Missing Women and India's Religious Demography*

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Abstract

The interaction between religion and fertility is the subject of intense debate in developing countries. This paper puts forward a new theory to provide an explanation for larger Muslim, relative to Hindu fertility, in the context of India. It does so by integrating the literature on missing women with that on religious differences in fertility. Formally, the paper takes the notion of 'son preference' and the complementary concept of 'daughter aversion', linking them to religious differences in fertility. Just as sons may bring 'benefits' to their parents, daughters may impose 'costs'. Consequently, the desire for sons may increase family size while the fear of daughters limits it. These two countervailing forces may act so as to determine equilibrium family size and composition. Econometric evidence is presented to test the theory using Poisson regression models estimated on a range of demographic variables relevant to this issue - the number of living children, the number of infant deaths and the sex ratio - estimated on data from a nationally-representative sample of Indian women who had adopted a terminal method of contraception. The analysis concludes that higher Muslim fertility in India may be related to significantly lower levels of daughter aversion among this community, bringing in to focus the interactions between religion, gender bias, and fertility behaviour.

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1 Introduction

There are two demographic features about India that receive particular attention. The first is gender bias - the small number of females compared to males [Visaria 1971; Chen 1982; Sen 1992; Kishor 1993; Dyson and Moore 1983]. The number of females per 1000 males is 933 in India, as reported in the 2001 Census, compared to a figure of 1050 for Europe and North America and 1022 for sub-Saharan Africa [Sen 2003]. Drèze and Sen [1996] have termed the low sex ratio in India as a 'missing women' phenomenon: on the basis of sub-Saharan ratios, the number of missing women in India is estimated to be between 35 and 37 million [Drèze and Sen 1996; Klasen, 1994; Agnihotri 2000; Sen 2003; Oster 2005; Klasen 2006].

The second feature is that the fertility rate of Muslim women is considerably higher than that for Hindu women (Dharmalingam and Morgan 2004; Basu 1997; Jeffery and Jeffery 1997). The latest findings of the National Family Health Survey (NFHS), conducted in 1998-99, show that for India as a whole, the Total Fertility Rate (TFR) was 2.8 for Hindus and 3.6 for Muslims [1][International Institute for Population Sciences and ORC Macro International, 2000]. At its most shrill, the higher fertility of Muslim women is blamed on Indian Muslims for obeying the tenets of Islam - and also being driven by their ambition to 'outnumber' Hindus - in rejecting family planning and embracing polygyny. Indeed in the last few years, one of the most serious political controversies in India has been the embattled row over the 2001 Indian Census religion figures, recently released, and the supposed extraordinary growth of 36% in Muslim fertility during the decade 1991-2001. Although the validity of these figures has come under intense academic scrutiny, there are politicians, holy men, the Muslim Personal Law Board, and census officials who have all participated in the discussion, expressing their views on the Census numbers. Some leaders have even gone so far as to say, 'It is obvious that Hindus are becoming more and more conscious of the importance of small families. This is going to tilt the population balance in favour of Muslims who are merrily producing more and more children'[2] In the face of such sentiments, economists too are drawn towards understanding the balance between these two vital factors for India's development – religion and reproduction.

This paper joins together these two demographic features about India - the higher fertility rate of Muslims and gender bias – to provide an alternative explanation for higher Muslim fertility in India. In the literature, analysis and debate of these two issues usually proceed independently of each other. The adverse sex ratio is discussed in the context of the preference that many South and East Asian families have for sons over daughters ('son preference') and related issues that concern the marriage market, fertility, and dowry [Edlund 1999; Zhang and Chan 1999; Bhat and Zavier 2003; Sen, 2001; Bloch and Rao 2002; Botticini and Siow 2003; Jacoby and Mansuri 2006]. On the other hand, the

[1] However, there were wide regional differences: for example in the state of Andhra Pradesh, the TFR for Muslims was 2.5 which was not significantly different from the Hindu TFR of 2.2.

[2] As cited in The Telegraph newspaper, 14 September 2004.

Muslim fertility issue is discussed usually in terms of the number of children to Muslim families with emphasis on the pronatalist tendencies within Islam, without any reference to the gender of the children, with the focus of this discussion also being on the low rate of contraceptive use among Muslim women.

Against this background, the first strand of this paper is to extend the notion of 'son preference' to the complementary concept of 'daughter aversion' in order to provide an explanation for larger Muslim families. This concept is developed more fully later in this paper. Suffice it to say, here, that one way to think about this is that just as sons bring 'benefits' to their parents, daughters impose 'costs'; consequently, complementing a desire *to have* sons is a desire *not to have* daughters. We argue that the desire for sons tends to increase family size while the fear of daughters limits it. A formal model, in which these two countervailing forces act so as to determine equilibrium family size and composition, is developed in section 2. From this we argue that a reason why Muslims have larger families than Hindus is that, firstly, they may not desire sons as much as Hindus[3] and, secondly, that they may be less apprehensive, compared to Hindus, of having daughters. In consequence, not only do Muslims have larger families than Hindus, but they also have relatively more daughters than sons.

We support this theoretical argument using quantitative evidence, based on data for 10,548 Indian women, who had completed their fertility by adopting a terminal method of contraception, and who might, therefore, be regarded as having attained their equilibrium family size and composition. Data on these women - of whom, 6,523 were non-Scheduled Caste Hindus, 549 were Muslim, and 3,476 were Scheduled Caste Hindus (or 'Dalits')[4] - were culled from a larger survey of 33,230 rural households - encompassing over 195,000 individuals - spread over 1,765 villages, in 195 districts, in 16 states of India. This survey - commissioned by the Indian Planning Commission and funded by a consortium of United Nations agencies – was carried out by the National Council of Applied Economic Research (NCAER) over January-June 1994 and most of the data from the survey pertain to the year prior to the survey, i.e. to 1993-94[5]. Using these data, this study estimates Poisson regression models for the number of living sons and daughters to the women, conditional upon the values of a number of determining variables, and estimates the degrees of 'son preference' and 'daughter aversion' of Hindu and Muslim families. These estimates, which show a much lower degree of 'daughter aversion' for Muslims than for Hindus, then provide a possible explanation for larger Muslim families. This analysis is supported also by more exhaustive econometric analysis of the sex ratio in these sub-populations, and the demand for contraception, by contraceptive method, adopted by these religious groups.

[3] In this context, Bhat and Zavier (2003) have commented that Hindus show greater son-preference than Muslims.

[4] Persons belonging to the castes and tribes – also known as Scheduled Castes and Scheduled Tribes - recognised by the Indian Constitution in 1947 as deserving special recognition in respect of education, employment and political representation.

[5] Details of this survey - hereafter referred to as the NCAER Survey - are to be found in Shariff (1999).

It is reasonable to suppose that if Muslim parents are less averse to daughters than Hindus, they would take better care of them than Hindus. In particular, we would expect female infant mortality rates to be lower for Muslim, than for Hindu, families. As we have argued elsewhere, a demographic feature of India that has drawn very little academic or popular comment is that infant mortality among Muslims, at 59 per 1000, is much lower than that among Hindus, at 77 per 1000 [Borooah and Iyer 2005a]. Similarly child mortality, which is 83 per 1000 for Muslims, is substantially lower than child mortality among Hindus, at 107 per 1000 [IIPS and ORC Macro International 2000]. Simply looking at these raw figures suggests that religious differentials in infant mortality need to be examined more closely and that it is possible that Muslim parents, on average, are looking after their offspring better than their Hindu counterparts. This proposition is explored further in this paper by estimating Poisson regression models for infant mortality, with separate equations for 'explaining' male and female infant deaths, and drawing attention to the importance of the religious and caste background of parents - even after controlling for non-religious factors - in determining these numbers. On the basis of all of this evidence, we argue that higher Muslim fertility in India may well be a consequence of significantly lower levels of daughter aversion among this community. Consequently, we argue that the theory and findings presented in this paper have significant implications for the academic discourse on religion and economic demography, both in India and elsewhere.

This paper proceeds as follows: Section 2 presents a model of son preference, daughter aversion and the demand for children. Section 3 presents an overview of India's religious demography. Section 4 outlines the key characteristics of the data. Section 5 presents the main econometric estimations and results from the Poisson regression models explaining the number of living sons and daughters, infant mortality by gender, and an analysis of the sex ratio. Section 6 presents the analysis of the demand for contraception. Section 7 concludes.

2 Son Preference, Daughter Aversion and the Demand for Children

Let S, D and $N = S + D$ represent, respectively, the number of sons, daughters and children to a family. It is assumed that the family gets positive utility from sons and negative utility from daughters – hereafter, the positive utility associated with sons is referred to as the 'benefits' from sons and the negative utility associated with daughters is referred to as the 'cost' of daughters. Let $B(S)$and $C(D)$ represent the benefit and cost functions associated with, respectively, S sons and D daughters where:

(1) $\partial B/\partial S > 0, \partial C/\partial D > 0$

$\partial^2 B/\partial^2 S < 0, \partial^2 C/\partial D^2 > 0$

A family with S sons and D daughters will then decide in favour of (or against) having another child if the marginal expected utility (EU) associated with another child is positive (or negative) where:

$$(2) \qquad EU = \pi B'(S) + (1 - \pi)C'(D)$$

If it is assumed, for the moment, that π, the probability of having a son, is a half, then the family will decide to have another child if, and only if, $B'(S) > C'(D)$ - the marginal benefit of a son outweighs the marginal cost of a daughter - and will decide against another child if, and only if, $B'(S) < C'(D)$- the marginal benefit of a son is outweighed by the marginal cost of a daughter. An equilibrium number of children is one to which the family does not wish to add.

Figure 1 illustrates the falling marginal benefit (MB) curve for sons and the rising marginal cost (MC) curve for daughters. A horizontal line, across the diagram, represents an equilibrium number of sons and daughters at the points where it, respectively, cuts the MB and MC curves: at these points, the marginal benefit of a son is exactly outweighed by the marginal cost of a daughter. From the set of equilibrium son-daughter configurations two special cases may be distinguished. First, the point X in the diagram represents a no son equilibrium: a family with no sons and D_X daughters will not want to increase its family size, in the hope of a son, because the marginal cost, in the event of a daughter, would exceed the marginal benefit from a son. Second, the point Z in the diagram represents a parity equilibrium: a family with an equal number of sons and daughters ($S_Z = D_Z$) will not want to increase its family size. By contrast, all other equilibrium points - a family of S_Y sons and D_Y daughters ($S_Y < D_Y$), or S_W sons and D_W daughters ($S_W > D_W$) - represent non parity equilibria.

Two concepts may be defined: son preference and daughter aversion. In Figure 2, the marginal cost curve OH represents a higher degree of 'daughter aversion' than the curve OM since, for a given number of daughters, the marginal cost of daughters is higher for OH than for OM. Then the 'no son equilibrium' will be greater with a lower degree of daughter aversion: $D_M > D_H$. Equally, the parity equilibrium will be greater with a lower degree of daughter aversion: $D^*_M > D^*_H$. Lastly, with a given number of sons in the family, S^{**}, the equilibrium number of daughters will be greater with a lower degree of daughter aversion: $D^{**}_M > D^{**}_H$

In Figure 3, the marginal benefit curve BH represents a higher degree of 'son preference' than the curve BM since, for a given number of sons, the marginal benefit of sons is higher for OH than for OM. The 'no son equilibrium' is the same with a lower degree of son preference: $D_M = D_H$. However, the parity equilibrium will be greater with a higher degree of son preference: $S^*_H > S^*_M$. Lastly, with a given number of daughters in the family, D^{**}, the equilibrium number of sons will be greater with a higher degree of son preference: $S^{**}_H > S^{**}_M$.

Suppose now that there are two groups, Hindus and Muslims, such that Muslims have the same degree of son preference as Hindus, but a lower degree of daughter aversion. Then by Figure 2, Muslims will always have an equilibrium family size larger than that of Hindus. On the other hand, if Muslims have the same degree of daughter aversion as Hindus, but a lower degree of son preference then, by Figure 3, Muslims will always have an equilibrium family size smaller than that of Hindus.

It is possible to see this more clearly in Figure 4. The line HH' in Figure 4 represents the equilibrium locus: all points on HH' represent son-daughter combinations at which the family is in equilibrium (in the sense of not seeking an increase in its size). The equilibrium locus slopes downwards reflecting the fact that, as the number of sons increases, the marginal utility of sons falls; to be in equilibrium the marginal cost of daughters must also fall for which a smaller number of daughters is required. The 'no-son equilibrium' is attained with OH daughters and the 'parity equilibrium' is attained at X where the equilibrium locus intersects the 45^0 line through the origin. A 'no-daughter' equilibrium is attained with OH' sons: the family does not seek an increase in its size even though it has only sons because the marginal utility of sons has fallen to zero.

Suppose HH' represents the equilibrium locus for Hindus. Suppose also that Muslims have the same degree of 'son preference', but a lower degree of 'daughter aversion', than Hindus. Then, as Figure 2 shows, Muslims will have a larger no-son, and a larger parity, equilibrium than Hindus; but, because Muslims have the same degree of son preference, they will have the same no-daughter equilibrium as Hindus. Consequently, the Muslim equilibrium locus will be represented by MH' in Figure 4 and, in equilibrium, Muslims will have larger families than Hindus.

On the other hand, suppose that Muslims have the same degree of 'daughter aversion', but a lower degree of 'son preference', than Hindus. Then, as Figure 3 shows, Muslims will have a smaller no-daughter, and a smaller parity, equilibrium than Hindus; but, because Muslims have the same degree of daughter aversion, they will have the same no-son equilibrium as Hindus. Consequently, the Muslim equilibrium locus will be represented by HM' in Figure 4 and, in equilibrium, Muslims will have smaller families than Hindus.

3 Overview of India's Religious Demography

India today has a total population of just over one billion people. In terms of distribution, Hindus form over 80% of India's population with Muslims, at about 14.7% of the population, constituting the most significant 'minority' population of approximately 147 million people. Fertility rates between Hindus and Muslims differ in India. There is a difference of one child per woman on average, in the Total Fertility Rate (TFR) between Hindus and Muslims at the national level. The TFR for Muslims is 3.6, down from 4.4 in 1991; for Hindus it is 2.8, a decrease from 3.3 in 1991 [International Institute

for Population Sciences and ORC Macro International, 2000]. Age-specific fertility also shows that Muslims, compared to Hindus, Christians or, indeed, any other religious groups in India, are bearing larger numbers of children at earlier ages. Age-specific fertility rates for the major religious groups in India are calculated from data for 2000 provided by the National Council of Applied Economic Research, and are shown in Figure 5.

The existing literature has emphasised two main theories to 'explain' these religious differences in fertility.[6] First, the 'characteristics hypothesis' – the relative poverty and lower education levels of Muslims – which may explain the differences in fertility [Iyer 2002]. The alternative is the 'particularised theology hypothesis' - or the 'pure religion effect' - that the intellectual content of religion affects fertility: in Islam, via religious injunctions in favour of multiple wives, large numbers of children, and a ban on the use of contraception and abortion. In the case of Hinduism, the Mysore Population Study conducted in 1961, concluded that Hindu religious traditions in Indian society favoured having many offspring [United Nations 1961]. There is an existing literature, largely drawn from historical and theological sources, which illustrates how Islam and Hinduism matter for demography. These include, for Islam, the institutional requirements of the religion as specified in the *Sharia* or Islamic law which is derived from two main sources – the *Koran* and the *Sunnah*[7], as also the writings of the medieval theologian Al Ghazzali, often cited by Muslim clerics, who summarised Sunni and Shia positions on demography-related issues such as marriage and birth control (Al Ghazzali, 1909). In the case of Hinduism we consider religious texts such as *Vedas*, and *Upanishads* (Radhakrishnan 1923); epic poems such as the *Ramayana* and *Mahabharata* (Deshpande, 1978); social commentaries such as Kautilya's *Arthasastra* (Shamasastry 1951); and verse-poems in praise of Hindu goddesses such as the *Lalita-sahasranama* and the *Sri-sukta* (Suryanaraya Murthy, 2000) in the context of Indian demography (see Iyer 2002 for a more detailed discussion of this literature).

One of the key points which emerges from this literature is that the costs and benefits of sons compared to daughters may be different within Islam compared to Hinduism. The distinct bias towards males compared to females in both the Islamic and the Hindu scriptures has been frequently commented upon, but there are certain important differences between them. For example, in the *Koran*, all Muslim males are encouraged to marry; and the universal remarriage of widowed and divorced women is also highly encouraged [Qureshi 1980: 564; Youssef 1978: 88, Coulson and Hinchcliffe 1978: 37-38]. An Islamic marriage or the *nikah*, is defined not really as a sacrament, but more as a civil contract, which has as its object the procreation of children[8][Azim 1997]. So a Muslim

[6] It is acknowledged that there are other hypotheses that also explain religious differentials in fertility such as the 'minority group status' hypothesis, which is not discussed explicitly here. For a detailed discussion of this hypothesis, see Goldscheider and Uhlenberg (1969).

[7] These are the interpretations of the words of Mohammad and their application to various situations.

[8] For a Muslim marriage to be legally valid, it needs to meet four conditions: proposal by one party; acceptance by the other; the presence of a sufficient number of witnesses (two in Sunni law); and a formal expression of both the

marriage is essentially a contractual obligation. Parents and guardians exercise control over the selection of marriage partners, and a dower or 'bride price' is paid to the bride or her guardian [Youssef 1978, p.78]. In the specific context of India, this is important for Muslim families as the investments in daughters are frequently recoverable in the event of a divorce.

As in Islam, Hinduism also encourages all Hindus to enter married life. For example Shakuntala, a princess from Hindu mythology tells Dushyanta her beloved that 'when a husband and wife are carrying on smoothly, then only pleasure, prosperity and piety are possible' [Deshpande 1978: 91]. The theology of Hinduism also encourages the early marriage of women compared to men, and treats men and women differently.[9] The marriage of a daughter for Hindus is described as *kanyadaan* – this can be translated as the 'donation' of a daughter. And Hindus gain both religiously and socially from giving their daughters in marriage (Niraula and Morgan 1996). So the Hindu notion of a girl's marriage is essentially a 'donational' one. This is why although it is illegal, even today Hindu marriages are often accompanied by the giving and taking of dowries. The dowry operates as an economic compensation for the man's family for undertaking the marriage and for accepting the donation of the girl to his family [Rao, 1989]. In the event of a divorce, the dowry is usually not returned to the woman or her natal family. This important distinction in the 'contractual' versus the 'donational' notion of marriage in Islam compared to Hinduism implies that investments in daughters may be less recoverable for Hindus compared to Muslims. In turn, this might have very different implications for the relative costs and benefits of having sons and daughters. From a purely economic perspective, the net benefit of having daughters may be more 'costly' for Hindu than for Muslim parents in India.

A large empirical literature has examined gender differentials in marriage in India [Mukhopadhyay 2000; Kapadia 2000] and marriage-related issues such as dowry [Anderson 2003; Sen 1998; Deolalikar and Rao 1998], but there is less discussion of this issue in the context of religion. Gender biases have been investigated extensively [Kishor 1993; Krishnaraj, Sudarshan and Shariff 1998; Murthi, Guio and Dreze 1995; Bhat and Zavier, 2003], with particular emphasis on the unequal distribution of food and health-care allocations between sons and daughters in India. Many historians attribute these unequal distributions to the preference for sons compared to daughters in classical Hinduism. For example, in the Mahabharata, a Hindu husband has sanction to terminate a marriage if 'a wife... acts as she pleases, is sterile or *gives birth only to daughters* or whose children die young.' [emphasis added; Deshpande, 1978, p. 93].

proposal and the acceptance at the same meeting (Azim 1997).

[9] These differences in the textual theology of Islam and Hinduism on marriage need also to be evaluated in the context of the Child Marriage Restraint Act of 1978 which set the legal age at marriage for all Indian women and men at, respectively, 18 and 21 years. When this Act was proposed first in 1929, some Muslim representatives who debated it opposed the Act on the grounds that it was irrelevant, since child marriage had no sanction in Islam. Others argued that if Muslims practised child marriage it was because they were following the example of the Hindus. Ultimately everyone voted in favour of the Act, but the dynamics of the negotiation process provides interesting historical background to these issues (Minault 1998: pp. 302-303).

There is the widely documented emphasis in Hindu philosophy on the role for surviving sons: 'At the end of the (*Sraddha*) death ceremony the performer asks, "Let me, O fathers, have a hero for a son!"' [Radhakrishnan, 1927, pp. 59-60]. A practice that is related to this, and which might also contribute to son preference, is the practice of the eldest son lighting the funeral pyre for Hindu parents in order that they may secure a 'good rebirth' in the afterlife. This belief contributes directly towards a distinct preference for sons in Hindu society. But a more temporal motivation for sons is that in societies in which the provision of publicly-provided social security is absent, and private sources of security such as pensions are restricted to certain social classes, sons act as a vital source of security in old age. For Hindus, daughters are frequently not relied upon to provide old-age security as they are considered to 'belong' to the family that they marry into due to the practice of *kanyadaan* discussed above.

Son-preference has also been documented in Islamic society and this gives men a more prominent place than women within the family. Under Islamic law, sons are given twice as large an inheritance as daughters and a man's testimony in court is worth twice that of a woman [Coulson and Hinchcliffe 1978]. For instance, 'Quranic provisions concerning women's status and position were dissipated and largely lost over time. Islamic law has continued to reflect the patriarchal and patrilineal nature of a society based on the male agnatic tie. Within the scheme of family law which developed in this way, woman, whether as daughter, wife, or mother, occupied an inferior position' [Coulson and Hinchcliffe, 1978: 38]. According to Obermeyer [1992], women in Islamic societies, regardless of ethnic origin, have been restricted to a lifestyle that guaranteed preservation of family honour and prestige. Landes [1998] has also pointed out that gender discrimination, observed particularly in the Arab Muslim nations, restricts the opportunities of women [Landes, 1998: 412]. There is evidence of son-preference among Muslim families in India; however, son-preference may not be as unequivocal as it is with Hindus. For instance, early in the 20th century, Maulana Ashraf Ali Thanavi wrote a compendium of useful knowledge for women in which he condemned expressions that bless a Muslim woman by wishing her husband, brother, or children long life, or wishing for her many sons and grandsons[10][Minault 1998, p. 62]. More recently, some sociological evidence has gestured towards lower son preference among Muslim populations compared to Hindus in India. For example, in his study of 378 Muslim women and men in Mangalore, Azim found that over two-third of respondents in his sample did not prefer sons, over daughters [Azim 1997, p. 187]; moreover, a large proportion of those who did were from poor and illiterate households [Azim 1997: 189]. Other nationally representative data from the National Family Health Surveys of India also show that about one-third of Muslims do not prefer sons over daughters [Kishor 1993].

This also suggests that the relative importance of sons and daughters may stem not only from

[10]Thanavi believed that these characteristics were not sufficiently Islamic because to view women blessed in terms of their relation to men and sons devalues their relationship to God, and hence goes against the tenet that all are equal in his sight. (Minault 1998: 69).

theology, but also from the differential socio-economic circumstances of Hindus and Muslims [Iyer 2002; Dharmalingam and Morgan 2004]. For example, in India today, it seems important to have educated sons, but in order to get daughters married, it is equally important to have educated daughters. If the average levels of education among Muslim men are for example lower than among Hindu men, then there may be lower educational investments also required of Muslim women (Borooah and Iyer 2005b). A related issue is land ownership – there may be a greater desire on the part of Hindus to have sons in order to keep land within the patrilineal family line. It is documented that land ownership among Muslims is less than among Hindus [Shariff 1999]. Some of these socio-economic characteristics are taken into account in the analysis presented and discussed below.

In summary, for reasons that stem both from theological considerations, and from the socio-economic characteristics of religious groups, there may be important differences between Hindus and Muslims in the costs and benefits of having sons compared to daughters, and therefore some justification for why we might observe Hindus depicting higher daughter aversion compared to Muslims.

4 Data and Characteristics

In order to support this theoretical argument, we use quantitative evidence, based on data for 10,548 Indian women, who had completed their fertility by adopting a terminal method of contraception[11], and who might, therefore, be regarded as having attained their equilibrium family size and composition. Data on these women - of whom, 6,523 were non-Scheduled Caste Hindus, 549 were Muslim, and 3,476 were Scheduled Caste Hindus (or 'Dalits') - are culled from a larger survey of 33,230 rural households - encompassing over 195,000 individuals - spread over 1,765 villages, in 195 districts, in 16 states of India. This survey - commissioned by the Indian Planning Commission and funded by a consortium of United Nations agencies – was carried out by the National Council of Applied Economic Research (NCAER) over January-June 1994 and most of the data from the survey pertain to the year prior to the survey, i.e. to 1993-94. The salient features of these data are set out in this section. The data from the NCAER survey are organised as a number of reference files, with each file focusing on specific subgroups of individuals. However, the fact that in every file an individual is identified by a household number and, then, by an identity number within the household, means that the reference files can be joined to form larger files. So, for example, the fertility, infant mortality and contraceptive choice equations (presented below) were estimated on data from the 'individual' file which gave information on the 194,473 individuals in the sample. From this file, data were extracted for 10, 548 women on fertility-related variables and associated with this information was data

[11] In the context of India, the most common terminal method of contraception adopted is the tubal ligation for females, popularly referred to as the 'sterilization' operation. A majority of contraceptive adoption in India takes the form of female tubal ligation operations, primarily because they are provided widely by public sector health service providers.

on: the educational attainments and occupation of the women; the income and size of the household to which the woman belonged; the state, district and village in which she lived; her caste/tribe (scheduled or non-scheduled only); her religion and so forth. The 'village file' contained data relating to the existence of infrastructure in, and around, each of the 1,765 villages over which the survey was conducted. This file gave information as to whether *inter alia* a village had *anganwadi* schools (informal village schooling institutions), primary schools, middle schools and high schools and, if it did not, what was the nature of access to such institutions. It also contained information on the quality of roads, public transport, water supply availability, health-care infrastructure, financial and commercial facilities. The village file could be joined to the individual file so that for each individual there was information not just on individual, family and household circumstances but also on the quality of the educational facilities – and general infrastructure - in the village in which the individual lived.

The sample of individuals was distinguished by three mutually exclusive subgroups: Dalits[12]; Muslims; and Hindus. In effect, the Hindu/Muslim/Dalit distinction made in this paper is a distinction between: non-Dalit Hindus; Muslims; and Hindus from the Dalit community. These subgroups are, hereafter, referred to as 'communities'. Because of the small number of Christians and persons of other religions in the Survey, the analysis reported in this paper was confined to Hindus, Muslims and Dalits. The Survey contained information for each of sixteen states in India. In this study, the states were aggregated to form five regions: the *Central* region consisting of Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh; the *South* consisting of Andhra Pradesh, Karnataka, Kerala and Tamilnadu; the *West* consisting of Maharashtra and Gujarat; the *East* consisting of Assam, Bengal and Orissa; and the *North* consisting of Haryana, Himachal Pradesh and Punjab.

5 Evidence on Fertility, Infant Mortality, and the Sex Ratio

The 10,548 currently married women in the sample, who had completed their fertility by adopting a terminal method of contraception, were, in terms of family size and composition, in equilibrium. For such women, indexed $i = 1...10,548$, $S_i \geq 0$ and $D_i \geq 0$ represented their number of (living) sons and daughters. Tables 1 and 2 show, respectively, the number of living sons and daughters to these women: 4.6% of Hindu, compared to 5.1% of Muslim, women completed their fertility without having any sons. On the other hand, 19.6% of Hindu women, compared to 13.4% of Muslim, women completed their fertility without any daughters.

A plausible measure of the degree of 'son preference' is 1 – the proportion of women who completed

[12] The term 'Dalit' translates as 'the downtrodden', and refers specifically to India's Scheduled Castes and Sceduled Tribes - these are those castes and tribes recognised by the Indian Constitution as deserving special recognition in respect of education, job reservation in employment, and political representation.

their fertility without any sons and the corresponding measure of the degree of 'daughter aversion' is the proportion of women who completed their fertility without any daughters. On these measures, as Table 1 shows, the degree of son preference was lower for Muslims (0.949) than for Hindus (0.954): however, this difference was not statistically significant[13]. On the other hand, the degree of daughter aversion was greater for Hindus (0.196) than for Muslims (0.134) and this difference was statistically significant. Consequently, one may conclude from Table 1, that Muslims had statistically the same degree of son preference as Hindus but a significantly lower degree of daughter aversion. These facts are, as the preceding analysis showed, sufficient to result in a larger average equilibrium family size for Muslims than for Hindus.

5.1 Explaining the Number of Living Sons and Daughters

The thrust of the econometric equations was to explain the number of sons and daughters to these women in terms of their personal and household characteristics. Since the two dependent variables (S_i and D_i) were 'count' variables, in that they assumed non-negative integer values, an appropriate estimation method is the Poisson Regression Model (PRM).[14]

The PRM estimates for the number of sons and daughters, to women who had completed their fertility, are shown in Table 7. Also shown in Table 7, alongside the column of coefficient estimates, are the associated marginal effects. These effects show the increase or decrease in the expected number of sons ('sons' equation) or daughters ('daughters' equation) when the value of the relevant variable is increased by one unit, the values of all the other variables being set to their respective means.

Since all the variables (except for the 'age at marriage' variable) were binary variables, taking 0/1 values, a unit increase in a variable implied a shift from one category to another. Thus, Table 7, shows that, in equilibrium, a Muslim woman would, on average, have 0.27 more sons and 0.34 more daughters - while a Dalit woman, would have 0.08 more sons and 0.07 more daughters - than a Hindu woman *ceteris paribus*. Similarly, women who were literate would, in equilibrium, have 0.22 fewer sons and 0.11 fewer daughters than women who, along with their husbands, were illiterate.

In addition to the influence of literacy and community, the number of sons and daughters, to women who had completed their fertility, also depended on the region in which the women lived and on whether they worked and, if they did, the occupation in which they were employed. Living in the South, the East and the West resulted in a smaller number of sons than living in the North (the

[13] Z-value of 0.53

[14] For count data in general, and for fertility data in particular, linear regression methods will lead to inefficient and inconsistent estimates. The Poisson Regression Model is to be preferred (Cameron and Trivedi, 1986; Iyer and Weeks 2006).

default region) or in the Central region. Women who worked as labourers or as cultivators had, in equilibrium, a smaller number of sons, but a larger number of daughters, than women who worked in non-manual occupations, or women who did not work.

5.2 Explaining the Number of Male and Female Infant Deaths

Another clue to differences between Hindus and Muslims in their differing degrees of son preference and daughter aversion is provided by infant mortality rates, as shown in Table 8. The male infant mortality rate (male infant deaths as a proportion of male live births) was not very different between the Hindu (4.5%) and Muslim (4.7%) women who had completed their fertility and, indeed, the difference between the Hindu and Muslim male infant mortality rates was not statistically significant. However, the female infant mortality rate (female infant deaths as a proportion of female live births) was considerably higher for the Hindu (6.3%) than for the Muslim (4.6%) mothers and this difference was statistically significant. Indeed, it is noteworthy that there was hardly any gender difference in the Muslim infant mortality rates but that there was a considerable gender gap in the Hindu infant mortality rates.

Table 9 shows the PRM estimates (along with the marginal effects) for the number of male and female infant deaths to all currently married women who had had one or more live births, whether or not they had completed their fertility. The sample size in this instance is therefore now over approximately 25,000 women. The important point to emerge from these results is that, after controlling for other factors, Muslim women had a smaller number of both male and female infant deaths compared to Hindus. *Ceteris paribus* being Muslim, instead of Hindu, would have reduced the number of male deaths per woman by 0.038, a reduction of 23% from the mean number of male infant deaths per woman (computed over all the 25,796 currently married women who had had male live births) of 0.168: as a consequence, the male mortality rate would have fallen from its observed value of 6.8% to its 'all Muslim' value of 4.4%. By similar token, being Muslim, instead of Hindu, would have reduced the number of female infant deaths per woman by 0.017, a reduction of 10% from the mean number of female infant deaths per woman (computed over all the 23,646 currently married women who had had female live births) of 0.171: as a consequence, the female mortality rate would have fallen from its observed value of 7.4% to its 'all Muslim' value of 6.2%.

The number of male and female infant deaths was significantly affected by village-level infrastructure: safe drinking water[15]in villages was predicted to reduce the average number of male and female

[15]The data include the main source of drinking water for each of the 1,758 villages covered in the NCAER survey. In this study, the water supply of a village is defined as being 'safe' if the main source is one of: protected wells; tanker truck; piped water; hand pump. It is defined as being 'unsafe' if the main source is one of: ponds; dug wells; running streams and canals. It must be emphasised here that the terms 'safe' and 'unsafe' are defined entirely in terms of the source of drinking water and not in terms of any inherent standard of purity.

infant deaths per woman by, respectively, 4% and 8% and the presence of *anganwadi* schools[16] in villages was predicted to reduce the mean number of male and female infant deaths by, respectively, 5% and 7%. The number of male and female infant deaths was also affected by the quality of housing conditions and by the occupation of the mother: poor housing conditions[17]were predicted to increase the mean number of male and female infant deaths by, respectively, 7% and 15%, while women who worked as labourers were predicted to have, on average, 15% more male infant deaths and 9% more female deaths than the sample averages.

Overarching these factors was the importance of mothers' (and, to a lesser extent, fathers') literacy in reducing the number of male and female infant deaths. Literate mothers were predicted to have, on average, 17% fewer male infant deaths and 23% fewer female infant deaths than the sample means; by contrast, paternal literacy (in the face of maternal illiteracy) would lead to reductions of only 4% and 7%, respectively, in the average number of male and female infant deaths.

5.3 Analysis of the Sex Ratio

The analysis of living children, and of infant deaths, is supported by an analysis of the sex ratio in this population. The sex ratio is the number of girls per thousand boys. The differences in the sex ratio by religion in this sample population are extremely large. Table 10 shows the sex ratio at birth by community for all currently married women in the sample who had completed their fertility. The sex ratio at birth is 976 for Hindus and 1026 for Muslims. For all currently living children, the sex ratio is 948 for Hindus and 1047 for Muslims.

Table 11 shows the OLS estimates for the equations pertaining to the sex ratio for women who had completed their fertility. In equation 1, the dependent variable is the sex ratio at birth while, in equation 2, it is the sex ratio of currently living children. A positive (negative) coefficient estimate implies that the sex ratio increases (decreases) with an increase in the value of the associated variable. The sex ratio equations are estimated as reduced form equations underpinned by the structural equations (Table 7) relating to the number of male and female children.

The specification shown in Table 11 takes account of: the literacy status of the women and their husbands; the region of residence; the occupations of the women and their husbands[18]; the level of

[16] *Anganwadis* are village-based early childhood development centres. They were devised in the early 1970s as a baseline village health centre, their role being to provide government-funded food supplements to pregnant women and children under five; to work as an immunisation outreach agent; to provide information about nutrition and balanced feeding and provide vitamin supplements; to run adolescent girls' and women's groups; and to monitor the growth and educational development of children in a village.

[17] Housing conditions are described in this study as 'poor' if there is: (a) no ventilation; (b) no separate kitchen; and (c) food is cooked on a traditional Indian charcoal-fired stove (*chula*).

[18] The residual occupations for men and women were, respectively, 'non-manual' and 'unoccupied'.

village development[19]; and the prosperity of the households in which the women lived. The coefficient on each of these variables was allowed to vary according as to the community to which the women belonged (Muslim, Dalit, Hindu[20]). Consequently, if X_i represents the value of an explanatory variable for woman i, the equation was specified as:

$$(3) \qquad (SexRatio)_i = \alpha X_i + \beta(X_i \times ms_i) + \gamma(X_i \times dl_i) + \varepsilon_i$$

where: $ms_i = 1$, if the woman is a Muslim and $dl_i = 1$, if the woman is a Dalit. The α coefficient in the above equation represents the 'Hindu coefficient' ($ms_i = dl_i = 0$) and the β and γ coefficients represent the additional effects (of the explanatory variable) stemming from the women being Muslim ($ms_i = 1$) or Dalit ($dl_i = 1$), respectively.

5.4 Decomposition of Community Effects on the Sex Ratio

Table 11 shows that the community to which a woman belonged exerted its influence on the sex ratio of her children (at birth or of currently living children) through a single channel: the effect of the husband's literacy status on the sex ratios of their children depended upon whether the family was Hindu, Muslim or Dalit. Although the fact of a husband being literate served to lift the sex ratio (both at birth and of currently living children) for all the women, this effect was smallest for Hindus, larger for Dalits, and largest for Muslims. A Hindu husband being literate added 47 points to the sex ratio at birth and 32 points to the sex ratio of living children; by contrast, the corresponding increments for Muslim husbands were 131 and 121 points, respectively.

These observations raise the question of how much of the difference between Muslim and Dalit women on the one hand, and Hindu women on the other, in the sex ratios of their children - at birth and currently living - is due to differences in religion or caste, and how much is due to differences between them in the values of their other socio-economic attributes? In order to answer this question, the difference between the Muslim and Hindu sex ratios ($SR_M - SR_H$) - and between the Dalit and Hindu sex ratios ($SR_D - SR_H$)- was decomposed, using the Blinder (1973)-Oaxaca (1973) statistical decomposition methodology as applied to discrete choice models, as also developed more fully in Borooah and Iyer (2005c), and which is as follows:

$$(4) \qquad SR_M - SR_H = (SR_M - SR_M^H) + (SR_M^H - SR_H)$$

and

$$(5) \qquad SR_D - SR_H = (SR_D - SR_D^H) + (SR_D^H - SR_H)$$

[19] On the basis of their general level of facilities, the 1,758 villages in the NCAER Survey are classified as (a) low-development villages; (b) medium-development villages; (c) high-development villages.

[20] Hindus being the residual category.

where SR_M^H and SR_D^H are what the Muslim and Dalit sex ratios *would have been* if their respective attributes had been evaluated using Hindu coefficients.

The first term in equation (4) and equation (5) represents the 'religion effect'. In equation (4), the first term is the difference between the observed Muslim sex ratio and the Muslim sex ratio arising from Muslim attributes being evaluated using Hindu coefficients; in equation (5), the first term is the difference between the observed Dalit sex ratio and the Dalit sex ratio arising from Dalit attributes being evaluated using Hindu coefficients. The second term in equation (4) and equation (5) represents the 'attributes effect'. In equation (4), the second term is the difference between the sex ratios when Muslim and Hindu attributes are evaluated using Hindu coefficients while, in equation (5), the second term is the difference between the sex ratios when Dalit and Hindu attributes are evaluated using Hindu coefficients. In each equation, the sum of the first and second terms equals the difference in the observed sex ratios between Hindus and Muslims, and between Hindus and Dalits.

Table 12 shows that, of the total difference of 51 points between the Muslim and Hindu sex ratios at birth, 71 per cent (36 points out of 51) could be attributed to differences in community and 29 per cent (15 points out of 51) could be attributed to differences in attributes between the communities. On the other hand, of the total difference of 99 points between the Muslim and Hindu sex ratios of currently living children, only 46 per cent (46 points out of 99) could be attributed to differences in community and 54 per cent (53 points out of 99) could be attributed to differences in attributes between the communities. The difference between the sex ratios to Hindu and Dalit women was considerably smaller than that to Hindu and Muslim women: the difference between the sex ratios at birth was only 17 points and the difference between the sex ratios of currently living children was only 15 points. A little over half of the difference between Dalit and Hindu women in their sex ratios at birth was due to the effect of community while the effect of community explained nearly three-fourths of the difference between them in the sex ratios of currently living children.

It is acknowledged that these findings also have to do with sex selective abortion which takes place in India (Sen 2003), and which upper caste Hindus have been shown to engage in more than other groups (Arnold, Kishor and Roy, 2002). However, since the NCAER data do not contain information on the prevalence and practice of abortion, this is one aspect that we are not able to investigate comprehensively. However, we do acknowledge, readily, the importance of these practices for the subject of this research.

6 The Demand for Contraception

Much of the debate concerning religious differentials in fertility in India has stressed the lower adoption of contraception by Muslims compared to other religious groups. Theoretically, it is the

enforced abstinence from sexual relations which, in the absence of birth control methods, is the cost of restricting family size (Becker, 1991). This cost is represented by DD (drawn as a line) in Figure 6. Costs are highest when the number of children is restricted to n^f where, n^f is the desired number of children in the absence of restriction costs; thereafter, costs fall as the number of children increases, reaching a value of zero when the number of children is equal to the woman's biological maximum, $n^{\max}$.

On the other hand, exceeding the utility-maximising number of children also imposes costs and the cost of not restricting family size may be represented as a non-negative function of the difference: $U(n^f) - U(n)$. The curve LL in Figure 6 represents this cost which is positive except at $n = n^f$, when it is zero. The point F represents the point of intersection of the LL and DD curves and this yields n^* as the optimal number of children. Let us define $m^* = n^* - n^f$ then as the optimal 'overshoot' - in the presence of restriction costs, when birth control methods are not available (note m^* is not shown explicitly in Figure 6).

When birth control methods are available, the degree of abstinence required to attain a given family size falls, the DD curve shifts to the left and the optimal overshoot, m^*, falls. As the effectiveness and the ease of availability of birth control methods improve, information about them spreads, and their price falls, m^* approaches zero. With terminal methods of birth control $m^* = 0$, if such methods are employed then $n = n^f$. In the context of this model, therefore, contraception reduces the cost of attaining a desired number of children, but does not change the desired number of children.

Within this model, group effects (Becker and Murphy, 2000) operate through two channels. First, the desired number of children may be higher under peer pressure than under social autarky: $n^s > n^f$ in Figure 6. The strength of this influence depends on the group in question (for example, Hindus or Muslims) and upon the position of the individual within a group (literate versus illiterate; rich versus poor) but its existence reduces the costs of not restricting family size by shifting the LL curve in Figure 6 to MM. As this paper has argued, differences between Hindus and Muslims in their degrees of son preference and daughter aversion could lead to differences between them in their equilibrium family sizes.

Second, there may be 'psychic costs' associated with using contraception stemming from the fact that the group disapproves of some, or all, methods of contraception. Again, the strength of this influence varies by group, and by the position of an individual within the group, but its effect would be to shift the DD curve by very little, if at all: even when birth control methods are easily and freely available, the psychic costs of using contraception replace the abstinence costs of not using contraception. The upshot is that when peer pressure towards larger families is combined with group opposition to contraception, the optimal number of children (n^{**} in Figure 6) is likely to be greater

than when these effects do not operate (n^*).

6.1 Analysis of contraceptive use

The pattern of contraceptive use by the Hindu, Muslim and Dalit women in the sample is shown in Table 13: a much larger proportion of Muslim women, relative to Hindu and Dalit women, did not use any contraception; among the Muslim women who did use contraception, there was, compared to Hindu and Dalit women, relatively greater reliance on spacing than on terminal methods.

The econometric equation to explain contraceptive use attempted to capture some of the above features. The dependent variable for the equation was the variable CNP such that $CNP_i = 1$ if woman i did not use any contraception; , $CNP_i = 2$ if she used spacing methods of contraception; and $CNP_i = 3$, if she had completed her fertility by adopting a terminal method of contraception. Since this variable was ordinal, the appropriate method of estimation was by ordered logit.

The estimation results from the contraceptive use equation are shown in Table 14, under the column 'coefficients'. Also shown in Table 14 are the marginal probabilities of the three outcomes: these numbers show how the probabilities of being in the different categories of contraceptive use changed in response to a change in the value of one of the covariates. For each variable, these probabilities sum to zero across the three outcomes: 'no contraceptive use', 'use of spacing methods', and 'use of terminal methods'. For discrete variables, the marginal probabilities refer to changes consequent upon a move from the default category for that variable to the category in question: for example from being Hindu (the default community) to being Muslim or from living in the North (the default region) to living in the South.

The marginal probabilities of Table 14 show that, in terms of changes in the probabilities of the different outcomes, most of the traffic was between 'no contraception' and 'terminal contraception' with hardly any change in the probability of 'spacing contraception'. This was not surprising since – reflecting the fact that the main instrument of family planning policy in India has been sterilisation – as Table 14 shows, of the 29,837 women in the estimation sample, 57.7% did not use any contraception, 7.1% used spacing methods and 35.2% used terminal methods.

The demand for contraception was hypothesised to depend on family size and composition: the number of daughters and the number of sons were important determining variables in the contraceptive use equation. Since one of the analytical planks of this paper is inter-community differences in son preference and daughter aversion, the effect of the number of daughters and of the number of sons on contraceptive use was allowed to vary by community. So, for example, the coefficient estimates in Table 14, associated with the variables 'number of daughters' (0.263) and 'number of sons' (0.740), represent the 'Hindu' coefficient estimates. The coefficient estimates associated with the interaction

of the number of daughters (sons) with being Muslim[21] represents the estimated change to these coefficients as a consequence of being Muslim instead of being Hindu. So also for the coefficient estimates associated with the interaction of the number of daughters (sons) with being Dalit.

In addition to the effects of community operating through the number of daughters and the number of sons variables, the effect of being Muslim (or Dalit) on the demand for contraception was allowed to vary by community, independently of all other determining variables, through intercept shifts. These effects were represented by the coefficient effects associated with the 'Muslim' and 'Dalit' variables in Table 14.

Table 14 shows that, for Hindu women, each additional daughter, and each additional son, would, on average, reduce the probability of no contraception[22] by, respectively, 6.4 and 17.9 percentage points and increase the probability of terminal contraception by, respectively, 5.8 and 16.4 points. Consequently, for Hindu women, the increased likelihood of completing fertility after the birth of a son was nearly three times the increased likelihood of completing fertility after the birth of a daughter. By contrast, the increase in the likelihood of Muslim women completing their fertility after the birth of a son (4.8 points[23]) - and of completing their fertility after the birth of a daughter (2.0 points[24]) - was substantially lower than the corresponding values for Hindus. The marginal probabilities for Dalit women lay between that of Hindu and Muslim women: the increase in the probability of Dalit women adopting terminal contraception after the birth of a son (13.6 points) or of a daughter (4.1 points) was smaller than the corresponding Hindu values but larger than the corresponding increases for Muslim women.

The community effect on the demand for contraception operated entirely through differences between Hindu, Muslim and Dalit women in the change in their demand for contraception, following an additional daughter or son. There were no significant community effects operating over and above these numbers-based effects: neither of the coefficients on the Muslim nor the Dalit dummy variables were significantly different from zero. The higher the infant mortality rate to a woman, the smaller would be the probability of her adopting terminal contraception: a point increase in the infant mortality rate would reduce the likelihood of adopting terminal contraception by nearly five points.

There was a strong regional pattern to contraception demand: relative to living in the North (the default region), women in the Central and the Eastern regions would be more likely not to use any contraception by, respectively, nearly 19 and 14 points and less likely to use terminal methods by, respectively, nearly 17 and 12 points; on the other hand, again relative to living in the North,

[21] Number of daughters x Muslim in Table 14.
[22] In the discussion of the results, the probabilities are taken as ranging from 0 to 100.
[23] 0.164-0.116, in Table 14 under the column showing the marginal probabilities of using terminal contraception.
[24] 0.058-0.038, in Table 14 under the column showing the marginal probabilities of using terminal contraception.

women in the Southern and the Western regions would be less likely not to use any contraception by, respectively, nearly 8 and 9 points and more likely to use terminal methods by, respectively, nearly 7 and 8 points. This may have had much to do with the proactive policies of the governments of the Southern and the Western states, these policies being manifest in better access to family planning facilities - coupled with the wider use of the media to promote family planning - in these states.[25] Reinforcing this could have been a more general regional ethos which led to the desired family size in the South being smaller than, say, in the Central region. The collective effect of family planning facilities and attitudes towards family size in a region then yielded a regional effect on contraception demand.

Table 14 shows also that maternal literacy exercised an important effect on the demand for contraception: compared to the default case, in which both parents were illiterate, a literate mother was less likely not to use contraception (by slightly over 8 points) and more likely to use terminal methods (by just under 8 points); even an illiterate mother, albeit with a literate husband, was less likely not to use contraception (by slightly under 6 points) and more likely to use terminal methods (by just over 5 points) than an illiterate mother with an illiterate husband.

Another factor impinging on the demand for contraception was whether or not women worked: relative to women who were unoccupied, or who worked in non-manual occupations, women who worked as labourers or as cultivators were less likely not to use contraception (by 6 points for labourers and nearly 8 points for cultivators) and more likely to use terminal methods (by just under 6 points for labourers and 7 points for cultivators).

The last factor shown in Table 14 affecting the demand for contraception was the level of village development. On the basis of their general level of facilities[26], the 1,758 villages in the NCAER Survey were classified as (a) low-development villages; (b) medium-development villages; and (c) high-development villages. Relative to women in low-development villages, mothers in medium and high development villages were less likely not to use contraception, by just over 5 points for medium, and nearly 7 points for high development villages; and more likely to use terminal methods, by nearly 5 points for medium, and by over 6 points for high development villages.

[25] It is also acknowledged, as the literature from gender studies has argued, that these regional patterns may also stem from differences in kinship and marriage practices, different agricultural practices, and so forth, in relation to womens' abilities to access contraception and health care.

[26] For example, the quality of roads, the presence of transport, educational infrastructure, health care infrastructure, financial and commercial facilities.

7 Conclusion

The interaction between religion and fertility is the subject of intense academic, economic and political debate in developing countries like India. Discussions of religion and fertility in India have usually dwelt upon the pronatalist tendencies within Islam and their implications for the observed higher fertility of Muslim populations in the subcontinent. However, a curious paradox in Indian economic demography, rarely commented upon, is that while Muslim fertility in India is considerably higher than Hindu fertility, infant mortality among Muslims is considerably lower than among other groups. Motivated by this paradox, this paper put forward a new theory to provide an explanation for larger Muslim, relative to Hindu, fertility. The literature on gender bias and son preference was linked directly with the discussion of religion and fertility. This paper argued that bringing together the notion of 'son preference' and the complementary concept of 'daughter aversion' provides insights: just as sons bring 'benefits' to their parents, daughters impose 'costs' and complementing a desire to have sons is a desire not to have daughters. Consequently, the desire for sons increases family size while the fear of daughters limits it. These two countervailing forces may act so as to determine equilibrium family size and composition. This hypothesis was then tested using quantitative data from a nationally representative sample of 10,548 rural Indian women who had adopted a terminal method of contraception, and who had therefore attained their equilibrium family size and composition. A number of Poisson regression models were estimated on the number of living children, the number of infant deaths, and the sex ratio.

The study undertaken here shows that in the sample, Muslims had statistically the same degree of son preference as Hindus but a significantly lower degree of daughter aversion. These facts may be sufficient theoretically to result in a larger average (equilibrium) family size for Muslims than for Hindus. The thrust of the econometric analysis went on to explain the number of sons and daughters to women in terms of their personal and household characteristics. The analysis showed that after controlling for other factors at the level of the individual, household, the village, and the region, there are differences by religion and caste in the determinants of the numbers of living children. Another important point to emerge from the analysis was that, after controlling for other factors, Muslim women had a smaller number of both male and female infant deaths compared to Hindus. For Hindu women, the increased likelihood of completing fertility after the birth of a son was nearly three times the increased likelihood of completing fertility after the birth of a daughter. By contrast, the increase in the likelihood of Muslim women completing their fertility after the birth of a son or daughter was substantially lower than the corresponding values for Hindus. This suggests that empirically there might be lower daughter aversion among Muslims. This is reflected also in the considerable differences by religion in the sex ratio at birth and in the sex ratio for currently living children, between Hindus and Muslims. Other analysis presented in the paper included a logit model of the demand for contraception adopted by the groups under study. The demand for contraception

was influenced by a range of economic characteristics. It was shown that the community effect on the demand for contraception operated entirely through differences between Hindu, Muslim and Dalit women in the change in their demand for contraception, following an additional daughter or son, with no significant community effects operating over and above these numbers-based effects.

Collectively, the findings from the analysis suggest that counter to popular belief that associates higher Muslim fertility with pronatalist tendencies within Islam, higher Muslim fertility in India may be related to gender bias, in particular to the significantly lower levels of daughter aversion among this community. Paradoxically, the reason for the higher fertility of Muslim, relative to Hindu, women may lie in daughters being more welcome in Muslim than in Hindu families, and *ipso facto* in the relatively better treatment that girls receive at the hands of Muslim parents. More research is needed on the complex interactions between religion, missing women, and fertility behaviour, both in India and elsewhere. But by making a first attempt at investigating the possible links between gender bias and religious differentials in fertility in the context of India, this paper proffers an alternative to the accepted wisdom about demography and religion in this society.

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Table 1
Number of Living Sons of Currently Married Women Who Completed Their Fertility

Sons	Hindus (%)	*Muslims (%)*	*Dalits (%)*
0	4.6	5.1	4.5
1	29.3	25.4	27.1
2	45.9	40.4	42.1
3	14.9	19.5	19.2
4+	5.3	9.6	7.1
Mean	1.9	2.1	2.0
Median	2	2	2

6,523 Hindu, 549 Muslim and 3,476 Dalit women

Table 2
Number of Living Daughters of Currently Married Women Who Completed Their Fertility

Daughters	Hindus (%)	*Muslims (%)*	*Dalits (%)*
0	19.6	13.4	17.4
1	39.1	35.8	38.5
2	25.1	25.6	26.2
3	11.0	15.8	12.2
4+	5.2	9.4	5.7
Mean	1.4	1.8	1.5
Median	1	2	1

6,523 Hindu, 549 Muslim and 3,476 Dalit women

Table 3
Number of Living Children of Currently Married Women Who Completed Their Fertility

Children	Hindus (%)	*Muslims (%)*	*Dalits (%)*
0	0.6	0.8	0.8
1	2.2	1.8	2.6
2	23.4	13.8	18.9
3	35.1	32.1	31.4
4	22.3	25.4	26.1
5+	16.4	26.1	20.2
Mean	3.3	3.8	3.5
Median	3	4	3

6,523 Hindu, 549 Muslim and 3,476 Dalit women

Table 4
Number of Living Daughters of Currently Married Women Who Completed Their Fertility Without Any Sons: 'No-Son' Equilibrium

Daughters	Hindus (%)	*Muslims (%)*	*Dalits (%)*
0	12.4	15.4	16.7
1	15.3	11.5	21.3
2	37.2	38.5	30.7
3	21.3	11.5	18.7
4+	13.8	23.1	12.6
Mean	2.1	2.2	
Median	2	2	

309 Hindu, 32 Muslim and 162 Dalit women

Table 5
Number of Living Daughters of Currently Married Women Who Completed Their Fertility With the Same Number of Sons as Daughters
'Parity' Equilibrium

Daughters=Sons	Hindus (%)	*Muslims (%)*	*Dalits (%)*
0	2.4	3.3	3.2
1	48.2	32.3	41.9
2	44.5	48.8	47.0
3	4.7	14.1	7.4
4	0.2	1.5	0.5
Mean	1.5	1.8	1.5
Median	1	2	1

1,585 Hindu, 138 Muslim and 802 Dalit women

Table 6
Number of Living Sons of Currently Married Women Who Completed Their Fertility Without Any Daughters:
'No-Daughter' Equilibrium

Sons	Hindus (%)	*Muslims (%)*	*Dalits (%)*
0	2.9	5.9	4.3
1	7.5	8.8	9.6
2	51.9	30.9	44.9
3	26.8	44.1	28.3
4+	10.9	10.3	12.9
Mean	2.4	2.5	2.4
Median	2	3	2

1,298 Hindu, 77 Muslim and 615 Dalit women

Table 7
Poisson Regression Model Estimates for the Number of Sons and Daughters to Currently Married Women Who Have Completed Their Fertility

	Equation for Sons		***Equation for Daughters***	
Variable	**Coefficient**	***Marginal Effects***	***Coefficient***	***Marginal Effects***
Age of woman at marriage	-0.028	-0.053	-0.029	-0.043
	(7.4)	(0.01)	(6.9)	(0.01)
Muslim	0.134	0.271	0.207	0.335
	(4.3)	(0.07)	(6.1)	(0.06)
Dalit	0.043	0.083	0.046	0.068
	(2.7)	(0.03)	(2.5)	(0.03)
Central region	0.039	0.075	-	-
	(1.7)	(0.04)		
Southern region	-0.167	-0.307	-	-
	(6.8)	(0.04)		
Western region	-0.032	-0.061	-0.027	-0.040
	(1.28)	(0.05)	(1.3)	(0.03)
Eastern region	-0.061	-0.113	0.037	0.055
	(2.1)	(0.05)	(1.4)	(0.04)
Woman literate	-0.119	-0.223	-0.076	-0.111
	(6.3)	(0.03)	(4.1)	(0.03)
Woman illiterate/husband literate	-0.034	-0.065	-	-
	(2.0)	(0.03)		
Woman works as labourer	-0.051	-0.095	0.050	0.076
	(2.3)	(0.04)	(2.1)	(0.04)
Woman works as cultivator	-0.053	-0.099	0.052	0.079
	(2.1)	(0.05)	(1.9)	(0.04)
Woman works in non-manual occupation	-	-	-	-
Husband works as labourer	-0.052	-0.098	-0.09	-0.130
	(2.7)	(0.036)	(4.2)	(0.03)
Husband works as cultivator	-	-	-	-

a. The equations were estimated on observations for 10,548 currently married women (6,523 Hindus; 549 Muslims; and 3,476 Dalits) who had completed their fertility by adopting terminal methods of contraception.
b. Figures in parentheses under column 'coefficient' are z-values and under column 'marginal effects' are standard errors.
c. The marginal effects show the increase/decrease in the expected number of sons/daughters for a unit change in the relevant variables, the values of all other variables being set to their respective mean values.
d. The LR test statistics for imposing zero restrictions on some of the coefficients were: $\chi^{2(}(2)=0.79$, for the 'sons equation' and $\chi^{2(}(5)=2.4$, for the 'daughters equation'.

Table 8
Average Number of Infant Deaths and Infant Mortality Rates to Currently Married Women

	Hindus	*Muslims*	*Dalits*
Male Infant Deaths	0.132	0.136	0.170
Female Infant Deaths	0.156	0.164	0.194
Total Infant Deaths	0.253	0.229	0.315
Male Infant Deaths as a Percentage of Male Live Births	4.5	4.6	5.4
Female Infant Deaths as a Percentage of Female Live Births	6.2	4.5	7.6
Total Infant Deaths as a Percentage of Total Live Births	5.1	4.5	6.1

a. Mean Infant Deaths and Infant Mortality Rates were computed over currently married women *who had had at least one live birth*: and who had completed their fertility: 6,505 Hindu, 545 Muslim and 3,469 Dalit women
b. Mean *Male* Infant Deaths and Male Infant Mortality Rates were computed over currently married women *who had had at least one male live birth* and who had completed their fertility: 6,295 Hindu, 523 Muslim and 3,365 Dalit women
c. Mean *Female* Infant Deaths and Female Infant Mortality Rates were computed over currently married women *who had had at least one female live birth* and who had completed their fertility: 5,422 Hindu, 489 Muslim and 3,009 Dalit women.

Table 9
Poisson Regression Model Estimates for the Number of Male and Female Infant Deaths to Currently Married Women

	Equation for Male Infant Deaths		***Equation for Female Infant Deaths***	
Variable	Coefficient	*Marginal Effects*	*Coefficient*	*Marginal Effects*
Male live births	0.577	0.069	-	-
	(64.6)	(0.001)		
Female live births	-	-	0.488	0.062
			(56.6)	(0.001)
Age of woman at marriage	-0.031	-0.004	-0.040	-0.005
	(3.5)	(0.001)	(4.4)	(0.001)
Muslim	-0.371	-0.038	-0.145	-0.017
	(6.9)	(0.005)	(2.7)	(0.006)
Dalit	-	-	-	-
Safe water in village	-0.052	-0.006	-0.115	-0.014
	(1.6)	(0.004)	(3.4)	(0.004)
Anganwadi in village	-0.066	-0.008	-0.096	-0.012
	(2.1)	(0.004)	(2.9)	(0.004)
Hospital within 5km of village	0.052	0.006	-0.103	-0.0133
	(1.6)	(0.004)	(3.1)	(0.004)
Midwife in village	0.076	0.009	-	-
	(2.3)	(0.004)		
Poor housing conditions	0.101	0.012	0.193	0.025
	(3.1)	(0.004)	(5.7)	(0.004)
Household assets	-0.036	-0.012	-0.019	-0.002
	(5.0)	(0.004)	(2.6)	(0.001)
Woman literate	-0.259	-0.029	-0.336	-0.040
	(5.5)	(0.005)	(6.9)	(0.005)
Woman illiterate/husband literate	-0.053	-0.006	-0.099	-0.012
	(1.5)	(0.004)	(2.8)	(0.004)
Woman works as labourer	0.194	0.025	0.123	0.016
	(4.8)	(0.006)	(2.9)	(0.008)
Woman works as cultivator	-	-	-	-

a. The male infant deaths equation was estimated on observations for the 25,796 currently married women who had had male live births; the female infant deaths equation was estimated on observations for the 23,646 currently married women who had had female live births.
b. Figures in parentheses under column 'coefficient' are z-values and under column 'marginal effects' are standard errors.
c. The marginal effects show the increase/decrease in the expected number of male/female infant deaths for a unit change in the relevant variables, the values of all other variables being set to their respective mean values.
d. The LR test statistics for imposing zero restrictions on some of the coefficients were: $\chi^{2(}(2)=2.2$, for the male infant deaths equation and $\chi^{2(}(3)=2.4$ for the female infant deaths equation.

Table 10
Sex Ratios of Children to Currently Married Women Who Have Completed Their Fertility

	Currently Married Women Who Have Completed Their Fertility		
	Hindu	Muslim	Dalit
Sex Ratio at Birth	976	1026	993
Sex Ratio of Currently Living Children	948	1047	963

a. Sex Ratio: Number of girls per 1000 boys

Table 11

Regression Estimates for the Sex Ratio to Women who have Completed Their Fertility

	Equation 1 *Sex Ratio at Birth*	*Equation 2* *Sex Ratio of Currently Living Children*
Muslim	Dropped	Dropped
Dalit	Dropped	Dropped
Wife literate	Dropped	Dropped
Husband literate	46.58 (2.05)	32.22 (1.41)
Muslim × Husband literate	83.99 (1.45)	89.85 (1.46)
Dalit × Husband literate	51.71 (1.76)	54.53 (1.85)
Log of household income per person	-338.99 (2.43)	-404.49 (2.88)
(Log of household income per person)^2	16.49 (1.93)	20.34 (2.37)
South	2573.62 (4.50)	2881.54 (5.01)
East	2562.56 (4.49)	2883.71 (5.02)
West	2535.43 (4.33)	2844.75 (4.94)
Central	2551.73 (4.46)	2810.48 (4.88)
North	2547.74 (4.45)	2842.88 (4.93)
Husband cultivator	Dropped	Dropped
Husband labourer	-72.46 (2.71)	-103.00 (3.74)
Mother cultivator	64.17 (1.91)-	79.93 (2.37)
Mother labourer	76.77 (2.55)	67.33 (2.22)
Mother in non-manual occupation	Dropped	Dropped
Level of village development: Medium	42.96 (1.60)	Dropped
Level of village development: High	69.21 (2.35)	32.73 (1.52)

a. The dependent variable in Equation 1 is the sex ratio (number of females per 1,000 males) at birth to women who have comlpeted their fertility (mean = 984.4): 10,176 observations

b. The dependent variable in Equation 2 is the sex ratio (number of females per 1,000 males) of currently living children to women who have completed their fertility (mean = 957.97): 10,044 observations

c. LR test of zero restrictions in Equation 1 (on dropped variables): $\chi^2(23)=26.0$; $\Pr > \chi^2=0.30$

d. LR test of zero restrictions in Equation 2 (on dropped variables): $\chi^2(24)=26.8$; $\Pr > \chi^2=0.32$

e. Figures in parentheses are t-values

f. Equation 1: $\overline{R}^2 = 0.508$; F-test that all the coefficients are zero: F(15,10161)=700.8

g. Equation 2:$\overline{R}^2 = 0.495$; F-test that all the coefficients are zero: F(15,10029)=658.1

h. The following interaction terms were dropped from the specification because their associated coefficients had t-values less than unity: Muslim × log(income); Dalit × log(income); Muslim × $[\log(\text{income})]^2$; Dalit × $[\log(\text{income})]^2$; Muslim × (Region); Dalit × (Region); Muslim × (Father's/Mother's Occupation); Dalit × (Father's/Mother's Occupation).

Table 12

The Decomposition of Muslim-Hindu and Dalit-Hindu Differences in the Sex Ratio at Birth and of Currently Living Children

Sex Ratio at Birth		
Sample Average	**Muslim Attributes Evaluated Using Hindu Coefficients**	
$SR_M - SR_H$	$SR_M - SR_M^H$	$SR_M^H - S_H$
$\mathbf{1027 - 976 = 51}$	$\mathbf{1027 - 991 = 36}$	$\mathbf{991 - 976 = 15}$
Sex Ratio of Currently Living Children		
Sample Average	**Muslim Attributes Evaluated Using Hindu Coefficients**	
$SR_M - SR_H$	$SR_M - SR_M^H$	$SR_M^H - S_H$
$\mathbf{1047 - 948 = 99}$	$\mathbf{1047 - 1001 = 46}$	$\mathbf{1001 - 948 = 53}$
Sex Ratio at Birth		
Sample Average	**Dalit Attributes Evaluated Using Hindu Coefficients**	
$SR_D - SR_H$	$SR_D - SR_D^H$	$SR_D^H - S_H$
$\mathbf{993 - 976 = 17}$	$\mathbf{993 - 985 = 8}$	$\mathbf{985 - 976 = 9}$
Sex Ratio of Currently Living Children		
Sample Average	**Dalit Attributes Evaluated Using Hindu Coefficients**	
$SR_D - SR_H$	$SR_D - SR_D^H$	$SR_D^H - S_H$
$\mathbf{963 - 948 = 15}$	$\mathbf{963 - 952 = 11}$	$\mathbf{952 - 948 = 4}$

a. SR_M, SR_D and SR_H are the sex ratios for, respectively, Muslim, Dalit and Hindu women.

b. SR_M^H is what the Muslim sex ratio would have been if Muslim attributes were evaluated using Hindu coefficients.

c. SR_D^H is what the Dalit sex ratio would have been if Dalit attributes were evaluated using Hindu coefficients.

Table 13
Contraception and Currently Married Women

	Hindu	*Muslim*	*Dalit*
Number of Currently Married Women	16,100	2,951	10,786
Percentage not using contraception	53	72	61
Percentage using spacing methods of contraception	7	10	7
Percentage using terminal methods of contraception	40	18	32

Source: NCAER Survey

Table 14
Ordered Logit Estimates for Contraceptive Use by Currently Married Women

	Coefficients	*Marginal Probabilities*		
		No Contraception	***Spacing Contraception***	***Terminal Contraception***
Age at marriage	-0.023	0.006	-0.001	-0.005
	(3.9)	(0.001)	(0.0001)	(0.001)
Number of daughters	0.263	-0.064	0.006	0.058
	(19.1)	(0.003)	(0.0003)	(0.003)
Number of daughters×Muslim	-0.169	0.041	-0.003	-0.038
	(4.8)	(0.009)	(0.001)	(0.008)
Number of daughters×Dalit	-0.075	0.018	-0.001	-0.017
	(4.0)	(0.005)	(0.0004)	(0.004)
Number of sons	0.740	-0.179	0.015	0.164
	(46.9)	(0.004)	(0.001)	(0.004)
Number of sons×Muslim	-0.523	0.127	-0.011	-0.116
	(15.0)	(0.008)	(0.001)	(0.008)
Number of sons×Dalit	-0.126	0.031	-0.003	-0.028
	(7.1)	(0.004)	(0.0004)	(0.004)
Muslim	0.121*	-0.029*	0.002*	0.027*
	(1.3)	(0.023)	(0.002)	(0.021)
Dalit	-	-	-	-
Infant mortality rate	-0.215	0.052	-0.004	-0.048
	(2.5)	(0.021)	(0.002)	(0.019)
Central region	-0.792	0.187	-0.018	-0.169
	(18.3)	(0.010)	(0.001)	(0.009)
Southern region	0.308	-0.076	0.006	0.070
	(6.9)	(0.011)	(0.001)	(0.010)
Western region	0.351	-0.087	0.006	0.081
	(7.2)	(0.012)	(0.001)	(0.012)
Eastern region	-0.588	0.136	-0.016	-0.120
	(12.1)	(0.011)	(0.002)	(0.009)
Woman literate	0.338	-0.083	0.007	0.076
	(10.1)	(0.008)	(0.001)	(0.008)
Woman illiterate/ husband literate	0.238	-0.058	0.004	0.054
	(8.0)	(0.008)	(0.001)	(0.007)
Medium development village	0.211	-0.051	0.004	0.047
	(6.4)	(0.008)	(0.001)	(0.007)
High development village	0.283	-0.069	0.005	0.064
	(7.7)	(0.009)	(0.001)	(0.008)
Woman works as labourer	0.246	-0.060	0.004	0.056
	(6.5)	(0.009)	(0.001)	(0.009)
Woman works as cultivator	0.304	-0.075	0.005	0.070
	(6.2)	(0.012)	(0.001)	(0.012)

a. Contraceptive use was estimated on observations for 29,837 currently married women of whom 16,100 were Hindu; 2,951 were Muslim; and 10,786 were Dalit.

b. Figures in parentheses under column 'coefficient' are z-values and under column 'marginal probabilities' are standard errors. The marginal probabilities show the increase/decrease in the expected probability of contraceptive use for a unit change in the relevant variables, the values of all other variables being set to their respective mean values: the marginal probabilities sum to zero across the three outcomes. An * denotes a coefficient or a marginal probability that was <u>not</u> significant at 5% level of significance.

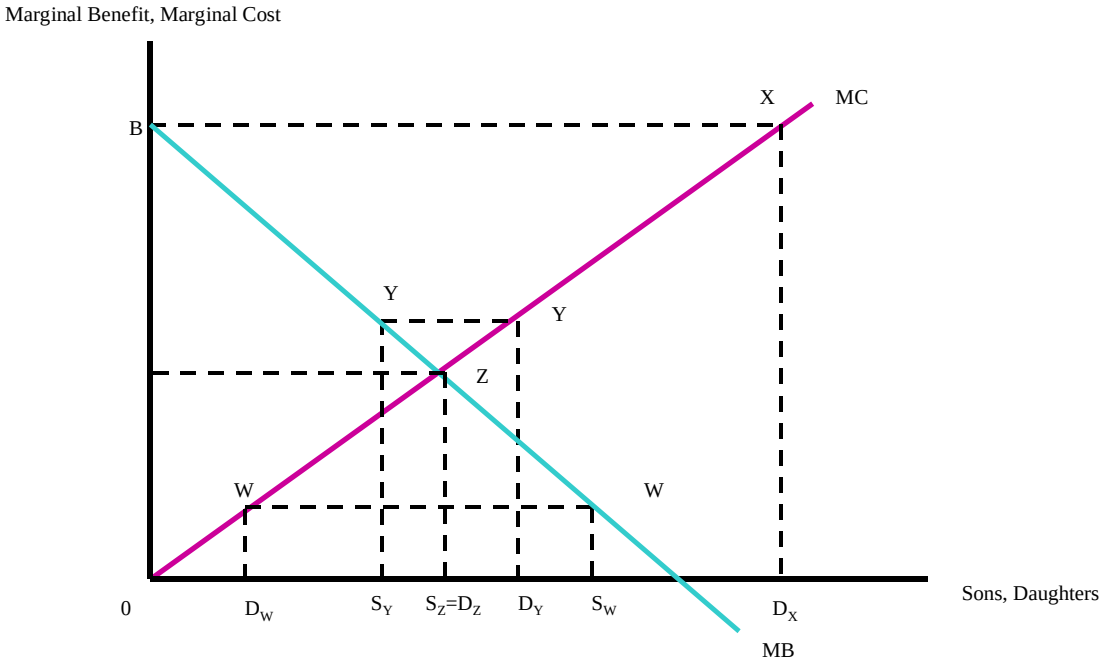

Figure 1: Equilibrium Son-Daughter Configurations

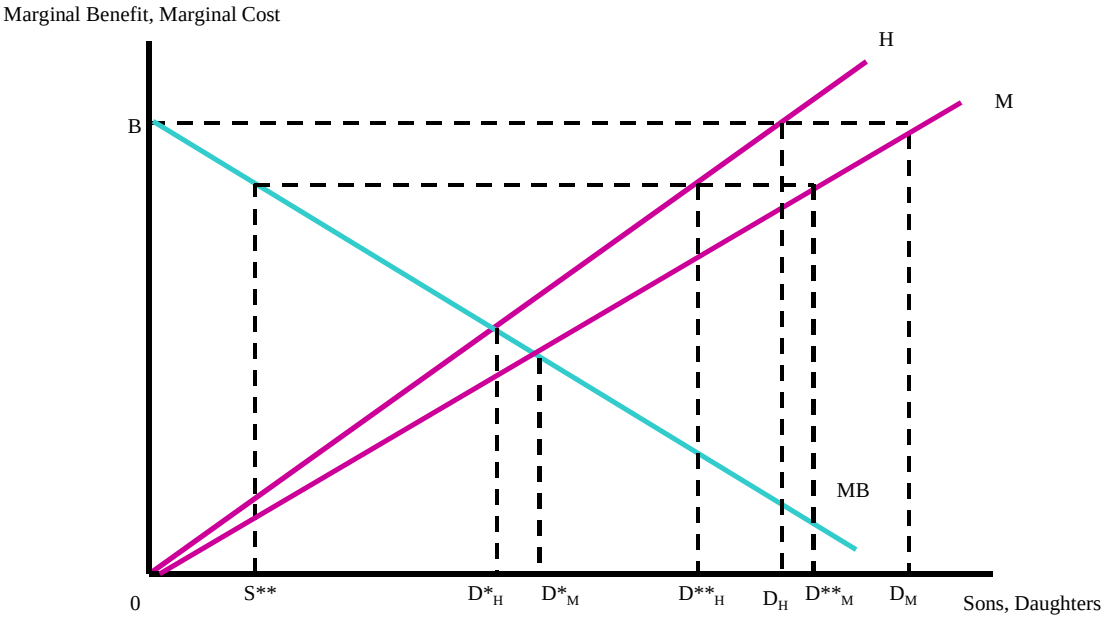

Figure 2: Daughter Aversion

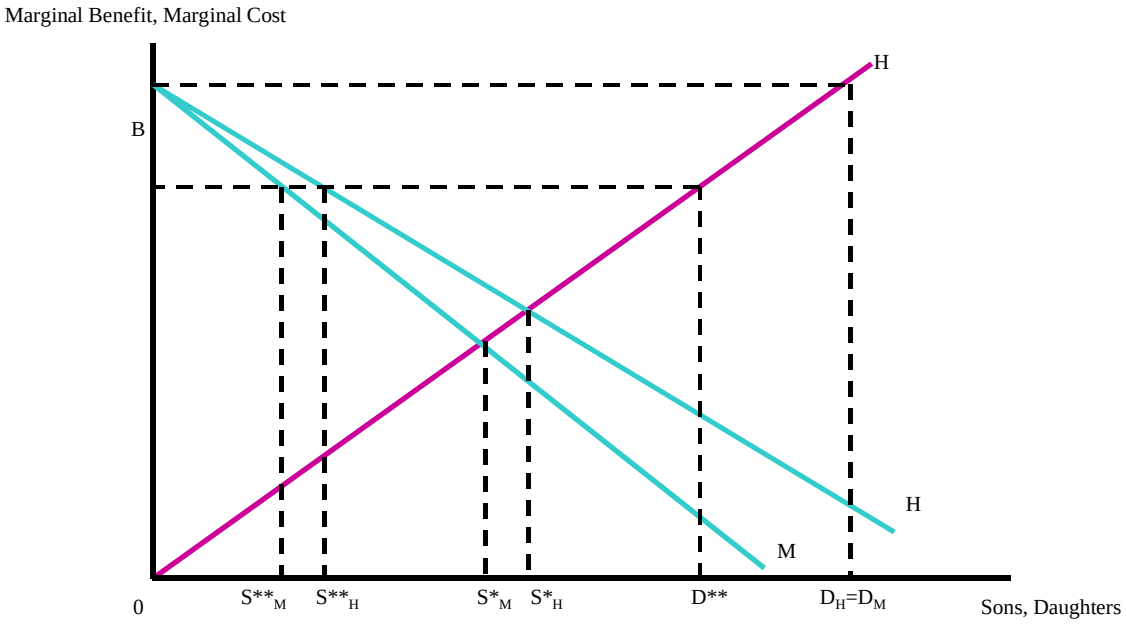

Figure 3: Son Preference

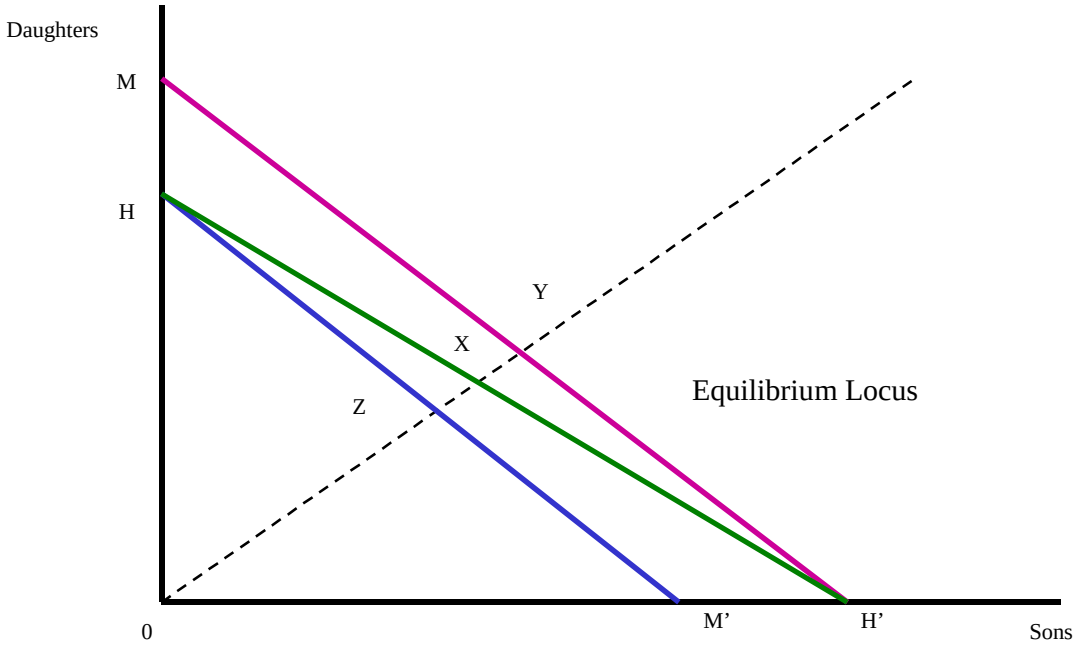

Figure 4: The Equilibrium Locus

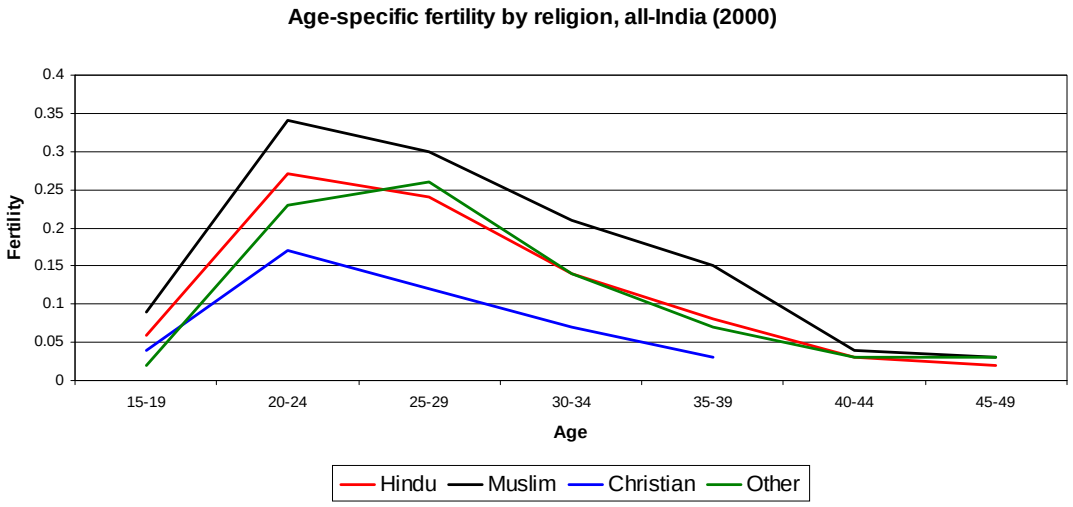

Figure 5: Age-Specific Fertility in India by Religion

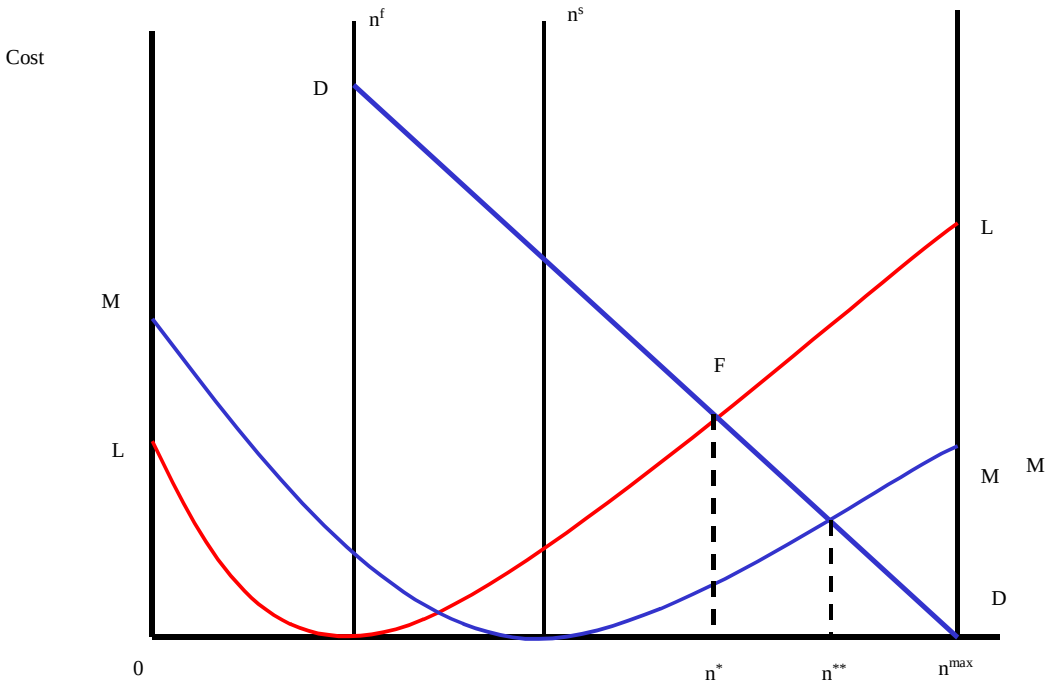

Figure 6: The Demand for Contraception