Educational Gradient in Parental Preference for Girls in the Czech Republic

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1 Introduction

In many societies around the world, parents prefer sons to daughters (e.g. Arnold and Kuo, 1984; Filmer et al., 2009). However, Hank and Kohler (2000), using FFS data, has found evidence for preference for girls in the Czech Republic, Lithuania and Portugal. Andersson et al. (2006, 2007) found preference for girls in Denmark, Norway and Sweden, Fuse (2010) in Ukraine, and Brockmann (2001) in the former German Democratic Republic. Outside Europe, preferences for daughters were observed in various manifestations in the Carribean (Sargent and Harris, 1992; Quinlan, 2006), in Australia (Gray and Evans, 2005), or in some ethnics of Cambodia, Indonesia and Philippines (Arnold and Kuo, 1984; Filmer et al., 2009; Fuse, 2010). The preference for sex (or sex composition) of children is driven by the value of children, which itself is determined by the set of social customs, cultural traditions, and economic roles, mediated through set of inheritance systems, dowry customs, intergenerational insurance systems etc (Filmer et al., 2009). While in modern societies, children often lost their economic value, there are still other values that parents attribute to their children (Hoffman and Hoffman, 1973), and this change might be accompanied by the shift in sex preference (Andersson et al., 2007).

Different means are used to reach the preferred sex composition of children. In some developing countries, preference for sons can be manifested by stark *ex post* agents, like excess still-birth rate and infant mortality among girls, or sex-selective abortion (e.g. Guilmoto, 2012 for Vietnam ;Gupta et al., 2009 for India and China). In Europe, sex preferences are usually manifested by far less drastic *ex ante* means, usually by the *differential stopping*

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behaviour. Basu and De Jong (2010) and Yamaguchi (1989) define the stopping rule of continuing childbearing until reaching the desired number, k, of sons. Hank and Kohler (2000); Andersson et al. (2006, 2007) and Arnold and Kuo (1984) identified more complex stopping rule of having the children of mixed sex. With the decreasing level of fertility, and increase of one-child and two-children families, the stopping behaviour may become more evident in more recent periods (*squeeze effect* of Guilmoto, 2012). And if there is change towards more selective behaviour, than this can be found more intensely among higher educated mothers (Andersson et al., 2007).

2 Data and Method

Analysis for the sex preference is one of the classic exercises in the demographic literature. Over the years, various statistical methods were used for testing the preference: sex ratio, parity progression ratio, OLS regression of birth interval, hazard estimation. In the critical evaluation of the methods, Leung (1988) proposes using hazard estimation to test for sex preferences. Hazard estimation deals with the problem of right censoring, and gives clear and strong evidence of sex preferences among studied societies.

We hypothesize, that with the drop of fertility levels in last two decades, linked with increased fertility control (Sobotka et al., 2008), there has been increasing selectivity in the fertility of second and third birth, that grow 1/ with time; 2/ with the social-economic status of women, measured by educational attainment. Therefore our analysis is birth-order specific, concentrating on the parity progression from first to second child, and from second to third child[1].

We estimate proportional hazards model, with relative risk of having second, or third child. Duration is measured by time since previous birth, censored at 1st January 2008. We explicitly investigate the role of period and mother's education, observing the interaction between education of mother and sex of previous child(ren), and period and sex of previous child(ren).

In this study we apply two distinct stopping rules:

- Couples continue childbearing until reaching balanced sex composition of kids. Following Hank and Kohler (2000); Andersson et al. (2006, 2007) and Arnold and Kuo (1984) we expect higher relative risk of third childbirth among parents of two boys, or two girls, as related to parents of one boy and one girl.

- Couples continue childbearing until reaching desired number of children of preferred sex. In our case the stopping rule will apply to one girl (or one boy), depending on the education of mother.

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[1]There has not been identified any systematic pattern in sex preference among transitions to higher parities.

Apart of other studies that usually use survey data, in this paper we use data from the birth vital statistics of the Czech Statistical Office, i.e. information on all births in 1986-2007 enters into the analysis. The analysis is divided into two parts: First part models risk of having second child as dependent on the sex of the first child; second part models the risk of having third child, as dependent on the sex composition of first two children. All computations were made in R (R Development Core Team, 2011).

All first births in 1986–2007 were linked to second (and third) births of the same mother (disregarding stillbirths and multiple births). Mortality and migration of mothers is neglected, as well as the problem of left-censoring (cases where we know the information about second or third child, but we do not know the information about first and/or second child). We assume that these problems do not affect results of our analysis in a substantive way.

We observe, whether the relative risk of having second and third child is higher for parents of boys or girls. Apart of sex of children we use following control or explanatory variables: highest attained educational level of mother (3 levels[2]), age of woman (<25, 25-29, 30-34, 35-39, 40+), period (1986-1993, 1994-1999, 2000-2007), and marital status (married/not married). All variables are measured at the moment of the previous (first or second) birth. In the tables 2–4 we show just results for sex of children, period and education, nevertheless all models include also controls for age of mother and marital status. Full model results with control variables and *p-values* are given in the Appendix tables. The number of cases and explanatory statistics are displayed at Table 1.

Table 1: Number of births in 1986–2007

Birth order	Number	Boys	Girls	Sex Ratio	Censored
First births	1,131,791	582,659	549,132	1.061	483,330
Second births	648,461	332,528	315,933	1.053	532,773
Third births	115,688	59,359	56,329	1.054	—

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[2]Czech Statistical Office distinguishes in vital statistics four levels of finished education (measured at the time of event — birth): primary education (including unfinished basic education); secondary education without the *maturita* qualification (including vocational training); secondary education with the *maturita* degree; and university education. We merge the two subcategories of secondary education into single one, as our preliminary computations revealed significant similarity across secondary educated women.

3 Results

3.1 Preference for sex of second child

In the first part of analysis we model the risk of having second child as dependent on the sex of the first child. The results, summarised in Table 2, indicate moderate evidence for preference for girls: The relative risk of having second child is higher for mothers of one boy (by 1.4 percent vs. mothers of one girl). Educational gradient is apparent already here, but very small. As apparent from the graph of Kaplan-Meier survival estimator, transition from first to second child is more-or-less similar for all educational categories of women (Figure 1).
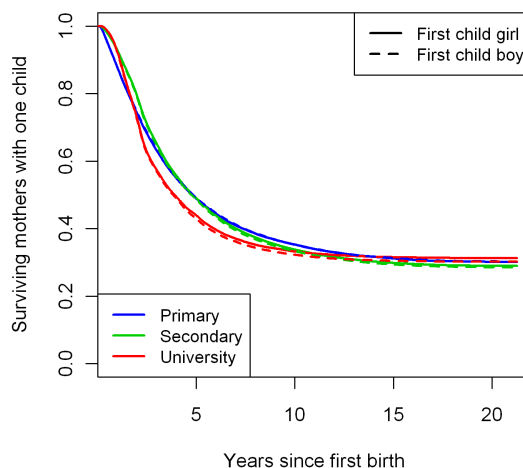

Figure 1: Kaplan-Meier survival estimator of women who stay with one child (as opposed to leaving this stage by having a second child), depending on the sex of first child, by mother's level of education

However, from the relative risks of the Model 2 we learn that there is modestly (by 2–3 percent) increased risk of second childbirth for women of secondary or university education when their first child is a boy. Moreover, this evidence for girls-preference strengthens in the last 25 years: After 2000 we identify clear preference for girls, although not big: Women of secondary and university education have by 3 percent higher risk of having second child if their first child is a boy, manifesting thus small but significant preference for girls.

Table 2: Relative risk of second birth by sex of first child and by education of mother, and period

Education	Model 1	Model 2	Model 3a 1986-93	Model 3b 1994-99	Model 3c 2000-07
First child girl	1	1	1	1	1
First child boy	**1.014**	—	—	—	—
X Primary	—	0.992	0.995	0.990	0.980
X Secondary	—	**1.015**	**1.013**	**1.014**	**1.027**
X University	—	**1.027**	**1.028**	1.022	**1.030**

Note: Values in bold: *p-value*<0.10

3.2 Preference for sex of third child

In the second part of the analysis we focus on the transition from second to third child. First we included all mothers of two children in the model, and found that there is a strong preference for kids of mixed sex, manifested by 19 percent higher risk of having third child for parents of two boys or two girls vs. parents of one boy and one girl (see Figure 2 and results for Model 4 in Table 3). This is with agreement with the prevalent evidence from other countries (Arnold and Kuo, 1984; Hank and Kohler, 2000; Andersson et al., 2006, 2007).
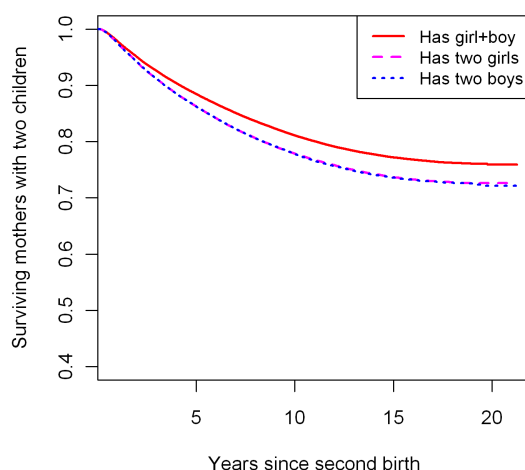

Figure 2: Kaplan-Meier survival estimator of women who stay with two children (or have a third one), depending on the sex of first two children

To identify the sex-preference net of preference for mixed sex offspring,

Table 3: Relative risk of third birth by sex of first and second child (in model 5, only previous children of same sex are included)

	Model 4	Model 5
Boy and girl	1	—
Two girls	**1.193**	1
Two boys	**1.195**	1.002

Note: Values in bold: *p-value*<0.10

Table 4: Relative risk of third birth if the previous two children are boys (vs. girls), by education of mother (only previous children of same sex are included)

Education	Model 5	Model 6	Model 7a 1986-1993	Model 7b 1994-1999	Model 7c 2000-07
Two girls	1	1	1	1	1
Two boys	1.002	—	—	—	—
X Primary	—	0.982	0.984	1.020	**0.925**
X Secondary	—	1.002	1.005	0.995	1.007
X University	—	**1.057**	1.015	1.053	**1.121**

Note: Values in bold: *p-value*<0.10

we have dropped these cases from further modelling, so only mothers of children of same sex are included into Models 5–7. The results (summarised in Table 4) first do not indicate any sex preference when taking all population together (Model 5). But when differentiating between periods and education of mothers, we found that such effect increases with the education of mother, and becomes significant in the most recent period — after 2000 university educated mothers of two boys had by 12 percent higher risk of having third child than university educated mothers of two girls (see Model 7). On the contrary, primary educated women seem to prefer boys [3].

4   Conclusions

The results are in accordance with our hypothesis of increasing preference for girls along period and educational strata. The preference was demonstrated just moderately in case of second child. Because of pronounced two-child

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[3]Figure 3 displays the Kaplan-Meier survival estimator for two distinct periods and three levels of education. It shows, that while before 1993 (and in 1994-1999 the picture is very much similar) there has not been any distinct difference between the mothers of two boys or two girls in respect of transition towards third childbirth, Kaplan-Meier for 2000-2007 shows clear pattern of preference for girls among university educated mothers, and preference for boys among primary educated.
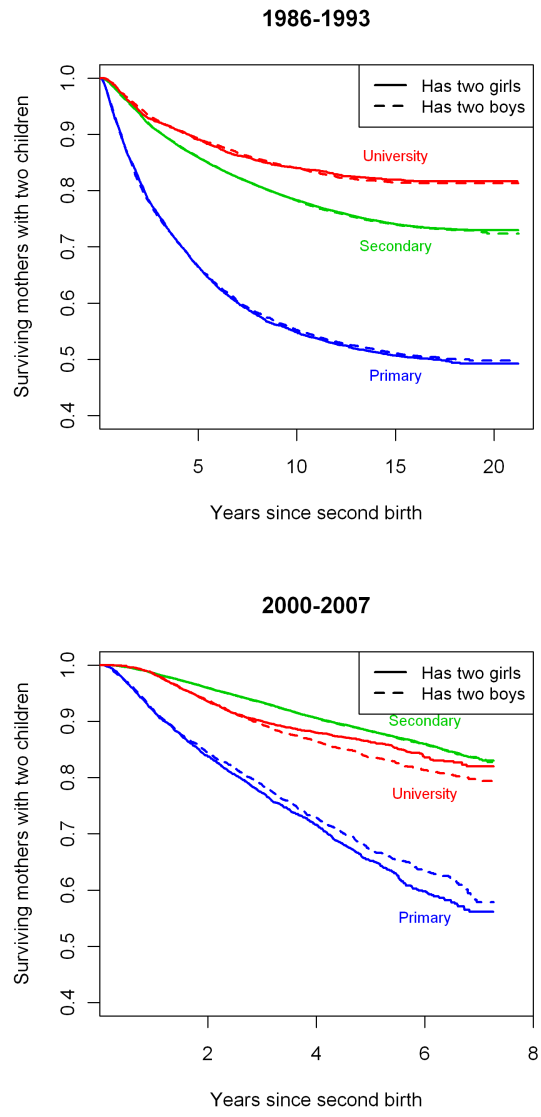
1986-1993

2000-2007

Figure 3: Kaplan-Meier survival estimator of women who stay with two children (or have a third one), depending on the sex of first two children (only children of same sex included) and mother's education and period

model in the Czech society, most women opt for second child anyway, if they had already one, and the relative risks of second childbirth are not affected by the sex of first child in a substantive way. However, even here we identified small but significant preference for girls, both overall, and especially among higher educated women, further increasing towards more recent periods.

We identified much stronger selectivity in the transition from second to third child, when only powerful incentives, among which we might count sex-preference, will push parents for having three children. One of our finding was strong preference for kids of mixed sex. Apart of this we have found evidence for preference for girls, increasing along educational strata, and with more recent periods. Our interpretation of the results is that the spread of fertility control and the drop of fertility intensity in the last two decades led to increasing selectivity among parents, and especially among higher educated mothers. While primary educated mothers show some preference for boys, university educated mothers are more likely to proceed to higher parity when their preferences to have daughters are not yet fulfilled.

5 Discussion

It is the general feeling that people usually prefer sons to daughters. Such judgement is induced by popular articles about missing girls in China and India, citing reports like that of United Nations (2010), or horrific reports about sex selective abortion around Asia (e.g. Guilmoto, 2012; Gupta et al., 2009). However, in fact there are societies which on the contrary seem to prefer girls, not only in most developed countries of Europe and Australia (Hank and Kohler, 2000; Andersson et al., 2006, 2007; Fuse, 2010; Brockmann, 2001; Gray and Evans, 2005), but also in the traditional societies of South-East Asia and of the Carribean (Sargent and Harris, 1992; Quinlan, 2006; Arnold and Kuo, 1984; Filmer et al., 2009; Fuse, 2010). There have been discussed various reason for the differences in sex-preferences for children, like different value of children in different societies (Hank and Kohler, 2000), role of culture (Fuse, 2010), modernization hypothesis (Filmer et al., 2009). Role of welfare system and high female labour-force participation was discussed in respect to changing sex preferences (Brockmann, 2001; Andersson et al., 2006), while longstanding cultural phenomenon was cited as opposing the change (Andersson et al., 2007). We have found an evidence of change towards preference for girls, which has the educational gradient. To see whether this evidence is anecdotal or systematic, research in more countries would be necessary, and we plan to perform similar exercise for Austria.

Acknowledgements

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Appendix table A1: Full results of the models of transition from first to second child (relative risks and p-values)

Variable	Value	Model 1		Model 2		Model 3a		Model 3b		Model 3c	
Age group	-24	1		1		1		1		1	
	25–29	0.779	0.00	0.779	0.00	0.711	0.00	0.787	0.00	0.962	0.00
	30–34	0.490	0.00	0.490	0.00	0.352	0.00	0.424	0.00	0.740	0.00
	35–39	0.173	0.00	0.173	0.00	0.123	0.00	0.147	0.00	0.311	0.00
	40+	0.044	0.00	0.044	0.00	0.025	0.00	0.034	0.00	0.097	0.00
Period	1986–1993	1		1		1986–1993		1994–1999		2000–2007	
	1994–1999	0.902	0.00	0.902	0.00						
	2000–2007	1.074	0.00	1.074	0.00						
Married	No	1		1		1		1		1	
	Yes	1.504	0.00	1.504	0.00	1.446	0.00	1.428	0.00	1.578	0.00
Education	Primary	1		1		1		1		1	
	Secondary	0.891	0.00	0.880	0.00	0.905	0.00	0.865	0.00	0.797	0.00
	University	1.199	0.00	1.178	0.00	1.067	0.00	1.261	0.00	1.310	0.00
First child	Girl	1									
	Boy	1.014	0.00								
Education X First child	Any X Girl			1		1		1		1	
	Primary X Boy			0.992	0.27	0.995	0.62	0.990	0.49	0.980	0.26
	Secondary X Boy			1.015	0.00	1.013	0.00	1.014	0.01	1.027	0.00
	University X Boy			1.027	0.00	1.028	0.03	1.022	0.17	1.030	0.04

Appendix table A2: Full results of the models of transition from second to third child (relative risks and p-values)

Variable	Value	Model 4		Model 5		Model 6		Model 7a		Model 7b		Model 7c	
Age group	-24	1		1		1		1		1		1	
	25–29	0.503	0.00	0.506	0.00	0.506	0.00	0.486	0.00	0.541	0.00	0.534	0.00
	30–34	0.338	0.00	0.337	0.00	0.337	0.00	0.314	0.00	0.302	0.00	0.382	0.00
	35–39	0.201	0.00	0.203	0.00	0.203	0.00	0.134	0.00	0.154	0.00	0.249	0.00
	40+	0.061	0.00	0.067	0.00	0.067	0.00	0.041	0.00	0.081	0.00	0.065	0.00
Period	1986–1993	1		1		1		**1986–1993**		**1994–1999**		**2000–2007**	
	1994–1999	0.972	0.00	0.945	0.00	0.945	0.00						
	2000–2007	1.246	0.00	1.229	0.00	1.229	0.00						
Married	No	1		1		1		1		1		1	
	Yes	0.543	0.00	0.563	0.00	0.563	0.00	0.578	0.00	0.512	0.00	0.577	0.00
Education	Primary	1		1		1		1		1		1	
	Secondary	0.492	0.00	0.504	0.00	0.499	0.00	0.501	0.00	0.503	0.00	0.473	0.00
	University	0.702	0.00	0.704	0.00	0.677	0.00	0.571	0.00	0.705	0.00	0.854	0.00
Previous children	Girl+Boy	1		—									
	Two girls	1.193	0.00	1		only previous children of same sex included							
	Two boys	1.195	0.00	1.002	0.77								
Education X Previous children	Any X Two girls					1		1		1		1	
	Primary X Two boys					0.982	0.36	0.984	0.58	1.020	0.55	0.925	0.06
	Sec. X Two boys					1.002	0.87	1.005	0.75	0.995	0.75	1.007	0.78
	Uni. X Two boys					1.057	0.06	1.015	0.75	1.053	0.32	1.121	0.03