On The Quantity of Girls*

A reproduction of On The Quailty and Quantity of Girls

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This paper discusses the impact of ultrasound machine availability and birth order on the number of female abortions in India. We find that as the number of ultrasound machine imports increase, they become more accessible and more frequently used by pregnant mothers. We also find that the abortion rate of secondborn girls is higher when the firstborn child is a girl. These findings matter as it enables us to understand the existing cultural preference towards sons and the lack of effectiveness of regulations placed to control sex-selective abortions in India.

1 Introduction

A patriarchy is defined as a social system in which positions of dominance and supremacy are primarily held by men (Dictionary.com n.d.). Stemming from ancient Greek, the word patriarchy literally means "rule of the father" (Higgins 2018). In Indian society, men as fathers or husbands are generally regarded as the official heads of households and figures of authority. According to a survey by Jonathan Evans and Corichi (2022) in 2019-2020, 64% of Indian adults completely agree that a woman should always obey her husband and 58% of Indian adults completely agree that men have priority when jobs are scarce. Moreover, daughters in Indian society are generally expected to live with their husbands and pay obligations towards their in-laws. Hence, the value of having a daughter is regarded as less than having a son.

In this paper, we explore the trends of ultrasound machines imported and used, the amount of first births that are girls, and the number of second children who are girls given that the first child was also a girl. Our findings show the impact of the increased availability of prenatal sex detection technologies; as the quantity of imported ultrasound machines increased, so did the number of mothers who used an ultrasound test during their pregnancy between 1996 and

*Code, data, and replication are available at: https://github.com/tayedzac/quality-and-quantity-of-girls.git and doi.org/10.1093/ej/ueab035

2002. We also found that the decision to abort girls was largely dependent on birth order; the fraction of firstborn females in India stayed relatively consistent through 1975 to 2005, however the number of second-born females, given that the firstborn is a girl, declined through 1975 to 2005.

This exploration is important as multiple regulations including the Medical Termination of Pregnancy (MTP) Act and Prenatal Sex Diagnostic Techniques (PNDT) Act were placed to control sex-selective abortions in India - sex-selective abortions increased with the legalization of abortions as well as the increased availability of ultrasound machines. By looking at the timeline of when these regulations were in place and its impact towards the number of aborted girls, we can better understand the cultural preference towards boys in India.

We will draw from and conduct a reproduction of The Economic Journal's publication "On the Quality and Quantity of Girls: Fertility, Parental Investments, and Mortality". This will allow us to explore their methodologies and results, as well as further expand on the exploration around sex-selective abortions in India. We first present our data, then discuss our results, and close our paper with a conclusion. We use R (R Core Team 2022) for all data cleaning and analysis, R packages *tidyverse* (Wickham et al. 2019), *janitor* (Firke 2023), *tidyr* (Wickham, Vaughan, and Girlich 2023), *dplyr* (Wickham et al. 2023), *ggplot* (Wickham 2016), to create the figures, and *haven* (Wickham, Miller, and Smith 2022) to read the dta files.

2 Data

2.1 Data Source and Methodology

The data used in this paper are obtained from The Economic Journal, which is available through the Journal website. The Economic Journal examined mortality and fertility through the National Family Health Survey (NFHS), which conducted three rounds of nationwide cross-sectional surveys in 1992-93, 1998-99, and 2005-06. The NFHS is representative at the state level and outlines reports by surveyed women including data on the children's month, year, and order of birth, mother's age at child's birth, and more. The overall sample includes data from 1973-2005, consisting of 503,316 births of 232,259 mothers.

2.2 Attributes

In this analysis we used 2 different datasets: one that summarizes ultrasound imports and uses, and one containing postbirth analytics in India. Through data cleaning, we chose to keep the following variables from the first data set: startyear (the year), ultrasoundscanner (the number of imported ultrasound machines), and ults_pct (the number of births with reported ultrasound use). In the second data set, we chose to keep: yearc (the year), femalec (indicates if the child is a girl), bord (birth order number), and girl1 (indicates if the first child is a girl).

3 Results

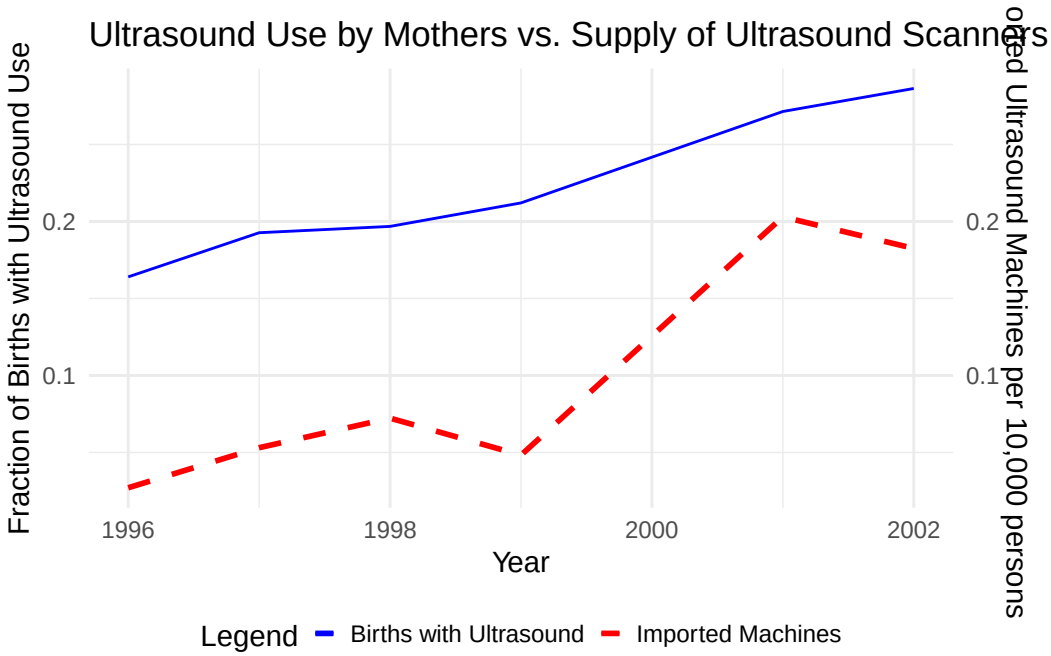

Figure 1: Fraction of birth with ultrasound use vs. imported ultrasound machines.

Figure 1 shows the quantity of imported ultrasound machines as well as the number of mothers who reportedly had an ultrasound test during their pregnancy between 1996 and 2002 (S Anukriti and Tam 2020). We see that throughout the years, the number of imports had an increasing trend as did the fractions of mothers that used ultrasound machines. The dotted line shows that, in 1996, the fraction of imported ultrasound machines was 271 per ten thousand persons, which was the lowest fraction in the trend. As the import tariff on medical devices dropped from 40%-60% in the 1980s to 25% in the late 1990s, the number of ultrasound machine imports increased. By 2002, the number of ultrasound machines imported rose to 1825 machines per ten thousand persons. In 1996, the fraction of mothers who reportedly used an ultrasound at some point of their pregnancy was 0.164, but the amount continued to grow each year before reaching 0.286 in 2002.

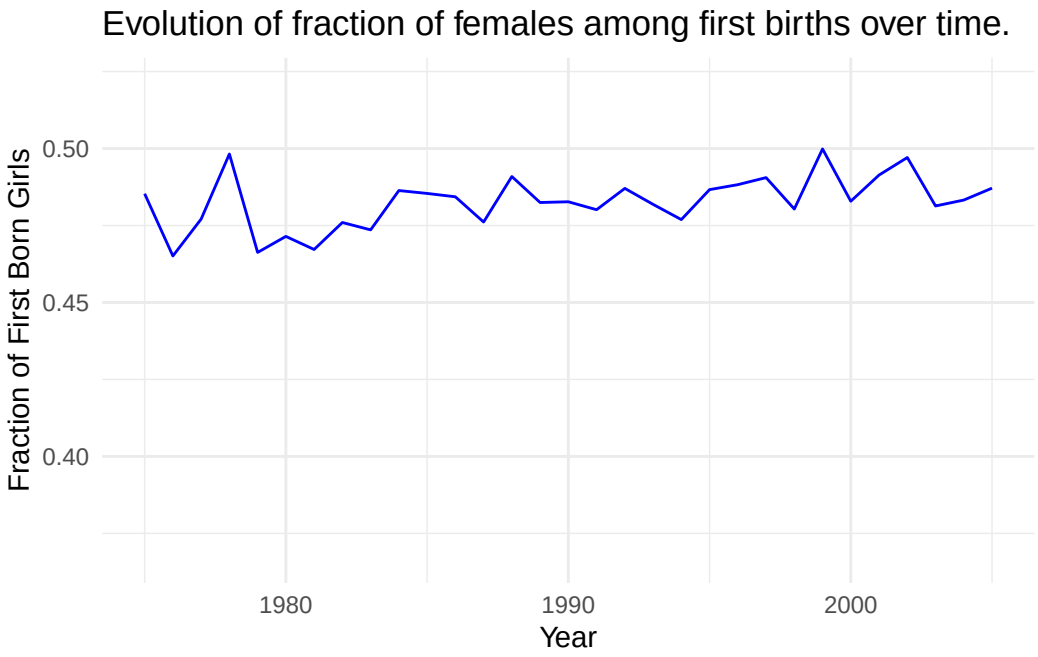

Figure 2: Number of second female children

Figure 2 shows the evolution of the fraction of females among first births in India from 1975 to 2005. We see that the overall trend of the fraction of firstborn girls is generally consistent throughout these years; the fraction of firstborn girls lies within the range of 0.46 as the lowest fraction in 1976, and 0.49 as the highest fraction in 1999. Thus, the fraction of firstborn girls is not heavily impacted by the legalization of abortion in 1971, or when abortion became safer and more accessible in 2002-2003. This makes sense according to S Anukriti and Tam (2020), which states that although the majority of families express a preference of having a son, this desire is only strong if there is only one child in the family. In a family size of two, there is a stronger preference towards having one daughter and one son in comparison to having two sons. Thus, even if the firstborn is a girl, this does not influence the decision towards choosing abortion, unless they are only planning to have one child.

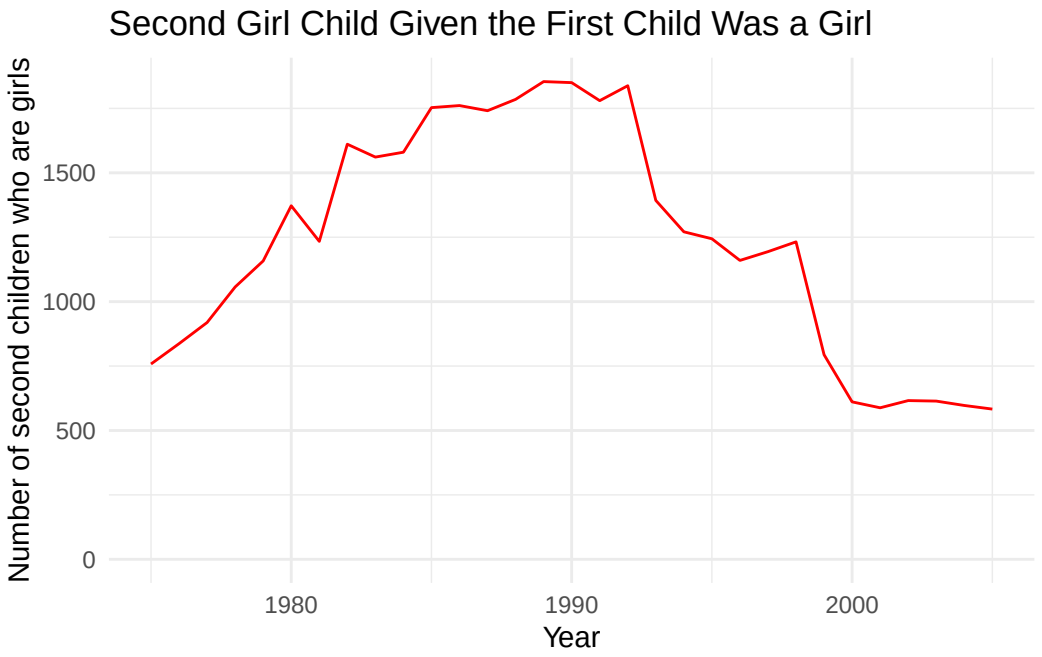

Figure 3: Number of second female children

Figure 3 shows the trend of the number of second children who are girls given that the first child in the family was a girl from 1975 - 2005. There is a general increase of second children who are girls between 1975 to 1990 from 758 girls in 1975 to 1850 girls in 1990. This makes sense according to S Anukriti and Tam (2020) as ultrasound machines were not widely available during this time period, thus, fetal sex detection was not feasible to many families. In Figure 3, we also see a declining trend of the number of second children who are girls from 1990 to 2002. This aligns with S Anukriti and Tam (2020) as the expansion of ultrasound machine availability in India occurred in the 1990s, driven by the relaxation of industrial licensing regulations. Lastly, between 2002 to 2005, we see the number of second children who are girls become more consistent, ranging between 583 and 616. This makes sense in reference to S Anukriti and Tam (2020) as a ban in advertising prenatal sex determination and increased penalties for violations was placed in 2002, hoping to control sex-selective abortions.

4 Discussion

The possibility of fetal sex determination in India started in 1970 with amniocentesis, a technology originally invented to detect genetic abnormalities (S Anukriti and Tam 2020). With this technology and the availability of ultrasound scanners starting in 1987, fetal sex selection started to become more affordable and accessible (S Anukriti and Tam 2020). The availability of ultrasound scanners became widespread around the 1990s, and was a combined result

of import duties being significantly lowered along with an increase in ultrasound domestic production due to relaxed industrial licensing requirements (S Anukriti and Tam 2020).

In order to control sex-selective abortions, the legalization of abortions in India, in 1971, with the passage of the Medical Termination of Pregnancy (MTP) Act, outlined that abortions were only legal within certain conditions: if the pregnancy were to endanger the women's life, was a result of rape or contraceptive failure, or result in the child suffering from abnormalities (S Anukriti and Tam 2020). Additionally, the Prenatal Sex Diagnostic Techniques (PNDT) Act, effective in 1996, made it illegal to use prenatal sex diagnostic techniques including ultrasound use to reveal the sex of the fetus (S Anukriti and Tam 2020).

In Figure 2, we see that the fraction of firstborn girls stays relatively consistent throughout 1975 - 2005. However, in Figure 3, we see a drop in the number of second-born female children given that the firstborn is a girl when ultrasound scanners became more widespread in the 1990s (S Anukriti and Tam 2020). The difference in trends between these graphs show that as long as one child in the family is a son, families have less of a desire to choose sex selective abortions. This suggests the lack of impact laws and regulations have against the cultural preferences towards sons in India. Parents will continue to illegally access ultrasound scans for sex selective abortions in the case that they have yet to have a son, claiming to need them for other health concerns.

Despite these government interventions and laws, our general findings show that these regulations made little difference in using amniocentesis and in particular, ultrasound machines for fetal sex determination. This is because these technologies are also used for medical purposes and prenatal care, making it easy for women and families to mask their true motive of accessing these technologies for sex determination.

However, with the increase in safety of abortions with public sector provision in 2002, the MTP Act in 2002 continued to try controlling sex-selective abortions, by banning advertising prenatal sex determination and increasing penalties for violations (S Anukriti and Tam 2020). We see the effect of this taking place in Figure 3, where the number of second children who are girls stop declining but become more consistent after 2002. With that being said, because we only have access to data up until 2005, we cannot confirm the long-term effectiveness of these laws against son preferences in India.

5 Conclusion

In this paper, we dissect the trends of ultrasound machines imported and used, the amount of first births that are girls, and the number of second children who are girls given that the first child was also a girl. It was found that the increase in sex-selective abortions was fuelled by the increased access to ultrasound machines, and also dependent on the birth order of the child. Despite the regulations put in place to control sex-selective abortions, we see that this has little impact on India's cultural preference of having sons over daughters.

5.1 Weaknesses and Next Steps

Our main weakness is that our paper did not address all of the variables and topics that were included in the original paper. We primarily focused on prenatal events however, it would be interesting to further explore the differences in treatment and care of girls versus boys post birth, as well as the differences in their mortality rate.

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