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# 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 among the target caste. 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. Results point towards a favorable impact of the policy with a 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..

*Keywords:* Infant mortality, child mortality, discrimination, India, duration analysis.

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# 1 Introduction

Child mortality constitutes a major problem in developing countries. Currently 5.3bn out of the 6.5bn of the total world population lives in developing countries and despite medical advances and development efforts child mortality is still high in these countries.<sup>2</sup> For example, in India, where 21% of the developing world's population lives, 95 children out of every 1000 live births die before the age of 5.<sup>3</sup>

A particularly worrisome fact about such continued high rates of child mortality is that while a high CMR<sup>4</sup> is an indicator of socioeconomic backwardness of a country, despite acceleration in economic development CMR can continue to remain high for a long time. In the case of India, for instance, Gross Domestic Product (GDP) growth rate has risen from an average of about 5.7 percent in the 1980s to an average of 8.1 percent in the year 2003-04 (Economic Survey 2003-04) CMR continues to be as high as 72 per thousand live births in 2007 (India country health system profile, WHO) compared to the average of 10 per thousand live births for the developed world. At the current rate of decline in CMR, India would reach the under-five mortality of 64 per 1000 live births by 2015, which is well short of the Millennium Development Goal of 41 per 1000. This break down in the expected correlation between economic development and CMR has recently caused alarm for organizations like the UNICEF<sup>5</sup> who find that, India accounted for more than two million of the 9.7 million children who died in the world before their fifth birthday in 2006. A further cause of concern is that, in a country with the GDP growth rate of 8.4 percent, the cause of death of at least half of these children has been identified as malnutrition. These facts seem to suggest either an extreme distinction between sections of the population enjoying high economic growth and those continuing to suffer from socioeconomic backwardness as characterized amongst other things by high CMR or a weaker negative relationship between CMR and national income than conventionally thought.

The occurrence of under-five mortality, indeed, does not only seem to vary between countries of different degrees of economic development, but also within nations exhibiting high inequality like India. This becomes evident, when distinguishing under-five mortality rates by caste affiliation. Tables 4.1 presents figures for neonatal, infant, child and total under 5 mortality by caste from the second round (1998-99) of the National Family and Health Survey (NFHS-II) for India. We note a concentration of high mortality rates amongst the group "scheduled caste/scheduled tribes (SC/ST)" which is the lowest caste. Similar inequality is also found when looking at economic status and educational attainment of prime aged men (ages 25-45) by caste (refer Table 2 and Table 3).

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<sup>2</sup>See UN, The World Population Prospects: The 2008 Revision.

<sup>3</sup>Refer table 1 (Source: United Nations Development Fund) for statistics on CMR in India and some other developing and developed economies.

<sup>4</sup>Child mortality rate (CMR) is defined as the number of deaths during the first 5 years of life per 1000 live births.

<sup>5</sup>Source: "State of World's Children 2008: Child Survival" , UNICEF Report.

This seems to suggest that like in the past, caste affiliation continues to be a crucial indicator of social status and have substantial implications for several aspects of life in India. It strongly affects educational attainment, career perspective, economic prosperity and even health outcomes as measured in its extreme form by mortality rates (Dommaraju, 2008). Hence, even about 60 years after the formal abolition of the caste system in the course of the independence of India, caste is an indicator of socioeconomic status with lower castes suffering from considerable economic disparity, discrimination (see for example Deshpande 2001) and sometimes even caste based violence. Such continuing disadvantaged position is bound to have an impact on health outcomes of members of lower castes.

Several past studies have found a significant impact of social status, driven from economic standing (Dommaraju, 2008) or subjective perceptions of ones' position in the social hierarchy (Demakakos et al., 2008; Sapolsky, 2004; Singh-Manoux et al., 2003), on individual health outcomes. Other studies have found that poorer health outcomes of members of 'lower strata' of society are the result of lower social capital (Kawachi et al., 1997). For instance historically disadvantaged populations might face greater difficulties in accessing or utilizing health care facilities either due to lower density of such services in areas with higher concentration of these groups or discrimination against disadvantaged users of these services by the providers.<sup>6</sup> We see this in the case of the so called backward castes in India for whom, higher incidence of poverty (Borooah, 2005) due to caste based occupational segregation or simply due to lower levels of education arising from years of subjugation and the resulting low levels of self worth (Hoff and Pandey, 2004) makes human capital investments, including those in health, un-affordable. It therefore seems that public efforts aimed at elevating the social standing of the backward castes either by means of boosting their socioeconomic status, for instance through better employment and educational opportunities, or by encouraging a public sense of equality would favorably effect health outcomes of these groups.

With an objective of increasing societal representation and providing compensatory gains to the historically deprived lower castes 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.<sup>7</sup> 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.

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<sup>6</sup>Some studies, for instance Thorat and Lee 2005, find evidence of such discrimination even in government programs like food rations for the poor.

<sup>7</sup>For SC/ST the quota amounts to 22.2%.

The main goal of this paper is to investigate whether the improvement of economic opportunities for the OBC by way of a positive discrimination policy had an impact on an important health measure of socioeconomic backwardness namely under-five mortality. Besides the obvious relevance of CMR, that the government would hope to lower by means of providing increased economic opportunities for previously deprived households for reasons of equity, impact of such a policy on children rather than only adults is in fact likely to be the preferred outcome on efficiency grounds as well (Heckman, 2006). Recent literature has established that economic and environmental deprivation in early years of life has long term adverse health and psycho-social consequences for the surviving group of children (see for e.g. Barker, 1997, Doblhammer, 2004, and Van den Berg, Lindeboom and Portrait, 2006). The economic and social burden of such a 'depleted' next generation is likely to be particularly harsh for a sect that is already deprived. Any public affirmative action policy aimed at the up-liftment of the backward would therefore not only wish to help the current adult population of this group but in fact like to target the next generation so as to have longer term and more far reaching gains. In addition, such a positive effect of the policy on the future generation is also likely to expedite the process of social up-liftment for the backward.

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 a macroeconomic variable which might also affect fertility and life expectancy, notably GNP. This exogenous indicator of the general macroeconomic conditions is particularly relevant in case of a fast growing and changing economy like India.

Using a duration model framework we estimate a before-and-after estimator in which we focus on the exit probability of a child into mortality as the outcome variable instead of considering the more popular overall CMR rates alone. under-five mortality rates are known to show considerable time/ duration dependence with mortality rates being the highest in the first month after birth and rapidly declining thereafter until the more or less constant 'prime age' low mortality level is reached at the end of the first 5 years of life. Our approach takes into account this duration dependence of CMR. We consider first births alone in order to avoid the endogeneity of subsequent fertility and mortality outcomes of higher order births. Thereafter hazard of mortality is modeled such that at given moment for a given child the mortality rate depends on socioeconomic and demographic family characteristics, the caste affiliation and the implementation of the affirmative action program. And indeed, our results point towards a decrease of the under-five mortality rate for the target group of the "affirmative action" in employment.

The remainder of the paper is structured as follows: First an overview of the affirmative action experience from around the world is presented. This is followed by some background

on the caste system and the affirmative action policy in India. Section 3 then summarizes past findings with respect to the determinants of under-five mortality. Our data set is described in section 4, while section 5 covers the empirical strategy. Section 6 provides empirical results.

## 2 Affirmative action

Affirmative action refers to policies that take into account race, ethnicity, religion or gender of an individual in order to increase diversity in all levels of society, along with its presumed benefits, and to decrease perceived disadvantages caused due to past cultural and institutional discrimination. These policies could operate in several spheres like employment, education, access to economic resources, public contracting and health programs. Policies of affirmative action have been and continue to be used by several countries representing the full spectrum of socioeconomic development (Mcharg and Nicolson, 2006; Weisskopf, 2004). They are mostly implemented in two forms: the more 'passive' form of affirmative action disallows discrimination on the basis of caste, color or creed, for instance the 'equal opportunity employment' offered by many establishments. The more 'active' form of such policies, sometimes referred to as 'reverse or positive discrimination' grants preferential treatment to targeted groups like minorities, women, disabled and war veterans. While the former set of affirmative action policies is more likely to earn the support of the non-targetted population as well the latter group is frequently opposed by the non-favored segments of society on grounds of the equity-efficiency trade off and sometimes even by the benefit recipients owing to the societal stigma attached to them. In either case the need and benefits of affirmative action continue to be controversial till date.

### 2.1 *Experiences from around the world*

Examples of affirmative action policies are found already for a very long time in many societies. For instance, in the United states starting as early as 1866 The Equal Protection Clause of the Fourteenth Amendment to the United States Constitution mandates that no State can "deny to any person within its jurisdiction the equal protection of the laws..". However, it was only in 1961 that Pres. John F. Kennedy issued the Executive Order 10925 that first made formal reference to "affirmative action" and required all federal funded projects to ensure that hiring and employment practices are free of racial bias. Formalization of this more active form of affirmative action policy took place under Pres. Lyndon Johnson with the issuance of the Civil Rights Act that prohibits discrimination of all kinds based on race, color, religion, or national origin in 1964 and the Executive Order 11246 in 1965 (with it's amendment in 1967 to include women) that mandates contractors to take specific measures to ensure equality in hiring and full documentation of these efforts. Since then affirmative action in it's passive or more active form has been extended to areas

beyond employment as well. For instance a 2003 Supreme Court ruling allows educational institutions to consider race as a factor in admitting students.

Similar examples can be found in several European countries as well. For instance, both French and German Constitutions disallow any discrimination on the basis of race, religion or sex. Some countries follow more aggressive policies of affirmative action by means of reservation of quotas for the targeted groups. In Finland for example certain university education programs, including legal and medical education, have quotas for the Swedish-speaking applicants in order to safeguard the linguistic rights of the Swedish-speaking Finnish minority and all Norwegian public limited company boards require both genders to be represented by 40% each.

Other examples of such quota based affirmative action policies from around the world are for instance Brazil that reserves 20% of vacancies for the disabled in the civil public services. But probably the most aggressive example of such reservations would be Malaysia that provides quotas for the majority, indigenous Malay population referred to as 'bumiputra'. Malaysia has a multi-ethnic population comprising of 52% of Malays and 30% and 8% of Malaysians of Chinese and Indian descent respectively. In general, the Malays have had lower economic standing than the Chinese who have traditionally owned all the businesses and held the highest posts in governance. In 1970, the average monthly income of a Malay household was 44 percent that of Chinese and 56 percent that of Indian household (Funston, 2001). Such high socioeconomic inequality led to inter-racial rioting in Kuala Lumpur in May 1969 and after a state of national emergency led to the launch of the Malaysian New Economic Policy which provides preferential placement for ethnic Malays in an attempt to raise their representation in the public sector and share in the corporate stock ownership from just 1.5 per cent in 1969 to 30 per cent in 1990s (Jomo, 2004).

Other examples of countries that have or in the past have had some form of affirmative action policies are Canada, Sri Lanka, China, Japan, New Zealand and South Africa. In most countries such policies have met with considerable opposition often leading to civil unrest. The international disagreement on the usefulness or correctness of affirmative action is highlighted by the fact that while so many nations have laid down strict rules and quotas providing preferential treatment to targeted groups a wide range of countries, for e.g. United Kingdom, Sweden and Slovakia amongst others have constitutionally banned any form of such 'reverse discrimination'.

Abstracting from the ethical debate that prominently figures in any discussion of the worth of affirmative action policies, an economic evaluation of the achievements of these policies would shed light on the future scope and usefulness of this public effort. Some past studies have attempted such an evaluation of the impact of affirmative action on increasing social diversity and equity. For the United States for instance, a study that compares the change in employment representation between 1974 and 1980 at about sixty-eight thousand establishments, finds that both minority and female employment have increased faster in

organizations subject to affirmative action (Leonard, 1984). Another study that looks at racial and gender equity in self-employment opportunities over the period of 1979-2004, using data from the Current Population Survey and the Census, find that while aggressive race conscious affirmative action policies bring about significant improvements in racial representation passive policies do not (Blanchflower and Wainwright, 2005). Moreover they find that, while the group that benefits most from these public efforts to increase opportunities of self employment is white women there is some evidence suggesting that these companies are 'fronts' which are in fact run by these women's white male family members to take advantage of the affirmative action programs.

Evidence from Malaysia suggests that if the objective of the Malaysian government was increased participation of the ethnic Malay population in government and positions of power it's affirmative action policy has definitely been successful in achieving that. The consequence of the active redistribution policy can be clearly seen when the share of ethnic Chinese in all government employment drops from 30% in 1960 to only 7% in 2004. Also between 1970-1990, making use of the commercial and educational opportunities granted by the NEP, the share of the ethnic Malay accountants, engineers, doctors and architects increased from 7 to 14%, 7 to 35%, 4 to 28% and 4 to 24% respectively. Over the same time window, ethnic Malay participation in the share market went up from just 2 to 20 percent (Funston, 2001). Such an extreme shift of economic power is however questionable in light of preferential treatments being granted to the majority rather than a minority group sometimes leading to increased marginalization of other groups like the Malaysians of Indian decent (Kuppuswamy, 2003).



## 2.2 *Affirmative action policy in India*

### 2.2.1 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 hierarchal 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. Jatis 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 castes are listed as such in Articles 341 and 342 of the Indian constitution under the heading “Scheduled Castes (SCs)” and “Scheduled Tribes (STs)”. The former group comprises of the *Ati Sudras* or the erstwhile ‘untouchables’ who over centuries have been deprived of economic and educational opportunities and who till date are lagging in educational attainment and continue to be concentrated in low paid unskilled and menial occupations. The socioeconomic backwardness of the latter group, that consists of the tribal indigenous population called ‘adivasis’, stems more from locational and linguistic factors that exclude them from conventional development process. On grounds of historical deprivation, exclusion, stigmatization and continued socioeconomic disadvantage both these groups are eligible for public benefits under the government mandated affirmative action policy since shortly after the independence of India in 1947.

Later on another group was defined under the heading “Other Backward Caste (OBC)” that consisted of castes belonging mostly to the *Sudra* jatis. Similar to both SC and ST categories members of OBCs suffer from considerable socioeconomic backwardness but unlike the SCs were not subject to ‘untouchability’ in the past. Castes that do not belong to the group of ‘SC/ST’ or ‘OBC’ are commonly referred to as “general or forward castes” or simply ‘others’.

While the Constitution refers to the OBC jatis as other ‘socially and educationally backward classes’ unlike the SC and ST classes the Constitution does not list the jatis that fall under this category. Over the years this has led to considerable disagreement on which jatis qualify as OBC especially since there exist large regional differences in jati classifications as OBC or not. This confusion is further aggravated by the fact that in an

attempt to dilute the role of caste in the social fabric of the country no official jati/caste based enumeration was done following independence and until the 55th National Sample Survey (NSS) of 1999-2000. The last official records of jati membership therefore date back to the 1931 Census of India which needless to say are rather outdated given inter-regional migration, caste based differences in fertility and mortality trends and some limited amount of caste mobility over the years. Owing to this there is no unanimous agreement on even the sizes of each of these categories in the total population. For instance, while the NSS lists 32% of the population as OBC the official statistic from the 1931 census is 52%. The approximate caste composition of the total population as given by the National Family and Health Survey round III is 33%, 38%, 18% and 8% of general, OBC, SC and ST categories.

Reclassification of the thousands of jatis into these broad 4 categories - SC, ST, OBC and others facilitates easier comparison of the socioeconomic status of these groups than the 3000 or so jatis themselves. However, given the large diversity of jatis that are grouped together in this broad classification and especially in the residual category of others, any inter-group measure of disparity between these 4 categories is likely to underestimate the differences between the so called general category and the backward castes. This is because the general group includes individuals whose are socioeconomically backward like the SC/ST or OBC but owing to jati membership are enlisted as non-backward or general.

### **2.2.2 Constitutional provisions**

In post independent India the Government of India (GOI) has pursued a multi-layered ‘affirmative action’ program to aid the up-liftment 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, socioeconomic status within the Indian society continues to be determined by ones’ caste affiliation (Gang et al., 2002). Deshpande, 2001 uses five indicators of determining socioeconomic 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 inter-caste disparity within the wider and more general problem of poverty. She also fails to find substantial upward caste mobility.

### 2.2.3 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 consider the impact of this increased political representation and find 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:*<sup>8</sup> 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 socioeconomic life in proportion to their share in population - quotas of 15 percent for SC and another 7.2 percent for ST categories were implemented. A recent study that evaluated the effect of these quotas on increasing representation of SC/ST persons in regular salaried employment found at least a 5 percentage point boost provided by reservation (Borooah et al., 2007). The authors further find that the under representation of SC/STs in regular salaried employment is in large part due to the groups low educational attainment on average which results in a concentration of the backward castes in low paying jobs requiring lesser education. This result leads the author conclude that public policy targeted at improving the job-related attributes of the SC/STs by means of better education and training rather than just job reservations is likely to be a more powerful instrument to bring about greater socioeconomic equality.

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<sup>8</sup>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.

Despite limited evaluations of the gains from the reservation policy for ST/SC, positive discrimination in employment in favour of these groups has largely been supported by the Indian society. However, similar concessions for the other backward classes (OBCs) have been more controversial. In 1979 the Mandal Commission was appointed by the GOI in order to 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<sup>9</sup> 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, 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 since then, till date reservation quotas continue to be controversial and with recent calls for extension of reservation to the private sector the debate has once again come into limelight. The case in favour of affirmative action is based on the following: continued economic disparity with per capita expenditures (PCE) varying considerably amongst the castes. In urban areas monthly PCEs in rupees are 686.90, 772.92, 849.74 and 1143.76 for the SC, ST, OBC and the others respectively. Similarly in rural areas PCEs are 449.92, 412.53, 511.52 and 624.77 for the SC, ST, OBC and others respectively (55th round of the NSS, 1999-2000). Furthermore, there is increasing disparity in the rates of growth of PCE between the different castes. These figures show that there is little evidence of decline in inter caste disparities following fast economic development, post liberalization. In addition to these very compelling economic factors, affirmative action seems fair in light of stigmatization,

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<sup>9</sup>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.

subjugation and historical deprivation of these groups (Deshpande, 2005). Moreover, any attempt to redress large socioeconomic inequality within the population has to start with reduced inter-caste disparity in opportunities by means of reservation. Finally, socioeconomic disparity is just one aspect of deprivation and in fact there is some evidence to suggest existence of large caste based differences in other outcomes like health as well. Considerable differences in CMR across castes, as seen in Table 1 are indicative of deeper and more long term deprivation of members of lower castes.

Opponents of reservation based affirmative action policies argue that use of criteria other than merit as a basis of employment is likely to compromise the quality of services available in the economy. Opposition to quota based affirmative action gains impetus in light of, past studies that find only modest effectiveness of caste based job reservation that places very little emphasis on improving the job related attributes of persons from backward classes (Borooah et al., 2007). While focussing on the moderate gains of past quotas on formal employment amongst SC/STs, adversaries of active affirmative action fail to take note of the authors conclusion that these estimated gains should only be taken as the lower bounds of the benefits from reservation. Another much debated aspect of the reservation policy is the use of 'caste' as the basis of preferential treatment. Several studies have noted that other groups like women (Chattopadhyay and Duflo, 2004) or religious minorities like Muslims (Borooah et al., 2007) 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. However, since the majority of the members of the OBC category are less rather than more affluent, despite some loss of opportunities to the relatively well off OBCs, reservation is likely to reach out to households that would otherwise be left out.

Although other groups might even be more socially backward it is undoubtable that for example poverty and high CMR is highly concentrated amongst the OBC population (refer Table 1 and 4.3). 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. A crucial factor that needs to be taken into account while evaluating the success of these policies is that guaranteed quotas for the OBCs does not necessarily translate into full uptake of these reservations. Mandal commission report laid out some rules to ensure that reserved positions could not be filled by members of higher castes. In case of the position not being filled in a particular hiring round, the position will remain vacant and will have to be filled in the next hiring round in addition to the quota for that round itself. Over the years several problems have arisen in the implementation of these simple rules. Firstly, the National Commission for Backward Classes has played a very limited role in actual

enforcement of the reservation policy. In the absence of any government agency ensuring the proper execution of the policy the only means to contest unfair implementation or denial of benefits is by way of a Writ Petition under Article 32 and 226 of the Indian Constitution. However, the legal process involved in the filing of the petition itself followed by several rounds of contesting are often too expensive for members of poor backward classes. Another significant problem in proper fulfillment of the quotas is the availability of suitable candidates from the backward castes. Lower educational attainments amongst the SC/ST/OBCs (refer Table 4) often makes it hard to fill the more well paid, higher officer posts reserved for these castes (Deshpande, 2005). For instance in 1998-99, although only 3 percent of Grade A (highest officer) jobs were filled by SC/ST candidates, there was an over representation of SC/ST workers in Grade D jobs with 29 percent of workers in this category being SC/ST (Xaxa, 2001). Despite these dismal figures on implementation Galanter 1991 points out these are probably averages over the broad categories of SC, ST or OBC. Redistribution is unlikely to be evenly spread throughout the targeted castes with backward class members situated in certain areas being better able to avail of these opportunities. Even if this be the case, as a community as a whole these policies have accelerated the rise of a backward caste middle class (Deshpande, 2005), with members holding positions of responsibility, power and even respect.

Our study focuses on exactly these community level gains of the 1993 affirmative action policy of quota reservations in public sector employment for the OBCs. Past research finds significant effect of community level factors, including economic standing of the community as a whole, on child health and survival even after controlling for the influence of individual socioeconomic and background characteristics (Robert, 1999). These studies find that community level factors mediate the relationship between individual level factors and the person's demographic outcomes (Dommaraju, 2008; Jaffe et al., 2005; Kravdal, 2004; Moursund and Kravdal, 2003 and Sastry 1996). So for instance, poverty in the area of residence could influence individual health in addition to the effect that individual traits might have on the person's health. This study focuses on similar community based characteristics and investigates whether increased affluence of the OBC caste by means of increased employment opportunities granted by the affirmative action policy have helped improve health status, measured by survival probabilities, of OBC children. In the presence of incomplete implementation of the reservation any benefits we might find are clearly lower bounds of gains that can be achieved with proper enforcement of the policy.

### **3 Determinants of under-five mortality**

A number of studies investigate factors affecting under-five 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 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 influence infant mortality within the family. For instance, in addition to determining household income, educational attainments of the parents also influence parenting abilities as education could result in better sense of hygiene and nutrition 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.

Following demographic literature, short birth intervals between children are also regarded as important determinants of infant and child mortality<sup>10</sup>. 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 socioeconomic background, health care demand, and environmental, biodemographic 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 as '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

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<sup>10</sup>Together infant and child mortality determine under-five mortality.

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').



Going beyond individual and household level characteristics, past studies find an impact of community level traits on individual health outcomes as well. As mentioned earlier, Robert 1999 finds a significant impact of the economic standing of the community as a whole on child health and survival. As has been pointed out in section 2 above, caste to a large extent defines community in India.

The above-mentioned literature focuses on finding factors affecting infant mortality at the level of the community 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.

Including an indicator of macro economic condition as a determinant of child mortality would be particularly useful in case of a developing economy for multiple reasons. For developing countries data on household income (which is highly volatile) is often not available and therefore the researcher is forced to infer the households economic status by looking at asset ownership (which is relatively more stable) or some other derived indicator. However, including an indicator of on-going macro economic conditions like GDP of the country could help capture some of the volatility in economic conditions that might be a crucial for child mortality in poor households. Furthermore, India in the past few decades has witnessed several carefully planned phases of privatization and liberalization of the economy which have dramatically influenced its macro-economic environment. These changes in the countries macro-economic policy could be additionally used to study impact of liberalization and globalization on infant mortality rates.

Based on the findings of past literature, the current study takes into account household economic conditions, maternal education, paternal education, age of mother at birth of the child in question, caste affiliation, religion, region of residence, indicators of access to health care and average macro-economic conditions as factors influencing child mortality. Given the potential endogeneity of birth and survival status of higher order births, our study only considers first births and then investigates the impact of increased community (defined by caste) affluence of the OBCs by means of the affirmative action policy on health status, as captured by CMR, of OBC children. Given the focus on first births only, that do not take into account scarring effects on subsequent births, and in the presence of incomplete implementation of the reservation as mentioned in section 2 above, any gains of the policy we may find are only conservative estimates of benefits from the policy. Proper enforcement of reserved quotas and accounting for cumulative declines in CMR amongst

higher order births due to fewer and longer spaced subsequent pregnancies are likely to further these gains.

## 4 Data

### 4.1 Sources of data, sample selection and data set-up

*Individual level data:* 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 database for such a study. The data set is a nationally representative sample constructed from multi-level surveys conducted at the level of the village, household, couple, individual (defined as women in the age group of 15-49) and children using separate questionnaires. For our study we primarily use the individual level data set, that contains birth histories of all women aged between 15-49 years at the time of the survey, to construct a retrospective panel of all child births. The resulting observation window of all births is 1960-2005 and the survey contains information on several crucial determinants of child mortality like mother's age, mother's education, mother works or not, mother's autonomy within the household, awareness and use of family planning methods and child specific variables like gender of the child, survival status, age at death (in case of a child who didn't survive) and finally father's education level. This information is merged with household level variables like income<sup>11</sup>, caste, religion and village level covariates like area of residence (state and urban/rural) and proximity to health care center derived from the household and village level surveys using identity numbers that facilitate linking of the different surveys. Owing to this multi-level information source, our final sample not only covers the standard variables like family income, asset holdings, other parental characteristics, caste and religious affiliations and other factors conventionally considered to affect infant mortality but also in-depth health related information at the level of the community and village.

The retrospective nature of the data necessitates some considerations. The NFHS-3 registers relatively fewer births in the 1960's, probably due to recollection errors. This problem however, is less 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.<sup>12</sup> Also the NFHS-3 data provides additional improvements over the two earlier rounds of 1992/93 (NFHS-1) and 1998 (NFHS-2). For instance, both the NFHS-1 and NFHS-2 lacked information on a crucial determinant of infant and child mortality- family income. The NFHS-3 however,

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<sup>11</sup>Information on family income is summarized in the NFHS3 as a five level wealth index which is used in our study to capture the effect of family income status.

<sup>12</sup>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 (2004), Bhalotra and van Soest (2004) and Bhalotra (2007).

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 socioeconomic status. Despite several such strengths in an ideal situation one might want to use a proper panel for such a study. Nonetheless, the NFHS-3 provides a useful starting point and an opportunity to answer several previously unanswered questions with a reasonable degree of precision.

Starting from the initial sample of 256,782 children significant sample size reduction occurs due to the following reasons: Firstly, since, survival probabilities of second and subsequent births are significantly influenced by survival status of the previous children large, time varying, scarring effects need to be taken into account prior to studying CMR amongst higher order births. In order to abstract from the complex analysis arising from such endogeneity and in an attempt to provide a benchmark evaluation of the affirmative action policy on CMR amongst OBCs the current study only considers first births.

Due to the retrospective nature of the NFHS data sets that includes fertility histories of women between the ages of 15-49 at the time of the survey, the resulting sample is somewhat wedge shaped. To end up in our sample, all reported births in the 1960s and 1970s correspond to relatively young mothers who are still in the age group of 15-49 years in 2005-2006. Births in the 1960s and 1970s to older mothers are therefore not included in our sample and hence, for these earlier years the NFHS not only reports fewer births but also over samples very young mothers. The current study controls for these problems by only considering births after 1985. To be in our sample of 15-49 years in 2005-2006, all first time mothers in 1985 would have to be under the age of 29 years. With reported ages at first births being between 7-45 years in the NFHS-3 sample, this restriction would still allow about 98% of all first births in 1985 to be represented the survey. Given that age at first birth has been rising over the years, the representation in fact is likely to be even more complete. Any remaining bias is dealt with by including age of the mother at the birth of the child as an explanatory variable for child mortality. As mentioned in section 3 above, past literature has found higher CMR amongst very young mothers (for instance Arulampalam and Bhalotra 2004b and Bhalotra and van Soest 2005a) and since relatively younger first time mothers<sup>13</sup> are included in our sample of births, inclusion of the age of mother at time of child birth would help capture any residual bias.

Next, since our study looks at under 5 mortality risks we drop all births after 2002. This allows full exposure to the risk period of 60 months to all births in our sample. Also, since mortality risks are highest for neonatal mortality (death within first month of birth) but the underlying factors can differ from those driving child mortality (under 5 mortality in this case) further observations are lost due to dropping of deaths in the first month of birth.

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<sup>13</sup>In our restricted sample of first births after 1985 only, the problem of over representation of relatively younger mothers is already very limited. As already mentioned almost 98% of all possible ages at first birth in 1985 would be captured in our sample.

The affirmative action policy was put in place on September 8, 1993. In order to be able to identify the effect of the program as clearly 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. Missing values of certain explanatory variables leads to a limited, additional loss of observations (refer Table 5).

*Macroeconomic data:* To capture macroeconomic volatility and effect of India's fast economic development in the recent years we merge to the survey data, state wise time series of the log per capita Domestic Product (Net State Domestic Product or NSDP) of India. Unavailability of consistent macroeconomic data for certain states and union territories owing to disruptive factors like political unrest, military rule or remote location (e.g. Kashmir or smaller northeastern states of Meghalaya, Tripura etc.) leads us to focus on only the 15 largest states of India. Given the unusual circumstances of the excluded states, the sample of 15 states is definitely more homogenous and captures 90 percent of the Indian population.

As mentioned in section 3 above, CMR can be influenced by not only the economic trend in the country with increased national income leading to higher government investments in public health and overall affluence but also by the state of the business cycle in current times as well as in the preceding years of life. Business cycle conditions would capture labor market conditions which would greatly influence employment, household income and consequently resources available for children within the household in the presence of limited formal insurance. In order to do this, one needs an indicator of the cyclical macro-economic condition for each year. Such an indicator is obtained by a trend/cycle decomposition of the log annual real per capital NSDP using the Hodrick-Prescott filter with smoothing parameter 500. However, it turns out that in our case the results concerning business cycle indicator are very much driven by outliers, which is why we use in our main results the economic trend only.

## 4.2 *Data analysis*

Table 5 provides the description of the child mortality relevant variables from the NFHS-3 that we include in our analysis. Given our focus on caste differences (refer Table 1) we construct descriptive statistics of our explanatory variables, separately by caste. These are provided in Tables 4.6.

First, the most crucial observation from the statistics of Table 6 is that in terms of most commonly employed indicators of socioeconomic status, the OBC are more similar to the SC and ST caste categories rather than to the forward/ general castes. The OBC, similar to the other backward castes of SC and ST, exhibit relatively young motherhood, lower maternal and paternal educational attainments, lesser wealth and female autonomy. So at least from raw data it seems that, if relative socioeconomic backwardness is the criteria for

receiving positive discriminatory public benefits then the OBC are a worthy candidate for affirmative action policies similar to those being received by the SC and ST castes.

Looking at each of the variables individually, we first note that while majority of the Indian population is rural, there is a predominance of the forward castes in more developed urban areas. Moreover, while the proportions of urban OBC and SC population are comparable not surprisingly tribal STs are largely concentrated in rural areas.

Next we observe that the most common age interval for first births is 15-20 years for the population as a whole. While most forward caste first births are also to women during the ages of 15-20 years, compared to backward caste women a large share of forward class women start their fertility in the later age interval of 21-25 years as well. Comparing the backward castes with each other we note that the proportion of 15-20 year old first time mothers, are almost comparable across the three castes.

Coming to parental education, we find that while the illiteracy levels amongst the OBCs is almost twice that of the general population, making them relatively similar to the backward SC and ST castes, there exist large differences in parental education between the three backward caste categories as well. The SC and ST categories are similar to each other and definitely the most backward in comparison to the general category. The OBCs, despite considerably lagging behind the forward castes, fare a lot better than the SC/ST.

These educational patterns are however not matched with the occupational involvement of women, as understood in most contemporary societies. Although, women of higher castes attain larger amount of education than their backward class counterparts, they are less likely to be working than SC/ST/OBC women. This observation is however expected in a male dominated society like India where female professional employment leading to financial independence of women is discouraged and often even prohibited. However poverty stricken, backward caste households would often have little choice but to send their women out for work as well.

Statistics on religious affiliation of the various castes show that although the caste system originates from Hinduism, over centuries it has become more of a societal rather than religious structure (Deshpande, 2005). Further, there are no large differences in religious compositions of any of the castes, with the majority of the population being Hindu.

Considering contraceptive use, we find that the majority of the households use modern methods of contraception. A troubling fact that emerges though is that the a very large proportion of households use no method of contraception, irrespective of caste. This of course would have consequences for the age of start of fertility and consequent reproductive history and in fact could be responsible for the very young age of motherhood mentioned above. No contraception would not only result in early start of reproduction but also lead to several quick pregnancies, which as mentioned in section 3 above is now known to

cause for increased risks of child mortality by means of maternal depletion, resource rivalry amongst children etc. (refer for instance Bhalotra and Van Soest, 2004).

In the raw data we find relatively slightly greater autonomy of forward class women in matters of their own health. Comparing the backward castes with each other, SC women appear closer to forward class women while ST and OBC women seem to have relatively larger say of 'somebody else' in matters pertaining to their health.

Since our study is concerned with CMR it would be useful to look for any signs of caste disparities in child mortality in the raw data. Looking at percentages of children who survive till their 5th birthday (refer Table 6) there appear to be considerable caste differences, even between the three backward castes.

Another useful raw measure of child mortality is survival probabilities over the first 60 months of life. Figure 1 plots the Kaplan-Meier survival functions by caste. This estimator provides the probability of survival in the current state beyond any given time for the sample. From this graph we can see, that similar to earlier evidence (refer section 3) in our data we find the lowest survival probabilities (or said alternatively as highest mortality) for neonatals and infants as well, with survival probabilities consistently increasing thereafter.

The more conventional measure of infant mortality however is IMR , which is the number of deaths under the age of 1 year per 1000 live births. Given the concentration of under-5 deaths in the first year of life and the gradual waning off of differences in survival probabilities by caste thereafter (refer Figure 1), caste differences in time trends of IMR also appears to be the most relevant measure of caste disparities in child mortality risks. Figure 2 plots the IMR by caste for all first births between 1985-2002 respectively. In terms of time trend it seems that IMR consistently declines over our observation window. Moreover, we note that while once again the 3 backward castes are more similar to each other there remain considerable inter-caste differences in time trend even between the three backward caste categories. This makes it hard to identify an obvious caste group to which OBC time trends in child mortality could be meaningfully compared and these descriptive statistics reiterate the expected differences between the 3 backward castes. It is worth remembering that although since 1947 SCs and STs have been granted affirmative action benefits similar to those given to the OBCs in 1993, these castes suffer from additional disadvantages besides socioeconomic backwardness similar to the OBCs. The SC category till date suffer from the stigma of past 'untouchability' which continues to hinder their process of growth despite the public initiative. The STs, due to their geographical seclusion, remain unaware and/ or unable to make use of the preferential treatment granted to them by the Constitution.

Table 9 finally, tabulates the reported ages of death of children in months (1-60). First, we note that death ages are reported in integer months and not continuously. Second, number of deaths consistently decline over the first 60 months of life with the largest number reported at age of 1 month. Finally, and crucially we observe considerable 'bunching' in

reported age of death. Although we observe this bunching or approximating at 12 months (age 1) this problem worsens after 24 months and only the age of death in years (36, 48, 60 months) is reported starting from year 3. This implies that while the data is almost monthly for the first 24 months it is annual thereafter. So a death that is reported at month 24 months could be anywhere between the ages of 24-30 months. Since the rounding off increases over age a death reported as 36, 48 and 60 months could lie anywhere between 30-42, 42-54 and 54-66 months respectively. This rounding off, which is quite common in data reporting death dates of children, needs to be taken into account during any estimation of CMR.

## 5 Empirical strategy

### 5.1 *The set-up*

Our aim is to specify a model for the CMR with which we can identify the effect of the affirmative action policy on child mortality. For this we take the random variable  $T$ , the time of death in the first 60 months of live, to be continuous and nonnegative. We express the mortality rate of a child at a given point of time in terms of the prevailing age  $t$ , individual socioeconomic and demographic background characteristics and calendar time  $\tau$ , i.e.  $\theta_1(t|x, \tau)$ .

We assume that we can capture the affirmative action effect by modelling a discontinuity in calendar time, whereby otherwise the effect of calendar time on the hazard rate is supposed to be a smooth function of calendar time. Therefore we can rewrite  $\theta_1$

$$\theta_1 = \theta_2(t|x, \tau, I(\tau > \tau_A)), \quad (1)$$

whereby  $\tau_A$  denotes the start of the affirmative action program.

The hazard function is based on a Weibull hazard rate model. It takes the following form:

$$\theta_2(t|x, \tau, I(\tau > \tau_A)) = \alpha t^{\alpha-1} \cdot \exp(c \cdot I(\tau > \tau_A) + x'\beta + g(\tau)). \quad (2)$$

Our specification of the hazard model is inspired by proportional hazard models. However, it is more general, as we incorporate a function in calendar time  $g(\tau)$ . The effect of interest, the affirmative action effect, is then given by the coefficient  $c$ .

In a sensitivity analysis we undertake, we allow  $\alpha$  to also depend on the policy shift in the following way:

$$\alpha = \exp(\rho_0 + \rho_1 \cdot I(\tau > \tau_A)). \quad (3)$$

In order to estimate the total effect of the affirmative action in this case, we need to look at the slope effect (the change in  $\alpha$ ) and level effect (the effect given by the coefficient  $c$ ) in conjunction. One convenient way to accomplish this is to calculate the ratio of the hazards after and before the introduction of the affirmative action policy evaluated at the moment of the introduction of the affirmative action policy:

$$\frac{\theta_2(t|x, \tau_A, I(\tau > \tau_A) = 1)}{\theta_2(t|x, \tau_A^-, I(\tau > \tau_A) = 0)} = \exp(c + \rho_1) \cdot t^{\exp(\rho_0)(\exp(\rho_1)-1)}. \quad (4)$$

A hazard ratio smaller than one would indicate that the affirmative action policy is effective in reducing child mortality.

## 5.2 *Implementation*

Crucial for our identification is the modelling of the influence of calendar time on child mortality. In our main results the function of calendar time consists of two different components, namely,  $g(\tau) = \gamma \cdot z_{tr}(\tau) + \delta(\tau)$ . Firstly, calendar time varying macro-economic information on contemporaneous conditions  $z_{tr}(\tau)$  are included using trend components of the log annual real per capita NSDP series derived using the Hodrick-Prescott decomposition method. Consequently, the coefficient  $\gamma$  expresses the influence of the trend component of NSDP on child mortality.

The second component of  $g(\tau)$ ,  $\delta(\tau)$  captures secular changes in child mortality over our observation window. This is specified flexibly by means of Chebyshev polynomials, for instance of degree 2, in time expressed as months since the start of our observation window in January 1985. This polynomial could be specified simply as a sum of terms  $\eta_v \tau^v$ ,  $v = 0, 1, 2$  where  $\tau$  is the months since January 1985. However, since the terms of  $\tau^v$  are not orthogonal, estimation of the parameters  $\eta_v$  is afflicted by multicollinearity. We take care of this problem by using Chebyshev polynomials of the second kind. In this case, the polynomial is specified as a sum of terms  $\eta_v U_v(\tau)$ ,  $v = 0, 1, 2$  where  $U_0(t)$ ,  $U_1(t)$  and  $U_2(t)$ <sup>14</sup>, are mutually orthogonal polynomials of indexed degree. Thus, the time trend in exit probabilities into child mortality is given by,

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<sup>14</sup>To start, the domain of the months since the start of 1985 is  $\tau$  where  $\tau \in [0, 276]$  is linearly transformed to the domain of the orthogonal Chebyshev polynomials such that now  $\tau_1 \in [-1, 1]$ .

Then our orthogonal polynomials are

$$\begin{aligned} U_0(\tau) &= 1 \\ U_1(\tau) &= 2\tau_1 \\ U_2(\tau) &= 4\tau_1^2 - 1 \end{aligned}$$



$$\delta(\tau) = \exp \left[ \sum_{i=0}^2 \eta_v U_v(\tau) \right] \quad (5)$$

We model the time trend  $\delta(\tau)$  as piecewise constant functions with shape determined by the polynomial expressions in equation 5.2 above. This piecewise, time trend specification lead to 3 parameters ( $\eta_v$ , with  $v = 0, 1, 2$ ).

Obviously, there is a trade-off between allowing flexibility by increasing the order of the polynomial and the possibility to identify the affirmative action effect. With more flexibility, the time trend might interact with the policy effect. In our sensitivity analysis we investigate this impact of a more flexible time trend specification by increasing the order of the polynomial.

In our main analysis, we implement our identification strategy by way of a *before-after* comparison, using only data on OBCs (refer Cameron and Trivedi, 2005). In addition, we also tried a *difference-in-difference* approach. This analysis is based on data of OBCs and a control group. In our case, the advantage of such an approach is that the identification of the time trend is also based on the control group. From the descriptive statistics presented in Section 4.2 it appears that a natural control group for OBC children would be members from another backward caste - the SCs or the STs. While both these castes have been recipients of a similar affirmative action program since independence of India in 1947 they differ from each other substantially. The SCs are historically different from the OBCs and the STs in that they are the ex-'untouchables' and till date suffer substantially from the stigma of untouchability. Moreover, given their uniform spread over the whole country, and relatively larger numbers, the public initiative has encouraged them to organize themselves under several 'Dalit' organizations that provide legal support and advise on uptake of preferential treatment opportunities to their members. The STs on the other hand, comprise of the tribal population and owing to their geographical remoteness of place of residence, smaller numbers and greater intra-caste heterogeneity similar to the OBCs have been less successful in the uptake of the affirmative action benefits available to them. Therefore we think that this caste constitutes the most suitable control group. However, as the STs live in very remote areas, are culturally very different from OBCs, and the OBCs and the STs have different trends in IMRs, we do not put much weight on these results. This is moreover so since there could be potential equilibrium effects of the policy that might affect the control group as well, making the *difference-in-difference* approach less suitable.

Estimation of the impact of the affirmative-action policy rests on the fact the policy implementation is an exogenous discontinuity. In the presence of anticipation, we would observe in our data what is often referred to as the 'Ashenfelter's dip' in which case in anticipation of preferential employment OBC individuals would either delay their entry into the labour market or become voluntarily unemployed. If this be the case, then any

measured effect of the policy would overestimate the impact of the policy on outcomes of interest. But in our case such anticipation appears highly unlikely since the affirmative action policy was introduced in the first place due the poor representation of OBC candidates in formal employment. So an OBC individual who already had a job was unlikely to quit. However, since the policy specified slightly lower entrance requirements for OBC candidates, it is likely that OBC unemployed who previously found it hard to get hired might anticipate admission post policy implementation. This however, would be the effect of the policy and not it's anticipation since it would not influence his labor prior to the policy coming into affect. High incidence of poverty amongst the OBCs would have forced them to continue in whichever employment they had until they found a more lucrative reserved quota job post affirmative action policy. Finally, the nations strong response by means of agitations, strikes and even self immolation in face of sudden and unexpected implementation of reservation quotas in favor of the OBCs highlights the totally unanticipated nature of policy.

As control variables that go beyond calendar time effects, we include all the relevant factors which are commonly know to influence under-five mortality. This encompasses family specific characteristics, such as education of the mother, father, income, area of residence, religion, type of health care facility used, method of contraception, as well as child specific characteristics, as gender, multiple births or not, age of mother at time of birth of child. We estimate our model using Maximum Likelihood.

Note, we observe considerable bunching in reported ages (in months) of death, particularly after 24 months (refer Table 7). Econometrically, this situation is similar to interval censoring that arises when the exit duration is observed not continuously but only in interval form such as. Our duration model framework is able to handle this kind of censoring in a natural way, such as we do.

## 6 Empirical findings

### 6.1 *Estimation results*

We start the multivariate analysis with estimates of the duration until death for children until the age of 5. Results for our *before-after estimator* for the OBC children are presented in Table 8 for all children and male and female children separately. For the estimates concerning under-five mortality hazards, positive values of estimates signify a shorter lifetime.

The first result we note is a significant impact of gender in determination of under-five mortality risks. This result is in line with past literature that finds better survival rates amongst female children (for instance refer Naeye et al., 1971; Khoury et al., 1985; Fanaroff et al., 1992; Hammoud, 1965 and Chen, 1993) and holds despite the evidence of large discrimination against the female child in India (for extensive review refer to Das Gupta, 1987). This makes it important to look at the two genders separately.

The most crucial result we find is the significant negative effect of the affirmative action policy on the under-five mortality hazard of all OBC children.<sup>15</sup> Furthermore we note gender differences in the impact of the policy on under-five mortality hazard with a stronger favorable effect of the employment based affirmative action policy for female OBC children. This result is encouraging since women enjoy only a secondary status in Indian society and an affirmative action policy that helps relax the resource constraints of poor OBC households could potentially also help reduce the discrimination in resource allocation against the female child.

The additional estimates that are shown in Table 8 are in line with the standard results concerning under-five mortality. The older and more educated the mother is, and wealthier the household is, the lower is the mortality rate of the first born child. The surprising result we find is that the impact of paternal education on under-five mortality hazards is relatively unclear with maximum educational attainment of primary education faring worse than no education. This result could be driven by a higher incidence of no education amongst well to do agricultural families in whose case economic well being rather than education would be the more important determinant of under-five mortality rates. In the absence of information on exact occupation we are however unable to conclusively determine the underlying factors behind this result. Furthermore, we find lower mortality hazards for first borns of working mothers. If occupational involvement is an indicator of female autonomy and greater bargaining power within the household (World Bank, 1995) then this result is in line with research that finds that women are more likely to invest in the health of their children than men, in low income, lesser educated households (UNICEF, 2007). As expected being part of a multiple birth significantly raises under-five mortality hazard. We also find some evidence of lower mortality hazard for children in urban areas. This result could be an outcome of better medical facilities in cities and towns as compared to villages. However, this effect is statistically insignificant. Season of birth also seems to influence mortality rates, with higher rates during the spring season as opposed to summer or winter. We find using modern contraception methods and private health care facilities reduces the risk of under-five mortality. Large religious differences are also seen, with the Muslim OBC children exhibiting significantly lower mortality hazards than the reference Hindu OBC category. Studies such as Bhalotra, 2008, attribute this lower CMR in Muslim households to better hygiene owing to ablutions prior to frequent prayers.

Looking at the effect of over all macroeconomic conditions, we find no significant effect of contemporaneous trend component of the NSDP on mortality rates of children. However, it must be borne in mind that our specification carefully controls for time trends in CMR separately. Looking at this time trend in CMR, we observe that the overall mortality rate declines over our observation window. As mentioned above in Section 5.1, in order to capture the effect of the affirmative action policy using a regression discontinuity design,

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<sup>15</sup>Significance is through out measured at 5% level. In this case the favourable effect of affirmative action on child mortality is significant for all groups - the full sample and also when the female and male children are considered separately.

the time trend in CMR should be a smooth function of calendar time  $\tau$ . Estimated time trends for the full sample and owing to subtle differences for the male and female children separately are presented in Figure 3. These plots show that our relative flexible specification of the calendar time effect estimate plausible reductions of CMR between 1990-2007, thereby allowing us to estimate the effect of the affirmative action policy in a clean way.

Significant state differences are also observed with most states having lower CMR amongst OBCs than the reference state of Uttar Pradesh (UP). This result seems reasonable since UP is the most populous state of India, with highest fertility rates and socioeconomic backwardness (Maitra, 2004). The state of Kerala, with reported 100 percent literacy rates and highest female empowerment, expectably performs the best. The specified Weibull baseline hazards is plotted in Figure 4 for the full sample of male and female children combined. Duration dependence for male and female children plotted separately look very similar to each other and to that of the full sample in Figure 4. To avoid duplication these have not been presented.

## 6.2 *Sensitivity analysis*

Several sensitivity tests were undertaken to ensure the validity of our results and in an attempt to uncover any salient features that our main model might have missed. As mentioned above evaluation of the effect of the affirmative action policy on under-five mortality hazards of OBC children using our regression discontinuity design, necessitates that the time trend in CMR is captured well. As documented in Section 5.1, we specify the time trend in under-five mortality,  $\delta(\tau)$  flexibly by means of Chebyshev polynomials of degree 2, in time expressed as months since the start of our observation window in January 1985. As discussed in Section 6.1 and shown in Figure 3, the two degree time trend captures a plausible decline in CMR over our observation window. However, to ensure the robustness of our results to different time trend specifications we re-estimated our model with alternative specifications of the time trend. As an example, we present in Table 9 and Figure 5 results from a model which specifies the time trend even more flexibly as a function of Chebyshev polynomials of degree 3.<sup>16</sup> From Table 9 we note that with this modification all estimates remain qualitatively unchanged and our result of a significant beneficial impact of the affirmative action policy on the mortality hazards of OBC children is robust to this new specification and in fact the coefficients are even larger. However the plots of this more flexible time trend, as presented for the full sample and for male and female children separately in Figure 5 reveal a highly unlikely time trend which is especially obvious at the time shortly after the introduction of the affirmative action policy. This suggests that this new specification does not control for the secular changes in child mortality in a suitable way.

As a second sensitivity test we allow both elements, the slope and the level of the hazard to depend on the policy discontinuity. As mentioned in Section 5.1 above, this

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<sup>16</sup>So now in the specification of  $\delta(\tau)$ ,  $v = 0, 1, 2, 3$ .

is done by allowing the Weibull duration dependence parameter  $\alpha$  to be dependent on the policy shift and specified as in equation 5.1. Parameter estimates of this alternative specification are given in Table 10. Plots of the after-before under-five mortality hazard ratios that jointly capture both the slope and the level effect of the policy, are presented in Figure 6 for the full sample of the OBC children and the two genders separately. This more sophisticated specification of the impact of affirmative action on under-five mortality hazards reiterates our main results. For the full sample, or when considering male or female OBC children separately, we find that there is a decline in under-five mortality hazard in the post-affirmative action policy period as shown by a hazard ratio of less than one and once again this effect is larger for female children. Furthermore, we note that this decline is concentrated within the first year of life. This can be expected since under-five mortality rates are the highest within the first year of life (refer Figures 4.1 and 4.2) and thus the policy is most likely to have the greatest impact on mortality risks during this time. As can be seen from Table 10 with this specification all other coefficients remain qualitatively unchanged. Most importantly, the time trend remains unchanged and in order to avoid duplication plots of these are not presented.

Our third sensitivity test stems from the idea that caste affiliation could have a stronger influence in rural than in urban areas. The lives of members of different castes are more separated in rural areas and their caste affiliation is more strongly upheld. Consequently, the effect of caste affiliation on under-five mortality could vary by the degree of urbanization. We already check for the presence of any such effect by including a dummy for urban area of residence in our main model specification. Although this parameter is found to be statistically non significant we investigate this further to ensure that no salient features are missed. This is done by estimating a model with interactions between caste and urban area of residence. Results for this specification are presented in Table 11. The most crucial result we find is that the significant negative effect of the affirmative action policy on the CMR of OBC children seems to be driven by the large favorable impact of the policy in rural rather than urban areas. Although one would expect more governmental jobs to be available in urban area, this could be plausible since caste affiliation plays a more important role in rural rather than urban life. Moreover given that a larger proportion of the OBC population resides in rural areas (refer Table 6) an affirmative action policy aimed to help the OBCs is likely to have a larger bite there as well due to potential spill-over effects. However it is worth mentioning that a part of this result might also reflect differences in the time trend in rural and urban areas. In the absence of different time series of the NSDP for rural and urban areas however, separate models cannot be estimated for the urban and rural areas and hence we are unable to comment on this further. Nonetheless this check highlights the importance of careful consideration of the role of caste and hence the success of a caste based preferential policy in different segments of the population. Suitable policy formulation needs to take into account these crucial interactions in order to evaluate the true gains of the policy for the target group. This is particularly so when determining subtle yet vital, inter generational gains of the public effort. With this alternative specification all other coefficients remain unchanged.

As the next sensitivity test we undertake, evaluates the impact of the affirmative action policy on under-five mortality hazards of OBC children using a *difference-in-difference* approach with STs as a control group. Table 12 presents the results of this *difference-in-difference* estimator of the impact of affirmative action policy on under-five mortality hazards of OBC children. Unlike the results of our main specification and all further sensitivity tests undertaken, we note that with this approach we find a significant adverse effect of the policy on mortality risks of OBC children. A result that a redistributive policy that is likely to relax the economic constraints of the recipient OBC households, by means of quotas in public sector employment, worsens the death risks of the children of the targeted caste seems highly counter-intuitive. Even if one was to accept that improved employment opportunities for the OBCs had no impact on the well-being of the OBC children, an adverse effect of a possible increase in resource availability seems unlikely. However, as pointed out in the Section 4.2, there is considerable disparity even between the three backward castes which is further reflected in the differences in time trends in IMR as shown in Figure 2. Since, similarity in time trends between the treated and the control group is crucial for the identification of the treatment effect using the *difference-in-difference* approach, we conclude that in the absence of a suitable control group these results, besides being unconvincing, are also less reliable. This is even more so the case as the *difference-in-difference* approach would still also not take into account any potential equilibrium effects arising from the policy influencing other castes as well.

### **6.3 *Policy implications and further work***

This study has several valuable policy implications. This study undertakes a evaluation of the affirmative action policy in employment, and finds that the policy is a success in improving the socioeconomic status of the targeted OBC population by significantly lowering their under-five mortality hazards. Moreover, since mortality can be viewed as an extreme negative health outcome, lower under-five mortality hazard would also imply improved health of OBC children. This in turn would lead to life long benefits for these children, in terms of lowered incidence of diseases, better educational and occupational outcome and even life expectancy. Such long lasting and wide spread advantages of a redistributive policy, benefitting a group that is clearly disadvantaged, are definitely desirable. This is particularly so given the large favorable impact the policy has on lowering female under-five mortality rates for the OBCs. In a male dominated society, the girl child holds only a secondary status to her male siblings. These gender preferences lead to discrimination in resource allocation against the girl child, resulting in life long negative effects on her health, education, occupational opportunities, autonomy and status within the household and in the society at large. By means of improving the mortality hazards and therefore health of the female child, the affirmative action policy also helps reduce the gender bias in a society plagued with such disparities.

While acknowledging the success of the public effort aimed at alleviating the socioeconomic position of the OBCs it is important to note that these gains could be even larger.

There are several obvious reasons for this outcome. First of all, past literature has noted that women are more likely to invest in the human capital accumulation of their children than the fathers. Consequently, an employment based policy that redistributes in favour of men (since women are mostly not working, at least not in formal paid employment) is less likely to increase transfers to children and help lower the under-five mortality hazard. Therefore, an affirmative action policy that provides benefits to OBC women, might have larger, longer term benefits. Secondly, lower educational attainments of the OBCs, as seen in the descriptive statistics, is likely to make it hard for them to avail of the opportunities granted to them by means of reservation quotas. Even if the OBC individual is able to up-take a reserved job, it is likely to be for a lesser paid Grade C or D category job rather than a well paid and respected officer level job. There is evidence that this indeed is the case, where there is over representation of lower castes in lower level jobs while quotas in higher level jobs remain unfilled (Deshpande, 2005). This suggests that along with the current policies the government should increase effort towards improving provision and uptake of primary and secondary level education amongst OBCs. This would help improve their job related attributes and allow them to make better use of affirmative action policies aimed at them in the realms of employment and higher education. Finally, a national enforcement agency could for example be put in place to ensure the proper implementation of the policy. Such an agency could also undertake from time to time evaluations of the public effort and make suggestions to the government of possible reformulations of the policy to make sure that the policy remains relevant and beneficial in times of privatization and rapid national economic growth.

This study provides a useful first step in the evaluation of the impact of a major affirmative action policy undertaken by the Government of India for the alleviation of socioeconomic backwardness amongst the OBC population, on under-five mortality hazards amongst OBC first borns. However, this work does not take into account the interaction of fertility and mortality, and higher order births. Since, death of a previous child has severe adverse effect on survival status of subsequent children, any measured gains from the policy are likely to get compounded when all births are taken into account. Given the already large size of the current study, estimation of such a fixed effect model with all births, in which birth, survival status and timing of death of children are endogenous is beyond the scope of the current study and is left to future work.

## 7 Conclusion

This paper investigates the inter-generational impact of an employment based affirmative action policy, targeting OBC households, on under-five mortality hazard of OBC children. Impact of the policy is captured using a regression discontinuity design, that carefully controls for time trends in under-five mortality hazards over time and thereby allows for the evaluation of the policy using a method that is popular in the treatment evaluation literature, the *before-after* estimator. Our estimates show a significant, favorable impact

of the affirmative action policy on under-five mortality hazards of OBC children. Gender differentials also emerge with gains from the policy being larger for female than male children. Several sensitivity tests are undertaken which validate our methods and results. The differential impacts of the policy by gender highlight the importance of evaluating the success of the policy within narrower population groups than the country as a whole and in light of where the impact of the policy is most vital and hence expected to be the largest.

There are several important policy implications of our study. Independent of compelling moral arguments favouring preferential benefits for backward and previously deprived OBC caste, this study shows that such positive discrimination by means of reservation quotas for OBCs in government employment has long term inter-generational gains. Such benefits are definitely desirable as healthy children will be an asset to their own communities/ castes and society in general in the future. Such longer-terms gains, spilling beyond the generation directly receiving the preferential treatment, also suggest that studies that only consider the progress of the recipient generation as a result of the affirmative action policy, underestimate the impact of the public effort in uplifting the disadvantaged castes.



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Figure 1: Kaplan Meier survival functions by caste for children born between 1985-2002, NFHS Round 3, 2005-2006.

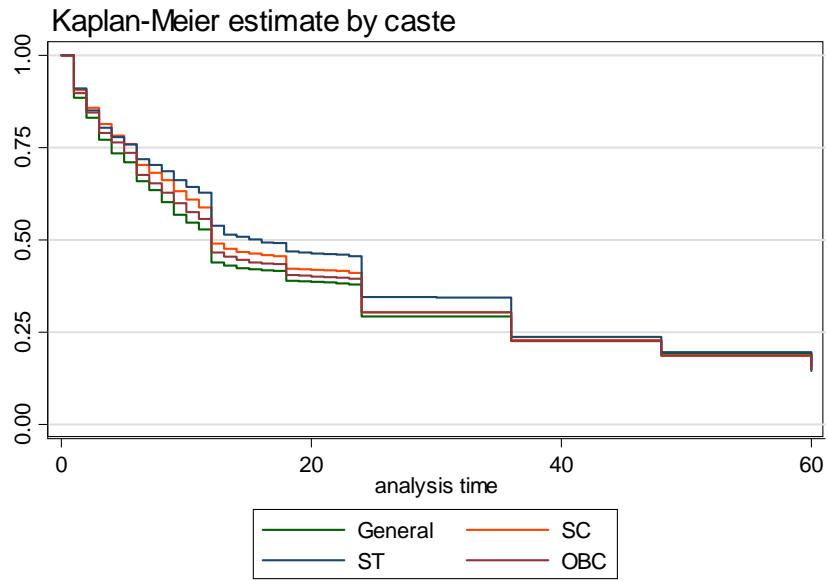


Figure 2: Descriptive time trends in Infant Mortality Rate by caste for children born between 1985-2002, NFHS Round 3, 2005-2006.

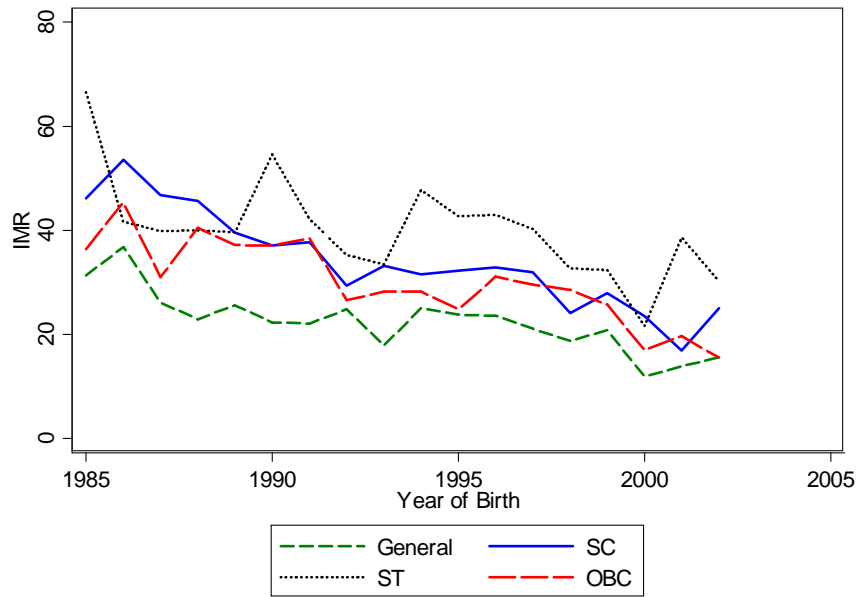


Figure 3: Estimated time trend in Child Mortality Rate for OBC children born between 1985-2002 from before-after estimation

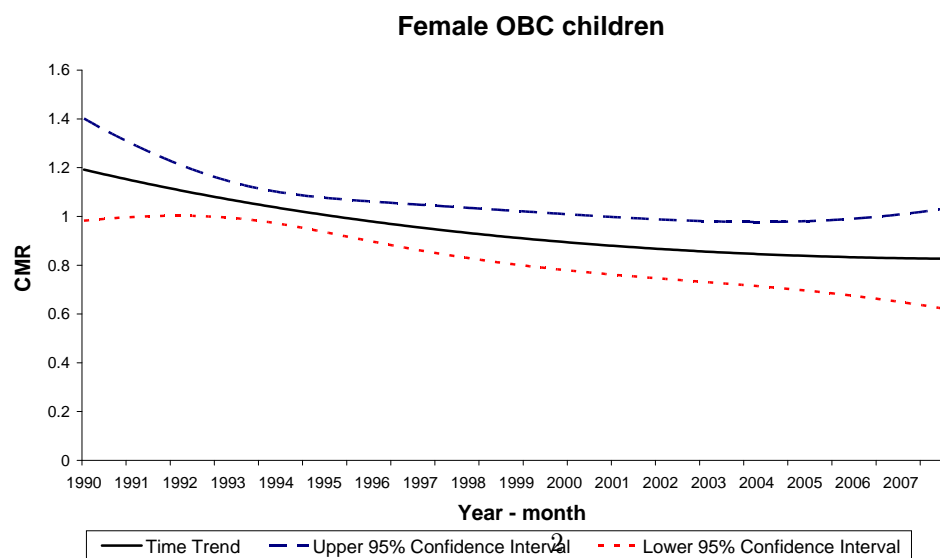
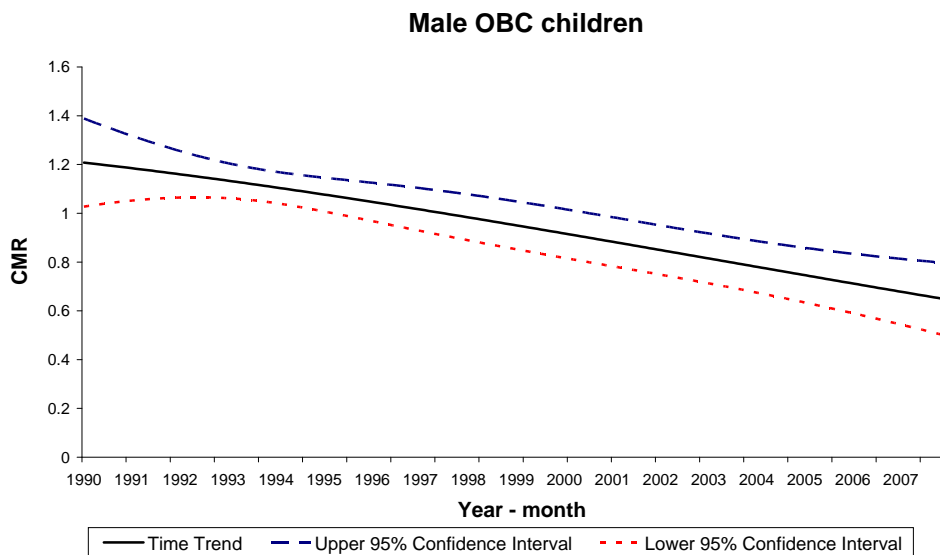
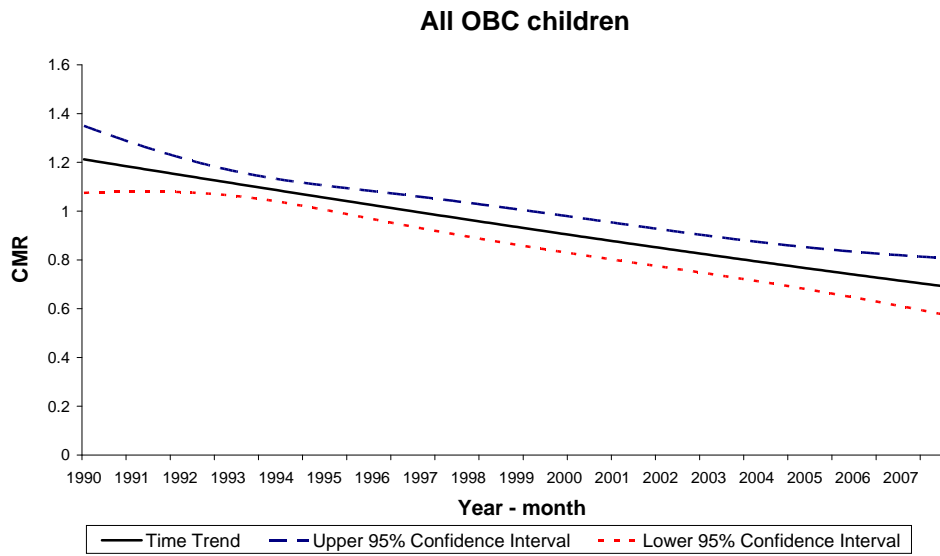


Figure 4: Age dependence of child mortality for full sample of OBC children from *before-after* estimation (baselines)

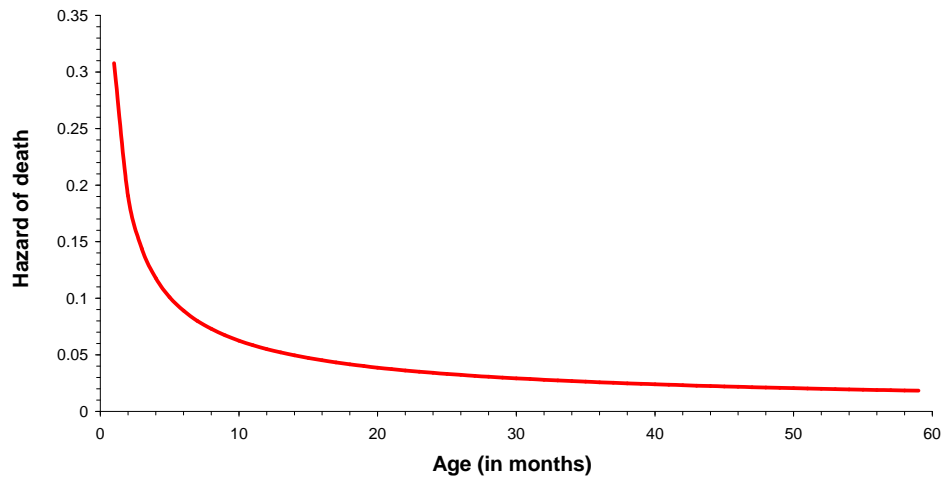




Figure 5: After-before hazard ratio of the before-after estimator with slope and level effect of affirmative action policy on child mortality hazard of OBC children

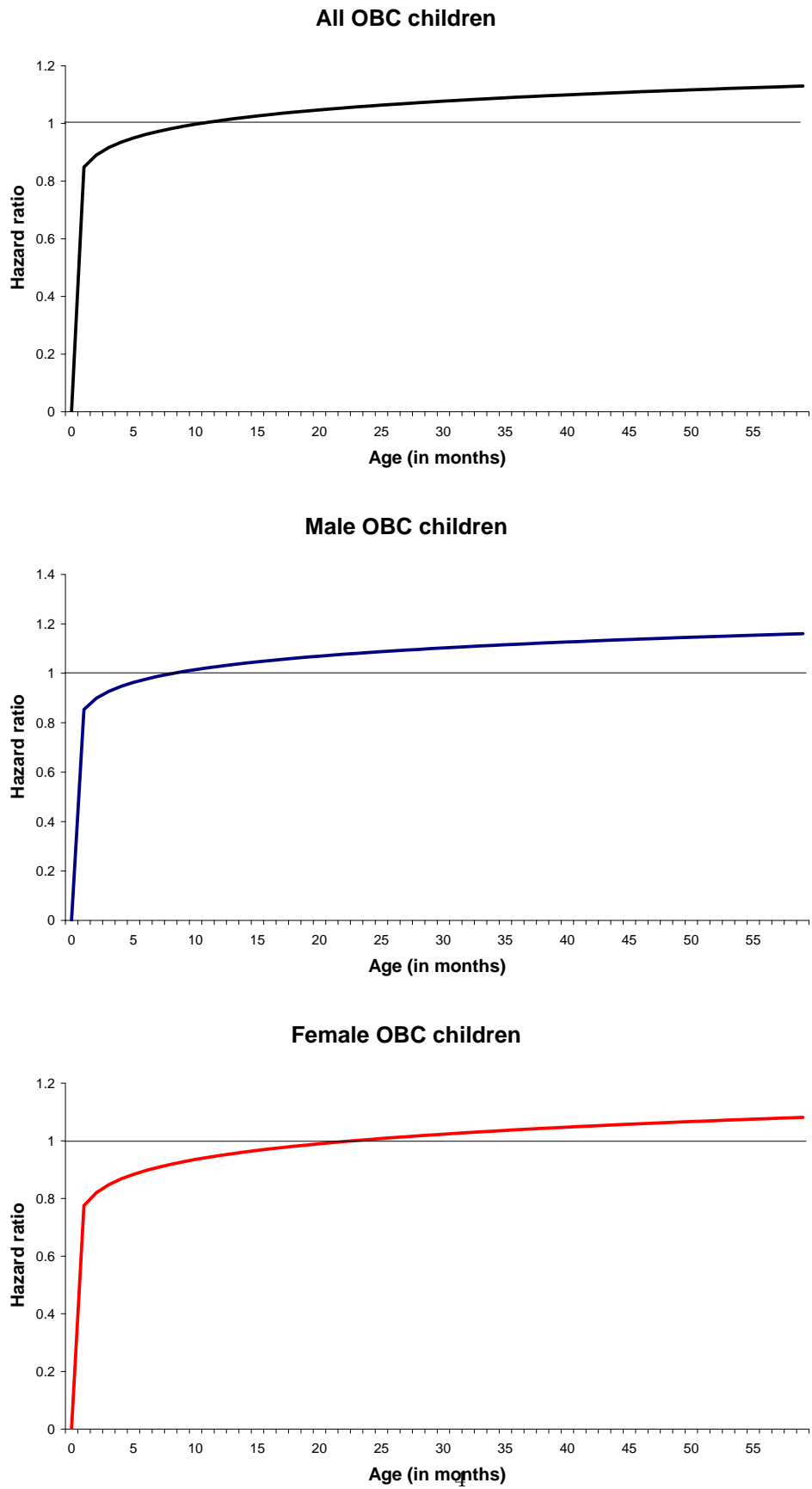


Figure 6: Age dependence of child mortality hazard for OBC children from *before-after* estimation with (baselines) with slope and level effect of affirmative action policy

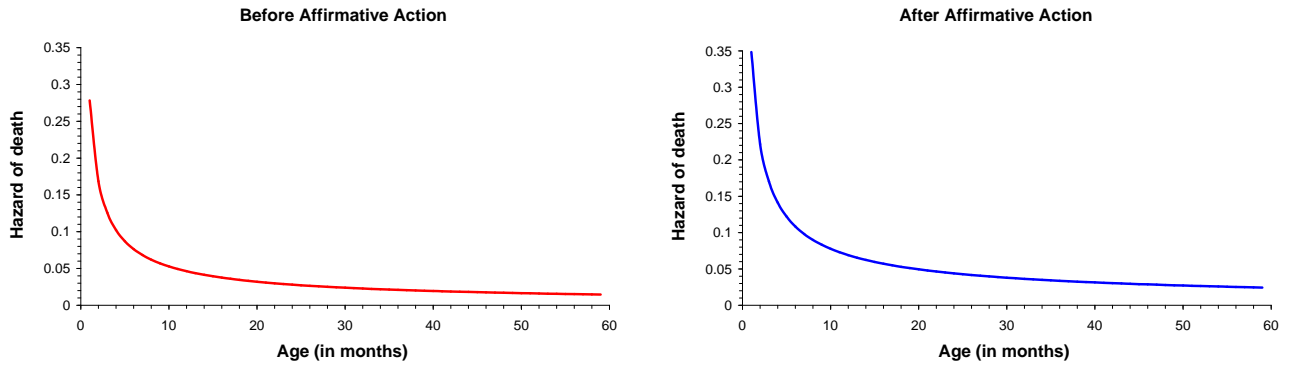


Figure 7: Estimated time trend in Child Mortality Rate for OBC children born between 1985-2002 from before-after estimation with more flexible time trend of degree three

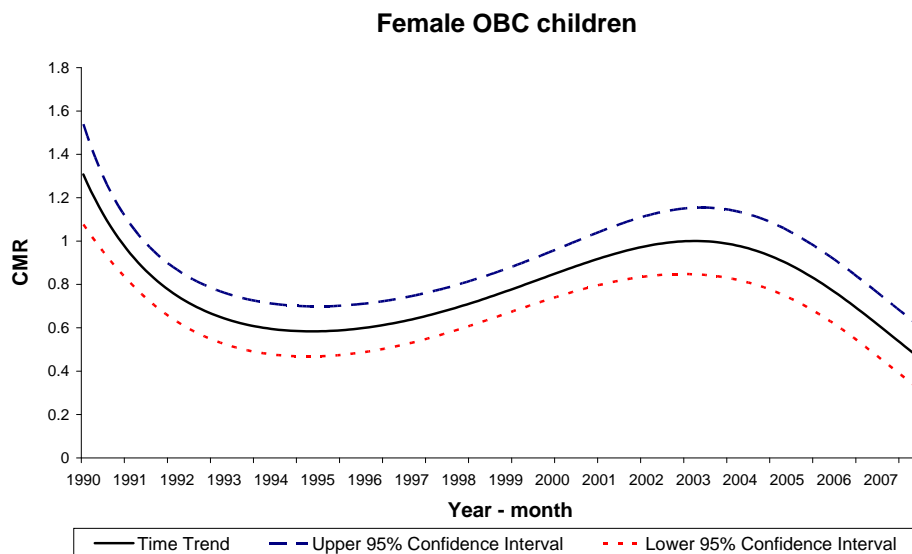
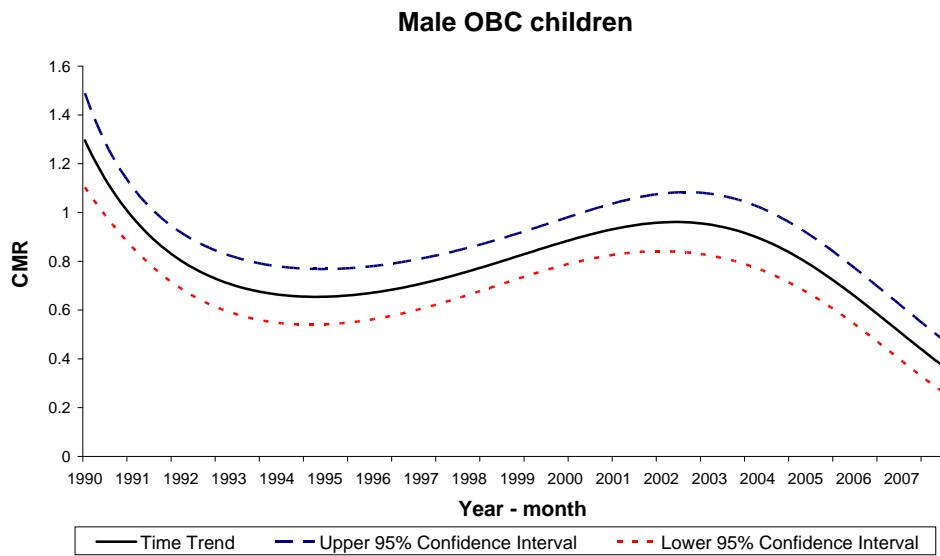
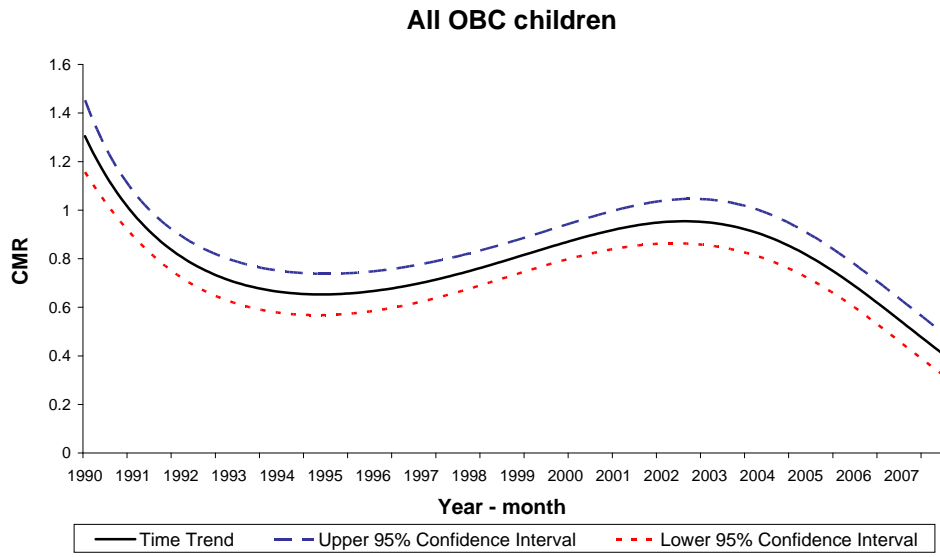


Table 1: Neonatal, post-neonatal, infant, child and under-five mortality rates 0-4 and 5-9 years preceding the survey by caste, India National Family and Health Survey, Round 2, 1998-99						
	1989-1993 <sup>†</sup>			1994-1998 <sup>‡</sup>		
	Scheduled caste/tribe	Other back- ward caste	Forward caste	Scheduled caste/tribe	Other back- ward caste	Forward caste
Neonatal mortality	58.0	57.8	48.1	51.1	46.2	37.8
Post-neonatal mortality <sup>⊗</sup>	32.6	26.1	24.3	29.2	25.6	19.1
Infant mortality	90.6	83.9	72.4	80.3	71.8	56.9
Child mortality	44.6	33.2	23.2	42.4	27.1	20.3
Under-five mortality	131.2	114.3	93.9	119.3	96.9	76.1

*Notes :*

† : 5-9 years preceding survey

‡ : 10-14 years preceding survey

⊗ : Computed as the difference between infant and neo-natal mortality rates

*Source :* Dommaraju, P., Agadjanian, V. and Yabiku, S. (2008), *The pervasive and persistent influence of caste on child mortality in India, Population Research and Policy Review, Vol. 27(4), pp. 483*

<b>Table 2: Economic status and caste/religion of men between 25-45 years of age, National Sample Survey 55th round, 1999-2000</b>							
	SE	EMP	UPFW	RSWW	CWL	SKW	Total
Schedule Tribe (ST), non-Christian	1,982 34.85% 6.65%	18 0.32% 1.76%	522 9.18% 6.16%	713 12.54% 4.12%	2,401 42.22% 12.44%	51 0.90% 3.11%	5,687 100.00% 7.33%
Schedule Tribe (ST), Christian	149 44.48% 0.50%	1 0.30% 0.10%	34 10.15% 0.40%	50 14.93% 0.29%	95 28.36% 0.49%	6 1.79% 0.37%	335 100.00% 0.43%
Schedule Caste (SC)	3,477 27.72% 11.67%	42 0.33% 4.11%	628 5.01% 7.41%	2,267 18.07% 13.09%	5,919 47.18% 30.67%	212 1.69% 12.93%	12,545 100.00% 16.18%
Other Backward Caste (OBC), non-Muslim	9,904 40.69% 33.25%	308 1.27% 30.11%	3,012 12.38% 35.54%	4,656 19.13% 26.89%	6,073 24.95% 31.47%	386 1.59% 23.55%	24,339 100.00% 31.39%
Other Backward Caste (OBC), Muslim	1,222 44.98% 4.10%	60 2.21% 5.87%	245 9.02% 2.89%	416 15.31% 2.40%	728 26.79% 3.77%	46 1.69% 2.81%	2,717 100.00% 3.50%
Hindu, non SC/ST/OBC	9,350 39.70% 31.39%	451 1.91% 44.09%	3,157 13.40% 37.25%	7,430 31.55% 42.91%	2,410 10.23% 12.49%	754 3.20% 46.00%	23,552 100.00% 30.38%
Muslim, non SC/ST/OBC	2,927 46.27% 9.83%	77 1.22% 7.53%	484 7.65% 5.71%	1,254 19.82% 7.24%	1,450 22.92% 7.51%	134 2.12% 8.18%	6,326 100.00% 8.16%
Christian, non SC/ST/OBC	200 25.32% 0.67%	46 5.82% 4.50%	37 4.68% 0.44%	296 37.47% 1.71%	176 22.28% 0.91%	35 4.43% 2.14%	790 100.00% 1.02%
Sikh, non SC/ST/OBC	576 46.30% 1.93%	20 1.61% 1.96%	357 28.70% 4.21%	232 18.65% 1.34%	44 3.54% 0.23%	15 1.21% 0.92%	1244 100.00% 1.60%
Total	29,787 38.42% 100.00%	1,023 1.32% 100.00%	8,476 10.93% 100.00%	17,314 22.33% 100.00%	19,296 24.89% 100.00%	1,639 2.11% 100.00%	77,535 100.00% 100.00%

Notes :

SE : self employed, EMP : employer, UPFW : unpaid family worker, RSWW : regular salaried or wage worker, CWW : casual wage worker, SKW : seeking work

First figure in column is total in caste/religion category, second figure is row percentage, third figure is column percentage

Source : Boroah, V.K., Dubey, A. and Iyer, S. (2007), *The effectiveness of jobs reservation : Caste, religion and economic status in India*, *Development and Change*, Vol.38(3), pp.430.

**Table 3: Educational standard and caste/religion of men between 25-45 years of age, National Sample Survey 55th round, 1999-2000**

	Illiterate	Literate, but below primary	Primary or middle	Secondary	Graduate	Total
Schedule Tribe (ST), non-Christian	2,630 51.61% 14.37%	705 13.83% 9.19%	1,066 20.92% 5.61%	508 9.97% 3.70%	187 3.67% 2.44%	5,096 100.00% 7.68%
Schedule Tribe (ST), Christian	103 35.03% 0.56%	40 13.61% 0.52%	87 29.59% 0.46%	46 15.65% 0.33%	18 6.12% 0.23%	294 100.00% 0.44%
Schedule Caste (SC)	5,007 42.93% 27.35%	1,627 13.95% 21.21%	3,113 26.69% 16.38%	1,401 12.01% 10.20%	515 4.42% 6.71%	11,663 100.00% 17.57%
Other Backward Caste (OBC), non-Muslim	5,764 27.94% 31.49%	2,550 12.36% 33.25%	6,601 31.99% 34.73%	4,106 19.90% 29.88%	1,612 7.81% 21.01%	20,633 100.00% 31.08%
Other Backward Caste (OBC), Muslim	818 34.57% 4.47%	338 14.29% 4.41%	778 32.88% 4.09%	337 14.24% 2.45%	95 4.02% 1.24%	2,366 100.00% 3.56%
Hindu, non SC/ST/OBC	1,926 10.04% 10.52%	1,434 7.47% 18.70%	5,253 27.37% 27.64%	5,978 31.15% 43.50%	4,599 23.97% 59.95%	19,190 100.00% 28.90%
Muslim, non SC/ST/OBC	1,845 32.77% 10.08%	876 15.56% 11.42%	1,638 29.09% 8.62%	866 15.38% 6.30%	406 7.21% 5.29%	5,631 100.00% 8.48%
Christian, non SC/ST/OBC	42 6.25% 0.23%	31 4.61% 0.40%	251 37.35% 1.32%	225 33.48% 1.64%	123 18.30% 1.60%	672 100.00% 1.01%
Sikh, non SC/ST/OBC	172 20.19% 0.94%	69 8.10% 0.90%	219 25.70% 1.15%	275 32.28% 2.00%	117 13.73% 1.53%	852 100.00% 1.28%
Total	18,307 27.57% 100.00%	7,670 11.55% 100.00%	19,006 28.62% 100.00%	13,742 20.70% 100.00%	7,672 11.55% 100.00%	66,397 100.00% 100.00%

Notes :

First figure in column is total in caste/religion category, second figure is row percentage, third figure is column percentage

Source : Boroah, V.K., Dubey, A. and Iyer, S. (2007), *The effectiveness of jobs reservation : Caste, religion and economic status in India, Development and Change, Vol.38(3), pp.431.*

<b>Table 4: Sample Selection</b>	
Selection criteria used	Resulting number of observations
All first births between 1968-2006	84,609
First births between 1985-2001	56,244
All first birth surviving at least first month	55,941
Not born between September - December 1993	54,936
Belongs to the 15 major states of India	42,039
Final sample with no missing values of explanatory variables	38,348

Table 5: Descriptions of variables in NFHS-3 used in the analysis	
Variable	Description
Gender	male/female
Mutiple birth	Dummy for whether child is part of a multiple birth like twins/ triplets etc.
Season of birth of child	3 seasons are: spring, summer, winter
Mother's age at childbirth	4 age categories are: 10-14 years, 15-20 years, 21-25 years and > 25 years
Maternal education	Highest educational attainment. 4 categories are: no education, primary education, secondary education and higher education
Paternal education	Highest educational attainment. 4 categories are: no education, primary education, secondary education and higher education
Mother works	Binary variable for whether mother works or not
Wealth index	captures economic status of the household: classified into poorest, poorer, middle, richer, richest
Caste	Caste affiliation of the family: <i>GEN</i> : general/ forward castes <i>OBC</i> : other backward castes. This is the targetted group for affirmative action <i>SC</i> : Scheduled caste. Ex-'untouchables' <i>ST</i> : Scheduled tribe. Tribal/indigenous population.
Religion	Religion of the household: Hindu/ Muslim/ Christian or Other religions
Urban	Binary variable for urban area of residence
Contraception	Method of contraception used by the parents. Classified into 4 categories: No method, folkoric method, traditional method and modern method.
Final say on mother's health care	3 categories: mother alone, mother and somebody else and finally somebody else alone.
Usual treatment center	3 categories: private health facility, government health center or other facility
State	15 state dummies to capture state fixed effects



Table 6: Summary statistics by caste					
Variable	Caste				
	Total	<i>GEN</i>	<i>OBC</i>	<i>SC</i>	<i>ST</i>
Percentage population	100	34.27	39.30	18.68	7.75
Female child, %	49.14	48.81	48.94	50.42	48.58
Urban, %	44.04	55.96	41.80	38.67	15.59
Mother's age at child birth, %					
10-14 years	2.76	1.75	2.85	3.84	4.12
15-20 years	57.34	47.40	60.08	64.92	69.09
21-25 years	31.39	38.15	30.13	25.36	22.45
> 25 years	8.51	12.69	6.94	5.88	4.33
Maternal education, %					
no education	42.54	25.09	46.21	54.65	71.93
primary education	14.86	14.11	15.68	16.07	11.12
secondary education	34.34	44.62	32.74	26.73	15.32
higher education	8.26	16.18	5.38	2.56	1.63
Paternal education, %					
no education	24.06	14.10	24.65	31.24	47.88
primary education	15.68	12.45	16.54	18.48	18.85
secondary education	46.26	49.89	47.98	43.56	27.92
higher education	14.00	23.56	10.83	6.72	5.35
Mother works, %	37.54	26.73	40.70	42.74	56.86
Wealth index, %					
poorest	16.00	6.37	14.82	21.71	50.87
poorer	16.20	9.50	18.34	21.73	21.69
middle	17.87	14.01	20.52	21.51	12.65
richer	22.31	24.61	23.90	20.61	8.14
richest	27.62	45.52	22.41	14.44	6.65
Religion, %					
Hindu	81.23	71.42	84.51	88.10	91.44
Muslim	12.00	19.66	12.70	1.31	0.28
Christian	2.03	1.75	1.75	2.28	4.05
Other	4.74	7.16	1.04	8.31	4.23
Contraception, %					
no method	30.49	26.29	31.27	31.70	42.20
folkloric method	0.43	0.23	0.41	0.43	1.39
traditional method	8.18	11.14	6.51	7.56	5.02
modern method	60.91	62.35	61.82	60.31	51.39
Final say on mother's health, %					
mother alone	29.82	32.75	27.24	31.74	25.29
mother and somebody else	37.43	38.05	37.93	35.80	36.07
somebody else alone	32.75	29.20	34.82	32.46	38.63
Child alive at end of 5 years, %	91.05	93.89	90.31	89.47	86.11

**Table 7:** Age of death in months in case of death at under 5 years of age

<b>Childs age in months at time of death</b>	<b>Frequency</b>
1	232
2	98
3	85
4	59
5	50
6	91
7	37
8	41
9	47
10	31
11	38
12	150
13	21
14	15
15	8
16	4
17	1
18	35
19	2
20	5
21	1
22	3
23	4
24	127
26	1
36	132
48	67
60	71

<b>Table 8: Parameter estimates of <i>before-after estimation</i> of impact of affirmative action policy on OBC child mortality hazard</b>						
Variable	Full Sample		Male children		Female children	
	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.
<i>Child specific characteristics:</i>						
Female child	-0.36	-8.82				
Multiple birth	1.40	9.53	1.30	6.44	1.49	5.73
Mother works	-0.12	-2.80	-0.14	-2.32	-0.14	-2.07
Urban area of residence	-0.07	-1.28	-0.07	-0.92	-0.11	-1.28
<i>Mother's age at child birth, reference category '15-20 years':</i>						
10-14 years	0.39	4.29	0.34	2.87	0.44	3.19
21-25 years	-0.29	-5.74	-0.25	-3.62	-0.36	-4.64
> 25 years	-0.47	-4.19	-0.38	-2.69	-0.56	-3.13
<i>Highest education of mother, reference category 'primary education':</i>						
No education	-0.37	-6.78	-0.36	-4.91	-0.46	-5.72
Secondary education	-0.45	-6.24	-0.38	-3.90	-0.56	-5.29
Higher education	-0.52	-2.92	-0.39	-1.78	-0.69	-2.22
<i>Highest education of father, reference category 'primary education':</i>						
No education	-0.29	-5.07	-0.30	-3.96	-0.33	-3.88
Secondary education	-0.21	-7.88	-0.21	-5.88	-0.24	-5.96
Higher education	-0.35	-3.37	-0.25	-1.84	-0.60	-3.55
<i>Wealth index, reference category 'poorer':</i>						
Poorest	-0.24	-4.05	-0.21	-2.76	-0.30	-3.37
Middle	-0.38	-6.55	-0.47	-5.93	-0.33	-3.76
Richer	-0.58	-8.44	-0.63	-6.83	-0.55	-5.23
Richest	-0.73	-7.69	-0.78	-5.91	-0.70	-4.98
<i>Contraception, reference category 'no method':</i>						
Folkloric method	-0.50	-1.67	-0.92	-2.04	-0.13	-0.31
Traditional method	-0.43	-5.24	-0.48	-4.26	-0.41	-3.37
Modern method	-0.70	-15.24	-0.82	-13.26	-0.55	-8.02
<i>Final say on mother's health, reference category 'mother and somebody else':</i>						
Mother alone	-0.22	-4.33	-0.22	-3.23	-0.25	-3.30
Somebody else alone	-0.19	-3.95	-0.22	-3.41	-0.16	-2.25
<i>Usual treatment center, reference category 'government health center':</i>						
Private health facility	-0.29	-6.28	-0.27	-4.34	-0.37	-5.33
Other facility	-0.44	-5.06	-0.43	-3.73	-0.54	-4.07
<i>Religion, reference category 'Hindu':</i>						
Muslim	-0.33	-5.22	-0.28	-3.40	-0.38	-3.93
Christian	0.01	0.07	-0.34	-1.14	0.48	1.94
Others	-0.53	-1.94	-0.30	-0.72	-1.09	-2.40
<i>Season of birth of child, reference category 'spring':</i>						
Summer	-0.32	-6.56	-0.33	-5.09	-0.33	-4.51
Winter	-0.35	-6.73	-0.33	-4.74	-0.40	-4.98

Table 8 (contd.):						
Variable	Full Sample		Male children		Female children	
	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.
Business cycle conditions in current and preceeding years of life:						
Trend (log annual real per capita NSDP)	0.00	-0.14	0.00	0.38	-0.01	-0.52
Weibull baseline coefficient:						
$\rho_0$	-1.18	-58.72	-1.19	-44.29	-1.18	-38.74
Time trend:						
$\eta_1$	-0.17	-3.71	-0.17	-2.84	-0.15	-2.04
$\eta_2$	-0.01	-0.30	-0.03	-0.73	0.03	0.74
Before-after estimate of impact of affirmative action on OBC child mortality hazard:						
Affirmative action	-0.19	-2.90	-0.19	-2.13	-0.29	-2.91
State dummies, reference category 'Uttar Pradesh':						
Andra Pradesh	-0.55	-6.14	-0.46	-3.91	-0.71	-5.09
Assam	-0.83	-7.80	-0.80	-5.88	-1.08	-6.14
Bihar	-0.50	-6.88	-0.64	-6.23	-0.40	-3.83
Gujarat	-0.22	-2.21	-0.09	-0.69	-0.44	-2.75
Haryana	-0.78	-4.25	-1.06	-3.64	-0.58	-2.47
Karnataka	-0.80	-9.33	-0.60	-5.45	-1.11	-8.10
Kerela	-2.18	-7.59	-2.43	-5.57	-2.12	-5.42
Madhya Pradesh	-0.38	-5.53	-0.35	-3.76	-0.48	-4.70
Maharashtra	-0.62	-5.62	-0.79	-4.67	-0.59	-3.99
Orissa	-0.92	-7.74	-0.77	-5.11	-1.27	-6.48
Punjab	-0.43	-1.64	-0.75	-1.66	-0.46	-1.22
Rajasthan	-0.71	-6.86	-0.60	-4.43	-0.96	-5.82
Tamil Nadu	-0.84	-9.43	-0.83	-6.81	-0.97	-7.39
West Bengal	-0.61	-3.86	-0.66	-3.13	-0.62	-2.59
- Log likelihood	14022.55		7761.41		6315.63	
Number of individuals	15734		8038		7696	

<b>Table 9: Parameter estimates of <i>before-after</i> estimation of impact of affirmative action policy on OBC child mortality hazard with more flexible time trend of degree three</b>						
Variable	Full Sample		Male children		Female children	
	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.
<i>Child specific characteristics:</i>						
Female child	-0.33	-8.19				
Multiple birth	1.44	9.29	1.34	6.37	1.50	5.68
Mother works	-0.10	-2.21	-0.11	-1.78	-0.11	-1.71
Urban area of residence	-0.06	-1.08	-0.05	-0.67	-0.10	-1.24
<i>Mother's age at child birth, reference category '15-20 years':</i>						
10-14 years	0.39	4.28	0.35	2.90	0.43	3.05
21-25 years	-0.27	-5.32	-0.23	-3.32	-0.33	-4.23
> 25 years	-0.46	-4.06	-0.37	-2.58	-0.54	-3.02
<i>Highest education of mother, reference category 'primary education':</i>						
No education	-0.30	-5.29	-0.28	-3.74	-0.38	-4.52
Secondary education	-0.40	-5.59	-0.33	-3.34	-0.52	-4.80
Higher education	-0.51	-2.86	-0.37	-1.69	-0.68	-2.19
<i>Highest education of father, reference category 'primary education':</i>						
No education	-0.25	-4.36	-0.26	-3.42	-0.28	-3.25
Secondary education	-0.18	-6.67	-0.19	-4.99	-0.20	-4.95
Higher education	-0.29	-2.75	-0.18	-1.37	-0.52	-3.04
<i>Wealth index, reference category 'poorer':</i>						
Poorest	-0.20	-3.39	-0.17	-2.17	-0.26	-2.94
Middle	-0.35	-5.87	-0.43	-5.36	-0.29	-3.23
Richer	-0.55	-7.87	-0.60	-6.43	-0.50	-4.69
Richest	-0.70	-7.31	-0.76	-5.67	-0.66	-4.61
<i>Contraception, reference category 'no method':</i>						
Folkloric method	-0.48	-1.59	-0.88	-2.00	-0.12	-0.27
Traditional method	-0.39	-4.75	-0.44	-3.93	-0.36	-2.88
Modern method	-0.67	-14.54	-0.80	-12.69	-0.53	-7.57
<i>Final say on mother's health, reference category 'mother and somebody else':</i>						
Mother alone	-0.19	-3.60	-0.18	-2.64	-0.21	-2.72
Somebody else alone	-0.16	-3.26	-0.18	-2.80	-0.14	-1.84
<i>Usual treatment center, reference category 'government health center':</i>						
Private health facility	-0.24	-5.11	-0.22	-3.45	-0.31	-4.38
Other facility	-0.39	-4.50	-0.39	-3.29	-0.48	-3.63
<i>Religion, reference category 'Hindu':</i>						
Muslim	-0.32	-5.13	-0.27	-3.33	-0.38	-3.86
Christian	-0.04	-0.19	-0.41	-1.36	0.43	1.68
Others	-0.51	-1.83	-0.27	-0.66	-1.06	-2.34
<i>Season of birth of child, reference category 'spring':</i>						
Summer	-0.27	-5.62	-0.29	-4.39	-0.27	-3.70
Winter	-0.30	-5.69	-0.29	-3.98	-0.34	-4.14

Table 9 (contd.):						
Variable	Full Sample		Male children		Female children	
	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.
Business cycle conditions in current and preceeding years of life:						
Trend (log annual real per capita NSDP)	0.00	-0.26	0.00	0.30	-0.01	-0.64
Weibull baseline coefficient:						
$\rho_0$	-1.14	-56.64	-1.15	-42.75	-1.13	-37.19
Time trend:						
$\eta_1$	-0.38	-7.14	-0.39	-5.55	-0.39	-4.71
$\eta_2$	0.38	6.44	0.37	4.76	0.48	5.32
$\eta_3$	-0.34	-7.90	-0.35	-6.13	-0.38	-5.89
Before-after estimate of impact of affirmative action on OBC child mortality hazard:						
Affirmative action	-0.50	-6.56	-0.52	-4.95	-0.63	-5.46
State dummies, reference category 'Uttar Pradesh':						
Andra Pradesh	-0.50	-5.57	-0.40	-3.41	-0.67	-4.76
Assam	-0.84	-7.84	-0.81	-5.91	-1.10	-6.17
Bihar	-0.46	-6.20	-0.59	-5.68	-0.35	-3.31
Gujarat	-0.19	-1.83	-0.04	-0.32	-0.42	-2.55
Haryana	-0.73	-3.95	-1.01	-3.43	-0.52	-2.18
Karnataka	-0.76	-8.75	-0.56	-5.03	-1.06	-7.62
Kerela	-2.12	-7.35	-2.35	-5.35	-2.09	-5.33
Madhya Pradesh	-0.33	-4.66	-0.30	-3.08	-0.41	-3.99
Maharashtra	-0.57	-5.12	-0.73	-4.31	-0.53	-3.57
Orissa	-0.81	-6.73	-0.66	-4.31	-1.14	-5.73
Punjab	-0.43	-1.61	-0.75	-1.63	-0.44	-1.17
Rajasthan	-0.64	-6.19	-0.53	-3.87	-0.88	-5.32
Tamil Nadu	-0.75	-8.40	-0.74	-6.06	-0.86	-6.47
West Bengal	-0.69	-4.38	-0.74	-3.58	-0.70	-2.92
- Log likelihood	13984.72		7737.76		6294.42	
Number of individuals	15734		8038		7696	

<b>Table 10: Parameter estimates of <i>before-after estimation</i> with both slope and level effect of affirmative action policy on OBC child mortality hazard</b>						
Variable	Full Sample		Male children		Female children	
	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.
<i>Child specific characteristics:</i>						
Female child	-0.35	-8.66				
Multiple birth	1.40	9.48	1.29	6.39	1.49	5.73
Mother works	-0.12	-2.66	-0.13	-2.20	-0.13	-1.97
Urban area of residence	-0.07	-1.21	-0.06	-0.86	-0.10	-1.23
<i>Mother's age at child birth, reference category '15-20 years':</i>						
10-14 years	0.39	4.30	0.35	2.90	0.43	3.12
21-25 years	-0.28	-5.58	-0.24	-3.48	-0.35	-4.52
> 25 years	-0.47	-4.14	-0.38	-2.65	-0.56	-3.10
<i>Highest education of mother, reference category 'primary education':</i>						
No education	-0.35	-6.35	-0.34	-4.56	-0.44	-5.38
Secondary education	-0.43	-6.01	-0.36	-3.68	-0.55	-5.12
Higher education	-0.51	-2.87	-0.38	-1.71	-0.68	-2.20
<i>Highest education of father, reference category 'primary education':</i>						
No education	-0.28	-4.88	-0.29	-3.79	-0.32	-3.73
Secondary education	-0.21	-7.56	-0.21	-5.64	-0.23	-5.69
Higher education	-0.34	-3.20	-0.23	-1.72	-0.58	-3.39
<i>Wealth index, reference category 'poorer':</i>						
Poorest	-0.23	-3.89	-0.20	-2.62	-0.29	-3.26
Middle	-0.37	-6.31	-0.45	-5.72	-0.32	-3.59
Richer	-0.57	-8.24	-0.62	-6.65	-0.54	-5.08
Richest	-0.72	-7.57	-0.77	-5.82	-0.69	-4.89
<i>Contraception, reference category 'no method':</i>						
Folkloric method	-0.50	-1.67	-0.92	-2.05	-0.13	-0.31
Traditional method	-0.42	-5.12	-0.47	-4.16	-0.40	-3.27
Modern method	-0.70	-15.22	-0.82	-13.25	-0.55	-8.00
<i>Final say on mother's health, reference category 'mother and somebody else':</i>						
Mother alone	-0.21	-4.12	-0.21	-3.06	-0.24	-3.12
Somebody else alone	-0.18	-3.71	-0.20	-3.20	-0.15	-2.07
<i>Usual treatment center, reference category 'government health center':</i>						
Private health facility	-0.28	-5.95	-0.26	-4.08	-0.36	-5.07
Other facility	-0.43	-4.92	-0.42	-3.61	-0.52	-3.96
<i>Religion, reference category 'Hindu':</i>						
Muslim	-0.33	-5.32	-0.29	-3.48	-0.39	-4.00
Christian	-0.01	-0.05	-0.37	-1.24	0.46	1.85
Others	-0.53	-1.90	-0.29	-0.70	-1.08	-2.37
<i>Season of birth of child, reference category 'spring':</i>						
Summer	-0.30	-6.32	-0.32	-4.92	-0.31	-4.28
Winter	-0.34	-6.47	-0.32	-4.57	-0.38	-4.73

Table 10 (contd.):						
Variable	Full Sample		Male children		Female children	
	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.
Business cycle conditions in current and preceeding years of life:						
Trend (log annual real per capita NSDP)	0.00	-0.15	0.00	0.39	-0.01	-0.56
Weibull baseline coefficients:						
$\rho_0$	-1.28	-44.24	-1.30	-33.43	-1.29	-29.09
$\rho_1$	0.23	5.86	0.24	4.73	0.26	4.49
Time trend:						
$\eta_1$	-0.19	-4.08	-0.20	-3.16	-0.17	-2.31
$\eta_2$	-0.03	-0.95	-0.05	-1.23	0.01	0.19
Before-after estimate of impact of affirmative action on OBC child mortality hazard:						
Affirmative action	-0.39	-5.03	-0.40	-3.86	-0.52	-4.41
State dummies, reference category 'Uttar Pradesh':						
Andra Pradesh	-0.53	-5.92	-0.44	-3.71	-0.69	-4.95
Assam	-0.87	-8.07	-0.84	-6.12	-1.13	-6.32
Bihar	-0.49	-6.68	-0.63	-6.06	-0.38	-3.66
Gujarat	-0.21	-2.06	-0.07	-0.55	-0.43	-2.65
Haryana	-0.77	-4.20	-1.05	-3.60	-0.57	-2.42
Karnataka	-0.80	-9.24	-0.60	-5.38	-1.10	-8.01
Kerela	-2.18	-7.57	-2.43	-5.54	-2.13	-5.45
Madhya Pradesh	-0.36	-5.24	-0.34	-3.54	-0.46	-4.46
Maharashtra	-0.60	-5.49	-0.78	-4.58	-0.57	-3.86
Orissa	-0.89	-7.48	-0.74	-4.85	-1.24	-6.33
Punjab	-0.45	-1.69	-0.77	-1.69	-0.48	-1.26
Rajasthan	-0.69	-6.67	-0.58	-4.28	-0.94	-5.67
Tamil Nadu	-0.81	-9.14	-0.80	-6.60	-0.94	-7.12
West Bengal	-0.68	-4.25	-0.73	-3.47	-0.69	-2.88
- Log likelihood	14008.71		7752.35		6307.42	
Number of individuals	15734		8038		7696	



<b>Table 11: Parameter estimates of <i>before-after estimation</i> of impact of affirmative action policy on OBC child mortality hazard with caste effects interacted with urban/rural area of residence</b>						
Variable	Full Sample		Male children		Female children	
	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.
<i>Child specific characteristics:</i>						
Female child	-0.35	-8.75				
Multiple birth	1.40	9.54	1.29	6.40	1.50	5.90
Mother works	-0.12	-2.73	-0.14	-2.31	-0.13	-1.96
<i>Mother's age at child birth, reference category '15-20 years':</i>						
10-14 years	0.39	4.29	0.34	2.87	0.45	3.24
21-25 years	-0.29	-5.74	-0.25	-3.62	-0.36	-4.62
> 25 years	-0.48	-4.24	-0.39	-2.70	-0.57	-3.20
<i>Highest education of mother, reference category 'primary education':</i>						
No education	-0.36	-6.64	-0.35	-4.85	-0.45	-5.59
Secondary education	-0.45	-6.25	-0.38	-3.88	-0.57	-5.36
Higher education	-0.54	-3.05	-0.40	-1.83	-0.73	-2.37
<i>Highest education of father, reference category 'primary education':</i>						
No education	-0.28	-4.99	-0.30	-3.91	-0.33	-3.85
Secondary education	-0.21	-7.73	-0.21	-5.82	-0.23	-5.80
Higher education	-0.34	-3.26	-0.24	-1.79	-0.58	-3.42
<i>Wealth index, reference category 'poorer':</i>						
Poorest	-0.23	-3.95	-0.21	-2.73	-0.28	-3.19
Middle	-0.38	-6.43	-0.46	-5.87	-0.32	-3.61
Richer	-0.57	-8.35	-0.63	-6.77	-0.54	-5.12
Richest	-0.72	-7.55	-0.77	-5.86	-0.67	-4.77
<i>Contraception, reference category 'no method':</i>						
Folkloric method	-0.48	-1.63	-0.91	-2.03	-0.09	-0.22
Traditional method	-0.43	-5.20	-0.47	-4.23	-0.41	-3.36
Modern method	-0.69	-15.20	-0.82	-13.25	-0.55	-8.00
<i>Final say on mother's health, reference category 'mother and somebody else':</i>						
Mother alone	-0.21	-4.20	-0.22	-3.19	-0.24	-3.09
Somebody else alone	-0.18	-3.80	-0.21	-3.36	-0.15	-2.06
<i>Usual treatment center, reference category 'government health center':</i>						
Private health facility	-0.29	-6.17	-0.27	-4.29	-0.36	-5.20
Other facility	-0.43	-5.00	-0.43	-3.70	-0.53	-4.02
<i>Religion, reference category 'Hindu':</i>						
Muslim	-0.33	-5.26	-0.28	-3.39	-0.39	-3.99
Christian	0.00	0.01	-0.34	-1.17	0.47	1.86
Others	-0.53	-1.94	-0.30	-0.72	-1.09	-2.40
<i>Season of birth of child, reference category 'spring':</i>						
Summer	-0.31	-6.48	-0.33	-5.05	-0.32	-4.47
Winter	-0.35	-6.66	-0.33	-4.70	-0.40	-4.98

Table 11 (contd.):						
Variable	Full Sample		Male children		Female children	
	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.
Business cycle conditions in current and preceeding years of life:						
Trend (log annual real per capita NSDP)	0.00	-0.13	0.00	0.39	-0.01	-0.52
Weibull baseline coefficients:						
$\rho_0$	-1.18	-58.63	-1.19	-44.25	-1.17	-38.66
Time trend:						
$\eta_1$	-0.18	-3.87	-0.18	-2.89	-0.16	-2.29
$\eta_2$	-0.01	-0.33	-0.03	-0.76	0.04	0.75
Caste effects:						
<i>OBC * (1994 – 2002)</i>	-0.26	-3.76	-0.22	-2.36	-0.41	-3.95
<i>OBC * urban</i>	-0.23	-3.17	-0.15	-1.62	-0.40	-3.55
<i>OBC * (1994 – 2002) * urban</i>	0.32	3.52	0.16	1.30	0.58	4.23
Before-after estimate of impact of affirmative action on OBC child mortality hazard:						
Affirmative action, Urban areas	0.06	0.61	-0.07	-0.52	0.17	1.16
Affirmative action, Rural areas	-0.26	-3.76	-0.22	-2.36	-0.41	-3.95
State dummies, reference category 'Uttar Pradesh':						
Andra Pradesh	-0.54	-6.08	-0.45	-3.88	-0.70	-5.00
Assam	-0.84	-7.83	-0.81	-5.91	-1.08	-6.13
Bihar	-0.49	-6.76	-0.64	-6.18	-0.37	-3.59
Gujarat	-0.22	-2.15	-0.08	-0.66	-0.44	-2.71
Haryana	-0.78	-4.26	-1.06	-3.66	-0.58	-2.44
Karnataka	-0.80	-9.34	-0.60	-5.47	-1.09	-7.99
Kerela	-2.18	-7.60	-2.44	-5.57	-2.13	-5.45
Madhya Pradesh	-0.38	-5.47	-0.35	-3.73	-0.47	-4.61
Maharashtra	-0.61	-5.56	-0.79	-4.63	-0.57	-3.89
Orissa	-0.91	-7.68	-0.77	-5.09	-1.25	-6.37
Punjab	-0.44	-1.70	-0.77	-1.69	-0.48	-1.26
Rajasthan	-0.71	-6.84	-0.60	-4.42	-0.96	-5.81
Tamil Nadu	-0.83	-9.32	-0.82	-6.76	-0.95	-7.22
West Bengal	-0.64	-3.99	-0.68	-3.20	-0.65	-2.71
- Log likelihood	14015.25		7760.22		6305.19	
Number of individuals	15734		8038		7696	

Table 12: Parameter estimates of difference-in-difference estimation of impact of affirmative action policy on OBC child mortality with ST as control caste						
Variable	Full Sample		Male children		Female children	
	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.
Child specific characteristics:						
Female child	-0.34	-9.34				
Multiple birth	1.40	9.87	1.31	6.68	1.50	6.47
Mother works	-0.13	-3.25	-0.13	-2.49	-0.16	-2.62
Urban area of residence	-0.03	-0.64	-0.02	-0.31	-0.07	-0.83
Mother's age at child birth, reference category '15-20 years':						
10-14 years	0.43	5.45	0.37	3.51	0.52	4.39
21-25 years	-0.25	-5.44	-0.21	-3.38	-0.31	-4.37
> 25 years	-0.45	-4.39	-0.32	-2.44	-0.65	-3.82
Highest education of mother, reference category 'primary education':						
No education	-0.31	-6.17	-0.30	-4.35	-0.40	-5.34
Secondary education	-0.40	-5.84	-0.35	-3.73	-0.51	-5.04
Higher education	-0.49	-2.82	-0.38	-1.74	-0.51	-1.77
Highest education of father, reference category 'primary education':						
No education	-0.23	-4.53	-0.24	-3.49	-0.25	-3.29
Secondary education	-0.18	-7.12	-0.19	-5.64	-0.19	-4.91
Higher education	-0.35	-3.50	-0.31	-2.38	-0.46	-2.85
Wealth index, reference category 'poorer':						
Poorest	-0.24	-4.76	-0.23	-3.43	-0.30	-3.87
Middle	-0.28	-5.05	-0.34	-4.56	-0.22	-2.60
Richer	-0.52	-7.86	-0.52	-5.85	-0.49	-4.86
Richest	-0.67	-7.30	-0.67	-5.30	-0.68	-5.00
Contraception, reference category 'no method':						
Folkloric method	-0.51	-2.20	-0.93	-2.41	-0.05	-0.18
Traditional method	-0.44	-5.70	-0.47	-4.53	-0.46	-3.85
Modern method	-0.68	-16.33	-0.81	-14.27	-0.53	-8.55
Final say on mother's health, reference category 'mother and somebody else':						
Mother alone	-0.17	-3.56	-0.17	-2.74	-0.18	-2.62
Somebody else alone	-0.12	-2.90	-0.14	-2.43	-0.11	-1.75
Usual treatment center, reference category 'government health center':						
Private health facility	-0.19	-4.61	-0.18	-3.17	-0.21	-3.35
Other facility	-0.31	-4.06	-0.25	-2.54	-0.47	-3.77
Religion, reference category 'Hindu':						
Muslim	-0.30	-5.00	-0.29	-3.59	-0.37	-3.88
Christian	-0.29	-1.87	-0.54	-2.33	-0.10	-0.48
Others	-0.54	-3.15	-0.31	-1.40	-0.83	-2.88
Season of birth of child, reference category 'spring':						
Summer	-0.25	-5.61	-0.24	-4.04	-0.29	-4.34
Winter	-0.27	-5.73	-0.27	-4.15	-0.34	-4.62

<b>Table 12</b> (contd.):						
Variable	Full Sample		Male children		Female children	
	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.
<i>Business cycle conditions in current and preceding years of life:</i>						
Trend (log annual real per capita NSDP)	0.00	-0.12	0.00	-0.18	0.00	0.01
<i>Weibull baseline coefficients:</i>						
$\rho_0$	-1.14	-64.53	-1.15	-49.11	-1.13	-42.19
<i>Time trend:</i>						
$\eta_1$	-0.30	-7.74	-0.29	-5.80	-0.34	-5.75
$\eta_2$	-0.01	-0.32	-0.04	-1.15	0.04	0.95
<i>Caste effects:</i>						
OBC	-0.52	-9.37	-0.52	-7.09	-0.62	-7.36
OBC * (1994 – 2002)	0.16	2.70	0.16	2.03	0.20	2.24
<i>Diff-in-diff estimate of impact of affirmative action on OBC child mortality hazard:</i>						
Affirmative action	0.16	2.70	0.16	2.03	0.20	2.24
<i>State dummies, reference category 'Uttar Pradesh':</i>						
Andra Pradesh	-0.60	-7.07	-0.53	-4.74	-0.84	-6.36
Assam	-1.02	-10.30	-0.96	-7.71	-1.23	-7.40
Bihar	-0.50	-7.35	-0.60	-6.31	-0.46	-4.68
Gujarat	-0.45	-4.96	-0.36	-3.06	-0.61	-4.39
Haryana	-0.79	-4.30	-1.09	-3.71	-0.57	-2.43
Karnataka	-0.84	-10.41	-0.69	-6.56	-1.18	-9.00
Kerela	-2.14	-8.12	-2.53	-5.86	-1.93	-5.63
Madhya Pradesh	-0.48	-8.12	-0.47	-5.82	-0.58	-6.66
Maharashtra	-0.87	-8.94	-1.12	-7.30	-0.76	-6.00
Orissa	-0.82	-9.45	-0.69	-6.19	-1.14	-7.91
Punjab	-0.69	-2.67	-0.91	-2.34	-0.79	-1.95
Rajasthan	-0.82	-9.05	-0.81	-6.72	-0.92	-6.53
Tamil Nadu	-0.77	-8.80	-0.76	-6.36	-0.85	-6.59
West Bengal	-0.83	-5.90	-0.77	-4.24	-1.08	-4.61
- Log likelihood	17362.02		9608.03		7755.19	
Number of individuals	18620		9522		9098	