Does a legal ban on sex selective abortion affect differential stopping behavior in couples ?

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Abstract: This paper analyzes the hypothesis that gender discrimination begins in the womb. One of the manifestation of this hypothesis is the continuously declining sex ratio against women in several parts of the world, particularly India. The most significant attempt taken by the Government of India to tackle the problem of dis-balanced sex ratio against women is the passing of the Pre Natal Diagnostics Techniques Act (PNDT) which bans the detection of the sex of the fetus. This paper examines whether the PNDT Act has affected the number of children and the gender composition of the children a couple chooses to have. Using a retrospective birth history data from the most recent round of Demographic Health Survey(2005-06) I use a difference and difference empirical strategy utilizing the exogenous placement of the Act across some of the states of India. My findings indicate that PNDT Act is ineffective in tackling the problem of an increasing trend of sex selective abortions and it has some unintended consequences on the number and gender composition of the children a couple may choose to have.

Introduction

This paper studies whether a legal ban on sex selective abortion can impact the number of children a couple will choose to have and the gender composition of the children. A male preferring stopping rule or Differential stopping behavior is defined as a hypothetical situation where the parents continue to bear children until they have a pre determined number of boys and then they stop.

This stopping rule is an unobserved phenomena, it is an untold story that remains with every couple. The only way through which the existence of this stopping rule is reflected in the data, specially secondary data, is the fertility behavior of the couples. Most of the theoretical works (Yamaguchi 1987, Basu DeJong 2010 Portner 2014) concern themselves with finding the channel through which the unobserved stopping behavior is reflected in some observed variables that can be studied by using secondary data. The empirical works (Ben Porath 1976,

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Arnold 1998, Anukriti 2014, Basu 2009) try to estimate the outcome variables proposed by the theoretical studies or to estimate the impact of a relevant policy on these outcome variables. Majority of the empirical works try to relate Sex Preferring Differential stopping behavior (SP-DSB) with the couple's decision of having another child depending on the sex composition of the existing children. The primary variables they look at are birth order of girl and boy children, number of siblings of girl and boy children, birth spacing between children etc.

Arnold et all (1998) attributes an inherent son preference in the minds of the couples born in India as the root cause of SP-DSB. Arnold et all (1998), Basu (2009, 2010) cites various studies where the existence of Son preference in India in the pre 1992 period is shown. Before ultrasound technologies were made available for public purposes, in India, it was not possible to diagnose the sex of the fetus and hence couples used to follow SP-DSB (Cochrane Bhalotra 2010). However, the introduction of ultra sound techniques made it possible for the sex of the fetus to be diagnosed before the birth of the child (Bhalotra & Cochrane 2010, Patel 2007) found out that from the early 1980's Sex determination (SD) of the fetus was available in India at a price that was as cheap as 75-500 INR (about 6-40 USD). As a result this service could be availed not only by the wealthy section of the society but also by the people belonging to the middle income or lower income category. Patel mentions two hospitals in Amritsar and Mumbai who circulated leaflets and advertisements in newspapers that publicly described a girl child as a "burden" and urged people to kill the girl child before her birth. This lead to a spiraling of female feticide.

To stop this process in March 1987, the government of the state of Maharashtra appointed an expert committee to propose comprehensive legal provisions to restrict sex determination tests for medical purposes only. This committee was appointed in response to a private bill introduced in the Assembly by an MLA. In April 1988 the Govt of Maharashtra introduced a bill for the prevention of the misuse of the NRT's and in June 1988 the Bill was passed in the Assembly and became an Act. Later on Govt of India passed the Pre Natal Diagnostic Techniques Act (PNDT) in 1994 which prohibited the sex determination of the fetus before the birth of the child. This Act was implemented in 1996 in all the states of India except Jammu and Kashmir. Punishments for the first time offenders amount to three years of imprisonment or a fine of Rs 10,000. Repeated offenders can be fined up to Rs 50,000 or an imprisonment of five years.

There have been some attempts in the past to try to study the effectiveness of the PNDT Act using community level and micro Data. Nandi and Deolalikar (2010) uses community level data to study the impact of this law on child sex ratio (females per 1000 males in 0-6 age group) and they found evidence to suggest that child sex ratio has improved after the passing of the PNDT

Act. Nandi (2014) uses micro level data to show that PNDT Act has lead to an increase in the likelihood of female birth and there is no evidence to suggest that PNDT has lead to any post natal discrimination against girl children. In my paper I look at completely different outcome variables compared to Nandi. The issues that I am interested in are also different than the issues he looks at. Our conclusions are also completely different from each other.

My hypothesis is if the PNDT Act has been effective then the couples should either resort to the increased use of contraceptives and accept the gender of his or her child or they should resort to Sex preferring differential stopping behavior where they continue to have children until the desired number of sons are born. The key thing to understand over here is that Sex selective abortion and differential stopping behavior are two sides of the same coin. The outcome variables that I study can be used to draw a conclusion on the extent of SP-DSB or the extent of sex-selective abortion that is going on. If son preference is a particular mindset of the people going for a sex selective abortion then that particular thought process cannot change overnight. So I hypothesize that people are more likely to resort to SP-DSB rather than accept the gender of the child born. So if the law is effective then they will resort to SP-DSB and if the law is ineffective then they will continue to use sex-selection. So in a way, by studying the impact of PNDT Law on SP-DSB, I am actually studying the effectiveness of the PNDT Law itself.

My results show that PNDT Law lead to a higher number of boy children born, higher birth spacing among children and also has decreased the average birth order of boy children and increased the average birth order of girl children significantly. If the couples were practicing SP-DSB then the opposite outcomes should have been displayed by the data. Hence, I conclude that PNDT Act was unable to stop Sex selective abortions and it could not serve its purpose of improving the gender dis-balance problem in India.

Conceptual Framework

Son preference is an unobserved phenomena. It's an age old perception or a way of thinking. Nandi (2010) Patel (2007) Arnold (1998) Ben Porath (1976) Basu(2009, 2010) Portner (2014) Anukriti (2014) talks about the existence of son preference and the observed outcomes through which son preference is manifested. From the existing literature some outcomes variables can be studied to draw some possible conclusions regarding SP-DSB. I use those outcome variables as the possible indicators of SP-DSB in my study.

1. Fertility

As a first pass, I look at three fertility outcomes to study whether the PNDT Act might have any impact on SP-DSB in couples.

a) *Number of children alive*: If the couples are practicing SP-DSB then they should be having more children compared to the scenario where they could choose the sex of their unborn child and hence have the desired gender composition of children.

b) *Number of girl children*: If couples are practicing SP-DSB then they should be having more girl children compared to the scenario where they could choose the sex of their unborn child and hence have the desired gender composition of children.

c) *Number of girl children*: If couples are practicing SP-DSB then the number of boy children they are choosing to have should not be affected in the new scenario compared to the previous scenario where they could choose the sex of their unborn child and hence have the desired gender composition of children.

2. Birth Order Effect

According to Yamaguchi(1987) and Basu (2009), one observed outcome of SP-DSB is the fact that boys are born earlier in birth orders than girls. He computed two effects called

a) *Within family birth order effect for boys (wfbob):* The average birth order of the boys in the family. This should go up if couples are practicing SP-DSB.

b*) Within family birth order effect for girls (wfbog)*: The average birth orders of the girls in the family. This should decrease if couples are practicing SP-DSB.

For example, for a family with the birth sequence BGBBG, the wfbob is 8/3 [(1+3+4)/3] and the wfbog is 7/2 [(2+5)/2].

c) *Birth order Effect (wfbob-wfbog):* Basu measures birth order effect as (wfbob-wfbog) and proves that if the difference between wfbog from the wfbob is positive then it means that male children are born earlier in the birth cohort and couples are practicing SP-DSB.

However, this measure has a caveat. It will generate the same wfbog for the two possible birth sequences namely- BGGB and GBBG. However, one can institutively say that the girls are better off in the GBBG sequence as one of the girls in this family is the youngest child and hence might not be a result of SP-DSB.

3. Sibling Effect

Yamaguchi(1987) and Basu (2009) also opines that another manifestation of SP-DSB is the fact that girls are born into larger families than boys. He computes the statistic called sibling effect which takes the difference between the expected number of siblings in families with at least one male child from the expected number of siblings in families with at least one female child. According to Basu, if this difference is positive then the family is showing evidence of SP-DSB.

4. Birth Spacing

According to Portner (2014) another key variable that looks at SP-DSB is birth spacing. His study finds out that sex selective abortion will reduce the space between the birth of two successive children by at least one year. Firstly, the uterus needs at least two menstrual cycles to recover before conception could be attempted again. Also for some families sex selection is costly affair. So it is likely that the poor families will wait before conceiving and giving birth to another child if they are going for sex-selective abortion.

The idea is if birth spacing between children goes down then the couples are showing manifestations of SP-DSB.

Experimental Design

In this paper I utilize a difference and difference method to study the impact evaluation of PNDT Act on SP-DSB of couples. I use the exogenous placement of the PNDT Act as my empirical strategy to construct the treatment and control group. I construct the respondents living in Maharashtra as the control group (Pre Treated Group) and the people living in the neighboring states of Maharashtra (referred as other states) as the Treatment group. The states included in the treatment group are Gujarat, Karnataka, Madhya Pradesh, Chhattisgarh and Andhra Pradesh. I treat any woman who did not give birth after 1996 (her youngest child was born before 1996) as a woman not exposed to the treatment and any woman who continued to give birth after 1996 (her youngest child was born after 1996) as a woman exposed to the treatment. The birth year of the youngest child is taken as the identifier of the temporal exposure of a woman to the PNDT Act. I excluded all women who did not complete their fertility decision[2] as any analysis based on the outcome variables I considered are valid only for those subjects who have completed their fertility circle.

Data

[2] DHS asks the respondents a question on their fertility preference. I excluded all those respondents who said that they are planning to have another child or who are undecided on their decision regarding the same.

I plan to use the latest round of DHS data (2005-06) for this study. It is the standard national level survey carried out in India that collects information related to the fertility, health and child care related decisions of women. Information is collected at a state level. Each women (in the reproductive age of 15-49) residing in a randomly selected household of a primary sample unit is interviewed and information (birth order health, immunization etc) on all her children is collected. It is a repeated cross sectional data.

Empirical Strategy

I am working on the following model to estimate the impact of PNDT Law on the differential stopping behavior in Couples.

$$Yijt = \beta 0 + \beta 1\, Tj + B2\, Pt + B3\, Tj * Pt + \beta 4\, Xijt + \varepsilon ijt$$

The subscript i refers to the respondent, j refers to the state where the respondent resides, t refers to the time period.

Y_{ijt} is the outcome variable for the i^{th} respondent living in the j^{th} state at the t^{th} time period.

T_j is the treatment variable. It takes a value zero if the i^{th} respondent lives in the state of Maharashtra, it takes a value 1 if the i^{th} respondent lives in the states belonging to the control group.

P_t is the variable denoting the timing of the treatment. It takes a value 1 if the respondent belongs to the pre treatment time period (stopped giving birth before 1996) and it takes a value 0 if the respondent belongs to the post treatment time period (continued to give birth after 1996).

$T_j * P_t$ is the primary interest variable of our study. It reflects the effectiveness of the treatment.

X_{ijt} is the set of controls. The set of controls that I include are Mother's education, mother's occupation, father's education, religion, ethnicity status, mother's age, square of mother's age, an indicator for the standard of living of the household etc.

ε_{ijt} is the error term which is assumed to follow a standard normal distribution.

Summary Statistics

The following table presents a list of summary statistics for the pre treated state (Maharashtra) and the treated states (others). Standard errors are reported in parenthesis.

	DHS 1 (1992-1993)	DHS3 (2005-2006)

	MAHARASHTRA	OTHERS	MAHARASHTRA	OTHERS
Sample Size				
Number of children	12005	56202	16319	55278
Number of Women	4146	18761	18761	8775
Age of the mother (Median)	**29 (8.94)**	**29 (8.98)**	**29 (9.42)**	**29 (9.57)**
(15-20)	613(14%)	2997 (15%)	1929 (21%)	5869 (22%)
(21-25)	846 (20%)	3850(20%)	1583 (18%)	4514 (17%)
(26-30)	745 (17%)	3574 (19%)	1437(16%)	4268 (16%)
(31-35)	659 (15%)	2852(15%)	1322 (15%)	3630 (14%)
(36-40)	575 (13%)	2423 (12%)	1116 (12%)	3290 (12%)
(41 +)	681 (16%)	2968 (15%)	1388 (15%)	4169 (16%)
Mother's education (Mean)	**4.2(6.6)**	**2.8(5.9)**	**7.65 (4.97)**	**5.48 (5.21)**
Illiterate	1927 (46%)	12189 (64%)	1604 (18%)	9675 (37%)
Below High School (less than 7 years of education)	1254 (30%)	3467 (18%)	2169 (24%)	6348 (24%)
High school but not college graduate (7-10 years of education)	606 (14%)	1890 (10%)	2773(31%)	5366 (20%)
Above college (10 and more years of education)	634(15%)	2155 (11%)	3199(36%)	6654(25%)
Spouse's education Education (Mean)	**7 (8.05)**	**5 (7.92)**	**8.84 (7.45)**	**7.29 (9.52)**
Illiterate	977 (23%)	7294 (38%)	791 (9%)	5604 (21%)
Below High School (less than 7 years of education)	1385 (33%)	4943 (26%)	987 (11%)	3370 (13%)
Highschool but not collegae graduate (7-10 years of education)	1358 (32%)	4820 (25%)	3640 (41%)	8518 (33%)
Above college (10 and more years of education)	406 (9%)	1625 (8%)	1156 (13%)	2766 (10%)
Number of children ever born (mean)	3 (2.00)	3(2.19)	1.85 (1.71)	2.14 (1.94)
Mother's Occupation				
Not working	2066 (49%)	10348 (55%)	5065 (57%)	13021 (50%)
Manual	422 (10%)	2198 (11%)	2292 (26%)	10061 (39%)
Non Manual	1951 (47%)	8002 (42%)	2144 (24%)	5838 (22%)
Religion				
Hindu	528 (76%)	1588 (88%)	6498 (74%)	21806 (84%)
Muslim	35 (12%)	286 (8%)	1136(12%)	2998 (11%)
Other	449 (10%)	476 (25%)	1303 (14%)	3636 (14%)

	DHS 1 (1992-1993)		DHS3 (2005-2006)	
	MAHARASHTRA	OTHERS	MAHARASHTRA	OTHERS
Ethnicity Status[3]				
General	NA	NA	4107 (46%)	6826 (26%)
Scheduled Caste	NA	NA	1479 (16%)	4010 (15%)
Scheduled Tribe	NA	NA	725 (8%)	2893 (11%)
Others	NA	NA	2426 (27%)	11941 (46%)
Contraception use				
Never Used	1812 (43%)	9807 (52%)	4010 (45%)	11702 (45%)
Used	2334 (56%)	8954 (47%)	4765 (54%)	14038 (54%)
Region				
Rural	1714 (41%)	5362(28%)	2540 (28%)	13133 (51%)
Urban	2432 (58%)	13399 (71%)	6235 (71%)	12607 (48%)
Family's standard of living[4]				
Low	NA	NA	889 (10%)	4763 (18%)
Medium	NA	NA	2075 (23%)	8036 (31%)
High	NA	NA	5636 (64%)	12558 (48%)

From the above table (calculated on the basis of DHS-1 and DHS-3 survey) we can compare the pre-treated (Maharashtra) and the treated group(Others). Maharashtra constitutes 30% of the total sample in both the surveys.

The two groups are balanced in terms of the distribution of the age of the mother. On an average mothers in the sample are around 29 years of age and one fourth of the mothers are less than 20 years of age. In terms of mother's education there is a slight imbalance in the two groups. Majority of the women in Maharashtra are either high school graduates or college graduates. Majority of the women in the treated states are illiterate. In terms of father's education the two groups are mostly balanced as majority of the fathers are high school graduates in the two groups. In both the groups, the women are mostly not-working and a large majority of the population practice Hindu religion. However, with respect to the ethnic background, majority of the respondents belong to the general category in Maharashtra and to the backward category in the neighbouring states. Also, majority of the respondents live in an urban set-up use contraception and can afford a high standard of living.

[3] DHS-1 did not collect specific information regarding the ethnicity status of the respondents
[4] DHS-1 did not collect information on the standard of living indicator of respondents.

Thus, the two groups are more or less balanced in their covariates except the one on mother's education.

Results

The results are explained in three sections. The first sections considers the outcome variable related to the fertility outcomes. The second section contains the outcome variables related to the birth order outcomes. The third section contains the outcome variables related to sibling effect and birth spacing outcomes.

The rows represent the outcome variables. The column represents the regressors included. Each cell reports the coefficient estimate of (β_3), estimated out of a separate regression.

The first column includes only three regressors- T_j, P_t and T_j*P_t.

The second column includes the regressors of the first column and the controls. In the controls I include a variable for mother's age and a variable representing square of mother's age. I believe that fertility decisions are intrinsically related to the age of the mother. A woman will choose to have less children once her age crosses a particular threshold. Hence, I included the square of mother's age term.

The third column is exactly similar to second column, it just includes mother's age as a categorical variable instead of a continuous variable. Mother's age square is excluded from the controls for this regression.

The fourth and fifth column includes state fixed effect with the two sets of controls.

The sixth column includes Mother's age fixed effect.

The seventh column includes birth of the youngest child fixed effect.

Cluster robust standard error, clustered at state level is reported in parenthesis.

Fertility Outcomes

The results reflecting the impact of PNDT Act on the fertility outcomes are explained in the following table.

Outcome Variables	Only treatment post interaction	Controls (includes mother's age and square of mother's age)	Controls (includes mother's age as categorical variable)	Controls (includes mother's age and square of mother's age)	Controls (includes mother's age as categorical variable)	Age fixed effect	Birth Year of Youngest child fixed effect
Number of children alive	0.1465808*** (.0400987)	.1345416*** (.0328456)	0.1344134*** (.0331076)	0.1179237*** (.0320272)	0.1165461*** (.0320876)	0.1345416*** (.0328456)	0.117519*** (.0280611)
Number of girls	0.0324329 (.0434185)	.019019 (.0369952)	0.0160193 (.0387009)	.0172947 (0.038463)	0.0140415 (.0396865)	-0.0202134 (.0387009)	0.0011073 (.0254297)
number of boys	.1141479*** (.0151999)	.1167913*** (.0249197)	.1185223*** (.0235845)	0.1006289*** (.0273453)	.1025046*** (.0261166)	0.1185223*** (.0235845)	0.1164116*** (.0261353)
Sample Size	17,160	17,160	17,160	17,160	17,160	17,160	17,160

According to the results shown in the above table we can say that PNDT act leads to an increasing number of children born and an increasing number of boy children born. PNDT does not have any impact on the birth of girl children. One can say that the variation in total number of children born is coming out of the fact that women who are continuing to bear children after 1996 are younger women. However, even that does not prove to be a credible explanation to prove the clear variation in terms of the gender composition of the children. It seems to be the case that PNDT Act is leading to the birth of more boy children, an outcome that in completely opposite to the expected outcome resulting out of SP-DSB. In fact, this outcome gives us preliminary evidence to establish the claim that PNDT Act is not successful in preventing sex selective abortion.

Birth Order Outcomes

The effect of PNDT Act on the birth order related outcomes is described in the following table.

Outcome Variables	Only treatment post interaction	Controls (includes mother's age and square of mother's age)	Controls (includes mother's age as categorical variable)	Controls (includes mother's age and square of mother's age)	Controls (includes mother's age as categorical variable)	Age fixed effect	Birth Year of Youngest child fixed effect
within family birth order effect for boys (wfbob)	-.4417956*** (.1140215)	-.4958885*** (.1229805)	-.5087564*** (.1254414)	-0.4579659*** (.1267054)	-.4721096*** (.1279326)	-.5087564*** (.1254414)	-0.5407389*** (.095939)
within family birth order effect for girls (wfbog)	.2621543** (.1066915)	.2997847** (.0979637)	.3051933** (.1021509)	.2607168 ** (.10586)	.2669603 * (.1100697)	0.3051933** (.1021509)	0.3392844 ** (.0846718)
Difference in birth order (wfbob-wfbog)	-.7039499*** (.1888151)	-.7956732*** (.1949741)	-.8139497*** (.197858)	-.7186827*** (.2047382)	-.7390699*** (.206516)	-.8139497*** (.197858)	-.8800233*** (.1457476)
Sample Size	17,160	17,160	17,160	17,160	17,160	17,160	17,160

As it is clear from the above table, PNDT Act seems to increase the within family birth order for girls and decrease within family birth order for boys. It also leads to a decrease in the birth order effect which is the difference between within family birth order effect of girls from within family birth order effect for boys. All the coefficient estimates are statistically significant. This means that the birth order of boys decrease as in boys are now born in earlier birth order. The birth order for girls increase which means girls are now born in alter birth orders. The birth order effect goes down which means something contradicting the hypothesis of SP-DSB is taking place.

This result is completely different from the expected theoretical result. Not only does the PNDT Act not have any impact on SP-DSB, in fact it seems to have a reverse effect. This gives evidence in favor of the fact that PNDT Act is not successful in curbing sex selection.

Effect on Sibling and Birth Spacing

The following table summarizes the regression run on the number of siblings of the children born in families with at least one boy or girl child.

Outcome Variables	Only treatment post interaction	Controls (includes mother's age and square of mother's age)	Controls (includes mother's age as categorical variable)	Controls (includes mother's age and square of mother's age)	Controls (includes mother's age as categorical variable)	Age fixed effect	Birth Year of Youngest child fixed effect
siblings of a child in a family with at least one boy child N= 15,200	.1050744 * (0.0484248)	.1033396 ** (.0386001)	.1008025 ** (.039686)	0.0864348 * (.0387953)	.0836023 * (.0393027)	.1008025 ** (.039686)	.0825721** (.0333883)
Siblings in a family with at least one girl child N=13,464	0.1857594 *** (.044613)	.172411 *** (.0338219)	.1737436 *** (.0349578)	0.148577 *** (.033572)	.1495236 *** (.0335186)	.1737436 *** (0.0349578)	.1550925 *** (.0277566)
Average birth space	0.0704199 ** (.0244903)	0.0540484 * (.0275391)	0.0526777 * (.0255594)	.0559483 * (.0264765)	0.0541942 * (0.0246496)	0.0526777 * (.0255594)	0.0286067 (.034535)
Sample Size	17,160	17,160	17,160	17,160	17,160	17,160	17,160

From the above table we can conclude that the number of siblings go up in families having at least one boy child and in families having at least one girl child. However, the number of siblings go up by a bigger magnitude in families having at least one girl children. This gives some evidence in favor of SP-DSB, but this evidence is not conclusive enough.

There is some evidence to show that average birth space between children for a woman goes up. However, the results are significant at 10% level. I think I should run this regression using data on children rather than on women to get a more appropriate result.

Conclusion

This study concludes that PNDT Act does not have a positive impact on SP-DSB. In fact, PNDT Act has a negative impact on SP-DSB which means that PNDT Act actually leads to sex selective abortion.

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