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## Son-preference, number of children, education and occupational choice in rural Nepal

Magnus Hatlebakk

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## Abstract

A unique family survey was conducted in Nepal to investigate the economic consequences of having a first-born girl. Women get more children, but we find no causal effect of number of children on economic outcomes. But independently of the number of children there is a positive effect on boys' education of having a first born sister, who presumably takes care of household work so the boys can focus on school. This indicates a stronger son-preference in Nepal than what is found in studies from neighboring countries.

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# 1. Introduction

In South-Asia a son-preference leads to abortion of girls (in India) and additional children if the first born is a girl. This paper focuses on the latter and uses data from Nepal where abortion of girls is still not a problem. We investigate whether the son-preference has a cost for households as they may get too many children and thus invest less in each child. Inspired by the literature we started out using the random gender of the first-born as an instrument for number of children to create exogenous variation in this variable. But we find that it is not the number of children that matters for education, but rather whether there is a first born sister.

We find that having two first-born girls is the best predictor for number of children, while having a first-born sister is the best predictor for the level of education, but only for her male siblings. That the number of children does not matter for economic decisions seems to be a robust finding in the literature. That the birth order does matter is also known from the literature, but we have not seen any study that simultaneously tests for the importance of number of children and the gender of the first born. And this is also the first time we have seen an effect of a first-born girl only on male siblings. This is a particular strong indication of son-preference in Nepal. Not only do women get more children if the first born children are girls, if there is a first born girl then her brothers, and not her sisters, get a better education. We believe that the first born girl takes care of household chores so that her brothers can focus on school.

As indicated there are two strands of the literature that we combine in a unified analysis. Angrist and Evans (1998) is the seminal contribution in the literature where the gender of siblings is used as an instrument for number of children. Their work led to an extensive literature focusing on the effect of family size on female labor supply, see for example Cruces and Galiani (2007) on data from Mexico and Argentina, and Daouli et al. (2009) on Greece. Then there is a more limited literature that looks at other economic outcomes, including Gupta and Dubey (2006) on poverty in India. Our focus is on education, and similarly to us, most studies find no causal effect of number of children on a child's education, although there is a recent study by Ponczek and Souza (2012) that finds a negative effect. Ponczek and Souza also have a good review of this literature.

The seminal contribution to theory on the link between number of children and investments in each child is due to Becker (1960, see footnote 10 for the formal model). Becker describes a quality-quantity trade-off in preferences, where the two variables are simultaneously determined. So any causal mechanism should reflect a change in the cost of either quality or quantity, or both. So if a woman for some reason (and we focus on the random event that she gets a girl first) decides to get more children, she may at the same time decide to compensate by investing less in each child. But that would be a causal effect of having a girl first on both quality and quantity of children. When we below attempt (unsuccessfully) to identify a causal effect of number of children on their education, then we implicitly assume a recursive structure where the women first observe the gender of the first born, then decide on the number of children, and finally decides on their education. This is not an unlikely sequence of events, but as said, we do not find a significant effect in the last part of the chain of decisions, only the first effect on number of children is significant. This may reflect that a first born girl simultaneously affects both the number of children and their education. But we focus below on a more direct interpretation of the finding, as it is likely that the first born girl takes care of household work so that her brothers can focus on school. This interpretation is supported by Edmonds (2006) analysis of time use among children in Nepal where he, in fact, finds that older girls work more than their brothers and even more if they have additional younger siblings.

The second strand of the literature applies birth-order and gender as direct explanatory variables. A robust finding seems to be that in poor countries siblings of first born girls get more education than others. But our findings seem to be the first that documents such effects only for male siblings. So apparently a stronger son-preference, since only boys benefit, than in similar studies from neighboring

countries where later born children of both gender benefit, see Sawada and Lokshin (2009) on data from Pakistan, and Ota and Moffatt (2007) on data from India. This male only effect is the main contribution of the paper. There is, however, a related literature where the focus is only on birth-order and a possible interaction with own gender (but without looking at the gender of the siblings), see for example Ejr n s and P rtner (2004) who find that later born boys (in the Philippines) spend more time in school, and Emerson and Souza, A.P. (2008) who find that daughters (in Brazil) who are first born are less likely to go to school than later born daughters.

We also consider it value added to use data from Nepal, where the literature on son-preference is limited, but see Koolwal (2007) who analyzes the link between son-preference and child labor in Nepal. There is also a related literature on son-preference elsewhere, in particular Basu and de Jong (2010) on son-preferences in India, Das Gupta et al. (2003) on determinants of son-preference in China, India, and South-Korea, and Edlund and Lee (2009) on theory and evidence for son-preference in South-Korea.

The fact that Nepali women get more children if the first born are girls, is well known, see for example Gudbrandsen (2010) who uses demographic and health survey (DHS) data<sup>1</sup>. The DHS data has, however, only limited information on economic outcomes. An alternative is living standards measurement study (LSMS) data, and the NLSS (1995, 2003, 2010) surveys are of high quality and contain information on a number of economic outcomes<sup>2</sup>. But with NLSS the problem is that the unit of observation is a household and not a woman. There are ways to identify the children of each woman, and their birth-order, but there are inconsistencies in the data, and one can never be sure that all children are identified since the focus of the surveys is on household members and not on children who may have left the household. As a result there is no national level survey available that can identify the link from birth-order of children to different economic outcomes in Nepal. As we did not have the resources to conduct a nation-wide family survey, we decided to do a survey in one area of Nepal where we expected to find variation in son-preference and fertility behavior due to the diverse caste and ethnic composition of the area. We interviewed women of age 40-59 as most of them have completed child-bearing and will have adult children for whom we can identify economic outcomes.

In addition to the effects on education, we wanted to identify any effects on occupations. These findings will be reported below, but since they are not significant they will get less attention than the effects on education. In the next section we discuss the suggested link between the gender of the first born, via number of children, to education of those children and their occupational choice. The third section presents the data, then comes results and finally a discussion of the findings.

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<sup>1</sup> For more background on the fertility transition in Nepal and South-Asia see KC (2004), Karki and Krishna (2008) and Veron (2008).

<sup>2</sup> For more information and examples of economic analysis of NLSS data see Hatlebakk (2009 and 2011).

## 2. Hypotheses

The main explanation given by women themselves for having more children if the first born is a girl is that they want a boy. And there is a general view, as shown by the targets for population growth in many countries, that poor people get too many children for their own good. The latter is, however, an imprecise statement, and we will investigate more specific elements of the presumption utilizing the fact that women get more children if the first born are girls. That is, how will the gender of the first born children affect the education and in the last instance the occupational choice of later born children? The effect is likely to depend on the gender of the later born themselves, so we separate the effects on girls and boys, and as fertility and investments in education may differ between social groups, we will control for social identity in the analysis. Son-preference is expected to be stronger within some groups depending first of all on religious beliefs. It is for example important for some social groups to have a son who can light the funeral pyre.

In the analysis we will utilize the natural experiment that the gender of a child is random in Nepal, as indicated by the sex-ratio at birth<sup>3</sup>. And even more so two decades ago, when our sample of children was born. We know that women get more children when the first born is a girl, and more children may, in turn, affect other economic decisions. But having a girl first, in stead of a boy, may also have additional effects. In particular we shall expect the girl to take over some of the household chores that the mother would otherwise do. This, in turn, means that the mother can work more outside the household bringing incomes that can be invested in for example education for the younger children. How far can theory help us in understanding these decisions? The discussion here is based on economic theory, but we do not provide a formal model, only a stylized strategy that may be "optimal" in some sense for a woman living in an economy where girls have fewer opportunities in the labor market than boys.

We assume that woman (and the family in general) makes a plan for number of children, investment in their education, as well as her own occupational choice, but a plan that is contingent on the gender of the children. A realistic strategy may be:

- Girls take care of household chores, which allow the boys to focus on education, and the mother to work outside.
- The woman gets children until she has two boys.
- Both boys and girls are allowed to complete primary school, but boys get more time for school work.
- Children with good school results are allowed further education.

The two boys target can be an optimal strategy if there are costs of having children, but a larger chance of at least one talented boy if you have more than one. If the women apply this strategy, then we shall expect to observe the following:

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<sup>3</sup> This ratio is not readily available, but there is no indication from neither the censuses nor the DHS surveys of any deviation from the normal sex-ratio, and the CIA (2012) World Factbook reports a normal sex-ratio-at-birth of 1.04. Leone, Matthews and Dalla-Zuanna (2003) believe the normal sex-ratio in Nepal explains the limited interest in son-preference in Nepal, and go on with a discussion of the consequences of the son preference for fertility behavior.

1. Women get more children if the first born is a girl (since they want two boys).
2. More boys, than girls, take education beyond primary school.
3. More boys take education beyond primary school if the first born is a girl.
4. As a result these boys may get a better job than other boys due to a first born sister.
5. The mother works outside the household if the first born is a girl.

Now, one may imagine that even if there is no first-born girl, but for example a second-born girl, she may also take care of household chores, and thus have some of the same implications. But in this case there will already be a boy around, and the family has been forced (for some time) to find another solution for household chores. So we shall not expect a later born girl to have the same strong implications. And since there is already a boy, there will probably be no effect on the number of children of a later born girl. So for these reasons, we start out with the gender of the first born as the natural experiment of interest, and we will now investigate the hypotheses listed above. As we shall see, we do, however, end up with an empirical analysis where we also utilize the gender of the second born in the empirical strategy.

### 3. Data

The survey was conducted in a rural area north-east of the city of Biratnagar in the plains (terai) of Nepal. The area has a particularly diverse caste and ethnic composition. There is an indigenous (Janajati) population (Tharu and Rajbansi in particular), then there are people of hill origin who over generations have migrated to the plains, in our sample mostly high caste groups, and finally there are people of Indian origin who also have migrated to the area over generations, mostly Dalits in our sample (Bantar and Musahar in particular). As there may be variation in son-preference between different Janajati or Dalit groups, we do not lump them together but rather construct dummy variables for the three largest groups in the sample, and have all other groups as the reference category<sup>4</sup>. These three groups are Tharu (36% of the sampled women), Bantar (13%) and hill origin Brahmin and Chettri (10%). The area is a relatively peaceful area (which was essential for conducting the survey given the recent civil war and post-war ethnic unrest in Nepal) and with all villages being 0.5-1.5 hours by bus or bicycle from Biratnagar. Every second household has an extended family member working in Biratnagar (with construction labor being the most common occupation among them), which reflects the fact that these villages are linked up to the urban economy. It was also of importance that we have been working in this area for the last 15 years and thus know the economic and social context well. For more information on the eastern terai see Hatlebakk (2007).

We randomly selected 5 out of the 12 villages (VDCs) in the area with probability given by the population size, and similarly 4 wards in each VDC, so a total of 20 PSUs<sup>5</sup>. Then we selected randomly 24 women of age 40-59, so a total sample of 480. There were three enumerators (two female), and they normally interviewed three women per day, so a PSU was completed in three days and they thus spent two months in the field from mid November 2011 to mid January 2012. The enumerators were from the Kathmandu based research institute New Era and had participated in the recent DHS some months earlier. We intentionally based parts of the survey on the DHS questionnaire to make sure that the questionnaire was familiar to the enumerators. But we added some questions on economic outcomes that were less familiar to the team. In the sample there were 16 women with no children. Table 1 shows the number of ever born children according to the gender of the first born for the remaining 464 women.

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<sup>4</sup> The reference category consists of 35 distinct groups that are separate categories in the national census, with the largest in our sample being Rajbansi (6%), Musahar (5%), Sanyasi (3%), and 2% each of Rai, Jangad, Kewat, Gangai and Mallah.

<sup>5</sup> In all analysis below standard errors are clustered at the PSU level.

**Table 1. Number of ever born children**

Number of children	Male-first-born	Female-first-born	All
1	12	8	20
2	44	28	71
3	64	55	119
4	58	56	113
5	23	31	54
6	25	30	55
7	7	5	12
8	3	9	12
9	2	2	4
10	0	2	2
N	238	226	464

We first note that there are 105 boys to every 100 girls among the first-born, or 51.3% boys, which is normal and in correspondence with available national level data. The sample is small, and thus the 95% confidence interval for the sex-ratio goes from 46.3% to 56.2%. So although the sex-ratio by coincidence is as expected, we shall not be surprised when the underlying data shows that the sex-ratio for later born children is 53%. We shall see below that we end up with a relatively small sub-sample of females with a first-born brother. We first thought that this was because a first-born brother gets priority in terms of food and health care and his sisters thus die early, but in our sample there are actually fewer girls at the time of birth, so this is most likely a statistical coincidence.

There is, however, a significant difference (at the 99%-level) in the number of children depending on the gender of the first born. We find that if the first born is a girl then the women get on average 4.1 children, while they get only 3.7 children if the first born is a boy, so by that we have confirmed that women in this area behave as women all over Nepal, and the first hypothesis from the previous section is confirmed. The median is three children if the first born is a boy, and four if the first born is a girl<sup>6</sup>. So we may conclude that if the median woman gets a girl first the child does not count, and the woman gets three more children, the same number as she would get in total if the first born was a boy. The median age of these women, at the time of the survey, was 48 years, while the median for their children was 23 years. So the children were born around 1990. Today women in this area get fewer children.

Now some of these children die early, and may thus be replaced before the woman gets to her ideal number of children. Let us say a boy dies at age 5, and the son preference is for adult sons, then she will probably get an additional child and even another one if the next one is a girl. Table 2 thus reports the number of live children at the time of the survey. There are 3.71 live children if the first born is a girl, and 3.17 if the first born is a boy, a significant difference of 0.5 children, while the median is again respectively 4 and 3 children.

Note that the following stopping rule will give 3.75 children if the first born is a girl, and 3.25 children if the first born is a boy (and we simplify by assuming 50% chance of having a boy in stead of 51%): Stop after 3 if you have at least 2 sons, otherwise stop after 4. This seems to be a realistic rule that

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<sup>6</sup> Among the women with at least one child, 59.7% get four or more children if the first-born is a girl, while the share is 49.6 % (significantly lower at the 99%-level) if the first born is a boy.

turns out to give the average number of children that we observe. It will, however, give only 3 and 4 children, while the real distribution is wider. As we shall see later the R-squared in the regressions, where we investigate whether the gender of the first born matters for economic outcomes, also indicates that there is lots of individual unexplained variation. So although there may be some underlying stopping rule of this kind that many households ideally want to apply, there will in reality be more variation. Women who get only one or two children may have wanted more but some children died, while women with six or more children, probably wanted fewer but were not able to restrict the number of pregnancies.

**Table 2. Number of live children**

Number of children	Male-first-born	Female-first-born	All
1	19	13	32
2	54	32	86
3	78	67	145
4	48	49	97
5	23	39	62
6	12	16	28
7	1	4	5
8	1	4	5
9	0	1	1
10	0	1	1
N	236	226	462

There are 1587 live children in Table 2, where 386 of the 462 first born are still alive. In the analysis below we focus on outcomes for those children who are not first-born, which gives a sample size of 1202. But we lack information on education for some of them, so for education we have a sample of 1187 children. These children vary in age from 5 to 48, with the median being 22 years. In the analysis we omit the youngest children as they have not had a chance to complete their education. From age 15 there is basically no variation in the mean years of schooling, the mean is seven years of schooling up to age 27, while older people have less education. For SLC the critical cutoff seems to be at 19 years. So below we will restrict the sample to adult children of at least 19 years old, which means a final sample of 787 children. More detailed descriptive statistics for this sample will come in the next section, but Table 3 gives an overview and also presents the variables that will be used in the regression analysis in tables 9 and 10. Standard deviations are here for the variables themselves, and not the mean, and are thus not clustered.

**Table 3. Descriptive statistics for people of 19+ years (N=787)**

Variables	short-name	mean	std.dev.	min	max
Completed years of education	edunfb	7.036	4.486	0	18
Completed 10-years of education	slcnfb	0.311	0.463	0	1
Male	male	0.525	0.500	0	1
Female first-born	female-first-born	0.525	0.500	0	1
Interaction male* female first-born	inter-male-femfb	0.262	0.440	0	1
Two female first-born (instrument for N-alive)	female-two-first	0.287	0.453		
Number of alive children of age 19+	N-alive	4.342	1.550	1	10
Indigenous group	tharu	0.344	0.475	0	1
Dalit group	bantar	0.121	0.326	0	1
High-caste group	BC	0.105	0.307	0	1

This sample of adults has on average seven years of schooling<sup>7</sup>, which is high by Nepali standard and reflects that the villages are close to the city of Biratnagar<sup>8</sup>. The 31% that after 10 years of schooling have managed to pass the exam for the school-leaving-certificate (SLC) is also above the national average. Among these adult live children we have 52% men, and also 52% children with a first-born sister. The identical percentages here are reflected in Table 4 where we see that two sub-samples are of the same size (N=207). And since both percentages are just above 0.5, the interaction dummy has a mean that is just above 0.25. By definition the standard deviations of binomial variables are close to 0.5 when the mean is close to 0.5. Since there are slightly more girls born than boys, the two-female-first-born dummy has a mean of 28.7% of the children, slightly larger than the 0.25 one would get with equal chance of boys and girls. The women have on average 4.3 live adult children (remember that we interviewed women of age 40-59). The most numerous social groups in our sample are, as discussed above, the Tharus, the Bantars and the hill origin Brahmin and Chettri high caste groups.

<sup>7</sup> We have a coding problem as one possible response to the question on education was "literate only", meaning that they have not completed class one, but are not illiterate either. We have coded the illiterate with zero years of education, and literate only with one year of education. In an earlier version of this paper it was coded as zero.

<sup>8</sup> Note that NLSS tend to report years of schooling in this range at the national level, but then only for those who have actually attended school, while we also includes the zeros.

## 4. Findings

As discussed based on Table 1 we have already confirmed the first hypothesis that women get significantly more children if the first born is a girl, and we now go on to the other hypotheses. Table 4 shows the level of education for four groups, female and male adult children with either a first-born sister or brother in the four first columns (with the four subsamples adding up to the sample in Table 3), while the last two columns show the first-born themselves. We have already commented on the fact that the sub-sample in the fourth column is, apparently by coincidence, smaller.

**Table 4. Years of completed education among people of 19+ years**

Years of education	Male		Female		Male	Female
	First-born sister	First-born brother	First-born sister	First-born brother	First-born	First-born
Illiterate	11	21	41	26	11	37
1	8	13	22	17	9	24
2	3	9	5	3	6	8
3	7	9	5	5	3	0
4	12	8	9	14	8	7
5	15	8	14	9	19	13
6	12	15	2	7	7	5
7	9	12	13	10	11	5
8	17	16	11	10	14	9
9	14	21	9	12	13	2
10	13	20	13	12	15	18
SLC	46	34	42	33	28	29
Studying	11	2	7	2	3	7
Intermediate	20	12	13	5	11	8
Bachelor	5	5	1	2	5	1
MA+	3	2	0	0	1	0
Median years	9	8	7	7	8	5
Mean years	8.3***	7.2	6.2	6.2	7.6***	5.7
95%-conf-int.	(7.3-9.4)	(6.0-8.4)	(4.9-7.6)	(5.1-7.4)	(6.7-8.5)	(4.6-6.9)
Illiterate-%	5.3*	10.1	19.8	15.6	6.7***	21.4
95%-conf-int.	(0.0-10.7)	(3.9-16.4)	(10.2-29.4)	(6.1-25.1)	(1.0-12.5)	(12.7-30.0)
SLC-%	41.3***	26.6	30.4	25.1	29.3	26.0
95%-conf-int.	(31.4-51.1)	(17.3-35.9)	(18.9-42.0)	(16.7-33.6)	(19.8-38.8)	(16.7-35.3)
N	206	207	207	167	164	173

Literate but no schooling is coded as completed one year of education. Confidence intervals corrected for intra-PSU correlations.

\* Significant different from next column at 10%-level

\*\* Significant different from next column at 5%-level

\*\*\* Significant different from next column at 1%-level

Each column shows the distribution of a sub-sample according to years of schooling with summary statistics at the bottom, where we show the median and the mean, followed by the percentage of illiterates and the percentage with completed 10 years of schooling. For all three indicators there is a significant difference in the level of education depending on the gender of the first born sibling, but only for (later born) males. These differences are found by comparing the summary statistics in the first and second column. In particular we find that if a boy has a first-born sister he will have on average 8.3 years of schooling, while if he has a first-born brother he will have on average 7.2 years of schooling. He will also have a much higher chance of completing the SLC exam (41.3% as compared to 26.6%), and a lower chance of being illiterate (5.3% as compared to 10.1%). There is no such difference for girls as we can see from the next two columns, where both groups have 6.2 years of schooling. So later born girls have the same chances independently of the gender of their first born sibling, while boys are much better off if their first born sibling is a girl. We thus have support for the third hypothesis. There is also support for the second hypothesis, boys get significantly more education in general, except for SLC where only boys with a first born sister are doing better than the other groups. We also see, from the summary statistics in the two last columns, that a first born girl gets less education than a first born boy.

We thus conclude that if the first born is a girl, it appears that she will more often than a first born boy have to work at home, in stead of going to school, and it is her brothers who benefit from this. Furthermore, the mother will get more children than otherwise in an attempt to get one or more of those boys who will ultimately benefit from their sister's work. We now go on to the two last hypotheses, where we attempt to identify economic consequences later in life of a first-born girl. Since all these children are adults we have information on their occupation, as well as the occupation of the mother, see Table 5 for the children and Table 7 for the mothers.

**Table 5. Occupation of people of 19+ years**

Occupation	Male		Female		Male	Female
	First-born sister	First-born brother	First-born sister	First-born brother	First-born	First-born
Farmer	26	27	57	45	25	50
Business	17	14	17	11	14	19
Rickshaw	4	3	0	0	4	0
Farm labor	7	6	43	37	4	37
Factory labor	43	45	7	2	40	2
Constr labor	27	26	1	4	29	1
Other labor	5	20	1	0	10	1
Empl rest	7	7	0	0	6	0
Empl shop	6	3	1	0	5	0
Empl priv off	5	2	1	1	4	0
Empl priv oth	17	21	3	1	6	5
Empl gov	4	8	2	5	3	3
Other work	2	2	4	2	2	1
Housework	0	1	40	41	0	40
Student	35	19	27	17	10	13
No work	1	3	3	1	2	1
%-farmer	13%	13%	28%	27%	15%	29%
%-farm labor	3%	3%	21%	22%	2%	21%
%-fact labor	21%	22%	3%	1%	24%	1%
N	206	207	207	167	164	173

We see that even though the gender of the first born has consequences for the level of education for boys, it appears to have no consequence for the type of work they end up with, for basically all occupations we find about the same number of people independently of the gender of their first born sibling, but of course with differences according to the gender of the person him- or herself. The exception is again for education, where there seems to be more students (the second last category) among men with a first-born sister.

Although they select the same occupation, there may be a difference in pay due to the difference in education, so we now check that before we go on to the mother's occupation. Approximately half of the people have occupations where they work for a daily wage or a monthly salary, we report these wages and salaries in Table 6.

**Table 6. Wage and salary among people of 19+ years**

Wage	Male		Female		Male	Female
	First-born sister	First-born brother	First-born sister	First-born brother	First-born	First-born
Median wage	300	300	150	150	300	150
Mean wage	297	324	147	148	338***	148
95%-conf-int.	(258-336)	(285-362)	(130-165)	(130-166)	(314-362)	(132-165)
N-wage	41	57	48	40	43	39
Salary						
Median salary	10000	10000	5000	11500	12000	7000
Mean salary	12281	11381	5761**	10230	14432**	7580
95%-conf-int.	(9885-14678)	(9459-13304)	(3102-8420)	(7034-13426)	(9647-19217)	(4303-10875)
N-salary	77	80	13	10	60	10

Wage is paid per day, salary per month

\*\*\* Significant different from next column at 1%-level

\*\* Significant different from next column at 5%-level

There is only one significant finding when it comes to regular incomes for the non-first born adult children, women earn a smaller salary if their first-born sibling is a girl (5761 rupees on average as compared to 10230 if she has a first born brother). So the difference we found for men for education has no implications for salaries or wages. But there is a difference for women, in stead. We also recall that there is no difference in type of occupations, but there may, of course, be a difference in incomes for self-employed, which we have not attempted to measure. The significant difference in salaries for women is for a very small sub-sample, there are only 13 women with a first-born sister, and 10 with a first born brother, so although significant, the sample (and thus probably the corresponding population) is small. The lower paid women work basically as teachers in private schools, while the higher paid women work in government schools, and for some reason the women with a first-born sister end up in private school, while women with a first-born brother end up in government school, maybe because those brothers have better networks. The main finding here, however, is that for the larger sample of men there is no difference, in contrast to the findings for education. This may reflect that education has limited value in Nepal, other than the intrinsic value, and the value of not having to do household or farm work while you go to school. But these men are still relatively young, and some of them are still students, so there may be an expectation that they will get higher incomes in the future.

Let us now go on the mother's occupation and earnings. The hypothesis was that a first-born girl will take care of household chores so that the mother can work outside the household. Now we do not have information on her occupation when the children were small, but if she did work at that time, she may have a better chance of having a good job today, and this is what we check in Table 7. There are so few women with a salaried job that we do not report on salaries. As for the children, the distribution over occupations is almost identical for the two sub-samples, so apparently no difference according to the gender of the first born, so it appears that there is no long-term effect of having a first-born daughter who helps out with household-work.

**Table 7. Occupation and wages for mothers**

Occupation	First-born daughter	First-born son
Farmer	115	117
Business	20	24
Farm labor	41	45
Factory labor	5	8
Constr labor	3	2
Other labor	1	1
Empl gov	1	2
Other work	2	2
Housework	33	31
Pensioner	0	1
No work	5	3
%-farmer	51%	50%
%-farm labor	18%	19%
%-fact labor	2%	3%
N	226	236
Median wage	100	128
Mean wage	136	135
N-wage	50	54

## Number of children

The main finding above is that boys get more education if they have a first-born sister. And we also confirmed the general finding from Nepal, that women get more children if the first born is a girl. We now go on to investigate whether the effect of a first born girl on her brother's education is a direct effect (via her taking care of household chores), or whether the effect goes via the number of children. If there are more children available, then the family will probably select the most talented one, maybe only among the boys, for further education. If so, then we may not see any difference between the children (at least not between boys) in primary school, but later they may prioritize one child. If this is the case, then there are two conflicting mechanisms. There will be more children with only primary school in large families, which will pull down the average number of years in school for large families. This effect will probably dominate, but there is a counteracting effect as the average talent of the best student will increase with the number of children, and thus the investments put into that child in terms of years of schooling may increase with the number of children. In addition, if there are more children around they may help each other out at home and in school, and thus do better in school, which in turn may also increase the investment in terms of years of schooling. So it is not clear what will be the total effect of number of children on the average level of education of those children. And, furthermore, we would like to separate the number effect from the gender of the first born effect.

We start with descriptive statistics, while we will discuss causality later. In the descriptive statistics we separate the total effect shown in Table 4 into the direct effect and the number of children effect by splitting the table according to number of children. Table 8 reports on the 413 men from the two first

columns of Table 4 as this is where we have a difference that appears to be determined by the gender of the first born. Very few of these men are from families with only one live child, or more than six children, so we categorize number of children into the five categories shown. We then show the average level of schooling (using all three indicators from Table 4) for the ten categories of men determined by these five family sizes and the gender of the first born.

**Table 8. Education among men of 19+ years**

Number of children	Years of education		SLC		Illiteracy	
	First-born sister	First-born brother	First-born sister	First-born brother	First-born sister	First-born brother
1-2 (N=39)	7.1	<b>9.1</b>	35.7	<b>48.0</b>	14.3	12.0
3 (N=115)	<b>9.1</b>	6.9*	<i>50.0</i>	25.4*	0.0	7.5
4 (N=105)	8.5	7.6	<i>43.4</i>	23.1*	1.9	<b>1.9</b>
5 (N=84)	8.2	6.7	37.3	24.2*	3.9	9.1
6-10 (N=70)	7.8	6.0**	35.0	20.0**	15.0	30.0*

\*\* Significantly different from the bold reference category in same column at 5%-level

\* Significantly different from the bold reference category in same column at 10%-level

Italic means significant horizontal difference for same variable at 5%-level

The higher level of education for men with a first born sister is consistently significant over all three indicators for the 3 children category, while the higher proportion of SLC is significant also for the 4 children category and the higher years of schooling for the 5 children category. These sub-group findings add up to the aggregate findings from Table 4 where men benefit from having a first-born sister. But when it comes to the number of children, and we control for the gender of the first born, then there is not much variation, with two exceptions that we will argue are special cases.

First we note that in the two children case, where both children are male, the second born has better education than other groups (48% have SLC for example). This is probably a case where the mother or some other women takes care of the household work. The second exception is the variation in literacy rates according to the number of children. There seems to be a U-shaped function, at least if the first-born is a boy. But if we restrict ourselves to only significant results this conclusion is based on a single number, the low illiteracy rate for men with a first-born brother in 4 children families. So the finding may be a statistical coincidence, but we do see a U-shaped function also for the first-born sister group, although not significant. If there is a real U-shaped effect for illiteracy it may be the result of endogeneity. With more children in a family they may help each other out learning to read, but with even more children the family may be poor, and the children must work in stead of learning to read. But again, this U-shaped function may be a statistical coincidence, and the main message from Table 8 is that there is basically no variation in education according to the number of children.

## Causality

The original strategy for identification was to follow the literature and use the (random) gender of the first born as an instrument for number of children to identify the potential costs of having many children. But when the descriptive statistics, which would also be the reduced form model, proved that the gender of the first born matters only for the male siblings of the first born, then we were not so sure that the number of children was the problem. In the reduced form the only significant finding is that if the first born is a girl then later born boys get a better education. So the reduced form also indicates the opposite sign of what we expected. If the first-born is a girl, we know there are more children around, but it turns out that this leads to better education, although only for boys. So it seems

we have to reject the number of children hypothesis and look for an alternative explanation, which actually jumps out of the data. A better education for boys when the first-born sibling is a girl is probably due to the direct effect of that girl taking care of household work so that her younger brothers can focus on school. So this is what we report as the main finding.

But let us now revisit the original hypothesis. If we control for the main effect, can we find an additional effect of the number of children? In identifying a useful instrument for the number of children, we can no longer use the gender of the first born. However, while controlling for the first born, we have found that a dummy for two first-born girls appears to be the best instrument for number of children<sup>9</sup>. The instrument will measure the additional effect on number of children of having a second born girl subject to having a first born girl. If there is a son-preference we expect the dummy to have a strong effect on number of children as shown by Gudbrandsen (2010).

The dummy is problematic to use as an instrument if a second born girl also contributes to the education of later born boys. To test this possibility we checked the educational level of third born boys to see whether it varies according to the gender composition of the two first born. We find that third born boys have 8.1 years of schooling if there are two first-born girls, which is not significantly different from the 9.2 years of schooling if only the first-born is a girl (and the second is a boy). This indicates that it is only the first born girl who matters. The finding is further strengthened when we shift the order, if the first born is a boy (and the second is a girl) then the third boys have 6.2 years of schooling, which is significantly lower than 9.2 years. Similarly if there are two boys, the third boy will have 5.8 years of schooling. So we conclude that it is only a first-born girl that matters for her brothers' education. This confirms the descriptive findings in Table 4, but in addition it supports the use of the dummy for two girls as an instrument for number of children as it appears that there is no direct effect of that second girl on the education of later born boys.

Before we go on to the result, note that we can include two-children families in the analysis, but we have to be careful in interpreting the reduced form model: The dummy for two first-born girls in a two children family automatically means that the sampled child is a girl, and thus on average has less education. So when we find no effect of this dummy in the reduced form, this can, in theory, be part of the explanation. In reality, however, this is not a problem, we get the same insignificant parameter if we restrict the analysis to families with three children or more. Similarly the IV-estimates do not change essentially if we restrict the sample to families with more than two children.

The IV regression (with the two-children families included) as well as different OLS regressions, including the reduced form model, are reported in tables 9 and 10, and are discussed in more detail below.

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<sup>9</sup> We have systematically investigated different combinations of the gender of the first born, but this is the best predictor for number of children. This systematic testing of different combinations of gender is similar to the first stage regressions in Angrist, Lavy and Sclosser (2010). As in that paper we may also control for ethnic dummies also in the first stage but that does not essentially change our results. Gupta and Dubey also use a dummy for two first born girls as the instrument, and similarly to us, and Angrist, Lavy and Sclosser (2010), they find no effect of number of children on the economic outcome (poverty in their model). But as far as we know we are the first to simultaneously estimate the direct effect of the gender of the first born.

**Table 9. Determinants of years of schooling among adult children**

Dep: edunfb	1 OLS	2 IV	3 Red-form	4 OLS	5 OLS
male	0.801*	0.947*	0.957**	0.957**	1.226***
	(0.452)	(0.454)	(0.442)	(0.441)	(0.359)
female-first-born	0.314	-0.010	-0.008	-0.033	-0.132
	(0.639)	(0.796)	(0.819)	(0.646)	(0.558)
inter-male-femfb	<b>1.145</b>	<b>1.164*</b>	<b>1.152</b>	<b>1.165*</b>	<b>1.023*</b>
	(0.680)	(0.663)	(0.749)	(0.657)	(0.574)
female-two-first			-0.033		
			(0.732)		
N-alive	-0.542***	-0.036			
	(0.165)	(0.791)			
Tharu					1.509**
					(0.697)
Bantar					-2.502***
					(0.816)
BC					4.043***
					(0.837)
Constant	8.506***	6.396*	6.246***	6.246***	5.550***
	(0.845)	(3.137)	(0.541)	(0.540)	(0.660)
<b>Observations</b>	<b>787</b>	<b>787</b>	<b>787</b>	<b>787</b>	<b>787</b>
<b>R-squared</b>	<b>0.071</b>	<b>0.042</b>	<b>0.038</b>	<b>0.038</b>	<b>0.179</b>
First-stage					
dep: N-alive					
Male		-0.288			
		(0.204)			
female-first-born		-0.044			
		(0.265)			
inter-male-femfb		<b>0.324</b>			
		(0.249)			
female-two-first		0.918**			
		(0.381)			
Constant		4.168			
		(0.167)			

Kleiberg-Paap rk Wald F statistics for the clustered IV is 5.799. Without cluster-corrections the Cragg-Donald Wald F statistic would be 33.093. If only second-stage is clustered (as in ivreg, cluster()), then the first stage F-statistics is 19.44. Bold means that femalefb+intmalefb is significant at the 5%-level (10%-level in the first stage). Clustered at the PSU level standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The purpose of this research was to investigate whether families with many children invest less in the children's education, which may be expected given a potential quantity-quality trade-off as indicated by the OLS-regression in the first column of tables 9 and 10, where we find that children have less education the more children (higher N-alive) their mother has.

However, the descriptive statistics (and the reduced form model in the third columns of tables 9 and 10) indicate that the gender of the first born only matters for male siblings of the first born. Boys with a first born sister, and only this group, get more education than any other group. And we have a positive effect, not a negative as we should expect if the quantity of children mattered only for boys. So we need an alternative explanation, and the immediate interpretation is the one discussed above that the boys benefit directly as the first born girl takes care of household work, while the boys focus on school. This finding is significant in the IV in the second column, as well as in the reduced form model in the third column.

The dummy for two first born girls instrument is highly significant in the first stage of the IV. Then in the second stage we find that number of children does not matter for the education of each child<sup>10</sup>. Subject to this finding we also report a regression without the apparently redundant (and endogenous) number of children variable in the fourth column, and the results are still the same, and we add social identity as controls in the fifth column, without changing the results. When we control for caste, however, the R-squared increases. As expected, the hill origin high castes are better educated than others, while the Bantar Dalit group that dominates in these villages, have less education. The indigenous Tharu group has more years of schooling than the control group.

We also note that boys in general get more years of schooling, but for SLC there is no significant direct gender effect. So if one of these non-first born girls is talented she will have the same chance of completing the SLC. This may be because a girl with a good education may enter the high status marriage market, and also will have some probability of getting a well paid job herself.

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<sup>10</sup> For the same reason the instrument is not significant in the reduced form in the third column. This is also true if we add the interaction effect with the male dummy as we do for the significant female-first dummy. Now similar to the discussion of a dummy for the second born, in theory the two-females-first dummy may have a positive direct effect on the education of boys similar to the female-first dummy, which must then be cancelled out by a negative indirect effect via the number of children, which would mean that it is not a good instrument. But we find this cancelling out hypothesis to be unlikely. When the two-females-first dummy completely dominates the female-first dummy in the first stage, with the latter being non-significant, and then no total effect of the two-females-first dummy on education in the reduced form, then we believe it to be a good instrument, and the lack of effect in the reduced form being explained by the lack of any effect of number of children on education.

Table 10. Determinants of SLC among adult children

Dep: slcnfb	1 OLS	2 IV	3 Red-form	4 OLS	5 OLS
male	0.004 (0.045)	0.008 (0.043)	0.014 (0.048)	0.014 (0.048)	0.029 (0.043)
female-first-born	0.076 (0.069)	0.066 (0.080)	0.066 (0.082)	0.053 (0.067)	0.048 (0.062)
inter-male-femfb	<b>0.093</b> (0.079)	<b>0.093</b> (0.079)	<b>0.087</b> (0.088)	<b>0.094</b> (0.078)	<b>0.082</b> (0.072)
female-two-first			-0.018 (0.059)		
N-alive	-0.036*** (0.013)	-0.020 (0.062)			
Tharu					0.081 (0.061)
Bantar					-0.161*** (0.050)
BC					0.353*** (0.088)
Constant	0.403*** (0.067)	0.335 (0.251)	0.251*** (0.041)	0.251*** (0.041)	0.204*** (0.050)
Observations	787	787	787	787	787
R-squared	0.033	0.030	0.019	0.019	0.095
First-stage					
dep: N-alive					
male		-0.288 (0.204)			
female-first-born		-0.044 (0.265)			
inter-male-femfb		<b>0.324</b> (0.249)			
female-two-first		0.918** (0.381)			
Constant		4.168 (0.167)			

Kleiberg-Paap rk Wald F statistics for the clustered IV is 5.799. Without cluster-corrections the Cragg-Donald Wald F statistic would be 33.093. If only second-stage is clustered (as in ivreg, cluster()), then the first stage F-statistics is 19.44. Bold means that femalefb+intmalfemfb is significant at the 5%-level (10%-level in the first stage). Clustered at the PSU level standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The main finding of this paper is thus that boys get a better education if they have a first born sister. For the US, Butcher and Case (1994) find the opposite result, women raised with brothers get a better education, while men's education does not depend on the gender of their siblings. For South-Asia, Sawada and Lokshin (2009) find a similar effect to ours in Pakistan, but for both gender, so in Pakistan even girls benefit from having older sisters. Ota and Moffatt (2007) replicate this finding on data from India<sup>11</sup>. So our findings indicate an even stronger son-preference in Nepal than in these studies from neighboring India and Pakistan, as only boys appear to benefit from having an older sister.

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<sup>11</sup> Although their descriptive statistics in Table 2 may indicate that boys benefit more, but this effect may not be significant?

## 5. Conclusions

We find that the number of children does not matter for how much education each child gets. In looking for a variable that could establish an exogenous variation in the number of children, we did, however, find another important indication of son-preference in Nepal. We knew from before that if the first born is a girl, then women gets more children, and even more children if the second born is also a girl, and two girls is what we have used as an instrument in our analysis. But controlling for the number of children (or the instrument itself), we find that a first born girl has a major direct effect on education of later born children, but only for boys. So boys benefit from having a first born sister, independently of how many siblings they have, with the most likely explanation being that the sister takes care of household work while the boys can focus on school. This is a strong evidence of son-preference in Nepal, and a kind that we have not seen in earlier studies from South-Asia. Some girls are basically domestic workers to the benefit of their brothers.

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**INDEXING TERMS**

Fertility

Intra-household gender

A unique family survey was conducted in Nepal to investigate the economic consequences of having a first-born girl. Women get more children, but we find no causal effect of number of children on economic outcomes. But independently of the number of children there is a positive effect on boys' education of having a first born sister, who presumably takes care of household work so the boys can focus on school. This indicates a stronger son-preference in Nepal than what is found in studies from neighboring countries.