

Exogenous variation in family size: Sex Composition of Children and the third birth.

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Estimand

Research Question

Does gender composition of the first two childbirth cause families to conceive a third child?

Specifically, do families having two daughters (as their first two children) exhibit **higher proclivity to have additional children** than those who have had at least one son?

Therefore, the research question pertains to sex preference (in this case son-preference)

Relevance

Why is this relevant?

General overview/context of son preference in East and South Asia are (Monica Das Gupta and Hwa-Ok, 2003) :

- ▶ **Economic factors** : Dowry requirement, old-age support from sons, gender discrepancies in labour market opportunities
- ▶ **Cultural factors** : strong patrilineal family systems, society's view on gender roles, shifts in women's power over her life-cycle (Gupta, 1996)

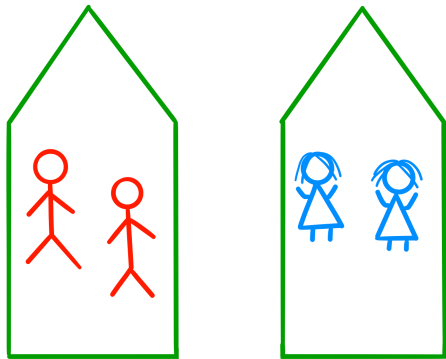
Thereby, son preference in fertility is a widely documented phenomena in **developing countries like Vietnam, India, China, Nigeria¹ and Nepal².**

¹(Haughton and Haughton, 1999; Pande and Astone, 2007; Das, 1987; Zheng et al., 2018; Graham et al., 1998; ?)

²(Brunson, 2010; Leone et al., 2003; Stash, 1996; Karki, 1988)

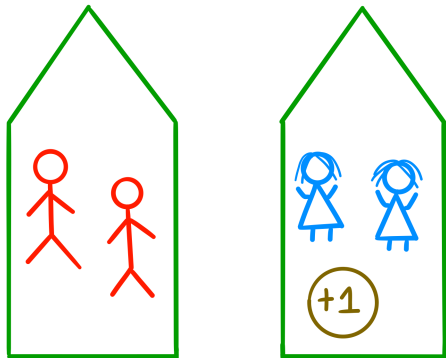
Intuition of Relevance

If we compare two identical households but with different gender composition of children...



Intuition of Relevance

If sex composition does indeed exogenously increase family size, the first and second-born girls will find themselves in a completely different economic and sociological predicament than the boys.



Selected Literature Review

- ▶ **Theory:** Much of the theoretical basis and intricacies for this paper was influenced by *Do Sex Preferences Really Matter?* (Ben-Porath and Welch, 1976)
- ▶ **Empirical foundation:** The empirical specification for this paper mirrors that of *Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size* (Angrist and Evans, 1998).

Estimator and Causality

Empirics

This paper uses the **first-stage least squares** of the 2SLS IV approach from the paper by (Angrist and Evans, 1998)(and others³)

The aim is to estimate a causal relationship between sex composition and continued fertility decision.

³(Lee, 2008; Moschion, 2013; Iacovou, 2001; Cruces and Galiani, 2007)

Causality in an Ideal Scenario

As shown in DAG, **if the distribution of sex at birth is indeed random and exogenous to the model**, the treatment effect here can be causally interpreted.

Also, the purpose of covariates in this case, is not a conditioning strategy but merely to look at heterogeneous treatment effects.

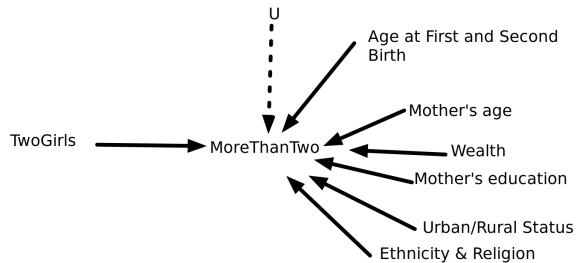


Figure: Ideal Causal Scenario where *TwoGirls* is exogenous

Realistic Causality

However, given the incidence of **sex-selective abortion**, *TwoGirls* may indeed not be exogenous with the presence of confounders.

In such cases conditioning on these confounders isolates our intended causal effect of *TwoGirls* on propensity for the third birth

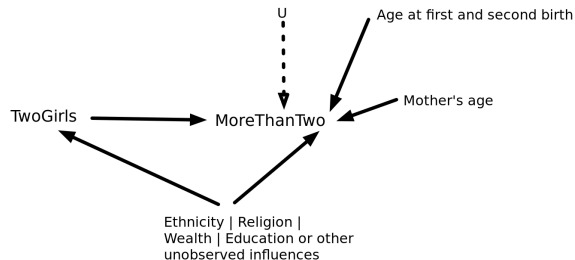


Figure: Effect of confounders

Empirical Specification

$$y_{it} = \alpha_0 + \alpha_1 x_{it} + \alpha_2 \mathbf{Z}_{it} + \varepsilon_{it}$$

y_i is *MoreThanTwo* (**1** if the mother had more than two children and **0** if not).

x_i is a categorical variable for **TwoGirls** where, if s_i is a female first-born, and s_2 is a second-born female,

$$TwoGirls = s_1 \cdot s_2$$

$$TwoBoys = (1 - s_1) \cdot (1 - s_2)$$

Empirical Specification

Z_{it} is a vector of parent/household-level covariates: mother's age, years of education, mother's age at first birth, mother's age at second birth.

It also includes **dummies for demographic indicators** such as Brahmin/Chhetri, religion (Hindu, Muslim, Buddhist, Christian and others), urban/rural status, and wealth index quantiles as provided by the NDHS.

The data used is **Nepal Demographic and Health Survey (NDHS)** dataset of 1996, 2001, 2006, 2011, 2016, and 2022 A.D., conducted by the USAID.

Estimates

A preliminary Graph

Figure: Proportion of women who had more than two children by respective birth cohorts i.e. the year they birthed their second child (Three year moving averages with trend lines OLS)

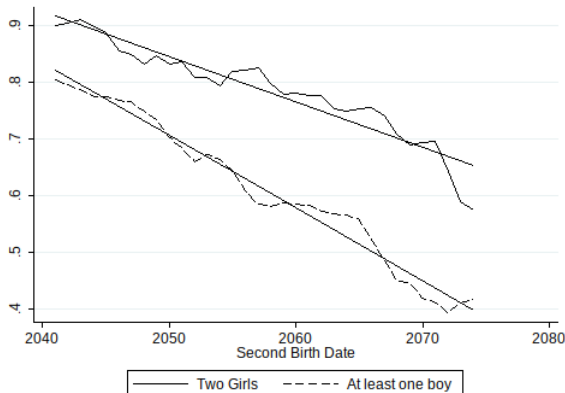


Table: OLS Estimates for More Than Two Children equation for 1996 NDHS iteration

	(1)	(2)	(3)
Two Girls	0.043*** (0.012)	0.033*** (0.013)	0.021 (0.014)
Two Boys		-0.028** (0.012)	-0.028** (0.012)
Boy Second		-0.006 (0.012)	-0.006 (0.012)
Years of education		-0.021*** (0.002)	-0.018*** (0.002)
Urban (Base: Rural)			-0.079*** (0.016)
TwoGirls X Urban (Base: Rural)			0.074** (0.033)
Observations	6323	6323	6323
Adjusted R-squared	0.002	0.278	0.281
Covariates	No	Yes	Yes
Dummy and Interaction	No	No	Yes

1996 NDHS iteration

- ▶ Women with two daughters are estimated to be **3 percentage points more likely** to have a third child than those with at least one son.
- ▶ Each additional year of schooling reduces the likelihood of a third child by 2 percentage points. (for all women)
- ▶ Heterogeneity: among women with two daughters, urban women are shown to be 7 percentage points more likely to further childbearing than their rural counterparts.

Table: OLS Estimates for More Than Two Children equation for 2022 NDHS iteration

	(1)	(2)	(3)
Two Girls	0.245*** (0.012)	0.188*** (0.013)	0.115*** (0.021)
Two Boys		-0.062*** (0.012)	-0.063*** (0.012)
Boy Second		-0.028** (0.012)	-0.025** (0.012)
Years of education		-0.030*** (0.001)	-0.021*** (0.001)
Two Girls X Muslim (Base: Hindu)			-0.243*** (0.055)
Two Girls X Wealth Index (middle income) (Base : Wealth index (poorest))			0.130*** (0.029)
Two Girls X Wealth Index (rich)			0.142*** (0.031)
TwoGirls X Wealth Index (richest)			0.231*** (0.037)
Observations	8162	8162	8162
Adjusted R-squared	0.045	0.362	0.388
Covariates	No	Yes	Yes
Dummy and Interaction	No	No	Yes

2022 NDHS iteration

- ▶ Women with two daughters are nearly **19 percentage points more likely** to have a third child, marking the largest effect observed across six DHS iterations.
- ▶ The three richest wealth index quantiles exhibit a higher propensity for further childbearing compared to the poorest quantile.

Summary of findings

1. For all six NDHS iterations, **women with two daughters are estimated to be more likely to have a third child** than those with at least one son (in models with covariates).
 - ▶ The result mirrors that of (Lee, 2008) but is different from balanced-sex preference findings in (Angrist and Evans, 1998; Iacovou, 2001; Moschion, 2013)
2. Women from wealthier households and urban background exhibited stronger son preferences.⁴

⁴However, the power to determine these heterogeneities depends on the number of samples for each category

Summary of findings

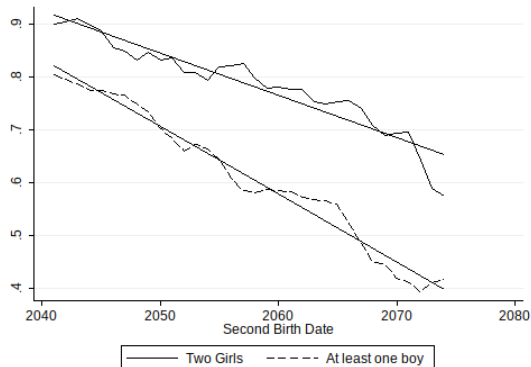


Figure: Prop. of women with more than 2 children

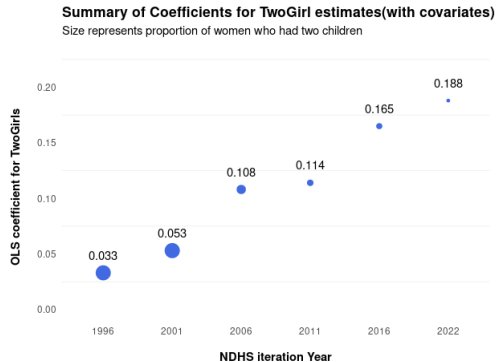


Figure: Summary of estimates

Caveats for the increasing trend:

- ▶ I only look at parity progression from 2 to more than 2, neglecting other transitions.
- ▶ The higher fertility rate in 1996 might have **masked gender-based fertility preferences** i.e. families expecting to have, for example, eight children, would not be worried that their first two are girls, even if they have a son preference.

Discussions and Limitations

Discussions and Limitations

The paper assumes the natural sex ratio at birth, but nationally representative studies on Conditional Sex Ratio (CSR) report skewed sex ratio at birth.^a

^a(Frost et al., 2013; Pradhan et al., 2019)

Year	1996	2001	2006	2011	2016	2022
Prop Two Girls	0.238	0.247	0.244	0.235	0.230	0.246
Prop Two Boys	0.264	0.264	0.254	0.266	0.252	0.257
Obs	6335	6451	6436	7106	7169	8163

Table: Estimates from author's own calculation using NDHS surveys

For Context, WHO's estimate for sex ratio at birth (1.05 males per female) means that

$$Pr(BB) = 0.262$$

$$Pr(GG) = 0.238^a$$

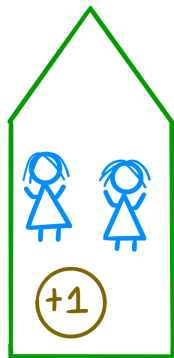
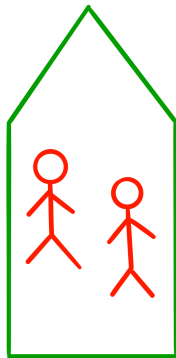
^aI report these measure for context. Analysis on these measures requires further studies

Considerations contd..

- ▶ There may be **variability in probability in male births** within the population. (Ben-Porath and Welch, 1976)
- ▶ Multiparous (women with more than one offspring) women **may be more likely to have prenatal knowledge of the sex of their offspring**. This will violate exogeneity assumption. (Pradhan et al., 2019)

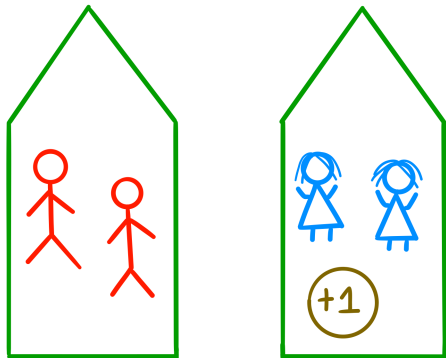
Policy Implication

The two girls will have to put up with the **increased pressure increased family size**, which may have adverse impact on their human capital development.



This research provides **policymakers awareness of this unintuitive phenomena.**

Any and all policy pertaining to SDG 4 :
"Gender equality" must be cognizant of
this factor.



Conclusion

Using six iterations of NDHS, the paper estimated that families with two daughters are more inclined to have additional children than those with at least one boy, indicating a persistent preference for sons.

References I

- Angrist, J. D. and Evans, W. N. (1998).
Children and their parents' labor supply: Evidence from exogenous variation in family size.
The American Economic Review, 88(3):450–477.
- Ben-Porath, Y. and Welch, F. (1976).
Do sex preferences really matter?
The Quarterly Journal of Economics, 90(2):285–307.
- Brunson, J. (2010).
Son preference in the context of fertility decline: limits to new constructions of gender and kinship in Nepal.
Studies in family planning, 41(2):89–98.
- Cruces, G. and Galiani, S. (2007).
Fertility and female labor supply in latin america: New causal evidence.
Labour Economics, 14(3):565–573.
- Das, N. (1987).
Sex preference and fertility behavior: A study of recent indian data.
Demography, 24(4):517–530.
- Frost, M. D., Puri, M., and 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.
- Graham, M. J., Larsen, U., and Xu, X. (1998).
Son preference in anhui province, china.
International Family Planning Perspectives, 24(2):72–77.

References II

- Gupta, M. D. (1996).
Life course perspectives on women's autonomy and health outcomes.
Health Transition Review, pages 213–231.
- Haughton, J. and Haughton, D. (1999).
Son preference.
Health and Wealth in Vietnam: An Analysis of Household Living Standards, pages 97–199.
- Iacovou, M. (2001).
Fertility and female labour supply.
Technical report, ISER Working Paper Series.
- Karki, Y. B. (1988).
Sex preference and the value of sons and daughters in nepal.
Studies in Family Planning, 19(3):169–178.
- Lee, J. (2008).
Sibling size and investment in children's education: An asian instrument.
Journal of Population Economics, 21:855–875.
- Leone, T., Matthews, Z., and Zuanna, G. D. (2003).
Impact and determinants of sex preference in nepal.
International family planning perspectives, pages 69–75.
- Monica Das Gupta, Jiang Zhenghua, L. B. X. Z. W. C. and Hwa-Ok, B. (2003).
Why is son preference so persistent in east and south asia? a cross-country study of china, india and the republic of korea.
The Journal of Development Studies, 40(2):153–187.

References III

Moschion, J. (2013).

The impact of fertility on mothers' labour supply in australia: Evidence from exogenous variation in family size.
Economic Record, 89(286):319–338.

Pande, R. P. and Astone, N. M. (2007).

Explaining son preference in rural india: the independent role of structural versus individual factors.
Population Research and Policy Review, 26:1–29.

Pradhan, E., Pearson, E., Puri, M., Maharjan, M., Maharjan, D. C., and 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.

Stash, S. (1996).

Ideal-family-size and sex-composition preferences among wives and husbands in nepal.
Studies in Family Planning, pages 107–118.

Zheng, Z., Gu, B., and Gietel-Basten, S. (2018).

Fertility preferences in china.
Family Demography in Asia: A Comparative Analysis of Fertility Preferences, pages 109–120.