CERIS

CENTRE FOR ECONOMIC RESEARCH
ON INCLUSIVITY AND SUSTAINABILITY

Son-Preference and Educational Attainment: Evidence from Sierra Leone

Working Paper Series 2025/01

Cite as: Collins M, Kargbo A (2025) Son-Preference and Educational Attainment: Evidence from Sierra Leone, Centre for Economic Research on Inclusivity and Sustainability (CERIS) Working Paper Series, 2025/01.

Son-preference and educational attainment: Evidence from Sierra Leone

Matthew Collins[a], Abass Momodu Kargbo[b]

[a] University of Galway, J. E. Cairnes School of Business and Economics, Centre for Economic Research on Inclusivity and Sustainability.

[b] Ministry of Planning and Economic Development, Sierra Leone.

Abstract:

Preferences toward sons has been documented across the world, including in sub-Saharan Africa. Using Demographic and Health Survey data, we study the impact of son-preferring fertility behaviour on the education outcomes of children in Sierra Leone. Exploiting exogeneity in the sex of the first-born child in a family, we provide evidence that parents in Sierra Leone exhibit fertility stopping behaviour, with those who have a first-born boy being less likely to have large families. We also find evidence that having a first-born brother has a negative impact on the education of 2nd- and 3rd-born siblings. These results provide new evidence on gender inequalities and determinants of intrahousehold inequalities in Sierra Leone.

Keywords:

Son-preference, education, intrahousehold inequality

1. Introduction

Son-preferring fertility behaviour has been well documented in the economic literature especially in South and East Asia, where it is mostly manifested in abnormally high sex ratios at birth (i.e. the ratio of male to female children), suggesting the prevalence of sex-selective technologies (Milazzo, 2014). Other common expressions of son preference include differential child mortality or differential health status of children (Rossi & Rouanet, 2015). Although anthropological and demographic evidence points to the patrilineal nature of most sub-Saharan African cultures (Isiugo-Abanihe, 1994; Milazzo, 2014) in which men play dominant roles, the sex ratios at birth in the region tend to be close to natural rates and rates of child mortality and infant health are similar for boys and girls (Anderson & Ray, 2010; Wamani, Astrom, Peterson, Tumwine, & Tylleskar, 2007; Rossi & Rouanet, 2015). Hence the issue of gender preference in sub-Saharan Africa has been relatively under researched.

Researchers focusing on the region have mostly inferred son preference in Africa by examining differential *stopping* behaviours (Jensen, 2005; Rossi & Rouanet, 2015) and differential *spacing* behaviours (Jensen, 2005; Basu & de Jong, 2010; Milazzo, 2014). Son-preferring *stopping behaviour* refers to the scenario where parents stop having children once they have reached their preferred number of sons (Jensen, 2005). *Spacing behaviours* refer to differences in birth spacing between siblings according to whether the preceding child is a boy or girl. Parents in patrilineal regions of sub-Saharan Africa tend to have shorter spacing after the birth of a girl, pointing to son-preference (Mace & Sear, 1997; Lambert and Rossi, 2014). Hence, the prevalence of natural sex ratios does not preclude gender preference among parents in sub-Saharan Africa. As sex-selection technologies are not readily available, son-preferences may manifest in other areas, such as in fertility behaviours but also in other factors such as health and education.

In this study, we examine the role of son-preference in determining the education of subsequent children in Sierra Leone, a country characterised by high fertility and low levels of education, with less than half of the population being literate (Statistics Sierra Leone, 2018). There are various reasons to expect son-preferences in this setting. The country's social structure is predominantly patriarchal and patrilineal (McFerson, 2012), with extended rural families organized into lineage groups. These groups are often characterized by the notion of a founding father, with membership,

land access, and property inheritance passing through the male line (Richards, Bah, and Vincent, 2004). Women in the country are thus generally less empowered than men, and these social dynamics contribute to the prevalence of son preference, which frequently has negative consequences for women and children.

We use data from the Demographic and Health Survey and exploit exogenous variation in the sex of the first-born child in a family. This allows us to identify the effect of having a first-born boy, relative to a first-born girl, on the education outcomes of subsequent children.

First, we examine fertility behaviours and find evidence of stopping behaviour, pointing toward the existence of son-preference in Sierra Leone. Indeed, mothers with a first-born boy go on to have fewer subsequent children, manifesting in a lower likelihood of having at least 4 or at least 5 children. Second, we examine education outcomes and find that subsequent children attain 1-2% fewer years of education on average if they have a first-born brother rather than a first-born sister. This negative effect is more pronounced for 2^{nd}- and 3^{rd}- born siblings. 5^{th}- and 6^{th}-born siblings actually experience a positive effect of having a first-born brother on years of education.

These findings provides evidence of son preference in the Sub-Saharan African context and sheds light on how son-preferring behaviour can affect the socio-economic outcomes of children, beyond family size. We also provide novel evidence of differential impacts of son-preference at different birth parities.

This paper makes two important contributions. First, we provide evidence of son preference in Sierra Leone. Existing studies in the sub-Saharan African context provide evidence of son-preferring fertility behaviour in Nigeria (Milazzo, 2014), in North Africa (Rossi & Rouanet, 2015) and across sub-Saharan Africa more generally (Genicot and Hernandez-de-Benito, 2023). We complement this literature by providing evidence of son-preference in Sierra Leone, a country where such country-specific evidence has not previously been produced.

Second, we provide new evidence on the effect of son preferences on the education outcome of siblings. Existing studies have found evidence of effects of sibling sex on the health and well-being of mothers (Milazzo, 2014; Anderson & Ray, 2010), and on the likelihood of divorce family structure (Milazzo, 2014, Dahl and Moretti, 2008). Similar to our paper, Jakiela, et. al. (2023) find

that, in rural Kenya, having an older sister leads to improved vocabulary and fine motor skills among subsequent children. We provide evidence that these effects hold in the longer term, manifesting in reduced educational attainment.

2. Data

The study uses data for 29,703 women and 102,454 children from the 2008, 2013 and 2019 waves of the Demographic and Health Survey (DHS) in Sierra Leone. The DHS are a series of harmonised household surveys. Importantly for our analysis, the DHS woman's questionnaire gathers information on her fertility history and links this to information on children's education outcomes. The woman's questionnaire also asks women about their husband's education and employment.

We construct two samples for our analysis. First, to examine son-preferring fertility behaviour, we build a sample of mothers. This includes all women surveyed by the DHS who have at least one child. Table 1 presents descriptive statistics for this sample. Mothers are on average 32 years of age and have 3.9 children at the time of the DHS survey. 21% have completed primary school, and only 4.4% have completed secondary school. Women are married to men who are on average 42 years of age. 51.8% of first-borns are male, which is in line with the natural sex-ratio of 1.05:1 (Morse and Luke, 2021).

Table 1 - Mothers' Sample: Descriptive Statistics

	Mean	Std. dev.	Min	Max
Age	32.381	8.150	15	49
Age at first birth	19.351	4.129	9	44
Age at first marriage/cohabitation	18.069	4.659	10	47
Primary education	0.210	0.407	0	1
Secondary education	0.044	0.206	0	1
husband age	42.429	12.229	15	95
Husband primary education	0.369	0.483	0	1
Husband secondary education	0.287	0.452	0	1
First child male	0.518	0.500	0	1
Total births	3.910	2.304	1	16
Total boys (exc. Firs- born)	1.477	1.449	0	10
Total girls (exc. first-born)	1.433	1.418	0	11
N	23,477			

Second, to examine children's educational attainment, we build a sample of the children of these mothers. We restrict our sample to children of school-going age. i.e. 6-18, and who have at least one older sibling. Table 2 presents descriptive statistics for this sample. The average child in our sample is just over 7 years old and is from a family with 5.17 children at the time of the survey. The average child has 1.59 years of schooling.

Table 2 – Children's Sample: Descriptive Statistics

	Mean	Std. dev.	Min	Max
Child age	7.026	5.629	0	37
Child twin	0.035	0.185	0	1
Child male	0.522	0.500	0	1
Family size	5.175	2.133	2	16
Total boys	2.674	1.583	0	11
Total girls	2.500	1.534	0	11
First-born male	0.525	0.499	0	1
First-born alive	0.774	0.419	0	1
Child years of schooling	1.591	2.723	0	16
Child completed primary	0.019	0.135	0	1
Child completed secondary	0.007	0.082	0	1
Mother age	34.850	7.040	15	49
Mother age at first birth	19.025	3.944	10	43
Mother age at first cohabitation	17.772	4.498	10	47
Mother completed primary	0.148	0.356	0	1
Mother completed secondary	0.025	0.155	0	1
N	39,925			

3. Empirical Strategy

To identify the effect of first-born sex on mothers' fertility and on the education outcomes of subsequent children, we exploit random variation in first-born sex. As, conditional on having a child, that child's sex is as good as random, this provides a natural experiment with which to test

the effects of having a first-born brother, relative to a first-born sister. First, to identify the effect of first-born sex on fertility behaviour, we estimate the following model using OLS:

$$Y_i = \alpha + \beta Male_i + \boldsymbol{X_i'\rho} + e_i \quad (1)$$

where Y_i is our outcome of interest, i.e. the fertility of woman i, and $Male_i$ is an indicator equal to one if a woman's first-born child is male. $\boldsymbol{X_i}$ is a vector of characteristics of the women, which includes her age and her age squared, her age at first birth, age at first cohabitation and indicators for whether she has completed primary school and completed secondary school. e_i are clustered at the DHS sampling cluster level, which corresponds to rural villages or urban city blocks, as this is the level at which households are sampled.

Second, to identify the effect of first-born sex on the education outcomes of subsequent children, we estimate the following OLS specification:

$$Y_i = \pi + \gamma Male_i + \boldsymbol{\lambda_i} + \boldsymbol{X_i'\delta} + u_i \quad (2)$$

where Y_i is our outcome of interest, i.e. the education outcomes of child i, and $Male_i$ is an indicator equal to one if a child's first-born sibling is male. $\boldsymbol{\lambda_i}$ is a vector of age fixed effects. $\boldsymbol{X_i}$ is a vector of controls, which include characteristics of the child, specifically family size and indicators for whether the child is a twin and whether the child is male, as well as the characteristics of the child's mother that are included in equation (1), including her age and her age squared, her age at first birth, age at first cohabitation and indicators for whether she has completed primary school and completed secondary school. e_i are clustered at the DHS sampling cluster level, which corresponds to rural villages or urban city blocks, as this is the level at which households are sampled.

The key identifying assumption in our analysis is that the sex of the first-born child is as good as random. To provide evidence in support of this assumption, we conduct a series of t-tests, to examine whether first-born sex predicts any pre-determined characteristics of others. If first-born sex is indeed random, this should not be the case. The results of this analysis are presented in table 3. As can be seen, we do not find any significant differences across first-born sex in these pre-determined characteristics.

Table 3 – Balance tests

	(1) First-born Female	(2) First-born Male	(3) Difference	(4) p-value	(5) N
Birth year	1981.4	1981.3	.08	.472	26,494
Age at first birth	19.35	19.29	.06	.2339	26,494
Rural	.665	.663	.001	.814	26,494
Completed primary	.214	.216	-.002	.946	26,494
Completed secondary	.046	.046	-.0007	.773	26,494

4. Results

4.1 Son-preferring fertility behaviour

Table 4 presents the results on son-preferring fertility behaviour. Panel A presents the results for the full sample. We do not identify any significant average effect of first-born sex on family size (col. 1), however we do find that mothers who have a first-born son go on to have 0.04 fewer additional sons, relative to mothers with a first-born daughters (col. 2). We find no corresponding effect on total daughters (col. 3). Cols. 4-7 present estimates for the effect of first-born sex on the likelihood of having at least 3, 4, 5 or 6 children. While we do not find any effects on the likelihood of having at least 3 or 4 children, we do find evidence of son-preferring fertility behaviour, with those who have a first-born son being 1.14 percentage points (pp) less likely to have at least 5 children and 1.23 pp less likely to have at least 6 children. This is notable because the average fertility of women in our sample is just under 4, meaning that preferences over having further children will become important for many mothers after having a fourth child. It is at these margins that son-preferring fertility behaviour becomes apparent.

Panel B presents corresponding results for mothers whose first-born child is still alive at the time of the survey. Preferences are likely stronger as those whose son is still alive can naturally benefit from having a child of their preferred sex. For mothers whose first-born does not survive, their preferences may reflect that they need further sons to make up for the loss of the first. Indeed, the effects we identify in this sample are larger in magnitude and more precisely estimated. In particular, we now find statistically significant evidence of an effect on total fertility of -0.044. the effect on the likelihood of having 6 or more children increases in magnitude to -0.0142. As only 19% of mothers in this sample have 6 or more children, this corresponds to a decrease of 7.5%.

Effects on the likelihoods of having minimum numbers of children do appear to increase monotonically in magnitude. Figure 1 presents the coefficients and 95% confidence intervals from the models in columns 4-7 of panel B, showing that the effects are close to zero for smaller family sizes, but rise monotonically for larger family sizes.

Table 4 – First-born sex and stopping behaviour

	(1) Total fertility	(2) Total sons	(3) Total daughters	(4) >=3 children	(5) >=4 children	(6) >=5 children	(7) >=6 children
Panel A: All mothers							
Male	-0.0328	-0.0409**	0.00812	-0.000642	-0.00357	-0.0114*	-0.0123**
	(0.0200)	(0.0149)	(0.0144)	(0.00431)	(0.00476)	(0.00474)	(0.00436)
Sample mean	3.916	1.478	1.438	0.674	0.505	0.352	0.230
N	26494	26494	26494	26494	26494	26494	26494
Panel B: Restricting to mothers whose first-born is alive							
Male	-0.0443*	-0.0498**	0.00555	-0.00139	-0.00535	-0.0109*	-0.0142**
	(0.0212)	(0.0153)	(0.0153)	(0.00499)	(0.00536)	(0.00513)	(0.00456)
Sample mean	3.655	1.350	1.305	0.639	0.461	0.307	0.190
N	21328	21328	21328	21328	21328	21328	21328

Standard errors, clustered by DHS sampling cluster, in parentheses. * p<.1, ** p<.05, *** p<.01. Controls include age, age squared, age at first birth, age at first cohabitation and indicators for completing primary school and completing secondary school.

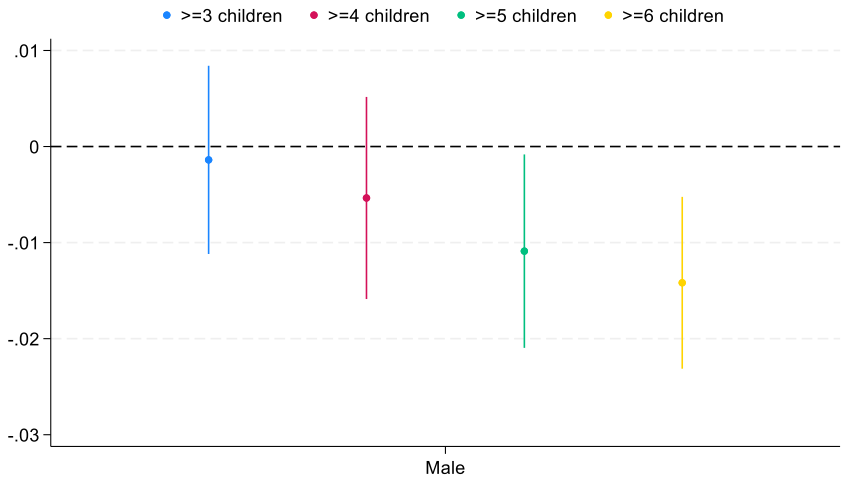

Figure 1 - First-born sex and family size: Point estimates and 95% confidence intervals.

4.1 Education outcomes

Table 5 presents the results on the education outcomes of subsequent children. Panel A presents the results for all subsequent children and panel B presents same for those whose first-born sibling is alive at the time of the survey. As most of the children in our sample are quite young and would not be expected to have attained many years of schooling, Panel C presents the results for those aged 10 and over.

Table 5 – First-born sex and education outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All birth orders			2nd born	3rd born	4th born	5th born	6th born
	Years of Schooling	Completed Primary	Completed Secondary	Years of Schooling				
Panel A: All mothers								
Male	-0.0170	-0.00215	0.000397	-0.0581	-0.0345	-0.0153	0.0349	0.0334
	(0.0200)	(0.00135)	(0.000808)	(0.0351)	(0.0331)	(0.0346)	(0.0365)	(0.0415)
S. mean	1.673	0.0192	0.00744	2.119	1.865	1.607	1.396	1.166
N	44073	44074	44074	12185	10069	7874	5566	3667
Panel B: Restricting to those whose first-born sibling is alive								
Male	-0.0124	-0.00140	0.000617	-0.0487	-0.0495	-0.00169	0.0209	0.0794
	(0.0223)	(0.00154)	(0.000898)	(0.0370)	(0.0358)	(0.0377)	(0.0405)	(0.0470)
S. mean	1.619	0.0188	0.00722	2.047	1.758	1.513	1.274	1.056
N	34053	34053	34053	10445	8184	6108	4030	2480
Panel C: Restricting to those aged 10 and over								
Male	-0.0716	-0.00641	0.000759	-0.119	-0.0844	-0.0541	0.0860	0.110
	(0.0521)	(0.00384)	(0.00229)	(0.0773)	(0.0844)	(0.0984)	(0.112)	(0.141)
S. mean	4.313	0.0538	0.0210	4.599	4.495	4.355	4.063	3.630
N	15547	15548	15548	5250	3846	2616	1695	1012

Standard errors, clustered by DHS sampling cluster, in parentheses. * p<.1, ** p<.05, *** p<.01. Controls include fixed effects for child age, and controls for whether a child is a twin, is male and family size. We also include controls for mothers' age, age squared, age at first birth, age at first cohabitation and indicators for completing primary school and completing secondary school.

While we do not find statistically significant evidence of any effect of first-born sex on the education outcomes of subsequent siblings, a consistent pattern of economically meaningful effects emerges when examining the results across all three panels. First, while we do not find any economically or statistically significant effects on primary or secondary school completion, we do see effects on years of education. Those who have a first-born brother tend to attain 1-2% fewer years of schooling than those who have a first-born sister.

The finding that those with a first-born brother attain less education could be seen as counterintuitive. With lower fertility after the birth of a first-born son, one may expect less competition for resources and thus improved education. However, these effects progress monotonically with birth order, progressing from negative to positive when moving to later birth orders. 2nd-born siblings experience the largest negative effect of having a first-born brother, which decreases in magnitude for 3rd- and 4th-born siblings. On the other hand, 5th- and 6th-born siblings experience positive effects of having a first-born brother. This might imply that for closer siblings in age, son-preference manifests in greater competition for limited educational resources within households, creating intrahousehold inequalities in education outcomes. Siblings spaced further away, who face less intense competition may instead benefit from spillovers from their oldest male sibling. Figure 2 presents point estimates and 95% confidence intervals for the effects of having a first-born brother on education for each birth order.

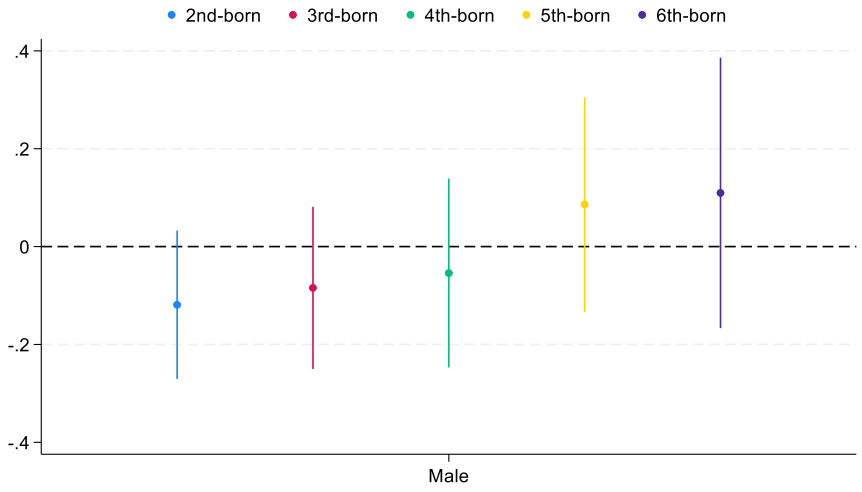

Figure 2 - First-born sex and educational: Point estimates and 95% confidence intervals.

5. Conclusion and Policy Implications

We find that in a high-fertility setting like Sierra Leone, son-preference may not be apparent on average but rather in the likelihood of having larger families. Son-preference also manifests in differential impacts on the educational attainment of subsequent children. Siblings closer in birth order go on to attain fewer years of schooling in the presence of a first-born brother, relative to a first-born sister, likely due to competing with that preferred son for limited resources. Later-born siblings benefit from an increase in educational attainment due to having a first-born brother, an effect that is likely driven by less competition for resources caused by having fewer later-born siblings.

These findings imply that the presence of systemic gender biases can result in or exacerbate sex-based intrahousehold inequalities in education. We can draw at least two possible policy recommendations from these insights. Firstly, governments and policymakers in sub-Saharan Africa, particularly in high-fertility contexts, should work to influence societal norms that create gender inequalities. Furthermore, governments may consider providing support for large families to mitigate intrahousehold competition for resources.

References

Anderson, S., & Ray, D. (2010). Missing women: age and disease. *The Review of Economic Studies*, *77*(4), 1262-1300.

Basu, D., & De Jong, R. (2010). Son targeting fertility behavior: Some consequences and determinants. *Demography*, *47*, 521-536.

Dahl, G. B., & Moretti, E. (2008). The demand for sons. *The Review of Economic Studies*, *75*(4), 1085-1120.

Genicot, G. & Hernandez-de-Benito, M. (2023) Firstborn girls and family structure: Evidence from sub-Saharan Africa.

Isiugo-Abanihe, U. C. (1994). Reproductive motivation and family-size preferences among Nigerian men. *Studies in family planning*, 149-161.

Jakiela, P., Ozier, O., Fernald, L. C., & Knauer, H. (2023). Big sisters.

Jensen, R. T. (2003). Equal treatment, unequal outcomes? Generating sex inequality through fertility behaviour.

Lambert, S., & Rossi, P. (2016). Sons as widowhood insurance: Evidence from Senegal. *Journal of Development Economics*, 120, p. 113-127.

Mace, R., & Sear, R. (1997). Birth interval and the sex of children in a traditional African population: An evolutionary analysis. *Journal of Biosocial Science*, 29(4), 499-507.

McFerson, H. M. (2012). Women and post-conflict society in Sierra Leone. *Journal of International Women's Studies*, 13(1), 46-67.

Milazzo, A. (2014). Son preference, fertility and family structure: Evidence from reproductive behavior among Nigerian women. *World Bank Policy Research Working Paper*, 6869.

Morse, A. and Luke, N. (2021). Foetal loss and feminine sex ratios at birth in sub-Saharan Africa.

Population Studies, p. 1–16.

Richards, P., Bah, K., & Vincent, J. (2004). *Social capital and survival: prospects for community driven development in post-confict Sierra Leone* (No. 12). World Bank, Social development Department.

Rossi, P., & Rouanet, L. (2015). Gender preferences in Africa: A comparative analysis of fertility choices. *World Development*, *72*, 326-345.

Wamani, H., Åstrøm, A. N., Peterson, S., Tumwine, J. K., & Tylleskär, T. (2007). Boys are more stunted than girls in sub-Saharan Africa: a meta-analysis of 16 Demographic and Health Surveys. *BMC pediatrics*, *7*, 1-10.