Impact of an Affirmative Action Program in Employment on Child Mortality in India

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Abstract

We evaluate whether a major affirmative action program for a deprived caste in India has affected infant and child mortality rates and fertility rates among the target caste and among adjacent castes. The program reserves a substantial fraction of public sector jobs for those from the deprived caste and was implemented on September 8, 1993. We use the National Family and Health Survey and we allow mortality rates to depend on family composition, conditions very early in life, current conditions, caste affiliation, and the implementation of the affirmative action program in employment. First results point towards a slight decrease of the child mortality rate for the target group of the program in rural areas - the areas where the child mortality has been highest.

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1 Introduction

Child mortality constitutes a major problem in developing countries. Currently 5.3bn out of the 6.4bn of the total world population lives in developing countries and despite medical advances and development efforts child mortality is still high in these countries.[1] For example, in India, where 21% of the developing world's population lives, 121 children out of every 1000 live births die before the age of 5.

The occurrence of child mortality, however, does not only vary between countries of different degrees of economic development, but also within countries. This is also evident for India, when distinguishing child mortality rates by caste. For example, in 1993 in the Indian state of Gujarat child mortality rates varied from 98 dead children of the highest castes to 127 dead children per 1000 live birth of the the group "scheduled tribes" which is part of the lowest caste (Das, Bhavsar and Patel 2000).

In the past, caste affiliation had substantial implications for life in India. It strongly affected educational attainment, career perspective and economic prosperity. Upper caste mobility was virtually absent. Even nowadays, more than 50 years after the formal abolition of the caste system in the course of the independence of India, studies shows that lower castes still suffer from economic disparity (see for example Deshpande 2001).

The main goal of this paper is to investigate whether the improvement of career opportunities for a specific caste by way of a positive discrimination policy had an impact on child mortality. In 1993, the Government of India implemented a policy which reserved 27% of all public sector jobs for the second lowest caste (the so called "Other Backward Caste (OBC)") - a policy that was already in place for the lowest caste "Schedule Caste/Schedule Tribes (SC/ST)" since the independence of India in 1947.[2] Such an intervention is likely to have an effect on those who are able to benefit from it directly by improving their career perspective and consequently their income. Moreover, better representation of a caste in executive function in the governmental sector might improve the provision of public goods for this specific caste. Both the direct and the indirect effect could positively influence the life expectancy of newly born children in the targeted caste. At the same time, members of adjacent castes may suffer from the policy.

[1] See UN, The World Population Prospects: The 2004 Revision.

[2] For SC/ST the quota amounts to 22.2%.

Our empirical analysis uses the 2005–2006 round of the National Family and Health Survey in India (NFHS–3). This covers the birth history of approximately 125,000 women. In addition it supplies unique information on family income, asset holdings, caste and religious affiliations, health care access and use of contraception. To these survey data we merge time series data on macroeconomic variables which might also affect fertility and life expectancy, notably GNP, weather information and governmental health care expenditure.

We estimate duration models for infant and child mortality and models for fertility (i.e., number of child births). Hereby we model the mortality rate such that at given moment for a given child the mortality rate depends on the family composition, the conditions very early in life, the caste affiliation and the implementation of the affirmative action program in employment.

First results point towards a slight decrease of the child mortality rate for the target group of the "affirmative action" program in rural, areas where the child mortality has been highest.

The remainder of the paper is structured as follows: First an overview over the caste system and the affirmative action policy in India is presented. Section 3 then summarizes past findings with respect to the determinants of child mortality. Our data set is described in section 4, while section 5 covers the empirical strategy. Section 6 provides first empirical results.

2 Affirmative action policy in India

2.1 The "caste" concept

It is useful to provide some background about the 3000 year old 'caste system' in India. In ancient Hindu society the population was divided on the basis of occupation into 4 and later 5 hierarchial groups called *Varnas* (English translation: Caste). These groups were mutually exclusive and exhaustive and over time also became hereditary and endogamous. These were, *Brahmins* (teachers and priests), *Kshatriyas* (warriors and royals), *Vaisyas* (businessmen or traders and moneylenders), *Sudras* (menial workers) and the *Ati Sudras* (the untouchables). Clearly in this basic economy the first three castes enjoyed a higher socioeconomic status than the last two. Over time the Varna system became metamorphosed into the Jati (also translated as 'caste' in English) system to incorporate a more complex economy. Jati's however are not exact subsets of Varnas and

they differ in their evolution across regions of the country. So while some Jati might be in a particular varna in one part of the country it might be in another varna in another region (Deshpande, 2000). This over years has resulted in several disputes over varna classifications of a given Jati.

In current times the most disadvantaged casts are summarized under the heading "Scheduled Castes (SCs)" and "Scheduled Tribes (STs)". This group is eligible for public benefits since shortly after the independence of India in 1947. Later on another group was defined under the heading "Other Backward Caste (OBC)" in order to identify additional castes that suffer from economic backwardness. Castes that do not belong to the group of 'SC/ST' or 'OBC' are commonly referred to as "general castes".

2.2 Constitutional provisions

In post independent India the Government of India (GOI) has pursued a multi-layered 'affirmative action' program to aid the upliftment of the SC/ST. The very idea behind this policy of anti-discrimination or popularly known as the 'Reservation Policy' is embedded in the Constitution of India adopted in 1950 (Thorat, 2005). The two important provisions of the constitution are the principle of "Non-discrimination and Equal Opportunity" and the provision empowering state to take steps to ensure equal opportunity. The former under Article 15 of the Constitution of the Republic of India bans discrimination, particularly in employment under state on basis of religion, caste, race, sex, descent, place of birth, residence or any of them. Article 17 abolished the institution of 'untouchability' rendering its practice punishable by law.

To put into practice these objectives of the Republic of India the government has implemented (1) a legal system making any discrimination punishable by law for instance Anti-untouchability act of 1955 and Schedule Caste (SC)/ Schedule Tribe (ST) Prevention of Atrocities Act 1989, (2) a Reservation policy which is a pro-active state policy for state and state supported sector and (3) an informal affirmative action policies for the private sector.

Despite such strong constitutional and legal support, socio-economic status within the Indian society continues to be determined by ones' caste affiliation. Deshpande, 2001 uses five indicators of determining socio-economic status - occupation, education, landholding, assets and livestock to calculate a 'caste deprivation index'. She ranks 25 states of India in terms of this index, disparity and real

per capita income. In her study she finds evidence of intercaste disparity within the wider and more general problem of poverty. She also fails to find substantial upward caste mobility.

2.3 Reservation policy - arithmetic of quotas

The main area of the reservation policy of the GOI encompassed political representation and employment aspects:

Political Reservations: The impact of reservation in grass root level government bodies called the Panchayati Raj has been the subject of past research. Through the Panchayati Raj system local councils, directly elected by the people, are responsible for a wide range of public good allocations in rural areas. In 1992, the 73rd Amendment of the Indian Constitution provided mandated reservation of seats in the Panchayat council as well as in posts of Pradhan (Panchayat head) for SC and ST in proportion to the size of these minorities in the population. A third of the seats were also reserved for women (Chattopadhyay and Duflo, 2003). Considering the impact of increased political representation, the research finds that while reservation for SC/ST has no effect on the choice of the public good provided more reservations of SC's in local government as well as the parliament increases transfers to SC/ST households and communities (Pande, 2003). A similar result is also found in case of reservations of Pradhan seats for SC/ST candidates (Besley and Rao, 2003).

Reservation in Employment:[3] A more contentious and yet not intensively studied area of operation of this positive discriminatory policy is the reservation of seats in public sector employment. Provisions for positive discrimination in favor of SC/ST in government jobs were put into place right from the establishment of the republic. With the objective to achieve representation of the SC/ST in various realms of socio-economic life in proportion to their share in population - quotas of 15 percent for SC and another 7.2 percent for ST categories were implemented.

While the reservation policy for ST/SC was largely supported by the Indian society, potential concessions for additional backward classes were more controversial. In 1979 the Mandal Commission was appointed by the GOI in order to

[3]This section draws heavily upon the description of the time line of reservations in India provided in the Annual Report, 2003-2004 of the National Commission for Backward Classes, India and Ramaiah, 1992.

determine criteria for defining the socially and educationally backward classes that do not belong to SC/ST and to recommend policy initiative in order to support this group. The Commission evolved a set of indicators pertaining to social, educational and economic aspects of the individual's life, for determining social and educational backwardness. On the basis of these indicators which were given certain weights, the commission estimated that 54% of the total population (excluding SCs and STs), belonging to 3,743 different castes and communities were 'backward'. Although the Constitution demands preferential quotas for employment in the public sector[4] for backward classes in proportion to their share in the population, in 1963 the Supreme Court of India ruled that reservations could not exceed 50 percent. This automatically restricted the potential reservations for the newly defined OBCs to 27 percent which became the recommendation of commission. Commission submitted its report in the end of 1980. The report remained buried and forgotten for a decade until the coming to power of the V.P. Singh government on 2 December, 1989. After much controversy the reservation for Other Backward Classes took effect from the 8th September 1993. This involved introduction of reservation of 27% for OBCs in the civil posts and services under Central Government, and in public sector undertakings and financial institutions to be filled by direct recruitment w.e.f. 7.8.90. As, however, recruitment in the past can hardly be influenced, it basically meant that starting with the 8th of September 1993 this policy came into place. The official ruling excluded socially advanced persons/sections comprising the so called 'creamy layer' of the otherwise backward castes from benefits of reservation.

This legislation resulted in nation-wide, violent protests by students who feared the adverse consequences of declining employment opportunities for non-SC/ST/OBC categories. Although extreme agitations against reservation have subsided, till date reservation quotas continue to be controversial for multiple reasons. The use of criteria other than merit as a basis of employment is feared to compromise the quality of services available in the economy. Furthermore, studies analyzing the effectiveness of job reservation on basis of caste in India have shown that such policies place very little emphasis on improving the job related attributes of persons from backward classes (Borooah et. al., 2005). Another much debated aspect of the reservation policy is the use of 'caste' as the basis of

[4]This includes central and state governments, and nationalized banks. All private sector undertakings which have received financial assistance from the government in one form or other should also be obliged to recruit personnel on the aforesaid basis.

preferential treatment. Several studies have noted that other groups like women (Chattopadhyay and Duflo, 2004) or religious minorities like muslims (Borooah et. al, 2005) can often be even more under represented, deprived and backward than members of certain backward classes, particularly amongst the OBCs. This is especially so in the presence of the so called 'creamy layer' comprising of a small number of affluent members of castes enjoying benefits of reservation that is neither socially nor economically backward. While legal measures have been taken to exclude this creamy layer from enjoying preferential treatment in spheres of education and public sector employment, implementation of this exclusion is often difficult. This has resulted in concentration of benefits from reservation amongst a hand-full of relatively privileged sections of the 'reserved' castes. This problem is particularly bad for the OBC's since, as mentioned above, there exist large regional variations in varna classifications of jatis leading to regional differences in eligibility for preferential treatment.[5]

Although other groups might even be more socially backward it is undoubtable that for example poverty is highly concentrated amongst the OBC population. And it is therefore a natural question to ask to what extent the current 'affirmative action' policies similar to those for SC/ST help the previously marginalized sections of society to take advantage of the recent rapid economic growth. We try to determine the answer to this question in terms of an important indicator for development, notably with respect to child mortality.

3 Determinants of child mortality

A number of studies investigate factors affecting child mortality. One natural determinant is the economic status of household, which is correlated negatively with infant mortality (Madise, 2003). This relationship can be direct, for instance

[5]Moreover, the actual figure of OBC population is itself controversial. No official caste-wise population figures exists post 1931 census. The use of 1931 figures of 52 percent of OBC population by the Mandal Commission to formulate it's quota suggestions is debatable in light of other data. National Sample Survey's 1999-2000 round estimated around 36 per cent of the country's population is defined as belonging to the Other Backward Classes (OBC). The proportion falls to 32 per cent on excluding Muslim OBCs. A survey conducted in 1998 by National Family Health Statistics (NFHS–2) puts the proportion of non-Muslim OBCs as 29.8 per cent. In absence of concrete figures on backward population, reservation quotas remain questionable.

families with higher incomes are better able to purchase healthier (or in case of very poor countries even just more) food or better health facilities. But economic status of a household is also likely to be indirectly related to infant mortality within the family. For instance educational attainments of the parents can determine household income and also influence parenting abilities as higher education could result in better sense of hygiene for children. Isolating these interacting forces can be often difficult and has been the focal point of a series of recent studies in the area.

The recent literature controls for the wealth effects that negatively impact infant mortality. Following demographic literature, short birth intervals between children are regarded as an important determinant of infant and child mortality. In one such study, Whiltworth and Stephenson (2002) have tried to study causal relationships between short birth intervals and infant and child mortality. Excluding first births and focusing only on children with previous birth intervals, they fit logistic models with mortality as a binary choice variable, in order to study interactions between birth interval and other covariates like socio-economic background, health care demand, and environmental, bio-demographic and geographic factors in determining 'pathways through which birth interval affect infant and child mortality.

The authors find that a short previous birth interval can significantly increase the risk of infant and child mortality. The causal relationship between birth interval and child mortality has been referred to 'frailty' by Bhalotra and van Soest, 2004 and various studies have proposed several different reasons for this. A common argument is that quick pregnancies (i.e. short birth intervals) leave little time for the mother to recover leaving her body depleted and consequently increasing the chances of child mortality ('fecundity hypothesis', Arulampalam & Bhalotra, 2004). Another frequently proposed reason is 'sibling rivalry'. Short birth intervals would imply that a given household could have several young child rent competing for the same resources at a given time. This could increase the probability of morbidity and mortality due to illness and malnutrition particularly so for the girl child who continues to hold only a secondary status to male siblings. Also, having several young children could imply an increased risk of secondary infections amongst siblings implying higher risk of mortality (Whiltworth and Stephenson, 2002).

As mentioned earlier there are several determinants of the birth interval between children. Higher maternal education for instance can significantly increase

the birth interval between children. Probability of a short birth interval also declines with the age of the mother at time of giving birth and with increase in the age of weaning of the previous child (Whiltworth and Stephenson, 2002). Interfamily heterogeneity, for instance household religion, caste and region, also seems to play some role in determining birth intervals (Arulampalam and Bhalotra, 2004). Hindu households have a higher relative probability of having longer birth intervals as opposed to Muslim households. Additionally, Christians have a greater probability of having shorter birth intervals and higher chances of longer birth intervals. General castes and Scheduled tribes have higher odds of having longer birth intervals and lower odds of shorter birth intervals as opposed to Scheduled castes. In terms of regional differences, there appears to be a north-south divide in India with families in north with relatively shorter birth intervals and higher incidences of infant and child mortality.

While these factors directly affect birth intervals which in turn affect rates of child mortality within the country, often they also interact with birth intervals acting as a catalyst to or diluting the effects of short birth intervals. For instance, low levels of maternal educational attainment accentuates the causal effect of short birth intervals on child mortality through demand of health care (Grossman, 1972). Maitra (2004) attempts to show the pathway through which maternal education can effect health outcomes of children via relative power of the two parents within the household and differences in the preferences between males and females with regards family planning and demand for health care for children. Higher level of mothers education would result in increased knowledge and exposure to the outside world, reduce the mobility constraints and result in increased emotional independence and control over the household resources by the mother. Given the higher relative demand of health care services by women, greater power of the mother in the household would imply higher share of health expenditure in total household expenditure. Higher health care usage, in addition with other factors like child specific characteristics, household level characteristics, and community level variables will in turn determine the child's health outcome (which in this case is survival status). The author points out that certain women could be more likely to demand health care services. These could include women who either anticipate health complications or those who just have a 'strong preference for healthy children'. According to the author ignoring these 'self selection' processes could lead to understatement or overstatement of impact of health care on health outcomes and therefore needs to be taken into account.

Whiltworth and Stephenson (2002), note that the survival status of a previous child could also interact with birth intervals thereby further increasing the impact on child mortality within the household. Bhalotra and van Soest (2004), discuss the bi-causal relationship between the mortality of a child within the household and birth interval. They point out that in addition to mother level and household level observed and unobserved heterogeneity, operating through factors like maternal education level, household income, age of mother at time of birth, religious and caste affiliations of household, region of residence etc, intra-family state-dependence or 'scarring' effects can also cause a clustering of incidences of infant and child mortality within households making them suitable for targeting. Arulampalam and Bhalotra, 2004 point out that death of a child in a household could increase the probability of death of the next child. Bhalotra and van Soest (2004) propose several pathways through which such state-dependence effects could operate. The 'fecundity hypothesis' as mentioned earlier works via the impact of death of a child on the birth interval preceding the next birth. Death of a child could imply a quick next pregnancy in order to 'replace' the dead child, without providing sufficient time for the mother to recover physically. This could adversely affect the health of the next-born. Likewise, death of a child could leave the mother depressed and this in turn could have a negative impact on the health status of the next child (called 'Depression hypothesis').

The above-mentioned literature focuses on finding factors affecting infant mortality at the level of the household, mother and the child. The recent literature (see e.g. Van den Berg, Lindeboom and Portrait, 2006) has emphasized both the need for exogenous indicators of early-life conditions and the need to take transitory macro conditions early in life into account. Obviously, caste is exogenous, so from this point of view our analysis is less sensitive to selection problems as e.g. studies using parental income as the main explanatory variable. Van den Berg, Lindeboom and Portrait (2006) find that children born during recessions have lower life expectancy later in life than children born during booms. Unfavorable macroeconomic conditions could imply not only lower household incomes (via higher unemployment rates within the economy), but also more directly lower access to food and reduced government spending on health services in the economy at large.

4 Data

4.1 National Family Heath Survey III

In absence of an existing longitudinal panel for India, the 2005-2006 (NFHS-3) round of the National Family and Health Survey data is an excellent data source for such a study. Not only does the survey cover the standard variables like family income, asset holdings, caste and religious affiliations and other factors conventionally considered to affect infant mortality they attempt to collect in-depth health related information at the level of the village, households and individuals which in these surveys are women in the age group of 15-49. The survey contains retrospective birth history of each person with detailed information concerning family planning, maternal and child health, child survival, HIV/AIDS/sexually transmitted infections (STIs), infectious diseases, reproductive health and nutrition and thus can be used to construct a retrospective panel. Important variables for the study which are available are household level variables like income, caste, religion, area of residence (state and urban/rural), proximity to health care center, type of housing, household assets like landholding and possessions of items like car, radio, television, bicycle etc.; mother level covariates like mother's age, mother's education, mother's autonomy within the household and child specific variables like birth order of index child, previous birth intervals, survival status of all the children, age at death (in case of a child who didn't survive) etc. In addition there is detailed information regarding awareness and use of contraceptive methods including sterilization. Currently this information is only accessible for a subset of the original sample. The whole sample of 124,385 ever married women will soon become available.

As mentioned earlier the panel is constructed using information collected by asking women about their birth histories for the time of 1960 to 2005. The retrospective nature of the data raises questions about its reliability. This is particularly so in case of poor households, lower educated mothers or accounts of births in the distant past. Consequently there are relatively fewer births reported in the 1960's, probably due to recollection errors. This however, is less of a problem in the decades of the 1980's and '90's, which are the years immediately before and after the implementation of the Mandal Commission report. Furthermore, in order to increase the precision of the information the interviewers asked several

questions as cross checks and included a measure of precision based on this[6]. Also the NFHS-3 data provides additional improvements over the two earlier rounds of 1992/93 (NFHS-1) and 1998 (NFHS-2). For instance, the latest round also provides a survey of couples and men in addition to the women survey. These are crucial in any study of fertility and child mortality in a country that is highly male dominated with low female autonomy. Secondly, both the NFHS-1 and NFHS-2 lacked information on a crucial determinant of infant and child mortality- family income. The NFHS-3 however, provides a useful measure of family income which is constructed on the basis of family asset holdings. Such a reliable measure of family income is fundamental in any study assessing the impact of government policies in raising individual socio-economic status.

4.2 Macroeconomic data

We merge to the survey data time series of the GDP of India, together with information on the weather conditions and health expenditure.

Detailed information about changes in GOI's affirmative action policies at the central and state level are not easily available electronically. Information on reservation quotas is obtained from various official sources including Census of India and publications of the Department of Personnel Training, GOI. These have been merged with supplementary information from the Constitution of India and state level Acts and ordinances in the realm of affirmative action/ reservation policy. This data has then been suitably consolidated for the purpose of empirical analysis to evaluate the effectiveness of the affirmative action program in India on lowering concentration of child mortality within lower castes.

5 Empirical strategy

In the analysis of mortality effects, we use a range of methods. We start off with a hazard rate model framework for mortality. We extend the model with unobserved heterogeneity, and we allow this to have household-specific and child-specific components. We estimate the models with random-effects and with fixed-effects assumptions. We also consider models for survival probabilities up to certain ages.

[6]Details of the problems and solutions emerging from a similar retrospective nature of the two earlier rounds of 1992/93 (NFHS-1) and 1998 (NFHS-2) can be found in earlier studies, for instance Maitra (2204), Bhalotra and van Soest (2004) and Bhalotra (2007).

The study observes J families where $j = 1, ..., J$ and child i such that,

z_j : is the vector of observed family-specific characteristics (this would include caste)

s_j : is the fixed effect of the state in which the family lives (constant across various ages)

v_j : unobserved family specific characteristics (it is assumed that both observed and unobserved family specific characteristics remain constant over time).

I_j: number of children born in household j during the observation period

x_{ij}: vector of observed child specific characteristics eg. gender, birth order etc.

$y_{j\tau}$: time varying explanatory variable (this includes a dummy variable that takes a value of 0 prior to and 1 after the implementation of affirmative action policies for OBC families)

w_{ij}: factor accounting for child specific frailty

The model assumes exogeneity of all covariates i.e. the joint distribution of $v_j$and w_{ij} does not depend on z_j, s_j and x_{ij}. Additionally,

τ : calender time

$m(\tau)$: current macro economic conditions

$m_{tr}(\tau - t + k)$: trend components of macro economic conditions in the past months ($k \in \{0, ...48\}$)

$m_c(\tau - t + k)$: cyclical components of macro economic conditions in the past months ($k \in \{0, ...48\}$)

T : continuous random variable (taking only non-negative values and measured in months) describing age of child i in family j at time of death with realization t_{ij}.

Given this setup, the hazard rate (in this case the mortality rate) $\theta_{ij}(t)$, i.e. the probability that the child survives at age t given that it survives up to age t, is

$$
\begin{aligned}
&\theta_{ij}(t|z_j, x_{ij}, v_j, w_{ij}, y_{j1,}y_{j2,}y_{j3,}) = \\
&\lambda(t) \exp\{I(t \leq 1)(z_j\gamma_1 + x_{ij}\beta_1 + y_{j1}\delta_1) \\
&+I(1 < t \leq 12)(z_j\gamma_2 + x_{ij}\beta_2 + y_{j2}\delta_2) \\
&+I(12 < t \leq 60)(z_j\gamma_3 + x_{ij}\beta 3 + y_{j3}\delta_3) \\
&+s_j + \alpha_1 m(\tau) + \alpha_2 m_{tr}(\tau - t) \\
&+I(t > 12)[m_c(\tau - t) + \tfrac{1}{t-12}\sum_{k=0}^{t-12} \alpha_k m_c(\tau - t + k)]\} \\
&\cdot v_j w_{ij}
\end{aligned}
\tag{1}
$$

This mortality rate can be seen as consisting of 3 parts. $\lambda(t)$ is the baseline hazard that is same for all children in all families and captures age dependence. The second is the regression function where $I(\cdot)$ is an indicator function taking the value of 1 if its argument is true and 0 otherwise. Both family specific (z_j) and child specific (x_{ij}) effects can effect mortality rates differently at different ages (three age groups are considered - 0-1 month (neonatal), 1month-1 year (infant), 1-5 years (child)). The macro economic indicators have similar interpretation as in Van den Berg, Lindeboom and Portrait (2006). The parameters of interest are the δ's and the α's.

To ensure identification of the model, mortality rates $\theta_{ij}(t)$ satisfy the mixed proportionality assumption and the time varying regressors $I(\cdot)x_{ij}$, $I(\cdot)y_{j\tau}$ and $I(\cdot)z_j$ change values exogenously. To take account of a possible correlation between family specific and child specific unobserved heterogeneity one can assume that both the frailty components to be mean one random effects, for which the joint distribution is independent of the covariates. Estimation of the impact of the affirmative-action policy rests on the fact the policy implementation is an exogenous discontinuity.

Implementation of the model involves isolating the family specific and child specific unobserved heterogeneity and then using MLE to estimate the parameters of the model. Using this set up we would like to see a significant negative effect of the $y_{j\tau}$'s on the hazard rate in case of a useful affirmative action policy change with long term gains. Soon after any effective policy change we should find a sharp downward jump of the hazard rate. Inability to find a sharp decline in hazard rates after an increase in the intensity of affirmative action policies would imply that the benefits of such policies do not extend to the future generations at least in the realm of equal opportunities to survive in early years of childhood. Such a situation would demand a reassessment of the benefits and the associated costs of such a program. This result would be particularly interesting given the interactions between such policies and changing macro-economic environment.

6 Empirical findings

6.1 Descriptive statistics

The empirical analysis starts off with a description of fertility trends (see table 1) for which we define three different cohorts consisting of women born during the time periods of 1956-1965, 1966-1975 and 1976-1985.

First, looking at the sample sizes of women by caste we note that social group composition has changed over time. While general category female population has declined by 6.06 percent over the three decades the number of SC/ST and OBC female populations have steadily increased over this time period by 3.64 and 2.42 percentage points respectively. This change in female population composition is matched by a similar but smaller decline of 4.78 percent in total births to general category women and an increase of about 2.5 percent in total births to mothers of the two other caste categories. Coming to the average age at first birth, we consistently find that once again caste affiliations matter. Women belonging to the SC/ST and OBC groups start their fertility on an average at a slightly younger age than women of the general castes from their own cohort. Next, considering average number of births we must point out that the last two cohorts are likely to have not yet reached the end of their fertility consequently making it difficult to study changes in average number of births and age at last birth over time. But comparing average number of births, across the three social caste categories, within each cohort we can note that the SC/ST and the OBC groups exhibit relatively higher fertility than the general category. These findings are of course in line with the fact that socio-economic backwardness could lead to lower human capital investment during youth leading to early marriages and start of fertility and consequently higher parity. Moreover, in terms of these basic trends SC/ST and OBC households are more comparable to each other and in contrast with the so called general category. If this be the case, SC/ST and OBC classes are clearly backward and therefore desirous of social support by the way of an affirmative action policy.

Table 1: Summary statistics of fertility by birth cohort of mother and caste

	Birth Year 1956-1965			Birth Year 1966-1975			Birth Year 1976-1985[a]		
	Gen.	SC/ST	OBC	Gen.	SC/ST	OBC	Gen.	SC/ST	OBC
Number of Women	925	657	1098	1331	1133	1662	1218	1205	1857
Total births	3486	2985	4599	4184	4344	5841	2686	2935	4435
Avg. no. of births	3.77*	4.54*	4.19*	3.14*	3.83*	3.51*	2.21*	2.44*	2.39*
	(2.09)	(2.19)	(2.08)	(1.79)	(1.95)	(1.75)	(1.17)	(1.27)	(1.20)
Avg. age at first birth	20.53*	19.76*	19.56*	20.44*	19.53*	19.19*	19.62*	18.75*	18.71*
	(4.34)	(4.28)	(3.98)	(4.39)	(4.28)	(3.80)	(3.11)	(3.06)	(2.88)
Avg. age at last birth	28.06*	29.86*	28.66*	26.19*	27.32*	25.94*	22.52*	22.34*	22.12*
	(5.54)	(6.19)	(5.95)	(4.61)	(4.99)	(4.64)	(2.89)	(3.10)	(2.87)

*: mean

( ): standard deviation

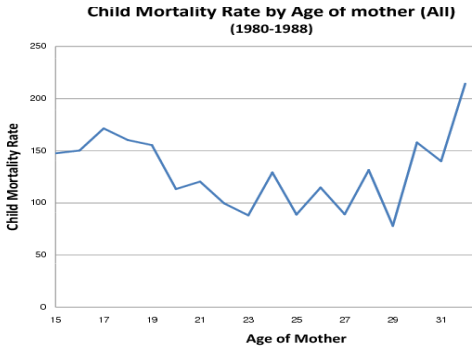
a : this cohort is likely to have not yet completed its' fertility. Therefore figures on total births, average number of births and average age at last birth are expected to be lower than actual

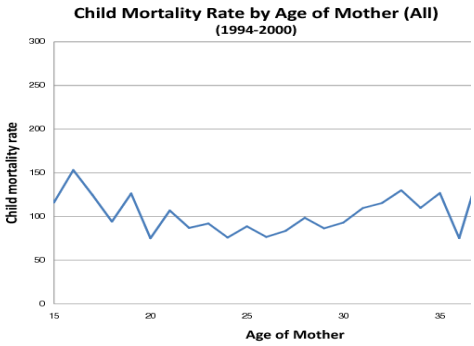
In order to evaluate the impact of such a reservation policy on child mortality amongst OBC households it is useful to consider child mortality rates shortly before and after the policy change. For the purpose we define two cohorts - children born between 1980-1988 and the second comprising of children born between 1994-2000. Figure 1 presents the plots of CMR as a function of age of the mother for the whole sample and separately for SC/ST and OBC households for these two cohorts.

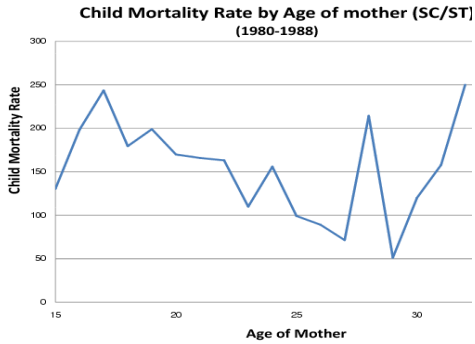
Certain general facts emerge from these basic graphs. Firstly, for all groups there is a clear decline in CMR over the years with cohort 1 exhibiting higher child mortality than cohort 2 in each of these plots. Secondly, child mortality clearly is a function of the age of the mother for all sections of the population. In each of these plots we note that while child mortality is rather high amongst young mothers (less than 18 years of age), it declines over the age interval of about 18-25 remaining relatively low till about 30 and sharply increasing thereafter. This of course would be understandable in light of the adverse health consequences for both mother and child of pregnancies and child birth for young teenage mothers.

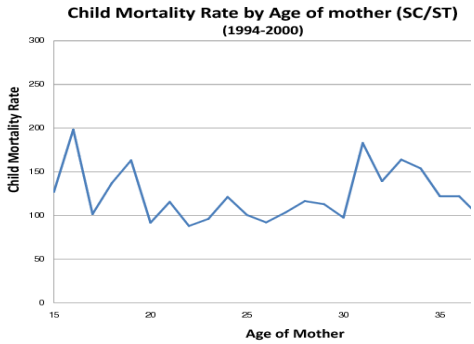
Looking at the different social groups we note that CMRs are clearly higher amongst SC/ST and OBC groups than the population as a whole, both before and after the implementation of the affirmative action policy. The relatively low CMR of about 100 child deaths per 1000 live births for the whole population is clearly driven by the lower child mortality amongst the general castes. SC/ST population seems to be worst off with a CMR of about 150 per 1000 live births for cohort 1 and continues to stand higher than that of the whole population after a decline to 100 per 1000 live births in the second cohort. While the OBCs start from a relatively better CMR of about 125 child deaths per 1000 live births than SC/STs during 1980-1988, they experience a lower decline in child mortality over the years. Consequently, in years following the implementation of affirmative action policy CMR amongst the OBC population is at par with child mortality rates of SC/ST population. What is also interesting to note is that in the second cohort CMR for the OBC and the pooled population as a whole begin to rise only at about the age of 35 for women. This is in contrast to the earlier cohort and the SC/ST group which does not exhibit a similar increase in the length of a woman's safe fertile window.

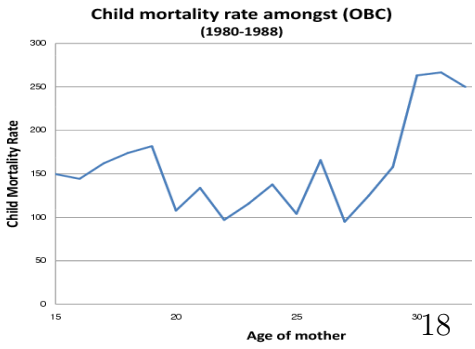
Figure 1: Child Mortality Rates by Cohort and Caste

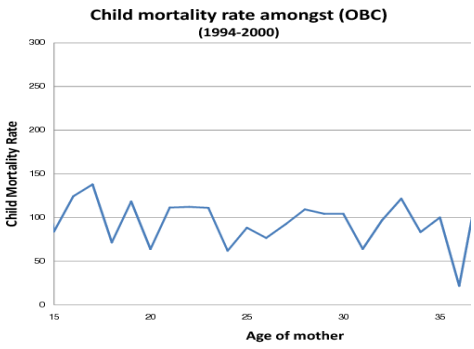












6.2 Estimation results

We start the multivariate analysis with estimates of a simple Proportional Hazard Model for the duration until death for children until the age of 5. We exclusively analyze first born children in order to avoid rank effects. Our time window covers children that were born in the time from 1980 to 2004.

While at this point we do not take into account unobserved heterogeneity, exogenous time varying explanatory variable in order to capture calendar time effects are however included. Those variables also encompass interaction dummies for caste and calendar time, in order to pick up the effects of the affirmative action program. We set the start date of the affirmative action program at the beginning of 1994. In order to be able to identify the effect of the program as clear as possible we exclude children born between September 1993 and December 1993. In addition we censor those life spells that are ongoing in September 1993. We analyze the mortality rate on an monthly basis, which is the smallest possible time interval that our data allows. Furthermore, we also control for a large variety of individual and household characteristics like, living in a urban area, caste affiliation, gender of the child, age of the mother at time of birth, educational level of the mother and her partner, wealth indicators, contraception method, type of medical treatment center and the influence of the mother on health care issues. As a time varying variable we include a time trend variable, that should cover, for example the influence of the medical progress on child mortality.

Table 2 presents the first set of results. In addition to individual and household characteristics and the time trend variable we added an interaction term for the 'OBC' affiliation and the time of the affirmative action program. The interaction dummy indeed indicates a decline in the mortality rate for the 'OBC' during the time of the affirmative action program. This decline is, however, not of statistical significance. The additional estimates that are shown in Table 2 are in line with the standard results concerning child mortality. Children are less likely to die in urban areas as compared to rural ares. Children who belong to the 'OBC' cast have a significant higher risk of dying than children of the general castes. Furthermore, girls have a lower risk of dying than boys and the mortality rate declines over calendar time. In addition, the older, the more educated and the more wealthy a mother is, the lower is the mortality rate of her first born child. Note that the age affect is not in contradiction with the age affect as described in the descriptive statistics of the child mortality rate. Here we exclusively look at

first born, whereas in the above we analyze all children. And finally using modern contraception methods and private health car facilities reduces the risk of child mortality.

Table 2: Parameter estimates of a Proportional Hazard model for the child mortality rate

parameter	estimate	st.error
OBC(1994-2005)*	-0.20	(0.14)
time trend	-0.05	(0.02)
urban area	-0.09	(0.10)
caste affiliation, reference category: highest caste		
OBC	0.31	(0.11)
SC	0.17	(0.12)
ST	0.05	(0.13)
age of mother at times of birth, reference category: 15-20 years		
10-14 years	0.29	(0.14)
21-25 years	-0.21	(0.10)
$>$ 25 years	-0.23	(0.19)
education of mother, reference category: primary education		
no education	0.14	(0.11)
secondary education	-0.16	(0.14)
higher education	-0.49	(0.33)
wealth index, reference category: poorer		
poorest	0.16	(0.10)
middle	-0.18	(0.11)
richer	-0.29	(0.13)
richest	-0.43	(0.17)
method of contraception, reference category: no method		
folkloric method	0.40	(0.36)
traditional method	-0.23	(0.14)
modern method	-0.47	(0.08)
mothers works	0.01	(0.08)

<continued on next page>)

Table 2: Parameter estimates <continued>

parameter	estimate	st.error
final say on mother's health care, reference category: mother and somebody else		
mother alone	0.01	(0.10)
somebody else alone	0.09	(0.09)
child is female	-0.15	(0.07)
usual treatment center of household, reference category: governmental center		
private center	-0.17	(0.08)
other facilities	-0.15	(0.14)
education of partner, reference category: primary education		
no education	0.16	(0.11)
secondary education	0.06	(0.06)
higher education	0.02	(0.21)
no partner	1.16	(0.42)

Table 3: Parameter estimates of a Proportional Hazard model for the child mortality rate – extended model

	estimate	st.error
OBC*(1994-2005)	-0.21	(0.16)
ST *(1994-2005)	-0.12	(0.22)
SC*(1994-2005)	0.17	(0.22)
general caste*(1994-2005)	-0.10	(0.17)
time trend	-0.05	(0.03)
remaining explanatory variables as in Table 2		

It is clearly conceivable that the interaction term for 'OBC' captures a time trend that other castes in some form also possess, but that can not be picked up by the general time trend variable. Consequently in a second step, we add interaction terms for the remaining castes. Table 3 depicts the resulting set of estimates. The table shows that the coefficients on the interaction terms vary

quite a lot between the different casts, whereby none is of statistical significance. It is noteworthy, however, that there are indication the mortality might have been declined most strongly for the other backward caste, followed by 'ST' and the general caste. This result leads to the obvious conclusion that it is essential to choose a proper control group in order to evaluate the 'affirmative action' policy. As 'OBC' is a backward caste the obvious solution might lie in using either one of or jointly 'SC' and 'ST'.

Table 4: Parameter estimates of a Proportional Hazard model for the child mortality rate – most extended model

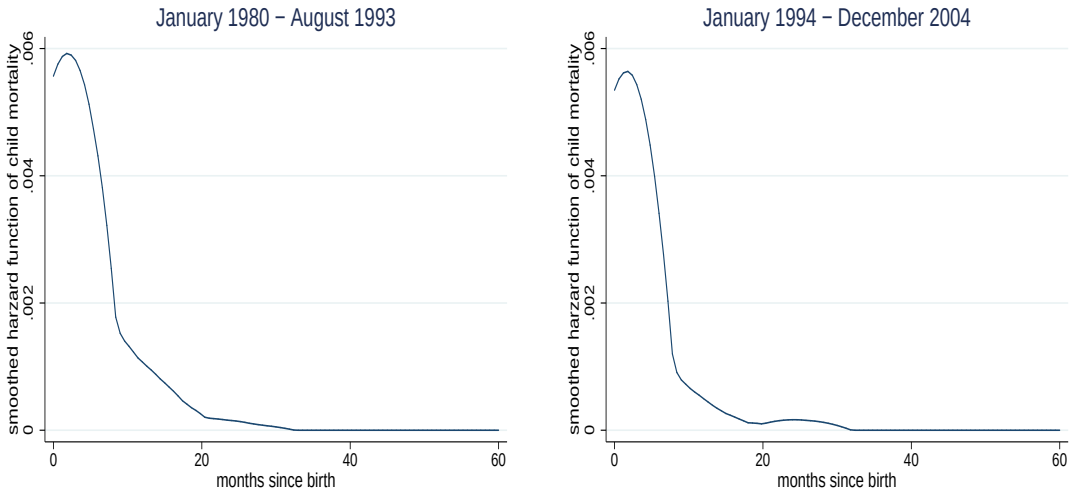
	estimate	st.error
OBC*(1994-2005)	-0.29	(0.18)
ST *(1994-2005)	-0.06	(0.23)
SC*(1994-2005)	0.24	(0.25)
general caste*(1994-2005)	- 0.12	(0.20)
OBC*(1994-2005)*urban	0.33	(0.24)
ST *(1994-2005)*urban	-0.24	(0.59)
SC*(1994-2005)*urban	-0.14	(0.39)
general caste*(1994-2005)*urban	0.21	(0.32)
time trend	-0.05	(0.03)
OBC	0.19	(0.14)
ST	-0.02	(0.17)
SC	-0.13	(0.20)
OBC*urban	-0.16	(0.16)
ST*urban	-0.12	(0.40)
SC*urban	0.12	(0.28)
general caste*urban	-0.48	(0.22)
remaining explanatory variables as in Table 2		

It is commonly found that caste affiliation influences more strongly the live of individuals in rural than in urban areas. The live of members of different castes is more separated in rural areas and their caste affiliation is more strongly uphold. Consequently, the effect of caste affiliation on child mortality might vary with the different agglomeration areas. In our third estimation step we want to capture these potential effects by including additional dummies for caste affiliation as well

as for the affirmative action dummies where both sets of dummies are interacted with living in urban areas (see table 4).

Although not significant, the dummies for caste affiliations and agglomeration area indicate that 'OBC' in rural areas suffer most from child mortality. At the same time 'OBC' in rural areas constitute the group that benefit most from the affirmative action program. Note that this effect is significant on the 10% level. In urban area, however, the affirmative action program appear not to have had an effect on child mortality for 'OBC'.

Figure 2: Estimated Baseline Hazard Functions



In order to check the robustness of the result for 'OBC' in rural areas with respect to the functional form specification, we estimate the model separately for the time before September 1993 and after December 1994. Here, we specify the model in such a way that the baseline hazard represent the hazard of child mortality for the 'OBC' in rural areas.

Figure 2, depicting the the estimated baseline hazards, confirm the result found above concerning the effect of the affirmative action program on child mortality. Notably, they show that the risk that a child in a rural 'OBC' household dies is lower for the second time period than for the first. This decline can be attributed to the affirmative action program.

— to be completed —

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