys as women whose first child was a girl had a higher chance of further fertility. At the same time they find an opposite pattern for the native U.S. citizens. Blau et al. (2020) also document a change in the preferences towards children's sex among the US natives: around the 1980s the positive effect of having a female first child on fertility has transformed into the negative effect.

Our research complements existing literature in several aspects. First we examine the impact of children's sex on the progression rate to subsequent children for a number of European countries, including both countries from Central and Eastern Europe as well as Western Europe that differ in terms of the prevailing gender norms and perceptions on gender equality. We also disentangle between young and old cohorts to investigate whether there was a change in the preference for children's sex. Finally, we use models that allow us to distinguish between the impact of the sex of children on the probability of having a next child and its timing. Our results thus show whether the sex of children affects one's fertility in terms of the parity or/and in terms of the speed at which the progression takes place.

### 3. Data and methods

We use data coming from Harmonized Histories dataset, which is an international comparative dataset created by the Non-Marital Childbearing Network. The dataset provides marital and fertility histories for around 25 countries worldwide. It has been created based on several country specific datasets, but in most cases it builds on data coming from the first wave of the Generations and Gender Surveys (GGS).

Given the data structure, i.e., retrospective data describing fertility histories, we model the impact of children's sex on the probability and timing of subsequent births using event history analysis. We apply mixture cure model which, as opposed to standard event history models, allows us to disentangle between the probability of (not) experiencing the event of interest and the timing of the event (Amico & Van Keilegom, 2018; Lambert, 2007). The model has been widely used in epidemiological research that examines e.g., the reoccurrence of a disease: because some individuals get cured they will never experience the event of interest and it is possible to study the timing of the reoccurrence for the remaining patients. Formally the model consists of two parts, i.e., the one that models the probability of being cured (i.e., not experiencing the event of interest) and the second one that for the uncured individuals (i.e., those experiencing the event of interest) models that timing of the event occurrence. This is represented by:

$$S(t) = \pi + (1 - \pi) * S_s(t)$$

where  $\pi$  is the proportion of cured,  $(1-\pi)$  is the uncured proportion, and  $S_s(t)$  is the conditional survival function of the susceptible individuals. Since we are interested in: (1) the impact of the sex of the 1<sup>st</sup> child on the probability and timing of the next birth, and (2) the impact of the sex composition of the first 2 children on the probability and timing of the next birth, we define two models, in which the event of interest

is defined as (1) conceiving the second child that results in a live birth, (2) conceiving the third child that results in a live birth, respectively. The censored proportions are thus women who fail to experience the subsequent births. To model the censored proportion we apply logit model and to model the survival function we use a parametric model that draws on lognormal distribution. We censor the observations after the maximum of 200 months, or at the age of 45 for respondents not having a second / third child.

In the analysis we control for the union status, age at first birth (plus the age at second birth in the case of the second model), education level and the number of siblings. We restrict the sample to selected EU countries that are representative of Central and Eastern Europe (Czech Republic, Estonia, Hungary, Lithuania, Poland) as well as Western (Austria, Belgium, France, Germany) and Northern Europe (Norway, Sweden). Following the existing research that finds a change in children's sex preferences in recent years (Blau et al., 2020), we split the samples into younger cohorts, i.e., individuals born after the year 1960, and the older ones.

#### **4. Preliminary findings**

##### **4.1. The sex of the 1st child and the probability and timing of the second birth**

The results of a pooled sample for all countries show that the sex of the first child matters for the probability of not having a second child for young cohorts but not for the older ones. In particular, we find that having the first child that is a female increases the probability of not having the second child, which points towards the preference towards having a girl. Irrespective of the cohort we also find that the sex of the first child does not affect the timing of the second pregnancy.

The results obtained from estimating the models by country groups further show that the preference towards having a girl, that is reflected in a higher probability of not having another child once the first baby is female, is particularly seen in the countries from Central and Eastern Europe but in other European regions. Models estimated by country moreover reveal that uncovered relation is particularly present in Hungary, Estonia and the Czech Republic; for Poland and Lithuania the coefficients are statistically insignificant.

The results reflecting the preference towards having a female child, that leads to a lower probability of having a second child if the first child is a female, that is seen for the young cohorts in CEE countries, are consistent with what is observed in the US and surprisingly we do not find such a relationship for other European countries. Similar trend for Poland and other countries from Eastern Europe (Belarus, Russia and Ukraine) has been recently reported by Myck et al. (2021). Our results add to these findings by showing that the girl preference is also present in other CEE countries and while it is important for whether or not a woman decides to have another child, it does not matter for the speed of when that happens.

##### **4.2. The sex composition of the first two children and the probability and timing of the third birth**

The findings related to the impact of the sex mix of the first two children on the probability and timing of having a third child reveal that, in line with theoretical considerations and previous research, having two children of the same sex decreases the probability of not having a next child. This relation is present both if the first two children are boys and girls. We also show that the relation is robust and present irrespective of the cohort and country groups.

Results by country groups, however, also reveal that in CEE countries the probability of not giving birth to another child is higher when the first two children are girls than when they are boys, which means that women who have boys only are less likely than women that have girls only not to have a next child. This discrepancy is larger among young cohorts and proves that among younger generations in CEE countries there is a prevailing preference towards having a female child.

Finally, the sex composition of the first two children is found to have little impact on the speed of progression to the third birth – irrespective of country and cohort.

## 5. Discussion

While our results reveal that there exists a significant preference towards having a female child among women from younger generations in the countries of Central and Eastern Europe, they also suggest that this preference affects the fertility in terms of the parity progression but not in terms of the speed at which this progression takes place. In other words the sex of the first child / the sex composition of the first two children are important for the probability of having a next child but not for the timing of the subsequent pregnancy.

Such findings have important empirical implications for research that focuses on identifying the impact of having children on e.g., women's careers, and that utilizes information on children's sex for the definition of an instrument that is further used to estimate a causal relation in question. An influential paper that exploits this approach used the sex composition of the first two children as an instrument for the estimation of the impact of having children on men's and women's labor market outcomes (Angrist & Evans, 1998). Our findings show that not only the sex composition of the first two children determines the probability of having a third child but – in some societies – already the sex of the first child matters. Thus, for certain countries, such as the selected CEE countries, already the information on the sex of the first child could potentially be a valid instrument for the identification of the causal effect of children on labor market outcomes. This is especially important given the critics that an instrument proposed by Angrist & Evans (1998) rather than identifying the effect of “having children” identifies the impact of having a third child, which in the context of European societies is a relatively rare event specific to certain socio-economic groups.

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