



Hidden consequences of a first-born boy for mothers



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HIGHLIGHTS

- In the US, the UK, Italy and Sweden women whose first child is a boy work less than women with first-born girls.
- Differently from the literature we show that after a first-born boy the probability that women have more children increases.
- The positive impact on fertility of a first-born boy is one of the possible explanations of the lower labor supply of mothers.

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ABSTRACT

Women whose first child is a boy work less than women with first-born girls. After a first-born boy the probability that women have more children increases. Higher fertility is a possible explanation for the lower labor supply of mothers.

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1. Introduction

Women whose first child is a boy are less likely to work in a typical week and they do so for fewer hours than women with first-born girls. We observe this fact in the US, the UK, Italy and Sweden. To our knowledge, this is the first paper documenting the negative effect of a first-born boy on maternal labor supply in advanced economies. Our empirical strategy relies on the random variation in first-child gender. This assumption – whose validity in our data is supported by evidence directly presented in this paper – is quite reasonable since we are considering advanced economies, where both socio-economic and cultural factors are not expected to affect the sex of children at birth. But the real puzzle is why

women in these countries react in this way to the sex of their first child.

It is a puzzle because a large body of evidence for developing countries suggests that if the first-born child is a girl, parents continue to procreate until a son arrives, while they tend to stop otherwise. Therefore, having a first-born boy should give mothers more possibilities to work, not only because of less need to spend time on childcare, but also because during pregnancies mothers typically reduce labor supply (e.g. Jayachandran and Kuziemko, 2011; Chun and Oh, 2002).

One possible solution for this puzzle is to consider that in advanced economies the sex of the first child affects fertility in opposite ways, of which only one is likely to be at work in less-developed economies. Also in advanced countries a first-born girl induces more fertility *within married couples*, because parents continue to procreate until they get a son (the “desire for a son” effect found by Dahl and Moretti, 2008). On the other hand, a first-born girl reduces substantially the stability of a marriage (the “divorce effect” found by Bedard and Dechênes, 2005, and Ananat and Michaels, 2008). The “divorce effect” has an

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Table 1

T and *F* statistics of a regression of first child gender and mothers' socio-demographic characteristics. *P*-values within brackets.

	US			UK		Italy	Sweden
	Census 1960–2000	CPS 1994–2011	NHIS 2005–10	Census 1991	BHPS 1991	LFS 2004–08	LISA 2004
Age	0.73 (0.46)	−0.29 (0.77)	0.46 (0.65)	−0.17 (0.86)	0.64 (0.52)	0.31 (0.76)	0.16 (0.87)
Age squared	−1.01 (0.31)	0.21 (0.84)	−0.67 (0.51)	0.24 (0.81)	−0.84 (0.40)	−0.25 (0.80)	−0.25 (0.80)
Race:							
–White	0.02 (0.99)	−0.44 (0.66)	−0.46 (0.65)	0.24 (0.81)	−0.5 (0.62)	No	No
–Black	−1.22 (0.22)	−1.59 (0.11)	−1.60 (0.15)	0.44 (0.66)	−0.25 (0.81)	No	No
–Other races	Yes	Yes	Yes	No	Yes	No	No
Year dummies	Yes	Yes	Yes	No	No	Yes	No
Sample size	3.4E+6	272,664	35,192	44,813	1186	336,564	699,805
<i>F</i> statistic	1.32 (0.25)	1.15 (0.28)	1.24 (−0.27)	0.17 (0.97)	1.28 (0.27)	0.97 (0.71)	0.37 (0.69)

Sample selection described in Section 2. In the US Census and the CPS race can be equal to: White, Black, Indigenous, Asian, Other, 2+ races. In UK Census data and the BHPS race takes the following values: White, Black, Asian, Other.

impact on the labor supply of women that goes through two channels. First, the higher marital stability generates less need to work for mothers, because they can expect income support from fathers. But, in addition, we show the existence of a second possible and less obvious channel. Marital stability following a first-born boy generates higher fertility and fertility reduces mothers' labor supply.

We do not rule out the possibility that other channels may exist and our analysis does not need to exclude them. Our results simply suggest that, also in advanced economies, the sex of the first child cannot be disregarded as an explanation for fertility and maternal labor supply.

2. Is the sex of the first child exogenous?

The main contribution of this paper concerns the effect of the sex of the first child on mothers' labor supply and fertility. Preliminarily, we provide evidence on the randomness of the sex of the first child for the countries that we consider. We focus on the US, the UK, Italy and Sweden and use the following datasets: the Census (years 1960–2000), the Current Population Survey (CPS, 1994–2011), the National Health Interview Survey (NHIS, 2005–2011) for the US, the Census (1991) and the British Household Panel Survey (BHPS, 1991 wave) for the UK, the Labor Force Survey (LFS, 2004–11) for Italy and a population-wide panel data set based on administrative records (LISA, 2004) for Sweden.

We focus on all women aged between 18 and 55 at the time of the interview, with at least one child, who had their first child between 18 and 40 years of age and whose first child is no more than 15. We limit the sample at age 15 of the first-born child for two main reasons. First, children older than 15 may potentially enter the labor market and their decision may affect maternal labor supply. Second, in the US datasets, the UK Census and the Italian LFS we can identify only mothers with cohabiting children (the BHPS and the Swedish data allow instead exact identification of the sex of children ever born). Since in all the countries considered children tend to leave the household not before 18 and the time spacing between the first and the second child in our sample is around 3 years, the 15-year cut-off minimizes the possibility that we are measuring the sex of the second child instead of the first (just because the first has already left the household).

The lack of exogeneity of the sex of the oldest child may arise because of three channels. First, the gender of the first child is random at conception but may not be random at birth because the success of pregnancies could be correlated with socio-economic

characteristics of parents for biological and evolutionary reasons (see e.g. Catalano et al., 2005; Cox, 2007; Trivers and Willard, 1973). In general, this evidence is rather inconclusive, but this hypothesis cannot be *a priori* excluded. Second, even if we are considering advanced economies, there is still the possibility of selective abortion based on child gender. This may occur when parents have strong preferences about child gender and manipulate natural births using, for instance, ultrasound techniques which allow them to know the gender of the child before birth. Almond and Edlund (2008) and Almond et al. (2013) prove that in the US (using Census data in 2000) and in Canada male sex ratios at birth are above the biologically normal level within Asian immigrants. They find, however, that the effect of selective abortion is significant at parity higher than the first, while it is absent at the first parity. Indeed, their evidence supports our identification assumption, based only on the sex of the first child. Third, endogeneity might arise if child custody after divorce is affected by the sex of the first child. Dahl and Moretti (2008) argue that in the case of divorce fathers get more frequently the custody of boys instead of girls. So, identifying the sex of the first child looking at the sex of the oldest cohabiting child might be biased.

To test the exogeneity of the sex of the first child, we regress a dummy indicating first-child gender on a quadratic function of mothers' age, interview year dummies, and, for the US and the UK only, also race, because in these countries this source of predetermined heterogeneity may be relevant (this is not the case of Italy and Sweden). Table 1 reports the Student's *t* and the *F* statistics for the significance of single and all covariates, respectively. Results confirm that the hypothesis that none of the covariates help to explain the sex of the first child cannot be rejected.

3. First child gender and mothers' labor supply

In the top panel of Table 2 we look at the weekly hours worked (except in Sweden where we do not have information on hours of work). Non-employed mothers are included with zero hours to avoid possible bias determined by the fact that women self-select into employment. In the bottom panel the dependent variable is a dummy equal to one if the person declares to be employed. All these estimates are obtained controlling for a quadratic function of age and for interview year dummies. In all the datasets a first-born boy negatively affects working time and the probability of being employed. Differences are always statistically significant with the exception of Sweden.

Table 2

First child gender and labor supply: US, UK, Italy and Sweden.

	US			UK		Italy	Sweden
	Census 1960–2000	CPS 1994–2011	NHIS 2005–10	Census 1991	BHPS 1991	LFS 2004–11	LISA 2004
Hours worked per week (1)							
First-born boy	−0.092	−0.169	−0.340	−0.232	−1.750	−0.193	
St. err.	0.021	0.074	0.200	0.139	0.898	0.059	
Baseline: girl	20.294	22.597	22.021	12.358	14.005	15.280	
St. err.	0.014	0.054	0.154	0.657	0.660	0.043	
Percent effect	−0.452	−0.750	−1.543	−1.881	−12.495	−1.260	
Probability of working							
First-born boy	−0.002	−0.003	−0.009	−0.007	−0.051	−0.006	−0.001
St. err.	0.000	0.001	0.005	0.005	0.028	0.002	0.001
Baseline: girl	0.536	0.645	0.606	0.520	0.540	0.494	0.652
St. err.	0.000	0.001	0.004	0.021	0.021	0.001	0.001
Percent effect	−0.366	−0.419	−1.422	−1.406	−9.514	−1.263	−0.153
No. obs.	3.4E+6	272,664	35,192	45,068	1186	336,564	699,805

In the top panel, for the US Census the dependent variable is equal to the number of hours worked per week in all jobs during the previous year. For the CPS, the NHIS and LFS, it is equal to the number of hours worked in the week preceding the interview. For the UK Census and the BHPS, it is equal to the usual working time in all jobs. In the bottom panel the dependent variable is a dummy equal to 1 if the person is employed and 0 otherwise, except for Sweden, in which case it is equal to 1 if the person has positive labor income, 0 otherwise. Sample selection described in Section 2. (1) For the US Census data on hours worked are available only for the period 1980–2000.

Table 3

First child gender, fertility and marital status of the mother in the US, the UK, Italy and Sweden.

	US			UK		Italy	Sweden
	Census 1960–2000	CPS 1994–2011	NHIS 2005–10	Census 1991	BHPS 1991	LFS 2004–11	LISA 2004
Probability of having more than one child							
First-born boy	0.0031	0.0045	0.0135	0.0074	0.0476	0.0040	0.0030
St. err.	0.0004	0.0018	0.0050	0.0044	0.0265	0.0017	0.0010
Baseline: girl	0.641	0.627	0.632	0.656	0.648	0.548	0.543
St. err.	0.000	0.001	0.004	0.020	0.020	0.001	0.001
Percent effect	0.489	0.720	2.139	1.127	7.343	0.726	0.552
No. obs.	3.4E+6	272,664	35,192	44,813	1186	336,564	699,805
Probability of being married (1)							
First-born boy	0.0067	0.0076	0.0104	0.0039	0.0135	0.0022	0.0030
St. err.	0.0004	0.0015	0.0044	0.0034	0.0058	0.0009	0.0010
Baseline: girl	0.864	0.794	0.764	0.846	0.792	0.919	0.670
St. err.	0.000	0.001	0.003	0.017	0.017	0.001	0.001
Percent effect	0.047	0.192	0.58	0.397	0.731	0.100	0.149
No. obs.	3.4E+6	272,664	23,121	44,813	1174	336,564	699,873

Same sample selection and model specification of Table 2. (1) Dummy equal to 1 if the woman is married and 0 otherwise. Widows excluded.

4. The effects of a first-born son on fertility and marital stability

Because of the “divorce effect”, a first-born boy, by increasing the probability of marital stability, may also increase fertility, as women in unstable marriages have fewer children over their life-time. Thus, we estimate the effects of a first-born boy on fertility including all women independently on their marital status (using the same sample criteria and model specification of Table 2). Our results are reported in Table 3 (top panel). The dependent variable is equal to 1 if the woman has at least two children and zero otherwise. We find that for all countries and datasets the probability of having more than 1 child increases when the first-born child is a boy.¹

This happens via the channel of greater marital stability induced by a first-born boy (see Table 3, bottom panel). Of course the

greater marital stability after a first-born son may also reduce maternal labor supply independently on fertility. In any case, higher fertility cannot be disregarded as an explanation of the observed evidence.

5. A missing result in the literature

If both the “divorce” and the “desire for a son” effects are at work in developed economies we should see different results depending on whether the analysis is restricted to women in married couples or is instead extended to all women independently of their marital status, and this explains why our results on fertility differ from Dahl and Moretti (2008). In Table 4 we compare the estimates of Dahl and Moretti (2008) for the US Census, which are based on a sample of only married women, with estimates obtained using all women in the same dataset and with the sample selection that they use. Even if we cannot replicate exactly their estimates as we do not have access to the same US Census sub-samples, our results closely resemble them.

In Table 4 the first 3 columns report estimates in which the dependent variable is the total number of children. If we consider only married women (column 1) we can conclude that a first-born

¹ The stronger results obtained for the BHPS are likely to depend on its sample design. Differently from the UK Census, aimed at accounting for all population living in UK at the given time, the BHPS is a survey of households. Consequently in the BHPS the share of married women living in stable households is higher than in the Census. In line with our results it is likely that within this sample the effect of a first-born boy on fertility and labor supply is stronger.

Table 4

Re-assessing the effect of first child gender on fertility in the US.

	Total number of children			Two or more children		
	Married	All women		Married	All women	
	(1)	(2)	(3)	(4)	(5)	(6)
First-born boy	−0.0028	0.0002	0.0053	0.0015	0.0029	0.0049
St. err.	0.0012	0.0011	0.0024	0.0009	0.0006	0.0013
Married			0.2208			0.1420
St. err.			0.0020			0.0011
Boy * Married			−0.0079			−0.0032
St. err.			0.0027			0.0014
No. obs	2.2E+6	2.8E+6	2.8E+6	2.2E+6	2.8E+6	2.8E+6
Test: H0: Coeff. “First-born boy” equal to column (1) for models (2) and (3), to column (4) for models (5) and (6)						
p-values		0.0147	0.0008		0.0166	0.0082

Women aged between 18 and 40 who had their first child between 18 and 40 years and whose first child is aged no more than 12, as in [Dahl and Moretti \(2008\)](#). All models include a quadratic in age, educational attainment, race and year dummies. The last row reports the *p*-value of a formal test for the hypothesis of equality of the “first-born boy” coefficient of models 1 with the ones of models 2 and 3 and of model 4 with the ones in columns 5 and 6.

boy reduces fertility. Columns 2 and 3 are based instead on all women. Column 3 includes the gender of the first child, marital status and the interaction between these two variables. In this decomposition (which cannot be interpreted as causal) a first-born boy has a positive and significant coefficient, but if the woman is married it changes sign. This evidence may seem puzzling given that after a first-born boy, the “desire for a son” effect should reduce fertility for all women independently of marriage, while the “divorce effect” should increase the stability of marriages and thus fertility for married women only. If this were the case, in Column 3 of [Table 4](#) we should find that the main effect of a first-born boy on fertility for all women is negative, while it becomes positive for married women.

However, [Dahl and Moretti \(2008\)](#) have shown that a first-born boy increases the probability of shot-gun marriages, that end up being more stable precisely because they originate from a first-born boy. So, the “divorce effect” applies to all women, not only to married women. Second the “desire for a son” effect is probably stronger among married women than among unmarried women, since, as shown again by [Dahl and Moretti \(2008\)](#), it mostly originates from fathers. Columns 4–6 replicate the results obtained by [Dahl and Moretti \(2008\)](#) for the probability that a woman has at least two children after a first-born boy.² Based on the evidence similar to the one reported in columns 1 and 4, [Dahl and Moretti \(2008\)](#) conclude that having a first-born boy reduces fertility. We suggest the possibility that their result is affected by selection bias, because the probability that a woman has more than one child and the total number of children are strongly correlated with her marital status, which is influenced by the sex of the first-born child. Our results also imply that the overall pattern of pregnancies, after the first one, may be affected by the sex of the first born, because of its effect on the probability that a marriage survives. While the sex of the first child is randomly assigned, the number of subsequent children is endogenous with respect to parental preferences and behavior.

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² For robustness check, we have replicated these estimates also for all the other datasets, finding rather similar results.

Appendix. Data appendix

- US Census data for the years 1960–2000 are collected within the IPUMS International project and are available at <https://international.ipums.org/international/> (Minnesota Population Center. Integrated Public Use Microdata Series, International. Minneapolis: University of Minnesota.). They are roughly a 2% random sample of the US population in the Census years and contain both personal and household identifiers and socio-demographic characteristics. Not all information is available for all years. Data on hours worked per week are available for the period 1980–2000. The data allow us to identify only cohabiting children. However, by the use of information on all children ever born, unfortunately available only for the 1980 US Census, for this dataset it is possible to check whether the number of cohabiting children is equal to the number of all children ever born to mothers. According to these data, the measurement error becomes severe for mothers aged more than 38. In our sample, the share of mothers satisfying our sample selection criteria and older than 38 is equal to 21% of the total sample. Their exclusion does not affect the results. In the subsample of women younger than 38 the effect of a first-born boy on the probability of working and hours worked are equal to −0.003 and −0.116, respectively (both significant at 1% level).
- The Current Population Survey (CPS) data are drawn from the NBER site <http://www.nber.org/cps/>. The universe is the civilian non-institutional population of the United States living in housing units and members of the Armed Forces living in civilian housing units on a military base or in a household not on a military base. In this paper we use the March supplement, which includes detailed information not only on labor supply, but also on socio-demographic characteristics of individuals and households. Each year about 57,000 households are currently interviewed, containing approximately 112,000 persons 15+ years old and approximately 31,000 children 0–14 years old. We use data from 1994 to 2011, because of a large redesign of the survey occurred in 1994.
- The National Health Interview Survey (NHIS) is conducted since 1957 and it is aimed at collecting information on a broad range of health topics. Data are collected yearly through cross-sectional household interview and are available for free at <http://www.cdc.gov/nchs/about/major/nhis/>. The sample over-weights both Black person and Hispanic persons and covers roughly 35,000 households and 87,000 individuals. Basic demographic information is available for all household members. In 2005 the NHIS was subject to major changes in the sample structure and questionnaire. For this reason we focus on years 2005–11. In this paper we have used the NHIS also to check

whether there is strong evidence of correlation between the health status of the first child and mother's behavior. We have not found any clear evidence and we have chosen to do not report this additional set of results.

- Census data for UK refer to year 1991 and are collected within the IPUMS International project and are available at <https://international.ipums.org/international/> (Minnesota Population Center, Integrated Public Use Microdata Series, International, Minneapolis: University of Minnesota). They amount to roughly 1% random sample of the UK population and contain both personal and household identifiers and socio-demographic characteristics. Data on the Census 2011, as reported by IPUMS, do not contain a household identifier and cannot be used in this paper.
- The British Household Panel Survey (BHPS) is conducted yearly since 1991 and data are available through the UK data archive, after a free-of-charge registration. The 1991 sample includes more than 8000 households and 23,000 individuals. The BHPS collects also detailed retrospective information on fertility and marital status of individuals before 1991. It also collects gender and age of children not cohabiting with the parents. The BHPS is subject to some non-negligible panel attrition, i.e. increasing levels of non-response with each successive wave of the panel. Since marital dissolution is endogenous to the sex of the first child and panel attrition is typically strongly correlated to marital dissolution, we prefer to avoid such potential source of bias and in this paper we use only data on wave 1.
- The Italian Labor Force Survey is conducted by the Italian Statistical Office, Istat, and includes around 80,000 households and 200,000 individuals, which are interviewed in different weeks of the year. The sample units are "de facto" households, composed of people living together even if with no formal arrangement. Each year 4 releases are available, in January, April, July and October. Because of a break in the sample design and questionnaire in 2004, data comparability before 2004 is not ensured. Istat produces two types of files: one for public-use and a full version for public Institutions, like for instance Italian

Universities. The public-use files contain a household identifier for around 95% sample households (for privacy concerns) and detailed socio-demographic characteristics also for individuals aged less than 16. In this paper we use the full-version files. Public-use files are released by Istat, free of charge. As the CPS no retrospective information on fertility and marital status are included. The estimates presented in this paper go from January 2004 to October 2011.

- The Swedish data, provided by Statistics Sweden, is a population-wide panel dataset (LISA) based on administrative records. Detailed socio-demographic variables are observed on a yearly basis for all individuals at least 16 years old. Moreover, households are identified and all children (regardless of age) are linked to their biological parents by the Multigenerational registry (Flergenerationsregistret). No information on hours worked is available.

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