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Essays on the Impact of Female Education, Female Empowerment and Public Policy

A Dissertation submitted in partial satisfaction
of the requirements for the degree of

Doctor in Philosophy

in

Economics

by

Shreya Bhattacherjee

March 2016

Dissertation Committee:

Dr. Anil Deolalikar, Chairperson
Dr. Mindy Marks
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The Dissertation of Shreya Bhattacherjee is approved

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Committee Chairperson

University of California, Riverside.

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Dedicated to my mother, the biggest inspiration of my life.

ABSTRACT OF DISSERTATION

Essays on the Impact of Female Education, Female Empowerment and Public Policy

by

Shreya Bhattacherjee

Doctor of Philosophy, Graduate Program in Economics
University of California, Riverside, March 2016
Dr. Anil Deolalikar, Chairperson

The purpose of this dissertation is to investigate how can certain public policies affect female sex ratio and female empowerment. This dissertation also proposes an alternative mechanism that can be used to appropriately target population sub-groups for the implementation of public health related policies. Skewed sex ratio against female children is a persistent problem in India and sex selective abortions is concluded to be the most probable reason behind it. The biggest public taken by the Indian Government, in various stages, to address this issue is to impose a legal ban on any public or private health facility offering this service. The first chapter of this dissertation investigates whether the first stage of this policy was successful in improving the birth rate of female children. A much discussed hypothesis is that women's education or women's access to finance leads to betterment of the life outcomes of children in terms of school enrolment,

child labor and female empowerment by improving their control over household resources. The second chapter of this dissertation looks at whether micro-credit programs directed towards educated women have any differential impact on social outcomes like school enrolment rates, child labor, expenditure on health and female empowerment. Another important issue that is extremely important in today's world is the appropriate targeting of public health policies. The third chapter of this dissertation proposes an alternative measure to estimate the extent of malnutrition across various population sub samples. This purpose of this measure is to construct a cardinal method enabling consistent comparison of the depth and severity of health deprivation across various population sub-groups.

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Chapter 1

1.1 Introduction

This paper evaluates the impact of Pre-Natal Diagnostic Techniques (PNDT) Act, as implemented in 1988, on the total fertility and birth spacing decisions of women in India. The PNDT Act was passed in India to improve the increasingly skewed sex ratio, in favor of girl children. The main objective of this paper is to investigate whether PNDT Act was successful in of increasing the number of girl children born in India and in curbing sex selective abortions .

The main motivation of this paper is reflected in Figure 1.1. which shows that the sex ratio (defined as number of females born per 1000 males) in India has been increasingly skewed since 1940's when compared against the biological standard (950 females per 1000 males). Several reasons have been put forward to explain this trend. One such explanation (Oster 2005) is that biological factors such as tendency of Hepatitis B could be the reason why a male fetus has a better chance of survival compared to a female fetus. This explanation is quite popular in medical literature. Another explanation that is put forward to explain this trend is the increasing under reporting of female births (Bhat 2006). The third and the most common explanation for this trend is a deep rooted son preference attitude persisting in the couples that is leading them to view a girl child as "undesirable" or "unwanted". Thus, easy access to cheap ultrasound technology is

resulting in the abortion of the female fetuses (Basu 2009, 2010, Jensen 2005, Roy 1998 Portner 2014, Cochrane Bhalotra 2010, Das Gupta 1987, Anukriti 2014, Patel 2007).

Amartya Sen coined the term missing women and directed the attention of the world to this serious problem. He estimated that, approximately, there are 100 million women who are simply "missing". Sen's estimates were revised, later, and some of the most conservative calculations suggest that roughly 0.48 million girls were selectively aborted in India in every year during the period of 1995 to 2005 (Cochrane and Bhalotra 2010). Patel (2007) points out that despite a fast decline in the mortality of women in India in the decades of 1980 and 1990, the deficit of girls compared to boys have dramatically increased. Her calculations show that compared to 1981 when there were 1.9 percent fewer girls than boys, in 2001 there are roughly 3.8 fewer girls compared to boys.

In order to tackle the problem of human intervention as one of the possible sources of skewed sex ratio, government of India passed the PNDT Act which banned the detection of the sex of the fetus in any public or private medical facility of India. This Act was passed in India in various stages. In 1978, sex selective abortion was banned in all the government hospitals of India and in 1988 it was banned in all the facilities of the state of Maharashtra. In 1996, it was banned in all the facilities of all the states of India. In this paper, I evaluate the impact of the PNDT Act as passed in the state of Maharashtra in 1988. I use a difference and difference framework to carry out this impact evaluating

exercise considering Maharashtra as the treated state and all the neighboring states of Maharashtra as the control states[1].

My hypothesis is that if sex-selective abortion is the reason behind skewed gender ratios then the PNDT Act should be effective in bringing the sex ratio closer to its biological norm of 950 females per 1000 males. This impact should be reflected in total the number of children (boy and girl) ever born to a woman. My premise is that son-preferring attitude is a thought process and it's not going to disappear by the passage of a Law. Hence if a couple is forced to be in dark about the fetus of their unborn child then they can either go back to the age old tradition of differential stopping behavior[2] or they can be extremely cautious in having a child and reduce attempts of conception to not risk the birth of an unwanted child. The former should increase total fertility of women while the latter should lead to a decrease. Either way, there should be a change in total fertility of women if the PNDT Law is effective. Portner (2010) shows that sex selective abortion reduces birth spacing between children by approximately one year as the uterus needs some time to recuperate before conception can be attempted again. So my second hypothesis is PNDT Act should reduce the birth spacing between two consecutive children because a woman can attempt conception right after giving birth to a child.

[1] I do not test the impact of PNDT Act , as passed in 1996, because it was implemented in all the states of India in 1996 and there is no geographical variation in the implementation of the Act to enable the construction of a treatment state and a control state. Nandi and Deolalikar (2010) evaluated the impact of PNDT Act of 1996. They assumed that the PNDT Act worked in Maharashtra and treated it as a pre-treated state and its neighboring states as the control states. However, they do not test the assumption that the PNDT Act actually worked in Maharashtra.

[2] If a couple continues to have children till the desired number of sons are born then that behavior of the couple is called differential stopping behavior.

I use the first round of Demographic and Health survey (DHS) conducted in India during the years 1992-93 to estimate the difference and difference experimental design. I construct a woman year panel data to trace the retrospective birth history information of women in their reproductive life span as reported in DHS-1 survey conducted in 1992-93. Using the most robust version of my experimental set up I conclude that PNDT Act was not successful in improving the sex ratio in favor of female children. I have weak evidence to suggest that PNDT Act lead to higher fertility and this higher fertility is reflected in the birth of male children.

Similar conclusions are drawn by Anukriti (2014) who investigated the impact of a conditional cash transfer program designed to improve the sex ratio in favor of girl children in one particular state of north India. Her study also showed that even if the parents are given a considerable monetary incentive to sterilize after giving birth to a girl child, they seem to continue trying for another son. Portner(2014) uses Cox Proportional Hazard Model to predict the extent of sex selection in India and his results also show a null impact of the PNDT Act in curing the problem of sex selective abortion. Deolalikar et. al. (2010)'s paper shows that PNDT Act was successful in improving the sex ratio in favor of girl children and it is truly a welfare maximizing policy. However, their experimental design assumes that the PNDT Act that was passed in Maharashtra in 1988 was successful and nowhere in their paper do they test this assumption. Hence, if the PNDT Act was not successful in 1988 then Maharashtra cannot be considered as a pre-treated state and their experimental design falls apart. To the best of my knowledge there

is no other paper that has investigated the effectiveness of the PNDT Act as passed in Maharashtra in 1988.

In section 1.2. I discuss the socio-economic background under which the PNDT Act was implemented followed by discussion on the identification strategy in section 1.3. In section 1.4. I discuss the data set that I use for this study and a brief analysis of the sample of women whom I investigate. In section 1.5. I discuss the main results, the heterogeneity of the results across various sub-samples of the population followed by the conclusion.

1.2 Background

Patel (2007) has carried out a series of extensive research in form of case studies, field surveys and individual interviews to document the expanse of female feticide, what drove some women to agree to a sex selective abortion and some of the other socio-economic background related to this phenomena. Her research shows that from early 1980's Sex determination 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. In 1974 an experiment on New Reproductive Technologies was carried out by All India Institute of Medical Sciences in New Delhi with 11,000 pregnant women. Patel cites studies concluding that the major incentive of all these women to take part in this experiment was to know the sex of the fetus. After the experiment, those women who were informed that they were carrying girl children wanted to abort the

unborn child. This lead to the banning of the sex determination of the fetus in government hospitals in 1978. However, the process was smoothly practiced in the private hospitals.

Patel describes a study carried out by the Govt of Maharashtra, because of the initiative of some lobbyists, to investigate the prevalence of this practice in the city of Mumbai. Forty two gynecologists were interviewed and 84% of them reported that they were regularly performing sex discrimination tests to diagnose the sex of the fetus. 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. These advertisements lead to a huge public protest against these phenomena by women's groups, NGO's, concerned social workers etc. Even research organizations such as Research Center on Women's studies (Mumbai), Center for Women's Development Studies (New Delhi) etc joined in the protest.

In March 1987, the government 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. An offense under this act is cognizable, non-bailable and non-compoundable[3].

1.3 Identification strategy

In this paper I utilize the arguably exogenous placement of the PNDT Act in the state of Maharashtra in 1988 to build the experimental design. I construct a Difference and Difference (DD) set up to look at the impact of PNDT Act using temporal and spatial variation of the implementation of the PNDT Act. In order to implement this experimental design I have constructed a woman year panel data out of the cross sectional data collected by the DHS-1 survey. Each row of this data set represents the reproductive decision of a woman in each year ranging between 1972 to 1992[4]. The primary reproductive decision that I have considered is whether a woman gave birth in each year or not in each year of her reproductive life span. The second reproductive decision that I have considered is whether a woman gave birth to a girl child or not in the years in which she gave birth. I have followed this interpretation of the word reproductive decision in my whole paper.

The spatial variation is reflected by the residence of a woman in the state of Maharashtra (treated state) or the neighboring states of Maharashtra (control states). I consider

[3] http://pndt.gov.in/index1.asp?linkid=19
[4] The details of the construction of the woman-year Panel data is discussed in section 4.

Gujarat, Madhya Pradesh, Karnataka and Andhra Pradesh as the control states of this experimental design. Since PNDT Act that was passed in 1988 was applicable throughout the state of Maharashtra, I cannot take a finer level of geographical variation. I consider the women living in the neighboring states of Maharashtra as the control group in order to ensure that the respondents of the treatment states and the control states are as similar as possible in terms of other exogenous factors like cultural norms, kinship structure, rainfall pattern etc. that might affect one's fertility choices. The temporal variation is reflected by the reproductive decisions taken by the woman in the years before and after 1988.

The econometric specification that I specify in this paper is designed to estimate the impact of PNDT Act on the outcome variables- whether a woman gave birth in each year or not (a zero/one indicator), whether a woman gave birth to a female child or not in the years when she gave birth (a zero/one indicator) and time (months) since last birth.

The impact of the PNDT Act on an outcome of a woman i living in state j in year t is estimated by the equation.

$$Y_{ijt} = \alpha + \beta MAHAR_j \times POSTLAW_t + \gamma X_{ijt} + \theta_j + \Phi_t + \psi_{jt} + \varepsilon_{ijt}$$

MAHAR is a dummy variable indicating the residence of a woman in the state of Maharashtra. POSTLAW is a dummy variable taking a value one for the years from 1989 to 1992 and a value 0 for the years from 1987 to 1972. I drop the year 1988 as the births that happened in that year are partially treated and partially untreated.

The assumption behind this econometric set up is that the PNDT Act affects the reproductive decisions of the women living in the state of Maharashtra in the years following 1988 differentially compared to that of women living in the neighboring states of Maharashtra after 1988. The interaction term MAHAR*POSTLAW is designed to capture that differential impact. The coefficient of interest is β.

The benefit of using a woman year panel is that it enables me to look at changes in the outcome variables in the years before and the years after the law. The exogeneity of the implementation of this Law on a particular part of a woman's reproductive life is very well represented by this woman year Panel. The exogeneity is reflected by the fact that a woman can be 20 or 30 or 40 years old when this Law was passed and hence the variation in the outcome variables in the years before and after the Law can be very well represented by this unique way of constructing the data[5]. This structure incorporates the variation in the outcome variable for each year ranging from 1972 to 1992. This structure also incorporates the variation in the variable of interest (MAHARj*POSTLAWt) across the years 1972 to 1992. In addition, this structure also incorporates the age of the woman in each year. Thus, age at year can be added as a control variable in the regression equation.

I use a set of economic and demographic characteristics of a woman as the set of controls. These characteristics are woman's age in each year , square of woman's age in each year, categories of woman's education, categories of spouse's education, an indicator

[5] The age of the woman is independent of the year in which the PNDT Act was passed. Hence, the temporal variation in the outcome variable is exogenous.

for the type (rural or urban) of residence of the woman, indicators for the religion of the woman and indicators for the occupation of the woman.

I also include state fixed effect (θ_j), year fixed effect (ϕ_t) and state-time trend (Ψ_{jt}) in the econometric specification. Since the PNDT Act affects each woman at a state-time level, I include state-time trends in the estimating specification to account for any type of unobserved heterogeneity that might affect the outcome variables at a state-time level.

Since, the PNDT Act is implemented at a state level, I have clustered the standard errors associated with this regression at a state level.

The three major outcome variables that I consider are: an indicator for whether a woman is giving birth in each year, conditional on her giving birth, an indicator for whether she is giving birth to a female child or not and time (months) since last birth[6].

Since the outcome variables considered in this paper are observed over several time periods they can suffer from serial correlation problem. To take care of this issue, I also estimate a more robust version of this specification following Dufflo (2003). In that version, I collapse the outcome variables into averages over two time periods- pre (years before 1988) and post (years following 1988). I run the regression on those averages where the subscript t takes two values-0 and 1 representing pre and post period. Each woman is represented in two rows of the data set - the first row contains the outcome variable for the pre-period and the second row contains the outcome variables for the post

[6] I also estimated the impact of PNDT Act on the gap between marriage and the birth of the first child. The result is a null impact and hence I did not include it in this paper. The results are available on request.

period. This version is the most robust version of the above econometric specification. Throughout this paper I use the term "robust version" to refer to this particular specification.

Since the first two outcome variables are zero-one indicators, I use a non-discrete outcome variable for estimating the impact of PNDT Act on the fertility decisions of a woman. Instead of a zero-one indicator for birth of a child and birth of a female child I use the variables called cumulative number of children and cumulative number of girl children a woman ever had in each year[7]. For estimating the more robust form of the above regression equation, I average these two outcome variables over the two pre and post time periods. I continue to use the variable time since last birth to estimate the impact of PNDT Act on birth spacing using this more robust version of the regression equation.

I use the term total fertility to denote the outcome variable: indicator for birth in each year and cumulative number of children in each year. I use the term sex ratio at birth to refer to the outcome variables: indicator for female birth conditional on a woman's giving birth in each year and cumulative number of girl children in each year. I follow this nomenclature throughout the paper for easy reading.

[7] For example, let us consider a woman who gave birth to three children in 1975, 1980 and 1989. The variable called cumulative number of children a woman had in each year will take a value 0 for the years 1970 to 1974, a value 1 for the years 1975-1979, a value 2 for the years 1980 to 1988 and a value 3 for the years 1989 to 1992. The aim of this variable is to consider the temporal variation in the reproductive decision for each year. The variables called cumulative number of girl children a woman had in each year is also constructed using the same logic.

1.4 Data

I use the first round of Demographic Health Survey (DHS) data (1992-93) for this study[8]. The DHS is a nationally representative 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. All married women (in the reproductive age of 15-49) residing in a randomly selected household of a primary sample unit in a state are interviewed and information (birth order, sex, date of birth, health status, immunization etc) on all her children is collected. I use individual recode file of the DHS I data set for this study where the unit of observation is a woman. It is a repeated cross sectional data.

I use the DHS-1 data to construct a woman year Panel starting from the year 1972 and ending in the year 1992. Since less than 1% of the births happened to women who were older than 35 years I drop every women who were more than 35 years old at 1992 from the DHS-1 data set[9]. Also, Less than 10% women gave birth to their first child before they were 15 years old and so I drop all women who gave birth before they were 15[10]. I consider 15 as the earliest year when a woman can give birth. Since a woman who is 35 years old at 1992 will be 15 years old in 1972, I have picked 1972 as the earliest year of

[8] I do not use the second or the third round of the survey as PNDT Act was nationally implemented in all the states of India in 1996 and the DHS II was carried out in 1998. Hence, the identification strategy that I have constructed cannot be implemented if I incorporate DHS-II and DHS-III data sets.
[9] 6416 women reported an age of 35 or more at 1992
[10] I consider these young mothers to be fundamentally different than the rest of the women in the sample. 1262 women were dropped.

the woman-year panel data set. I have not taken the birth information of women at 1993 as some women were interviewed at that date while some women were not. However, the results don't change even when I include the year 1993 in the woman-year panel. Since a woman in the age group of (15-18) in the year 1992 was too young in the years following 1988, her decision of not having a child during these years cannot be influenced by the PNDT Act. So I drop all women less than 19 years old at 1992 from the sample[11]. In the appendix I present a table (Table A1.1.) describing all possible ages of women in each year of the woman year panel dataset.

To construct the woman-year panel dataset I duplicate the observation of each woman 21 times in the cross sectional data set. Each row represents her reproductive decision in each year, starting from 1992 and ending in the year when she was 15 years old[12]. For each year, I construct a zero- one indicator representing whether the woman gave birth in that year and also a zero-one indicator showing whether the birth was a male or a female one. I use these two variables to construct two outcome variables- the cumulative number of children and girls a woman ever gave birth to if she starts back-counting in one particular year starting from the year of her first birth.

I also construct a variable for birth spacing based on the number of months that have passed since the birth of the last child at the end of any particular year. If a child was born in the month of December in any year, then I assume that zero months have passed since

[11] There exists 2143 women younger than 19 in the sample.
[12] If a woman is less than 15 years old in any particular year of the woman-year panel [1992-1972], then information on the outcome variable for that woman and for those years is treated as missing observations.

the birth of that child in that particular year[13]. Then at every year if a woman does not give birth to a child, the number of months that have passed since she gave birth to her last child gets added by the number 12.

Each woman's reproductive decision starts getting recorded in the woman year panel whenever she attained 15 years of age (in the span of 1972 to 1992) and this recording continues till the year of 1992. Her reproductive decisions prior to her attaining 15 years of age (if she turned 15 in any year after 1972) are treated as missing observations. Since I allow 20 (35 minus 15) years of reproductive life span to each woman of the data set, I have dropped all women[14] who gave birth to her last child before 1972 (1992 minus 20).

Also, for the calculation of birth space, I have dropped all those women who have given birth to more than 6 children. Since less than 10% women in the sample have more than 6 children I believe that the women who had more than 6 children are fundamentally different than the rest of the sample[15].Also, I have dropped all women who reported a birth interval of 8 months or less between two successive children in order to ensure that there is no measurement error[16]. I have also dropped those women who reported the birth year of her first born child before the year of her marriage. The logic behind dropping these women is that pre-marital pregnancy is a very rare phenomena in Indian society and hence it is likely that these women have reported an erroneous data regarding the year of

[13] There is a variable in DHS-1 called preceding birth interval. But that variable has a lot of missing values.
[14] There were only 2 women in the sample who gave birth to the last child before 1972.
[15] However, these women are included in the analysis of other outcome variables. 388 women were dropped.
[16] It could be a case that a woman reporting less than 8 months birth spacing between two consecutive children is because of pre-mature births. But it can also be the case that she is quoting the birth months of her children incorrectly. 26061 observations i.e. 1241 (26061/21) women were deleted from the woman-year panel dataset. These women were ,however, included in the analysis of the other outcome variables.

marriage or the year of birth of her first born child. However, these women were not dropped for the analysis of fertility outcomes i.e. total number of children ever born etc.

In Table 1.1 I present the summary statistics of all the women living in Maharashtra and in the neighboring states of Maharashtra as surveyed in DHS-1. From Table.1.1. one can compare the women living in Maharashtra and in the neighboring states in terms of various demographic and socio-economic characteristics. Women living in both the states are similar in terms of their age distribution, occupation, religion and rate of contraceptive use. Majority of the women in both the states are less than 30 years old and have got married at the age of 18. In Figure 1.2. I present the age distribution of the women[17] in the woman-year data set that I have constructed. From this histogram I can conclude that majority of the women in the woman year panel data, spanning between 1972 to 1992 set are in the age group of 15-25. Thus, I can say that the panel data, spanning over 1972 to 1992 set consists of women who are in the earlier portion of their reproductive cycle and hence likely to be affected by the passage of the PNDT Act.

From Table1.1. I also conclude that most of the women are either not working or working in non-manual jobs. Hinduism is the main religious affiliation of most of the women in both the groups. There is no information in DHS-1 on their ethnicity status and standard of living. However, in terms of education of the women and their spouse there seems to be a difference. Women in Maharashtra are more educated in terms of mean years of education. Majority of the women in Maharashtra are literate and have graduated out of

[17] For Fig. 1.2. I have dropped women aged less than 15. This figures shows the age distribution of all women whose birth giving decisions (at each year of her reproductive life span) are considered in this study

junior high school whereas the majority of women in the neighboring states seem to be illiterate. Similarly, majority of women in Maharashtra seem to have spouses who are literate and have graduated out of high school whereas their counterparts in the neighboring states are illiterate or have dropped out of high school. The distribution is same in terms of higher education of the women and their spouses.

Also, majority of the women in Maharashtra reported to be living in an urban set-up compared to those in the neighboring states. Since, education and rural-urban living set ups are time invariant characteristics of a woman, the difference and difference experimental design should be able to take care of that. However, I still incorporate state fixed effect and year fixed effect to factor out any variation that might result out of the woman's affiliation to a particular state or out of the woman's decision to give birth in a particular year. These time invariant differences in educational attainment between the women of Maharashtra and the neighboring states is taken care of by the Difference and Difference approach.

In this section I have also presented the time trend of the outcome variables considered in this study. These variables show the mean of the outcome variables at each year of a woman's reproductive life starting from the year when she turned 15. In order to differentiate the treatment effect I have constructed separate time series plot for Maharashtra (Treated states) and others (Control states). From Figure. 1.3. to Figure 1.5.b. we can see that outcome variables do not show any kind of trend shift around the

time period 1988 signifying a null impact of the treatment[18]. I have included the standard difference and difference table in the appendix section (Table A.1.2).

At the end of this section, I conclude that the parallel trends diagram do not capture any differential impact of the PNDT Act between the Maharashtra and the other states. However, I will like to add that the differential impact on the outcome variables might so small that a visual representation tool like a time series plot might not be able to capture it. Also, the variation in these outcome variables is also caused by several other factors like the age of the woman which increases with time. Thus, the variation in these outcome variables that is caused by the PNDT Law might not be visible in this graph. I present the formal difference and difference tables in the appendix (Table A.1.2). also shows a null impact of the PNDT Act.

1.5 Results

In this paper I evaluate the impact of PNDT Act on five main outcome variables. They are- an indicator for a woman's giving birth in a particular year, an indicator for a woman's giving birth to a female child in the years in which she gave birth, birth spacing (month) between two consecutive children, Cumulative number of children a woman ever gave birth to in each year, Cumulative number of girl children a woman ever gave birth to in each year. The main results are discussed in section 5.1. Section 5.2. reports the coefficient estimates of the interest variable of econometric specification estimated

[18] Figure 1.5.b. shows some impact of the PNDT Act at the year 1992. Due to paucity of data I could not investigate this trend further.

on various subsets of the population. These subsets are based on the religious affiliation of each woman, the educational attainment of each woman, the type of residence of each woman and the sex composition of children of those women who gave birth to only one child before 1988.

1.5.1 Main Results

In this section I explore the impact of PNDT Act on total fertility and birth spacing decisions of women in the age group of (15-35) across their reproductive years between 1992 to 1972 (or whichever year they attain 15 years of age). Table 1.2. to Table 1.4. report the coefficient estimate of β using three major outcome variables reflecting total fertility, sex ratio and birth spacing decisions of women. Column (1) of these three tables include the interest variable and the state and year fixed effect. Column (2) includes the interest variable, the covariates and state & year fixed effects. Column (3) includes the interest variable, the covariates, state & year fixed effects and state-time trends. Column (4) reports the coefficient estimates of the most robust version of the econometric specification where the outcome variable of the woman year panel data is collapsed into two time periods- pre (years before 1988) and post (years after 1988).

Table 1.2. reports the coefficient estimate of the interaction term MAHAR*POSTLAW estimated on the zero-one indicator of a woman's giving birth in each year from the beginning of her reproductive life span to 1992. If everything else is being held constant, then if the interaction term takes a value one from zero then the magnitude of β represents the magnitude by which the probability of a birth happening in a particular

year changes. Using the woman year panel data there seems to be a positive impact of the PNDT Law on the probability of a birth happening in a particular year. If I take all the covariates, fixed effects and the state time trends then the probability of a birth happening increases by .013 among women living in Maharashtra in the years following 1988 compared to their counterparts living in the neighboring states. However, this statistically significant impact vanishes the moment I consider the most robust version of the econometric specification collapsing the outcome variable into averages across two time periods. Thus, I conclude that PNDT Act did not have a significant impact on total fertility of women.

Table 1.3. reports the coefficient estimate of the interaction term MAHAR*POSTLAW estimated on the zero-one indicator of a woman's giving birth to a female child from the beginning of her reproductive life span to 1992. If everything else is being held constant, then if the interaction term takes a value one from zero then the magnitude of β represents the magnitude by which the probability of the birth of a female child, happening in the years in which the woman is giving birth, changes. Using the woman year panel data there seems to be no impact of the PNDT Law on the probability of a female birth happening in the years when a woman is giving birth. This null result continues even if I include the state-time trends or if I consider the most robust version of the econometric specification collapsing the outcome variable into averages across two time periods. Thus, I conclude that PNDT Act did not have a significant impact on the variable reflecting sex ratio at birth.

Table 1.4. reports the coefficient estimate of the interaction term MAHAR*POSTLAW estimated on the number of months that have passed since a woman gave birth to her last child from the beginning of her reproductive life span to 1992. If everything else is being held constant, then if the interaction term takes a value one from zero then the magnitude of β represents the magnitude by which the number of months since the last birth of the woman changes. Using the woman year panel data there seems to be a no impact of the PNDT Law on the birth spacing decisions of a woman between two consecutive children. This result holds even if I include the state-time trends or if I consider the most robust version of the econometric specification collapsing the outcome variable into averages across two time periods. Thus, I conclude that PNDT Act did not have a significant impact on the birth spacing decisions of a woman.

1.5.2 Results on Heterogeneity Tests

In this section I test the impact of PNDT Act on the outcome variables- consecutive number of children a woman gave birth to in each year (referred to as total fertility), consecutive number of girl children a woman gave birth to in each year (referred to as sex ratio at birth) and birth spacing between two consecutive children among various subsections of the population. I present the coefficient estimates of the most robust version of the econometric specification where I collapse the outcome variable into averages over two time periods[19]. I construct the sub-sections based on four major

[19] Results don't change if I estimate the impact of the PNDT Act among these population sub-sections using the woman year panel data without collapsing the outcome variable across two time periods.

criteria, namely- pre-1988 sex composition of children, religion, education of the women and type of residence where the respondent woman lives.

Table 1.5. reports the result of my investigation on the impact of PNDT Act among the women who had only one girl child or one boy child before 1988[20]. The logic behind the construction of this population sub section is that the number of children a woman has is not independent of how old she is and hence the number of children a woman has is not independent to the temporal variation caused by the PNDT Act in her reproductive life span. Hence, I am holding the fertility of the woman as constant i.e. I am considering only those women who gave birth to only one child before 1988.

The underlying premise of this paper is that son preferring mindset persists in people and hence PNDT Act, if effective, is going to make it difficult for the respondents to give birth to the children of their preferred gender. Now, women who gave birth to one girl child already should be the ones who are affected by the PNDT Act at a greater scale than women who gave birth to one boy child. Also, following Portner(2014), Bhalothra (2010), the gender of the first born child is random for most of the women as sex selective abortion is mainly carried out by women from the second born child onwards. Hence, the variation with respect to the gender of the first born child is random.

From Table 1.5. I conclude that PNDT Act had no impact on total fertility, sex ratio at birth and birth spacing among those women who gave birth to only one boy child before 1988. PNDT Act also does not have any impact on total fertility and birth spacing of

[20] Roughly 2947 women in the sample have given birth to only one children before 1988.

women who gave birth to only one girl child before 1988. However, PNDT Act seems to have an impact on the sex ratio at birth or the cumulative number of girl children being born in each year among women who gave birth to only one girl child before 1988 Thus, there is weak evidence to suggest that PNDT Act had an impact in improving the sex ratio in favor of girl children among women who gave birth to only one girl child before 1988. Since these women are most likely users of the sex determination technique, we can conclude that PNDT Act had some success in ensuring it's major objective of improving the skewed sex ratio.

I also study the impact of PNDT Act among women having different levels of education. I have used the variable "education in single years" to construct three broad categories of education, namely - illiterate (0 years of education), Primary[21] and Secondary education (1 to 10 years of education), Higher secondary education and above (greater than 10 years of education). The logic behind the construction of this population sub section is that educated women are supposed to be aware of the philosophies and theories on the ineffectiveness of gender discrimination in different spheres of life. Hence, if a mother is well educated, it is expected that she will not succumb to the age old tradition of paying dowry for a daughter's wedding or allow only the son to light the funeral pyre. Thus, PNDT law is expected to have a higher impact on women who are less educated than women who are highly educated. From Table 1.6. I conclude that PNDT Act had no

[21] In India, kindergarten is a recent phenomena. Most of the people who live in India and study in state-funded schools start school from primary education or grade1.

differential impact on total fertility, sex ratio and birth spacing of children across women having various levels of education.

In this paper I also test the impact of PNDT Act among women following Hindu Religion and Islam religion. The logic behind the construction of this population sub section is that son preference is an intrinsic part of Hindu religion. Traditionally, in the Hindu religion, when a person dies, the boy child has the right to light the funeral pyre of that person. Hence, people following Hindu religion, have an inherent preference for a boy child. Also, a person following Hindu religion has to pay a huge dowry to marry off his or her daughter to a respectable groom. Hence, a girl child is often viewed as a liability as people often can't afford to pay a socially acceptable dowry, required for a daughter's wedding. However, people following other religions do not have such stringent restrictions associated with a girl child. Hence, PNDT Act should affect only those people who are following Hindu religion. However, from Table 1.7. I get a counter-intuitive evidence. PNDT Act seems to have a positive impact on fertility and sex ratio of women following Islam religion. One possible explanation for this result is the fact that Muslims constitute a religious minority in India and majority of them belong to a lower income group[22]. That is highly related with their knowledge and affordability of contraception methods which could be leading to a higher fertility among Muslims compared to Hindus.

[22] http://www.irfi.org/articles/articles_901_950/where_do_muslim_stand__in_india.htm. This is a research article published by the Islamic Research Foundation in India.

At the end of this section, I study the impact of PNDT Act among women having different types of residences, namely- rural and urban[23]. I have divided the sample into two categories, namely - rural and urban. The logic behind dividing the population into these two sub-categories is the fact that urban women have better access to private hospitals that carry out sex-selective abortions compared to rural women. Thus, PNDT Act should have a higher impact on urban women living in Maharashtra compared to their counterparts living in the neighboring states. From Table1. 8. I conclude that PNDT Act does not have a differential impact on total fertility, sex ratio and birth spacing decisions on women living in urban and rural type of residences respectively.

1.6 Conclusion

This paper investigates the impact of PNDT Act, as passed in the state of Maharashtra in 1988, on fertility and birth spacing decisions of women. PNDT Act, as passed in Maharashtra in 1988, bans any individual of that state to seek the service of sex selective abortion in any government or private medical facility. If this Act is effective then it is supposed to reduce the birth spacing between two consecutive children. It's impact on fertility could be in either directions. Fertility might increase as people might go back to the age hold practice of sex-preferring differential stopping behavior. Fertility might also decrease as individuals might be extremely in attempting conception again.

[23] In DHS-1 Survey, a woman living in a "kaccha" house, i.e. a house without a cement roof, is treated as a rural woman as those residences are typically a feature of rural India. A woman living in a "pakka" house, i.e. a house with a cement roof, is treated as an urban woman as those types of residences is pre-dominantly a feature of urban India.

The results show that PNDT Act did not have a statistically significant impact on either fertility or birth spacing decisions of women. There is weak evidence to suggest that PNDT Act might have some impact on the fertility decisions of women who had only one girl child before 1988, however those women are a minority in the data set. However, the birth spacing decisions of all women are not affected by the PNDT Act and this enables me to conclude that PNDT Act was not successful in fulfilling its agenda of curbing the throbbing industry of sex-selective abortion.

One possible explanation for this is the way the punishment mechanism of the PNDT Act, as passed in 1988, was designed. PNDT Act, as passed in 1988, has the power to convict those couples who are seeking the service of a sex selective abortion. There was no provision to offer any kind of punishment mechanism to the providers of this service. Patel (2007) is of the opinion that the PNDT Act of 1987 failed its objective because of the fact that it is extremely difficult for the existing law and order institutions to trace the individuals demanding the service and then convict them. The PNDT Act as passed in the rest of the country in 2003 has some provisions to convict the suppliers of the service of sex selective abortion. Even then questions are being raised with respect to its effective implementation[24]. However, paucity of data sources did not allow me to estimate the impact of the 2003 ratification of the PNDT Act. Further needs to be undertaken to investigate the mechanism leading to the failure of the PNDT Act.

[24] http://www.thehindu.com/news/national/despite-skewed-sex-ratio-conviction-for-female-foeticide-rare/article7190273.ece?homepage=true

Also, One can argue that this paper does not address the issue of inter-state migration i.e. a respondent can travel to the neighboring states of Maharashtra and avail the service of sex-selective abortion. According to my opinion, the null result of the impact of the PNDT Act can be further substantiated by the fact that there exists scope of inter-state migration. This could be another explanation of the null result that I am getting. However, more research needs to be done to reach a definite conclusion on whether inter-state migration could be a cause for the null impact of this PNDT Act in Maharashtra in the years following 1988.

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1.8 Figures and Tables

Table 1.1. Summary Statistics

	DHS 1 (1992-1993)	
	MAHARASHTRA	OTHERS
Sample Size		
Number of children	12005	56202
Number of Women	4146	18761
Average number of children ever born per respondent	1.89 (1.72)	2 (1.83)
Average number of boy children ever born per respondent	.97 (1.07)	1.03 (1.15)
Average number of girl children ever born per respondent	.91 (1.12)	.96 (.96)
Median number of children ever born per respondent	2	2
Median number of boy children ever born per respondent	1	1
Median number of girlchildren ever born per respondent	1	1
Mean Age of respondent at first birth	18.48 (3.56)	18.42 (3.29)
Mean birth spacing between two children (Months)	32.83 (33.4)	32.7 (32.6)
Median birth spacing between two children (Months)	21	22
Mean Age of the mother (at 1992)	**29 (8.94)**	**29 (8.98)**
(15-20)	613(14%)	2997 (15%)
(21-25)	846 (20%)	3850(20%)
(26-30)	745 (17%)	3574 (19%)
(31-35)	659 (15%)	2852(15%)
(36-40)	575 (13%)	2423 (12%)
(41 +)	681 (16%)	2968 (15%)
Mother's education (Mean)	**4.2(6.6)**	**2.8(5.9)**
Illiterate	1927 (46%)	12189 (64%)
Below High School (less than 7 years of education)	1254 (30%)	3467 (18%)
Highschool but not collegae graduate (7-10 years of education)	606 (14%)	1890 (10%)
Above college (10 and more years of education)	634(15%)	2155 (11%)

This table presents the mean of the non-binary cahracteristics of the respondents.
Standard errors are presented in the parenthesis.
This table presents the frequency of all the binary characteristics of the survey respondents.
DHS1 does not collect information on the standard of living or the ethinicity status of the respondents.

Table 1.1. Summary Statistics (Continued)

	DHS 1 (1992-1993)	
	MAHARASHTRA	OTHERS
Spouse's education Education (Mean)	7 (8.05)	5 (7.92)
Illiterate	977 (23%)	7294 (38%)
Below High School (less than 7 years of education)	1385 (33%)	4943 (26%)
Highschool but not collegae graduate (7-10 years of education)	1358 (32%)	4820 (25%)
Above college (10 and more years of education)	406 (9%)	1625 (8%)
Number of children ever born (mean)	3 (2.00)	3(2.19)
Mother's Occupation		
Not working	2066 (49%)	10348 (55%)
Manual	422 (10%)	2198 (11%)
Non Manual	1951 (47%)	8002 (42%)
Religion		
Hindu	528 (76%)	1588 (88%)
Muslim	35 (12%)	286 (8%)
Other	449 (10%)	476 (25%)
Contraception use		
Never Used	1812 (43%)	9807 (52%)
Used	2334 (56%)	8954 (47%)
Region		
Rural	1714 (41%)	5362(28%)
Urban	2432 (58%)	13399 (71%)

This table presents the mean of the non-binary cahracteristics of the respondents.
Standard errors are presented in the parenthesis.
This table presents the frequency of all the binary characteristics of the survey respondents.
DHS1 does not collect information on the standard of living or the ethinicity status of the respondents.

Table 1.2. The Impact of PNDT Act on Total Fertility

OUTCOME VARIABLE	Birth in each year (Y/N)			Children ever born
	(1)	(2)	(3)	(4)
MAHAR*POSTLAW	0.0165	0.0170	0.0131**	-0.0544
	(0.0109)	(0.0108)	(0.00449)	(0.0669)
State Fixed Effect	X	X	X	X
Year Fixed Effect	X	X	X	
Covariates		X	X	X
State Time Trends			X	
Observations	149,264	149,264	149,264	25,157
R-squared	0.009	0.039	0.040	0.536

This table reports the coefficient estimate of the variable MAHAR*POSTLAW

This regression omits out the reproductive decision taken by a woman in the year 1988.

Co-effcients of first three columns are estimated on Woman-Year Panel Data

This regrssion for column (4) is estimated on the mean of the outcome variable collapsed for the two years before and after the PNDT Act for each woman

Robust standard errors(clustered at state level) are reported in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 1.3. The Impact of PNDT Act on birth of female child

OUTCOME VARIABLE	Female Birth in each year (Y/N)			Girls ever Born
	(1)	(2)	(3)	(4)
MAHAR*POSTLAW	0.00524	0.00524	0.00297	-0.0174
	(0.00582)	(0.00582)	(0.00383)	(0.0285)
State Fixed Effect	X	X	X	X
Year Fixed Effect	X	X	X	
Covariates		X	X	X
State Time Trends			X	
Observations	150,009	150,009	150,009	25,157
R-squared	0.004	0.004	0.004	0.310

This table reports the coefficient estimate of the variable MAHAR*POSTLAW

This regression omits out the reproductive decision taken by a woman in the year 1988.

Co-effcients of first three columns are estimated on Woman-Year Panel Data

The regressions for column (1), (2) and (3) are estimated only on those years in which a woman gave birth

This regrssion for column (4) is estimated on the mean of the outcome variable collapsed for the two years before and after the PNDT Act for each woman

Robust standard errors(clustered at state level) are reported in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 1.4. The Impact of PNDT Act on birth spacing between two consecutive children

OUTCOME VARIABLE	Time since Last birth (months)			
	(1)	(2)	(3)	(4)
MAHAR*POSTLAW	0.471	0.352	0.0612	0.527
	(1.477)	(0.925)	(0.486)	(1.327)
State Fixed Effect	X	X	X	X
Year Fixed Effect	X	X	X	
Covariates		X	X	X
State Time Trends			X	
Observations	76,266	76,266	76,266	16,785
R-squared	0.119	0.467	0.467	0.547

This table reports the coefficient estimate of the variable MAHAR*POSTLAW

This regression omits out the reproductive decision taken by a woman in the year 1988.

This regrssion is estimated on Woman-Year Panel Data

This regrssion for column (4) is estimated on the mean of the outcome variable collapsed for the two years before and after the PNDT Act for each woman

Robust standard errors(clustered at state level) are reported in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 1.5. Impact of PNDT Law between couple having only one boy and only one girl child before 1988

OUTCOME VARIABLES	One boy child before 1988			One girl child before 1988		
	Children ever Born	Girls ever born	Birth Interval	Children ever Born	Girls ever born	Birth Interval
MAHAR*POSTLAW	0.0100	0.0141	1.696	0.120	0.0827*	-1.858
	(0.0686)	(0.0308)	(2.143)	(0.0620)	(0.0356)	(1.427)
State Fixed Effect	X	X	X	X	X	X
Covariates	X	X	X	X	X	X
Observations	2,428	2,428	2,398	2,150	2,150	2,130
R-squared	0.718	0.249	0.423	0.720	0.600	0.419

This table reports the coefficient estimate of the variable MAHAR*POSTLAW

Birth Interval is measured in Months

This regression omits out the reproductive decision taken by a woman in the year 1988.

This regression is estimated on those women who gave birth to one child only before 1988

This regrssion is estimated on the mean of the outcome variable collapsed for the two time periods before and after the PNDT Act for each woman

Robust standard errors(clustered at state level) are reported in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 1.6. Impact of PNDT Act on women having different levels of education

OUTCOME VARIABLES	Illiterate			Primary and Secondary			Higher Secondary and Above		
	Children ever Born	Girls ever born	Birth Interval	Children ever Born	Girls ever born	Birth Interval	Children ever Born	Girls ever born	Birth Interval
MAHAR*POSTLAW	-0.0258	0.00992	1.994	0.0722	0.0317	0.0633	-0.0550	-0.0144	-0.916
	(0.0687)	(0.0285)	(1.446)	(0.0522)	(0.0205)	(1.797)	(0.0812)	(0.0565)	(1.237)
State Fixed Effect	X	X	X	X	X	X	X	X	X
Covariates	X	X	X	X	X	X	X	X	X
Observations	14,341	14,341	9,570	8,600	8,600	5,845	2,216	2,216	1,370
R-squared	0.522	0.296	0.520	0.531	0.304	0.606	0.551	0.308	0.502

This table reports the coefficient estimate of the variable MAHAR*POSTLAW

Birth Interval is measured in Months

This regression omits out the reproductive decision taken by a woman in the year 1988.

This regrssion is estimated on the mean of the outcome variable collapsed for the two time periods before and after the PNDT Act for each woman

Robust standard errors(clustered at state level) are reported in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 1.7. Impact of PNDT Act on women following different religion

OUTCOME VARIABLES	Hindu			Muslim		
	Children ever Born	Girls ever born	Birth Interval	Children ever Born	Girls ever born	Birth Interval
MAHAR*POSTLAW	-0.0872	-0.0282	0.674	0.150*	0.0619**	-1.843
	(0.0720)	(0.0315)	(1.400)	(0.0677)	(0.0204)	(1.318)
State Fixed Effect	X	X	X	X	X	X
Covariates	X	X	X	X	X	X
Observations	21,821	21,821	14,692	2,391	2,391	1,436
R-squared	0.537	0.305	0.552	0.545	0.359	0.509

This table reports the coefficient estimate of the variable MAHAR*POSTLAW

Birth Interval is measured in Months

This regression omits out the reproductive decision taken by a woman in the year 1988.

This regrssion is estimated on the mean of the outcome variable collapsed for the two time periods before and after the PNDT Act for each woman

Robust standard errors(clustered at state level) are reported in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 1.8. Impact of PNDT Act on women living in rural and urban residences

OUTCOME VARIABLES	Rural			Urban		
	Children ever Born	Girls ever born	Birth Interval	Children ever Born	Girls ever born	Birth Interval
MAHAR*POSTLAW	-0.0144	-0.00411	1.334	-0.0533	-0.00811	0.0529
	(0.0719)	(0.0309)	(1.427)	(0.0526)	(0.0327)	(1.124)
State Fixed Effect	X	X	X	X	X	X
Covariates	X	X	X	X	X	X
Observations	16,982	16,982	8,175	8,175	11,376	5,409
R-squared	0.534	0.305	0.540	0.320	0.550	0.545

This table reports the coefficient estimate of the variable MAHAR*POSTLAW

Birth Interval is measured in Months

This regression omits out the reproductive decision taken by a woman in the year 1988.

This regrssion is estimated on the mean of the outcome variable collapsed for the two time periods before and after the PNDT Act for each woman

Robust standard errors(clustered at state level) are reported in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Figure 1.1.

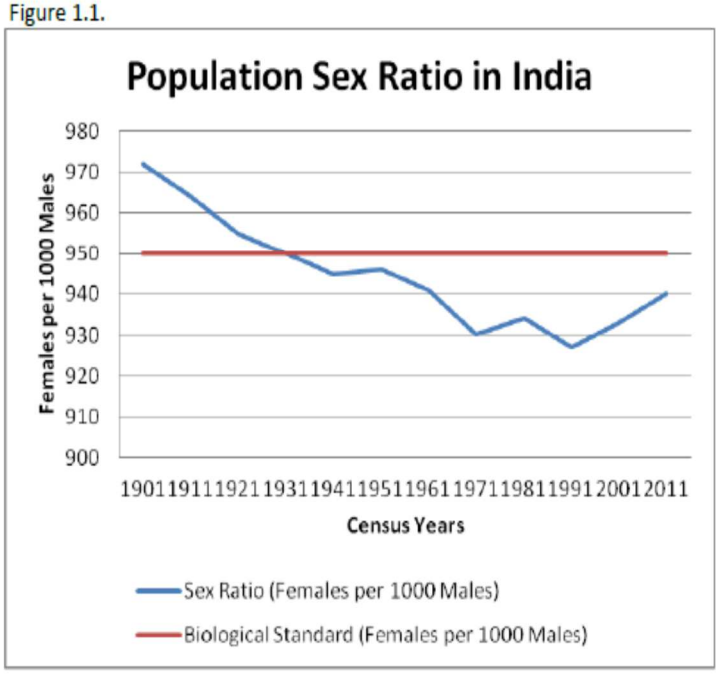


Figure 1.1. is constructed from the decadal Population census Data published by the Sample registration System in India.

Figure 1.2. Age Distribution of Women in the Woman Year Panel Data Set

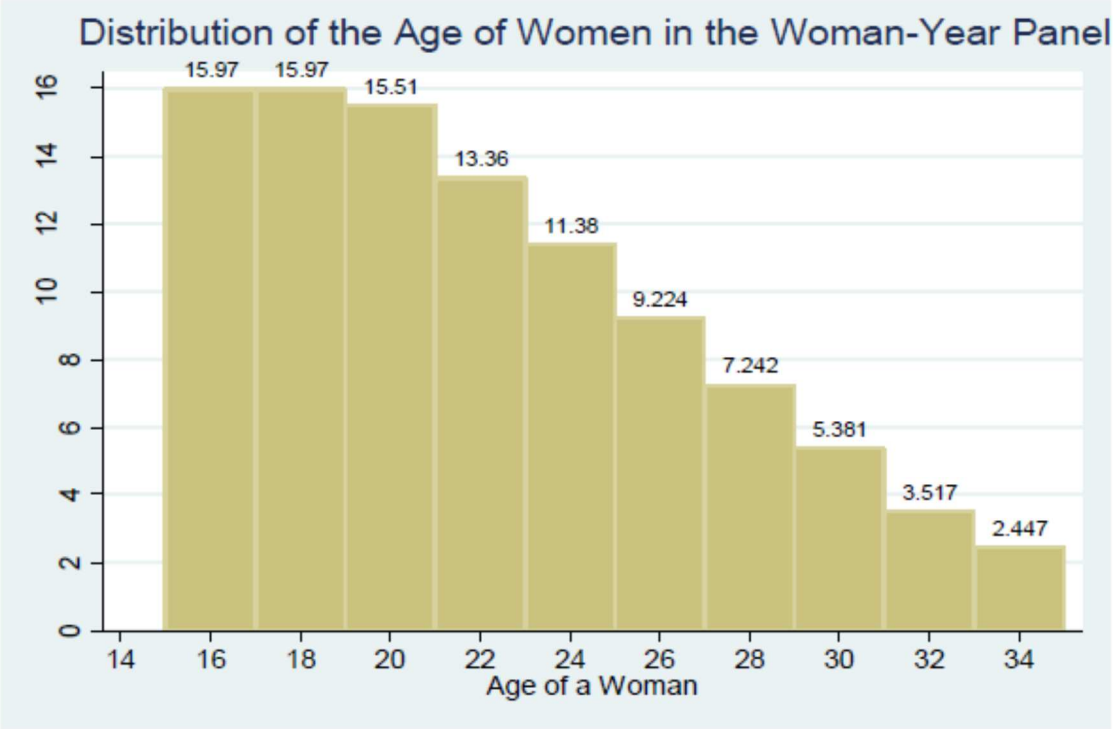


Figure 1.3.

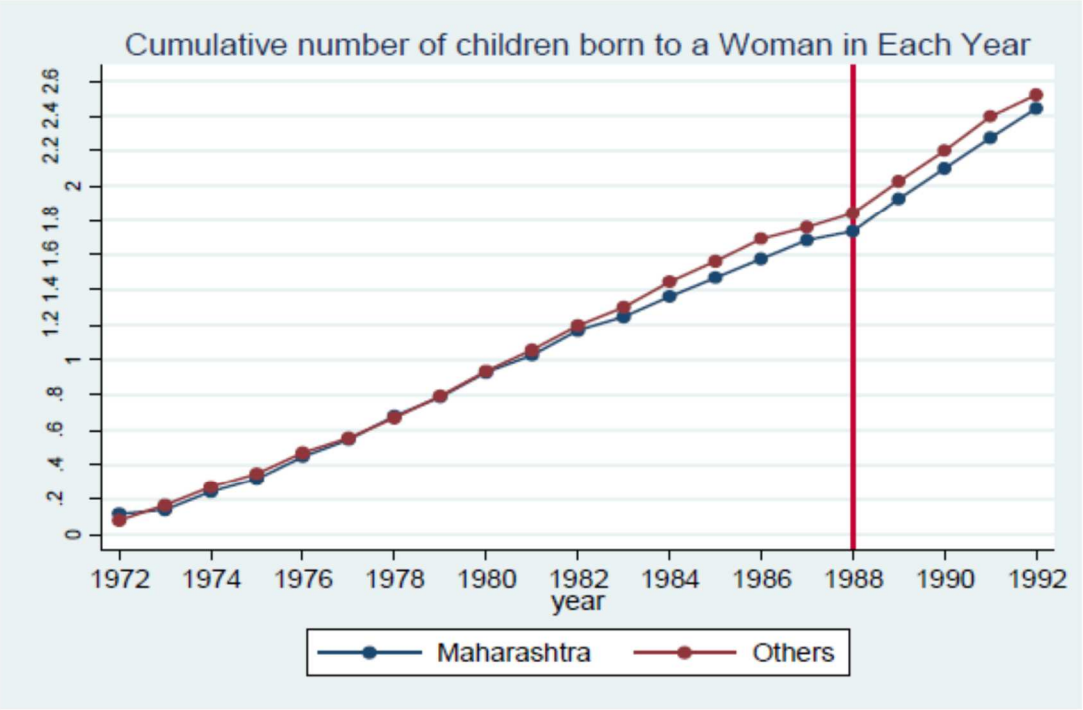

Cumulative number of children born to a Woman in Each Year
0
.2
.4
.6
.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
year
Maharashtra
Others

Figure 1.4.

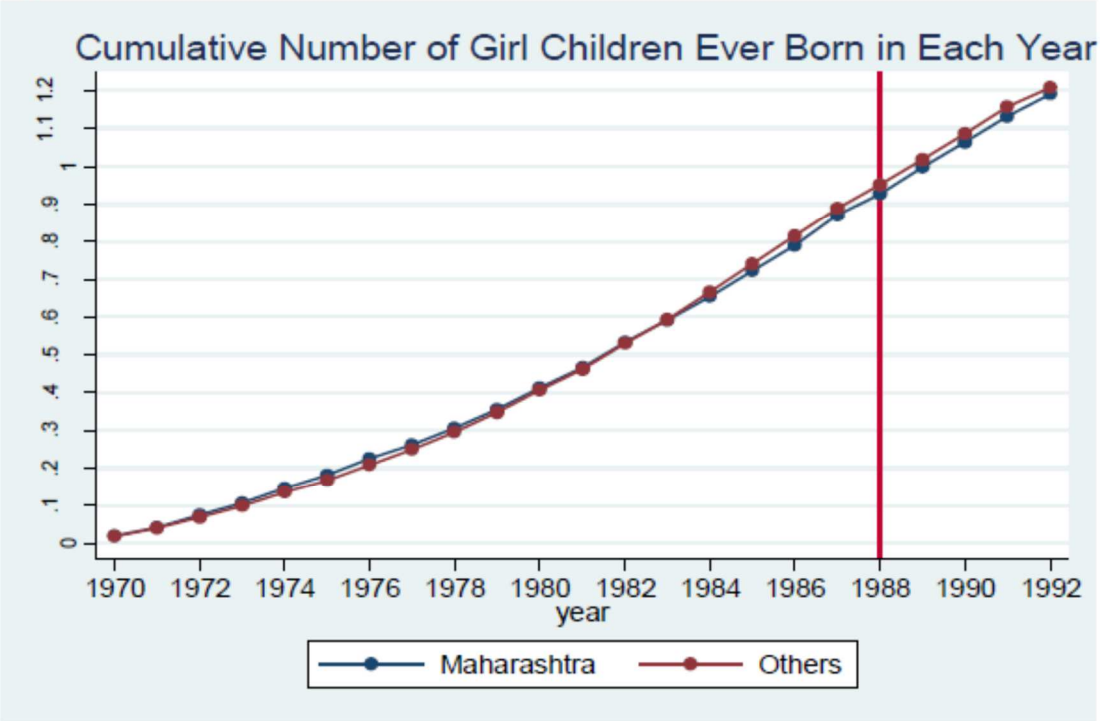

Cumulative Number of Girl Children Ever Born in Each Year
0
.1
.2
.3
.4
.5
.6
.7
.8
.9
1
1.1
1.2
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
year
Maharashtra
Others

Figure 1.5.a.

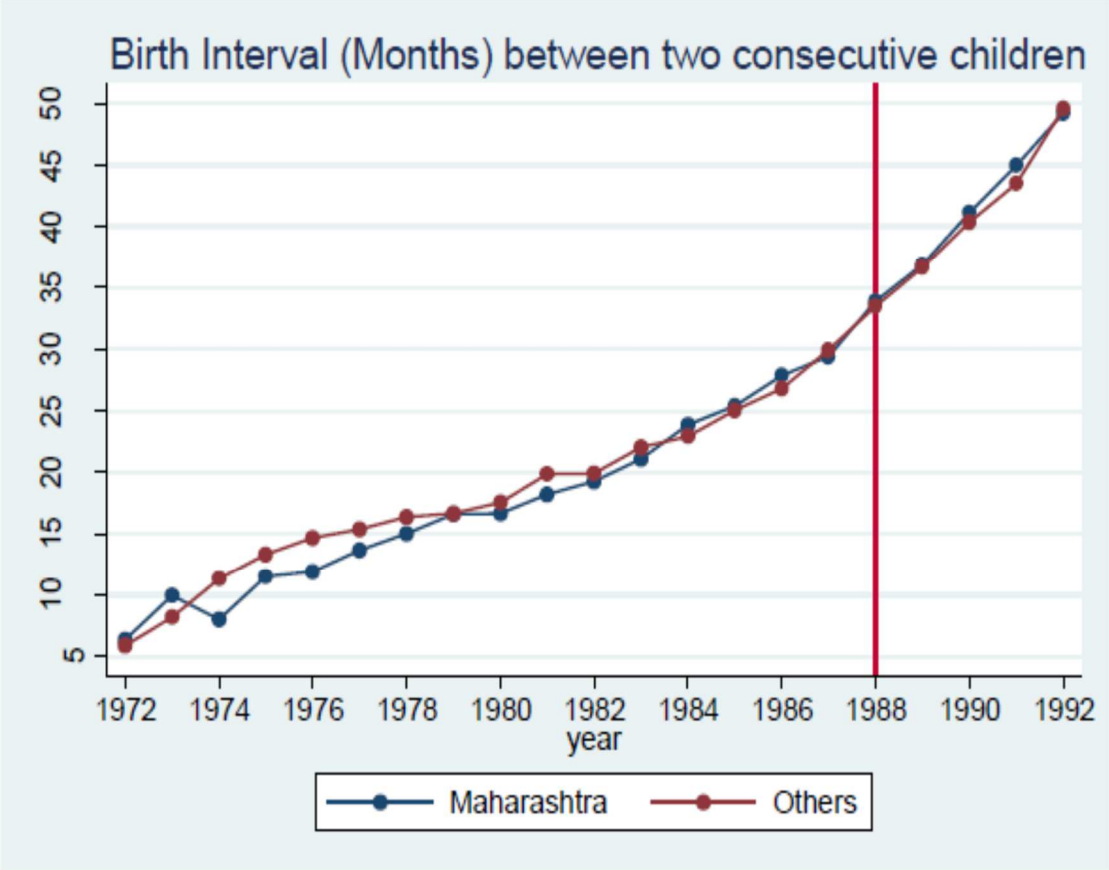
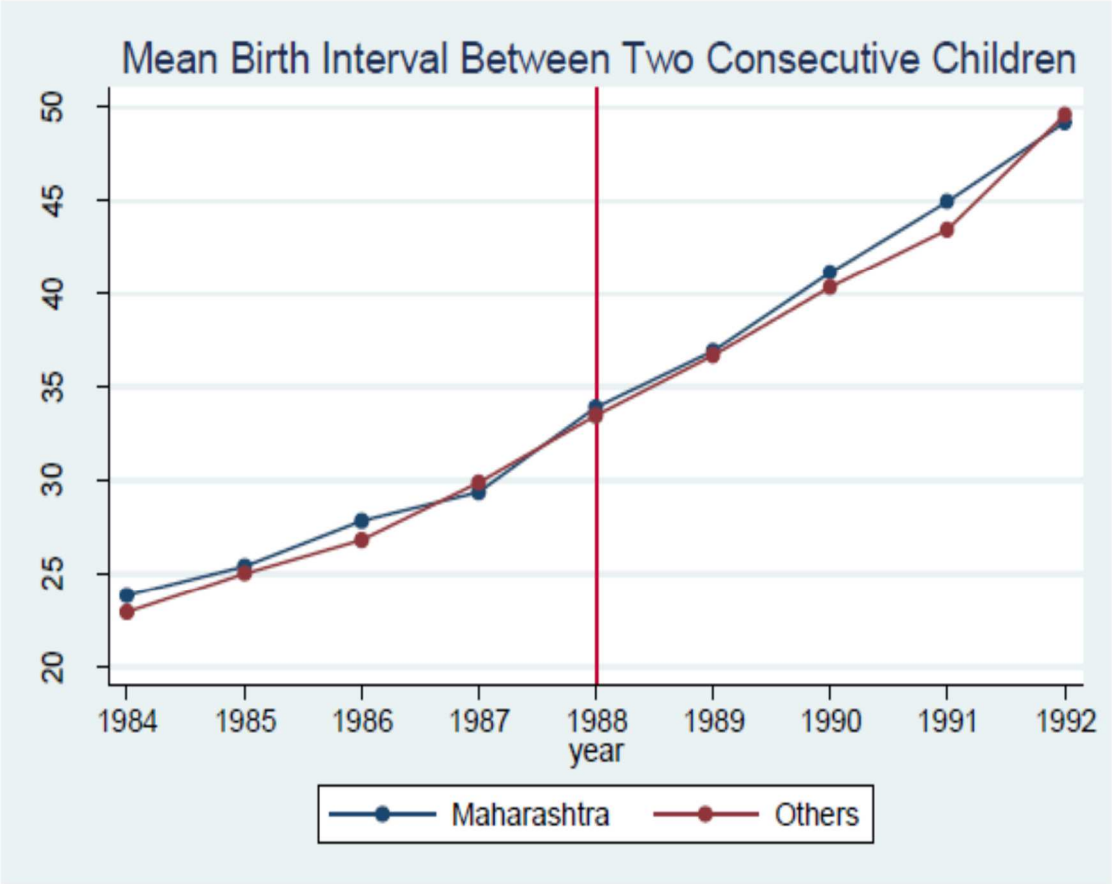

Birth Interval (Months) between two consecutive children
5
10
15
20
25
30
35
40
45
50
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
year
Maharashtra
Others

Figure 1.5.b.


Mean Birth Interval Between Two Consecutive Children
20
25
30
35
40
45
50
1984
1985
1986
1987
1988
1989
1990
1991
1992
year
Maharashtra
Others

1.9 Appendix

Table A1.1

Years before DHS-1 survey	Years in panel Data set	Possible Ages of women																					Years before DHS-1 survey	Years in panel Data set
0	1992	**15**	**16**	**17**	**18**	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	0	1992
1	1991		**15**	**16**	**17**	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	1	1991
2	1990			**15**	**16**	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	2	1990
3	1989				**15**	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	3	1989
4	1988					15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	4	1988
5	1987						15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	5	1987
6	1986							15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	6	1986
7	1985								15	16	17	18	19	20	21	22	23	24	25	26	27	28	7	1985
8	1984									15	16	17	18	19	20	21	22	23	24	25	26	27	8	1984
9	1983										15	16	17	18	19	20	21	22	23	24	25	26	9	1983
10	1982											15	16	17	18	19	20	21	22	23	24	25	10	1982
11	1981												15	16	17	18	19	20	21	22	23	24	11	1981
12	1980													15	16	17	18	19	20	21	22	23	12	1980
13	1979														15	16	17	18	19	20	21	22	13	1979
14	1978															15	16	17	18	19	20	21	14	1978
15	1977																15	16	17	18	19	20	15	1977
16	1976																	15	16	17	18	19	16	1976
17	1975																		15	16	17	18	17	1975
18	1974																			15	16	17	18	1974
19	1973																				15	16	19	1973
20	1972																					15	20	1972
Total Num	20																							

Table A1.2.

cumulative number of children		Pre-1988	Post-1988	T-Statistic
	Others	1.21	2.29	-116.96
	(Control Group)	(1.42)	(1.73)	(0.00)
	Maharashtra	1.15	2.19	-54.16
	(Treatment Group)	(1.39)	(1.63)	(0.00)
	T-Statistic	4.81	5.09	-1.99
		(0.00)	(0.00)	(.04)
cumulative number of girl children		Pre-1988	Post-1988	T-Statistic
	Others	0.58	1.11	-87.93
	(Control Group)	(0.89)	(1.17)	(0.00)
	Maharashtra	0.57	1.07	-39.51
	(Treatment Group)	(0.89)	(1.15)	(0.00)
	T-Statistic	2.07	2.59	-1.35
		(0.04)	(0.01)	(0.17)
Time since last birth (months)		Pre-1988	Post-1988	T-Statistic
	Others	23.24	42.87	-78.08
	(Control Group)	(22.57)	(38.66)	(0.00)
	Maharashtra	22.88	43.39	-37.78
	(Treatment Group)	(22.47)	(39.98)	(0.00)
	T-Statistic	1.24	-1.00	1.51
		(0.21)	(0.32)	(0.13)

This table reports the mean of the major outcome variables across treatment and control groups in the pre and post treatment time period.
Standard errors are reported in parenthesis
P-values are reported in the parenthesis below the T-statistics.

2 Chapter 2

2.1 Introduction

This paper investigates whether there is any differential impact of access to microcredit with respect to women's educational level on downstream social outcomes like female empowerment, child labor, school enrolment rate and expenditure on health & education.

In the early 2000's microcredit was thought to potentially be the most powerful tool to fight against poverty because of its unique technique of disbursing loans among poor people without collateral and the use of peer monitoring mechanism as the means of ensuring repayment. Pitt and Khandker in a series of papers (2003, 1998) concluded that female participation in microcredit programs improved the health status of children through alteration of intra-household resource allocation. They do not find any such impact of microcredit programs that disburse credit to men only. They also established that women's participation in microcredit programs has a significant positive impact on female empowerment. Thus, this series of papers have tried to establish the popular hypothesis that "mother's control over resources importantly alters human capital of her children" (Pitt Mark M. K. S., 2003).

However, these papers suffer from self-selection problem as the participants of the microcredit program are not randomly chosen. Dufflo (2014), Banerjee (2014) argue that the women or individuals who choose to participate in a microcredit program are fundamentally different compared to those who do not choose to participate in one. Thus,

all the coefficient estimates generated by these studies, showing the impact of a microcredit program on a self selected sample, are likely to be biased. For a more rigorous analysis of the impact of microcredit on poverty alleviation indicators a series randomized control trials (RCT) were organized in six different countries of the globe, where microcredit was offered randomly to a group of similar individuals (Angelucci Manuela, 2014) (Attanasio Orazio, 2014) (Augsberg Britta, 2014) (Crepon Bruno, 2014) (Duflo Esther, 2014) (Tarrozi Alessandro, 2014). A very important result of this experiment is that microcredit programs do not have any significant impact on downstream social outcomes like women's empowerment, casting shadows over the much talked about hypothesis on the benefits of a mother's access to financial resources (Banerjee Abhijeet, 2014).

In my paper I use data from these six RCTs and reinvestigate the hypothesis saying that mother's access to resources lead to improvement in human capital investment on children and women's empowerment. However, I differentiate the sample between women having high and low education. My primary goal is to see whether the hypothesis stated in the first sentence of this paragraph works for the educated women with access to microcredit.

I employ a traditional difference and difference (DD) experimental design where the sources of identification are the random assignment of an individual to a treatment or control group and the baseline educational attainment of an individual. Since the treatment allocation is random I argue that the baseline educational attainment of an

individual is orthogonal to treatment assignment. Thus, the two sources of variation in this DD experiment are independent of each other.

My results show that microcredit does not seem to be a very good instrument for improving women's empowerment and child health for women of any educational level. There is weak evidence to suggest that the operation of Micro Finance Institutions (MFI) lead to an improvement in women's empowerment but that evidence is not consistent across various countries. There is no evidence in favor of the hypothesis that MFI targeting educated women have any differential impact on human capital investment on children when compared to uneducated women. Microcredit also does not have any differential impact on child and teenage labor supply based on mother's education.

In the next section I talk about the background under which MFIs operated ever since its foundation followed by a brief discussion of the theoretical structure underlying my research hypothesis. After that I talk about the empirical strategy and the econometric specifications that I use for this impact evaluation exercise followed by a discussion of the data set and the summary statistics. In the next section I discuss the results followed by the conclusion.

2.2 Background

2.2.1 Previous Evidence

In the mid 1970's group based credit programs came into existence to facilitate credit constrained rural populations across various developing countries. One of the earliest known microcredit institutions is Grameen Bank, founded in 1976 by Mohammed Yunus. Grameen bank used to provide loans, primarily, to landless households in rural Bangladesh for self-employment activities. By the end of 1994 it served over 2 million borrowers with a claimed loan recovery rate around 90%. Thus, Grameen Bank and its credit giving mechanism was established as an ideal model and was followed in many other countries. It was the basis on which Mohammed Yunus was awarded the 2006 Nobel peace prize as microcredit was viewed as the gateway for "world's poorest people to free themselves from the bondage of poverty and deprivation and bloom to their fullest potential" (Results, 1997).

All these group based credit programs provide loans to self selected groups of five[25] or more people and use peer monitoring as an alternative to collateral for loan recovery. If any one member of a group defaults on a particular loan payment then the whole group becomes ineligible to receive further loans. Different microcredit programs have different loan criteria. Land ownership below a threshold level[26] was a popular criteria followed by

[25] This number varies from institution to institution. Grameen Bank used to give out loans to groups of five or more individuals.
[26] Those who owned less than half acre of land.

Grameen Bank. Also, some of these program targeted primarily women as there was a popular belief that women are more credit constrained than men[27].

According to Pitt and Khandker (1998) MFI was believed to be a very effective instrument of poverty alleviation for several reasons. First, microcredit uses peer monitoring as an instrument of loan recovery compared to the traditionally used collateral. Lenders suffer from an imperfect information scenario and hence it is difficult for a lender to determine the probability of a potential client defaulting on a loan or to monitor the activities of each member of a group. However, the members of a self-selected group are usually from a closely knit community, and hence a peer monitoring mechanism generates a more efficient way of gathering information on a potential or existing client.

Second, in some societies there are cultural restrictions on a woman's interaction with men in the labor market. Hence, a woman will prefer a self-employment activity inside her own residence which will also allow her greater time for child care. However, for a poor household, devoting a large share of the household income for consumption purposes, it is not possible to cut consumption and save money for asset accumulation (Pitt and Khandker 1998). Thus, a woman's participation in a microcredit program can increase the shadow value of her time leading to the provision of a complementary input in the production process and the necessary capital required for starting a business (Pitt and Khandker 2003). Hence they argue that a microcredit program where the eligible

[27] Pitt and Khandker (1998)

program participants are women has a better chance of circulating money in a credit constrained household.

Earlier impact evaluation studies (Hashemi et.al. 1996), (Results, 1997) conducted to investigate the effectiveness of micro credit as a poverty alleviation tool mainly use anecdotes, descriptive statistics etc. and they conclude that microcredit is one of the most useful tool against poverty reduction. These studies primarily focus on the impact of the gender of the participant on a set of poverty outcomes and they conclude that Grameen Bank and BRAC[28] have significant positive effects on women's empowerment even when the researcher controls for a woman's independent contributions to household income. Pitt Kandker (1998) conclude that microcredit has a larger impact on self employment activities when women are given loans compared to men. Their paper shows that "annual household consumption expenditures increases by 18 Taka for every 100 additional taka borrowed by women from these credit programs, compared with 11 taka for men"[29].

Pitt and Khandker (1998, 2003) write about the importance of microcredit programs as a tool for initiating female empowerment and child health. These are some of the much talked about downstream impacts of microcredit. Pitt et.al. (2003) find that a woman's participation in a microcredit program has large statistically significant impact on health status of children and a similar impact was not found for a microcredit program that lends out to male potential borrowers[30]. Pitt and Khandker (2003) have also concluded

[28] Bangladesh Rural Advancement Committee
[29] Pitt and Kandker (1998)
[30] A 10% increase in credit giving to a woman leads to a 6.3% increase in the upper arm circumference of girl children which the most reliable indicator of long term health status.

that a woman's participation in a microcredit program have lead to substantial increase in women taking greater role in issues like- household decision making, having access to better social network and having increasing control over economic resources.

However, with the passage of time scholars and researchers seem to be holding a rather pessimistic view on the effectiveness of microcredit as a poverty reduction tool. The popular opinion on the effectiveness of microcredit as a powerful poverty alleviation tool was often criticized in widely circulated media. Dufflo (2013) talks about an article in New York Times accusing Microcredit of making "hyper profits off the poor". Duflo also cites various studies where MFI's have come under attack in India, Mexico and even in Bangladesh the Gramen Bank operates. The same New York Times article portrays MFI's as the "industry had become no better than the widely despised village loan sharks it was intended to replace."[31]

Most of the earlier impact evaluations on the effectiveness of microcredit programs fail to disentangle causation from correlation (Banerjee et.al. 2014). Firstly, all these studies suffer from the problem of selection bias. Microcredit programs evaluated in these exercises give out loans to groups comprising of self selected men and women. Duflo et.al. (2013) argue that the people who choose to participate in a microcredit program are on a different trajectory compared to the non-participants even without any microcredit. Banerjee (2014) argue that people may choose to participate in a microcredit program because they are anticipating harsh times ahead of them. In those cases the estimates will suffer from a downward bias. He also argues that another reason for a person to

[31] http://www.nytimes.com/2010/11/18/world/asia/18micro.html

participate in a microcredit program is because he or she expects an improvement in his or her capability of doing business and hence in those cases the estimates will suffer from an upward bias. Thus, these papers do not really manage to tell us anything about the impact of microcredit on an average borrower and they are further from concluding anything on the downstream effects of the access to microcredit on an average household.

Also, all the former impact evaluation studies suffer from the problem of endogenous program placement. Lenders may have consciously chosen villages based on their wealth, attitude or other attributes that make their residents more likely to enroll for a microcredit program. Pitt et.al. (1998) uses village level fixed effect to take care of the issue of endogenous program placement. However, there could still be chances of individual level unobserved heterogeneity among the residents of lender selected villages that could be causing an upward bias in all these estimates that are used to portray a positive impact of microcredit on variables like household consumption and household expenditure.

2.2.2 Multi-Country Evidence using RCT

To get rid of the problem of selection bias and endogenous program placement Dufflo, Banerjee et.al. published a group of papers containing evidences from a series of randomized control trials performed on microcredit loan disbursal conducted in six different countries across various parts of the globe. In these six experiments microcredit was randomly assigned to some areas(participants) and not in the others. That way, the only difference between a treatment and control group is in the ease of access to

microcredit. Also, some of these papers also organize a second round follow-up survey in order to collect information on some outcome variables on which microcredit should seem to have an impact only in medium run. A detailed description of the RCT carried out in each one of these six countries can be found in the appendix of this paper (Section 2.10.1. to 2.10..6.)

Apart from the fact that a randomized control trial can identify the causal effect most accurately Banerjee et. al. (2014) also talk about the wide geographical, cultural and socio-economic backgrounds that these set of experiments cover resulting in a huge scope for external validation. These experiments were conducted in six different countries namely- India, Mexico, Morocco, Mongolia, Bosnia and Ethiopia from 2003 to 2012. Thus, this study can be considered as a representative sample of the micro credit industry existing around the world. An extensive survey was carried out on the residents of the area assigned to the random treatment[32] to ensure that actual treatment effects and spillover effects can be captured by the study.

All these studies reached their conclusion based on the coefficient estimates of the randomly assigned treatment dummy of an OLS[33] regression equation. There were six OLS regression equations having six broad categories of outcome variables[34]. There are several key results of these experiments. First, the take-up rate for all micro-credit programs were rather low ranging between 6-10% which not only poses a statistical

[32] Treatment is defined as the implementation of the microcredit program. The randomization is ensured by strategies like actively carrying out micro credit campaigns in the areas assigned to treatment and no campaign was organized in the areas not assigned to treatment.
[33] Ordinary Least Square
[34] The broad categories are - Borrowing, Consumption, labor supply, expenditure, social effects, income.

inconvenience for any impact evaluation exercise but also questions the desirability of microcredit to an average household. Second, none of the six experiments find any statistically significant impact of microcredit take-up on average household income, seriously challenging the hypothesis that microcredit can be a powerful instrument of poverty alleviation. Third, the inability of MFI in augmenting household income did not stem from the fact that there was a lack of investment in small scale enterprises. There is some evidence to suggest that microcredit is leading to the formation of small enterprises and enough evidence to suggest a statistically significant impact on revenues and profits from existing business.

Unlike the previous studies, in none of the six RCT experiments the authors find any impact on women's empowerment. There is also very little evidence of microcredit improving any other social indicators[35] that can be construed as possible downstream impact of microcredit. Thus, the hypothesis claiming a positive social impacts of microcredit programs resulting from a spillover effect is also seriously challenged by these six papers. However existing literature (ICRW, 2005) (Mocan Naci H., 2012) suggest that increased education has a positive impact on women's attitude regarding issues related to women's empowerment. Thus, I try to investigate whether segregating women based on their educational level produce any significant impact of microcredit on female empowerment and other social indicators.

[35] These papers considered several social indicators like expenditure on health & education, percentage of children being sent to school, incidence of child labor etc.

Banerjee et.al. (2014) also suggest that there were limited experiments conducted on heterogeneous impact of the six RCT experiments. In those few experiments that were conducted on the heterogeneous impact of microcredit programs (implemented through the six RCTs) it has been proved that microcredit is good for some sub-population and bad for some others. For Example, the microcredit experiment conducted in India reports that there was a statistically significant impact on business revenues and profit for those entrepreneurs with high levels of initial capital investment. Similarly the experiment conducted in Mongolia looked at the heterogeneous impact based on educational level of the respondents on selected outcome variables and find some evidence of high educated respondents showing significant impact of MFI on those outcome variables[36]. However, the authors of this paper do not look at any causal impact of female education on microcredit.

To the best of my knowledge there is no paper that looks at the causal impact of women's education on the impact of MFI on any of the outcome variables considered in this RCT study. Hence, my paper makes a significant contribution by trying to investigate the importance of women's education in providing differential impact on a MFI implemented through a randomized control trial. My hypothesis is that if a woman is educated then she might be able to use the loan generated by her participation in a microcredit program to the best of her advantage and thereby leading to some of the much talked about downstream social impacts of MFI. I try to investigate this hypothesis by constructing a

[36] They find weak evidence in favor of an increase in teenage schooling among high educated households.

difference and difference experimental design using the data collected for the six RCT experiments.

2.3 Theory

The theoretical basis of this chapter lies in a series papers published by Mullainathan. In Mullainathan (2013) explores the hypothesis that poverty taxes the mind. Poor people have more pressing needs like utility bills rent payments etc that make them more likely to think about how to divide their resource carefully among objects of necessity and objects of luxury (Shah et.al. 2015). Thus, poor people are likely to make bad decisions and hence relaxation of credit constraint is likely to lead them to the path of more intelligent decision making.

Another factor that should impact smart financial decision making is education. Katarachia (2013) has shown that subjects with some exposure to financial education are unlikely to commit errors like blindly following other people in matters of financial decisions. Lusardi (2012) has also emphasized on the fact that the level of numeracy is directly correlated with a person's ability to make better financial decisions. Thus, I explored the hypothesis: Does education have any differential impact on the social outcomes affected by the relaxation of credit constraint in a poor household? The conclusion presented by this paper should show a positive impact of education and relaxation of credit constraint on the decision making activities in a poor household.

On the other hand, it is also true that education makes it less likely for a person to be credit constrained. As reflected in the six papers, discussed in the previous section, the

take-up rate of microcredit loans is lower for educated respondents compared to uneducated respondents. Thus, it is possible that education will show a negative impact on decision making for poor educated people. That is because the educated poor people who are enrolling themselves with an MFI are on a different trajectory compared to those who are not. Hence, the positive and negative impact might cancel each other out and one can get a null result of the impact of micro-credit and education on decision making.

2.4 Empirical Strategy

I use the differential educational attainment of the survey respondents and the random placement of the microcredit program among the sample as the basis for my identification strategy. I use a Heterogeneous Treatment Effect framework to investigate whether education of a woman has any impact on the desired social outcomes of a micro-credit program that disburses loans to her or her family. The data collected for the RCT experiment includes information about the educational attainment of the respondent and his/her spouse (if applicable) at the baseline. Since this is a RCT experiment the variation in the outcome variable due to a respondent's belongingness to the treatment or the control group is independent of the variation in the outcome variable due to the respondent's or his/her spouse's educational attainment.

The impact of microcredit program on the outcome Y of the i^{th} woman belonging to the j^{th} group and having e^{th} educational level is evaluated by the following equation.

$$Y_{ije} = \beta_0 + \beta_1 Treatment_j + \beta_2 EduHigh_e + \beta_3 Treatment_j \times EduHigh_e + \beta_4 Controls_{ije} + \epsilon_{ije}$$

The variable Treatment is a dummy taking a value one if the respondent belongs to the treatment group and zero otherwise. EduHigh is a dummy that takes a value one if the respondent is considered to be highly educated[37]. The interaction term between treatment and EduHigh is designed to capture the differential impact of microcredit caused by the fact that the respondent lives in the assigned-to-be-treated area and her high educational attainment. The co-efficient of interest is β_3. In addition I also include a broad set of baseline controls[38]- age of the respondent, number of members in the family of the respondent, religion of the respondent etc.

I focus on intent - to- treat (ITT) estimate. Treatment group includes all those respondents who live in an area that was assigned to be treated. The co-efficient of interest (β_3) compares the average impact of educational attainment and Participation in a microcredit program between treatment and control areas, averaged over borrowers and non-borrowers.

However, in Ethiopia the Randomized Control trial could not be carried out because of a mis-management on the part of the consulting firm who was in charge of the data

[37] This variable takes a value 1 if the respondent has experienced, roughly, more than 6-8 years of schooling. More details are discussed in Section 5.

[38] The set of controls used in this study varied from country to country. Six sets of control variables were used for datasets experiments run on data collected in six different countries. Some broad categories of control variables are stated here. More information on the control variables are available upon request.

collection in the field and also the micro credit program was not implemented in all the areas assigned to be treated. Hence, only 78% of the surveyed respondents actually lived in the area where treatment was designed to be assigned. To comply with the ITT experimental design the researchers assigned a value 1 to the treatment dummy for those respondents who lived in the area originally assigned to be treated (Tarrozi Alessandro, 2014). Also, at the same time a family planning (FP) program was implemented in the treatment areas and hence there was a chance that the outcome variables (related to economic activities) could be affected by the changed fertility decisions of women. To dis-entangle the variation in the outcome variables caused by the FP program I look at respondents living in those areas where only the Microcredit program was introduced . (Tarrozi Alessandro, 2014) take care of the deviation from the experimental protocol by carrying out a difference and difference (DD) experimental design for their paper. Hence, I have designed a triple difference (DDD) experimental set up.

First source of variation in the outcome variable stems from the fact that the microcredit program should differentially affect those respondents living in the areas originally assigned to be treated. Second source of variation is caused by the fact that the impact of microcredit programs should be different on the respondents before and after the treatment assignment. Surveys conducted before and after the treatment should reflect the temporal variation in the outcome variable. The third source of variation is reflected by the baseline educational attainment of the respondents. I also control for the presence of FP program in isolation of the microcredit program and also in presence of the microcredit program.

The impact of MP on the i[th] respondent with eth educational level living in p[th] treatment unit surveyed in t[th] time period is given by

$$\gamma_{iept} = \beta_0 + \beta_1 Post_t + \beta_2 Educ_e + \beta_3 MP_p + \beta_4 FP_P(1 - MP_P) + \beta_5 FP_P \times MP_P + \beta_6 Educ_e \times Post_t + \beta_7 Educ_e \times MP_P + \beta_8 Educ_e \times FP_P(1 - MP_P) + \beta_9 Educ_e \times FP_P \times MP_P + \beta_{10} Post_t \times MP_P + \beta_{11} Post_t \times FP_P(1 - MP_P) + \beta_{12} Post_t \times FP_P \times MP_P + \beta_{13} Educ_e \times Post_t \times MP_P + \beta_{14} Educ_e \times Post_t \times FP_P(1 - MP_P) + \beta_{15} Educ_e \times Post_t \times FP_P \times MP_P + \epsilon_{iept}$$

The variable post is a dummy that takes a value one if the survey was carried out after the Microcredit or Family Planning programs were introduced. The variable Educ is a dummy that takes a value one if the respondent reports having formal education. MP and FP are a dummies that takes a value 1 if the respondent lives in the area where the Microcredit program and FP program were assigned to be introduced. FP(1-MP) takes a value one if the respondent lives in an area where only the FP program was introduced and MP program was not introduced (FP=1, MP=0).

The interaction term $Edu_i * Post_t * MP_p$ is designed to catch the differential impact on the outcome variables resulting from the residence of a respondent, who has experienced formal education, in an assigned to be treated area in the year after the treatment. The coefficient of interest is β_{13} . This equation does not include any baseline covariates as there was a deviation from the proposed experiment scheme.

2.5 Data

I use a cross country panel[39] data set for this paper. Six surveys were conducted across six different countries of the world in two or more rounds[40] before and after the RCT experiments[41], starting from the year 2003 and ending around the year 2013. Apart from Bosnia, the unit of randomization was a particular administrative unit- village or neighborhoods. Individual level randomization was organized in Bosnia where the individuals were given loan on the basis of a credit scoring model[42]. The response rate of the endline survey varies between 63 to 92% when compared to the baseline survey. The time interval between the treatment and the first endline survey is between 14 to 36 months. Loan take up rate varied between 17 to 100%. As discussed in the background section, the low take up rate of the microcredit program poses a very important challenge to the researchers.

Banerjee et. al. (2014) present a summary[43] of the six RCT experiments that were conducted for this impact evaluation exercise. The seven lenders who participated in this program were a balanced mix between profit and non-profit (Ethiopia and Morocco) organizations. Based on the dollar value of the amount of money that these organizations have given out in total, they conclude that all these organizations are big players in their

[39] The data set collected by surveying the respondents of Ethiopia is a multiyear cross-sectional data.
[40] In India, a second round follow-up survey was conducted.
[41] The Survey that was organized before the RCT experiment is called the baseline survey and the one organized after is called the endline survey.
[42] All the individuals whose credit score reflected them to be a little riskier client but should be eligible for a loan if the bank is prepared to take a little bit more risk were declared to be the potential beneficiary of the microcredit program.
[43] Banerjee et.al. (2014) Table 1.

field. This study also incorporates a fairly representative distribution of lenders, borrowers and markets in the world of microcredit. Apart from India all of these programs lent out to borrowers belonging to rural areas, while the RCT's in Ethiopia, Mongolia and Morocco lent out only to rural borrowers. In the RCT's carried out in India, Mexico and Mongolia only women were the eligible borrowers, in the remaining countries both men and women were eligible to borrow money. Apart from the microcredit program in Bosnia, no collateral was required for the borrowers and hence peer monitoring was the principal instrument for ensuring loan repayment. The survey data is mainly individual level data except for India, Ethiopia and Morocco where the unit of observation is a household.

In this study three broad categories of outcome variables are considered. They are - labor supply decisions, household consumption decisions and social impacts. Labor supply decisions are mainly represented by variables like fraction of children[44] or teenagers[45] supplying labor for the household's own enterprise or outside wage-earning activities and number of hours[46] devoted by the children or teenagers in household's own enterprise and outside wage earning activities. The household consumption decisions that I focus on are expenditure on health and expenditure on education. Consumption data is collected in terms of the expenditure incurred by the respondent or household in the last month. Not

[44] In various data sets information is collected on children of various age groups. To make a valid cross country comparison I have included children of 6-15 age group.
[45] The teenagers are all aged between 16-20.
[46] In some studies the hours are collected in terms of last month while in some others the same information is collected on a weekly basis.

all the surveys collect information about expenditure on health and education[47]. There are three major variables under the category of social impacts. They are - share of children in school, share of teenagers in school[48] and women's empowerment. Some surveys calculate a woman empowerment index while some others collect information on questions like the fraction of household decisions where the woman has a say or the extent of her access or control over household resources.

In this study, one important source of variation in the outcome variable is designed in terms of the baseline educational attainment of the respondents. The educational attainment of the respondents are divided into two broad categories - respondents with high education and respondents with low education. In different data sets information on educational attainment is collected in different ways. For example, the survey that was carried on in India divided the respondents into two broad groups- literate and illiterate whereas the survey that was conducted in Morocco captured information on years of schooling. To ensure a consistent cross country comparison I considered all respondents with more than six years of formal education or all those who have studied beyond primary schools as the ones with high education. In India, Mexico, Mongolia and Bosnia, the number of highly educated women are more than number of women with lower education. However, for Ethiopia and Morocco, the numbers are completely opposite.

In this paper I investigate whether access to microcredit programs among educated women have any differential impact on social outcomes compared to the same among

[47] The survey conducted in Ethiopia does not collect information on household consumption.
[48] Ethiopia and India collect information separately on male and female children. Rest of the surveys collect information on children in general.

uneducated women. To address this question I needed to segregate the sample based on women's education. The surveys conducted in Mexico and Mongolia interview individual women and hence for these two countries the segregation was a straightforward exercise. For India and Morocco the unit of observation was a household head and in most of the cases the household head was a man. So for those cases I have considered the educational attainment of the spouse of the male household head. Since the treatment in Bosnia was an individual level Microcredit program information on individual respondent's education was considered[49]. For Ethiopia, information on the educational attainment of the spouse of the male household head was not available.

In Table. 2.1. I have presented a statistical comparison between educated and uneducated respondents across treatment and control villages. Since this is a cross country study I have used six different data sets for my final analysis. Each data set collects information on different covariates that were used for estimating the regression equations. In this table I have picked those control variables that are commonly used as covariates for all the six regression equations. In this table I present the baseline mean[50] of the major covariates of the treatment and the control groups slitting the sample across highly educated and not highly educated groups. I also present the t statistics and the p-value[51] resulting from the

[49] I could have carried out this exercise only on women. However, that would have reduced the sample size by half and significantly reduce the power of the estimates.
[50] For India, baseline statistics were not used for the analysis as the authors were not sure of the degree of randomization of the baseline sample selection. They suspect that the baseline population is not representative and hence I carry out this analysis based on endline statistics. For Ethiopia, I construct this table using the groups assigned to be treated and control groups. For Mongolia, I define the individuals selected for a group-loan as treated individuals.
[51] The p-values are reported in parenthesis, under the t-statistics.

t-test carried out on the sample means between treatment and control groups across the two sub-samples.

From Table 2.1. I can conclude that the high educated and not-high educated groups of the sample are very similar across treatment and control groups. Apart from the variable age of the household for the country of Morocco, for all the other countries the t-statistics testing for the difference between treatment and control means across the two sub-samples are not statistically significant. In all the countries the respondents are in the age group of 30 to 45 and there are two-three adults in the household. Apart from Ethiopia, in all the other countries the size of the household or the number of adult members of the household is higher for the low educated group. Also, apart from Mongolia and Morocco[52], the number of educated and uneducated females is not significantly different.

Hence, I conclude that randomization with respect to treatment and control groups was more or less successful for all the countries. Thus, the estimated impact of the microcredit program captured in Section 6. should be free from any imbalance on potential outcomes resulting from selection bias.

[52] The stark reduction in sample size for Morocco is caused by missing variables on baseline covariates. Also, only 55 females (head of the household or spouse of the head of the household) report having more than 6 years of education.

2.6 Results

In this paper the three broad categories of outcome variables considered here are labor supply, household consumption and social impacts. Since I am primarily interested in looking at the downstream effects of female education and microcredit program the outcome variables that I consider under these categories are- child labor[53], teenage labor, expenditure on health, expenditure on education, school enrolment rates of children, school enrolment rates of teenagers and women's empowerment . In section 2.6.1. I talk about the overall impact of female education on the social impacts of the six microcredit programs using the most comparable set of outcomes across six different countries. In section 2.6.2. I talk about the same using the results separately developed for each country.

2.6.1 Overall Impact of female education on the social outcomes of microcredit programs

In this section I present a broad picture of the differential impact of microcredit on educated and uneducated women. In Table 2.2. I present the coefficient estimates of the interest variable of the econometric specifications described in section 2.4. of this paper for six different countries. The last column of this table reports the same but the regression equation is based out of a pooled dataset for all the countries. This regression also does not include the baseline controls. My key objective while preparing this table is

[53] For each data set information on labor supply had three broad categories- adult labor (respondent and her spouse), teenage labor (labor supply by any teenager -defined by age greater than 15 and less than 20) in the respondent's house), child labor (labor supply by children- defined by age greater than 6 and less than 15)

to include a similar set of outcome variables for the three broad categories for each of the six countries.

For the category labor supply I have included two board categories- Child labor and teenage labor. For a majority of the countries, this variable reflects the number of hours[54] devoted by the children or the teenagers in the self-employment business activity of the household. The variable for Mexico is defined as the fraction of children or teenagers working. I define those workers as children and teenagers whose age roughly ranges between 6-15 and 16-20 respectively[55]. In the surveys conducted in India and Ethiopia a detailed male-female break up of labor supply was provided for each household and that information was reported in a percentage form without a precise measurement of the whole from which the percentage was calculated. So, to maintain consistency with the other four countries, for India and Ethiopia Table 2.2. (which contains the summarized results for the six countries) reports the estimated impact on labor supply of female children and teenagers. However, in section 2.6.2. the impact on the labor supply of both male and female children is reported.

For consumption, I take into consideration two major outcome variables- expenditure on health and education. For some countries this variable is measured in terms of 12 months whereas in some other countries it is measured in terms of 1 month. The precise estimates are stated in the individual tables for each country described in section 2.6.2. The survey

[54] In India and Ethiopia, this variable is measured in terms of hours per week. There is no such precise measurement unit for the rest of the countries.
[55] A precise match in the age-group wise definition was not possible as different data sets reported this information in different age categories.

in Ethiopia did not collect any information on consumption of households. Mongolia and Bosnia did not collect information on household expenditure on medical goods.

For social impacts, I consider the variables school enrollment rate of teenagers, school enrolment rates of children and women's empowerment. The age group of children and teenagers are constructed in the same way by which they were constructed for the category of labor supply. Majority (four out of six) of the studies measure these two variables in terms of fraction of children or teenagers attending school. Ethiopia and Bosnia measure this variable as a binary variable[56] collected at an individual level. For India and Ethiopia, this information is broken up in terms of male and female children. The strategy that was followed for reporting the impact on labor supply outcomes is also followed here. For women's empowerment, India and Morocco construct a woman's empowerment index while the rest report it in terms of female intra-household decision power. The surveys in Mongolia and Bosnia do not collect information on this variable.

A cursory glance at Table 2.2. tells us that we cannot fail to reject the hypothesis that access to credit by educated women have any differential impact on the downstream impacts of microfinance. Most of the coefficient estimates reported in this table are not statistically significant. For some countries we see one or two co-efficient estimates that are statistically significant but there is no consistency in that result for the rest of the countries. For example, we can see that women's empowerment improves in Mexico and Ethiopia because of access to credit by educated women. But the evidence from India and

[56] The questionnaire used for the survey in Bosnia contains a yes/no question to each respondent with respect to whether their children are attending school or not.

Morocco do not support that hypothesis. There is also contradictory evidence. For India it looks like access to credit by educated women leads to a reduction in education expenditure, while in Morocco we see an opposite impact.

However, judging by the statistical significance of the coefficient estimates of all the cells of table 2.2, I will conclude that Microcredit does not seem to be the most important tool to fight poverty and unleash downstream social improvement even if they were provided to educated women.

2.6.2 Impact of female education on the social outcomes of microcredit programs for each country

In this section I describe the impact of female education and access to microcredit program on the survey respondents living in six different countries. Table 2.3.a to Table. 2.8. reports the co-efficient estimates for each outcome variable estimated on residents of each country using the econometric specification described in section 2.4.

2.6.2.1 Impact on India

In this paper I use the panel data published by (Duflo Esther, 2014) to investigate the impact of female education on the desired social outcomes of a microcredit program conducted in India. Table 2.3a. to Table 2.3d[57]. depict the results of that impact evaluation exercise. From table 2.3a. we can conclude that there is no impact of female

[57] Sample size is lower for the regressions using child schooling or child labor decisions as there are many missing values for these particular outcome variables.

education and access to microcredit program on child labor in both endline1 and Endline 2. From table 2.3b. we can conclude that when more educated women had access to microcredit then the share of teenage boys who were sent to school in their families reduced significantly. However, that impact disappears when we consider the treatment expands to the control group. From table 2.3c. we can conclude that when more educated women have access to microcredit then expenditure on health decreases by 206 INR but once again, that impact disappears when the control groups are exposed to treatment. Female education and microcredit seem to have no impact on women's empowerment index. Also, microcredit does not have any significant differential impact on all other variables considered in this study.

2.6.2.2 Impact on Mexico

In my paper I look at the impact of female education and microcredit program on three broad categories of outcome variables- labor supply, expenditure on health and education and social impact. From Table 2.4. I do not find evidence in favor of the hypothesis that if educated women receive microcredit then the incidence of child labor in their household reduces. I also do not find evidence in favor of the hypothesis that if educated women receive microcredit loans then they will spend more on health and education and will be increasingly likely to send their children in school. I find some evidence in favor of the hypothesis that if educated women are given access to microcredit program then her intra-household decision making power increases by a magnitude of .12. This magnitude is slightly higher than 0.7, the magnitude of the co-efficient estimate of the

treatment dummy in Angelucci (2013). There is no impact on a woman's control over the financial decisions of a household.

2.6.2.3 Impact on Morocco

In this subsections I define educated respondents as those who have more than 6 years of formal education. From Table 2.5. I do not find any impact of female education and microcredit on the labor supply outcomes of children and teenagers. I also find no impact on the outcome variable expenditure on health. However, I find statistically significant positive impact on expenditure on education. Educated women with greater access to microcredit increase expenditure on their children's education by 189.3 Dirham compared to uneducated women. However, this impact is not matched by a similar impact in terms of the percentage of children and teenagers being sent to school in each household. Also, there is no statistically significant impact on female empowerment.

2.6.2.4 Impact on Mongolia

For the results reported in reflected in Table 2.6. I define treated group as those individuals who resided in an area assigned for the Group Lending Microcredit program. I have defined educated women as those who have completed at least 8th grade of schooling[58]. I do not find any impact of female education and microcredit on the incidence of child labor, teenage labor. I also do not find any differential impact of female education and access to microcredit on expenditure on education and school

[58] This variable was built into the data set. I did not have any information on respondent education to construct another education dummy.

enrolment of children and teenagers. Since there was no information collected on the status of women's empowerment, I could not estimate the impact of female education and access to microcredit on female empowerment.

2.6.2.5 Impact on Bosnia

For the results reported in table2. 7. I defined high education level to be one where an individual has attended more than secondary school. The incidence of child labor is very limited among the respondents and hence no information on child labor was collected. I don't find any impact of education and microcredit on the incidence of teenage labor. I also don't find any impact of microcredit on expenditure on education or school enrolment rate. I could not measure the impact of education and microcredit on female empowerment and expenditure on health as this survey did not collect any information on those outcomes.

2.6.2.6 Impact on Ethiopia

The results for my impact evaluation exercise carried out in Ethiopia are depicted in Table 2.8. The dummy Educ takes a value one if the head of the households have had some formal education. I find no statistically significant impact of female education and access to credit on the incidence of child and teenage labor. However, I do find evidence in favor of the hypothesis that if microcredit program is provided to households with educated household heads then the number of school enrolment rate of female children goes up. I also find evidence in favor of the hypothesis that if microcredit is provided to

households with educated household heads then the intra-household decision making power of the female members, an indicator of women's empowerment, goes up.

2.7 Conclusion

This study is an addition to six other papers that have investigated the role of microcredit as a tool for poverty reduction using data published by American Economic Journal: Applied Economics (Vol. 7 No.1 January 2015) . This objective of this paper was to determine whether access to microcredit by educated women had any differential impact on downstream socio-economic outcomes (women's empowerment, child labor etc.).

The broad result of this study is a null result. Microcredit, even among educated individuals, does not lead to a significant improvement in the downstream social indicators. There is weak evidence that access to microcredit among women leads to an improvement in women's empowerment. However, this result needs to be substantiated with more evidence. There is no differential impact of access to microcredit to educated women on outcome variables like child labor, teenage labor and school employment. The evidence on household consumption is either null or counter intuitive.

There are some caveats in this study that limited the ability to generate comparable and consistent estimates. Firstly, this is a cross-country study and hence I had to work with six different data sets generated from six different surveys using six different questionnaires. Hence I could not use the exactly similar outcome variables and

regression covariates for the analysis of each of the countries. I have tried my best to keep the variables of the regression equations as similar to each other as possible. Nonetheless, the inter-country comparisons suffer from a mis-match of variables types. Secondly, in the survey conducted in Ethiopia, there was a deviation from experimental protocol and hence the data of the treatment and the control group are not randomly generated for all the countries. Thus, in a very strict sense, the result from Ethiopia should not be matched with the results from all other countries. Thirdly, in India, the baseline survey did not follow the randomization protocol and hence, area-level covariates were used for the estimating equation. So the co-efficient estimates generated for India might not capture the full causal impact. Fourthly, in some of the studies (e.g. Morocco) there is a huge gap between the number of highly educated and not highly educated women. Thus, for the case of Morocco, the results generated by this study suffer from a very serious statistical power challenge.

However, this paper makes a modest attempt to address a very popular hypothesis that claims that relaxing the credit constraint of women is a very powerful instrument for delivering social goods like more educated children, more healthy family members, more empowered women or reduction in child labor. This study is another addition to the already validated conclusion on the inability of microcredit to deliver on the much hoped social outcomes.

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2.9 Results and Tables

Table 2.1. Summary Statistics

	Baseline Covariates	Respondent Highly Educated			Respondent Not Highly Educated		
		Treatment Mean	Control Mean	T-Statistic	Treatment Mean	Control Mean	T-Statistic
India	Household Size	5.43	5.44	0.19	5.77	5.81	0.50
		(2.08)	(2.14)	(0.85)	(2.20)	(2.08)	(0.62)
	Number of adults	3.63	3.64	0.15	4.08	4.12	0.61
		(1.72)	(1.74)	(0.88)	(1.71)	(1.74)	(0.54)
	Age of the household head	38.13	38.30	0.55	44.11	44.29	0.46
		(9.50)	(9.21)	(0.58)	(10.10)	(10.13)	(0.65)
	Number of Observations	1795	1618	3413	1408	1291	2699
Mexico	Age of the respondent	35.16	34.85	-0.49	41.54	40.34	-1.46
		(9.65)	(10.15)	(0.62)	(10.85)	(10.96)	(0.14)
	Respondent Married at the Baseline	0.76	0.79	1.01	0.74	0.76	0.52
		(0.43)	(0.41)	(0.31)	(0.44)	(0.43)	(0.60)
	Respondent Separated at the Baseline	0.08	0.08	-0.00	0.10	0.08	-0.54
		(0.27)	(0.27)	(1.00)	(0.30)	(0.28)	(0.59)
	Number of Observations	5278	5225	10503	2979	3066	6045
Mongolia	Number of male aduts in the household	1.40	1.33	-1.07	1.63	1.32	-1.73
		(0.98)	(1.01)	(0.28)	-1.26	-1.07	-0.09
	Number of female adults in the household	1.76	1.77	0.17	1.79	2.07	1.65
		(0.94)	(0.97)	(0.87)	-1.04	-1.13	-0.1
	Age of the Respondent	39.71	40.25	1.04	40.27	42.82	1.41
		(8.50)	(8.74)	(0.30)	-10.97	-12.37	-0.16
	Number of Observations	680	475	1155	82	84	166
Morocco	Household Size	4.00	4.23	0.30	5.29	5.18	-1.33
		(2.75)	(2.18)	(0.77)	(2.73)	(2.68)	(0.18)
	Number of adults in the household	2.80	3.68	1.38	3.55	3.47	-1.38
		(2.12)	(2.03)	(0.18)	(2.04)	(1.99)	(0.17)
	Age of the household head	48.84	48.65	-0.05	49.21	48.13	-2.22
		(13.23)	(11.79)	(0.96)	(15.50)	(15.60)	(0.03)
	Number of Observations	20	22	42	1987	2089	4076
Bosnia	Proportion of female respondents	0.37	0.37	-0.09	0.48	0.45	-0.53
		(0.48)	(0.48)	(0.93)	(0.50)	(0.50)	(0.59)
	Age of the respondent	35.87	35.68	-0.23	41.97	41.09	-0.74
		(12.13)	(12.10)	(0.82)	(11.34)	(11.99)	(0.46)
	Proportion of respondent who are not never-married						
		0.31	0.31	-0.19	0.12	0.10	-0.63
		(0.46)	(0.46)	(0.85)	(0.33)	(0.30)	(0.53)
	Number of Observations	414	393	807	211	175	386
Ethiopia	Number of adults in the household	2.60	2.55	-1.36	2.60	2.59	-0.36
		(1.11)	(1.06)	(0.17)	(1.16)	(1.15)	(0.72)
	Household having a business less than three years old	0.05	0.06	1.60	0.03	0.04	1.61
		(0.22)	(0.24)	(0.11)	(0.18)	(0.20)	(0.11)
	Number of observations	2274	1121	3395	4091	1993	6084

This Table reports the mean of each of the variables for treatment and control groups.

This table also reports the T-statistic of the mean-difference test between the treatment and control group.

Standard errors are reported in parenthesis below the means of the control and treatment groups.

P-Values are reported in parenthesis below the t-statistics.

Table 2.2. The Impact of Microcredit Program on major outcome Variables for all countries

		India	Mexico	Morocco	Mongolia	Bosnia	Ethiopia	Pooled
Labor Supply	Child Labor	0.0146	-0.00286	0.0125	-0.305	N/A	1.153	-0.179
		(0.376)	(0.0102)	(0.0626)	(0.367)		(3.884)	(0.349)
	Observations	2,700	12,296	4,096	611		4,792	3,310
	R-squared	0.008	0.017	0.268	0.023		0.161	0.001
	Teenage Labor	0.0929	N/A	0.0125	1.212	-1.048	N/A	0.246
		(1.845)		(0.0626)	(1.228)	(0.915)		(1.063)
	Observations	1,888		4,096	611	11,904		6,015
	R-squared	0.009		0.268	0.043	0.040		0.010
Consumption	Expenditure on health	-206.5**	33.00	229.0	N/A	N/A	N/A	-198.2**
		(89.89)	(21.13)	(144.3)				(90.60)
	Observations	6,079	15,907	4,063				6,079
	R-squared	0.005	0.002	0.004				0.001
	Expenditure on Education	-116.1*	1.557	189.3*	-40,649	-79.61	N/A	-1,478
		(67.35)	(3.768)	(98.83)	(46,280)	(132.1)		(10,268)
	Observations	4,849	15,564	4,080	611	11,904		8,976
	R-squared	0.039	0.013	0.065	0.125	0.049		0.006
Social Impacts	Share of children in School	0.0346	-0.00622	0.183	-0.0109	0.0160	0.0261	0.0490
		(0.0213)	(0.0116)	(0.206)	(0.0395)	(0.0330)	(0.0239)	(0.0362)
	Observations	2,700	12,296	2,355	611	507	8,490	6,826
	R-squared	0.026	0.023	0.015	0.320	0.064	0.831	0.002
	Share of teenagers in school	-0.0273	N/A	0.481	0.0484	0.153	0.0559	-0.00841
		(0.0433)		(0.365)	(0.0392)	(0.105)	(0.0656)	(0.0251)
	Observations	1,888		1,488	611	234	1,770	6,014
	R-squared	0.064		0.024	0.111	0.163	0.415	0.002
	Women's Empowerment	-0.0195	0.121**	0.400	N/A	N/A	0.111***	-0.0193
		(0.0249)	(0.0532)	(3.521)			(0.0415)	(0.0255)
	Observations	6,111	12,184	4,096			9,023	6,111
	R-squared	0.011	0.029	0.032			0.019	0.007

Each cell reports the coefficient estimate of Treatment*EduHigh

For Ethiopia each cell reports the coefficient estimates of Edu*Post*MP

The column to the extreme right reports the co-efficient estimates of treatment*eduhigh for all countries (except Ethiopia) pooled together.

Robust standard errors (clustered at unit of randomization) in parentheses

N/A means data not available on that variable for that country.

*** p<0.01, ** p<0.05, * p<0.1

Table 2.3a. Impact of Microcredit Program on labor Supply in India

	Child Labor (Female)		Child Labor (male)		Teenage Labor (Female)		Teenage Labor (male)	
VARIABLES	E1	E2	E1	E2	E1	E2	E1	E2
Tretament*Education	0.0146	-0.353	0.466	0.896	0.0929	-1.077	2.896	-2.677
	(0.376)	(0.303)	(1.281)	(0.773)	(1.845)	(1.457)	(3.217)	(2.850)
Control Mean	0.6	0.3	0.6	1.4	7.9	5.8	25.1	21.0
	(5.16)	(3.37)	(27.46)	(8.04)	(20.38)	(16.27)	(35.82)	(30.58)
Observations	2,700	2,445	2,758	2,461	1,888	1,565	1,635	1,464
R-squared	0.008	0.007	0.005	0.014	0.009	0.006	0.019	0.034

Each cell reports the coefficient estimates of the interest variable Treatment*EduHigh

EduHigh takes a value 1 for those respondents who spouses are literate

Variables related to labor supply are measured in terms of hours worked in the last week for children

Variables related to labor supply are measured in terms of hours worked in each week week for teenagers

The age group for children is defined as 5-15

The age group for teenagers is defined as 16-20

E1 and E2 refers to Endline 1 and Endline 2

Robust standard errors (Clustered at the unit of randomization) in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table2.3b. Impact of Microcredit Program on Household Consumption in India

	(1)	(2)	(3)	(4)
	Expenditure on health (Monthly)		Expenditure on Education (Monthly)	
VARIABLES	Endline 1	Endline 2	Endline 1	Endline 2
Tretament*Education	-206.5**	-73.67	-116.1*	-33.43
	(89.89)	(138.8)	(67.35)	(99.44)
Control Mean	629.9	1022.4	777.3	1141.5
	(1915.56)	(2655.41)	(1178.79)	(1691.25)
Observations	6,079	5,461	4,849	4,378
R-squared	0.005	0.006	0.039	0.032

Each cell reports the coefficient estimates of the interest variable Treatment*EduHigh

EduHigh takes a value 1 for those respondents who spouses are literate

Robust standard errors (Clustered at the unit of randomization) in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2.3c. Impact of Microcredit Program on School Enrolment in India

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Schooling fem child		Schooling fem teen		Schooling male child		Schooling male teen		Women's Empowerment	
VARIABLES	E1	E2	E1	E2	E1	E2	E1	E2	E1	E2
Tretament*Education	0.0346	-0.0153	-0.0273	-0.00542	0.0186	-0.00556	-0.122***	0.0122	-0.0195	0.0302
	(0.0213)	(0.0205)	(0.0433)	(0.0502)	(0.0224)	(0.0222)	(0.0455)	(0.0504)	(0.0249)	(0.0330)
Control Mean	0.9	0.9	0.3	0.3	0.9	0.9	0.4	0.5	-0.0	-0.0
	(0.26)	(0.25)	(0.45)	(0.45)	(0.26)	(0.25)	(0.48)	(0.48)	(0.46)	(0.54)
Observations	2,700	2,445	1,888	1,565	2,758	2,461	1,635	1,464	6,111	5,462
R-squared	0.026	0.036	0.064	0.051	0.021	0.021	0.053	0.042	0.011	0.019

Each cell reports the coefficient estimates of the interest variable Treatment*EduHigh

EduHigh takes a value 1 for those respondents who spouses are literate

Schooling is defined as the share of female children or teenagers attending school in a respondent's household.

The age group for children is defined as 5-15

The age group for teenagers is defined as 16-20

Women's Empowerment is measured by an index

E1 and E2 refers to Endline 1 and Endline 2

Robust standard errors (Clustered at the unit of randomization) in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2.4. Impact of Microcredit Program in Mexico

Variables	(1) Fraction of children (4-17) working	(2) Amount spent on medical expenses	(3) Amount spent on school expenses	(4) Fraction of children (4-17) in school	(6) Number of household issues she has a say on	(7) Number of household issues in which conflict arises
Eduhigh*treatment	-0.00286	33.00	1.557	-0.00622	0.121**	0.000593
	(0.0102)	(21.13)	(3.768)	(0.0116)	(0.0532)	(0.00650)
Control Mean	0.1	37.0	32.5	0.9	2.7	1.5
	(0.25)	(270.59)	(92.72)	(0.28)	(1.35)	(1.41)
Observations	12,296	15,907	15,564	12,296	12,184	12,174
R-squared	0.017	0.002	0.013	0.023	0.029	0.007

Each cell reports the coefficient estimates of the interest variable Treatment*EduHigh

EduHigh takes a value 1 for those respondents who have attended middle school or higher level of education

Robust standard errors (Clustered at the unit of randomization) in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2.5. Impact of Microcredit program in Morocco

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Outcome Variables	Lab Supply (Self)		Lab Supply (out)		Lab Supply (Tot)		Expenditure		Share in school enrolment		Women's
	Child	Teen	Child	Teen	Child	Teen	Eduaction	Health	Child	Teen	empowerment
Treatment*Eduhigh	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	189.3*	229.0	0.183	0.481	0.400
	(0.0626)	(0.0626)	(0.0626)	(0.0626)	(0.0626)	(0.0626)	(98.83)	(144.3)	(0.206)	(0.365)	(3.521)
Control Mean	0.1	0.1	0.1	0.1	0.1	0.1	277.7	443.4	0.8	0.7	-0.0
	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(509.35)	(2817.75)	(0.38)	(0.46)	(8.29)
Observations	4,096	4,096	4,096	4,096	4,096	4,096	4,080	4,063	2,355	1,488	4,096
R-squared	0.268	0.268	0.268	0.268	0.268	0.268	0.065	0.004	0.015	0.024	0.032

Each cell reports the coefficient estimates of the interest variable Treatment*EduHigh

For a female headed household if the head of the hosuehold had more than 6 years of education then that household is classified as eduhigh

For a male headed household if the spouse of the head of the hosuehold had more than 6 years of education then that household is classified as eduhigh

Lab supply (self) refers to number of hours devoted to self-enterprise activities

Lab supply (out) refers to number of hours devoted to outside wage earning activities

Lab supply (Tot) refers to number of hours devoted for all income earning activities, outside and self.

The age groups for children and teenagers are (6-15) and (16-20) respectively.

Robust standard errors (Clustered at the unit of randomization) in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2.6. Impact of Microcredit Program in Mongolia

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Hours in own self enterprise		Hours devoted to outside wage earning		Expenditure on school	Share of school enrolment		
VARIABLES	child	Teen	child	Teen		Children (6-15)	Teenager (16-20)	Respondent has her own enterprise (Y/N)
					in last 12 months			
EduHigh * Treatment	-0.305	1.212	0.414	-0.408	-40,649	-0.0109	0.0484	-0.138*
	(0.367)	(1.228)	(0.695)	(0.810)	(46,280)	(0.0395)	(0.0392)	(0.0701)
Control Mean	0.8	1.3	1.9	2.4	251027.7	0.7	0.3	0.4
	(6.10)	(9.15)	(10.75)	(10.84)	(546018.84)	(0.45)	(0.43)	(0.49)
Observations	611	611	611	611	611	611	611	611
R-squared	0.023	0.043	0.043	0.069	0.125	0.320	0.111	0.067

Each cell reports the coefficient estimates of the interest variable Treatment*EduHigh

EduHigh is defined here as those respondents who have completed 8th grade of schooling

Robust standard errors (Clustered at the unit of randomization) in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2.7. Impact of Microcredit Program in Bosnia

	(1)	(2)	(3)	(4)	(5)
	Hours worked (16-20 age)		Amount spent on	Whether attending school	
VARIABLES	All Activities	Business Activity	education in Each year	Age Group (6-15)	Age Group (16-20)
EduHigh*Treatment	-1.595	-1.048	-79.61	0.0160	0.153
	(1.299)	(0.915)	(132.1)	(0.0330)	(0.105)
Control Mean	1.6	0.4	547.4	1.0	0.8
	(8.21)	(3.35)	(1610.92)	(0.18)	(0.39)
Observations	11,904	11,904	11,904	507	234
R-squared	0.047	0.040	0.049	0.064	0.163

Each cell reports the coefficient estimates of the interest variable Treatment*EduHigh

Eduhigh takes a value 1 for those individuals who had more than secondary school education

Robust standard errors (Clustered at the unit of randomization) in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2.8. Impact of Microcredit Program in Ethiopia

	Labor Supply				Schooling				Women's Empowerment	
VARIABLES	Male child	Female child	Male Teen	Female Teen	Male child	Female child	Male Teen	Female Teen	Decision	Eco Decision
Treatment*post*EduHigh	-4.848	1.153	-3.048	-0.297	0.0412	0.0261	0.0902	0.0559	0.111***	0.131***
	(4.303)	(3.884)	(5.185)	(2.508)	(0.0252)	(0.0239)	(0.0628)	(0.0656)	(0.0415)	(0.0456)
Control Mean	20.3	10.9	22.9	8.2	0.3	0.3	0.4	0.2	0.8	0.8
	(26.59)	(21.55)	(23.33)	(12.77)	(0.61)	(0.63)	(0.49)	(0.42)	(0.24)	(0.29)
Observations	5,007	4,792	1,770	1,756	9,041	8,490	1,790	1,770	9,023	9,020
R-squared	0.259	0.161	0.165	0.030	0.816	0.831	0.375	0.415	0.019	0.022

Each cell reports the coefficient estimates of the interest variable Edu*post*MP as specified in Section 4

EduHigh takes a value 1 for those respondents who have formal education

Labor supply is measured in terms of average hours of work per week in the last 12 months

Schooling is a yes/no indicator to the question "currently attending school" for each member of the household

The age group for children (child) is (6-15)

The age group for Teenagers (Teen) is 16-20

The variable "Decision" refers to percentage of household decisions where the female respondent is involved.

The variable "Eco Decision" refers to percentage of household economic decisions where the female respondent is involved.

Robust standard errors (Clustered at the unit of randomization) in parentheses

*** p<0.01, ** p<0.05, * p<0.1

2.10 Appendix

2.10.1 Background information on the six RCTs

In order to keep the chapter short I have not included a detailed description of each of the six RCTs carried out in India, Mexico, Morocco, Mongolia, Bosnia and Ethiopia. However, for the reader's convenience I have included it in the appendix section.

2.10.1.1 RCT in India

The microcredit program implemented in India through a series of RCT is the first of its kind in the sense that it follows a household for the longest period of time (3.5 years) after a microcredit program was introduced. This has ensured that this study can adequately capture all the long term impacts of microcredit. There were two survey rounds conducted after the MFI started its operation (endline1 and endline2). In endline1 only the households areas residing in the assigned to be treated areas were exposed to treatment. In endline 2 the households residing in both the treatment and control areas were exposed to treatment. A short summary statistics reveal that 50% of the women in sample households are literate.

One of the major findings of this paper is that microcredit programs leads a household to sacrifice long term or even medium term consumption in order to invest in durable goods or to invest in business enterprises. This purchase of durables is partly financed by an increase in labor supply and partly by a reduction in the consumption of temptation goods. However, this increase in labor supply came from the adult members of the

households. There is no evidence of any impact on child labor. Also, this study does not find any impact on women's empowerment and school enrollment of children.

2.10.1.2 RCT in Mexico

The RCT in Mexico was a large scale clustered randomization program aimed at providing increased access to credit to women in the working age with an intention to start up a business. However, there was no restriction on a potential borrower with respect to the area in which she will chose to spend the money that she borrowed. The RCT was implemented in early 2009 in both rural and urban areas of North Central Mexico. A baseline survey was carried out before the program was implemented and an end-line survey was organized 26 months after the program implementation. Randomization was implemented by carrying an active door-to-door campaign in the areas assigned to be treated. However, no such campaign was organized in the control group areas. Further adherence to experimental protocol was implemented by the MFI by verifying the addresses of potential borrowers to ensure that only those who resided in the treatment area received loans. This study also followed an ITT approach where respondents were randomly selected from the treatment and control areas. Thus, any spillover impact of the microcredit program will be included in the coefficient estimates.

Angelucci et. al. (2013) finds a very modest impact of this RCT on all the outcome variables she considered. She found evidence in favor of the fact that the RCT lead to substantial business growth in the households of the treated area and no impact on household income and number of new enterprises. There is no statistically significant

impact on child labor, school attendance, expenditure on health and education. However, there is modest evidence showing a statistically significant impact on women's empowerment (measured in terms of female intra-household decision power).

2.10.1.3 RCT in Morocco

The RCT that was undertaken in Morocco was rather unique in the sense that no other microcredit program was in operation in the years immediately before and after the implementation of the program. So the pure impact of this particular RCT could be captured in this program. The randomness of the microcredit program was mainly implemented at a village level with each sample village containing some households with a greater likelihood of borrowing[59]. The endline survey, that was carried out two years after the program implementation, also contained five randomly selected households from each village along with the households who are most likely to borrow. This survey design was followed for both treatment and control villages. This study has a very low (8%) attrition rate between the baseline and the endline survey. This survey mechanism can help the researchers to estimate the spillover effect of the microcredit program, if any, on the low-propensity-to-take-up-loan households.

[59] Before the program implementation the authors carried out a survey on 100 randomly selected households in each village and calculate, for each household, the propensity score to borrow. This score was based on exogenous household characteristics that make a household more prone to take up a loan. For the post-program survey they included all the households in the top quartile category of this propensity to borrow score for each village. After the microcredit program they re-estimated this take-up equation for the whole sample and included a third category of households likely to borrow.

The take-up rate of the microcredit program was 17%, which is quite low. (Crepon Bruno, 2014) find significant impact of this program on the rural households in terms of investment in new agricultural and animal- husbandry businesses. The authors find statistically significant reduction in child labor and teenage labor in the area of household chores and outside business activity. However, this decrease is not matched by any impact on share of children and teenagers being sent to school. There is no significant impact of the microcredit program on expenditure on health & education and women's empowerment indicators. Thus, the microcredit program on Morocco seems to have a modest to null impact on the desired social indicators considered in my study.

2.10.1.4 RCT in Mongolia

The microcredit Program in Mongolia is aimed to provide access to credit to the hitherto undeveloped section of rural females, whose lives were primarily dependent on traditional agricultural and animal husbandry related activities. According to Attanasio (2014), the eligibility criteria was determined by the asset ownership and income of potential borrowers in compliance with the "poor lists" circulated by the local governments. Before lending a group had to accumulate savings worth 20% of the loan amount or keep an equivalent collateral with the MFI. Group members chose each other independently and were responsible for monitoring and collecting repayments from each other and hand it over to the bank officials at the end of every month. The MFI did not put any restriction on the modalities of group operation and hence this MFI is one of the

most flexible ones considered in this study. A sample of 40 villages in Northern Mongolia was chosen and the residents of these villages were told that there is a 75% probability that the microcredit program will be operative in their village. A baseline survey was carried out before the loan operation[60]- where the 30[61] villages (out of the previously chosen 40) were chosen as treatment villages by a random number generator. After 1.5 years of MFI operation a follow-up survey was conducted in all the 40 villages.

Attanasio et. al. (2014) conclude that most of the borrowers use the loan from MFI to finance personal consumption rather than start a new enterprise. Only group borrowers show some tendency of using the money from the loan to start a new business or to invest in the existing one- showing support in favor of the traditional microcredit loan disbursement mechanism. The authors also show that MFI borrowing has lead to a significant reduction in the incidence of teenage labor in other household activities, no significant impact on expenditure on education and school enrolment of children. This survey do not collect information on any possible indicator of women's empowerment.

2.10.1.5 RCT in Bosnia

The microcredit program in Bosnia is the only individual level lending program considered in this study. This program offered loans to customers who were considered to be risky and unreliable potential borrowers by other credit programs. The main purpose

[60] Thus, during the baseline interview a respondent did not know whether she will be a part of the treatment village or not.
[61] Out of these 30, 15 villages were chosen for group loans and 15 were chosen for individual loans.

of the loan disbursement was to help marginal clients[62] to set up a new business, although there was no monitoring mechanism in place to ensure that the clients are actually using the loan-money for that purpose. Majority of these marginal clients ended up being male and married and young and majority of the loans ended up being collateralized. The loan officers were offered adequate financial incentives to ensure that a desired number of marginal client is identified from the whole pool of borrowers in the bank's main database. A baseline information survey was conducted with all the potential beneficiaries of the program before a random number generator was used to assign half of the total list of eligible candidates as treatment candidates. After 14 months of treatment assignment all the candidates of the treatment and control groups were contacted again for an follow-up survey.

Augsberg (2015) found that this microcredit program in Bosnia lead to increases in self employment activity and business activity but this did not translate itself into increased household income for the program beneficiaries. There is some evidence to suggest that business profits increased as the individuals ran down their savings to top up the loans for in the hope of getting higher returns from future business. The microcredit program also does not have any significant impact on labor supply of children and teenagers, expenditure on education or school enrolment rate. This study does not collect information on women's empowerment or expenditure on health.

[62] Clients whom the bank will normally reject because they were suspected to be fraudulent or poor or a risky client but if the bank agrees to take up a little more risk than these clients will be eligible for getting a loan.

2.10.1.6 RCT in Ethiopia

Tarozzi et. al. (2014) talk about the impact of one of the few existing microcredit programs in rural Ethiopia, trying to initiate the creation of new enterprise among poor women residing in the rural parts of the country. The details about this randomization exercise is already mentioned in Section 2.3. The authors find large point estimates of the impact on the MFI on the incidence of new business enterprises and new profits, however, these estimates are imprecisely estimated because of the existence of large standard errors. So the authors make the conclusion of a null estimate of the microcredit program on the incidence of self-enterprise activities and household income. However, they do find evidence in favor of the hypothesis that access to credit has significantly reduced the involvement of female teenage labor[63] in self employment activities and have increased teen employment in outside wage activities. The authors do not find any impact of the microcredit program on school enrolment and female empowerment. Due to paucity of data the authors could not investigate the impact of the microcredit program on monthly consumption.

[63] Hours per week

3 Chapter 3

3.1 Introduction

The purpose of this paper is to study deprivation in terms of weight and height of children in the 0-5 years of age cohort in India. I focus on the extent of growth deprivation in India following Foster-Greer-Thorbecke (FGT) method as proposed by Foster et.al. (1984). I also see the extent of disparity in terms of health outcomes in children of the same age cohort across several groups (e.g.. boy-girl, ethnic minority-general population, economically backward states-other states).

Physical growth is an important parameter in the attainment of a sound health status among children. Growth deprivation (i.e. deprivation in weight or height) is a manifestation of under-nutrition and the latter is heavily correlated with the probability of health hazards among children. Blossner and De Onis (2005) claim that malnutrition is positively correlated with risk of early death. For children of the age cohort 0-5 this is even more applicable. Scrimshaw et. al. (1968), Pelletier (1994) have established a mutual synergy based relation between malnutrition and morbidity. Pelletier (1994) has empirically established the fact that malnutrition has a "potentiating (multiplicative) effect on mortality within populations". Thus, growth deprivation among children is a major symptom of malnutrition which is one of the most challenging problems faced by the developing and the less developed world in these days.

The most commonly used way of measuring weight or height deprivation is to take the weight for age or height for age statistics, more widely known in the literature as the Z-score. A Z-score is the difference between the actual weight/height from the threshold weight/height normalized by the standard deviation of the weight or height of the individuals in the sample. In this paper I depart from the literature in two ways. Firstly, I normalize the shortfall[64] of the actual weight/height of an individual child from the threshold[65] weight/height by the threshold weight/height itself rather than the standard deviation of weight/height of the children included in the sample. Secondly, I consider not only the depth[66] of the occurrence of deprivation but also the severity[67] of the occurrence of deprivation by taking a square of the normalized index. I construct this measure by directly following the income poverty measure that Foster Greer and Thorbecke (1984) proposed (the famous FGT measure as a way of measuring poverty). The convenience of using the class of FGT measures is their flexibility across samples. We can look at the level, depth and severity of the deprivation of an achieved attribute (weight or height)- something we cannot do using a weight or age or height for age Z score. Also one cannot compare the extent, depth and severity of malnutrition across different samples using the Z score as the latter varies from sample to sample. I use

[64] This measure takes a value zero for those children whose weight or height is above the threshold weight or height.
[65] In this study threshold weight/height is determined by WHO child growth standards.
[66] I use the word depth to refer to the magnitude of deprivation in weight or height.
[67] The damage done by the deprivation in weight/height from the threshold weight/height in terms of well being of an individual might not be linearly related to the magnitude of the deprivation. Hence, I use the word severity to describe the rate at which the magnitude of the deprivation affects an individual in terms of physical handicap or other measures of well being.

WHO child growth standards as a benchmark for measuring the extent of deprivation in weight and height of the children aging between 0-5 years.

There have been a few attempts in the literature to investigate the health status of the children in India using the FGT index of malnutrition. Swain (2008) looked at deprivation in terms of body weight and nutritional intake among children of Orissa (one particular state of India) and he finds considerable evidence to support the hypothesis regarding the existence of severe stunting and wasting among the children in the sample villages of his analysis. However his study is limited to a very narrow sample. Mukhopadhyay (2011) focuses exclusively on growth deprivation in terms of physical weight across different income quintiles and she finds considerable evidence to support the hypothesis that malnutrition increases across the lower income quintiles. However, physical weight is a short run indicator of health status. A child might suffer from under-weight because of some random shock (a sudden illness or income loss of the family etc). A more credible indicator of growth deprivation is height. If a child suffers from stunting then that is mostly because the child was subject to inadequate nutrition from a long period of time and that gives us a stronger ground to make any kind of conclusion about the long term health status of the child. Hence, in this study I characterize growth deprivation both in terms of weight and in terms of height. Also I look at the extent of growth deprivation across different socio-cultural groups.

In this paper I study growth deprivation among boy children and girl children and the extent of growth deprivation among the ethnic minorities vs. the non ethnic group of

people in India. I also discuss regional disparities across various states of India. India is a land of different cultures or customs. However, gender discrimination of a female child is present in almost all the major states. Biologically a female child is stronger than a male child[68] and hence common sense will suggest that biologically a female child is less susceptible to sickness and hence height and weight deprivation compared to a male child. However, in India son preference is common across various families and that is reflected in the difference between the nutritional input of a female child compared to that of a male child[69]. That leads to considerable malnutrition among female children.

There exists considerable discrimination among the ethnic minorities of India commonly known as the Scheduled Caste-Scheduled Tribe and Other Backward Class community or SC-ST and OBC community[70]. In India the people belonging to the SC-ST-OBC communities have a social stigma attached to them because of which they face considerable social exclusion in the day to day activities of a village or an urban small town . Deolalikar (2005) has shown that there is a positive association between one's belongingness in the SC/ST/OBC community and one's child being malnourished. In this paper I investigate the extent of worse health outcomes that SC-ST-OBC children are subject to compared to children belonging to the general category.

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[68] Source: http://www.nybooks.com/articles/archives/1990/dec/20/more-than-100-million-women-are-missing/?pagination=false

[69] Behrman (1981), Miller et all (1988) Deolalikar Nandi (2013) Bharadwaj (2010)

[70] SC or Scheduled Caste are considered to be the members of the lowest hierarchy of the Hindu Caste System, often considered as untouchables by religious laws.
ST or Scheduled Tribes are, by Indian Constitution, deemed to be those tribes or ethnic groups which have indications of" primitive traits, distinctive culture, geographical isolation, shyness of contact with the community at large, and backwardness." (Ministry of Tribal Affairs, Govt of India)
OBC refers to Other Backward Class. Historically disadvantaged groups not covered by the SC-ST categories are included in OBC community.

Another problem that exists in India in terms of any welfare indicator is considerable heterogeneity across various states. Some states like Bihar, Madhya Pradesh, Orissa, Rajasthan etc are subject to considerable backwardness in terms of several income and non-income indicators, whereas the northeastern states of India and Kerala have shown better progress in terms of the non-income indicators compared to income based indicators. Again, the states such as Gujarat, West Bengal and Maharashtra have done well in both income and non-income indicators. In this study I also discuss the regional disparity in terms of the health outcomes across several states.

In this paper after this brief introduction, I will discuss the methodology and the dataset in section 3.2.1 and 3.2.2. Section 3.3 is dedicated to the results. In subsection 3.3.1 I will talk about the weight and height deprivation of children in 0-5 years age cohort across India. In the next three subsections 333.2, 3.3.3 and 3.3.4 I will investigate the same across boy children vs. girl children, SC/ST/OBC vs. general category and different states of India. Section 4 discusses the conclusion.

3.2 Methodology and Data

3.2.1 Methodology

In this paper I follow an FGT income poverty[71] approach to measure weight and height deprivation. The reason why I follow an FGT measure is that it allows us to do a

[71] Foster-Greer-Thorbecke (1984)

cardinal comparison across the individuals of *any* sample with respect to a threshold level of parameter. As I wrote in the introductory section, an index that measures deprivation in terms of a physical growth related parameter should be independent of the sample of analysis in order to allow for comparison across various samples. In this study my principal focus is on the extent and spread of deprivation and the depth and the severity of deprivation in terms of weight and height across several sub samples of 0-5 years of children in India. I argue that a FGT index for growth deprivation is more suitable for this study because unlike the weight for age or height for age Z scores it allows us to construct a measure independent of the sample of analysis. Also unlike the Z scores the FGT measure allows us to capture the extent, depth and the severity of the weight and height deprivation. Theoretically the class of FGT measure satisfies the completeness axiom, monotonicity axiom [72], transfer axiom, anonymity axiom, normalization axiom and uniform scale invariance axiom.

The exact method of computation of the growth deprivation indices are described below.

For each group j, there are n_j individuals. If b_j is the threshold level of achievement[73] of a parameter for group j and if a_i is the actual achievement level of the parameter for individual i belonging to group j then the normalized shortfall of the i^{th} individual belonging to j^{th} group is given by

[72] FGT(0) or the headcount index does not satisfy monotonicity.

[73] Threshold level of achievement of a particular parameter (e.g. height or weight) is an externally determined value of that parameter. In this study I have used WHO child growth standard as the threshold weight and height to calculate weight and height deprivation. This is the standard singular growth reference followed by public health researchers across the world. The WHO child growth standard is a table representing the minimum weight or the height that should be achieved by a child in a particular age group (measured in months -0 to 60) in order to be categorized as not an under-weight or stunted child. More details can be found in De Onis et.al. (2007)

$$s_i = \frac{b_j - a_i}{b_j} \; if \; b_j > a_i$$

$$= 0 \qquad if \; b_j < a_i$$

For each group j deprivation is given by

$$d = (1/n_j) \sum_{i \in n_j} s_i^{\alpha}$$

Here we are considering the summation across all the observations in the sample for a particular group.

Depending on the value of α we get different measures of the FGT index. For this study I consider three conspicuous values of α namely- 0,1 and 2. If α=0 then we have a measure of the headcount index (FGT 0) which signifies the level of the deprivation. The headcount index generates information on the number of respondents who are deprived in terms of weight and height. If α=1 then we get a measure of the normalized shortfall (FGT 1) which gives us the magnitude or the depth of the deprivation. The normalized shortfall measure generates information on the average of the magnitude of the normalized shortfall in weight/height of an individual child across a particular age group from the threshold weight/height for that age group. If α=2 then we get the MSDG[74] measure (FGT 2) which reflects the severity of the deprivation. The MSGD measure is a weighted index where the weight is the magnitude of normalized shortfall. Hence greater is an individual's magnitude of normalized shortfall of weight and height from the

[74] Mean Square Deprivation Gap

threshold, greater is the MSDG measure. MSDG ranges between 0 and 1 and it generates a sharply increasing curve over the zero one interval. Although the range of the MSGD measure is small but a small change in the magnitude of MSGD measure reflects a very high change in the magnitude of normalized shortfall or the FGT1 measure.

In this paper I shall principally focus on the measure called normalized shortfall generated by $\alpha=1$ because this measure reflects the information that is most relevant for this analysis- how deep is the magnitude of the deprivation in terms of weight and height among different sub groups of population. I will also look at the distribution of the population across various deciles of the measure of normalized shortfall as it gives a very clear picture of the extent of the deprivation. I will also focus on the most deprived group in the population in some sections of this study. I will include an analysis of the level of severity generated by a MSGD measure taking $\alpha = 2$.

3.2.2 Description of the dataset

I use National Family Health Survey (NFHS) data set collected on the 3rd round. The survey was carried on 2005-2006 and this is a part of the Demographic Health Survey that is undertaken across various countries of the globe. This survey was previously carried on in two other rounds NFHS-1 (1992-93) and NFHS 2 (1998-99). This survey collects data related to fertility, family planning, women's empowerment indicators, anthropometric development of children etc. A nationwide survey is conducted with standard sets of questionnaires collecting information on the birth giving history of married women and the anthropometric weight and height measures of their children.

Usually three sets of core questionnaires were used uniformly across all the 29 states of India. The sample size was selected based on the number of married women in the sample in the age cohort of 15-49 years based on the 2001 census information. Also, appropriate sample weights were designed to ensure the representativeness of the sample.

Stratified random sampling was carried out to ensure that people from all socio economic backgrounds were selected. In the rural areas the sampling was carried out in a two stage process while in an urban area it was a three stage process. In the rural areas, the census population of each state was divided into a number of primary sampling units (PSU) and under each PSU the households were randomly selected. In urban areas, the census data divides the population into several wards out of which a set of wards were randomly selected. These wards contained a list of blocks the selection of which comprised the second stage of sampling. From each block, a household was randomly selected using stratified sampling techniques.

In this paper I use national level dataset of NFHS-3 to address my research question.

3.3 Results

In this section I discuss the results. The purpose of this paper is to show the extent of weight and height deprivation that exists in India among children belonging to the age cohort of 0-60 months. To ensure an appropriate portrayal of the enormous extent of this problem across different subgroups, I divide this section into four subsections. In each sub-section, I discuss the distribution of the weight and height deprivation across one particular subgroup of Indian population. In subsection 3.3.1, I discuss the depth and

severity of weight and height deprivation across all the children of all the respondents of India. In subsection 3.3.2, I analyze the same across the boy children and girl children. In subsection 3.3.3, I explore the disparity in weight and height deprivation between the ethnic minorities (SC/ST/OBC) and the general population of India. Finally in subsection 3.3.4, I investigate the disparities across the developed and less developed states of India.

3.3.1 Result on weight and height deprivation in India

The magnitude of weight and height deprivation among the children of 0-5 years age cohort is quite severe. The variable s_i (FGT 1) of the model represents the normalized shortfall in weight and height of a child in 0-5 years of age group. It captures the cardinal difference between the actual weight or height and the threshold weight or height normalized by the threshold weight or height. It gives a stark picture of the difference in weight and height achievement of a particular child in the 0-5 age cohort from the threshold weight or height. Table 3.1. represents the data in the following way. The continuous variable called shortfall (FGT1) in weight and height is divided into ten discrete groups: A to J. Group A consists of children with a weight and height shortfall lying between 0 to.1(i.e. 0 to 10% shortfall) but not including .1. Similarly group J consists of children with a weight and height shortfall lying between .9 to 1(i.e. 90% to 100 % shortfall but not including 1). The observations having negative shortfalls i.e. those observations who have more than the threshold weight or height are dropped from the study. The intermediate groups have similar interpretations. In a nutshell higher the

group number is in the alphabetical order, the higher is the magnitude of weight or height deprivation of the observations belonging to that group.

From Table 3.1. it is clear that the size of the sample is 51,555 and deprivation in weight exists among 34,733 children i.e. in more than three quarters of the sample. Out of the deprived population, majority of them have a weight deprivation ranging from 10% to 40% and height deprivation ranging from 10% to 20%. Almost half of the population have a weight deprivation up to 30% and a height deprivation of 10%.

Table 3.2. gives an idea about the distribution of weight and height among the most deprived group i.e the observations in the last decile of the sample. [1] For example if 90% of the sample children have a weight deprivation less than 30% then the remaining 10% of the sample children are the most deprived group in terms of weight. That's because this group has a weight deprivation greater than the majority of the population. In DHS- III dataset for India, 90% of the children have a weight deprivation less than 35% and height deprivation less than 16%. Observations lying in Group D onwards and Group B onwards are considered to be observations in the most deprived group in terms of weight and height .

From Table 3.2. it is clear that approximately 16% of the total sample lie in the most deprived group[75]. Within the most deprived group, more than half the respondents have a weight height deprivation of almost 40% and 20% respectively. The bottom ten percent of this group have a weight deprivation of almost 50% and 30%. which constitutes roughly 7.5%[76] of the total sample. This fact is very striking in the sense that quite an accountable number of children in the sample are surviving with a weight half of the required weight and height 30% of the required height, required weight or height is determined by WHO child growth standard. This fact portrays the seriousness of the health status of the children in certain segments of the population of India.

The distribution of weight and height deprivation becomes clearer through the Figure 3.1. Throughout the rest of the analysis I carry out my discussion in terms of percentage of the respondents in the sample having a particular percentage of weight and height shortfall[77]. The horizontal axis of all the graphs of this paper will measure the magnitude (FGT 1) or depth (FGT 2) of the shortfall in weight or height. The vertical axis will measure the percentage of respondents in the survey having a particular magnitude or depth of weight and height shortfall.

Deprivation in terms of weight and height exists among 63% of the total respondents in the sample. Out of the deprived group between 20-30% of the respondents have 10 to

[75] The group of population whose shortfall in weight is greater than 35% and shortfall in height is greater than 16%. These observations lie in the extreme right hand side tails of the distribution of weight and height shortfall.
[76] Approximately 3958 respondents lie in the most deprived group for weight and height shortfall
[77] For example, if the magnitude of the normalized weight or height shortfall is .1 then it means that the child's weight is 10% less than the threshold weight. Hence, the child suffers from 10% weight shortfall.

30% deprivation in weight and the about 5 to 15% of the respondents have a more severe weight deprivation of 40 to 50%. The distribution of the deprivation in terms of height is more skewed. About 60% of the respondents have around 10% deprivation in height, around 30% of the respondents have less than 20% deprivation in height and about 5% of the respondents have more than 20% deprivation in height.

The distribution of deprivation in terms of weight or height in the most deprived group (respondents who have more than 30% shortfall in weight and 15% shortfall in height) is described in Figure 3.2.

There are 8290 respondents in the most deprived group in terms of weight and 8278 respondents in the most deprived group in terms height. Out of 8290 respondents more than 50% have a weight deprivation between 30-40% and 15-30% have a weight deprivation of 40-50%. Around .02% respondents have a weight deprivation greater than 90%[78]. The distribution of height deprivation gives the following picture. Out of 8278 respondents, around 70% have close to 20% height deprivation, 20% have close to 30% height deprivation and 1% have close to 50% deprivation in height. All these pose a very serious picture about the state of malnutrition in India in the current scenario.

[78] 3472 respondents have a more than 90% shortfall in weight.

3.3.2 Results on weight deprivation across the boy children and girl children

Gender discrimination is a much discussed social problem that is faced by many developing countries, especially those in the South-West Asian subcontinent. From the moment of their birth in some families there is a son preference because of which the boy children are given more healthcare inputs (like immunizations and nutritious diets) and are subject to better care and nourishment[79]. Hence, significant differences in health outcomes are seen across boy children and girl children.

From this study we get a clear evidence of the fact that the girl children are at a higher health risk than the boy children due to deprivation in terms of weight or height. Figure 3.3. and 3.4. illustrate the situation.

The sample of analysis has a size of 51555 with 48% female children. About half the children having weight and height deprivation are female children. So from a crude data analysis it will seem as if there is no disparity in terms of these health outcomes among male and female children. However, from Figure 3.3. and Figure 3.4. it is clear that majority of the male children have a weight deprivation of 0-30% and height deprivation of 0-15%. On the other hand, weight deprivation is more spread out among the female children ranging from 0 to 40% and height deprivation ranges from 0 to 25%. From the Figure 3.3. it is also clear that more female children have higher degree of the FGT 1 health index compared to their male counterparts.

[79] Nandi (2010)

Figure 3.4 reflects the severity of the male female disparity in health outcomes. These graphs show the distribution of the FGT 2 measure which puts more weight on the respondent having a higher magnitude of FGT1 index of weight or height deprivation. The FGT2 index ranges between 0 and 1 and it has a very sharply increasing curve. Thus a small change in the magnitude of the FGT2 index reflects a very large change in the magnitude of the FGT 1 index.

From Figure 3.4 it is clear that majority of the male children have a severity index ranging from 0-5% whereas majority of female children have the severity index between 0-15% in terms of weight deprivation. In terms of height deprivation the severity seems similar for both the categories of the population.

Overall from the above Figures one can conclude that higher levels of weight and height shortfall exists among female children. Also, the severity of this shortfall is more among female children.

3.3.3 Results on weight deprivation across SC/ST/OBC and general population

There is a wide spread discrimination across SC/ST/OBC sections of the population in India in different aspects of day to day life. Some of them are a result of the specific institutional set up whereas some others result from the cultural perception borne by the people for thousands of years. In this study we find clear evidence of discrimination in terms of health outcomes of the children born into parents belonging to these communities. In the sample 66% of the total respondents belong to the SC/ST/OBC

category out of which 91% are deprived in terms of both weight and height. The following graph poses a very striking situation.

From Figure 3.5 it is clear that there exists considerable disparity in terms of weight and height deprivation among the SC/ST/OBC vs. the general population of India. Majority of the children born to parents belonging to the general population of India have a deprivation of 0-20% in terms of weight and 0-10% in terms of height. Their counterparts in the SC/ST/OBC category have a weight deprivation ranging from 10-40% and a height deprivation ranging from 0-15%. Also, the distribution of weight deprivation is more spread out among the children of the SC/ST/OBC population which means that the existence of weight deprivation is more among the SC/ST/OBC community.

Figure 3.6. explains the severity of the weight and height deprivation.

From Figure 3.6 it is clear that the severity of weight and height deprivation is more within the SC/ST/OBC community than in the general section of the population. The FGT 2 index for weight deprivation lies between 0-5% for majority of the general category population whereas it lies between 0-10% for the majority of the SC_ST_OBC population. The analysis for the severity of height deprivation follows the same pattern.

Thus, from Figures 3.5. and 3.6. it is clear that there exists considerable disparity in terms of weight and height deprivation among the children born to parents belonging to the ethnic minorities vs. the general population of India.

3.3.4 Results on weight deprivation across different states of India

India is one of the biggest countries in the South-West Asian subcontinent. It has 28 states each of which has its different language, culture, customs and cuisine. Hence, it is important to explore the regional disparities across the country. I will try to analyze the extent of weight and height deprivation in the children belonging to respondents residing in the less developed and least developed states vs. the those in the relatively developed states[80].

In this study we find clear evidence of the fact that there exists persistent difference in the normalized shortfall of weight and height of the children belonging to 0-5 age cohort across the backward states (least and less developed states) and other states (relatively developed states) of India. The following Figure depicts the situation.

From the Figure 3.7 it is clear that the less and least developed states exhibit considerable weight and height deprivation among the children in the 0-5 age group. Majority of the children born in families residing in less or least developed states exhibit about 0-40% of weight deprivation and 0-15% of height deprivation. On the other hand their counterparts living in the relatively developed states experience weight and height deprivation ranging between 0-30% and 0-15% respectively.

Figure 3.8. analyzes the severity of the weight and height deprivation.

[80] In 2013 the Finance Ministry of India has tabled the report of the Raghuram Rajan Committee that constructed a relative backwardness index of each state of India based on per capita consumption, expenditure, housing amenities, health, education, poverty, female literacy, urbanization, financial inclusion, connectivity etc. After the assignment of the index (ranging between 0 and 1) to each state, the states were grouped under three broad categories- relatively developed, less developed, least developed.

The children born into parents residing in least or less developed states have a more severe degree of weight and height deprivation than their counter parts living in relatively developed states. The severity index or the FGT 2 index ranges between 0-5% for weight deprivation and 0-3 % for height deprivation for majority of the children born into parents living in relatively developed states. Their counterparts in less or least developed states have a severity index ranging between 0-13% and 0-7% for weight and height deprivation respectively.

3.4 Conclusion

Thus from the above analysis two key propositions emerge. There is considerable poor performance of the health indicators among the children of 0-5 age cohort in India. There is also considerable disparity in terms of the health outcomes among various sub-groups of Indian population (boy-girl, ethnic minorities-general population, economically backward states-other states). This disparity takes a prominent shape around the threshold. The disparity in the health outcomes is sharpest in the sub group containing the SC/ST/OBC population in India when compared to the general population.

The key result of this study is the hypothesis that disparity in terms of the health outcomes are prominent for the respondents lying around the threshold. The magnitude of the disparity is more for the non-deprived group, i.e. among those whose weight and height are more than that of the threshold weight and height. This is particularly true for any comparison across the SC/ST/OBC vs. the general population where the attributes are markedly different for the 10th percentile of the non-deprived group. For the same

group the disparity in achievement of height is almost double than that of weight. This signifies that in terms of long run health outcome, the people just above the threshold perform way better in the general population than in the SC/ST/OBC population.

The same story holds for the issue of gender disparity in health outcomes. However, the magnitude of the disparity in health outcomes among boy vs. girl children is lower than that of SC/ST/OBC vs. general population. Another very striking result is in terms of height achievement which says that there is almost no girl child in the sample whose height is not less than the threshold height. This gives out a strong message in favor of gender disparity of the long term health outcomes.

The regional disparity speaks in favor of the age old understanding that there is a strong positive correlation in terms of income and health outcomes. Respondents residing in the economically backward states (least and less developed states) perform worse than those in the richer states (relatively developed states). Thus, the overall economic and non economic elements of the state of residence also has an impact on the health outcomes.

If I compare the FGT1 and FGT2 indices calculated on weight and height of children with the same calculated on income of individuals then I can say that the measures are comparable. Based on the Poverty database of World Bank (2012)[81] 24% of the population in rural India and 13% of the population in urban India earns an income that is less than the poverty line income ($1.91 per day). On an average the poor people in rural India earn an income that is 5% less than poverty line income and those in urban India

[81] http://iresearch.worldbank.org/PovcalNet/index.htm?2

earns an income that is 2.6% less than the poverty line income. The squared poverty gap index is 1.51 for rural India and 0.78 for urban India. Thus, deprivation in weight is comparable to deprivation in income in rural India. However, deprivation in height is of a much lesser magnitude than deprivation in income.

3.5 References

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3.6 Tables and Figures

Table 3.0.1. Distribution (in percentage) of weight and height deprivation (FGT 1) of children in 0-5 years age cohort across India.

Groups	A	B	C	D	E	F	G	H	I	J
Magnitude of shortfall (FGT1)	0 -.1	.1 -.2	.2 -.3	.3- .4	.4-.5	.5-.6	.6-.7	.7- .8	.8- .9	.9 - 1
Weight	15.43	30.88	32.20	16.09	4.22	0.98	0.17	.03	0	0
Height	62.71	32.59	3.70	0.62	0.22	0.10	0.03	0.02	0	0
Total Number of observations in the sample : 51,555 Total number of observations with shortfall in weight or height: 34,733 Range of shortfall in Weight (FGT 1): [0, .94] Range of shortfall in Height (FGT 1): [0, .79]										

Table 3.0.2. Distribution (in percentage) of weight and height deprivation (FGT 1) of children in 0-5 years age cohort across India in the most deprived group

Groups with shortfall (FGT1)	Weight Deprivation (FGT 1)	Height Deprivation (FGT 1)
Group B (0-.1)	-	52.95
Group C (.1-.2)	-	37.03
Group D (.3-.4)	45.89	6.25
Group E (.4-.5)	42.23	2.22
Group F (.5-.6)	9.83	1.04
Group G (.6-.7)	1.73	0.35
Group I (.8-.9)	0.29	0.17
Group J(.9-1)	0.03	-
Total Number of observations : 3469 (Weight Deprivation) 3473 (Height Deprivation)		

Percentage numbers are calculated using the total number of children in the most deprived group.

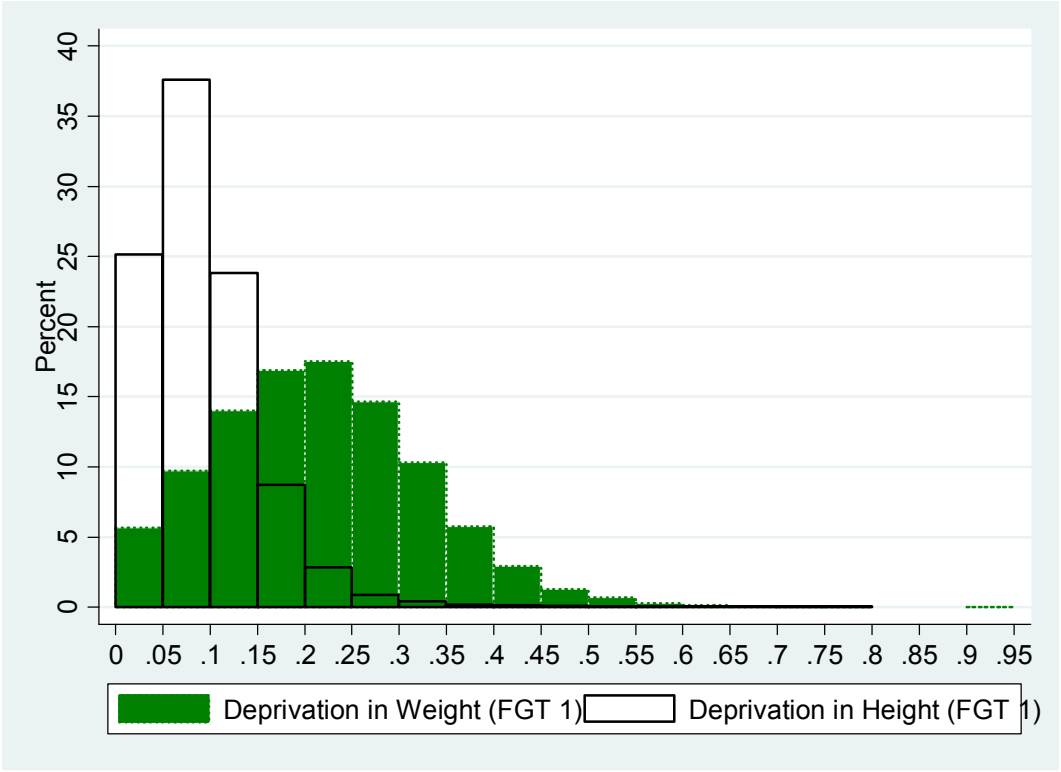

Figure 3.1 The magnitude of the normalized shortfall in weight and height (FGT1) across all children of India belonging to the 0-5 age cohort.

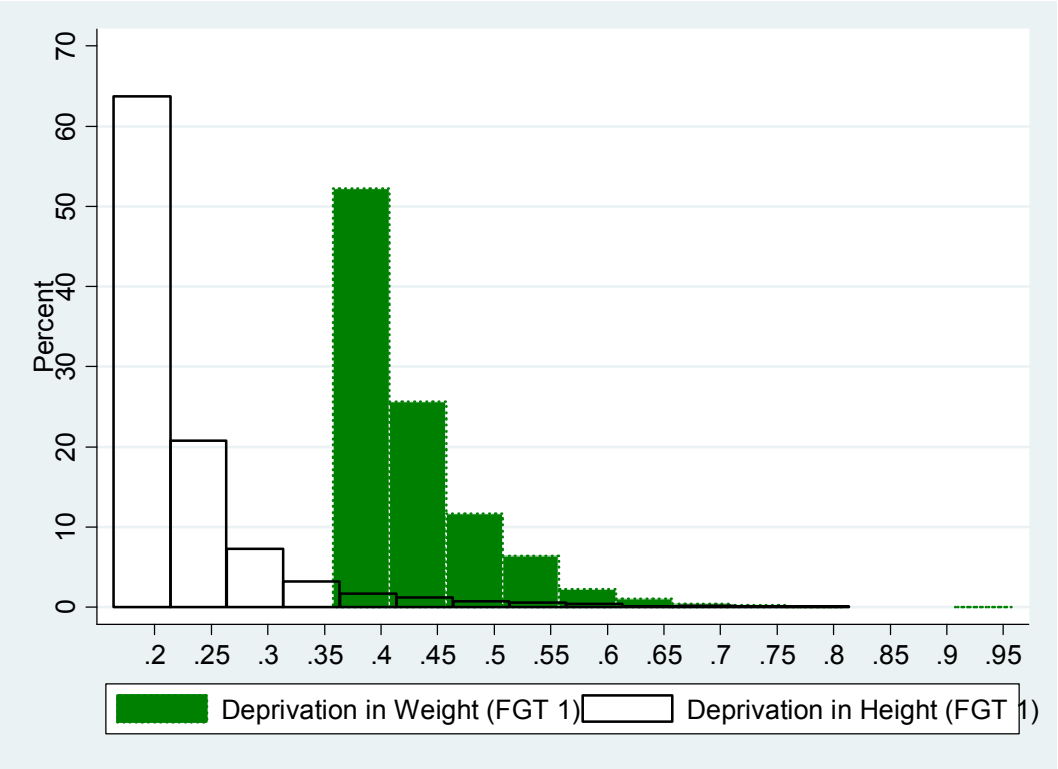

Figure 3.2. Weight and height deprivation (FGT1) among children of 0-5 years age across the most deprived group of the sample.

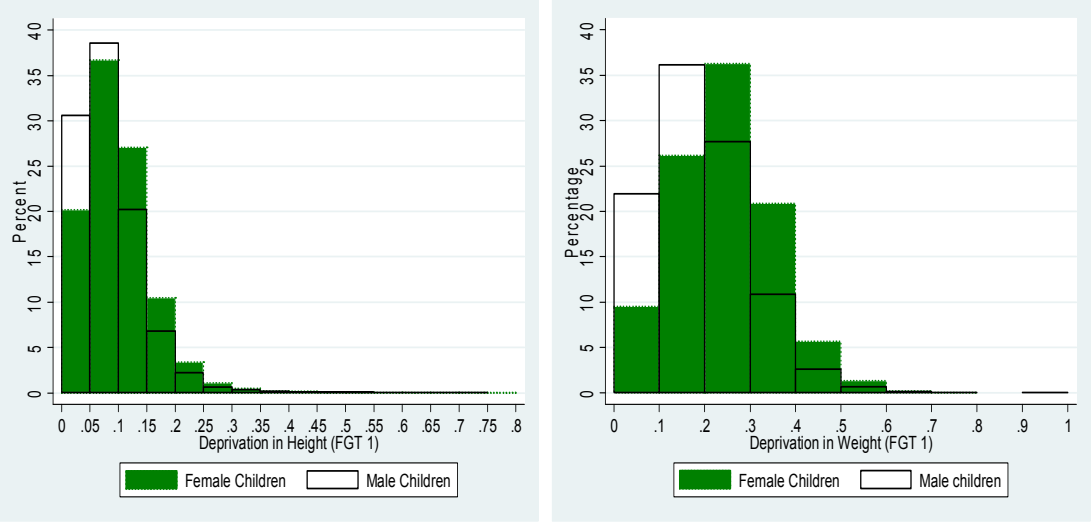

Figure 3.3. Magnitude of normalized shortfall in weight and height across boy children and girl children belonging to 0-5 age group.

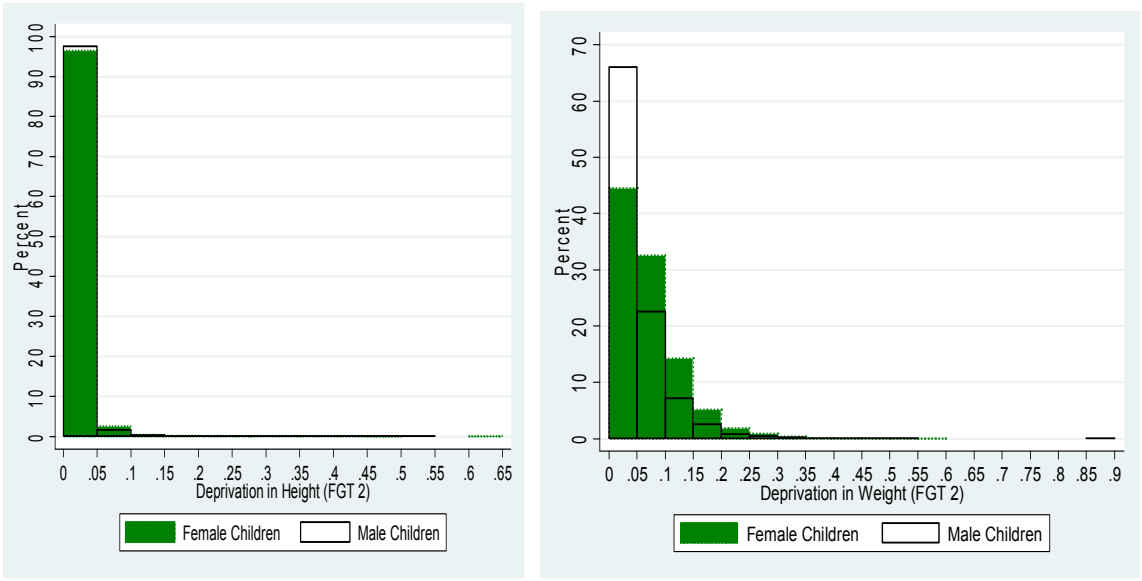

Figure 3.4.. Severity of weight and height deprivation across boy children and girl children in the 0-5 age group of India

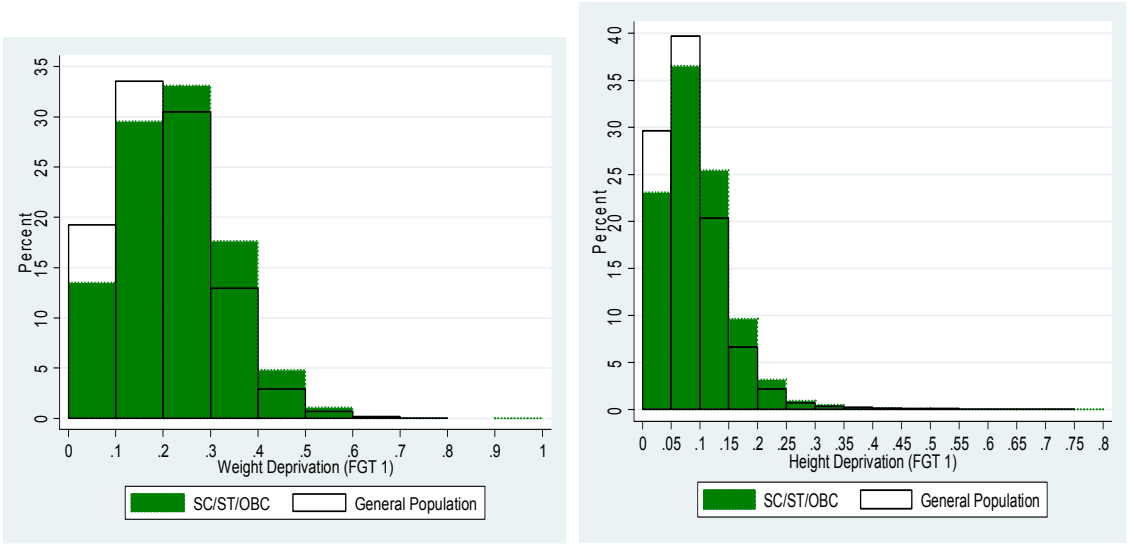

Figure 3.5..The magnitude of normalized shortfall across children of 0-5 years age group among SC/ST/OBC vs. general population in India.

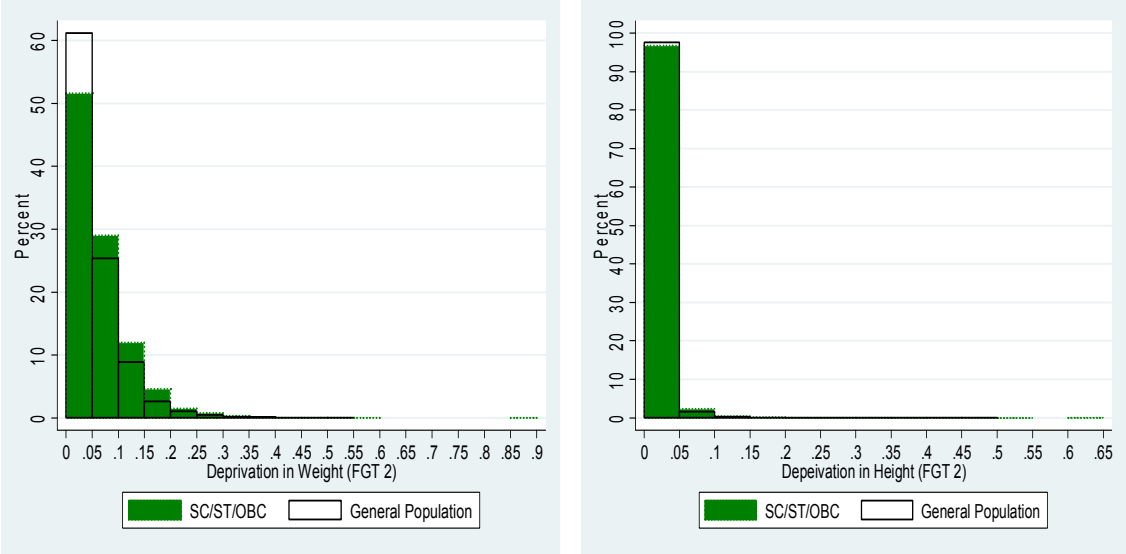

Figure 3.6.. The depth of weight and height deprivation across children of 0-5 years age group among SC/ST/OBC vs. General population in India.

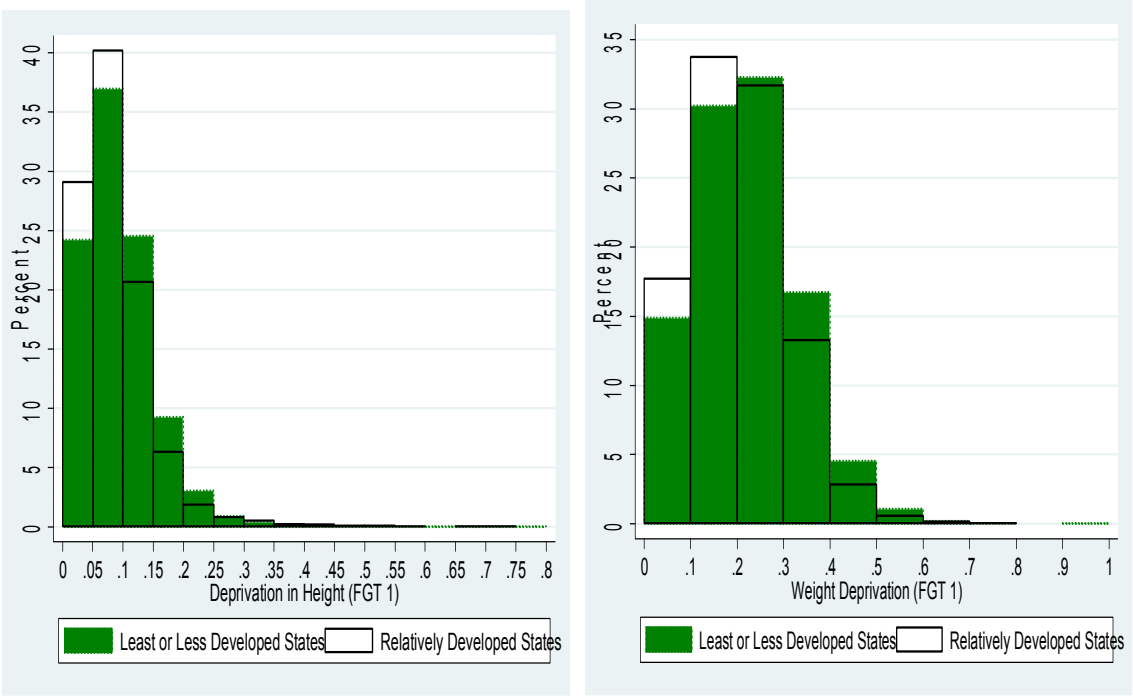

Figure 3.7. The magnitude of normalized shortfall across children in 0-5 years age among Relatively developed vs. less and least developed states of India.

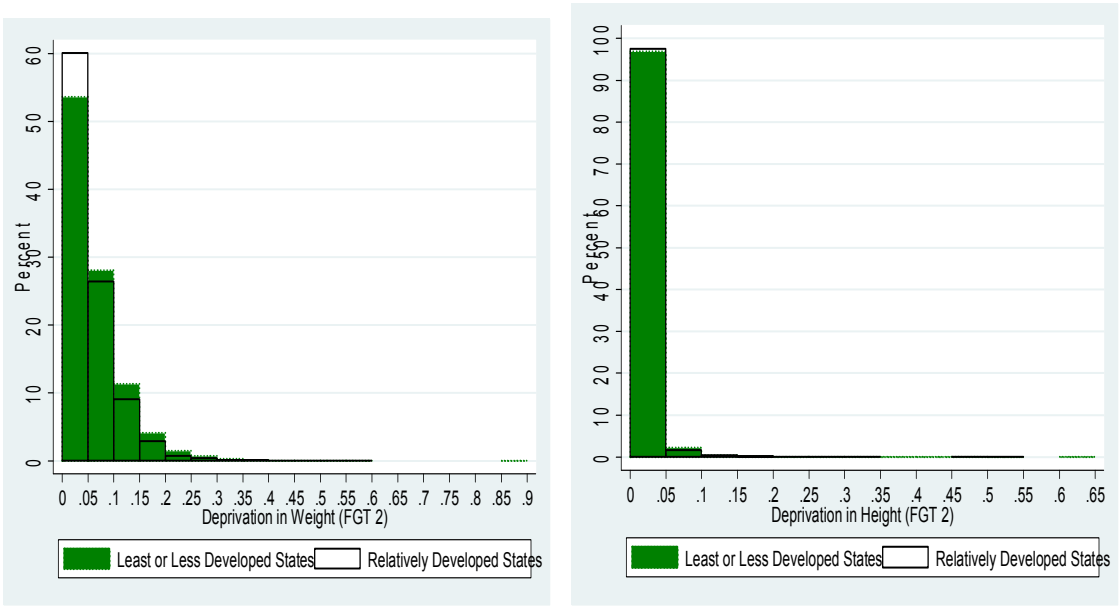

Figure 3.8. The severity of weight and height shortfall across children of 0-5 years of age among relatively developed vs. less or least developed states of India.