

Working paper

Examining the role of female education on son preference among Nepalese women

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Abstract

This paper investigates the impact of female education on son preferences in Nepal. It analyzes changing trends in son preferences in children among Nepalese women from 1996 to 2022 based on data from the Nepal Demographic and Health Surveys (NDHS). Using multivariate and multilevel regression, the study explores the roles of both individual and contextual education in reducing son preference. In addition to individual female education, a novel contribution of this research is the identification of a compositional effect of education on son preference. Furthermore, the study investigates the relationship between women's son preferences and their partner's education to check whether the latter also influences the gender preference of women in children. The positive association between the compositional effect of higher education and lower son preference suggests the need for policymakers to prioritize female education as one of the key investments to reduce son preference. The results highlight the importance of future research on how education's individual and compositional effects influence the sex ratio at birth. This is crucial for making informed decisions about including individual and compositional education effects in population projection models to better project future sex ratio at birth and population structure.

Keywords: Son preference, Female education, Nepal, Sex ratio at birth

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Introduction

Son preference is a long-standing aspect of Nepalese society; however, it becomes more evident as fertility decreases. In Nepal, the average number of children born per woman dropped from 4.6 in 1996 to 2.1 in 2022. In the same period, the Sex Ratio at Birth (SRB) significantly increased from around 106 to 119.1 male births per 100 female births (Ministry of Health and Population et al., 2022). Commonly, the SRB would lie around 103 to 107 male per 100 female birth. The male-biased skewed SRB (MBSRB), characterized by a SRB tilted towards more male births than naturally expected, is a topic of interest in many Asian countries because of the short and long-term implications on marriage patterns, fertility, population structure, inequality, and violence (Diamond-Smith & Rudolph, 2018; Feldman & Li, 2012; Guilmoto, 2012). While a large body of literature examines MBSRB and son preference in countries such as India, China, and Pakistan, research on son preference and its mitigating factors in Nepal is limited (Leone et al., 2003; Rai et al., 2014).

When Nepal transitioned from high fertility to low fertility, MBSRB became more prevalent. Despite the illegality of sex-selective abortion in Nepal, increasing MBSRB indicates a consistent rising trend in the abortion of female fetuses. Most couples in Nepal idealize a family with two children, one son and one daughter (Sapkota et al., 2019), however not all can achieve this ideal child composition within their idealized family size. Therefore, when couples do not have a son within their ideal family size, they may end up having more children than idealized because of son preference. On the other hand, couples may also want to achieve their lower idealized number of children but feel compelled to prioritize having a son, leading to pressure to avoid having daughters through sex-selective abortion (Brunson, 2010; Frost et al., 2013; The Kathmandu Post, 2023; Yi et al., 1993).

The MBSRB is a clear indication of gender discrimination, which is linked to various adverse health outcomes for females. Research in South Asian countries, including Nepal, shows that female children with older female siblings are more likely to suffer from malnutrition and stunted growth compared to those with older male siblings (Fledderjohann & Channon, 2022; Mitra, 2014; Raj et al., 2015). Studies from India, Bangladesh, and Pakistan have demonstrated that parents often continue having children until they achieve their desired number of sons, frequently resulting in a lack of resources and care for female children. This disparity leads to

higher rates of infant and child mortality among girls (Arnold et al., 1998; Gupta, 1987). While the absence of male siblings is associated with severe malnutrition and mortality risk for female children in Nepal, there is no definitive evidence supporting a direct relationship between son preference and female child mortality (Fledderjohann & Channon, 2022). Son preference has also been linked to intimate partner violence (IPV) against women in Nepal and India (Deuba et al., 2016; Weitzman, 2020). Having a firstborn daughter or no sons is found to increase the risk and severity of IPV in both countries. Weitzman's (2020) study shows that the severity of IPV due to the absence of sons is highest among women with no formal education.

MBSRB, a consequence of son preference in Nepal, is driven by the cultural and economic importance placed on sons over daughters. Nepalese society values sons for continuing the family lineage, which is important for continuing ancestral worship (Nanda et al., 2012; Sapkota et al., 2019; Acharya, 2019). Ancestral worship, performed by only male child (son or grandson) is considered to bring peace to deceased parents or grandparents; therefore, having a son is important from the parents' perspective even after their death. Besides the collective benefits for parents, having a son is important to increase female autonomy in household decisions. Studies from Pakistan, Nepal, and India (Gopalakrishnan et al., 2023; Gudbrandsen, 2013; Javed et al., 2019) show that having a son increases the woman's decision-making power and involvement within the decision-making of in-law family. Another factor of son preference in Nepal is the expectation of sons to provide physical and financial support to parents in their old age. In Nepal, parents usually co-reside with their son and his family, where the daughter-in-law takes on responsibilities for caregiving for in-laws and household chores. Since the government lacks significant old-age support and benefits, the son and his family become a primary source of physical, financial and emotional support for parents as opposed to daughters who traditionally move to their husbands' families after marriage. Therefore, having a son is considered to be important in Nepal to secure all forms of support at an older age. Research across various countries also shows that son preference is prevalent in countries where parents commonly reside with their married son (Ebenstein, 2021; Ebenstein & Leung, 2010).

Female education has been one of the major factors that is positively associated with socio-economic development as well as female autonomy. Various studies from developing countries, including Nepal, have shown a consistent positive relationship between female education and higher female autonomy regarding household decision-making, health care decisions and reproductive decisions (D. R. Acharya et al., 2010; Nigatu et al., 2014; Sheikh & Loney, 2018). Education is considered to empower women to realize their fertility intention (Lutz, 2017) and negotiate within their families and communities (Jose & Younas, 2023; Kien & My, 2021; Medel-Anonuevo, 1995; Stromquist, 2015). Educated women are also more likely to access paid job opportunities (Heath & Jayachandran, 2018; Lincove, 2008), enabling them to secure their future financially without relying on their husbands and sons. Educated women can also make financial and non-financial decisions (Kien & My, 2021). Education can empower women to challenge the existing gender norms through knowledge and skills, such as finance and rational thinking capacity. Therefore, female education may help to reduce son preference in countries where the importance of having a son is generally a social norm. Some studies in developing countries have already established a positive association between female education and reduced son preference (Nguyen & Le, 2022; Raza, 2023). However, the measurement of son preference in those studies is controversial and considered to have serious flaws (Jayachandran, 2017). This study will therefore investigate the relationship between female education and son preference in Nepal by using information regarding whether women want additional children once they meet their idealized number of children based on the sex composition of their previously born children.

Besides the individual advantage of female education on rational choices and decision-making regarding fertility and gender norms, there is also an additional compositional effect. As human beings are inherently influenced by the behaviour and choices of those around them, the desire to conform and gain acceptance from their social circles, including friends, family, and neighbours in proximity, is a powerful motivator to make decisions (Asch, 1956). The collective behaviour in society forms societal norms that guide individuals in their decision-making and behaviour (Cialdini & Goldstein, 2004). In the context of Nepal, where son preference is a prevalent social norm, residing in a community with norms preferring sons may lead individual women to share the same preference for sons regardless of their education.

Research statement and questions

Previous literature on son preference in Nepal showed the greater values associated with sons regarding the financial and physical support to parents and the cultural norms regarding the continuation of family lineage. Even though female education is associated with greater financial stability through paid jobs and greater autonomy to make decisions regarding fertility, as discussed above, there appears to be a gap in research addressing the direct impact of female education on son preference in Nepal over the last two decades. Education helps individuals see the world from a different perspective and evaluate their choices and decisions with different rationality than uneducated people do (Lutz, 2022). Therefore, there can be differences in the son preference between women of different education.

The enrollment of Nepalese women in higher education has significantly increased, rising from 23% in 1992 to 52% in 2018. During the same period, female participation in the labour force also increased from 25.3% to 37.8% (D. R. Acharya, 2021). This shift in female education and labour force participation has the potential to reshape women's perspectives on gender norms. In light of these changes, this study aims to investigate the evolving trend of son preference in childbirth, considering women from various educational backgrounds and diverse societal contexts over the past 25 years. The research delves into son preference in childbirth trends by assessing whether women desire additional children after achieving their idealized number of children.

Previous studies in Nepal primarily focused on son preference in relation to the ideal sex composition of the ideal number of children. As the majority of women prefer to have two children (57% in the sample of this study), one son and one daughter, son preference among these women was often overlooked. Since not all women are able to have both a son and a daughter in their first two births, some may have two sons or two daughters instead. Hence, this study investigates whether women desire to have additional children after reaching their ideal number of children, where they have only sons, only daughters, or a mix of both. This analysis assumes that the absence of a son may influence women to have more children than idealized if a son preference still exists. Based on this objective to investigate the desire for additional children in the presence and absence of a son, this paper assessed the following two research questions:

1. How does female education impact son preference, and how does this relationship change over time?
2. Does female education have a compositional effect on son preference in addition to the individual education level?

By investigating son preference in birth within communities at various education levels, the study provides insights into how son preferences may evolve as education continues to expand in the future. The outcomes of this study have practical implications for policy development, particularly in addressing the pressing issue of sex-selective abortions through female education. Furthermore, the findings can be used to better project the SRB in Nepal for future population projection, especially during social transitions from lower to higher levels of female education.

Hypothesis

Based on the established positive relationship between female education, female employment, and female autonomy, I propose the following hypotheses:

1. Women with higher levels of education can support themselves financially and have bargaining power within the family and society to reach their fertility preference. Therefore, highly educated women do not feel compelled to have sons, and son preference in birth decreases with increased female education.
2. Son preference in birth is a prevalent social norm in Nepal. Women feel compelled to have sons because of social pressure. However, when women live in a community where their peers have higher levels of education, the prevailing social norms in that community may lean more towards a reduced emphasis on son preference, aligning with the attitudes expected to see in highly educated women. Women may encounter less societal pressure to have a son in such cases. Therefore, an increase in higher educated women in a community decreases son preference.

Data and method

The Nepal Demographic Health Survey (NDHS) was conducted at six different time points in Nepal: 1996, 2001, 2006, 2011, 2016, and 2022, involving 53,484 interviews with women of reproductive age 15-49.

Among them, 39,898 (74.6%) ever-married women who had already met their ideal number of children were included in the study. This study includes only ever-married women who have already achieved their ideal number of children, assuming women will stop childbirth once they meet their idealized family size unless they specifically desire children of a certain gender. Based on Arnold, (1997) definition, gender preference in birth is considered to have existed if the probability of wanting additional children within specific parity differs significantly by the gender composition of already-born children. So, if women who had no sons or had only daughters wanted additional children after meeting the idealized family size, they were considered to have a son preference. Using this criterion, we investigate how the gender composition of previously born children impacts the desire for additional children among women with different education levels across various years and in diverse communities.

A multivariate binomial model is used to investigate the son preference among women with different education levels. The dependent variable is the desire to have additional children, categorized into two groups: "wanting or undecided" versus "not wanting". Only 0.9% of the sampled women were undecided about wanting additional children; 53% had no sons, and 22% had no daughters. Therefore, women who wanted more children and those undecided were grouped, assuming the uncertainty might be related to not having children of a specific gender.

The first model examined how the son preference changes over time for women with different educational backgrounds. Women's education is categorized into three groups: "no education", "primary", and "secondary or above". Similarly, the gender composition of previously born children is also categorized into three groups: only sons (no daughters), only daughters (no sons) and both (both son/s and daughter/s).

Secondly, the multilevel binomial regression model is used to estimate the interaction effect of the community's education and the gender composition of previously born children separately for women with different levels of education. Community education is measured by taking the mean years of schooling (MYS) of sampled women in each NDHS stratum. NDHS stratum is the group of multiple NDHS clusters (smallest spatial unit of DHS). Overall data includes 459 communities. The average sample size in each stratum is 355 women, and 75% of the stratum consists of at least 50 sampled women. In multilevel binomial regression

model individual women were considered as a first or individual level who are nested within community (second level) and community also nested within survey years. Using multilevel modeling also avoids the effect of changing socio-economic development on son preference over time. NDHS data from 1996 to 2022 are pooled together, with the survey year and community included as a fixed effect (Hazlett & Wainstein, 2022).

A sensitivity analysis is also performed to see whether the husband's education impacts the women's son preference, i.e., to explore whether the son preference among women is because of the pressure put by the husband on his wife.

The multivariate equation for each model is given below:

$$y = \beta_0 + \beta_1 * \text{survey year: gender composition of previously born children} + \beta_2 * \text{birth parity} + e \dots \dots \dots (1)$$

$$\text{Log} (p_{ijk} / (1 - p_{ijk})) = \beta_0 + \beta_1 * \text{community MYS}_{jk}: \text{gender composition of previously born children}_{ijk} + \beta_2 * \text{birth parity}_{ijk} + u_{jk} + v_k + e_{ijk} \dots \dots \dots (2)$$

Where, p_{ijk} is the probability of wanting additional child by an individual woman i living in the community j and surveyed in the year k . $\text{community MYS}_{jk}$ is the MYS in community j surveyed in year k . $\text{gender composition of born children}_{ijk}$ is the gender composition of children of women i living in community j and surveyed in year k . $\text{Birth parity}_{ijk}$ is the total number of children woman i living in community j and surveyed in year k have had. u_{jk} is the fixed effect specific to the j -th community surveyed in year k . v_k is the fixed effect specific to the k th survey year. e_{ijk} is the residual error term representing individual-level variability.

$$\text{Log} (p / (1 - p)) = \beta_0 + \beta_1 * \text{Partner education: gender composition of born children} + \beta_2 * \text{Birth parity} \dots \dots \dots (3)$$

Where: p represents the probability of wanting to have additional children

β_0 is the intercept term, β_1 and β_2 are the coefficients of respective variables.

All models run separately for each of three education level of women.

Result

Initially, the SRB is computed for women at various parities. The objective is to examine the variation in SRB between firstborn and lastborn children and to determine whether there is a preference for a specific gender in different birth orders. Figure 1 illustrates the SRB for both the first- and lastborn child among 14,746 women who idealized and had two children at the time of the interview (left side of Figure 1). The right side of Figure 1 shows the SRB among 5,669 women who idealized two children but ended up having three. Among the participants, 57% idealized having two children, while almost 24.2% aimed for three children. The inclusion of women who achieved their idealized number of two children on the left side of the figure allows to investigate whether sex selection occurs within the idealized number of children. Conversely, the right side of Figure 1 includes women who had three children, irrespective of their initial idealization of two children. This is based on the assumption that those who originally idealized two children might opt for sex selection at the third birth if they did not have a son within their idealized number of children.

On the left side of Figure 1, the SRB for the firstborn child (depicted by the yellow line) and the SRB for the second-born child, given that the firstborn is a son (shown by the blue line in the figure), exhibit a similar trend. However, there is a notable increase over time when considering the SRB for the second-born child, given that the first child is female (represented by the pink line in the figure). Specifically, the SRB increased from around 150 male births per 100 female births in 1996 and 2000 to a peak of 225 male births per 100 female births in 2016 before experiencing a slight decrease in 2022. However, on the right side of Figure 1, the SRB skews towards more female births for the firstborn (a similar pattern is observed in parity four; see Appendix D). This shift is because most women with daughters as their first child or their first two children opt to have three children to ensure they have at least one son. The SRB of the lastborn child is significantly skewed towards more male births if the first two children are daughters. This MBSRB becomes even more pronounced with increasing birth orders because the majority of women who continue to have more children are those who have not yet had a son and keep giving birth until they have at least one son. Overall, this result supports that despite the illegality of sex-selective abortion, there is a clear sex selection happening in the second and higher birth orders in Nepal to ensure having at least one son.

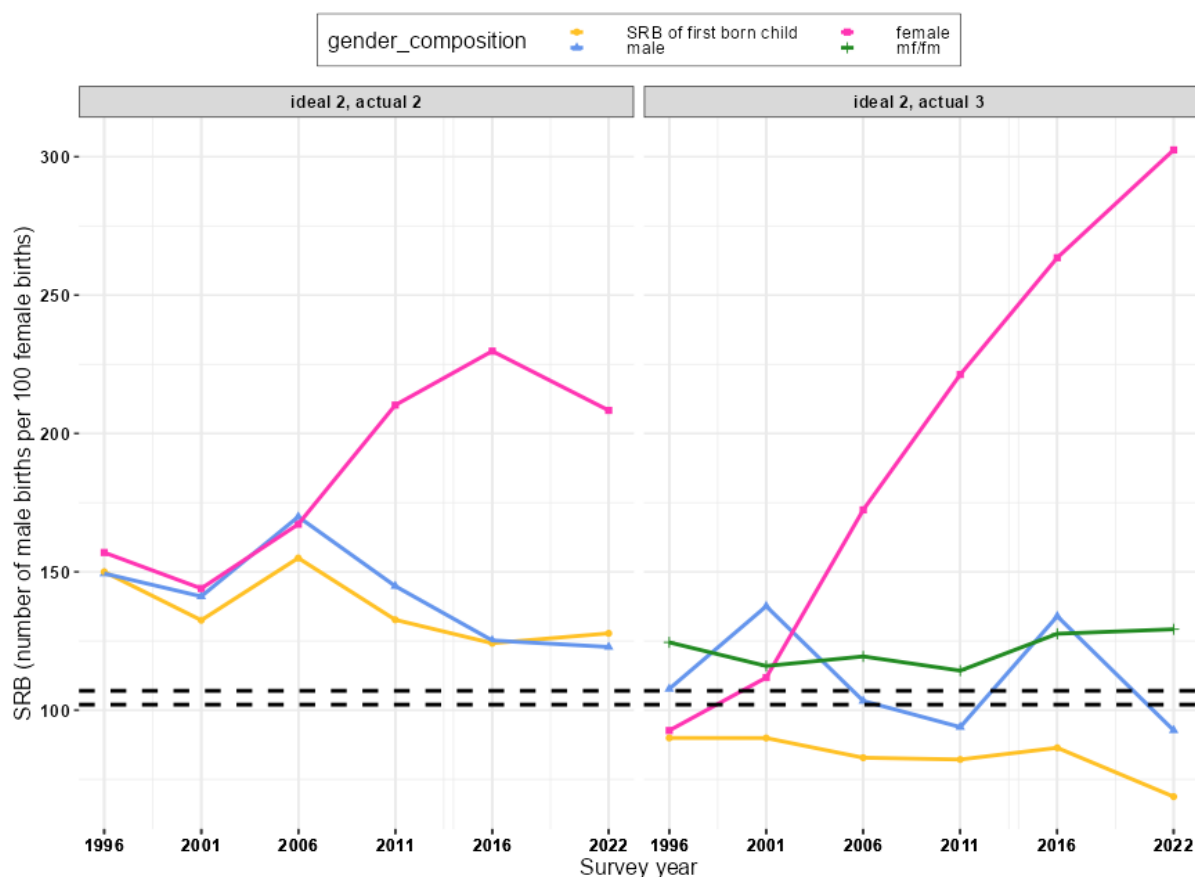


Figure 1: SRB of last-born child by the gender composition of previously born children and SRB of first child¹ among women idealized two children and had two surviving children (left side) and had three surviving children (right side) between 1996 and 2022

Secondly, the study examined how son preference changes over time among women with different educational backgrounds. To do this, I used a Binomial regression model to estimate the probability of wanting another child based on the gender composition of their previously born children in each survey year. This probability is estimated separately for women with three different education levels. These analyses are limited to women with at least two children and who have achieved their ideal family size. Overall, for women with only daughters (no sons), the desire to have more children after reaching their ideal number of children, which is called son preference in this text, is significantly higher than for those who have only sons (no daughters), indicating son preference. This son preference, however, has changed slightly over the last 25 years. For all women, regardless of their education level, son preference decreased by 20

¹ SRB for the first child is calculated without considering the gender composition of previously born children, given that no children were born prior to the first child.

percentage points, starting from a 50% likelihood to desire additional children in 1996 to a 30% likelihood in 2022. However, this decline is mainly influenced by women with no formal education, for whom the probability decreases from around 60% in 1996 to 30% in 2021. For educated women, primary or secondary and above, the probability of wanting more children decreases slightly from around 40% in 1996 to 25% in 2022. Initially, education had a significant impact, especially between those with some education and those with none. As stated in Hypothesis 1, women with higher levels of education might exhibit reduced son preference due to their capacity for financial security and empowered decision-making stemming from their education. However, this effect of education became less significant over the period. This change from a more significant to less significant educational gradient in son preference over time may be attributed to the effect of social norms. It is plausible that social norms emphasizing the importance of having a son could still contribute to a certain degree of son preference among all women, including educated women. Numerical estimates from the model is provided in Appendix A.

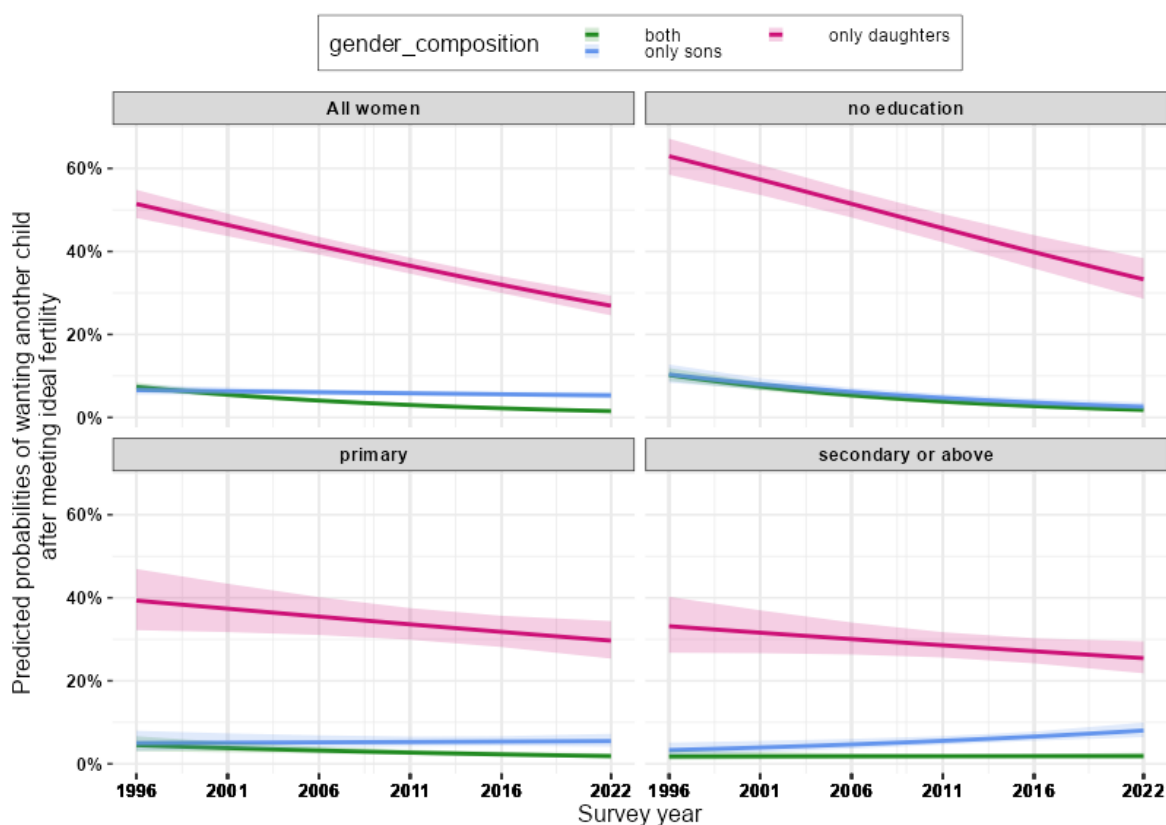


Figure 2: probability of wanting additional child after meeting ideal fertility by survey year and gender composition of previously born children for parity 2, stratified by individual education.

In this study, I further looked into the influence of community education, or the compositional effect of education, on the son preference of women with varying educational backgrounds. To do this, data from all surveys were pooled together. By using a binomial regression model with fixed effects for both community and survey years, the impact of community education on son preference is estimated. The survey year was incorporated as a fixed-effect variable to account for the potential influence of changing socio-economic development over time. Each stratum of each survey was treated as a unit of community, resulting in a total of 459 strata or communities. These communities were characterized by the mean years of schooling of the sampled women.

Figure 3 visually represents the probability of women desiring an additional child with at least two children, based on community education where women reside and the gender composition of their previously born children. This analysis provides insights into how community education levels relate to son preference among women with different educational backgrounds. The finding shows an additional compositional effect of education in reducing son preference. Specifically, when residing in communities with lower MYS, women with no sons tend to have a higher probability of wanting additional children than those living in higher MYS. In the community with the highest MYS (8 years of schooling), the probability of wanting an additional child for women with no sons is only 10% for all education groups. In general, for each unit increase in MYS within a community, the likelihood of wanting additional children among women with only daughters decreases by 12% relative to the initial probability. This reduction is 23% for those with no education, 29% for primary education, and approximately 15% for secondary education or higher. It is worth noting that while gender preference is at its lowest in highly educated communities, daughter preference (blue line in Figure 3) is almost as pronounced as son preference among secondary or above-educated women residing in highly educated communities. This increasing daughter preference is mainly pronounced among women with one child and almost insignificant if they had two or more children (see Appendix B).

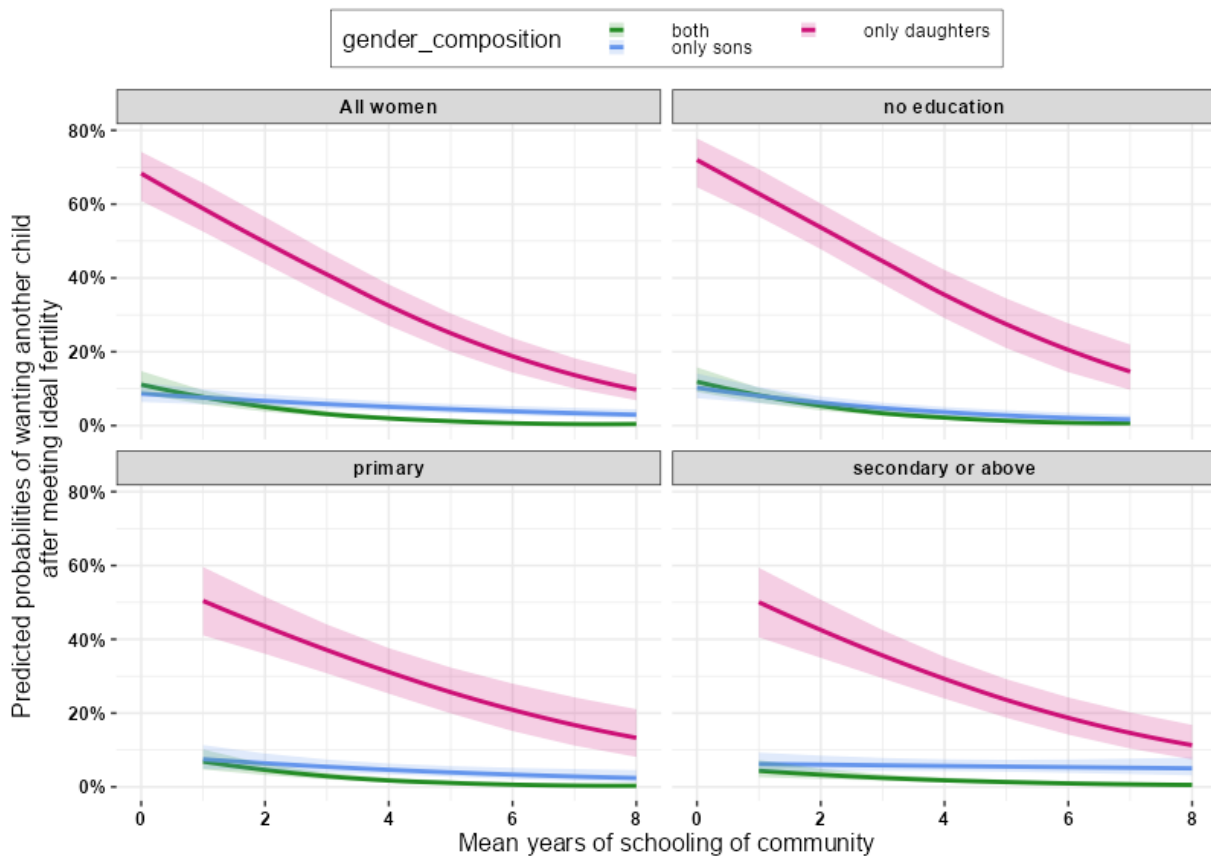


Figure 3: Probability of wanting an additional child after meeting ideal fertility by gender composition of previously born children and community education for parity 2, stratified by individual education

We included the education level of a woman’s partner and women’s individual education to see if it impacts the son preferences of women. Appendix E visually shows the likelihood of women wanting more children, along with the associated standard errors, based on two education categories: “no education” and “some education” for both women and their partners. In this context, “some education” means that the woman or her partner has had some formal education. The interesting finding is that, overall, a woman’s partner’s education level does not significantly influence her preference for having sons. This lack of influence could be due to a few reasons. One, there may not be significant differences in educational attainment between women and their partners in the study population. Additionally, shared social values and norms within families and the communities where they both live might play a more prominent role in shaping the son preference, overshadowing the influence of the individual partner’s education. Overall, the partner’s education level does not seem to be a big factor in determining whether a woman prefers to have sons. The numeric estimates are provided in Appendix c.

Conclusion

This study aimed to understand how education influences the preference for having sons among Nepalese women and how this preference has changed over the past 27 years. I started by looking at the SRB spanning the past 27 years and focused on how female education and contextual factors contribute to mitigating son preference. In this study, we defined "son preference" as the desire to have more children even after reaching the idealized number, especially if no sons were born. This definition aligns with Arnold's (1997) gender preference definition. The study included 39,039 women with at least two children and already achieved their idealized family size.

The result shows an increasing MBSRB over the period, supporting previous evidence of increasing sex-selective abortion in Nepal (Channon et al., 2021; Pradhan et al., 2019). Even though sex-selective abortion is illegal in Nepal, sex selection at birth seems apparent from the second birth order, and it gets pronounced with increasing birth order. This increasing MBSRB could be attributed to increasing norms of lower family size but the traditional values and importance associated with having a son. As the primary goal of this study is to investigate the influence of female education on the preference for having sons rather than the outcome itself, which is considered to be the result of that preference, the subsequent analysis looked into how the preference for having sons evolves over time among women of varying educational levels.

The finding suggests that female education not only reduces son preference among women but also exerts a broader influence beyond individual preferences, shaping the preferences of other women regarding the gender of their child. The study highlights a notable positive role of female education in reducing son preference, supporting the first hypothesis. This aligns with the results of a study conducted by Nguyen and Le in 2022 across 67 developing countries. Similar studies in India, Bangladesh, and Pakistan (Asadullah et al., 2021; Bose, 2012; Chowdhury, 1994; Raza, 2023) have demonstrated similar positive effects of women's education on reducing son preference. However, it is essential to note that individual education alone is insufficient to eliminate son preference. Although a significant difference in son preference between educated and uneducated women was observed at the study's beginning, this difference became less significant by the end. Despite this, son preference remains evident.

Community education, as characterized by the MYS in this paper, can be viewed as a proxy of social norms which can sometimes also act as a social pressure. The study shows that, regardless of no formal education, women who live in a community with a higher MYS have lower son preference. On the contrary, women living in a community with lower MYS have higher son preferences despite having higher education. This finding is consistent with the second hypothesis of this study, which is established based on the idea advanced by Cialdini & Goldstein (2004) that the collective behaviours of the majority in a society act as a norm. Individuals tend to follow this norm in order to gain acceptance and validation from their peers, neighbours or families to get a sense of belonging in their community. Therefore, changing educational composition can bring a shift in the norms regarding gender preference. As society progresses from lower to higher levels of education, the inclination toward son preference reduces among women of all education. It is crucial to recognize that son preference is influenced by the norms of the community where women reside. The process of change within a community norm is gradual, which takes time. However, investing in female education yields other various advantages beyond reducing son preference, including higher female labour force participation, thus contributing to the country's economy, empowering women to think rationally and to behave as they think, enhanced health outcomes for both mothers and children, a reduction in gender-based violence, and the bridging of gender inequality gaps.

While sex-selective testing of fetuses is prohibited in Nepal, the lack of effective law enforcement allows couples to abort female fetuses illegally (UNFPA, 2020). The government has enacted various laws to promote gender equality, including women's rights to ancestral property, reproductive rights, and reserved seats for women in the civil service. However, the implementation of these laws is often overshadowed by prevailing social rules and norms. There are also some programs that aim to reinforce regulations against violence related to women and children (Puri & Tamang, 2015). Besides these, a big economic aspect is still related to son preference in Nepal. The lack of effective old-age benefits and weak social security system is one of the major reasons that force parents to rely financially on their children, especially sons who co-reside with older parents. Since the patrifocal tradition compels daughters to move with their husbands and their husbands' families after marriage, having a son becomes crucial for parents seeking economic support in their old age. Therefore, investing in female education can provide a country with long-term demographic benefits,

including a reduction in son preference, the establishment of effective social protection, and a comprehensive healthcare system that could hasten the reduction in son preference.

This study also offers an important suggestion to demographers, emphasizing the importance of female education in forecasting future sex ratios at birth in Nepal. The changing nature of son preference in relation to the changing educational composition of society emphasizes the need to incorporate both individual female education and the broader compositional effect of education while projecting SRB. Integrating these factors is likely to improve the accuracy of Sex Ratio at Birth (SRB) and population projections. However, further research on the direct impact of compositional effects of female education on SRB is important before making any concrete decision as the outcome is SRB rather than son preference. Such studies can provide more valid insights, allowing for more accurate predictions of future populations by incorporating individual and compositional education effects into population projection models.

References

- Acharya, D. R. (2021). Status of Girls' Participation in Higher Education in Nepal. *International Journal of Multidisciplinary Perspectives in Higher Education*, 6(2), Art. 2.
<https://doi.org/10.32674/jimphe.v6i2.3922>
- Acharya, D. R., Bell, J. S., Simkhada, P., van Teijlingen, E. R., & Regmi, P. R. (2010). Women's autonomy in household decision-making: A demographic study in Nepal. *Reproductive Health*, 7(1), 15.
<https://doi.org/10.1186/1742-4755-7-15>
- Acharya, T. (2019). *Sex, Gender and Disability in Nepal: Marginalized Narratives and Policy Reform*. Routledge.
- Arnold, F. (1997). *Gender preferences for children*. Macro International Incorporated.
- Arnold, F., Choe, M. K., & Roy, T. K. (1998). Son Preference, the Family-building Process and Child Mortality in India. *Population Studies*, 52(3), 301–315. <https://doi.org/10.1080/0032472031000150486>
- Asadullah, M. N., Mansoor, N., Randazzo, T., & Wahhaj, Z. (2021). Is son preference disappearing from Bangladesh? *World Development*, 140, 105353. <https://doi.org/10.1016/j.worlddev.2020.105353>
- Asch, S. E. (1956). Studies of independence and conformity: I. A minority of one against a unanimous majority. *Psychological Monographs: General and Applied*, 70, 1–70.
<https://doi.org/10.1037/h0093718>
- Bose, S. (2012). A Contextual Analysis of Gender Disparity in Education in India: The Relative Effects of Son Preference, Women's Status, and Community. *Sociological Perspectives*, 55(1).
<https://doi.org/10.1525/sop.2012.55.1.67>
- Channon, M. D., Puri, M., Gietel-Basten, S., Stone, L. W., & Channon, A. (2021). Prevalence and correlates of sex-selective abortions and missing girls in Nepal: Evidence from the 2011 Population Census and 2016 Demographic and Health Survey. *BMJ Open*, 11(3), e042542. <https://doi.org/10.1136/bmjopen-2020-042542>
- Chowdhury, M. K. (1994). Mother's education and effect of son preference on fertility in Matlab, Bangladesh. *Population Research and Policy Review*, 13(3), 257–273. <https://doi.org/10.1007/BF01074337>
- Cialdini, R. B., & Goldstein, N. J. (2004). Social influence: Compliance and conformity. *Annual Review of Psychology*, 55, 591–621. <https://doi.org/10.1146/annurev.psych.55.090902.142015>

- Deuba, K., Mainali, A., Alvesson, H. M., & Karki, D. K. (2016). Experience of intimate partner violence among young pregnant women in urban slums of Kathmandu Valley, Nepal: A qualitative study. *BMC Women's Health*, *16*(1), 11. <https://doi.org/10.1186/s12905-016-0293-7>
- Diamond-Smith, N., & Rudolph, K. (2018). The association between uneven sex ratios and violence: Evidence from 6 Asian countries. *PLoS ONE*, *13*(6), e0197516. <https://doi.org/10.1371/journal.pone.0197516>
- Ebenstein, A. (2021). Elderly Coresidence and Son Preference: Can Pension Reforms Solve the 'Missing Women' Problem?. Available at SSRN 3829866.
- Ebenstein, A., & Leung, S. (2010). Son Preference and Access to Social Insurance: Evidence from China's Rural Pension Program. *Population and Development Review*, *36*. <https://doi.org/10.1111/j.1728-4457.2010.00317.x>
- Jin, X., Liu, L., Li, Y., Feldman, M. W., & Li, S. (2012, May). Gender imbalance, involuntary bachelors and community security: Evidence from a survey of hundreds of villages in rural China. In *Annual Meeting of the Population Association of America, May* (pp. 3-5). <https://www.semanticscholar.org/paper/Gender-Imbalance-%2C-Involuntary-Bachelors-%2C-and-%3A-a-Feldman-Li/d1ebc72e74950bb214267a9e52070c54b1c641fe>
- Fledderjohann, J., & Channon, M. (2022). Gender, nutritional disparities, and child survival in Nepal. *BMC Nutrition*, *8*, 50. <https://doi.org/10.1186/s40795-022-00543-6>
- Frost, M. D., Puri, M., & Hinde, P. R. A. (2013). Falling sex ratios and emerging evidence of sex-selective abortion in Nepal: Evidence from nationally representative survey data. *BMJ Open*, *3*(5), e002612. <https://doi.org/10.1136/bmjopen-2013-002612>
- Gopalakrishnan, L., Bertozzi, S., & Rabe-Hesketh, S. (2023). Role of marriage, motherhood, son preference on adolescent girls' and young women's empowerment: Evidence from a panel study in India. *PLOS ONE*, *18*(9), e0292084. <https://doi.org/10.1371/journal.pone.0292084>
- Gudbrandsen, N. H. (2013). Female Autonomy and Fertility in Nepal. *South Asia Economic Journal*, *14*(1), 157–173. <https://doi.org/10.1177/1391561413477945>
- Guilmoto, Christophe. *Sex imbalances at birth: Current trends, consequences and policy implications*. Bangkok, Thailand:: UNFPA Asia and the Pacific Regional Office, 2012.
- Gupta, M. D. (1987). Selective Discrimination against Female Children in Rural Punjab, India. *Population and Development Review*, *13*(1), 77–100. <https://doi.org/10.2307/1972121>

- Hazlett, C., & Wainstein, L. (2022). Understanding, Choosing, and Unifying Multilevel and Fixed Effect Approaches. *Political Analysis*, 30(1), 46–65. <https://doi.org/10.1017/pan.2020.41>
- Heath, R., & Jayachandran, S. (2016). *The causes and consequences of increased female education and labor force participation in developing countries* (No. w22766). National Bureau of Economic Research.
- Javed, R., null, null, Mughal, M., & null, null. (2019). Have a Son, Gain a Voice: Son Preference and Female Participation in Household Decision Making. *The Journal of Development Studies*, 55(12), 2526–2548. <https://doi.org/10.1080/00220388.2018.1516871>
- Jayachandran, S. (2017, June 19). *Odds are you're measuring son preference incorrectly*. <https://blogs.worldbank.org/impactevaluations/odds-are-you-re-measuring-son-preference-incorrectly>
- Jose, J., & Younas, J. (2023). Financial inclusion and women's bargaining power: Evidence from India. *International Review of Applied Economics*, 37(1), 76–92. <https://doi.org/10.1080/02692171.2022.2044459>
- Kien, L., & My, N. (2021). How Education Empowers Women in Developing Countries. *The B.E. Journal of Economic Analysis & Policy*, 21(2), 511–536. <https://ideas.repec.org/a/bpj/bejeap/v21y2021i2p511-536n5.html>
- Leone, T., Matthews, Z., & Zuanna, G. D. (2003). Impact and Determinants of Sex Preference in Nepal. *International Family Planning Perspectives*, 29(2), 69–75. <https://doi.org/10.2307/3181060>
- Lincove, J. Arnold. (2008). Growth, Girls' Education, and Female Labor: A Longitudinal Analysis. *The Journal of Developing Areas*, 41(2), 45–68. <https://doi.org/10.1353/jda.2008.0023>
- Lutz, W. (2017). Education empowers women to reach their personal fertility target, regardless of what the target is. *Vienna Yearbook of Population Research*, 15, 27–31. <https://www.jstor.org/stable/26506096>
- Lutz, W. (2022, June 6). Cognition-driven demographic transition. *N-IUSSP*. <https://www.niussp.org/fertility-and-reproduction/cognition-driven-demographic-transition/>
- Medel-Anonuevo, C. (1995). *Women, Education and Empowerment: Pathways towards Autonomy*. *UIE Studies* 5.
- Ministry of Health and Population, N., New ERA, & ICF. (2022). *Nepal Demographic and Health Survey 2022*. Ministry of Health and Population, Nepal. <https://dhsprogram.com/publications/publication-PR142-Preliminary-Reports-Key-Indicators-Reports.cfm>

- Mitra, A. (2014). Son Preference in India: Implications for Gender Development. *Journal of Economic Issues*, 48(4), 1021–1037. <https://doi.org/10.2753/JEI0021-3624480408>
- Nguyen, M., & Le, K. (2022). Maternal education and son preference. *International Journal of Educational Development*, 89, 102552. <https://doi.org/10.1016/j.ijedudev.2022.102552>
- Nigatu, D., Gebremariam, A., Abera, M., Setegn, T., & Deribe, K. (2014). Factors associated with women's autonomy regarding maternal and child health care utilization in Bale Zone: A community based cross-sectional study. *BMC Women's Health*, 14(1), 79. <https://doi.org/10.1186/1472-6874-14-79>
- Pradhan, E., Pearson, E., Puri, M., Maharjan, M., Maharjan, D. C., & Shah, I. (2019). Determinants of imbalanced sex ratio at birth in Nepal: Evidence from secondary analysis of a large hospital-based study and nationally-representative survey data. *BMJ Open*, 9(1), e023021. <https://doi.org/10.1136/bmjopen-2018-023021>
- Puri, M., & Tamang, A. (2015). *Assessment of Interventions on Sex-Selection in Nepal: Literature Review*. CREHPA.
- Rai, P., Paudel, I. S., Ghimire, A., Pokharel, P. K., Rijal, R., & Niraula, S. R. (2014). Effect of gender preference on fertility: Cross-sectional study among women of Tharu community from rural area of eastern region of Nepal. *Reproductive Health*, 11(1), 15. <https://doi.org/10.1186/1742-4755-11-15>
- Raj, A., McDougal, L. P., & Silverman, J. G. (2015). Gendered Effects of Siblings on Child Malnutrition in South Asia: Cross-sectional Analysis of Demographic and Health Surveys from Bangladesh, India, and Nepal. *Maternal and Child Health Journal*, 19(1), 217–226. <https://doi.org/10.1007/s10995-014-1513-0>
- Raza, F. (2023). Do educated mothers have lower desired son preference? The case of Pakistan. *Women's Studies International Forum*, 99, 102790. <https://doi.org/10.1016/j.wsif.2023.102790>
- Sapkota, J. B., Paudel, D. B., Neupane, P., & Thapa, R. B. (2019). Preference for Sex of Children Among Women in Nepal. *Global Social Welfare*, 6(2), 69–78. <https://doi.org/10.1007/s40609-018-0117-9>
- Sheikh, S. M., & Loney, T. (2018). Is Educating Girls the Best Investment for South Asia? Association Between Female Education and Fertility Choices in South Asia: A Systematic Review of the Literature. *Frontiers in Public Health*, 6. <https://doi.org/10.3389/fpubh.2018.00172>
- Stromquist, N. P. (2015). Women's Empowerment and Education: Linking knowledge to transformative action. *European Journal of Education*, 50(3), 307–324. <https://www.jstor.org/stable/26609280>

The Kathmandu Post. (2023, May 21). *Gender bias forcing women into sex-selective abortions*.

<http://kathmandupost.com/province-no-5/2022/01/13/gender-bias-forcing-women-into-sex-selective-abortions>

UNFPA. (2020). *PREVENTING SON PREFERENCE AND UNDERVALUING OF GIRLS IN ASIA PACIFIC*.

<https://www.semanticscholar.org/paper/PREVENTING-SON-PREFERENCE-AND-UNDERVALUING-OF-GIRLS/46d3cd4b2ab87921a70aaf7bf31682c12852cba5>

Weitzman, A. (2020). The Sex of Firstborn Children and Intimate Partner Violence in India. *Violence Against Women*, 26(6–7), 590–613. <https://doi.org/10.1177/1077801219833823>

Yi, Z., Ping, T., Baochang, G., Yi, X., Bohua, L., & Yongpiing, L. (1993). Causes and Implications of the Recent Increase in the Reported Sex Ratio at Birth in China. *Population and Development Review*, 19(2), 283. <https://doi.org/10.2307/2938438>

Appendix

Appendix A: Average Marginal effect from regression Model 1

Variables	Labels	Average marginal effect (LL - UL)			
		No education	Primary	Secondary or above	All women
Intercept	Intercept				
Gender composition of already-born children (ref= "Both")	Only daughter/s	0.3414*** (0.3174-0.3654)	0.2647*** (0.2399-0.2894)	0.2844*** (0.2537-0.3149)	0.306*** (0.290-0.322)
	Only son/s	0.0043 (-0.0026- 0.011)	0.0453*** (0.0346-0.056)	0.026** (0.0144-0.0377)	0.02*** (0.015 - 0.026)
Parity (ref= "Two")	One	0.0543** (0.034- 0.074)	0.0627*** (0.047 - 0.0784)	0.0563*** (0.035 - 0.077)	0.06*** (0.05 -0.0712)
	Three or more	-0.0358*** (-0.044- -0.027)	-0.0287*** (-0.042 - 0.015)	-0.0139* (-0.0256 -0.002)	-0.0219*** (-0.027 - -0.016)
Five-year survey period	Survey period	-0.0029*** (-0.003- -0.002)	0.0002 (-0.0005-0.001)	-0.001** (-0.0016-- 0.0004)	-0.0023*** (0.0025 - -0.002)

Notes: *** p<0.001, ** p<0.01, * p<0.05, . p<0.1,

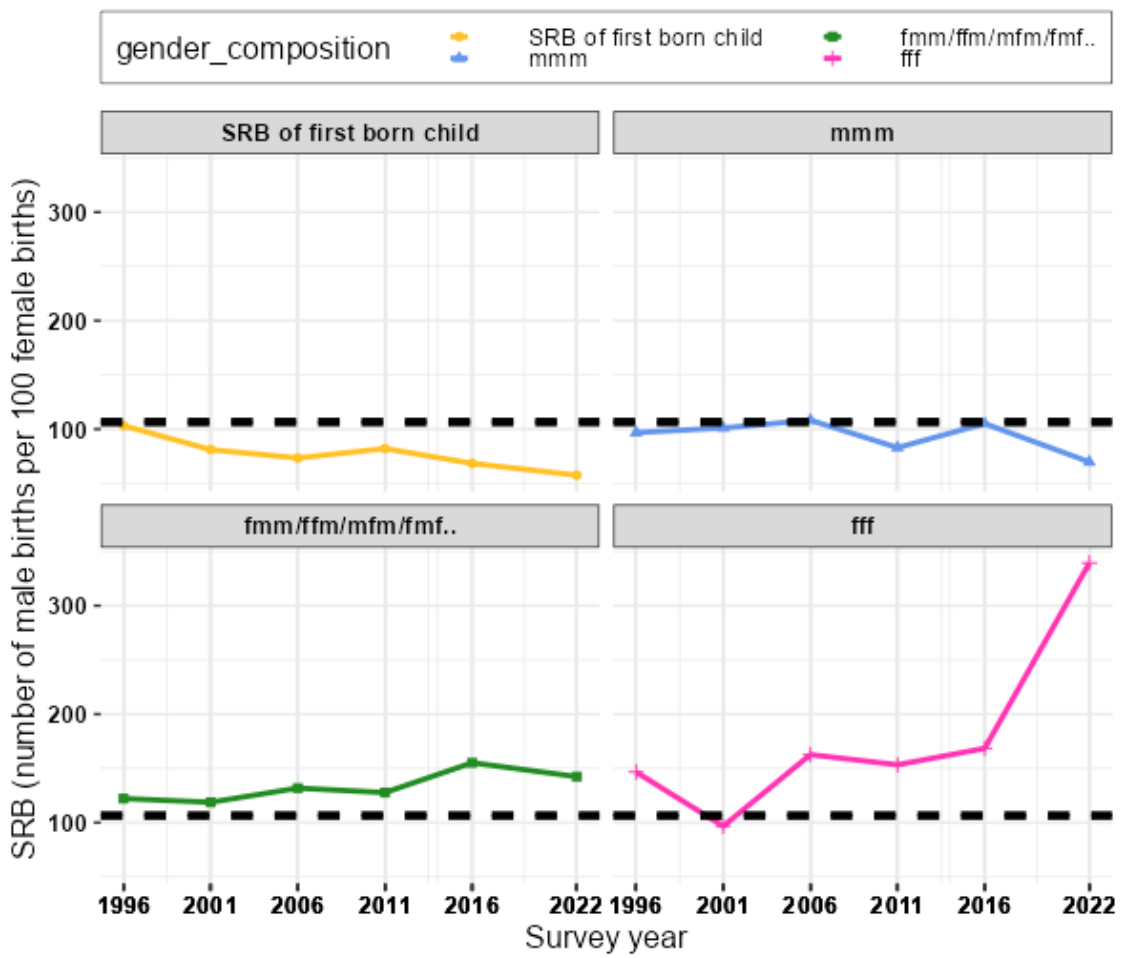
Appendix B: Average Marginal effect from regression Model 2

Variables	Labels	Average marginal effect (LL - UL)			
		No education	Primary	Secondary or above	All women
community education	MYS	-0.02*** (-0.023 - -0.017)	-0.009*** (-0.014--0.005)	-0.013*** (-0.017--0.009)	-0.018*** (-0.021 - -0.016)
Gender composition of already-born children (ref= "Both")	Only daughter/s	0.34*** (0.313 - 0.367)	0.275*** (0.247-0.304)	0.292*** (0.257-0.328)	0.317*** (0.297 - 0.338)
	Only son/s	0.003 (-0.004 - 0.01)	0.045*** (0.033-0.056)	0.026*** (0.014-0.038)	0.018*** (0.012 - 0.024)
Parity (ref= "Two")	One	0.059*** (0.037 - 0.081)	0.069*** (0.052-0.086)	0.058*** (0.037-0.08)	0.07*** (0.058 - 0.082)
	Three or more	-0.042*** (-0.051 - -0.033)	-0.034*** (-0.048--0.021)	-0.019*** (-0.031--0.007)	-0.033*** (-0.039 - -0.027)

Appendix C: Average Marginal effect from regression Model 3

Variables	Labels	Average marginal effect (LL - UL)		
		Partner's education		
		No education	Some education	Total
Intercept	Intercept			
Gender composition of already-born children (ref= "Both")	Only daughter/s	0.278*** (0.213-0.343)	0.288*** (0.268-0.308)	0.288*** (0.268-0.307)
	Only son/s	0.011 (-0.01-0.032)	0.033*** (0.025-0.041)	0.03*** (0.023-0.037)
Parity (ref= "Two")	One	0.053** (0.001-0.104)	0.06*** (0.048-0.072)	0.059*** (0.048-0.071)
	Three or more	-0.033*** (-0.056--0.009)	-0.017*** (-0.025--0.008)	-0.018*** (-0.026--0.01)
Women's education (ref= "no education")	Some education	0.008 (-0.011-0.027)	-0.021*** (-0.034--0.008)	-0.016*** (-0.026--0.006)

Appendix D: Trend in SRB of lastborn child and firstborn child by the gender composition of siblings among women with 4 children



Appendix E: Desire to have additional children by women's and their partners' education, stratified by the sex composition of their previously born children

