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FEMALE AND CHILD WELFARE IN INDIA: AN EMPIRICAL ANALYSIS

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A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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Declaration

This thesis is submitted to the University of Warwick, Department of Economics, in accordance with the requirements of the degree of Doctor of Philosophy. I declare that any material contained in this thesis has not been submitted for a degree to any other university and that none of the three Chapters, even in a much earlier version, has been published so far.

I declare that:

Chapter One: „Son Preferences and Completed Lifetime Fertility in Uttar Pradesh, India" is my own work.

Chapter Two: „Female Autonomy and Education of the Subsequent Generation: Evidence from two states in India" is co-authored with Wijii Arulampalam (wiji.arulampalam@warwick.ac.uk), University of Warwick, Oxford University Center for Business Taxation and Institute for the study of Labor (IZA), Bonn and Uma Kambhampati (u.s.kambhampati@henley.reading.ac.uk), School of Economics, University of Reading.

Chapter Three: „Female Autonomy and Gender Disparities in Child Survival in India" is my own work.

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Dedication

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Overview

The welfare of women and children is essential to a country's development. Children's welfare represents an important determinant of a country's future. Women often play a key role in the household and their agency can be essential for the well being of all family members. And yet, women and children are often the most vulnerable individuals in society.

Policy makers have increasingly come to recognise this and consequently changes to the welfare of women and children have been laid at the very heart of the transformational promises enclosed in the Millennium Declaration of the United Nations and have been implemented in the Millennium Development Goals (MDGs) – eight development targets agreed upon by all United Nation member states and all major international organisations. Children are critical for all eight aspects and four goals focus exclusively on women or children. These comprise primary education, gender equality, child survival and maternal health. Indeed, in the 2010 Review Summit the member states have expressed major new commitments to improving women's and children's health. The correlation between achieving an improvement in female and child welfare and fulfilling the MDGs never becomes clearer than when considering India. India's progress is considered by many as pivotal to achieving the MDGs. A reason for this is the country's size. With 1,171 million inhabitants it is the world second most populous country. Furthermore, in the recent past India has combined impressive economic growth and wealth creation with stagnation in key socio-economic indicators, particularly among disadvantaged groups of society.

This thesis focuses on four aspects closely linked to the MDGs. The first is fertility. India takes an important place in the population growth debate. Its population is still second to China but estimates of the Population Reference Bureau suggest that it will have reached China's population by 2025 and will have well overtaken it by 2050. Consequently, a thorough understanding of the determinants of high fertility in this country will be invaluable to policy makers.

Female autonomy makes up the third MDG and constitutes the second point of interest. Societies throughout South Asia are characterised by a low status of women. According to the International Labour Office in India in particular discrimination against women is widespread. Evidence from Demographic Health Surveys suggests that women have little say on a number of household matters among which their own health care and two thirds of them work without pay. These matters in turn have devastating effects on the life of a woman's children: The National Population Policy for example singled out the low status of women as a significant barrier to the achievements of population targets as well as of child health. Thus local and international policy makers have recognised the status of women as a policy priority.

The third aspect is primary education, which is reflected in the second MDG. India has made impressive strides in improving its schooling record but there is still room for substantial improvement. Data from the UNICEF suggests that an estimated 42 million children aged 6 to 10 are not in school. Again, gender differences in schooling are still widespread throughout the country.

Child survival is this thesis' final factor of interest. India has the world's largest under-five population of 127 million children and its under-five deaths account for 22% of the world's mortality rates and figures from the United Nations suggest that India is off-track to achieving the target set in the MDGs by the year 2015. Reasons for these high rates of child mortality range from malnutrition to insufficient immunisation coverage. Yet some of the reasons may also lie in the proximity of India's deep-rooted gender discrimination: survival rates are disproportionally skewed towards boys.

The thesis has a strong empirical focus and all three chapters employ data from the third round of the National Family Health Survey for India (2005/2006), which is part of the Demographic and Health Survey Series conducted in about 70 low and middle income countries around the world.

The **First Chapter** investigates the relation between son preferences and completed lifetime fertility in India's largest state, Uttar Pradesh, and investigates the hypothesis that sex mixes of surviving children skewed towards sons decrease a woman's lifetime fertility. The decision on how many children to have is seen as a number of sequential stopping decisions. The explanatory variables of interest are binary indicators for the gender compositions of the couple's surviving offspring. The results suggest that sex compositions with more surviving boys than girls decrease the probability of a further birth. Exclusively male as well as female offspring, conversely, increase this probability. A possible conclusion to draw is that parents in Uttar Pradesh appear to prefer offspring of both sexes with more sons than daughters. Furthermore, the analysis finds evidence that more educated women discriminate less against girls, a potentially important finding for policy makers.

The subsequent two chapters focus on female autonomy. Both use a novel approach to model a woman's autonomy by employing a latent factor structural equation model where female autonomy is treated as a latent construct. This framework addresses the problem of reverse causality and measurement error that is present in conventional analyses employing simple sum of answers elicited from a set of questions that are assumed to measure autonomy. Intuitively the model can be pictured as follows: female autonomy consists of four sub-spheres, each of which cannot be observed directly but is captured by a set of fallible measures. For each sphere, common variation in its error prone measures is used to infer its properties, which are subsequently used to say something about the overarching latent concept of female autonomy.

The **Second Chapter** of the thesis is co-authored with Wiji Arulampalam and Uma Kambhampati and analyses the impact of female autonomy on children's starting ages in school. School entry is modelled within a discrete time duration model and the parameter of the latent factor capturing female autonomy on school enrolment is the coefficient of interest. The analysis focuses on the two states of Andhra Pradesh and Uttar Pradesh. The results indicate first that female autonomy is affected by socio-economic characteristics of the woman and her family. Second, starting school at the recommended age of 6 years is more of a norm in Andhra Pradesh than in Uttar Pradesh where the school starting age is affected by female autonomy levels, caste, religion characteristics, wealth and initial conditions. The positive effect of female autonomy on school enrolment is more pronounced in Uttar than in Andhra Pradesh.

The **Third Chapter** of the thesis scrutinises the interrelations between a woman's autonomy and her children's survival. It investigates the hypothesis that girls particularly benefit from an autonomous mother. Similarly to the above, female autonomy is treated as a latent characteristic in a survival model for child mortality. The analysis focuses on two states; a medium and a high mortality state: West Bengal and Uttar Pradesh. The results show considerable differences in the effect of female autonomy on child survival with a more pronounced influence on daughters' survival. This effect is stronger in Uttar Pradesh, which is characterised by both higher mortality rates and larger gender disparities.

Chapter One

Son Preferences and Completed Lifetime Fertility in Uttar Pradesh, India

Marco Umberto Alfano

A thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy

1.1. Introduction

The long-term consequences of population growth are a hotly debated topic. Academic research on the issue is still divided but – since Malthus – has tended to produce results indicating a negative relationship between fertility and economic development. Standard growth models – more recently Barro and Becker (1990) and Becker et al. (1990) – argue that a capital shallowing effect of higher population growth ultimately translates into a decrease in standards of living. Poorer countries, for example, tend to be characterised by higher total fertility rates (TFR).[1,2] This negative relationship has been confirmed by a number of empirical studies, most notably, Mankiw et al. (1992) and Barro (1997). In this context, the household is seen by many as the key decision-making unit; although the ramifications and origins of fertility behaviour are still far from exhaustively understood, these models do appear to have some explanatory power (Schultz, 2001). Consequently, along with household preferences, the social, economic and time constraints on household members become likely determinants of the number of births as well as of other family decisions.

India is often characterised by widespread relative preferences for sons over daughters (Das Gupta et al., 2003), defined as the attitude that sons are more important and more valuable than daughters (Clark, 2000). Parents might prefer sons for economic reasons; for instance, boys are more likely to have a higher productivity, especially in rural areas. Alternatively, couples may prefer sons for non-economic considerations. If society in general discriminates against girls, for example, parents will wish to have a

[1] The Population Reference Bureau defines the Total Fertility Rate (TFR) as "The average number of children that would be born alive to a woman (or group of women) during her lifetime if she were to pass through her childbearing years conforming to the age-specific fertility rates of a given year. This rate is sometimes stated as the number of children women are having today."

[2] According to the Population Reference Bureau in 2009 Europe with a GNI of around $26,000 per capita had a TFR of 1.5. The corresponding figures for less developed countries are $5,200 and 2.7. For the least developed countries it is $1,200 and 4.6 respectively.

higher number of sons than daughters. In the past, these preferences have been linked with a number of adverse outcomes for girls, sex selective abortions (Bhalotra and Cochrane, 2010), for instance. If particularly strong, this social phenomenon has been argued to be a potential impediment to reducing fertility (Dreze and Murthi, 1999): a reason why policy-makers have become increasingly interested in the topic. Couples may prefer sons for economic, cultural or religious reasons. In the literature, preferences for sons have been analysed extensively in the Indian context (Das, 1987 and Arnold et al., 2002, for instance) the possible effect of these preferences on completed lifetime fertility, however, has received less attention.

The present analysis aims to fill this gap by investigating empirically the relation between completed fertility and son preferences in Uttar Pradesh (UP), India. This state has been chosen because it lags behind India in a number of human development indicators and shows higher fertility figures than most other Indian states. The empirical model employs data from the third round of the National Family Health Survey (NFHS-3), 2005/2006 and selects women who have come to the end of their reproductive cycle (aged 40 years and above). These individuals were born between 1956 and 1966 and at the time they started childbearing, fetal sex determination technology was not easily available. As a consequence, the total number of births is employed to achieve the desired number of children. The explanatory variables of interest are three indicator variables denoting the sex composition of the couple's surviving offspring. The first takes the value 1 if the woman has more surviving sons than daughters, the second if the couple's offspring is exclusively male and the third if it is exclusively female. These variables are hypothesised to influence the couple's propensity to have a further birth at a given parity. The parity is defined as the state a woman is in before giving birth. The couple's decision on the total number of children is viewed as a number of sequential stopping decisions. First, the parents decide whether or not to enter parenthood. Once the first child is born, the parents will face the same decision: whether or not to have a further child. This process is repeated after every child until the woman stops childbearing. In this context, a couple characterised by son preferences is hypothesised to be less likely to opt for a further birth if the gender composition of her surviving offspring is skewed towards boys. This hypothesis is investigated in the context of a dynamic Probit specification.

The results suggest a strong correlation between the sex mix of surviving children [3] and the probability of opting for another birth at every parity. Both, exclusively male and female offspring increase the chances of a further birth. In contrast, a sex mix containing more sons than daughters decreases the likelihood of a further birth. A possible interpretation of this result is that couples employ their fertility pattern to achieve a sex mix of offspring containing more boys than girls. They are, however, adverse to gender compositions containing only one sex – may it be male or female.

The paper is structured as follows: Section 1.2. lays out the motivation and policy relevance of the present analysis. Section 1.3. outlines previous work on the theoretical as well as empirical aspects of fertility and preference for male offspring with a particular focus on India. Section 1.4. explains the data and Section 1.5. the empirical framework employed. The results are discussed in Section 1.6. and Section 1.7. concludes.

[3] The NFHS-3 reports the survival status of each child born. This information was used to derive the number of surviving children.

1.2. Motivation

India takes an important place in the population growth debate. With 1.171 billion inhabitants it is - after China - the second most populous country in the world. Due to its high rate of natural increase[4] of 1.6% per annum, however, estimates say that by 2025 it will have reached China's population and will have well overtaken it by 2050.[5] Within India, the northern state of UP is a particularly interesting case. With a current 190 million inhabitants, it is India's most populous state. If it were an independent country, it would be the sixth most populous one in the world. In addition to this, it is characterised by the second highest total fertility rate of 3.8 which is well above the Indian and world averages of 2.7 and 2.55.[6] Furthermore, UP lags behind India in a number of human development indicators. For example, it has a considerably lower level of child survival than most other Indian states. The under-five mortality rate in UP is 93 deaths per 1000 births, which lies significantly above the Indian rate of 75.[7] Similarly the immunisation coverage in UP is 21%, which is only half of the coverage throughout the whole country.

Previous studies have found preferences for sons to exert a positive influence on the total number of children a woman gives birth to (Arokiasamy, 2002; Yount et al., 2000; for instance). A couple characterised by preferences for sons is likely to want to achieve a determined sex mix or a minimum number of sons rather than a determined family size. There are a number of ways in which a couple can achieve their desired sex mix. They can use sex selective abortions, allocate a disproportionately high

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[4] The rate at which a population is increasing (or decreasing) in a given year due to a surplus (or deficit) of birth over deaths, expressed as a percentage of the base population.

[5] Figures come from the Population Reference Bureau. 2025 and 2050 estimates for India are 1,444 billion and 1,747 billion and for China 1,476 billion and 1,437 billion respectively. Homepage: http://www.prb.org/

[6] National Family and Health Survey, 2005/2006.

[7] National Family and Health Survey, 2005/2006.

proportion of resources to sons or adjust the total number of births. In the latter case, the couple will only stop childbearing once the desired son preference outcome is achieved. Ex ante, the direction of the effect son preferences can have on fertility is ambiguous. On the one hand, son preferences may decrease the total number of births a woman experiences in her lifetime. Consider the following example. Parents, who are strongly averse to daughters, have a first-born son. Having a second child would imply incurring the "risk" of having a daughter. The couple might, therefore, stop after the first birth. On the other hand, son preferences can potentially and substantially increase fertility. In the absence of sex selective abortions, the sex of the child is randomly assigned. This uncertainty implies that in some instances the total amount of children will have to be large in order to achieve a certain sex mix. Consider the following example: a couple wants to have two children. If the couple is indifferent about the sex of the children, they will stop childbearing after parity two (assuming the children survive). If the same couple, however, wishes to achieve two sons then two children will achieve this goal with a probability of 25%. Similarly, three children will be made up of at least two boys in 50% and four in slightly less than 70% of cases. In some instances, therefore, these preferences will considerably increase the total number of children per couple.

As already mentioned, the literature speaks of widely spread preferences for sons in India. The NFHS-3 elicits questions about the ideal number of children in general, as well as of boys and girls in particular.[8] Due to recall bias and endogeneity problems, this information cannot be employed as covariates in the empirical model. It can, however, give a good first impression of the extent to which son preferences are present in Indian society. For women aged 15 to 49 in India, the ideal family size is 2.3

[8] The relevant question is *"If you could choose exactly the number of children to have in your whole life, how many would what be?"* and *"How many of these children would you like to be boys, how many girls and for how many would the sex not matter?"*

children on average; 1.1 boys, 0.8 girls and 0.4 children of either sex. Furthermore, 22% of these women report to want more sons than daughters, only 3% report the opposite (IIPS, 2007). These patterns appear even stronger in the sample used for the empirical analysis (women in UP aged 40 or more). These women have on average an ideal number of boys of 4.33. The corresponding number for girls is 3.95. In addition to this, 34% of women stated a higher number of ideal sons than daughters whereas only 1% reported the opposite. Furthermore, a number of indicators suggest that these preferences are particularly pronounced in UP. In 2001, its sex ratio was 902 women per 1000 men. For the whole of India, the corresponding figure in the same year was 933.[9] Schooling achievements – another possible measure of son preferences – also vary considerably between boys and girls. For India, 78% of boys and 66% of girls, between the ages of 6 and 17, are enrolled in school. For UP, the former percentage is very similar namely 76%. The latter, however, is considerably lower at 61%.[10]

Knowledge about the influence of son preferences on fertility can be valuable to policy makers. If son preferences do indeed exert a positive influence on fertility, reducing son preferences may become an effective tool in curbing population growth. Although son preferences appear to be rooted in Indian society (UNICEF, 2008) they are not inalterable. Increasing female education (as argued by Pande and Astone, 2007), improving working conditions for women and teaching parents about the equal value of sons and daughters are possible – though lengthy – ways of decreasing preferences for sons.

[9] Census of India, 2001. Homepage: http://www.censusindia.net/
[10] National Family and Health Survey, 2005/2006.

1.3. Background

The past literature has identified a number of influences on fertility and preferences for male offspring are among these factors. Empirical evidence on the relationship between these preferences and fertility is mixed. More recent evidence suggests considerable effects.

1.3.1. The Influence of Son Preferences on Fertility

Much of the theoretical literature on fertility is concerned with the "quality-quantity" trade-off proposed by Becker (1960) and Becker and Lewis (1973). The quantity of children and the outcomes of every child – defined as child quality – are considered as imperfect substitutes by the parents. The marginal cost of child quality, with respect to quantity, then leads to a trade-off between these two aspects. In developing countries, this trade-off can be seen as particularly pronounced since parents only have a very limited amount of resources to distribute among their offspring. The implication of this hypothesis – children with many siblings fare worse – has found considerable empirical support (Leibowitz, 1974; Heckman and Walker, 1991; Caudill and Mixon, 1995). Rosenzweig and Wolpin (1980), in particular, argue that schooling per child and the number of children are substitutes. Willis (1973) highlights the importance of the mother: as women are typically the main care-takers of children, any constraint on their time will have a potential effect on their total number of children. The author uses a time-allocation model to show that the opportunity cost of this time has a strong negative effect on the time allocated to raising children. The empirical implication of this is a negative relation between the woman's employment and the quantity of her children. Fertility has also been analysed in the context of the relative income hypothesis (Easterlin, 1975; 1987).

In richer economies, decisions regarding fertility have been treated as decisions over "consumption goods". In less developed countries, however, children are more likely to conduct producer roles and the range of factors influencing fertility must consequently be increased in a framework in which children are equivalent more to "producer" goods than to "consumer" goods. Similarly, the absence of insurances and old age pension schemes forces parents to treat their children as investment goods, especially when labour markets are largely unregulated. In this context, any factor influencing the expected lifetime earnings of the parents' offspring can potentially affect fertility. Discrimination against women, for instance, is likely to have a significant impact on the total amount of children born to a woman.

A child's gender is often seen as a determinant of its "quality". Many societies have been found to be characterised by widespread preferences for male offspring. Parents might prefer sons to daughters for three reasons (Schultz, 1993). Firstly, the productivity of sons net of child rearing and investment costs might exceed that of daughters. Due to their greater physical strength, sons are more likely to produce more on farms, for instance. Furthermore, girls often require dowries. Secondly, remittances from this net productivity might be larger for sons than for daughters. If children are seen as investments for old age, this will determine the profitability of the investment. Finally, the non-economic value of male offspring might exceed that of female children. In this sense, son preferences can arise from a more or less conscious desire by couples to raise children with culturally accepted characteristics. If the society is a patriarchal one or discriminates against women, parents will have an incentive to prefer sons to daughters. In the past, preferences for sons have been linked with a number of socio-economic outcomes comprising discriminatory practices against girls in feeding, health care, nutrition and education. Furthermore, various studies highlighted a link between son preferences and excess female mortality rates, sex selective abortions, rising sex ratios and even female infanticide. In addition to this, son preferences may have a potentially strong effect on a woman's completed lifetime fertility. It has been argued that in countries where one sex is strongly preferred to the other, couples will stop having children only if they are satisfied with the sex composition of their offspring (Leone et al., 2003).

Empirical evidence on the relation between son preferences and fertility varies. Older studies argue for a comparatively small effect of son preferences (Leung, 1991; Srinivasan, 1992; Davies and Zhang, 1992; for example). More recent evidence, however, suggests larger effects. Yount et al. (2000), for instance, examine the effect of son preferences on contraception and fertility in rural Egypt. The authors find that having one or more sons has a positive effect on contraceptive use. Furthermore, families with no sons were found to have higher odds of a further birth compared to families with two or more sons. Similarly, Leone et al. (2003) using Nepalese data calculate TFR in the absence of son preferences and investigate the probability of a couple's last child being a son and find considerable effects.

Much of the literature in the Indian context has focused on the linkages between son preferences and either contraception or current fertility levels. Completed lifetime fertility has received comparatively little attention so far. Arokiasamy (2002) argues that low female autonomy and a strong preference for sons are two patriarchal constraints particularly pronounced in the North of India and son preferences are found to decrease contraception and increase fertility. In connection with religion, Borooah and Iyer (2004) find that higher Muslim fertility may reflect differences in preferences for sons. Jensen (2007) exploits the presence of son preference as an instrument for fertility when analysing schooling outcomes for children in India. Moursund and

Kravdal (2003) argue that the average education of women in the community has a positive effect on contraceptive use in India. A possible explanation for this is the presence of son preferences. The endogeneity of son preferences has also been acknowledged. Ex ante, the causal relation between this concept and fertility is not clear and son preferences may also depend on fertility; Bhat and Zavier (2003), for instance, examine son preferences as fertility decreases in an area with little female autonomy in Northern India. They find that preferences for sons are reduced when the ideal family size is small, even though it does not completely disappear. In a similar vein, Murthi et al. (1995) find that female literacy significantly decreases mortality, fertility and gender bias against girls. Pande and Astone (2007) find maternal education to significantly decrease preferences for male offspring.

One of the major challenges for this literature is how to capture the influence of the abstract concept of son preferences empirically. Parental preferences for a particular sibling-sex composition were first analysed by Angrist and Evans (1998). The authors employ a variable indicating whether the first two children are of the same sex as an instrument for fertility. This instrument exploits parental preferences for mixed-sex offspring. The authors find that couples with two firstborn sons or two firstborn daughters are more likely to have a further child compared to couples whose first two children are a son and a daughter. More recently, Jensen (2007) used the same instrument to analyse educational outcomes in India. Most studies under scrutiny adopt some measure of children’s sex composition to isolate the effect of son preferences on fertility. Arokiasamy (2002), for instance, employs two indicator variables for the number of surviving sons at the time of the interview. The first takes the value 1 if the woman has one surviving son and the second takes the value 1 if she has to two or more male children. Similarly, Yount et al. (2000) use variables for the sex composition of living children. Finally, Mishra et al. (2004) scrutinise the birth order of every child controlling for the number of sons alive.

The present analysis aims to contribute to the literature in a number of ways. In the first instance, the vast majority of previous studies has investigated fertility employing count models (Caudill and Mixon, 1995; Winkelmann and Zimmermann, 1994; Wang and Famoye, 1997). In these models, all counts are derived from the same data generating mechanism. The underlying assumption of these specifications is that parents have an ideal family size before they enter parenthood. These preferences are further assumed to remain constant over time and will not change with newly available information (the sex mix of surviving children, for instance). Hurdle or Double-Hurdle Count models (Santos-Silva and Covas, 2000; Wang and Famoye, 2004; Miranda, 2003; 2010, for instance) have addressed this issue. Although the incorporation of one or more hurdles allows for different data generating mechanisms, these frameworks do not appear apt to analyse the influence of the sex mix of surviving children on the total number of births. The truncated count, for instance, retains the assumption that more than one count are generated by the same density and does not allow the influence of covariates to vary from one count to the next. A more intuitive way to model this process is to see the overall decision on how many children to have as a number of sequential stopping decisions. First, the parents will decide whether or not to enter parenthood. Once the first child is born, the couple will decide on whether to have a second child or to stop. After the birth of the second child, the parents will face the same decision again: whether to continue child bearing or to stop. At every stage of the aforementioned process, parents can modify their choices in accordance with information, which has become available at the relevant time period. Parents characterised by son preferences are hypothesised to stop childbearing if the sex composition of their surviving children is skewed towards sons. The sequential nature of this decision-making process is approximated by a dynamic Probit specification here.

As a motivating starting point for the econometric analysis outlined in section 1.5. consider three count models. For each model the dependent variable is the number of births experienced by each woman. The results are reported in Table 1.1. Model A is a Generalised Poisson. The advantage of this specification is that it allows for under- as well as over-dispersion.[11] The use of a variable for the sex mix of a woman's surviving offspring is not possible in this framework. The very notion of such a variable presupposes that a certain number of births have already occurred. For this to be modelled empirically, the distribution of the number of births must be truncated at a certain value, which cannot be done in this framework. The results of this model suggest that the major influence on lifetime fertility are the woman belonging to a scheduled caste (positive) or another backward caste (positive), Muslim religion (positive) and maternal education (negative). These results hold across all three specifications outlined here.

Model B is a hurdle count model consisting of two parts. The first partscrutinises the probability of a woman entering parenthood, uses a complementary logistic distribution[12] and the results suggest that Muslim women have a lower probability of entering parenthood, whereas all other covariates are insignificant. The second part is a Generalised Poisson distribution truncated at zero and includes an explanatory variable taking the value 1 if the first born child is female, which appears to exert a positive influence on the truncated count. Compared to Model A, this

[11]Under-dispersion denotes a case where the variance of a variable exceeds its mean and over-dispersion if the mean of a variable exceeds the variance.
[12]The cloglog distribution is equivalent to the Generalised Poisson distribution evaluated at y=0.

specification has the advantage that the effect of the sex of the first child can be modelled. However, it cannot model this effect for higher parities.

Finally, Model C is a double hurdle specification. This specification consists of three parts. The first hurdle scrutinises the probability that the woman has one or more children, the second that the woman stops at exactly one child and finally the subsequent count is a Generalised Poisson distribution truncated at one from the left. This specification goes a step further than Model B. The second hurdle includes an indicator variable for the first child being female. The truncated count, in turn, includes two dummies; one for the first two children being male and one for them being female. The results suggest that the sex of the first child is not relevant for the probability of the woman stopping at parity two. Similarly, the coefficient for the first two children being female is insignificant. The first two children being female, by contrast, appears to exert a positive influence on counts of births greater or equal to two.

The results from Models A to C highlight the limitations of the application of count models to fertility decisions. Irrespective of the value at which the distribution is truncated, these models still retain the assumption that all counts subsequent to the truncation are derived from the same data generating process. This assumption allows for the possibility that parents update their beliefs only for the parts of the distribution modelled as hurdles. As soon as the dependent variable is modelled as a truncated count, the parental decision on the total number of children is assumed to have been taken. By contrast, treating every birth as a separate decision allows parents to change their beliefs at every parity in accordance with newly available information. It, therefore, appears a more realistic way of modelling lifetime fertility.

Furthermore, considering every choice separately is particularly advantageous to investigate the effect of the gender composition of surviving children on fertility choices. The sex composition of a woman's offspring is likely to change at every parity. Ideally the explanatory variable for the sex composition should be allowed to change from one parity to the next. In contrast to count models, in the dynamic Probit specification, every child contributes one observation to the analysis. This allows the values of all explanatory variables to change from one child to the next thus allowing the gender composition to be updated after every surviving child.

Finally, no previous study – to our knowledge – has focused on the effect of son preference on lifetime fertility in India. Previous studies have focused on current fertility (Mutharayappa et al. 1997, Arokiasamy, 2002; for instance). Results relating to lifetime fertility are likely to be more useful for policy makers than to current fertility. This latter concept only explains a short time window of a woman's reproductive life. Policy makers, however, are more likely to be interested in a woman's complete reproductive history.

1.3.2. <u>Other Influences on Fertility</u>

A large number of empirical studies have analysed numerous further influences on fertility. Most studies identify the following factors as important determinants: income, maternal education, contraception and child mortality.[13] Concerning income, Becker (1981) finds that the elasticity on the demand for child quality is larger than that for child quantity. Hence, as income increases, parents will substitute away from the latter towards the former and the total number of children is expected to decrease. Maternal education can influence fertility in a number of ways. Aside from being a predictor of the woman's labour market outcomes, it facilitates contraceptive use and empowers women in general. Changes in women's schooling achievements accounted for a large part of fertility changes in many developing countries from the 1960s and in Africa

[13] Arroyo and Zang (1997) provide a survey of structural and reduced form models.

from the 1980s (Schultz, 1994; Shapiro and Tambashe, 2001). Schultz (1997) finds maternal education to decrease both fertility rates as well as child mortality. The estimates for the former effect exceed the ones for the latter and hence the overall effect on the number of children is negative.

Child mortality is a very important factor in explaining fertility rates. Ex ante, the causal relation between these two concepts is not clear. On the one hand, the death of one child is likely to prompt the birth of another. On the other hand, a higher number of children imply less resources per child decreasing each individual’s survival chances. Due to this endogeneity, fertility has been modelled in a variety of ways. Instrumental variables have often been used in this context (Maglat, 1990, and Benefo and Schultz, 1992). Alternatively, this factor has been left out all together and the resulting equation treated as a reduced form (Schultz, 1994).

In the Indian context, most studies have focused on contraception rather than explicitly modelling fertility. As one of the few, Dreze and Murthi (1999) find that even after controlling for state-specific effects, female education and child mortality strongly explain fertility in India. In a similar vein, Bhat (2002) analyses the relations between a woman’s education, fertility and her children’s education. In the initial stage of the demographic transition, education has a significant negative effect on fertility. At later stages, however, the fertility level exerts a significant negative influence on educational attainment of children, especially of girls. Abadian (1996) examines the interrelations between female autonomy and the total fertility rate across different countries. She finds that increasing female autonomy, not only helps in meeting welfare goals but also promotes a reduction in fertility. Similarly, Malhotra et al. (1995) argue that even within the kinship-based patriarchal structure, women’s position is multidimensional and that the various dimensions can exhibit relationships to the TFR independently of one another.

Contraception and family planning are closely linked to fertility and have received considerable attention in the Indian context. McNay et al. (2003) find the mass media, community level and diffusion effects to be important. Various studies highlight the importance of a woman's position within the household for the adoption of contraceptive methods. Sathar et al. (2003), for instance, examine the relative importance of religion, caste and female autonomy. Similarly, Jejeebhoy (1991) looks at the effect of female autonomy on fertility control over time in the Southern state of Tamil Nadu. In a similar spirit, Dharmalingam and Morgan (1996) examine the role of woman's work. Prakasam et al. (2006) also consider social factors and investigate whether exposure to persons of diverse social identities in their communities reduces the impact of women's own social identity on fertility control.

1.4. Data, Measurements and Variables

The data used for the empirical analysis are taken from the third round of the National Family Health Survey for India (NFHS-3), 2005/2006 (IIPS and Macro International, 2007). The NFHS is part of the Demographic and Health Survey (DHS) series and is conducted in about 70 low and middle-income countries around the world. In India, the survey was conducted in 29 states and interviewed around 230,000 women and men, aged 15 to 49, during the period December 2005 to August 2006. The questionnaire collects extensive information on health, nutrition, population and focuses particularly on women and children. The empirical analysis selects women in the Northern Indian state of UP, who have come to the end of their reproductive years and investigates their completed lifetime fertility. As mentioned in section 1.2, due to its high fertility rate and pronounced gender disparities, UP is a particularly interesting case.

1.4.1. <u>Fertility</u>

The empirical analysis scrutinises the probability of a woman continuing child-bearing at every parity. In this context, the total number of births a woman experiences in her lifetime becomes important. A number of previous studies has taken the count of a woman's births as the dependent variable (Arokiasamy, 2002, for instance). The intuitive reason for focusing on the total number of births is that couples employ contraceptive methods in order to achieve their desired number of pregnancies. An assumption behind this reasoning is that the actual number of births per couple corresponds to their desired total of births. In other words, this assumption states that a woman will only give birth if she and her partner desire so. There are a number of reasons for this assumption to be considered as too restrictive. In a first instance, it assumes that contraceptive methods are completely effective. In this framework, unwanted births are ruled out. In practice, however, most contraceptive methods cannot guarantee complete effectiveness. The only contraceptive method that is completely effective is sterilisation. This method, however, is only adopted by around 20% of women under consideration. A further reason for doubting the above mentioned assumption is infertility. It may be, for instance, that the couple desires a further child but cannot have another – either because of the wife or her partner. This shortcoming is inherent to studies analysing fertility and might also influence the results of the present analysis.

The means, standard deviations and percentages of the total number of births a woman experienced in her lifetime are reported in Column [1] of Table 1.2. The figures are based on a sample of 1,948 women, who have come to the end of their reproductive cycle (aged 40 or above). On average, a woman in UP gave birth to 5.24 children. The standard deviation of this mean is 2.55. A small minority of women has one or less children, only 4% of the sample reported having experienced one birth or none in their lifetime. Parities between two and six children are the most commonly observed ones. 63% of women in the sample have given birth between two and six times. Parities above these are less frequently found. Less than a fifth had between seven and ten children. Finally, only 2% of women in the sample have experienced more than ten births in their lifetimes.

1.4.2. Son Preferences

A relation of particular interest to the present investigation is the one between son preferences and the total number of births a woman experiences in her lifetime. From a theoretical point of view Ben-Porath and Welch (1976) argue that the sex mix of children is something determining the quality of children within a quality/quantity framework à la Becker (1960). Past studies have documented the presence of son preferences in India (Bhalotra and Cochrane, 2010; Das Gupta et al., 2003) and – as mentioned in the previous section – these preferences appear to be particularly pronounced in UP. Furthermore and as mentioned above, descriptive evidence suggests these preferences to be present in the sample under consideration. The present analysis employs a strategy similar to the one used by Angrist and Evans (1998) to capture the effect of son preferences on fertility. The authors employ a dummy variable for the first two children having the same sex; the base case being one son and one daughter, irrespective of the birth order. In contrast to this, the present analysis defines three indicator variables. The first takes the value 1 if a couple has more surviving sons than daughters, the second if all children are male and the third if all are female. The base category in the case at hand is that the couple has either an equal number of sons and daughters or more daughters than sons.

There are alternative measures of empirically modelling the sex mix of a woman's offspring. An often employed strategy is to use the male to female ratio of offspring (Yount et al., 2000, for instance). This approach, however, has an important drawback. There are good reasons to believe the effect of the offspring's sex mix to have a non-linear effect on fertility. Past studies have documented that parents are adverse to sex mixes consisting exclusively of one gender – either male or female (Angrist and Evans, 1998, for instance). Consequently, the effect of a child's sex on fertility will depend on the sex mix of its older siblings. For example, the birth of a daughter is likely to decrease fertility if she is born into a household with an exclusively male offspring. By contrast, a female birth might increase fertility if the child is born into a household with an equal number of boys and girls. The use of three indicator variables enables the researcher to account for this particularity whereas a single ratio cannot. A further alternative is to employ indicator variables for all male and female sex mixes and a ratio of boys to girls for intermediate gender compositions. A drawback of this approach is that the values that the last variable takes depend on the parity of the woman. In other words: if the woman has two children, the ratio can take the value of ½, if she has three the values of 1/3 and 2/3, if she has four the values of ¼, ½ and ¾ and so on. The values of the indicator variable, by contrast, will be independent of the parity.

One way to determine which empirical strategy to adopt is to investigate how well the three alternatives fit the data. For this a dynamic probit is estimated three times. In the first run, son preferences are captured by the three indicator variables outlined above. In the second run, the same concept is measured via an index and in the third via two indicator variables (one for an all male and one for an all female gender composition) and a ratio. The maximised log likelihood value of the former model is the largest[14] – an indication that the three indicator variables produce a better fit compared to the two alternatives mentioned above.

A further alternative of modelling the sex mix of a woman's offspring is to employ the number of sons alive at each parity. This strategy produces a better fit compared to the three indicator variables outlined above.[15] The drawback of this approach, however, is that it does not allow the researcher to differentiate between the effect of, for instance, exclusively male or mixed male-female offspring. For this reason, this strategy is not pursued further.

An important issue in this context is child survival. The theoretical literature stresses that parents decide on the total number of surviving children (Becker, 1960; 1972). The death of one child will, therefore, prompt the birth of another. Similarly "excess children" will receive disproportionately little resources, which will decrease their survival chances. Mortality rates in India are not negligible. Since children belonging to mothers in the sample were born at different points in time, they were subject to varying survival rates. For the whole of India, the under-5 mortality rate in 1980 was 152 deaths per 1,000 live births. This figure decreases over time: in 1990, it was 117, in 2000, 91 and in 2005, 77 deaths per 1,000 live births.[16] For UP, in particular, the DHS[17] (2005/2006) reports under-5 and infant mortality rates of 96 and 73 deaths per 1,000 births respectively.[18] To take account of this, the present analysis considers the sex mix

[14]The maximised log likelihood value for the model with the three indicator variables is -5,797.86, for the model with a single ratio -6,028.30 and with a ratio and two dummy variables for exclusively male and female offspring -5,851.16.

[15]The maximised log likelihood value for the model with the number of surviving sons is -5,712.92 compared to -5,797.86 of the model with the three indicator variables.

[16] Source: World Bank, Development Indicators, 2010. http://data.worldbank.org/

[17] The DHS (2005/2006) is the overarching report encompassing the NFHS-3.

[18] NFHS-3 Final Report for India, 2005/2006.

of surviving children rather than the gender composition of previous births. Children, who died before the conception of the subsequent child, are, therefore, not considered here. The NFHS-3 provides information about the survival of all children born per woman. This was used to derive the total number of surviving children.

The following example might help to clarify the role child death plays in the construction of the sex mix variables. A woman with two sons gives birth to a girl. After this birth the individual will be in her fourth parity and must decide whether or not to opt for a further birth. In the absence of any deaths, the sex mix of this mother would be denoted as her having more boys than girls. Now suppose the girl dies. In this case, the woman is still regarded as in her fourth parity because she has given birth three times. The sex mix of her offspring, however, is reclassified to her having only two sons. The dead child, therefore, is disregarded for the construction of the three indicator variables employed in the present analysis. It is, however, counted as an extra parity.

As mentioned before, the interrelationships between child mortality and fertility behaviour are well documented (Maglat, 1990; Benefo and Schultz, 1992; for instance) and these relations should be accounted for when modelling lifetime fertility decisions. Consequently, it becomes important to control for such occurrences when modelling fertility decisions. The present analysis defines an indicator variable to capture the death of a child in a family. This variable takes the value of one at parity p if the child at parity p-1 died before the birth of the subsequent child. For example: if a woman's third child (parity 4) died, the indicator variable for child death will take the value of one at parity 5 for the respective woman.

The percentages of the three explanatory variables of interest are given in Columns [2] to [4] of Table 1.2. The values for the indicator variable for the couple having more sons than daughters vary considerably from one birth to the other. For odd number of children the values lie around 50%. For the first, third and fifth child the relevant values are 52%, 52% and 50%. By contrast, the percentages for an even number of surviving children lie around the one-third mark. For the second, fourth and sixth child, for instance, the numbers are 28%, 32% and 35%. The reason for this being that the odds of having the same amount of sons and daughters or more daughters than sons are obviously higher for even number of children. Notice that the variation in the values for this variable increases as the birth order increases. This is due to smaller sample sizes. In contrast to this, the percentages for all children being male and female decrease with the number of children. 52% of firstborn children are boys. The relevant percentages for 2, 3 and 4 children are 28%, 15% and 7%. The corresponding figures for an exclusively female offspring are 23%, 12% and 5%.

The fact that the sex of the first child is virtually randomly assigned has prompted many to give the coefficient on this variable – in the context of a labour supply framework, for instance – a causal interpretation. A possible reason for doubting the exogeneity of the sex of the first child is the presence of sex selective abortions, which give the parents a degree of control over the sex of the first child (Bhalotra and Cochrane, 2010). Foetal sex determination technology has caused such behaviour to become more and more frequent in India (Patel, 1989). It is possible to test for the presence of such practices by examining the sex ratio at birth. The natural sex ratio at birth is 105 boys per 100 girls.[19]

A possible way of testing for sex selective abortions is to investigate the gender composition of live births. Table 1.3. reports the sample percentages of all male and female births[20] alongside the percentages predicted by the natural rate outlined above.[21]

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[19]For a general discussion on the natural sex ratio see Trivers and Willard (1973).

[20]Note: In contrast to the explanatory variables, these numbers reflect births irrespective of whether or not the child died before the subsequent birth.

At a first glance, the frequencies in the sample under consideration and the predicted rates are very similar. They rarely differ by more than one percentage point. The largest differences can be found for the first parity where the difference between the predicted and actual percentage is 1.1%. Furthermore, for no instance could the null hypothesis of equality of means be rejected. This can be seen as evidence against the presence of sex selective abortions for the sample under consideration. A possible reason for this is the following: women under consideration were born between 1956 and 1966. At the moment these individuals were giving birth, ultrasound facilities were not widespread and discovering the sex of the child before its birth was, consequently, difficult.

1.5. Econometric Model

The empirical model analyses the probability of a woman experiencing a further birth at each parity within a dynamic Probit framework. This specification has previously been employed in a variety of different contexts. Previous applications comprise infant mortality (Arulampalam and Bhalotra, 2006), self-reported health status (Contoyannis et al., 2004), unemployment duration (Arulampalam et al., 2000) and unemployment and low pay dynamics (Stewart, 2007). This is – to our knowledge – the first application of this model to an investigation of the effect son preferences can have on fertility.

A woman's unobserved propensity to give birth at parity j is modelled as

$$y*_{ij} = s'_{ij-1}\gamma + x_{ij}\beta + \alpha_i + u_{ij} \qquad (1.1)$$

Where s'_{ij-1} is a vector modelling the sex mix of surviving children, x_{ij} a vector of exogenous covariates, β and γ the associated coefficient vectors, α_i the unobserved, mother-level heterogeneity and u_{ij} the parity specific error term. The u_{ij} are assumed to be independent of the α_i, which in turn are assumed to be invariant across parities. In

[21]These sex compositions have been chosen since same sex offspring is likely to produce the strongest incentives to employ sex selective abortions to alter the gender composition of children.

the present case j=1,…,K denotes the woman's parity. Women with no children are denoted as j=1. As mentioned above, s'_{ij-1} consists of three binary indicators; the first takes the value 1 if the woman's surviving offspring consists of more boys than girls. The second and third take the value of 1 if the surviving children the woman gave birth to are all male or female.

The vector x_{ij} comprises socio-economic factors pertaining to the woman and her partner. The first category comprises the caste of the woman and is measured by two indicator variables, which take the value 1 if the woman belongs to a scheduled caste or any other backward caste. The base category here is the woman belonging to one of the four castes. The woman's religion is captured by a dummy variable for her being of Muslim faith (base category: Hindu). A woman's education has been identified as a major determinant of fertility and is measured via an indicator variable for whether the woman has completed primary education. Finally, women are divided into various age cohorts, which are identified via indicator variables. Educational achievements vary considerably between men and women. Male education is on average higher and is measured via two dummy variables, one for the partner having achieved completed primary and one for secondary education. Relations between husband and wife can be captured by looking at the age difference between the spouses. For this, an indicator variable is defined, which takes the value 1 if husband and wife are five or more years apart. Furthermore, the indicator variable for the presence of child death outlined above is included as a covariate.

In this framework, every woman will contribute multiple observations to the analysis: one for every birth she experiences with the addition of one observation accounting for the first parity – in this state the woman has not experienced a birth. The resulting dataset is an unbalanced panel where every woman contributes a minimum of one and a maximum of K observations, where K is the parity of the woman – the number of children she gave birth to plus 1. A woman with a total of three births in her lifetime, for instance, will contribute four observations. The advantage of this data structure is that it allows the sex mix of surviving children to vary from parity to parity. In practice, the value of this variable is allowed to change from one observation to the next. If the first two children born to a couple are male, the indicator variable for all children being male takes the value 1 for the first and second parity. If the couple's subsequent child is female, however, the value of this indicator variable will take the value 0 for the third parity.

The dependent variable consists of a binary indicator taking the value 1 if the woman experienced a birth at parity j

$$y_{ij} = 1[y_{ij}* > 0] \qquad (1.2)$$

where $y_{ij}*$ indicates the woman's unobserved propensity to experience a birth at parity j. Consequently, every woman will have a series of 1s followed by a 0 once she stops childbearing at parity K. Note, the number of binary indicators per woman is K. In the example laid out above – a woman with three children – the vector for the dependent variable will have four elements. For the first three rows, the dependent variable will take the value of one, indicating that the couple decided to have a further child three times at parities one, two and three. In the last row, this variable will take the value zero, denoting that the parents decided to stop childbearing at parity three.

A problem for the present analysis is that u_{i1} is likely to be correlated with the mother-level unobserved heterogeneity, α_i. In other words: for the first period the error term is likely to be correlated with unobserved characteristics of the mother. A possible way to account for this is to condition decisions taken after the birth of the first child on the first birth. In the present case the equation for the first birth is specified as

$$y_{i1}{*} = z_i'\lambda + \theta\alpha_i + u_{i1} \qquad (1.3)$$

where z_i is a vector of exogenous covariates, which contains the same elements as x_{ij} with the addition of a number of instruments for the first equation and θ the parameter on the mother-level unobserved heterogeneity. This coefficient captures the correlation between the initial coefficient and the subsequent equations. A test of θ=0, therefore, will be a test of the exogeneity of the first parity.

In the present case, the vector z_i contains all the aforementioned variables with the addition of the woman's age at marriage. This variable constitutes the instrument for the initial conditions equation and is assumed to influence a woman's first birth. This influence might stem from biological as well as from social factors. A woman's age at marriage often coincides with the beginning of her reproductive life. From a biological perspective, the older the woman is, the less fertile she is likely to be. An advanced age at marriage, therefore, should decrease the chances of a woman having any offspring. From a social perspective, the age at which a woman marries might determine her say in the household as women, who marry younger, may have less bargaining power. As a consequence, such individuals will be less able to influence decisions regarding childbearing and the main decision-maker on whether or not the couple should have a child will be the husband. Since men are less likely to internalise the full costs of childbirth they are more likely to wish to become a parent. Hence both biological and social factors point towards a negative relationship between a relatively advanced age at marriage and the probability of the first birth.

An alternative instrument for the initial conditions equation is the age difference between the spouses. The assumption behind this exclusion restriction is similar to the one behind the woman's age at marriage. Women, who are considerably younger than their husbands, are assumed to have little say within the household. The argument for this to be the case is strong and has been employed in the literature on female autonomy (Abadian, 1996, for instance). Nonetheless, the woman's age at marriage appears to be a preferable instrument. This variable – like the age difference between the spouses – is likely to affect a woman's bargaining power within the household. In addition to this concept, however, the age at marriage also captured biological concerns regarding the woman's fertility – older women are considerably less fertile. The fact that the woman's age at marriage captures biological as well as sociological factors and the alternative only the latter class, makes a woman's age at marriage a preferable instrument. Against this, one may argue that the vast majority of marriages in UP occur a long time before the woman reaches the end of her reproductive years. Nonetheless, a decrease in biological fertility – rather than reaching the end of one's reproductive life – appears sufficient for the present purposes. In summary, it is apparent that finding a good instrument for the initial conditions equation is a demanding task where the researcher is forced to choose among a number of very valid alternatives.

The full model consists of equations (1.1) and (1.3). Note that this framework assumes a fixed correlation between ($\theta_1\alpha_i + u_{i1}$) and u_{ij}. This assumption of "equi-correlation" is common in the literature.

Under the assumption that u_{ij} and u_{i1} are independently and normally distributed, the conditional probability of all binary indicators y_{ij} can be written as

$$P(y_{i1}...y_{iK} \mid x_i, z_i, \alpha_i) =$$

$$\Phi[(z_i\lambda+\theta\alpha_i)(2y_{i1}-1)]\prod_{j=2}^{K}\Phi[(x_{ij}\beta+s'_{ij-1}\gamma+\alpha_i)(2y_{ij}-1)] \qquad (1.4)$$

Where Φ denotes the cumulative standard normal distribution function. Integrating α_i out, the contribution to the likelihood function of woman *i* can be written as

$$L_i = \int \{\Phi[(z_i\lambda+\theta\alpha_i)(2y_{i1}-1)]$$

$$\prod_{j=2}^{K}\Phi[(x_{ij}\beta+s'_{ij-1}\gamma+\alpha_i)(2y_{ij}-1)]\}g(\alpha_i)d\alpha_i \qquad (1.5)$$

Where $g(\alpha_i)$ is the probability density function of the unobservable mother-level heterogeneity. As common in the literature α_i is assumed to be normally distributed.

Arulampalam and Stewart (2009) proposed a convenient shortcut implementation for the model outlined in equations (1.1) and (1.3) and the present analysis follows their approach. The procedure involves the creation of an indicator variable for the first period $d_{ij}^{(0)}=1$ if j=1. Employing this variable, equations (1.1) and (1.3) can be combined as follows

$$\Pr[y_{ij}=1\,|\,s_{ij-1},x_{ij},z_i,\alpha_i]=$$

$$\Phi[(1-d_{ij}^{(0)})(s'_{ij-1}\gamma+x_{ij}\beta)+d_{ij}^{(0)}z_i\lambda+(1-d_{ij}^{(0)}+\theta d_{ij}^{(0)})\alpha_i] \qquad (1.6)$$

This model can be estimated using the programme GLLAMM (Rabe-Hesketh, Skrondal and Pickles, 2004)[22] in Stata (StataCorp., 1985).

1.6. Estimation and Results

The empirical analysis investigates the probability of the woman giving birth at each parity. Three models are estimated. Model 1 is a pooled Probit, Model 2 is a random

[22] The programme can be downloaded freely at gllamm.org

effect Probit which ignores the initial condition given in equation (1.3) and Model 3 is the full model that incorporates the initial equation laid out in Section 1.5.

Given the discussions above, the following seven results are expected. Although from a theoretical point of view son preferences may exert a positive as well as a negative influence on a woman's fertility, the vast majority of studies finds a positive connection between the two. The hypothesis, therefore, is that a) the coefficient on the indicator variable for the woman having more surviving sons than daughters is negative. For the two indicator variables for exclusively male and female sex compositions, the theoretical predictions are less clear. For these variables, two effects must be considered. On the one hand, couples are likely to prefer sons over daughters. On the other hand, couples have been found to be adverse to sex compositions consisting only of one sex (Angrist and Evans, 1998, for instance). For the indicator variable for all children being female, both effects work in the same direction. The hypothesis is that b) the coefficient on this dummy variable is positive. For the indicator variable denoting an all male offspring, by contrast, the two effects work in opposite directions. Given the vast evidence on the strength of the effect of son preferences on fertility, the former effect is hypothesised to outweigh the latter. It is expected that c) the coefficient on the dummy for an all female sex composition is negative. Evidence on whether the effect of son preferences varies with the number of births is scarce. Nonetheless, it is hypothesised that d) the influence of son preferences on fertility to be attenuated with the parity of the woman. Regarding the other covariates, the coefficients are expected to correspond to what has been found previously. For instance, the hypotheses are tested that e) maternal education exerts a negative influence on the probability of the woman opting for a further birth, f) Muslim religion and g) the age difference between the spouses have a positive relation to lifetime fertility.

1.6.1. Sex Mix of Previous Children

The parameter estimates for Models 1, 2 and 3 are reported in Table 1.4. Columns [1] and [2] report the parameter estimates for the pooled Probit and Random Effects Probit specifications. The coefficient estimates for these two models are very similar. The results from Model 3 in columns [3] and [4], however, vary from the two previous specifications. Comparing the log likelihood values for the three models under scrutiny, one notices that Model 3 shows the smallest absolute value indicating its fit to be the best. Furthermore, the parameter estimate for θ is significantly different from zero. Hence the null hypothesis of the exogeneity of the first period is rejected. Model 3, therefore, appears to be the preferred model and the discussion will focus on this specification.

The explanatory variables of interest are the three indicator variables for the different gender compositions of surviving offspring. Recall the base case is an equal number of surviving sons and daughters or more daughters than sons. The first indicator variable takes the value 1 if – at any given parity – the couple has more surviving sons than daughters. The second and third binary indicators take the value 1 if the couple's surviving offspring consists solely of sons or of daughters. The results suggest that the sex mix of previous children matters for the probability of the woman experiencing a further birth. Hypotheses a) and b) find some empirical support. By contrast, the results suggest the opposite of hypothesis c). The coefficient on the indicator variable for an all male offspring is positive. The results indicate that – at every parity – parents with more surviving sons than daughters are less likely to opt for a further birth (compared to the base case outlined above). By contrast, couples with surviving children exclusively of one sex show higher probabilities of experiencing a further birth. This finding is noteworthy and discussed in the following section.

The coefficients on the remaining variables show interesting patterns. The woman belonging to a scheduled or backward caste, for instance, appears to exert a positive and significant influence on the probability of the woman having a further child. The coefficients for this variable are positive and significant. The high positive correlation between lower castes and fertility is in congruence with a body of literature arguing that still today caste is a major determinant of an individual's socio-economic outcomes in India. Past studies have found that caste still determines inequalities (Deshpande, 2000), self-confidence (Hoff and Pandey, 2006) and how people respond to opportunities (Hoff and Pandey, 2004). A further reason for believing backward castes to have higher fertility is connected with income. These castes are – on average – poorer. As income might have changed over a woman's lifetime, it has not been included as a covariate. The higher fertility of the backward castes might, therefore, be a consequence of poverty rather than of anything particular of these social groups.

Hypothesis f) also finds support, as the woman being of Muslim faith appears to be positively correlated with the probability of further childbearing. A large body of literature analyses differences in socio-economic outcomes between Hindus and Muslims. The majority of studies concludes that Muslims fare worse in many relevant measures (Borooah and Iyer, 2004, for instance). These results appear to support these previous findings. As mentioned before, however, these results might be driven by income. Similarly to backward castes, Muslims tend to be – on average – poorer compared to Hindus. Their higher fertility might, therefore, be a results of this. A further possible reason for this positive association is the contraceptive use among Muslim women. Muslim faith strongly discourages the use of any contraceptive method, which will be likely to increase fertility considerably.

In contrast to the above, parental education appears negatively correlated with the woman continuing childbearing. The indicator variable for the woman having complete primary education or more is negative and significant. The indicator variable for her partner having complete secondary education or more, similarly, is negative.

Most of the literature has focused on the negative relation between maternal education and fertility rates (Schultz, 1994; Shapiro and Tambashe, 2001). However, the channels through which maternal education works are less explored and possibly more informative. Female education might be seen as a proxy for the woman's labour market outcomes. According to Willis (1973), this increase in the opportunity cost of the woman's time will lead to a reduction in fertility. Alternatively, maternal education can be seen as enabling women to make better informed choices about many aspects of the household – among these fertility. Educated women may, therefore, be more likely to understand the quality-quantity trade-off developed as by Becker (1960) and will consequently want a lower number of children. Finally, a woman's education has been seen as an important factor determining her autonomy. It has consequently been used as measurement of this last concept (Quisumbing and Maluccio, 2003, and Thomas et al., 2002). If this is accepted, the natural conclusion to draw is the negative correlation between female autonomy and fertility. According to this argument, a more autonomous woman would bargain for – and achieve – a lower number of children. Since women bear all the burden of child birth and most the burdens of child raising, they are more likely to internalise all relevant costs of fertility. The result is a lower demand for children.

Furthermore, the age difference between husband and wife bears a negative relation to the probability of the woman experiencing a further birth at parity j thus lending support to hypothesis g). This implies that couples, who are more than five years apart, have a lower chance of a further birth. A possible reason for this is the fertility of the partner, which is likely to decrease with his age. The coefficients on the woman's birth cohort show a noteworthy pattern. The coefficients are negative and increasing in absolute magnitude. This implies that younger women, ceteris paribus, have a lower probability of experiencing a further birth. This finding is in congruence with descriptive evidence documenting a steady decline in fertility in India (Population Reference Bureau, 2010)[23]. Finally, a child death in the family has a positive and significant influence on the probability of the woman experiencing another birth. This result is intuitive: a death might change the family size to a sub-optimal level and the parents are likely to react to this by giving birth to another child.

An advantage of the econometric specification employed here is that the effect of the covariates on the fertility decision is allowed to vary between the first and all subsequent parities. This feature of the model unveils that some characteristics of the woman and the household affect the decision to enter parenthood in one way and the decision on following parities in another. This suggests that hypothesis e) to be a very simplistic way of analysing the effect of maternal education on fertility. First, the coefficients on maternal education differ between the two equations. The mother having attained primary education or more appears to exert a positive influence on the decision to have the first child. As mentioned above, it does, however, have a negative relation to the probability of her opting for further birth. This suggests that more educated women are more likely to have children but also experience a lower expected number of births in their lifetime. Second, paternal education behaves in a very similar way to the mother's education. The coefficient on the variable for the father having attained secondary schooling or more is positive in the initial conditions and negative in the

[23] Website: http://www.prb.org/, accessed November 2010.

main equation. Third, the influence of Muslim religion on fertility has been discussed to be positive. In contrast to this, the Muslim faith appears to have no effect on the decision regarding the first birth. Finally, younger women appear less likely to have children but the expected number of their births is higher.

1.6.2. Sex mix of previous children by parity

The results shown in Table 1.4. suggest a significant impact of the sex composition of previous offspring on the probability of the woman experiencing a further birth. A question arising in this context is whether these influences are stable across different parities – see hypothesis d). For instance, is the influence of an exclusively male or female sex composition on the probability of a further birth the same in parity two as in parity three or four or five? In order to investigate this idea further, the three indicator variables for the sex mix of surviving children are interacted with the parity of the woman. The model distinguishes between the second, third, fourth, fifth and sixth and above parity.

Three models are estimated. The first model distinguishes between three parities: the second, the third and parities of four and above. The second and third models extend this and consider parities up to five and six (and above), respectively. The results are reported in Table 1.5. It is apparent that the gender of the first child does not have a significant influence on the probability of the woman experiencing a further birth. For all three models the coefficient estimates on the dummy for the first child being male are not significantly different from zero. The sex mix of the first two children, by contrast, appears to have a significant influence on the probabilities of a further birth. For the second parity the signs of the coefficients on the three indicator variables are in congruence with the ones outlined in the section above. A sex mix skewed towards boys decreases the probability of a further birth, whereas exclusively male and female gender compositions increase this probability. The first effect is stable across parities. The coefficients remain negative and highly significant also for the fourth, fifth and sixth parities. By contrast, the influence of an exclusively male gender composition is attenuated as the parity increases. In two of the three models estimated the coefficients for the fourth parity and above become insignificant. A similar pattern can be observed for an all female sex mix. Here also the significance disappears for higher parities. Contrary to the all male indicator variable, however, the coefficients remain significant in all three models for the fourth parity. Overall the results suggest that for higher parities the influence of exclusively male or female sex mixes on fertility is weaker compared to sex mixes containing more sons than daughters. The weakest effect appears to be the one of gender compositions containing only male children.

1.6.3. Sex mix of previous children by maternal education

The results in Table 1.4. suggest a significant correlation between the sex composition of surviving children and fertility. The interpretation put forward here argues that preferences for sons have a positive influence on fertility. Whilst interesting, this finding on its own is not very useful for policy makers. Unless one can detect possible determinants of son preferences, the insights of this analysis will not have much practical applicability. A first step in this direction is to investigate whether and to what extent the results of the present analysis hold for various sub-groups of the sample. The present investigation, therefore, tests the hypothesis whether the effect of the sex composition of surviving children varies by the education of the woman. For this, the three explanatory variables of interest are interacted with the dummy for the woman having complete primary education or more. Maternal education has been chosen for two major reasons. In a first instance, much of the past literature has focused on the relation between a woman's education and her fertility (Schultz, 1994; Shapiro and

Tambashe, 2001). According to the vast majority of studies, more educated mothers tend to have fewer children. Furthermore, female education is an aspect, over which policy makers have some sort of control. India has made great strides improving its educational record through, for instance, the programme Sarva Shiksha Abhiyan. Although changing female education is a daunting and difficult task, it appears easier than changing other socio-economic aspects like caste or religion.

Table 1.6. reports the parameter estimates for the covariates and interaction terms. The influence of the sex mix of surviving children appears to differ between women with and without complete primary education, albeit not to a very large extent. For uneducated women, the results are similar to the ones for the whole sample. The signs and significances for the three indicator variables are the same as in Table 1.4. The interaction terms in Model 3, however, paint a different picture. For more educated mother, the first indicator variable (for sex mixes skewed towards sons) the estimates do not appear to differ between the two sub-samples. The coefficient on the interaction term is insignificant. For the second and third explanatory variables, however, statistical differences can be found. The coefficients on both interaction terms are negative and significant, indicating that the positive influence of an all male and all female offspring on fertility is smaller for women with complete primary education. Furthermore, the coefficient on the dummy for all surviving children being female is significant at the 5% level. The estimate for all surviving children being male, however, only at the 10% level. This indicates that the difference between women with and without complete primary education is more pronounced for couples with an all female sex mix of surviving children. These results are discussed further in the final section.

1.6.4. <u>Predicted Probabilities</u>

The results from the preferred specification, Model 3 in Table 1.4, can be used to predict the probability of a further birth conditional on the sex mix of surviving children. The estimated probabilities multiplied by 100 are reported in Table 1.7.[24] The following points appear noteworthy. In a first instance, comparing the base case to the an offspring consisting of more sons than daughters (columns [1] and [2]) one notices that the probability of a further birth tends to be higher in the base case. With the exceptions of the first three parities (the sample sizes for parities 1 and 2 are very small), the probabilities of the woman experiencing a further birth are higher if her offspring either consists of an equal number of boys and girls or of more girls than boys. This is in congruence with the results outlined so far. The differences tend to increase with the parity of the woman, albeit not monotonically. This suggests that son preferences are slightly more pronounced for higher parities.

A comparison of columns [3] and [4] paints the following picture. The probability of a further birth tends to be higher if the woman's offspring consists solely of girls, compared to boys. The relevant percentages are higher in all instances with the exception of parities 6 and 8. For example: a couple, whose first three sons are male, has an estimated 82% chance of having a further child. The corresponding figure for 3 firstborn daughters is 92%. In this case, the offspring being female increases the likelihood of a further birth by 10% more than male offspring. This finding indicates that parents are more averse to an all female sex composition than to an exclusively male one. This further confirms that couples tend to prefer sons over daughters.

[24] The sample sizes for parities larger than ten are very small and therefore not reported.

1.7. Discussion and Conclusion

A number of results arising from the empirical analysis appear worthy of further discussion. The first is the negative coefficient on the indicator variable for the couple having more surviving sons than daughters. This parameter indicates that sex compositions skewed towards male children decrease the probability of a woman giving an additional birth. The interpretation put forward for this finding is that parents prefer sons. This phenomenon, in turn, is strongly positively associated with the total number of children born to a woman. This result is in congruence with a growing body of literature documenting discrimination against girls in India and the north of the country in particular. An often-employed measure for this discrimination is the sex ratio between men and women. UP is known for its particularly skewed sex ratio of 112 men per 100 women. The average of this figure for India is 106.[25] In the past, three possible reasons for this positive association have been prominent (Schultz, 1997). Firstly, the net economic productivity of sons exceeds the one of daughters. Secondly, remittances by sons are higher than by daughters and finally the non-economic value of sons exceeds the one of daughters. There are a number of possible manifestations of this last aspect. Women with many sons might have a higher social status or sons might be valued more as they carry on the family name. Furthermore, daughters will require dowries, which many families cannot afford. Rather than a cultural factor, the fact that women prefer male children might also be a rational response to the general environment. As mentioned earlier, agricultural productivity of boys is likely to exceed the one of girls due to physical strength. A more important reason for the lifetime earnings of boys to exceed the one of girls, however, is labour market discrimination against women. If – ceteris paribus – the wage for women is lower than the one for men,

[25] UNICEF (2008), The state of Asia-Pacific children, Child Survival.

or if women are segregated into lower paying occupations, boys will have considerably higher expected lifetime earnings. As mentioned before, children in developing countries are seen as investments (as well as consumption) goods. This fact will increase the "profitability of the investment in boys" which makes sons preferable to daughters. In India, labour market discrimination against women is widespread. In many countries many women work on farms or in other family enterprises without formal pay (World Bank, 2007). The relations between fertility and labour market discrimination are an interesting point and a possible direction for further research.

A further noteworthy finding is the divergence in the coefficients on the three explanatory variables of interest. In particular, offspring of exclusively one sex – may it be male or female – increases the chances of a further birth. Together with the result discussed at the beginning of this section, this finding suggests that – although couples do prefer sons over daughters – they are adverse to gender compositions consisting solely of one sex. Descriptive evidence from UP confirms this idea. As mentioned before, the DHS elicits questions on the ideal number of children by sex. Despite the retrospective nature of these questions, they can still be informative. For the sample at hand, the mean number of ideal sons is 4.33 and of daughters 3.95. These figures indicate the presence of two preferences among women in UP. Firstly, women do appear to prefer sons to daughters but secondly, it is also apparent that women do desire some female offspring. Preferences in favour of a mixed sex combination of children have already been documented in developed economies (Ben-Porath and Welch, 1976; Angrist and Evans, 1998; for instance). The results of the present analysis suggest these "mixed sex" preferences are also present in UP. A possible reason for couples preferring offspring of mixed sex is connected to household production. Stereotypically boys and girls are allocated different tasks around the household. For example, boys often help with collecting wood or work on the farm, whereas girls are allocated to household chores like cooking or caring for their younger siblings. In this sense, having sons as well as daughters increases household efficiency.

A further finding of the analysis is that the connection between the sex-mix of the surviving children and the probability of having a further child is weaker for educated than for uneducated women. In this sense, more educated women – when faced with a same sex gender mix of surviving children – appear to have a lower propensity to have a further child than their less educated counterparts. This difference in propensity appears particularly pronounced for gender compositions consisting exclusively of girls. A possible explanation for this is that more educated women tend to have lower son preferences, which would imply that education changes the woman's preferences. Pande and Astone (2007), for instance, argue for a negative effect of education on son preferences.

An alternative explanation is that education, rather than changing the woman's preferences, simply increases her role in the household. According to this line of thought, women tend to discriminate less against girls and an increase in their bargaining power will consequently decrease the couple's desire for sons. There are a number of reasons why women are less likely to discriminate against girls. In a first instance, women will have experienced the disadvantages of unequal treatment of sons and daughters first hand in their childhood. Due to this reason, they will be more likely to internalise all the ramifications of treating their children differently. Consequently, they are more likely to make no distinction between their offspring. Alternatively – from a more emotional point of view – in light of their past experiences, women might be more likely to empathise with their daughters' situation and therefore be more likely to change it. Due to their experiences, women might also have developed resentment towards the patriarchal society they grew up in. Treating all their children equally, irrespective of their sex, might be a way to change these habits and attitudes. In previous research, female education has been found to increase her role within the household. More educated women will, therefore, bargain for and achieve a lower level of preference for boys.

In either explanation, the negative connection between female education and son preferences is interesting for policy makers. The policy implication to draw from this is that increasing maternal education can help to curb son preferences, which in turn is likely to decrease lifetime fertility.

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Table 1.1.

Maximum Likelihood Estimations of Probability of Giving Birth: Coefficient from Models A, B and C (Standard Errors)

	Model A	Model B	Model B	Model C	Model C	Model C
	[1]	[2]	[3]	[4]	[5]	[6]
	G. Poisson	Hurdle	Truncated G. Poisson	First Hurdle	Second Hurdle	Truncated G. Poisson
Ma: Scheduled Caste	0.123***	-0.134	0.132***	-0.134	-0.069**	0.110***
	(0.033)	(0.127)	(0.033)	(0.127)	(0.034)	(0.034)
Ma: Other Backward Caste	0.086***	0.037	0.083***	0.037	-0.038	0.063**
	(0.028)	(0.101)	(0.027)	(0.101)	(0.024)	(0.028)
Ma: Muslim	0.157***	-0.442***	0.198***	-0.442***	-0.049	0.208***
	(0.033)	(0.104)	(0.029)	(0.104)	(0.030)	(0.030)
Ma: Complete Prim Education	-0.440***	-0.091	-0.453***	-0.091	0.054**	-0.365***
	(0.031)	(0.112)	(0.031)	(0.112)	(0.024)	(0.030)
Pa: Complete Prim Education	0.021	-0.047	0.022	-0.047	-0.079**	-0.007
	(0.032)	(0.128)	(0.030)	(0.128)	(0.031)	(0.029)
Pa: Complete Sec Education	0.008	0.004	0.009	0.004	-0.048*	-0.022
	(0.024)	(0.095)	(0.023)	(0.095)	(0.026)	(0.023)
Age Difference > 5	-0.028	-0.165*	-0.014	-0.165*	-0.001	0.004
	(0.021)	(0.088)	(0.020)	(0.088)	(0.024)	(0.020)
Ma: Cohort 1958 - 1960	0.011	-0.018	0.015	-0.018	-0.050	-0.006
	(0.033)	(0.141)	(0.031)	(0.141)	(0.037)	(0.033)
Ma: Cohort 1961 - 1963	-0.013	0.115	-0.021	0.115	-0.008	-0.018
	(0.033)	(0.138)	(0.031)	(0.138)	(0.036)	(0.034)
Ma: Cohort 1964 - 1966	-0.037	0.142	-0.041	0.142	-0.014	-0.057
	(0.033)	(0.143)	(0.032)	(0.143)	(0.037)	(0.036)
<u>Sex Mix of Surviving Children:</u>						
First Child is a Girl	-	-	0.081***	-	0.003	-
			(0.018)		(0.021)	
First Two Children are Girls	-	-	-	-	-	0.074***
						(0.022)
First Two Children are Boys	-	-	-	-	-	-0.024
						(0.023)
θ	-0.028	-	-0.068***	-	-	-0.503***
	(0.019)		(0.019)			(0.022)
Constant	1.729***	1.562***	1.733***	1.562***	0.170***	2.175***
	(0.045)	(0.160)	(0.044)	(0.160)	(0.046)	(0.047)
Log Likelihood	-4,276.80	-	-4208.51	-	-	-5400.01

<u>Notes:</u> (i) Estimates are based on sample of women having completed their reproductive cycle. (ii) Dependent variable takes the value 1 if couple has a further child.(ii) Model A: Generalised Poisson. Model B: Generalised Poisson truncated at zero. Model C: Double Hurdle Model, first hurdle at zero, second hurdle at one.

Table 1.2.

Total Number Surviving Children and Selected Explanatory Variables, Percentages

	[1]	[2]	[3]	[4]	[5]
	Percentage with Children:	**More Sons Than Daughter**	**All Sons**	**All Daughters**	**Observations**
0	2	-	-	-	34
1	2	52	52	49	35
2	10	28	28	23	198
3	14	52	15	12	279
4	15	32	7	5	291
5	14	50	4	3	267
6	10	35	2	2	263
7	8	50	1	0	197
8	6	37	1	0	162
9	2	51	1	-	119
10	2	35	-	-	43
11	1	55	-	-	33
12	1	40	-	-	17
13	0	63	-	-	5
14	0	67	-	-	3
15	0	50	-	-	2
16	0	100	-	-	1

Notes: (i) Means, standard deviations and percentages are based on sample of women having completed their reproductive cycle. (ii) Column [1]: Percentages of women by number of births; Column [2]: Percentage of indicator variable for couple having more boys than girls; Column [3]: Percentage of indicator variables for couple having only sons; Column [4]: Percentage of indicator variables for couple having only daughters; Column [5]: number of observations. (iii) Columns [2] to [4] refer to children surviving until the subsequent birth.

Table 1.3.

Total Number of Births, Percentages and Predictions:

Number of Children	All Boys			All Girls		
	[1]	[2]	[3]	[4]	[5]	[6]
	Sample	Natural Rate	t-statistic for Col. [1] - Col. [2]	Sample	Natural Rate	t-statistic for Col. [4] - Col. [5]
1	52.3	51.2	0.962	47.7	48.8	-0.982
2	27.2	26.2	0.945	23.7	23.8	-0.101
3	13.6	13.4	0.259	11.9	11.6	0.399
4	6.4	6.9	-0.734	5.9	5.7	0.363
5	4.4	3.5	1.425	3.7	2.8	1.529
6	2.5	1.8	1.255	2.2	1.4	1.643
7	1.0	0.9	0.309	0.5	0.7	-0.625
8	0.5	0.5	0.193	0.3	0.4	-0.344

Notes: (i) Means, standard deviations and percentages are based on sample of women having completed their reproductive cycle. (ii) Column [1]: Percentage of women in sample giving only birth to sons, Column [2]: Percentage of women giving only birth to sons as predicted by the natural rate; Column [3]: t-statistic for test h_0: [1] – [2] = 0; Column [4]: Percentage of women in sample giving only birth to daughters, Column [5]: Percentage of women giving only birth to daughters as predicted by the natural rate; Column [6]: t-statistic for test h_0: [4] – [5] = 0; (iii) Columns [2] and [5] refer to births irrespective of survival status.

Table 1.4.

Maximum Likelihood Estimations of Probability of Giving Birth: Coefficient from Models 1, 2 and 3 (Standard Errors)

	Model 1	Model 2	Model 3	Model 3
	[1]	[2]	[3]	[4]
	Probit	Random Effect Probit	Random Effect Probit: Heckman Estimator Initial Conditions	Random Effect Probit: Heckman Estimator
Ma: Age at Marriage	-	-	0.031***	-
			(0.009)	
Ma: Scheduled Caste	0.173***	0.172***	0.291**	0.157***
	(0.041)	(0.040)	(0.145)	(0.044)
Ma: Other Backward Caste	0.103***	0.101***	0.305***	0.084**
	(0.033)	(0.033)	(0.111)	(0.035)
Ma: Muslim	0.285***	0.290***	0.213	0.277***
	(0.039)	(0.041)	(0.187)	(0.040)
Ma: Complete Prim Education	-0.320***	-0.322***	0.269**	-0.383***
	(0.035)	(0.032)	(0.128)	(0.037)
Pa: Complete Prim Education	0.044	0.029	0.077	0.044
	(0.043)	(0.053)	(0.167)	(0.045)
Pa: Complete Sec Education	-0.077**	-0.079**	0.405***	-0.114***
	(0.033)	(0.034)	(0.126)	(0.035)
Age Difference > 5	-0.061**	-0.068**	0.130	-0.068**
	(0.028)	(0.030)	(0.101)	(0.030)
Ma: Cohort 1958 - 1960	0.112***	0.123***	-0.156	0.141***
	(0.038)	(0.076)	(0.151)	(0.040)
Ma: Cohort 1961 - 1963	0.086**	0.090**	-0.230*	0.105***
	(0.035)	(0.037)	(0.132)	(0.037)
Ma: Cohort 1964 - 1966	0.080**	0.082**	-0.357***	0.112***
	(0.036)	(0.037)	(0.127)	(0.038)
Previous Child Died	0.277***	0.288***	-	0.087**
	(0.038)	(0.050)		(0.041)
Sex Mix of Surviving Children:				
More Sons than Daughters	-0.485***	-0.491***	-	-0.495***
	(0.033)	(0.040)		(0.033)
Only Sons	1.036***	1.052***	-	0.692***
	(0.040)	(0.051)		(0.044)
Only Daugthers	1.153***	1.178***	-	0.781***
	(0.051)	(0.061)		(0.055)
θ	-	-	0.489***	-
			(0.185)	
Constant	0.461***	0.502***	-	0.519***
	(0.047)	(0.047)		(0.049)
Log Likelihood	-5986.29	-5988.3	-	-8797.58

Notes: (i) Estimates are based on sample of women having completed their reproductive cycle. (ii) Dependent variable takes the value 1 if couple has a further child. (iii) Model 1: Pooled Probit Regression. Model 2: Probit Regression with unobserved heterogeneity at mother level. Model 3: Heckman's Estimator of the Random Effects Probit model accounting for initial condition.

Table 1.5.

Maximum Likelihood Estimations of Probability of Giving Birth by Parity: Coefficient from Models 1, 2 and 3 (Standard Errors)

	[1]	[2]	[3]	[4]	[5]	[6]
Age at Marriage	0.042***	-	0.042***	-	0.042***	-
	(0.009)		(0.009)		(0.009)	
S. Caste	0.311**	0.166***	0.310**	0.168***	0.312**	0.166***
	(0.143)	(0.043)	(0.143)	(0.044)	(0.143)	(0.044)
O. B. C.	0.332***	0.092***	0.328***	0.096***	0.329***	0.096***
	(0.110)	(0.035)	(0.110)	(0.035)	(0.110)	(0.035)
Muslim	0.187	0.311***	0.178	0.319***	0.169	0.329***
	(0.187)	(0.040)	(0.187)	(0.040)	(0.187)	(0.040)
Ma: Prim. Educ	0.328***	-0.415***	0.330***	-0.417***	0.331***	-0.418***
	(0.124)	(0.036)	(0.124)	(0.036)	(0.124)	(0.036)
Pa: Sec. Educ	0.329***	-0.076**	0.331***	-0.078**	0.330***	-0.077**
	(0.116)	(0.032)	(0.116)	(0.032)	(0.116)	(0.032)
Age Diff > 5	0.110	-0.057*	0.112	-0.058**	0.112	-0.058**
	(0.100)	(0.029)	(0.100)	(0.029)	(0.100)	(0.029)
1958 - 1960	-0.121	0.171***	-0.128	0.178***	-0.132	0.182***
	(0.149)	(0.040)	(0.149)	(0.040)	(0.149)	(0.040)
1961 - 1963	-0.150	0.105***	-0.156	0.110***	-0.159	0.114***
	(0.130)	(0.037)	(0.130)	(0.037)	(0.130)	(0.037)
1964 - 1966	-0.285**	0.125***	-0.291**	0.131***	-0.292**	0.133***
	(0.126)	(0.038)	(0.126)	(0.038)	(0.126)	(0.038)
Child Died	-	0.109***	-	0.111***	-	0.111***
		(0.040)		(0.041)		(0.041)
δ	-	0.401***	-	0.411***	-	0.421***
		(0.109)		(0.111)		(0.115)
Constant	-	1.298***	-	1.023***	-	1.302***
		(0.698)		(0.705)		(0.569)

Table 1.5. Continued

Second Parity						
First Boy	-	0.109	-	0.109	-	0.109
		(0.092)		(0.092)		(0.092)
Third Parity						
More Boys than Girls	-	-0.363***	-	-0.363***	-	-0.362***
		(0.045)		(0.045)		(0.045)
All Boys	-	0.220***	-	0.219***	-	0.219***
		(0.081)		(0.081)		(0.081)
All Girls	-	0.680***	-	0.679***	-	0.679***
		(0.120)		(0.120)		(0.120)
Fourth Parity						
More Boys than Girls	-	-0.788***	-	-0.621***	-	-0.621***
		(0.040)		(0.063)		(0.063)
All Boys	-	0.259***	-	0.170	-	0.169
		(0.099)		(0.129)		(0.130)
All Girls	-	0.524***	-	1.005***	-	1.005***
		(0.142)		(0.238)		(0.238)
Fifth Parity						
More Boys than Girls	-	-	-	-0.872***	-	-0.730***
				(0.047)		(0.061)
All Boys	-	-	-	0.186	-	0.019
				(0.164)		(0.203)
All Girls	-	-	-	0.106	-	0.087
				(0.189)		(0.235)
Sixth Parity						
More Boys than Girls	-	-	-	-	-	-1.042***
						(0.066)
All Boys	-	-	-	-	-	0.398
						(0.279)
All Girls	-	-	-	-	-	0.136
						(0.318)
Log Likelihood	-	-9001.76	-	-9021.56	-	-9032.58

Notes: (i) Estimates are based on sample of women having completed their reproductive cycle. (ii) Dependent variable takes the value 1 if couple has a further child. (iii) Model 1: Pooled Probit Regression. Model 2: Probit Regression with unobserved heterogeneity at mother level. Model 3: Heckman's Estimator of the Random Effects Probit model accounting for initial condition.

Table 1.6.

Maximum Likelihood Estimations of Probability of Giving Birth: Coefficient from Models 1, 2 and 3 (Standard Errors)

	Model 1	Model 2	Model 3	Model 3
	[1]	[2]	[3]	[4]
	Probit	Random Effect Probit	Random Effect Probit: Heckman Estimator	Random Effect Probit: Heckman Estimator
	Initial Conditions		Initial Conditions	
Ma: Age at Marriage	-	-	-0.064***	-
			(0.005)	
Ma: Scheduled Caste	0.154***	0.154***	0.699**	0.139***
	(0.048)	(0.048)	(0.272)	(0.050)
Ma: Other Backward Caste	0.102***	0.102***	0.416**	0.095**
	(0.039)	(0.039)	(0.179)	(0.041)
Ma: Muslim	0.189***	0.189***	0.483*	0.187***
	(0.042)	(0.042)	(0.280)	(0.043)
Ma: Complete Prim Education	-0.314***	-0.314***	0.593***	-0.305***
	(0.055)	(0.055)	(0.206)	(0.056)
Pa: Complete Prim Education	-0.021	-0.021	0.677*	-0.038
	(0.049)	(0.049)	(0.359)	(0.050)
Pa: Complete Sec Education	-0.101***	-0.101***	0.635***	-0.124***
	(0.038)	(0.038)	(0.191)	(0.040)
Age Difference > 5	-0.092***	-0.092***	0.099	-0.101***
	(0.032)	(0.032)	(0.145)	(0.034)
Ma: Cohort 1958 - 1960	-0.027	-0.027	0.525**	-0.053
	(0.051)	(0.051)	(0.217)	(0.053)
Ma: Cohort 1961 - 1963	-0.062	-0.062	0.404**	-0.100*
	(0.049)	(0.049)	(0.188)	(0.051)
Ma: Cohort 1964 - 1966	-0.100**	-0.100**	0.321*	-0.131**
	(0.051)	(0.051)	(0.186)	(0.053)
<u>Sex Mix of Surviving Children:</u>				
More Sons than Daughters	-0.297***	-0.297***	-	-0.296***
	(0.039)	(0.039)		(0.039)
Only Sons	1.270***	1.270***	-	0.829***
	(0.062)	(0.062)		(0.073)
Only Daugthers	1.467***	1.467***	-	0.995***
	(0.091)	(0.091)		(0.101)
<u>Interactions with Maternal Education:</u>				
More Sons than Daughters	-0.097	-0.097	-	-0.098
	(0.088)	(0.088)		(0.088)
Only Sons	0.100	0.101	-	-0.232*
	(0.106)	(0.106)		(0.125)
Only Daugthers	-0.032	-0.032	-	-0.284**
	(0.126)	(0.126)		(0.144)
θ	-	-	0.432***	-
			(0.098)	
Constant	1.947***	1.947***	-	2.129***
	(0.115)	(0.115)		(0.119)
Log Likelihood	-4475.32	-4473.32	-	-4295.01

<u>Notes:</u> (i) Estimates are based on sample of women having completed their reproductive cycle. (ii) Dependent variable takes the value 1 if couple has a further child. (iii) Model 1: Pooled Probit Regression. Model 2: Probit Regression with unobserved heterogeneity at mother level. Model 3: Heckman's Estimator of the Random Effects Probit model accounting for initial condition.

Table 1.7.
Predicted Probabilities of Giving Birth:

	[1]	[2]	[3]	[4]
Parity	**Base**	**More Boys Than Girls**	**All Boys**	**All Girls**
1	100	99	99	100
2	100	99	99	100
3	75	82	82	92
4	77	74	87	91
5	77	73	88	89
6	74	71	91	88
7	79	69	79	99
8	78	73	85	76
9	83	76	99	99
10	84	71	53	9

Notes: (i) Estimates are based on sample of women having completed their reproductive cycle. (ii) Percentages based on parameter estimates of Model 3 in Table 1.4. (iii) Column [1]: Base case: couple has equal number of sons and daughters or more daughters than sons; Column[2]: Couple has more sons than daughters; Column [3]: Couple has only sons; Column [4]: Couple has only daughters.

Chapter Two

Female Autonomy and

Education of the Subsequent Generation

Evidence from Two States in India

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2.1. Introduction

The vast literature on children's education identifies a number of factors that influence children's educational inputs and outcomes including, for instance, parent's education, income levels, social norms and regional factors. One factor that has been considered extensively in the context of other child welfare indicators, like health and child mortality, but has been less extensively considered in the context of education, is the importance of the autonomy of women within the household. In this paper, we concentrate on this issue, analysing in particular the impact of female autonomy on children's starting age in school in India. Our analysis is based on Round 3 of the National Family Health Survey of India, which collected detailed information about the freedoms enjoyed by women across all states and Union Territories in India.

Academic researchers as well as policy makers have long argued that female autonomy will help improve family welfare. Some studies have implied that this is because women are more altruistic in their decisions with regard to the family than men. Even if we abstract from this, however, female autonomy is likely to improve child welfare outcomes because two independent adults (mother and father) are likely to be more effective than a single independent adult (the father alone). In this paper, we test whether female autonomy will influence one particular aspect of child welfare: the age at which children start school. We expect that it will, because female autonomy might capture the bargaining power of the woman within the household, her mobility and ability to collect information regarding schooling and to act on this information. We will explicitly indicate the pathways through which female autonomy might influence child schooling in the next section. Analysing the impact of mother's autonomy on the school starting age is complicated by the fact that mother's autonomy is very hard to measure. Attempts to use proxies like mother's education or employment, which are often good reflectors of female autonomy, are problematic because they might influence children's education for reasons other than mother's autonomy. These variables as well as mother's incomes or assets are indirect measures that do not necessarily reflect the mother's potential and actual decision-making power within the household. In this paper, we use more direct information relating to the economic, decision-making, physical and emotional autonomy of a woman to capture her autonomy within the household while controlling for other characteristics of the woman.

The legal school starting age in India, like that in most other countries, is set by the state. This is the age against which we measure the actual age at which children start school in this study. In using this variable, we do not aim to contribute to the very large debate (see Stipek, 2002 for a survey) on the impact that school entry age is considered to have on educational outcomes. Instead, we see the actual school starting age (SSA[26]) as a child welfare indicator just as school enrolment or school performance is. Our starting point is that children who enter school at the legal age have higher welfare than those who enter late. In this context, we are interested in the characteristics of families that enrol children in school at the age that the state recommends and also in the role (if any) that the autonomy of the mother plays in this. While most studies within the literature on education have concentrated on enrolment and performance of children in school, the SSA provides a new and interesting perspective on how to model education. The actual age at which children enrol might be seen as encompassing considerable information relating to the interest taken by parents in the child's education, their priorities and the constraints they face. Thus, the SSA may be seen as an early indicator of the educational prospects of the child. Second, the SSA does not affect the grade at which children enter school in India. It is therefore possible that there will be children

[26] The acronym SSA refers to the actual starting school age throughout.

of different ages in each class, which then throws up a number of pedagogic challenges that will affect the quality of education that can be offered.

This paper makes two main contributions to the existing literature. It is innovative in the way in which it models female autonomy as well as child school entry age. First, our analysis models 'entry into school' in the context of duration analysis. This specification allows for two issues – right censoring of data and the initial conditions problem - that affect all analyses of this kind. The data is right censored because of the presence of school-age children who have still not started school in the sample. The initial conditions problem, on the other hand, arises because children of different ages at the time of interview would have become eligible for school admission at different times. Secondly, this paper deviates from the previous literature with respect to how the autonomy of the woman is modelled. The customary way of modelling female autonomy is to create an index by aggregating the qualitative answers provided by the woman to a set of questions assumed to capture the concept of autonomy, and then to use this index as one of the explanatory variables in an empirical model. Contrary to this, the present analysis assumes that the above qualitative answers are fallible measures of female autonomy which is assumed to be a latent characteristic. In addition, we allow this latent characteristic to be a function of religion, caste, education and other characteristics.

The paper is structured as follows. Section 2.2. lays out the research questions motivating the present analysis. Section 2.3. describes the issues connected to primary education in India and Section 2.4. explains the concepts and issues of female autonomy. Section 2.5. describes the data, measurements and summary statistics. The econometric methodology is laid out in Section 2.6. the results of which are outlined in Section 2.7. Section 2.8. discusses the results and concludes.

2.2. Research Questions

This paper concentrates on two main questions – what determines the age at which children start school and what role does mother's autonomy play in determining this age?

The importance of the age at which children start school has received increased attention in the public discourse (District Information System for Education, 2008a). The theoretical literature is divided on whether a young SSA has positive or negative long run impacts on children's outcomes. An often cited advantage of a low SSA is that early school enrolment often implies an early finish, which gives the individual a longer time to learn new and more applied skills as well as to earn income. Furthermore, under the assumption that children learn more at school than at home, early school enrolment will increase their human capital. An often employed argument for the disadvantage of starting school early is that children are less perceptive in the early parts of their lives. This disadvantage might be exacerbated by younger children achieving lower marks and consequently facing worse employment prospects in the long run. Despite a large debate on this topic, there is little solid evidence in favour of any of the aforementioned theories. For instance, the effect of SSA on test scores has been shown to decrease with age (Elder and Lubotsky, 2007; and Cascio and Schanzenbach, 2007). Similarly, Black et al. (2008) find that a low SSA has a short run positive effect on earnings, which, however, is eroded by the age of 30.

The literature outlined above, however, is only of limited relevance for the present analysis. In a first instance, most of the countries it covers are highly developed economies. Secondly and perhaps more relevantly, this literature only considers children that enrol within the legal age limits. In most instances, the variation in school enrolment ages is a result of children being born in different months of the same year. In other words, the variation in age of school enrolment is at the margin. In many developing countries, by contrast, a significant proportion of children do not enter school at the age prescribed by the government. In such a context, the SSA could be considered as a good indicator of child welfare. This is one of the reasons why we are interested in the determinants of the actual age at which children enter school. Both absence from school and the possibility that children are working instead, have welfare implications for the child. In addition, a child’s late start at school might be indicative of the time and money constraints that its parents face as well as the priority they place on education.

The age at which a child starts school is also important because it complements the existing literature on primary school enrolment in a number of ways. Focusing on enrolment rates alone only tells part of the story. For a child to receive an adequate education, two things are important. On the one hand, she must be enrolled in school and on the other hand, she must attend a grade suitable to her age. Enrolment rates will only give information about the first aspect and neglect the second. In connection with this, late enrolment can have potentially far reaching implications for a child's human capital. Not only is the accumulation of human capital delayed, its expected lifetime amount can also decrease. The consequences of late school enrolment are exacerbated by the fact that a fraction of the population is likely to be constrained by compulsory attendance laws stipulating that individuals must remain at school until a determined age. For these individuals, every year school entry is delayed by implies a year less of schooling, a fact that can have considerable consequences. Angrist and Krueger (1991), for instance, show that earlier enrolment increases lifetime earnings.

There are a number of factors that might influence the SSA in India including parent’s own education levels, number of siblings and the mother’s autonomy within the household. It is this last that our analysis in this paper will concentrate on. Female autonomy in our study, as in many others, can be seen as the ability to be independent in four areas – emotional, decision-making, physical and economic autonomy – so that power is accepted as being multi-dimensional. Emotional autonomy indicates how independent the woman feels from her husband while decision-making autonomy measures the extent to which the woman is involved in the decision-making process of the household. Physical autonomy denotes how much freedom the woman has to move around and economic autonomy quantifies the woman's control over her own finances.

Female autonomy might be expected to have an impact on the SSA because it is an indicator of the bargaining power of the woman within the household. If women are also more altruistic in the decisions they make with regard to the welfare of children (Hoddinott and Haddad, 1995), then we might expect more autonomous mothers to have a positive impact on the SSA of their children. This identifies the decision-making aspect of autonomy as being crucial. As indicated in the introduction, we do not need to accept that mothers are more altruistic than fathers for this impact to hold. Having two adults, both of whom are able to work effectively in the interests of the child, is likely to be more advantageous for the child than having a single adult (with his/her attendant time and incentive constraints) responsible for its welfare. This line of thought will be explored in more detail below.

Similarly, even when parents are aware of the importance of schooling and convinced about the returns from education, they may not have the information or the logistical ability to do all that is necessary to send children to school. Given the male bread-winner model that is common in India, fathers rarely have the time or the inclination to spend time obtaining and processing information relating to schooling. While mothers within this system might have the time, they may not have the freedom to interact with others, obtain information and act on it if they live under very restrictive social norms that dictate what women can and cannot do. The autonomy of mothers in this context can be crucial. Women with greater autonomy have greater physical mobility and are better able to network freely and obtain information about schools. They may also be able to act on this information better than mothers who are very dependent because they are able to visit schools, speak with teachers, take children to/from schools, buy books etc. Both physical and decision-making autonomy are important in this respect.

Third, mothers who have greater economic autonomy are likely to be able to influence such decisions because they have economic freedom. This might also mean that the household is better off and such economic autonomy might help in prioritising schooling. On the other hand, female autonomy might increase the mother's employment and if this keeps her very busy, she might prefer to put off child schooling for as long as possible. In this case, some aspects of female autonomy would actually worsen the starting age of children.

Thus, there are many ways in which female autonomy might influence the SSA. We consider these in more detail in the empirical analysis in this paper. Before we do this, it would be useful to consider the institutional background for schooling in India.

2.3. Primary Education in India

In India, the prescribed age of starting school is 4 years (though the first two years are spent in kindergarten). Children therefore enter primary school (Class 1) at 6 years. For children aged 6-11 in our data at the time of the interview, the SSA distribution is given in Table 2.1. We can see that while a significant number of children start school between 6 and 8 years, there is no single entry point into education. Having said this, the 'more developed' states like Kerala and Tamil Nadu, for instance, have a smaller window in which children enter school. Thus, around 97% of children at school started at the age of 6 in these states, the corresponding figure for UP is 57% and for Bihar is 35%, which is the lowest in India.

We only considered children aged 6 or above (rather than 5 or 4 and above) for two main reasons. First, the information provided for children aged 5 or 4 might not be accurate. The Demographic Health Survey (DHS) asks household members aged 5 or above about their schooling achievements.[27] In India, children aged 4 and 5 may attend pre-school or kindergarten. Children aged 5 can, therefore, be a) in school, b) in pre-school or c) in kindergarten. The problem of inaccurate information arises because some women may interpret pre-school as the child attending school, whereas other individuals may not interpret the child's status that way. It may, therefore, be the case that two children in the same state (e.g. pre-school) are recorded as having two different school attendance statuses: one as being in school and one as not attending school. To avoid possible misunderstandings the start of the sample coincides with the legal age at which children must start school. Second, the welfare implications of a child not attending school at the age of 5 are far from clear. If a child aged 5 is recorded as not attending school, it could, as discussed above, be attending pre-school. If, however, a child aged 6 is not attending school, it is more likely that it is working or helping with chores around the house instead.

Children who start late begin at the beginning and start in Class 1. So, it is possible that if children start school at different ages, then there will be children of different ages in each class, making the task of educating them more challenging. Evidence shows that in 2004-2005, 14% of children in primary school were not in the

[27] The question capturing schooling attainments of household members aged 5 or above in the household questionnaire is *"Has (NAME) ever attended school?"*.

right age group (District Information System for Education, 2008a). Similarly, an estimated 6% of children in primary schools and 9% in upper primary schools in 2004-2005 were over-aged (DISE, 2008b). The presence of over-aged children in primary education has therefore become a point of political interest in India, making our analysis in this paper more policy relevant.

In the context of the Millennium Development Goals, primary education has received renewed interest from policy makers. India's flagship education programme, the Sarva Shiksha Abhiyan, set itself the goal of achieving universal elementary education by 2010. This scheme is sponsored by the Central Government and provides additional funding to states to enrol out-of-school children and improve school quality. The precursor to this programme was the District Primary Education Programme (DPEP), which was introduced in a few states in 1994 by the Government of India in collaboration with a number of international organisations. Phase I of the DPEP concentrated on 7 states – Assam, Haryana, Karnataka, Kerala, Maharashtra, Tamil Nadu and Madhya Pradesh. Phase II extended the DPEP to more states before it too was overtaken by the Sarva Shiksha Abhiyan. Overall, India has made impressive strides towards improving its schooling record. There is, however, still room for substantial improvement. According to the UNICEF (2010)[28], for instance, an estimated 42 million children aged 6 to 10 in India are still not attending school. Furthermore, gender differences appear widespread.

Thanks to programmes like the DPEP and the Sarva Shiksha Abhiyan, India's primary schooling record has improved considerably with elementary enrolment increasing by 3.2% per annum between 2000 and 2005. The primary school enrolment rate for boys was approximately 92% during this period and approximately 87% for

[28] Webpage: unicef.org; accessed December 2010.

girls (UNICEF, 2008). One of the achievements of the Sarva Shiksha Abhiyan programme was that by March 2007 98% of the rural population had a school within one kilometre.[29] Given these successes in improving quantity of schooling, it is recognised that further improvement requires quality of schooling to be targeted. In this context, the role of age at school-entry and the consequent presence of over- and under-aged children in school is an important part of the policy agenda.

2.4. Female Autonomy: Concepts and Issues in the Literature

As indicated above, our second research question relates to the role played by female autonomy in determining the age at which children enter school. The literature on the interrelations between female autonomy and child education is relatively small (Basu and Ray, 2002; Lancaster et al., 2006; Afridi, 2005; Durrant and Sathar, 2000; Smith and Byron, 2005; and Aslam, 2007). However, the broader literature on autonomy has much to contribute to our analysis in this paper. We will therefore situate the paper within this broader literature.

Autonomy has been defined variously in the literature as 'the ability to influence and control one's environment' (Safilios-Rothschild, 1982), or the 'capacity to obtain information and make decisions about one's private concerns and those of one's intimates' (Dyson and Moore, 1983). Dixon-Mueller (1978) defines it as 'the degree of access to and control over material and social resources within the family, in the community and in the society at large'. The term autonomy has often been confused with empowerment, though the latter is a process and the former is the outcome (at least partly) of the process. While in some instances the difference does not matter, in this paper we are interested in whether the ability of women to make independent decisions influences the decisions they make in relation to child schooling. We are therefore

[29] Government of India, Annual Report 2007–2008.

primarily concerned with autonomy. Such autonomy can arise from “the enhancement of assets and capabilities” (Bennet, 2002), from processes that change “the distribution of power both in interpersonal relations and in institutions throughout society" (Stromquist, 1993) and from "a process of acquiring, providing, bestowing the resources and the means or enabling the access to a control over such means and resources" (Lazo, 1993).

The very fuzziness of the concept of female autonomy makes a conceptualisation, which is quantitatively measurable, necessary. Various attempts have been made to measure female autonomy and to make it empirically tractable. These have relied on two broad categories of variables: variables proxying autonomy through a number of characteristics of the woman (her age, education and employment for example) and variables reporting the woman's own perception of her status (relating to her freedom to make decisions, associate with others and make choices).

As part of the first category of variables, Abadian (1996) uses female age at marriage, age difference between husband and wife and female secondary education to measure the impact of female autonomy on fertility. Others have used the educational and economic condition of the woman at marriage[30] as well as variables capturing the woman's labour market experience.[31] This measurement, however, is problematic. The woman’s labour market experiences, for instance, may affect children’s outcomes through channels, which are not female autonomy. To get round the endogeneity inherent in such measures, many studies used proxies like the instrumented share of income earned by women (Hoddinott and Haddad, 1995), women’s unearned income (Thomas, 1990; Schultz, 1990), their inherited assets (Quisumbing, 1994), their assets at marriage and their current assets.

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30 See for example, Quisumbing and Maluccio (2003) and Thomas, Contreras and Frankenberg (2002).
31 DeRose (2002) uses continuity of woman's work.

The second approach in measuring women's autonomy, and one that we use in this paper, has been to use variables that directly reflect women's perceptions of their emotional, decision-making, physical and economic autonomy. These variables are obtained from responses to questions relating to whether women have to ask for permission to go out, whether they make decisions relating to their children (how many to have, whether they should go to school, whom they should marry etc.) and whether the woman decides what food or other goods to buy. These studies also include questions on gender preferences for children which are often used for measuring the attitudes of the woman.[32] The issue of son preferences is investigated in the specific case of fertility in the first chapter of this thesis.

The depth and breadth of the information that is available throws up a challenge to researchers in relation to how best to capture it for the purposes of analysis. Are all aspects of autonomy equally important? Are they all equally important on all occasions? Is it sufficient to use an index that subsumes the variation across measures or should we try and explicitly capture the variability? Some researchers have concentrated on specific dimensions of autonomy rather than summary indices (Vlassoff, 1992; Morgan and Niraula, 1995; Jejeebhoy, 2000). Jejeebhoy and Sathar (2001), for instance, consider women's autonomy in terms of freedom from violence, mobility, control over resources and contribution to decision-making, while Vlassoff (1992) as well as Morgan and Niraula (1995) consider three dimensions of autonomy (control over resources, decision-making power and mobility). Chavoshi et al. (2004) use distinct variables on mobility, decision-making access, control over resources and freedom from threat to analyse women's reproductive behaviour in Iran. Using only specific aspects of autonomy has been critiqued on the ground that it is not always clear that people are

[32] Yount, Langsten and Hill (2000) use this approach despite not interpreting it as female autonomy.

talking of the same thing. To counter this, some researchers have used summary indices instead. Thus, Hogan, Berhanu and Hailemariam (1999) construct an index using questions on who purchases major items, consumption patterns, resource allocation, joining a woman's club, sending children to school and age at which girls should marry. Afridi (2005) also summarises the various aspects of female autonomy into a single index. This approach has been criticised by Agarwala and Lynch (2007) on the grounds that it is too simplistic and ignores differences across measures. Employing confirmatory factor analysis, they find that using summary indices results in a significant loss of fit, partly because such indices neglect measurement error and do not scale different factors distinctly. Overall, the variability in measures used across studies is such that it is difficult to compare the results.

Our analysis in this paper accepts the multi-dimensionality of autonomy as a starting point and extends it to allow other covariates like religion, caste and female education as controls. Thus, in the present analysis, we adopt a model in which female autonomy is a latent factor that cannot be observed directly but will be assumed to affect a number of variables which can be captured empirically.[33, 34] Common variation in these measurement variables will be used to infer the properties of the latent factor of female autonomy. Despite explicitly modelling female autonomy in this way, we follow the existing literature in treating female autonomy as an exogenous cultural factor.[35]

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[33] Both factor analysis (FA) as well as principal component analysis (PCA), tries to identify underlying latent factors that help to explain correlations among a set of observable items. FA tries to capture this data variability in terms of a number of unobservable or latent factors that are conceptualised as some theoretical concepts. In contrast, extracted components in PCA which are uncorrelated with one another are simple geometrical abstractions which may not map onto theoretical concepts. Our analysis is a generalisation of factor analysis where we not only account for the binary nature of the observables that are used to capture the common variations, but also control for the fact that some underlying characteristics such as religion, caste and education can also explain the unobserved factor.

[34] A list of variables is provided in Appendix 2.1.

[35] There have been, however, a number of studies endogenising this very concept. Hashemi, Schuler and Riply (1996), for example, find that the BRAC (Bangladesh Rural Advancement Committee) and Grameen Bank credit programmes significantly improve female empowerment in Bangladesh. Alternatively Jejeebhoy and Sathar (2001) examine whether differences in female autonomy are

While the autonomy of women is an outcome in itself, it is also the impact of this autonomy on household welfare that has attracted much attention in the literature. In this context, a large literature has analysed the impact of female autonomy on household expenditure (Hoddinott, 1992; Doss, 1996; Kabeer, 1994; Lundberg et al., 1997; Haddad and Hoddinott, 1991). Afridi (2005), working within this general context, uses data from India to investigate the effect of female autonomy on children's educational outcomes, defined as the deviation of the highest grade attained by the child from the cohort mean. Quisumbing and Maluccio (2003), in turn, use assets and human capital at the time of marriage as indicators of the woman's power in the household to investigate expenditure decisions taken by the household and children's education. They focus on the deviation of each child's completed schooling compared to the average of the relevant age group and on expenditures on education. Durrant and Sathar (2000), analysing the impact of female autonomy in Pakistan, find that a higher level of women’s status at the individual level enhances child survival and boys’ school attendance, while community-level autonomy is more important for improving the chances of girls attending school in rural Punjab. This is an interesting finding because it indicates that the ability of mothers to obtain information and act on it are important autonomy variables as far as boys are concerned but ‘social’ norms or acceptance of girl’s activities are more important for girls. Smith and Byron (2005), on the other hand, studying four South Asian countries – Bangladesh, India, Nepal and Pakistan – find that for South Asia as a whole, improving women’s autonomy is effective in reducing gender discrimination against girls. Dharmalingam and Morgan (2004) find that better educated and employed women have very different levels of autonomy and therefore may have different impacts on the school starting age. From this evidence, however, it

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attributable to the geographical location and the religion of the woman. Additionally Bloom, Wypij and Das Gupta (2001) argued that close ties to kin increase female autonomy.

is hard to infer that female has a causal effect on children's education. Better educated women, for instance, might invest more in children's education and at the same time have greater autonomy.

In the next section, we will consider the data that are available and the measurement of female autonomy in more detail.

2.5. The Data, Summary Statistics and Measurements

The data used for the empirical analysis are taken from the third round of the National Family Health Survey (NFHS-3) for India. The NFHS is part of the Demographic and Health Survey (DHS) series conducted for about 70 low to middle income countries.[36] The survey was conducted in 29 Indian states by the International Institute for Population Sciences and Macro International (2007) and interviewed over 230,000 women (aged 15-49) and men (aged 15-54) during the period December 2005 to August 2006. In common with the DHS, this survey collected extensive information on population, health, and nutrition, with an emphasis on women and young children. However, the survey also obtained information on schooling of all household members such as the highest grade achieved, level of literacy and whether the household member is still enrolled at school. In addition, information concerning household decision-making as well as the 'autonomy' status of surveyed women was also collected.[37]

To fully exploit intra-state heterogeneity, we have conducted our analysis separately for each state. Preliminary analyses were conducted on 15 major states of India, though in this paper we concentrate on two states (Andhra Pradesh (AP) and Uttar Pradesh (UP)) in order to keep the discussions focussed. AP and UP are interesting to analyse because they provide a variety of conditions with regard to both

36 The data are in the public domain and can be downloaded from www.measuredhs.com.
37 Due to the protocols associated with the collection of HIV data, this round of the NFHS unfortunately, did not provide any village level information or any district identifiers.

child welfare outcomes and female autonomy. First UP has one of the lowest outcomes in India. AP, by contrast, is often considered the median state in India. Thus, in UP, 74% of boys and 64% of girls between 6-17 years are enrolled in school, whereas it is 77% of boys and 66% of girls in AP.[38] Again, 8% of children in AP and 18% in UP have never entered school (Table 2.2.). More crucially for our analysis, 69% of mothers in UP and 46% in AP have never attended school (Table 2.2.). In addition, 6% of women in AP and UP have tertiary education. The difference in mother's education across the states is crucial because it could influence child education both through the impact on autonomy as well as through its impact more directly on school enrolment. Second, these states also diverge significantly in terms of their prosperity: in 2004/5, UP had a per capita GDP of Rs. 29,065 approximately and AP's was Rs.23,755.[39]

Third, the two states have very different kinship systems that underlie family relations and therefore determine the role of women within them. If India is divided into three separate kinship systems (following Dyson and Moore, 1983) – the North Indian System, the South Indian system and the East Indian System, UP is part of the North Indian system and AP of the South Indian system. Within the North Indian kinship system, spouses are unrelated in terms of kinship, males co-operate with and receive help only from other males to whom they are related by blood and women do not inherit property. Such patriliny gives rise to the system of 'purdah' for women which is supposed to enable them to maintain their honour, reputation and power. In contrast, within the South Indian kinship system, spouses are often closely related (cross-cousins) to each other; there are close socio-economic relations between males who are related by blood and by marriage and women may inherit property. This results in a system within which female movements are less rigidly controlled. Within the South Indian

38 IIPS, DHS Final Report on India, 2005-06.
39 Government of India, Annual Report 2007–2008.

system itself, AP presents a special case. It like most of the rest of India has a patrilineal system, though its kinship system is broadly South Indian. While our analysis highlights intra-state differences in autonomy, it will be interesting to compare how our models results vary across states.

Measurement of Female Autonomy

As is common with the DHS, the Indian NFHS also elicited responses to certain questions that may be interpreted as providing information on various aspects of autonomy enjoyed by the woman. The questions have commonly been grouped into four spheres of autonomy: economic, decision-making, physical and emotional autonomy. Details of the questions used in the model are included in Appendix 2.1.

The econometric model is estimated for each of the two states separately and consequently the intra-state variation of the variables for female autonomy and children's schooling is the focus of the present analysis. Nonetheless, descriptive comparisons between all 15 major states are still informative for our purposes for a number of reasons. Although the analysis focuses on only two states, it still aims to produce results that say something about the whole country. For this purpose, it is important to set the states employed in the econometric analysis into the context of the whole country. This context is provided by the summary statistics, which also sheds light on the reasons for which these two states in particular have been chosen. Summary statistics of the female autonomy variables for the whole country are, therefore, provided here. The relevant tables are reported in Appendix 2.2.

Information on economic autonomy is captured through questions relating to whether the woman has a say about what should be done with her husband's money, whether she has money for her own use and whether she has a bank account. Table

A2.1. presents summary measures for the responses to these questions. In what follows, we will consider these measures for the two states we concentrate on in this paper. About two-thirds of women at the All-India level (71%) have some say in what happens to the money of their husband, 80% in UP and 56% in AP. A lower percentage, 45%, of women in India have money for their own use and the corresponding figures are 59% in AP and 65% in UP.

To capture their decision making autonomy, women were asked whether they decided jointly with their husbands on a number of household matters. These included decisions relating to health care, to small and large household purchases and to visits to family and friends. Summary measures for these aspects of decision-making autonomy are reported in Table A2.2. For the whole of India 70% of women have a say on their own health care and 68% on small and 60% on large household purchases. For the whole country, 67% of women have a say in visiting family and friends. UP is at or above the All-India average on all indicators except the decision to visit family and friends. AP is lower than the All-India average on all four measures.

The present analysis defines decision-making autonomy as the woman *participating* in the decision-making process of the household. In practice, each of the four binary variables capturing decision-making autonomy takes the value of one if the woman either decides by herself or together with her husband on the particular aspect of their life. In this practice, joint and individual decisions are treated as equivalent. This is not uncontroversial. Some might argue, for instance, that although the woman participated in the decision-making process, her role was de facto only nominal. Nonetheless, we believe that this definition comes closest to one of the more prominent definitions of female autonomy. Dixon-Mueller's (1978) definition of female autonomy as *"the degree of access to and control over material and social resources within the* *family, in the community and in society at large"* has been crucial to the approach we have taken here. The author suggests that female autonomy or the extent to which women are involved in various aspects of decision-making comes in *varying degrees*. We maintain that joint decisions imply some involvement by the woman, even if only to a limited extent and we hence take these as indicative of the woman having some degree of female autonomy. Furthermore, one may argue that decisions taken by the household should be decided by all household members – or at least by all adult ones. According to this argument, the husband should be involved in the decision-making process and the ideal scenario becomes one where husband and wife jointly decide on household matters. Female autonomy in this sense does not imply that the woman is the only one taking decisions regarding household matters, rather it denotes a woman who is involved to some extent in the decision-making process of the household.

Three variables are employed to measure the extent of the woman's physical autonomy. These indicate whether the woman is allowed to go to a health facility, the market and places outside the community. More than 90% of women across all states enjoy all of these freedoms though again, UP women seem to fare the best. The respective figures are reported in Table A2.3.

Finally, emotional autonomy is captured by considering questions on physical violence and sexual relations within the household. First, the woman is asked whether she believes that her husband is justified in beating her in the following circumstances: she goes out without telling him, neglects the house, argues with him, refuses sex, burns the food, is unfaithful or disrespectful. Secondly, whether she believes she is allowed to refuse sex if her husband has other women, he has a sexually transmitted disease or if she is tired. Again, UP women fare better than the All-India average on all 10 of these questions whereas in the case of AP women, emotional autonomy varies according to the question being asked. Summary measures of the responses to these questions can be found in Table A2.4.

It is customary to aggregate qualitative responses into indices. Aggregate responses for each dimension of autonomy are reported in Table A2.5. Economic autonomy is captured by combining responses to the two questions laid out above. This indicator takes an All-India average value of 1.2. The index for decision-making autonomy takes a maximum value of 4 and an All-India average of 2.6. The index for physical autonomy takes a maximum value of 3. Its mean for the whole country is 2.8. Emotional autonomy, in turn, is captured by 10 questions and the index has an All-India average of 7.2. One way to capture the underlying notion of female autonomy is to add these four indexes. The resulting number takes a maximum value of 19 and an average of 13.8 for the All-India sample.

These summary autonomy indicators in Table A2.5. show that the All-India average is 13.8, with UP above this average at 14.8 and AP at 12.8. Furthermore, the inter quartile ranges for both states are similar. (Table A2.5.). Given the similarity in the autonomy indices, one would not expect the impact of female autonomy on SSA to vary considerably between the two states under scrutiny. Our results, however, indicate that – once the variation across the different measurements is taken into account – there is a considerable difference in how autonomy functions in UP and AP.

2.6. <u>Econometric Methodology</u>

Our estimation methodology uses survival analysis in which female autonomy is treated as a latent construct. The main variable of interest is the age at which the child entered primary school. In survival analysis terminology, a child here is transiting from the state "out of school" into the state "in school". The time a child spends without entering school from the prescribed start-age (usually 6) is the duration we are interested in. Starting age is recorded with respect to the Indian academic year, which is the 1st of April, and is recorded in years. We use a discrete time hazard framework and restrict our analysis to a sample of children between 6 and 11 years at the time of the interview. If a child has not started school at the time of the interview the duration is coded as censored.

All durations are measured with respect to age 6. For example, if a child is observed to enter school at age 8, the duration for this child will be recorded as 3 years. This implies an observable window of duration equal to a maximum of six years. All children entering school at age 6 will be recorded to have duration of one.

The discrete time hazard h_k for the kth interval (k=1,..,6) denotes the conditional probability of a child entering school in the kth interval conditional on not having enrolled in school before,

$$h(k) = \frac{\Pr(t_{k-1} \leq T < t_k)}{\Pr(T \geq t_{k-1})} \tag{2.1}$$

Hence, the probability of observing a completed duration of length d is given by

$$p_{ij}(d) = h_{ij}(d)\prod_{k=1}^{d-1}\{1 - h_{ij}(k)\} \tag{2.2}$$

In the above specification, d denotes the age at which the child i in family j enters school where the entry age is measured with respect to age 6. In the case of a child who is not observed to enter the school, i.e. the probability of an incomplete spell of d years, is given by

$$p_{ij}(d) = \prod_{k=1}^{d}\{1 - h_{ij}(k)\} \tag{2.3}$$

The above model consisting of equations (2.2) and (2.3) can be recast in terms of a binary choice model by observing that each child will have multiple observations (Allison, 1982). Since the observation window is age 6 to 11, each child will have a set of up to six binary indicators taking the value of 0, continuously in all years, starting from age 6 until s/he enters school when the binary indicator will take the value of 1. If an observation is censored, that is if the child is not observed to enter school during the observation window, the child will only have a series of 0s. To provide an example, first consider a child who is aged 8 at the time of the interview and who entered school at the age of 6. This child will have one observation recording a value of 1 as the child entered aged 6. Take another child who is also aged 8 but has not entered school by the time of the interview. This child will have three observations (one for each year starting from 6 to 8) recording a value of 0 for every observation. A child who is 11 at the time of the interview and not observed to enter school will have six observations all recording a value of 0. The last two cases provide an example of a case where the durations are censored.

In summary, given the above discussion, there will be a set of 0s and 1s for each child in the family. The length of this column vector will depend on the age at which the child entered school and also whether the time to starting the school is censored or not.

For child *i* with mother *j*, we assume *h*(*k*) to be a logit

$$h_{ij}(k) = \frac{\exp(\mathbf{x}'_{ij}\boldsymbol{\alpha} + \tau_k + \lambda_F \eta_{Fj}^{(3)} + \eta_{Cij}^{(2)})}{1 + \exp(\mathbf{x}'_{ij}\boldsymbol{\alpha} + \tau_k + \lambda_F \eta_{Fj}^{(3)} + \eta_{Cij}^{(2)})} \qquad (2.4)$$

$\mathbf{x}_{ij}$ is a vector of observable child and family specific characteristics (to be discussed later) that influence $h_{ij}(k)$ and $\boldsymbol{\alpha}$ is the vector of parameters associated with $\mathbf{x}_{ij}$. τ_k is the interval specific intercept that informs us about the shape of the hazard. The autonomy status of the mother is $\eta_{Fj}^{(3)}$ and the effect of this on the hazard is λ_F which is known as the factor loading, is our parameter of interest.[40] $\eta_{Cij}^{(2)}$ denotes the child specific unobservable. The above specification is a multilevel hierarchical model where Level 1 refers to the age specific time intervals(τ_k). Levels 2 and 3 refer to the child and mother respectively. In addition, we also allow for an additional cluster at the district level which forms the 4th level. However, we do not explicitly show this to keep the notation simpler.

As per our prior discussions, we do not use an aggregate index formed from the set of answers given by the woman as measurement of female autonomy. Instead, we assume that the latent trait of female autonomy is an exogenous cultural trait which is correlated with the woman's characteristics such as caste, religion, education, and whether the woman lives in a rural household. In addition, we also allow this latent trait to depend on when the woman was born. For mother *j*, this is specified as

$$\eta_{Fj}^{(3)} = \boldsymbol{\theta}'\mathbf{z}_j + \zeta_{Fj} \tag{2.5}$$

Next we assume that the unobserved female autonomy trait ($\eta_{Fj}^{(3)}$) affects a number of different but interrelated aspects of the woman's life. Based on the form in which the data has been made available and also on the approach taken by researchers in the past, we consider four categories or spheres of autonomy: economic, decision-making, physical, and emotional autonomy and specify relationship between these spheres of autonomy ($\eta_{lj}^{(3)}$ with l=1,..,4) and $\eta_{Fj}^{(3)}$ as

$$\eta_{lj}^{(3)} = \beta_l \eta_{Fj}^{(3)} + \zeta_{lj} \tag{2.6}$$

40 For identification and facilitating inter-state comparisons the variance of female autonomy is set equal to one in the estimation.

The assumption here is that variations in these four spheres can be used to say something about the overarching concept of female autonomy that is also unobserved. Since the spheres of autonomy are likely to be correlated with one another we allow for correlations in the error terms (ζ_{lj}).

The last part of our model links the answers given by the woman to different spheres of autonomy in order to generate the necessary variations to use in equation (2.6). Intuitively, this can be pictured as follows: each of the four autonomy-spheres cannot be observed directly but is captured by a set of nineteen fallible measures (given by the answers to a set of questions provided in Appendix 2.1.). For each sphere, common variation in these measurements is used to infer its properties. All nineteen measurement variables are binary and we consequently specify the following linear predictor for a logit link as

$$\nu_j = \delta_j + \Lambda \eta_j^{(3)} \tag{2.7}$$

where δ_j is a vector of intercepts and $\eta_j^{(3)}$ a vector of latent autonomy spheres (economic autonomy, physical autonomy, decision-making autonomy, and emotional autonomy). The matrix of coefficients $\mathbf{\Lambda}$ contains the factor loadings.

An important advantage of this specification is that it accommodates correlations between the latent factor and female characteristics. Often female autonomy is modelled as a random effect. This framework assumes the unobserved heterogeneity to be uncorrelated with all covariates. There are, however, good reasons to believe that the latent factor of female autonomy is not independent of female characteristics (education, for instance). This would make the estimator inconsistent. By contrast, equation (2.5) allows us to explicitly incorporate the fact that female autonomy is correlated with a sub-set of the covariates.

Appendix 2.1. provides further details of the full specifications and the restrictions needed for identification. Figure 2.1. provides a simple representation of the path diagram associated with the various relationships that are considered here.[41]

Estimation of the Model

Equations (2.4) to (2.7) form the basis of our model and they are estimated jointly using maximum likelihood method under the assumption that ζ is normally distributed. We use GLLAMM (Rabe-Hesketh, Skrondal and Pickles, 2004) in Stata (StataCorp., 1985) to estimate the model parameters.[42]

2.7. <u>Results</u>

The empirical analysis focuses on a sample of children aged 6 to 11. For the whole country, the total sample size consists of 41,282 children born to 28,610 mothers. The model estimated allows for a number of additional factors to influence children's entry into school. These comprise characteristics of the children, the mother, the father, the household and the baseline hazard. Children's characteristics are the sex of the child and the number of older and younger brothers as well as sisters. Mother's characteristics include a dummy for whether she has completed primary school, her caste and her religion. The father's education is also controlled for. The household's characteristics can affect its member's economic outcomes and are therefore included in the model. They encompass an indicator variable for the wealth quintile the household belongs to and whether it is situated in a rural area. Finally, age interval indicators and indicators for the year the child turned 6 are included. The former make up the baseline hazard and

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41 The above model is slightly different to the model used in Hansen et al. (2004) and Heckman et al. (2006), where they assume two underlying latent independent characteristics 'cognitive' and non-cognitive' abilities and relate these to test scores. These authors allow the test scores to be affected by additional school level variables conditional on the latent variables. In contrast, in our model, we allow the latent variables to be correlated with characteristics such as religion, caste etc. In addition, we also link the female autonomy trait to the four sub-spheres and allow these to be correlated.

42 The programme can be downloaded at gllamm.org

the latter control for initial conditions. This is important as children born in different years would have faced different environments at the time of entry into primary school. Mother specific covariates are allowed to influence the overall concept of female autonomy.

Given the discussions above, we expect the following four results. Although the effect of a mother's autonomy on child welfare is not unambiguous, most arguments in the literature point towards a positive relation between the two. We, therefore, hypothesise that a) the factor loadings λ_F on η_F will be positive. Intuitively, the probability of a child enrolling in school is likely to decrease with its age. Therefore, the baseline hazard is likely to decrease. We hypothesise that b) the coefficients on the age intervals (τ_k) will be negative and increasing in absolute size. Gender differences in schooling outcomes in India are well documented. Hence we expect that c) school enrolment will happen earlier for boys than for girls, or in econometric terms that the coefficient on the girl dummy will be negative. We allow female autonomy to be influenced by a number of different factors and we acknowledge that it is ex ante difficult to tell whether a particular factor is positively or negatively correlated to female autonomy. We maintain, however, that d) the most obvious positive correlation will be between a woman's autonomy and her education.

We estimate four models. Model 1 analyses school entry independently of female autonomy. This specification encompasses all the above-mentioned child-, mother-, father- and household-specific factors. We do not include the female autonomy variable but allow for mother level random effect. Model 1 includes a random intercept at the child-, mother- and district-level. Models 2 and 2a, include the female autonomy via an index constructed as a z-score (mean zero and unit variance) using the sum of qualitative answers provided by the woman. The original variable takes a maximum value of 19 and the means and standard deviations of the sub-spheres as well as the overall ‘female autonomy’ variable, are reported in Table A2.5. The approach used in Model 2 corresponds to the usual way of capturing female autonomy. Model 2 is estimated with the three aforementioned random intercepts while Model 2a with a random intercept at the child- and district-level (Model 2a).

Finally, Model 3 is our structural equation model specification summarised in equations (2.4) to (2.7). In this specification, each sphere of female autonomy is captured by a number of fallible measures, which are restricted to have zero mean and unit variance. These spheres subsequently make up the overarching concept of female autonomy, which in turn affects entry into school. Unlike in Models 2 and 2a, the structural approach taken in Model 3, allows us to separate the direct and indirect effects coming through the effects on autonomy, of parental characteristics (Figure 2.1.). In order to capture gender differences in the effect of female autonomy, this latent construct is interacted with the girl dummy in the hazard equation.

2.7.1. <u>Female Autonomy & School Starting Age</u>

In Table 2.3., we present the coefficient and the standard error estimates for our main variables of interest: female autonomy and the baseline hazard variables.[43] Note, the mother level random effect in Model 1 will pick up the effect of unobserved ‘autonomy’ characteristic as well as other omitted mother level factors. A comparison of Models 2 and 2a will tell us something about how much of the mother-level variance is being

[43] The estimates for all other covariates are reported in Appendix 2.3.

picked up by the aggregate index for female autonomy.[44] In Model 3, the mother level unobservable is the 'autonomy' variable. The estimates of the variance of the mother-level random effect are reported at the bottom of Table 2.3.[45] Significant unobserved heterogeneity is found in UP and AP (Models 1 and 2).[46] Furthermore, the inclusion of the aggregate index does not seem to help to capture this heterogeneity (Model 2).[47] Despite the inclusion of the z-score as an explanatory variable in Model 2 the variance of the mother-level random effect is still significantly different from zero in these states. If the index were properly capturing the unobserved heterogeneity, we would expect the variance of mother level random effects to become insignificant once this variable is added. Excluding the mother-level random effects in Model 2a (but leaving the z-score in), we find it does not make a significant difference to the results in any of the two states under consideration. In addition, if the qualitative answers are fallible measures of the underlying autonomy trait, the aggregate index will be correlated with the unobserved autonomy variable and hence the estimator would be inconsistent in this model invalidating our inference in Models 2 and 2a.[48]

In summary, hypothesis a) of a positive effect of female autonomy on school enrolment finds empirical support in UP and to a lesser extent in AP. In UP for Model 1 and 2, mother level random effects are very significant in determining school entry. In Model 3 for the same state, the female autonomy variable and its interaction with girls are both highly significant. Our results indicate that, like UP, mother level random

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[44] Note omitting the mother-level random component will not affect the consistency property of the estimator (Robinson, 1982) except in the case where the mother-level random component is correlated with one or more of the regressors.

[45] Since the autonomy variables are restricted to have unit variances, the coefficient on the autonomy variables in Models 2a and 3, is equivalent to the square-root of the estimated mother-level variance in Model 1.

[46] Same conclusion is drawn from a comparison of the maximised values of the log likelihood.

[47] Models 1, 2 and 2a are not nested within Model 3 and thus not comparable with Model 3 in terms of log likelihood values.

[48] This is similar to the reasoning that test scores used in traditional wage equation models to capture unobserved ability will be correlated with omitted ability if the test scores are assumed to be fallible measures of 'ability' (see for example Heckman et al. (2006)).

effects are significant in AP with the size of the effect being largest in AP implying a higher variation in the unobserved heterogeneity. When modelled as a latent variable in Model 3, however, there is only a marginally significant impact of female autonomy on school entry of girls in AP. These results present an interesting contrast to expectations. In UP, female autonomy is highly significant in influencing the SSA. In AP, it is significant only for girls. We make the following observations. First, once allowance for correlation between covariates and female autonomy is allowed for, the variation in female autonomy across mothers in the state is too low to show an impact in the model.[49] This would imply that the norm for female autonomy is established in the state. This was clearly not the case from our summary figures. Second, the norm for schooling is too strong for individual household effects (including female autonomy) to have an effect.

Comparing Model 2 and Model 2a results, we find that the use of the aggregate index does not explain school enrolment of children. As Agarwala and Lynch (2007) pointed out, measuring female autonomy by employing indices is overly simplistic. One of the major drawbacks is that every answer is given the same weight. So, for instance, the woman having money for her own use is assumed to be as important for female autonomy as the woman's freedom to decide what to purchase for the household. Furthermore, aggregating qualitative answers provided by the woman ignores the fact that different questions relate to different spheres, which in turn are interconnected. The results of the present analysis imply that, by neglecting these details, a large part of the effect of female autonomy is not captured. In other words, by not modelling the complex relationships between the various measurements of autonomy as well as their

[49] Note, the estimated coefficient of the autonomy variable is the square root of the estimated variance of this variable since we have imposed the autonomy variable to have unit variance for identification purposes.

interrelations, the effect of female autonomy is attenuated. We discuss this issue further in Section 2.8. of the paper.

Prima facie, the present findings suggest four conclusions. First, in situations (like UP) where there is considerably more variation in SSA, female autonomy is extremely significant in influencing SSA. Second, in states like AP, school entry at 6 years is not a norm but female autonomy is not so crucial in determining school entry. Instead, a number of other factors like household wealth, religion etc. are important. Third, methodologically, we can also conclude that the impact of this variable would be missed if we did not model it appropriately – allowing for variations across spheres of autonomy, correlations with household characteristics and also interactions between them – as we have done in Model 3.

2.7.2. School Enrolment Probability Age Profiles

We next turn to the conditional probabilities of entering school as the child gets older (conditioned on the child not having enrolled up to that point), *ceteris paribus*. These are the τ_k coefficients given in equation (2.6) - the baseline hazard estimates. We allow this to be different for boys and girls. The results are reported in Table 2.3. The reference case is the entry at the recommended age of six. The results in this table give support to hypothesis b) of a decreasing baseline hazard, albeit more so in UP.

In UP however, there are significant changes to the probability of entry as the children get older. The probability of entry at age 6 is significantly smaller for girls relative to boys (the coefficient on 'girl' dummy), this also lending support to hypothesis c). The other interesting observation is, in Models 1 and 2, the probability of school entry is found to <u>increase</u> with age for both genders before it flattens out and becomes insignificant after age 8-9 years. In contrast, the probability for girls is only significantly different (and lower) for girls in the 8-9 years age group. Thus, our results for models 1 and 2 would lead us to conclude that for boys the longer they stay out of school, the higher the probability that they will go to school next year. For girls, if they are still out of school at age 8 years, then they are significantly less likely to go to school at this point. Model 3, by contrast, indicates an inverted U-shaped hazard wherein the probability of going to school first increases between 6-7 years but decreases thereafter. For girls, on the other hand, even in Model 3, the probability of going to school keeps decreasing.

In AP, Models 1 and 2 show a significant decrease in the probability of school entry only between 8-9 years and 9-10 years. For girls, the probability decreases a little earlier (7-8 years). Our results indicate that the probability of school entry for girls is higher than for boys in AP. Model 3 indicates that the probability of school entry for boys first increases (up to 7-8 years) and then decreases significantly. For girls, the only hazard that is significantly different than that for boys is the hazard for 7-8 years. All other hazards are not significantly different.

These results are consistent with the fact that in the initial years, many children are not sent to school because their parents have other priorities so that a delay of a year or two in schooling is not seen as very significant. In the initial years, therefore, the probability of entry may increase as parents recognise that time is passing and they need to send their children to school. However, beyond a certain age, only the more difficult cases remain and parents may simply decide that it is ‘too late’. In this case, if the child has not gone to school at 8-9 years, then he/she is less likely to go after this and the hazard will decrease.

2.7.3. Autonomy Variables and Other Female Characteristics [Equations (2.5), (2.6) and (2.7)]

Our preferred model is Model 3 where we assume that the answers given to a set of nineteen questions (see Appendix 2.1.) are fallible measures of unobserved underlying sub-spheres of autonomy. In this model, we also allow the overall concept of female autonomy to be correlated with female characteristics. The estimated associations are reported in Table 2.4. Since the autonomy variable is set of have zero mean, the reference case in this model is assigned a value of 0 for 'autonomy'. Additionally, for identification purposes, the effect of a mother belonging to scheduled caste was set equal to (positive) one. Hence, all estimated effects are to be interpreted with respect to the effect of this variable. As one would expect more educated women to be more autonomous, the positive sign of the education variable indicates that the estimated effects of all the other covariates are correctly signed.

Overall the estimated results are mixed and vary by state. For UP and AP, many of the female characteristics are found to be significantly correlated with autonomy. Caste and education play an important role in shaping the autonomy the woman has – this lending support to hypothesis d). Women belonging to scheduled tribes and other backward castes have greater autonomy relative to women from 'forward' castes (which is the base category). Education is positively correlated with autonomy. Muslim women have more autonomy than others and rural women have less autonomy than urban women in both states. Generally, older women are found to have more autonomy, as expected.

Our specification allows us to estimate the interrelations between the four sub-spheres of autonomy and their overarching concept. In the present model, every sub-sphere is regressed on the overall concept of female autonomy. Results for this are in Table 2.5. In UP and AP, by contrast, the estimated factor loadings vary between the various sub-spheres. In UP, female autonomy appears to have a positive influence on emotional and a negative effect on decision-making autonomy relative to its effect on economic autonomy which is assigned a value of 1 (for identification purposes). A tentative interpretation of these results is that they arise from strategic interaction between the spouses. More precisely: it might be the case that the woman trades off one sphere against the other. It may be the case, for instance, that she values emotional more than decision-making autonomy. In such a case, she might renounce bargaining power on one set of issues in order to increase her say on another set. As a result, female autonomy influences decision-making negatively and emotional autonomy positively. These interactions could be the focus of further research. In AP, once again, female autonomy has a significant effect on decision-making autonomy and emotional autonomy. Both effects are positive indicating that female autonomy increases both decision-making autonomy and emotional autonomy though it doesn't significantly influence physical autonomy.

Overall, the heterogeneity exhibited by the results in this sub-section is noteworthy and emphasises the complexity of the concept of female autonomy. The fact that the correlations between the explanatory variables and the four sub-spheres varies to such an extent is particularly telling. This finding must suggest that a plethora of factors and strategic interactions lies behind the autonomy of a woman, further highlighting the importance of more research in this area.

2.7.4. Effects of Other Covariates on School Entry Probabilities

Our results outlined in Model 3 (see Appendix, Table A3.1.) indicate that scheduled tribe children are less likely to enrol in school in UP. In UP, both scheduled caste and other backward caste children are less likely to enter into school, while it is scheduled tribes and other backward castes that are less likely to go to school in AP. Muslim children, similarly, are less likely to go to school in both AP and UP. We have already seen that mother's education influences female autonomy and through this affects SSA. Our results in Appendix 2.3. indicate that mother's education also has a direct significant positive effect on the hazard of the child entering school in AP, though this effect is variable across models in UP. Father's education is also highly significant and this is true for both primary and secondary education, though the size of the latter effect is smaller.

Wealth has a significant effect in UP, particularly in the top quintile and especially so in AP in all quintiles. It is clear that the probability of school entry is higher for the 5th wealth quintile than for the first in all the models for both AP and UP. The conditional probability of a child entering school is higher in rural areas in UP and AP than in urban areas, which is rather surprising given that schools are further apart in rural areas and there are more alternative uses of children's time in farming regions.

The birth order of the indexed child slightly increases the probability of school entry for the second born child in AP. However, in UP, children born second or third show lower probabilities of entering into school than firstborn children. Contrary to this, the influence of the birth order being three or above in UP on the hazard is positive and significant in Model 3. Furthermore, girls appear to be significantly less likely to enrol in school in UP and significantly more likely to enrol in AP. With regard to the initial conditions, we find these to be highly significant in UP. Children who were 6 years in 2003 were more likely to go to school in UP whereas those who were 6 years in 2005 were less likely to go to school. In AP, children who were 6 years in 2004 and 2005 were less likely to go to school.

We can conclude that both in AP and UP, socio-economic characteristics of the household and demographic characteristics of the child as well as initial conditions play a significant role in determining the age of entry of the child into school.

2.8. Discussion and Conclusion

According to conventional wisdom, women's autonomy is higher in the Southern compared to the Northern states. UP, for instance, is known for its particularly skewed sex ratio. With a national average of 106 men for 100 women, UP has 112 men per 100 women. AP shows a ratio below the national average of 102 men per 100 women.[50] AP lies within the Southern kinship system but is considered the median Indian state on a number of indicators. Contrary to this, the indices constructed by adding the qualitative answers provided by the woman within the NFHS (Table A2.5.) suggest that Northern states are characterised by higher female autonomy than the South. UP shows an overall female autonomy index of 14.8. By contrast, the index for AP is 12.8. Our more detailed analysis offers greater insight into these findings. In particular, two results stand out clearly distinguishing the experience of female autonomy as well as school entry in AP and UP. In AP and UP, almost all socio-economic characteristics (caste, religion, birth cohort, rural abode) influence female autonomy. This confirms that in these states female autonomy depends heavily upon the socio-economic characteristics of the woman. It is also possible that additive indices customarily used, fail to properly reflect the autonomy enjoyed by women, in particular because they neglect the multi-dimensionality of female autonomy. For the schooling decision, for instance, it is likely that physical and decision-making autonomy are more important than emotional autonomy.

Our second main finding in this paper is that in AP and UP the school starting age is significantly affected by female autonomy levels, caste, religion characteristics, wealth and initial conditions. These results indicate that while children from some families start school at the prescribed age, others lose out. It is therefore not surprising

[50] Source UNICEF (2008).

that there is a considerable starting school window as well as a substantial proportion of censored observations in these two states.

From the point of view of policy, our results therefore indicate that in states like AP and UP, where there is greater variability of SSAs, an attempt to target children in families with certain household characteristics would help to improve school outcomes. The importance of influencing schooling outcomes is borne out by the fact that the one variable that is significant for both states in influencing female autonomy as well as child education is the parent's education. Results from both states therefore confirm that the impact on future generations will be greatest if we can educate current generations.

Furthermore, in these two states where many socio-economic characteristics influence the SSA, there are many policy levers that a government can pull to help improve outcomes. One of these is the autonomy of women. We note that this variable is highly significant in UP but less so in AP. Given that school entry is an issue in both UP and AP, our finding is encouraging for two reasons. First, the fact that one intrinsically valuable concept improves another can significantly increase the effectiveness of policies. By improving a woman's position within the household, policy makers will not only improve women's lives but will also contribute towards the second Millennium Development Goal of universal primary education. In addition to this, the findings of the present analysis provide policy makers with an additional tool for improving educational outcomes. Policies aimed at improving school enrolment should, therefore, not only focus on children but also on their mothers' position within the household. The present analysis views female autonomy as an exogenous cultural factor but a number of studies try to endogenise this concept and investigate possible determinants of a woman's autonomy.[51] The present results might be used to formulate effective policies for improving women's situations, especially in areas where both female autonomy and children's educational outcomes are low.

[51] Jejeebhoy and Sathar (2001) are an example of this.

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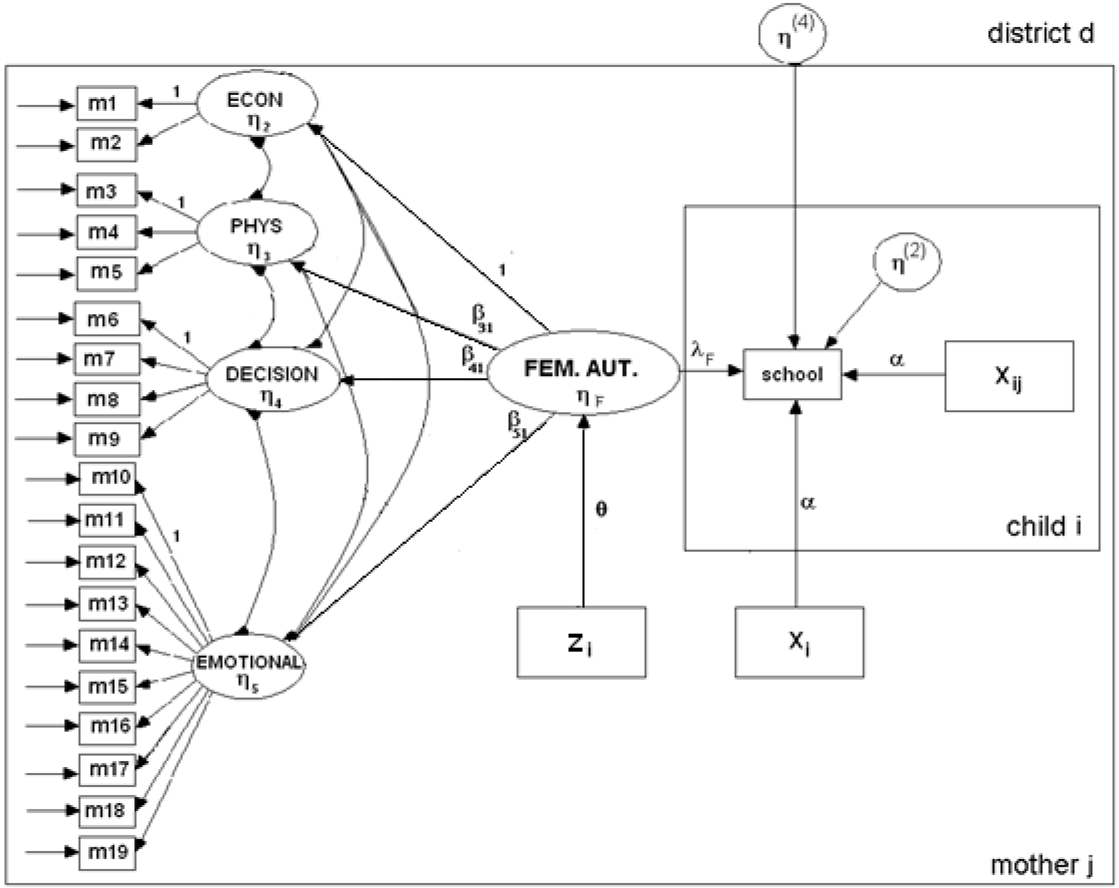
Figure 2.1.: Path Diagram



Notes: (i) Path diagram represents workings of our statistical model given in equations (2.4)-(2.7). (ii) m1 to m19 refer to Female Autonomy measurements laid out in Appendix 2.1. (iii) Squares refer to observed variables and circles to latent variables. (iv) Single-headed arrows refer to coefficients or factor loadings, double-headed arrows to correlations; (v) district d, family j and child i refer to clusters at district, mother and child levels.

Table 2.1.
Distribution of Starting school age, percentages

	Age When School Started						
	6	**7**	**8**	**9**	**10**	**11**	**Censored Observations**
STATES	**[1]**	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[7]**
All India	70	10	4	1	0.3	0.02	14
Andhra Pradesh (AP)	81	8	2	0.2	0.04	-	9
Bihar	35	14	8	3	1	0.1	38
Gujarat	85	6	2	0.2	0.2	-	7
Haryana	77	8	2	1	0.2	-	12
Karnataka	84	7	1	0.5	0.2	0.1	7
Kerala	97	2	0.1	0.3	-	-	0.7
Madhya Pradesh (MP)	69	10	4	1	0.3	-	15
Maharashtra	85	7	2	0.4	0.03	-	5
Orissa	80	7	3	1	-	-	10
Punjab	73	13	4	0.7	0.2	-	10
Rajasthan	63	11	5	1	0.3	-	19
Tamil Nadu (TN)	96	2	1	-	-	-	1
West Bengal (WB)	63	15	7	2	0.2	-	14
Uttar Pradesh (UP)	57	14	7	2	0.4	0.02	19
North Eastern States (NE)	64	12	6	2	0.4	0.1	17

Notes: (i) The percentages are based on the sample of children aged 6-11 at the beginning of the academic year April 2005. (ii) The North Eastern states are Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram and Meghalaya. (iii) Columns [1]-[6]: children entered school at age 6, 7, …, 11; Column [7]: children never having attended school.

Table 2.2.
Educational Attainments of Children and the Parents in Percentages

	CHILDREN					MOTHER				MOTHER'S HUSBAND			
STATES	**Never attended School**	**Entered**	**Advanced**	**Repeating**	**Dropped out**	**Never Attended**	**Primary Education**	**Secondary Education**	**Tertiary Education**	**Never Attended**	**Primary Education**	**Secondary Education**	**Tertiary Education**
	[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[7]**	**[8]**	**[9]**	**[10]**	**[11]**	**[12]**	**[13]**
All India	13	7	76	2	1	47	16	31	6	26	19	44	11
Andhra Pradesh (AP)	8	4	85	1	1	46	14	34	6	31	18	39	12
Bihar	36	13	49	0.2	1	72	8	17	2	40	11	37	11
Gujarat	6	2	85	5	1	46	15	33	6	21	20	50	9
Haryana	10	6	81	2	0.2	58	12	27	3	26	12	54	8
Karnataka	6	7	82	1	1	49	14	34	4	30	20	40	9
Kerala	1	5	93	1	0.3	3	11	71	16	3	17	68	12
Madhya Pradesh (MP)	13	8	75	2	1	57	15	21	7	30	20	36	14
Maharashtra	5	7	86	1	0.5	28	16	46	10	14	19	52	15
Orissa	9	5	81	3	1	52	21	24	3	32	26	32	8
Punjab	9	8	80	1	1	40	16	38	6	25	14	53	8
Rajasthan	18	8	71	1	1	77	9	10	4	38	17	35	9
Tamil Nadu (TN)	1	3	96	1	0.1	27	28	37	8	17	28	46	10
West Bengal (WB)	14	10	72	3	1	48	20	27	6	34	22	34	9
Uttar Pradesh (UP)	18	10	69	2	1	69	10	16	6	31	16	42	11
North Eastern States (NE)	15	6	74	3	0.3	36	20	39	5	23	20	46	11

Notes: (i) The percentages are based on the sample of children aged 6-11 at the beginning of the academic year April 2005. (ii) The North Eastern states are Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram and Meghalaya. (iii) Column [1]: child has never attended school; Column [2]: child has entered school at the beginning of the academic year April 2005; Column [3]: child has advanced to the next grade at the beginning of the academic year April 2005; Column [4]: child did not advance to the next grade at the beginning of the academic year April 2005 and must repeat year; Column [5]: child dropped out of school at the beginning of the academic year April 2005; Column [6]: mother has never attended school; Column [7]: mother has either incomplete primary education or complete primary education; Column [8]: mother has either incomplete secondary education or complete secondary education; Column [9]: mother has tertiary education; Column [10]: mother's husband has never attended school; Column [11]: mother's husband has either incomplete primary education or complete primary education; Column [12]: mother's husband has either incomplete secondary education or complete secondary education; Column [13]: mother's husband has tertiary education.

Table 2.3.
Maximum Likelihood Estimates of the Conditional Probability of Entry into School: Main Coefficients from Models 1, 2 and 3 (Standard Errors)

	AP				UP			
	Model 1 [1]	**Model 2 [2]**	**Model 2a [3]**	**Model 3 [4]**	**Model 1 [5]**	**Model 2 [6]**	**Model 2a [7]**	**Model 3 [8]**
Female Autonomy	-	-0.044	0.024	-0.026	-	0.007	-0.017	1.315***
		(0.098)	(0.075)	(0.076)		(0.052)	(0.035)	(0.066)
Female Autonomy * Girl	-	0.130	0.078	0.206*	-	0.051	0.028	0.082***
		(0.132)	(0.106)	(0.122)		(0.066)	(0.048)	(0.026)
Baseline Hazard:								
Age Interval 6-7	0.040	0.028	-0.826	-1.053***	0.410***	0.398***	-0.353***	-0.784***
	(0.467)	(0.414)	(0.529)	(0.167)	(0.150)	(0.149)	(0.113)	(0.077)
Age Interval 7-8	0.392	0.366	-0.639	-1.014***	1.442***	1.423***	0.239	-0.283***
	(0.763)	(0.676)	(0.875)	(0.280)	(0.226)	(0.223)	(0.180)	(0.104)
Age Interval 8-9	-1.936**	-1.966**	-2.931***	-3.291***	1.817***	1.794***	0.335	-0.317**
	(0.894)	(0.820)	(0.983)	(0.495)	(0.300)	(0.297)	(0.242)	(0.154)
Age Interval 9-10	-2.680**	-2.719**	-3.695***	-4.040***	0.582	0.555	-0.962**	-1.816***
	(1.326)	(1.271)	(1.388)	(1.038)	(0.504)	(0.502)	(0.454)	(0.407)
Age Interval 10-11	-	-	-	-	1.252	1.227	-0.427	-1.340
					(1.241)	(1.239)	(1.191)	(1.188)
Baseline Hazard * Girl:								
Age Interval 6-7	-0.313	-0.315	-0.250	-0.283	0.077	0.077	0.069	0.232**
	(0.301)	(0.299)	(0.274)	(0.257)	(0.132)	(0.132)	(0.113)	(0.112)
Age Interval 7-8	-2.049***	-2.044***	-1.995***	-1.940***	-0.035	-0.036	-0.080	0.040
	(0.585)	(0.581)	(0.574)	(0.539)	(0.171)	(0.170)	(0.149)	(0.149)
Age Interval 8-9	-	-	-	-	-0.785***	-0.784***	-0.726***	-0.607***
					(0.256)	(0.255)	(0.232)	(0.233)
Age Interval 9-10	-	-	-	-	0.406	0.410	0.415	0.753
					(0.542)	(0.541)	(0.510)	(0.512)
Age Interval 10-11	-	-	-	-	-	-	-	-
Girl	0.447***	0.450***	0.367***	0.454***	-0.192**	-0.189**	-0.112*	-0.451***
	(0.162)	(0.158)	(0.131)	(0.124)	(0.081)	(0.080)	(0.059)	(0.072)
Constant	1.584***	1.616***	1.025***	0.695***	-0.741***	-0.740***	-0.515***	1.212***
	(0.483)	(0.485)	(0.346)	(0.032)	(0.222)	(0.220)	(0.153)	(0.020)
Mother Level Random Effect	1.772***	1.789***	-	-	1.508***	1.500***	-	-
	(0.340)	(0.335)			(0.106)	(0.104)		
Log Likelihood	1321.17	-1320.66	-1347.59	-26907.18	-6402.17	-6230.47	-6401.99	-30501.09

<u>Notes:</u> (i) Estimates are based on the sample of women with children aged 6-11 at the beginning of the academic year April 2005. (ii) the dependent variable is the dummy whether child enters school and the reference case for the baseline hazard is the normal entry at age 6. (iii) Model 1: duration specification without female autonomy variable; Model 2: duration specification with female autonomy indices, Model 3: structural equation model specification. (iv) * p<0.1, ** p<0.05, *** p<0.01; (v) Log likelihood values for Model 3 are not comparable to the other Model values. (vi) - coefficient estimates too small to report. (vii) The remaining coefficient estimates are reported in Appendix 2.3.

Table 2.4.
Estimates of the Regression of Female Autonomy on Female Characteristics, Equation 5 (Standard Errors)

FEMALE AUTONOMY	AP	UP
Ma: Belongs to Schleduled Caste	1	1
Ma: Belongs to Scheduled Tribe	0.705***	1.634***
	(0.198)	(0.587)
Ma: Belongs to Other Backw. Caste	0.630***	0.104***
	(0.104)	(0.037)
Ma: Muslim	0.737***	0.487***
	(0.136)	(0.106)
Ma: Completed Primary Educ or More	0.559***	0.387***
	(0.100)	(0.101)
Ma: Birth Cohort 1968 – 1972	-0.933***	-1.056***
	(0.173)	(0.298)
Ma: Birth Cohort 1973 – 1977	-0.713***	-1.745***
	(0.149)	(0.309)
Ma: Birth Cohort 1978 – 1982	-1.140***	-1.569***
	(0.131)	(0.349)
Ma: Birth Cohort 1983 – 1991	-1.321***	-1.834***
	(0.151)	(0.509)
Rural	-0.575***	-0.634***
	(0.106)	(0.101)

<u>Notes:</u> (i) Estimates are based on the sample of women with children aged 6-11 at the beginning of the academic year April 2005. (ii) Correlations between the scheduled caste dummy and the spheres have been set to one for identification. (iv) * p<0.1, ** p<0.05, *** p<0.01.

Table 2.5.
Estimates of Regression of Sub-Spheres on Female Autonomy (Equation 2.6) – (Standard Errors)

FEMALE AUTONOMY	AP	UP
Economic Autonomy	1	1
Decision-Making Autonomy	0.863***	-0.734***
	(0.024)	(0.101)
Physical Autonomy	0.124**	0.108
	(0.061)	(0.198)
Emotional Autonomy	1.627***	0.451***
	(0.041)	(0.102)

<u>Notes:</u> (i) Estimates are based on the sample of women with children aged 6-11 at the beginning of the academic year April 2005. (ii) Estimates are derived from Regression of sub-spheres on concept of female autonomy (8). (iii) Coefficient of female autonomy on economic autonomy has been set equal to one for identification (iv) * p<0.1, ** p<0.05, *** p<0.01.

Appendices for Chapter Two:

Appendix 2.1:

1. Economic Autonomy:

- m1: takes the value of 1 if the woman decides either herself or jointly with her husband on what to do with her husband's money.
- m2: takes the value of 1 if the woman has money of her own that she alone can decide how to use.

2. Physical Autonomy:

- m3: takes the value of 1 if the woman is allowed to go alone or jointly with someone else to the market.
- m4: takes the value of 1 if the woman is allowed to go alone or jointly with someone else to the health clinic.
- m5: takes the value of 1 if the woman is allowed to go alone or jointly with someone else to places outside the community.

3. Decision-making Autonomy:

- m6: takes the value of 1 if the woman decides either alone or jointly with her husband on her own health care.
- m7: takes the value of 1 if the woman decides either alone or jointly with her husband on small household purchases.
- m8: takes the value of 1 if the woman decides either alone or jointly with her husband on large household purchases.
- m9: takes the value of 1 if the woman decides either alone or jointly with her husband on visiting family and friends.

4. Emotional Autonomy:

- m10: takes the value of 1 if woman believes her husband is not justified in beating her if she argues with him.
- m11: takes the value of 1 if woman believes her husband is not justified in beating her if she is disrespectful.
- m12: takes the value of 1 if woman believes her husband is not justified in beating her if she goes out without telling him.
- m13: takes the value of 1 if woman believes her husband is not justified in beating her if he suspects her of being unfaithful.
- m14: takes the value of 1 if woman believes her husband is not justified in beating her if she neglects house or children.
- m15: takes the value of 1 if woman believes her husband is not justified in beating her if she refuses to have sex with him.
- m16: takes the value of 1 if woman believes her husband is not justified in beating her if she does not cook the food properly.
- m17: takes the value of 1 if the woman believes she is justified in refusing sex if husband has sexually transmitted disease.
- m18: takes the value of 1 if the woman believes she is justified in refusing sex if husband has other women.

- <u>m19</u>: takes the value of 1 if the woman believes she is justified in refusing sex if she is tired.

<u>The Outcome Model – linear predictor for mother *j* (equation (7))</u>

$$v = \begin{bmatrix} v_{11} \\ v_{12} \\ v_{21} \\ v_{22} \\ v_{23} \\ v_{24} \\ v_{31} \\ v_{32} \\ v_{33} \\ v_{41} \\ v_{42} \\ v_{43} \\ v_{44} \\ v_{45} \\ v_{46} \\ v_{47} \\ v_{48} \\ v_{49} \\ v_{410} \end{bmatrix} = \begin{bmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \\ \delta_4 \\ \delta_5 \\ \delta_6 \\ \delta_7 \\ \delta_8 \\ \delta_9 \\ \delta_{10} \\ \delta_{11} \\ \delta_{12} \\ \delta_{13} \\ \delta_{14} \\ \delta_{15} \\ \delta_{16} \\ \delta_{17} \\ \delta_{18} \\ \delta_{19} \end{bmatrix} + \begin{bmatrix} 1 & 0 & 0 & 0 \\ \lambda_{12} & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & \lambda_{22} & 0 & 0 \\ 0 & \lambda_{23} & 0 & 0 \\ 0 & \lambda_{24} & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & \lambda_{32} & 0 \\ 0 & 0 & \lambda_{33} & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & \lambda_{42} \\ 0 & 0 & 0 & \lambda_{43} \\ 0 & 0 & 0 & \lambda_{44} \\ 0 & 0 & 0 & \lambda_{45} \\ 0 & 0 & 0 & \lambda_{46} \\ 0 & 0 & 0 & \lambda_{47} \\ 0 & 0 & 0 & \lambda_{48} \\ 0 & 0 & 0 & \lambda_{49} \\ 0 & 0 & 0 & \lambda_{410} \end{bmatrix} \begin{bmatrix} \eta_{1j}^{(3)} \\ \eta_{2j}^{(3)} \\ \eta_{3j}^{(3)} \\ \eta_{4j}^{(3)} \end{bmatrix}$$

<u>Notes:</u> The variables v11 to v410 are the linear predictors for the binary indicators associated with the measurements m1 to m19 laid out above.

Appendix 2.2.: Descriptive Evidence on Female Autonomy

Table A2.1.
Economic Autonomy, Percentages [State Ranks]

STATES	Woman decides on husband's money [1]	Woman has money for own use [2]
All India	71 [8]	45 [7]
Andhra Pradesh (AP)	56 [16]	59 [4]
Bihar	71 [8]	63 [2]
Gujarat	69 [11]	60 [3]
Haryana	74 [5]	35 [10]
Karnataka	58 [15]	59 [4]
Kerala	61 [13]	22 [15]
Madhya Pradesh (MP)	72 [6]	47 [4]
Maharashtra	76 [3]	44 [8]
Orissa	70 [10]	38 [9]
Punjab	72 [6]	28 [13]
Rajasthan	62 [12]	33 [11]
Tamil Nadu (TN)	78 [2]	24 [14]
West Bengal (WB)	58 [14]	38 [9]
Uttar Pradesh (UP)	80 [1]	65 [1]
North Eastern States (NE)	76 [3]	33 [11]

Notes: (i) The percentages are based on the sample of women with children aged 6-11 at the beginning of the academic year April 2005. (ii) The North Eastern states are Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram and Meghalaya. (iii) Column [1]: Woman decides either herself or jointly with her husband on what to do with husband's money; Column [2]: woman has money for her own that she alone can decide how to use.

Table A2.2.
Decision-Making Autonomy, Percentages [State Ranks]

STATES	Woman decides on own health care [1]	Woman decides on small household purchases [2]	Woman decides on large household purchases [3]	Woman decides on visiting family and friends [4]
All India	70 [7]	68 [6]	60 [6]	67 [8]
Andhra Pradesh (AP)	64 [10]	62 [12]	55 [11]	65 [10]
Bihar	61 [11]	69 [5]	60 [6]	63 [11]
Gujarat	61 [11]	72 [4]	56 [9]	73 [4]
Haryana	73 [4]	64 [10]	56 [9]	72 [6]
Karnataka	51 [16]	57 [14]	51 [14]	55 [14]
Kerala	75 [3]	67 [8]	62 [5]	78 [2]
Madhya Pradesh (MP)	57 [14]	63 [11]	56 [10]	56 [13]
Maharashtra	68 [8]	75 [3]	65 [2]	75 [3]
Orissa	67 [9]	66 [9]	60 [6]	67 [8]
Punjab	76 [2]	59 [13]	50 [13]	69 [7]
Rajasthan	54 [15]	56 [15]	46 [15]	47 [16]
Tamil Nadu (TN)	72 [5]	77 [2]	64 [3]	73 [4]
West Bengal (WB)	61 [11]	50 [16]	41 [16]	51 [15]
Uttar Pradesh (UP)	72 [5]	68 [6]	64 [3]	61 [12]
North Eastern States (NE)	79 [1]	78 [1]	73 [1]	81 [1]

Notes: (i) The percentages are based on the sample of women with children aged 6-11 at the beginning of the academic year April 2005. (ii) The North Eastern states are Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram and Meghalaya. (iii) Column [1]: woman decides alone or jointly with husband on own health care; Column [2]: woman decides alone or jointly with husband on small household purchases; Column [3]: woman decides alone or jointly with husband on large household purchases; Column [4]: woman decides alone or jointly with husband on visiting family and friends.

Table A2.3.
Physical Autonomy, Percentages [State Ranks]

STATES	Woman can go to the market [1]	Woman can go to places outside the community [2]	Woman can go to health facility [3]
All India	91 [8]	94 [9]	97 [7]
Andhra Pradesh (AP)	87 [12]	95 [7]	97 [7]
Bihar	90 [11]	88 [14]	97 [7]
Gujarat	97 [2]	96 [4]	97 [7]
Haryana	95 [6]	88 [14]	97 [7]
Karnataka	81 [14]	99 [1]	99 [1]
Kerala	80 [15]	85 [15]	94 [15]
Madhya Pradesh (MP)	97 [2]	98 [2]	98 [3]
Maharashtra	91 [8]	90 [12]	94 [15]
Orissa	86 [13]	96 [4]	98 [3]
Punjab	97 [2]	90 [12]	98 [3]
Rajasthan	98 [1]	98 [2]	99 [1]
Tamil Nadu (TN)	97 [2]	93 [10]	97 [7]
West Bengal (WB)	80 [15]	91 [11]	96 [14]
Uttar Pradesh (UP)	91 [8]	95 [7]	97 [7]
North Eastern States (NE)	95 [6]	96 [4]	98 [3]

Notes: (i) The percentages are based on the sample of women with children aged 6-11 at the beginning of the academic year April 2005. (ii) The North Eastern states are Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram and Meghalaya. (iii) Column [1]: woman is allowed to go alone or jointly with someone else to the market; Column [2]: woman is allowed to go alone or jointly with someone else to places outside the community. Column [3]: woman is allowed to go alone or jointly with someone else to a health facility.

Table A2.4.
Emotional Autonomy, Percentages [State Ranks]

STATES	Woman believes her husband is not justified beating her if she goes out without telling him [1]	Woman believes her husband is not justified beating her if she neglects the house and children [2]	Woman believes her husband is not justified beating her if she argues with him [3]	Woman believes her husband is not justified beating her if she refuses sex [4]	Woman believes her husband is not justified beating her if she burns the food [5]
All India	67 [6]	60 [9]	66 [6]	82 [7]	81 [5]
Andhra Pradesh (AP)	55 [14]	50 [13]	61 [11]	72 [15]	73 [10]
Bihar	75 [4]	79 [1]	66 [6]	85 [4]	82 [2]
Gujarat	62 [11]	55 [11]	55 [16]	74 [13]	66 [16]
Haryana	63 [8]	67 [5]	64 [8]	73 [14]	73 [10]
Karnataka	53 [15]	46 [14]	61 [11]	67 [16]	69 [15]
Kerala	63 [8]	55 [11]	73 [4]	83 [5]	78 [8]
Madhya Pradesh (MP)	79 [2]	78 [2]	75 [2]	89 [2]	82 [2]
Maharashtra	79 [2]	64 [7]	74 [3]	82 [7]	80 [6]
Orissa	57 [13]	56 [10]	57 [14]	82 [7]	73 [10]
Punjab	67 [6]	64 [7]	64 [8]	76 [12]	75 [9]
Rajasthan	63 [8]	65 [6]	61 [11]	83 [5]	72 [13]
Tamil Nadu (TN)	51 [16]	37 [16]	56 [15]	81 [10]	71 [14]
West Bengal (WB)	81 [1]	74 [3]	76 [1]	86 [3]	87 [1]
Uttar Pradesh (UP)	75 [4]	72 [4]	72 [5]	90 [1]	82 [2]
North Eastern States (NE)	60 [12]	44 [15]	64 [8]	81 [10]	80 [6]

STATES	Woman believes her husband is not justified beating her if she is unfaithful [6]	Woman believes her husband is not justified beating her if she is disrespectful [7]	Woman believes she is justified refusing sex if husband has other women [8]	Woman believes she is justified refusing sex if husband has sexually transmitted disease [9]	Woman believes she is justified refusing sex if she is tired [10]
All India	69 [9]	54 [10]	81 [8]	82 [7]	80 [4]
Andhra Pradesh (AP)	57 [15]	47 [13]	80 [10]	78 [11]	77 [10]
Bihar	72 [6]	65 [1]	91 [1]	86 [4]	80 [4]
Gujarat	63 [10]	55 [8]	74 [13]	77 [12]	69 [16]
Haryana	61 [12]	57 [6]	87 [4]	83 [6]	79 [6]
Karnataka	57 [15]	43 [16]	82 [7]	79 [9]	78 [8]
Kerala	76 [4]	56 [7]	75 [11]	76 [13]	72 [15]
Madhya Pradesh (MP)	72 [6]	62 [3]	91 [1]	92 [1]	92 [1]
Maharashtra	80 [3]	58 [5]	71 [15]	75 [14]	75 [13]
Orissa	60 [13]	47 [13]	56 [16]	75 [14]	76 [11]
Punjab	58 [14]	55 [8]	85 [5]	85 [5]	79 [6]
Rajasthan	70 [8]	51 [11]	91 [1]	92 [1]	87 [3]
Tamil Nadu (TN)	85 [1]	51 [11]	73 [14]	79 [9]	78 [8]
West Bengal (WB)	84 [2]	65 [1]	75 [11]	69 [16]	75 [13]
Uttar Pradesh (UP)	74 [5]	62 [3]	85 [5]	88 [3]	89 [2]
North Eastern States (NE)	62 [11]	44 [15]	81 [8]	82 [7]	76 [11]

Notes: (i) The percentages are based on the sample of women with children aged 6-11 at the beginning of the academic year April 2005. (ii) The North Eastern states are Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram and Meghalaya. (iii) The answers to the questions are binary indicators as explained in Appendix 2.1.

Table A2.5.
Traditional Female Autonomy Indices, Means (Standard Deviation)
[State Ranks]

	Economic Autonomy	Dec-Making Autonomy	Physical Autonomy	Emotional Autonomy	Female Autonomy	Female Autonomy
	Mean [S.D.]	Mean [S.D.]	Mean [S.D.]	Mean [S.D.]	Mean [S.D.]	Median [Interquartile Range]
	[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**
All India	1.2 [4]	2.6 [5]	2.8 [7]	7.2 [7]	13.8 [6]	14 [5]
	0.7	1.53	0.5	2.6	3.5	5
Andhra Pradesh (AP)	1.1 [8]	2.5 [11]	2.8 [7]	6.4 [14]	12.8 [15]	13 [13]
	0.7	1.65	0.6	3	4	6
Bihar	1.3 [2]	2.5 [11]	2.8 [7]	7.8 [3]	14.5 [3]	15 [1]
	0.7	1.5	0.6	2.3	3.3	5
Gujarat	1.3 [2]	2.6 [5]	2.9 [2]	6.7 [12]	13.5 [9]	14 [5]
	0.7	1.4	0.5	2.9	3.9	6
Haryana	1.1 [8]	2.6 [5]	2.8 [7]	7.2 [7]	13.7 [7]	14 [5]
	0.6	1.5	0.6	3	3.8	6
Karnataka	1.2 [4]	2.1 [14]	2.8 [7]	6.4 [14]	12.5 [16]	13 [13]
	0.7	1.6	0.5	2.7	3.7	5
Kerala	0.8 [16]	2.8 [3]	2.6 [16]	7.1 [10]	13.4 [11]	14 [5]
	0.7	1.4	0.8	2.4	3.3	5
Madhya Pradesh (MP)	1.2 [4]	2.3 [13]	2.9 [2]	8.2 [1]	14.6 [2]	15 [1]
	0.7	1.6	0.4	2.3	3.5	6
Maharashtra	1.2 [4]	2.8 [3]	2.7 [14]	7.5 [5]	14.3 [4]	15 [1]
	0.7	1.4	0.7	2.5	3.5	5
Orissa	1.1 [8]	2.6 [5]	2.8 [7]	6.4 [14]	12.9 [14]	13 [13]
	0.7	1.5	0.5	2.9	3.8	6
Punjab	1 [12]	2.6 [5]	2.9 [2]	7.2 [7]	13.6 [8]	14 [5]
	0.6	1.4	0.5	2.7	3.5	6
Rajastan	1 [12]	2 [15]	3 [1]	7.3 [6]	13.3 [13]	13 [13]
	0.7	1.6	0.3	2.6	3.5	5
Tamil Nadu (TN)	1 [12]	2.9 [2]	2.9 [2]	6.6 [13]	13.4 [11]	14 [5]
	0.6	1.4	0.5	2.3	3	4
West Bengal (WB)	1 [12]	2 [15]	2.7 [14]	7.8 [3]	13.5 [9]	14 [5]
	0.7	1.6	0.7	2.6	3.8	6
Uttar Pradesh (UP)	1.4 [1]	2.6 [5]	2.8 [7]	7.9 [2]	14.8 [1]	15 [1]
	0.7	1.5	0.6	2.4	3.3	4
North Eastern States	1.1 [8]	3.1 [1]	2.9 [2]	6.8 [11]	13.9 [5]	14 [5]
	0.6	1.4	0.4	2.5	3.2	4

Notes: (i) The percentages are based on the sample of women with children aged 6-11 at the beginning of the academic year April 2005. (ii) The North Eastern states are Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram and Meghalaya. (iii) Column [1]: sum of dummy variables based on questions laid out in Table A2.1; Column [2]: sum of dummy variables based on questions laid out in Table A2.2.; Column [3]: sum of dummy variables based on questions laid out in Table A2.3.; Column [4]: sum of dummy variables based on questions laid out in Table A2.4.; Column [5]: addition of indices reported in Columns [1], [2], [3] and [4].

Appendix 2.3.

Table A3.1. Estimates of Remaining Coefficients from Models [1], [2] and [3], (Standard Errors)

	AP				UP			
	Model 1 [1]	Model 2 [2]	Model 2a [3]	Model 3 [4]	Model 1 [5]	Model 2 [6]	Model 2a [7]	Model 3 [8]
Female Autonomy	-	-0.044	0.024	-0.026	-	0.007	-0.017	1.315***
		(0.098)	(0.075)	(0.076)		(0.052)	(0.035)	(0.066)
FE. Autonomy * Girl	-	0.130	0.078	0.206*	-	0.051	0.028	0.082***
		(0.132)	(0.106)	(0.122)		(0.066)	(0.048)	(0.026)
Caste:								
Scheduled Caste	-0.207	-0.205	-0.163	-0.080	0.024	0.019	-0.002	-0.691***
	(0.269)	(0.267)	(0.214)	(0.172)	(0.135)	(0.135)	(0.088)	(0.067)
Scheduled Tribe	-1.016***	-1.019***	-0.781***	-0.738***	0.269	0.341	0.393	-1.293***
	(0.375)	(0.365)	(0.262)	(0.192)	(0.790)	(0.684)	(0.282)	(0.233)
Other Backward Caste	-0.406*	-0.402*	-0.336**	-0.232*	-0.131	-0.132	-0.175**	-0.661***
	(0.224)	(0.221)	(0.171)	(0.130)	(0.110)	(0.109)	(0.071)	(0.055)
Religion:								
Muslim	-0.968***	-0.970***	-0.704***	-0.687***	-0.992***	-0.989***	-0.664***	-1.014***
	(0.324)	(0.302)	(0.224)	(0.141)	(0.124)	(0.124)	(0.081)	(0.058)
Highest Education:								
Ma: Completed Prim.	0.385*	0.386*	0.282*	0.283**	0.450***	0.442***	0.353***	0.075
	(0.205)	(0.200)	(0.149)	(0.129)	(0.115)	(0.115)	(0.076)	(0.071)
Pa: Completed Prim.	0.373*	0.359*	0.287**	0.272**	0.681***	0.678***	0.434***	0.331***
	(0.190)	(0.184)	(0.135)	(0.114)	(0.103)	(0.102)	(0.061)	(0.053)
Pa: Completed Sec.	1.202***	1.194***	0.960***	0.989***	1.272***	1.262***	0.874***	0.762***
	(0.353)	(0.342)	(0.284)	(0.240)	(0.166)	(0.166)	(0.107)	(0.096)
Wealth:								
2nd Quintile	0.415	0.395	0.265	0.366**	0.264**	0.263**	0.224***	-0.107*
	(0.338)	(0.333)	(0.233)	(0.175)	(0.116)	(0.115)	(0.072)	(0.062)
3rd Quintile	0.662**	0.641**	0.430*	0.521***	0.599***	0.595***	0.414***	-0.064
	(0.327)	(0.320)	(0.226)	(0.153)	(0.137)	(0.135)	(0.085)	(0.071)
4th Quintile	0.698**	0.685**	0.513**	0.561***	0.610***	0.605***	0.475***	-0.145*
	(0.343)	(0.340)	(0.240)	(0.158)	(0.151)	(0.150)	(0.099)	(0.077)
5th Quintile	1.206***	1.170***	0.927***	0.945***	1.680***	1.668***	1.180***	0.229**
	(0.435)	(0.422)	(0.312)	(0.206)	(0.211)	(0.209)	(0.139)	(0.103)
Rural Household	0.443**	0.439**	0.376**	0.393***	0.419***	0.431***	0.343***	0.126**
	(0.217)	(0.214)	(0.168)	(0.117)	(0.134)	(0.135)	(0.095)	(0.054)
Child Characteristics:								
Girl	0.447***	0.450***	0.367***	0.454***	-0.192**	-0.189**	-0.112*	-0.451***
	(0.162)	(0.158)	(0.131)	(0.124)	(0.081)	(0.080)	(0.059)	(0.072)
Birth Order = 2	0.312*	0.306*	0.271*	0.277**	0.004	0.003	0.034	-0.564***
	(0.176)	(0.172)	(0.146)	(0.120)	(0.102)	(0.102)	(0.078)	(0.073)
Birth Order = 3	0.234	0.235	0.184	0.208	-0.095	-0.098	-0.052	-0.479***
	(0.192)	(0.189)	(0.154)	(0.136)	(0.109)	(0.109)	(0.080)	(0.061)
Birth order > 3	-0.060	-0.058	-0.015	-0.026	0.030	0.029	0.026	0.373***
	(0.205)	(0.203)	(0.155)	(0.138)	(0.100)	(0.099)	(0.069)	(0.061)

Appendix 2.3. Table Continued

	AP				UP			
	Model 1 [1]	**Model 2 [2]**	**Model 2a [3]**	**Model 3 [4]**	**Model 1 [5]**	**Model 2 [6]**	**Model 2a [7]**	**Model 3 [8]**
Initial Conditions:								
Aged 6 in 2003	-0.172	-0.177	-0.118	-0.131	0.760***	0.755***	0.525***	0.479***
	(0.166)	(0.165)	(0.136)	(0.126)	(0.097)	(0.096)	(0.069)	(0.071)
Aged 6 in 2004	-0.349**	-0.350**	-0.264*	-0.262**	0.893***	0.889***	0.605***	-0.130
	(0.178)	(0.176)	(0.146)	(0.132)	(0.109)	(0.108)	(0.079)	(0.127)
Aged 6 in 2005	-1.506***	-1.514***	-1.173***	-1.069***	-0.054	-0.054	-0.019	-0.348***
	(0.380)	(0.362)	(0.292)	(0.199)	(0.173)	(0.172)	(0.130)	(0.057)
Baseline Hazard:								
Age Interval 6-7	0.040	0.028	-0.826	-1.053***	0.410***	0.398***	-0.353***	-0.784***
	(0.467)	(0.414)	(0.529)	(0.167)	(0.150)	(0.149)	(0.113)	(0.077)
Age Interval 7-8	0.392	0.366	-0.639	-1.014***	1.442***	1.423***	0.239	-0.283***
	(0.763)	(0.676)	(0.875)	(0.280)	(0.226)	(0.223)	(0.180)	(0.104)
Age Interval 8-9	-1.936**	-1.966**	-2.931***	-3.291***	1.817***	1.794***	0.335	-0.317**
	(0.894)	(0.820)	(0.983)	(0.495)	(0.300)	(0.297)	(0.242)	(0.154)
Age Interval 9-10	-2.680**	-2.719**	-3.695***	-4.040***	0.582	0.555	-0.962**	-1.816***
	(1.326)	(1.271)	(1.388)	(1.038)	(0.504)	(0.502)	(0.454)	(0.407)
Age Interval 10-11	0	0	0	0	1.252	1.227	-0.427	-1.340
	(0.000)	(0.000)	(0.000)	(0.000)	(1.241)	(1.239)	(1.191)	(1.188)
Baseline Hazard * Girl:								
					0.077	0.077	0.069	0.232**
Age Interval 6-7	-0.313	-0.315	-0.250	-0.283	(0.132)	(0.132)	(0.113)	(0.112)
	(0.301)	(0.299)	(0.274)	(0.257)	-0.035	-0.036	-0.080	0.040
Age Interval 7-8	-2.049***	-2.044***	-1.995***	-1.940***	(0.171)	(0.170)	(0.149)	(0.149)
	(0.585)	(0.581)	(0.574)	(0.539)	-0.785***	-0.784***	-0.726***	-0.607***
Age Interval 8-9	1.584***	1.616***	1.025***	0.695***	(0.256)	(0.255)	(0.232)	(0.233)
	(0.483)	(0.485)	(0.346)	(0.032)	0.406	0.410	0.415	0.753
Age Interval 9-10	1.772***	1.789***	-0.118	-0.131	(0.542)	(0.541)	(0.510)	(0.512)
	(0.340)	(0.335)	(0.136)	(0.126)				
Age Interval 10-11	-0.172	-0.177	-	-	-	-	-	-
	(0.166)	(0.165)						
Constant	-0.349**	-0.350**	-0.264*	-0.262**	-0.741***	-0.740***	-0.515***	1.212***
	(0.178)	(0.176)	(0.146)	(0.132)	(0.222)	(0.220)	(0.153)	(0.020)
Mother Level Random Effect	-1.506***	-1.514***	-	-	1.508***	1.500***	-	-
	(0.380)	(0.362)			(0.106)	(0.104)		
Log Likelihood	1321.17	-1320.66	-1347.59	-26907.18	-6402.17	-6230.47	-6401.99	-30501.09

<u>Notes:</u> (i) Estimates are based on the sample of women with children aged 6-11 at the beginning of the academic year April 2005. (ii) Model 1: duration specification without female autonomy variable; Model 2: duration specification with female autonomy indices; Model 3: structural equation model specification. (iii) Dependent Variable in Columns [1], [2] and [3]: Dummy for child entering school - SSA; (iv) * p<0.1, ** p<0.05, *** p<0.01. (v) Models allow for unobserved heterogeneity at the child-, mother- and district-levels.

Chapter Three

Female Autonomy and Gender Disparities in Child Survival in India

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3.1. Introduction

India has the world's largest under-five population of 127 million children and its under-five deaths account for 22% of the world's mortality rates (UNICEF, 2008). These figures make India's progress in decreasing mortality rates pivotal to meeting the Millennium Development Goal (MDG) of reducing child mortality[52] by two-thirds before 2015. The determinants of mortality have been subject to rigorous scrutiny and a number of different influences have been identified. These comprise environmental aspects like indoor pollution (van der Klaaw and Wang, 2008) and safe water (Kishor and Parasuraman, 1998), biological variables like twin births (Sullivan et al., 1994) and mother's age (Pebley and Strupp, 1987), socio-economic influences like income (Filmer and Pritchett, 1999), behavioural factors like immunisation (Hanmer et al., 2003) and breastfeeding (Palloni and Tienda, 1986) as well as the survival status of older siblings (Arulampalam and Bhalotra; 2006, 2008; Bhalotra and van Soest, 2008). In practice, a large percentage of child deaths can be traced back to preventable causes. Simple and affordable interventions are often readily available[53] and their effectiveness depends to a large extent on parents' behaviour. Increasing attention in recent years has thus been paid to the role of the parents and in particular to the role of the mother. Maternal education has been found to be an important determinant of the demand for health services (Maitra, 2004) and a recent study by van der Klaaw and Wang (2008) found that improving the mother's education can substantially increase child survival rates.

This paper focuses on an interrelated yet distinct and less explored explanatory factor: female autonomy – a concept relating to the extent to which a

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[52] Child mortality refers to deaths of children before they reach their 5th birthday.

[53] State of the World's Children, UNICEF (2007).

woman can influence various aspects of her life.[54] In contrast to maternal education, the focus of this concept is on the woman's role within the household as well as on her ability to influence decisions, which in turn can affect the survival rates of children. From an intuitive point of view, a woman's autonomy may affect her children's survival probabilities in a number of ways. More autonomous women will be more likely to provide better health care for their children. They will, for instance, be better at gathering information regarding health and be more likely to know where the best health facility is located. In addition, a woman with a higher degree of autonomy will be better at networking and establishing social connections. She will consequently benefit from the experiences of her peers. Furthermore, there is evidence suggesting that mothers are more altruistic with regard to how resources are allocated to their children (Hoddinott and Haddad, 1995).

South East Asia and India in particular are characterised by considerable gender gaps in child survival. According to the World Health Organization in 2002 in India, boys' under-five mortality rates were 81 per 1000 live births; the corresponding figure for girls was 89.[55] This phenomenon has received an increasing amount of attention in academic research as well as in the public prints. A recent article in *The Economist*, for instance, has pointed out the skewed sex ratios in India as well as in other countries and highlighted the possible adverse long-term consequences of this phenomenon.[56] A possible explanation for this gender gap is the widespread preference[57] for sons in Indian society, which is particularly pronounced in the North of the country (Bathia, 1978; Mutharayappa et al., 1997).

[54] A more precise definition will be given in section 3.4.
[55] Source: who.int; Accessed January 2010.
[56] *The Economist*, 4th of March 2010.
[57] Parents might prefer sons for social, economic or cultural reasons. The productivity of sons net of child rearing and investment costs might exceed that of daughters. Due to their greater physical strength, sons are more likely to produce more on farms, for instance. Furthermore, girls often require dowries.

Past studies have documented connections between these preferences and female infanticide (Arnold et al., 2002) as well as sex selective abortions (Retherford and Roy, 2003). Bhalotra and Cochrane (2010), for instance, estimate that between 1995 and 2005 480,000 sex selective abortions against female foetuses took place in India every year. In practice, a preference for sons can lead to them receiving a disproportionately high amount of resources and so increase female mortality rates. Oster (2009) finds that 50% of the sex differences in mortality levels in India can be explained by different vaccination rates and nutritional statuses.

Intuitively, there are a number of reasons why female autonomy might mitigate these practices. Son preference, for instance, is rooted in a patriarchal culture that might lead to men developing a preference for sons. Women, in contrast, might not empathise with this way of thinking and treat male and female children with greater equity, influencing decisions taken by the household and leading to a more balanced distribution of resources. Indeed, past research has found that women tend to favour their daughters when allocating the household's resources (Thomas et al., 2002). Given the presence of excess female mortality rates,[58] this type of decision-making may eventually lead to higher rate of decrease in female mortality.

The present analysis employs data from the third round of the Indian National Family Health Survey (NFHS-3), 2005/2006 (IIPS and Macro International 2007). The NFHS is part of the Demographic and Health Survey (DHS) series conducted for about 70 low to middle income countries around the world.[59]

This paper aims to contribute to the literature by providing an innovative way of investigating the hypothesis that girls particularly benefit from an autonomous

[58] See Table 3.1.
[59] The data are in the public domain and can be downloaded from www.measuredhs.com.

mother. Female autonomy is customarily modelled using indices constructed by aggregating the qualitative answers provided by the respondent to a set of questions assumed to measure autonomy. In contrast, the approach taken in this paper treats these answers as fallible measures of an underlying latent trait called 'female autonomy' and assumed to consist of four sub-spheres; economic, decision-making, physical and emotional autonomy. In addition, factors such as the woman's education, religion and caste are allowed to affect the underlying autonomy trait. The framework used is the structural equation modelling framework (Skrondal and Rabe-Hesketh, 2007) which is a generalisation of the Item Response Theory model.[60]

The paper is structured as follows. Section 3.2. introduces the reader to important issues related to child survival in India. Sections 3.3. and 3.4. lay out previous work on Children's Outcomes and female autonomy respectively. The data employed are explained in Section 3.5. Section 3.6. outlines the econometric methodology used, the results of which are reported in Section 3.7. Section 3.8. discusses these results and concludes.

3.2. Child Survival in India

Child survival has become a politically important topic in many developing countries and makes up the fourth Millennium Development Goal (MDG). In recent years, India has made great strides in improving child survival. In 1960, the child mortality rate stood at 236 per 1000 live births.[61] By 2006, it decreased by two-thirds to 76 deaths per 1000 births. Since 1990, India decreased its child mortality rates by about one-third. Despite these achievements, India is still far away from reaching the

60 These models are also known as factor models.
61 Source: The state of Asia-Pacific children, Child Survival UNICEF (2008).

fourth MDG and, at current rates, it is unlikely to meet the 2015 target of 40 per 1000 live births (UNICEF, 2007; 2008).

South Asia is characterised by strong gender differences, which affect mortality rates as well as a number of connected social and economic indicators. South Asia, for instance, is the only region in the world where girls have a higher probability of being underweight than boys (UNICEF, 2008). Similarly, girls' survival chances are worse than those for boys. Older data for India suggest considerable gaps between male and female mortality rates. The NFHS-1 (1992/93) for instance, indicates mortality rates of 29.4 boys and 42.0 girls per 1,000 births. This corresponds to excess child mortality for girls of 43%. Discrimination against girls such as neglect and receiving a disproportionately low percentage of resources, have been seen as some of the major reasons behind female excess mortality (Das Gupta et al., 2003). The authors argue that between 1981 and 1992, discrimination alone accounted for about one fifth of child mortality. Despite the fact that gender disparities have decreased in recent years, they are still significant in India. Arnold et al. (2002), for instance, suggest that girls with older sisters are often subject to higher risks of mortality. For Uttar Pradesh, Bhargava (2003) finds that unwanted pregnancies significantly decrease female survival rates.

The present analysis focuses on two Indian states: Uttar Pradesh (UP) and West Bengal (WB). UP is the largest Indian state which lies in the north and has social and demographic indicators that put it below the Indian average. For example, the immunisation coverage in UP is 21%, which is half the one of the whole of India.[62] Furthermore, a number of other indicators suggest considerable gender differences in socio-economic outcomes from this state. Schooling achievements, for

[62] Census of India, 2001. http://www.censusindia.net/

instance, vary considerably between boys and girls. For India, 78% of boys and 66% of girls between the ages of 6 and 17 are enrolled in school. For UP, the former percentage is very similar, 76%. The latter, however, is considerably lower at 61%. Rural women appear particularly disadvantaged. In UP, 32% of girls (aged 10 to 12) and 49% of women (aged 15 to 19) living in rural areas have never attended school. The corresponding percentages for the whole country are 27% and 39%.[63] WB, by contrast, exhibits considerably better economic indicators than UP (see Dreze and Sen, 1997).

3.3. <u>Previous Work on the Determinants of Children's Outcomes</u>

The determinants of child survival have received considerable attention by academics and policy makers alike. Relevant influences identified in the past comprise maternal education, health care and nutrition. While female autonomy has been recognised to be one of the important influences on child survival, its interrelations with gender gaps in children's outcomes have remained relatively unexplored.

On numerous occasions, maternal education has been found to have a positive influence on child survival. Whitworth and Stevenson (2002), for instance, use the NFHS-1 (1992/93) data to suggest that the mother's education has a diluting effect on the negative influence of a short previous birth interval. Furthermore, van der Klaaw and Wang (2008) use NHFS-2 data (1998/99) to analyse child mortality in rural India and find important determinants to be indoor air pollution caused by dirty cooking fuel and the education of the mother. A number of other studies

[63] National Family and Health Survey, 1998/1999.

suggests a positive correlation between maternal education and child survival (Sullivan et al., 1994; Shiva Kumar, 1995). Das Gupta (1990, 1997), however, argues that this effect is weakened if indicators of health care are included in the analysis.

A large part of the literature on India has scrutinised the reasons behind the gender gap in child survival rates. Vaccination rates, nutrition and treatment of diseases are the most cited aspects. Oster (2009) estimates the relative importance of these factors. She argues that gender differences in vaccinations account for 20% to 30% of female excess mortality, malnutrition for 20% and treatment of illnesses for 5%. Similarly, Pande (2003) analyses the connection between nutrition and immunisation on the one hand and the sex composition of siblings on the other. The results suggest that, although both boys and girls born after multiple same-sex births are disadvantaged, boys are comparatively better off. In a similar vein, Mishra et al. (2004), stress the importance of the birth order of the indexed child. In contrast to these studies, Griffiths et al. (2002) scrutinise health outcomes and find no significant gender differences in low weight for age indicators. Health care access and usage have also been found to be an important factor. Masset and White (2003) investigate infant and child mortality in Andhra Pradesh and find that health service provision, like tetanus injections and use of antenatal services significantly decrease mortality rates.

An increasingly investigated issue is whether and to what extend parental characteristics can close the gender gap in child survival. Borooah (2004) takes a first step in this direction and finds that discrimination between boys and girls varies with maternal education. The results suggest that literate mothers do not discriminate whereas their illiterate counterparts do. The relation between female autonomy and excess female mortality is similarly unexplored. As one of the few studies Murthi et al. (1995) focus on variables related to female agency like maternal education and labour force participation in India. The former is found to reduce the female disadvantage in child survival, whereas the latter has no significant impact. For Korea, Choe (1987) finds that girls are particularly disadvantaged during childhood than during infancy.

Whilst the interrelations between maternal education and gender gaps in survival rates have received considerable attention, the role of the mother's autonomy has remained relatively unexplored. This flies in the face of vast descriptive evidence documenting a low status of women in India. Evidence from Demographic Health Surveys (NFHS, 1998-1999; NFHS, 2005-2006) suggests that women often have little influence on decisions concerning their own health. This problem is particularly severe in South Asia and Sub Saharan Africa. In this context, empowering women is seen by many as a way to decrease maternal, newborn and child death. Similarly, various studies have documented that this exclusion can comprise health outcomes of both women and children and are linked to high child and maternal mortality rates.[64] Maitra (2004) investigates the interrelations between the woman's position within the household, health care usage and child mortality. Female autonomy is measured by a number of different indicator variables. These comprise dummies for whether the woman decides on a number of important household issues, whether she has money for her own use, needs permission to leave the house and whether her husband beats her in a variety of circumstances. The author's results suggest, inter alia, that maternal education has a stronger effect on health care usage compared to the husband's and that a woman's control over

[64] An example is World Health Organization, Women's Health in Afghanistan, WHO Department of Gender and Women's Health, 2004.

resources has a significant effect on the usage of health care. Beegle et al. (2001) also scrutinise the effect of bargaining power within the household on health outcomes. The authors use socio-economic measures to capture the bargaining power of the woman and find that various measures of female bargaining power are positively associated with prenatal care.

3.4. Previous Work on Female Autonomy

The concept of female autonomy is an inherently vague one and has been defined in a number of different ways. Dixon-Mueller (1978), for instance, defines it as 'the degree of access to and control over material and social resources within the family, in the community and in society at large'. Alternatively, it has been described as 'the ability to influence and control one's environment' (Safilios-Rothschild, 1982) and as the 'capacity to obtain information and make decisions about one's private concerns and those of one's intimates' (Dyson and Moore, 1983). Female autonomy is often divided into four distinct but interrelated sub-spheres: emotional, decision-making, physical and economic autonomy. Emotional autonomy indicates how independent the woman feels from her husband. Decision-making autonomy measures the extent to which the woman is involved in the decision-making process of the household and economic autonomy measures the woman's control over her own finances. Physical autonomy denotes the woman's freedom of movement.

From a theoretical point of view the way in which each agent's position within the household affects economic variables depends crucially on the way in which the household is viewed. Unitary models developed by Becker (1972) view the household as a single homogenous entity. In these models the balance of power between husband and wife is irrelevant for household decisions and consequently female autonomy should not have any effect on household outcomes (Chiappori, 1992). Contrary to this, collective models consider households as the setting in which individuals with varying preferences bargain for outcomes. In this general framework, the distribution of power between the spouses is denoted by θ. Holding household income constant, the effect of bargaining power on demand for a particular good can be interpreted as the effect of changing the sharing rule (θ) of household income allocated to that particular person.

The very vagueness of female autonomy makes the conceptualisation, which is quantitatively measurable, mandatory. For this purpose, two broad categories of variables are used: economic variables and questions reporting the woman's perception on her status. As part of the first category, Abadian (1996) uses female age at marriage, age difference between husband and wife, and female secondary education to measure the impact of female autonomy on fertility. Alternatively, the economic condition of the woman at marriage have also been used to capture her autonomy (Quisumbing and Maluccio, 2003; Thomas et al., 2002). Still another possibility is to use the woman's labour market experience. DeRose (2002), for instance, uses continuity of the woman's work. The second category of studies exploits questions about various aspects of the woman's autonomy. The most common way to employ these pieces of information is to construct indices using the qualitative answers provided by the woman. These are then used as explanatory variables in the econometric analysis. Hogan et al. (1999) construct an index using questions on who purchases major items, consumption patterns, resource allocation, whether the woman has joined a woman's club, views on sending children to school and views on the age at which girls should marry. Chavoshi et al. (2004), instead, use distinct variables on mobility, decision-making access, control over resources and freedom from threat to analyse women's reproductive behaviour in Iran. The adoption of indices to measure female autonomy has recently been criticised (Agarwala and Lynch, 2007). One obvious drawback of this approach is its implicit assumption that every question is equally important for female autonomy. Ideally, the empirical modelling of a woman's autonomy should take account of the fact that different aspects are more or less important for female autonomy. Furthermore, the "aggregate index approach" is hard to reconcile with the fact that female autonomy consists of different sub-spheres, which can – in turn – be interrelated. The present analysis aims to propose an innovative approach, which addresses these issues.

3.5. Data, Measurements and Summary Statistics

The data used for the empirical analysis are taken from the third round of the National Family Health Survey for India (NFHS-3), 2005/2006 (IIPS and Macro International, 2007). The NFHS is part of the Demographic and Health Survey series and is conducted in about 70 low and middle income countries. In India, the survey was conducted in 29 states and interviewed around 230,000 women and men aged 15 to 49 during the period December 2005 to August 2006. The questionnaire collects extensive information on health, nutrition, population and focuses particularly on women and children. The data are in the public domain and can be downloaded from www.measuredhs.com.

3.5.1. Mortality

The main dependent variable of interest is child mortality which refers to children dying before reaching their fifth birthday. The survey data used in this study comes from retrospective information collected on the complete histories of births and child deaths experienced by the woman aged 15-49. Hence, the data contain information on children born over a span of 35 years. Using all this information, however, is not advisable, as the resulting dataset will not constitute a representative sample of children born (Rindfuss, et al. 1982) at that time. For example, among children born 25 years prior to the survey date, the data will only include mothers who were aged 24 or younger at the time of their birth. Births to very young mothers are known to be associated with high risk of child deaths and inclusion of these births that happened long time ago to very young mothers in the analysis would overestimate the mortality risks. Another problem with using all children contained in the original sample irrespective of their date of birth is that the sample information collected does not tell us where the mother was resident at the time of birth or death of children born some years prior to the survey date. The analysis, therefore, is restricted to children born during the last 10 years prior to the survey. This will also help to minimise recall errors in the dates of birth and death of children.

The mortality figures split by gender and age are provided in Table 3.1. Neonatal, infant and child mortality refer to children dying in the first 28 days, 12 months and five years of life respectively. For the whole of India, based on the NFHS-3, the under-five mortality rate is 74.9 deaths per 1000 births. Of these deaths 34 occur within the first month of a child's birth (corresponding to neonatal mortality), 50.9 within the first year (which is denoted as infant mortality) and 24 between the first and the fifth year. The two states under scrutiny show remarkably different mortality rates. WB has the lower under-five mortality rate of the two: 54. UP, by contrast, shows a figure of 92.9. This ranking holds for neonatal as well as for infant mortality. The respective rates for the former rate are 32.1 and 46.9. For the latter they are 43.6 and 69.6. Similarly, the mortality rates between one and five years show the same patterns; in WB and UP , 10.4 and 23.3 children per 1000 births die.

Previous research on India has documented considerable differences in child survival. At first sight, this does not appear to be the case for the sample at hand. For the whole country the under-five mortality rates are very similar across the two genders. In India, 74.3 boys every 1000 male births die. The corresponding number for girls is 75.4. In other words: female mortality rates exceed male ones by 0.9 deaths every 1000 births. This difference does not appear substantial and indeed at odds with the widely documented gender differences in child survival. These aggregate figures, however, mask an important part of the story. Consider neonatal mortality. The rate for boys is considerably higher than the one for girls: 36.8 compared to 31.1 deaths. This disparity stems from the fact that in the very early periods of their lives, boys are more susceptible to diseases and will consequently have a higher mortality rate.[65] An important observation is that the mortality rates of girls catch up with the ones for boys after the first 28 days. The mortality rates between one and twelve months show that the initial trend is reversed. For this observation window girls' mortality rates exceed the one of boys: 17.5 compared to 16.3. Combining these two rates has the result that boys' mortality rates lye above the ones of girls. The difference, however, is much smaller compared to the one in neonatal mortality. From the first month onwards, therefore, girls' rates have started to catch up. This trend is continued between the ages of one and five. For this period, the mortality rates for girls now markedly exceed the one for boys: 26.9 compared to 21.1.

These descriptive statistics can be seen as first evidence for the presence of discrimination against girls. As mentioned before, mortality rates in the first days of

[65] For a general discussion see Trivers and Willard (1973)

a child's life are determined to a large extent by biological factors. As a child grows older, however, other factors like nutrition and medical care become increasingly important. The fact that the mortality rates for girls exceed the ones of boys in the latter periods of the observation window, consequently, is likely to be a result of the parents allocating a disproportionately high amount of resources to boys and neglecting girls. In both states, neonatal mortality for boys exceeds the ones for girls and this trend is reversed for infant mortality. For WB, the rates are 10.3 for boys and 12.6 for girls. For UP, the respective infant mortality figures are 21.9 and 23.5. Finally, in both states the mortality rates between one and five years for girls exceed the one for boys. In WB, the mortality rate for the former is 10.7 and for the latter 10.1. For UP, the respective figures are 31.4 and 15.2.

The above patterns are reinforced in the Kaplan-Meier product limit estimates of the survivor function by gender provided in Figure 3.1. The NFHS-3 reports the age at death with decreasing detail as the child gets older. If the child died in the first month, the age at death is recorded in days; if it died within the first year in months and after that in years. For the whole of India, boys' mortality rates lie above the ones for girls in the earlier periods of the child's life. The rates for girls, however, catch up with the one of boys after the first year. For WB, the probability of a girl surviving past a determined time always exceeds the one for boys. In this state, the probability of surviving decreases steadily with time and both functions appear to follow the same pattern. There is no divergence in the rates of boys and girls. The estimates for UP paint a different picture. For the first year, the survival function for girls exceeds the one for boys, albeit only by little. After the first year, the opposite is the case. The estimated probability for boys to survive is higher than for girls. As mentioned above, this finding may be a result of discrimination against girls.

3.5.2. Female Autonomy Measurements

The NFHS-3 contains a number of questions, which can be used to capture female autonomy and its sub-spheres. The precise definitions of the variables used in the empirical analysis are given in Appendix 3.1. Table 3.2. reports the relevant figures. Economic autonomy denotes the woman's independence concerning financial matters. The two questions used are whether the woman has money for her own use and whether she has a say on how her husband's money is spent. In the whole of India, 68% of women are involved in deciding what to do with their husband's money. The percentages are relatively similar across the states with 56% for WB and 71% for UP. A lower percentage of Indian women, 43%, has money for own use. In WB the figure is 40% and in UP 64%.

Decision-making autonomy reflects the degree to which a woman can influence decisions concerning herself and her environment. In this context, women were asked whether they have the final say on a number of decisions concerning the household. These comprise her own health care as well as large and small household purchases and on visiting family and friends. In the whole of India, 66% of women reported to have a say on their own health care. The percentage for this question is larger for UP (67%) than for WB (60%). Slightly more than half of women in India (56%) have a say on small household purchases. The figure for UP is similar to the country average. The percentage for WB lies below this at 38%. A marginally higher percentage of women are involved in the decision on large household purchases, 62%. Similarly to before, the figure for UP is comparable to the one for the whole country and the percentage for WB is inferior, 46%.

Physical autonomy denotes to what degree the woman can move from one geographical area to the next. This concept is captured by three variables. Women were asked whether they were allowed to go on their own to the market, to a health care facility and to places outside the community. For the whole of India, 90% of women are allowed to go to the market, 97% to a health care facility and 93% to places outside the community. Variations for these questions are not very high.

Emotional autonomy is captured by two sets of questions. The first centres on whether the woman believes her husband is justified to hit her in a variety of circumstances. These comprise her being unfaithful, disrespectful, going out without telling him, neglecting house and children, burning the food, arguing with him and refusing sex. For the whole of India, almost half (45%) of women believe their husband to be justified in beating them if they are disrespectful. Conversely, 16% have the same opinion for refusing sex. The other figures lie between these two extremes. The second set of questions concerns whether the woman believes she is allowed to refuse sex in the following three scenarios: if the husband has a sexually transmitted infection, if he has other women and if she is tired. The percentages of women believing to have to right to refuse sex all lie around 80%.

The customary way of modelling female autonomy is to aggregate the questions outlined above into an index by addition. This methodology produces five indices – one for each of the four sub-spheres as well as one for overall female autonomy. The relevant figures are reported in Table 3.3. The one for economic autonomy takes a maximal theoretical value of 2, the one of decision-making a value of 4, the one of physical a value of 3, for emotional autonomy of 10 and of overall autonomy of 19. The means for these indices for the whole of India are 1.1, 2.5, 2.8, 7.3 and 13.7.

3.5.3. Other Covariates

The empirical analysis includes a number of factors commonly associated with child survival as covariates in the empirical model. These comprise characteristics of the child, its mother, her partner and the household. The relevant figures are given in Table 3.4. As mentioned above, persistent gender differences can be found in India. Slightly less than half of children born in the last 10 years, 48%, are girls. The figure is very stable across the two states under scrutiny. Furthermore, the empirical analysis accounts for the birth order of the child. For the whole country every woman contributes on average 1.92 children to the sample. The figure is lower for WB (1.68) than for UP (2.24).

Parental background and maternal education have been identified as important determinants of child survival. For the whole of India, around half of mothers have ever attended school. The figure for WB is similar to the Indian average. In UP, the relevant figure is lower, around one third of mothers in this state have attained primary education. Educational attainments – like numerous other socio-economic indicators – show considerable gender disparities. On average, men have higher education. For the whole country, 32% of men have completed primary and 30% completed secondary education. Akin to above, these figures vary considerably between the states under consideration. In WB 32% of men have completed primary and 21% completed secondary education. UP shows lower educational attainments. In this state, 24% of men have primary and 35% secondary education.

A woman's age at birth has been identified as an important biological factor determining a child's survival. The mean value for the woman's age at birth of the first child in the sample is 20.1 years. The figure is slightly higher for WB (19.3

years) than for UP (19.1 years). The empirical model also controls for important social factors. One of these is the mother's caste. This concept is captured by three indicator variables. The first takes the value 1 if the woman belongs to a scheduled caste, the second if she is part of a scheduled tribe and the third if the mother belongs to another backward caste. The base case is the woman belonging to one of the four major castes. For the whole country around 17% belong to the first, 16% to the second and 34% to the last category. The mother's religion is captured by a binary indicator for whether she is of Muslim faith. Around 14% of women in the All-India sample are Muslim. These figures are considerably higher for the two states under scrutiny.

Finally, the empirical model accounts for wealth by including the wealth quintile the household belongs to as well as a dummy for the household being located in a rural area. In India, about a quarter of families reside in rural areas. For the two states under consideration the percentages slightly exceed the average for the whole country.[66]

3.6. Econometric Methodology

Our estimation methodology uses survival analysis in which female autonomy is treated as a latent construct. A sample of children born within the last 10 years is selected for reasons discussed in the last section. The model focuses on children born alive and investigates their mortality probabilities over time until they reach their fifth birthday. Hence, the observation window for each child is time of birth to the

[66] Unlike previous studies, the present analysis does not include vaccinations and variables approximating the woman's cooking habits. Ceteris paribus, children alive are more likely to be vaccinated. Focusing on this aspect will, therefore, likely make cause sample selection. Furthermore, the questionnaire is a retrospective one and children in the sample may have died up to ten years before the interview. Questions regarding cooking are centred on present behaviour and including them would cause time inconsistency problems.

fifth birthday. Each child is either observed to die within the observation period or observed to be still alive at the time of interview or age 5 whichever comes first. This observation window is divided into a set of discrete time intervals and the analysis conducted in discrete time framework. These intervals are specified as follows[67]

$$\mathrm{T} = \begin{cases} \tau_1 & 0\ days < t \le 1\ day \\ \tau_2 & 1\ day < t \le 2\ days \\ \tau_3 & 2\ days < t \le 8\ days \\ \tau_4 & 8\ days < t \le 15\ days \\ \tau_5 & 15\ days < t \le 28\ days \\ \tau_6 & 28\ days < t \le 1\ month \\ \tau_7 & 1\ month < t \le 7\ months \\ \tau_8 & 7\ months < t \le 13\ months \\ \tau_9 & 13\ months < t \le 5\ years \end{cases} \tag{3.1}$$

Note that the older the child was when it died, the less precise the age of death is recorded. This is common practice in the literature and reflects the fact that mortality rates decline with age, a pattern that can also be found in the data at hand.

We specify the conditional probability of a child dying in the *k*th interval conditional on its survival until interval *k-1* as

$$h(k) = \frac{\Pr(\tau_{k-1} \le T < \tau_k)}{\Pr(T \ge \tau_{k-1})} \qquad k=1,..,9 \tag{3.2}$$

Hence, the probability of observing a completed duration of length *d* is given by

$$p_{ij}(d) = h_{ij}(d) \prod_{k=1}^{d-1} \{1 - h_{ij}(k)\} \tag{3.3}$$

[67] The grouping has been chosen to ensure identification which requires enough deaths to be observed within each interval.

In the above specification, *d* denotes the age at which the child *i* in family *j* died. For a child who is observed to be still alive at the time of the interview, the probability of an incomplete spell of *d*, is given by

$$p_{ij}(d) = \prod_{k=1}^{d} \{1 - h_{ij}(k)\} \qquad (3.4)$$

We record the survival status during a particular time interval as a series of binary indicators. For each child, we record a value of 0 during a specific time interval if the child is alive and 1 if the child had died by the end of the time interval. Each child will have a series of 0s followed by a 1 if the child is observed to have died. If a child is observed to be still alive at the time of interview, the particular observation relating to that time interval will be recorded as being censored and this child will only have a series of 0s. Note, the maximum number of binary indicators each child can have is 9. As an example, consider two children born on the same day four years before the interview. The first child died after three weeks. This child falls into the time interval τ_5 and will consequently have five binary indicators. For the first four the response variable will take the value of 0 whereas for the last observation the indicator will take the value 1. The second child is still alive and will hence fall into time interval τ_9. This child will have nine observations with the response variable taking the value 0 in every instance. This child is an example of a censored observation.

In summary, given the above discussion, the response variable for the child's survival status will be a vector of a set of 0s and 1s for each child in the family. The length of this column vector will depend on the age at which the child died and also whether the observation is censored or not.

For child *i* with mother *j*, we assume *h*(*k*) to be a logit

$$h_{ij}(k) = \frac{\exp(x'_{ij}\alpha + \tau_k + \lambda_F \eta_{Fj}^{(3)} + \eta_{Cij}^{(2)})}{1 + \exp(x'_{ij}\alpha + \tau_k + \lambda_F \eta_{Fj}^{(3)} + \eta_{Cij}^{(2)})} \tag{3.5}$$

$\mathbf{x}_{ij}$ is a vector of observable child and family specific characteristics (outlined in section 3.5.) that influence $h_{ij}(k)$ and $\boldsymbol{\alpha}$ is the vector of parameters associated with $\mathbf{x}_{ij}$. τ_k is the interval specific intercept that informs us about the shape of the hazard. The autonomy status of the mother is $\eta_{Fj}^{(3)}$ and the effect of this on the hazard is λ_F which is known as the factor loading.[68] $\eta_{Cij}^{(2)}$ denotes the child specific unobservable. The above specification is a multilevel hierarchical model where Level 1 refers to the age specific time intervals. Levels 2 and 3 refer to the child and mother respectively. In addition, we also allow for an additional cluster at the district level which forms the 4th level. However, we do not explicitly show this to keep the notation simpler.

As per our prior discussions, we do not use an aggregate index formed from the set of answers given by the woman as measurement of female autonomy. Instead, we assume that the latent trait of female autonomy is an exogenous cultural trait which is correlated with the woman's characteristics such as caste, religion, education, and whether the woman lives in a rural household. In addition, we also allow this latent trait to depend on when the woman was born. For mother *j*, this is specified as

$$\eta_{Fj}^{(3)} = \boldsymbol{\theta}'\mathbf{z}_j + \zeta_{Fj} \tag{3.6}$$

Next we assume that the unobserved female autonomy trait ($\eta_{Fj}^{(3)}$) affects a number of different but interrelated aspects of the woman's life. Based on the form

[68] For identification and facilitating inter-state comparisons the variance of female autonomy is set equal to one in the estimation.

in which the data has been made available and also on the approach taken by researchers in the past, we consider four categories or spheres of autonomy: economic, decision-making, physical, and emotional autonomy and specify relationship between these spheres of autonomy ($\eta_{lj}^{(3)}$ with l=1,..,4) and $\eta_{Fj}^{(3)}$ as

$$\eta_{lj}^{(3)} = \beta_l \eta_{Fj}^{(3)} + \zeta_{lj} \tag{3.7}$$

The assumption here is that variations in these four spheres can be used to say something about the overarching concept of female autonomy that is also unobserved. Since the spheres of autonomy are likely to be correlated with one another, we allow for correlations in the error terms (ζ_{lj}).

The last part of our model links the answers given by the woman to different spheres of autonomy in order to generate the necessary variations to use in equation (3.6). Intuitively, this can be pictured as follows: each of the four autonomy-spheres cannot be observed directly but is captured by a set of nineteen fallible measures (given by the answers to a set of questions provided in Appendix 3.1.). For each sphere, common variation in these measurements is used to infer its properties. All nineteen measurement variables are binary and we consequently specify the following linear predictor for a logit link as

$$\nu_j = \delta_j + \Lambda \eta_j^{(3)} \tag{3.8}$$

where $\boldsymbol{\delta}$j is a vector of intercepts and $\boldsymbol{\eta}_j^{(3)}$ a vector of latent autonomy spheres (economic autonomy, physical autonomy, decision-making autonomy, and emotional autonomy). The matrix of coefficients $\boldsymbol{\Lambda}$ contains the factor loadings. Appendix 3.1. provides further details of the full specifications and the restrictions needed for identification.

An important advantage of this specification is that it accommodates correlations between the latent factor and female characteristics. Often female autonomy is modelled as a random effect. This framework assumes the unobserved heterogeneity to be uncorrelated with all covariates. There are, however, good reasons to believe that the latent factor of female autonomy is not independent of female characteristics (education, for instance). This would make the estimator inconsistent. By contrast, equation (3.5) allows us to explicitly incorporate the fact that female autonomy is correlated with a sub-set of the covariates.

Estimation of the Model

Equations (3.5) to (3.8) form the basis of our model and they are estimated jointly using maximum likelihood method under the assumption that ζ is normally distributed. We use GLLAMM (Rabe-Hesketh, Skrondal and Pickles, 2004) in Stata (StataCorp., 1985) to estimate the model parameters.[69] Figure 3.2. provides a simple representation of the path diagram associated with the various relationships that are considered here.[70]

3.7. Estimation and Results

The empirical analysis focuses on a medium-mortality state (WB) and a high-mortality state (UP). We estimate four models. Model 1 includes all the above-mentioned child-, mother-, father- and household-specific characteristics as well as a random intercept at the child-, mother- and district level. To this specification, Model 2 adds a further explanatory variable, an index for female autonomy entered

[69] The programme can be downloaded at gllamm.org

[70] The above model is slightly different to the model used in Hansen et al. (2004) and Heckman et al. (2006), where they assume two underlying latent independent characteristics 'cognitive' and non-cognitive' abilities and relate these to test scores. These authors allow the test scores to be affected by additional school level variables conditional on the latent variables. In contrast, in our model, we allow the latent variables to be correlated with characteristics such as religion, caste etc. In addition, we also link the female autonomy trait to the four sub-spheres and allow these to be correlated.

as a z-score (see Table 3.3.). The purpose of this exercise is to facilitate inter-model comparisons. Recall the latent factors of female autonomy all have mean 0 and a variance set equal to 1. In Models 3 and 4, female autonomy is seen as a latent construct and captured via 19 fallible measures. In Model 3, which is specified as a covariate measurement error model, these variables measure a single underlying concept, i.e. there is no distinction between different spheres of autonomy. Model 4 is the main model specified in equations (3.6) to (3.8) and shown in the path diagram in Figure 3.2. In this specification, the overarching concept of female autonomy determines its four sub-spheres, which in turn are measured via the 19 fallible measures report in Appendix 3.1. In these two latter models, we also allow the latent factors to be correlated with a number of female characteristics.

Given the discussions above, we expect the following five results. The vast majority of previous studies document a positive relation between female autonomy and child survival. The first hypothesis to be tested, therefore, is that a) the factor loading λ_F on the latent factor of female autonomy is negative. Similarly, there is some evidence for female autonomy to close the gender gap in various human development indices. We consequently hypothesise that b) the effect of female autonomy on child survival is stronger for girls than for boys. Gender disparities in child survival have been widely documented and in accordance with this we expect c) the mortality probability for girls to exceed the one for boys. The literature on child survival has argued for mortality rates to decline with age – a trend that can also be observed in the data at hand – and we, therefore, expect to find d) a decreasing baseline hazard. The descriptive evidence outlined above also shows that mortality rates of girls are "catching up" with the ones of boys. In congruence with this we hypothesise e) the interaction between the time interval dummies and the girl indicator variable to be positive, especially for the latter time periods.

3.7.1. **The Effect of Individual Measurements and Gender Differences in Child Survival**

The variables employed to capture female autonomy are outlined in Table 3.2. One question arising in this context concerns the importance of each variable for the child's survival status. In order to capture the relative importance of these variables on the survival probabilities, a number of simple duration models are estimated. Model A includes indicator variables for the two questions approximating economic autonomy, Model B only the dummy variables for decision making autonomy, Model C only the covariates for physical autonomy, Model D only the indicator variables for emotional autonomy and finally Model E includes all 19 variables capturing female autonomy.

The parameter estimates for WB are reported in Tables 3.5. and 3.6.[71] and do not suggest a strong correlation between female autonomy and child survival. None of the coefficients is significantly different from zero. This holds for all the individual spheres of Models A to D. Furthermore, the variance of the mother level random effect is not significantly different from zero. All these results suggest a weak relation between a woman's autonomy and child survival in WB. The results for UP are also reported in Tables 3.5. and 3.6. and paint a similar picture. The vast majority of parameters is not significantly different from zero. The only exception is the coefficient on the dummy variable for the woman having a say on what to do

[71] Table 3.5. shows the results for economic, decision-making and physical autonomy. The results for emotional autonomy and for all variables approximating female autonomy are reported in Table 3.6.

with her husband's money, which is positive. The coefficient on its interaction with the girl dummy, by contrast, is negative.

The estimates for Model E paint a similar picture. The vast majority of coefficients are not significantly different from zero. For WB, all parameter estimates are statistically insignificant. For UP, however, the coefficient on the indicator variable taking the value of 1 if the woman has a say on what to do with her husband's money is significantly different from zero. The parameter estimate on the variable for male offspring is positive whereas the coefficient on its interaction with the girl dummy is negative. This suggest that the fact that women have a say on their husband's money increase the probability of death for boys whereas the effect for girls is the opposite.[72]

The results outlined above do not suggest a strong correlation between the indicator variables capturing the various aspects of female autonomy and survival probabilities of children. There are at least two possible reasons for this result. First, the various measures of female autonomy are likely to be highly correlated. These relations are likely to be especially strong within a particular sphere of autonomy. The freedom to decide on small and large household purchases, for instance, are likely to be determined jointly and consequently the correlation between the two indicator variables is likely to be strong. In addition to this, the correlation between the various measurements is also likely to exist across spheres, albeit maybe to a lesser extent. The woman having a say on her own health care, for instance, is likely to have an effect on her physical autonomy of not needing permission to leave the house to go to a health facility and vice versa. The resulting multicollinearity

[72] The parameter estimates of the remaining covariates are reported in Appendix 3.2.

between the various measurements of female autonomy will attenuate the influence of these variables on the probability of child survival.

Second, the use of qualitative answers as covariates relies on the assumption that these variables are perfect measurements rather than error prone indicators of female autonomy.

The models estimated throughout this chapter only scrutinise gender differences in the influence of female autonomy on survival and on the duration dependence of the survival model. There is, however, a concern that the effect of the remaining covariates (caste, religion and education, for instance) differs with the gender of the child. To investigate this point further, for each state a duration model is estimated where all covariates are interacted with the indicator variable for the child being female. The parameter estimates are reported in Table 3.7. For WB, none of the other interaction terms are significant at the 5% level. In UP, by contrast, the indicator variable for the child being born in the year 2000 is positive and significant. Overall, the results suggest that the influence of most of the covariates on the survival probability does not vary with the gender of the child. For this reason, the analysis concentrates on gender differences of the influence of female autonomy on child survival and the duration dependence.

3.7.2. <u>Female Autonomy and Child Survival</u>

The estimates of the main parameters of interest are reported in Table 3.8. These are the factor loadings on female autonomy, on its interaction with the girl dummy and the estimates for the baseline hazard.[73] The mother-level random effect in Model 1 will pick up omitted mother level characteristics – amongst them female autonomy. In Models 3 and 4 the mother level unobservable is the latent factor of female

[73] The estimates for all other covariates are reported in Appendix 3.2.

autonomy. The estimates of the variance of this latent factor are reported at the bottom of Table 3.8. The estimates are insignificant for WB and strongly significant for UP.[74] This can be seen as evidence for unobserved heterogeneity at the mother level in this latter state. A possible way to interpret this heterogeneity is to see it as the mother's autonomy. The fact that the variance is significant in Model 2 is noteworthy. This specification models female autonomy via an index and the presence of unobserved heterogeneity suggests that this index does not adequately capture the abstract concept of female autonomy. If the index in Model 2 were appropriately picking up all the mother level unobservables, the variance of the mother-level random effect should be insignificant. In addition to this, if the qualitative answers are fallible measures of the underlying autonomy trait, the aggregate index will be correlated with the unobserved autonomy variable. The consequence of this is that the estimator becomes inconsistent.

In summary, hypotheses a) and b) find empirical support for the state of UP only. The results suggest that female autonomy matters for child survival (see Models 2 and 4), but only in UP. The results in WB do not suggest a strong connection between female autonomy and child survival. All the estimates for female autonomy are insignificant. In Models 3 and 4, however, the interactions term of the latent factors with the girl dummies are weakly significant (at the 10% level). In the former model, the estimate is negative whereas it is positive in Model 4. In contrast to these two states, the results for UP suggest a much stronger linkage between a woman's autonomy and her children's survival. For Models 2 and 4, the factor loading on female autonomy is positive and its interaction with the girl dummy negative. These

[74] Note, Models 1 and 2 are not nested in Models 3 or 4 and Model 3 is not nested in Model 4. The log likelihood values of these models are, therefore, not comparable.

estimates suggest that a higher degree of female autonomy increases the chances of boys dying whereas it decreases the chances of a girl dying.

An overall positive association between female autonomy and child survival would be in congruence with a large body of literature highlighting the mother's importance for child welfare. Maitra (2004), for instance, argues that female autonomy increases health care usage. Similarly, Beegle et al. (2001) find that prenatal care increases with a woman's bargaining power. A different argument for the positive relation between female autonomy and child survival can be made by interpreting the former concept as the bargaining power of an agent in the household. From a theoretical point of view, collective models (Chiappori, 1992) state that the distribution of power between the spouses can have far-reaching effects on household outcomes. According to this argument, the woman will use her bargaining power to achieve better survival outcome for her children. The results presented here, however, differ from this general finding. For UP, female autonomy has a different influence on boys' than on girls' survival. This finding is noteworthy and discussed further in the next section.

3.7.3. Child Survival Age Profiles

We next turn to the τ_k coefficients in equation (3.6) – the estimates of the baseline hazard. These correspond to the conditional probability of a child dying as it gets older, *ceteris paribus*. Furthermore, these covariates are interacted with the girl dummy to allow the probabilities to differ between boys and girls. The estimates (baseline hazard) are reported in Table 3.8. The reference case is death in the first day of a child's life. The findings suggest more pronounced gender differences in UP than in WB. Hypotheses c) and d), therefore, do find some empirical support. The evidence for this, however, is stronger in the state of UP.

In WB, the conditional probability of dying decreases as the child gets older in Models 3 and 4. Three of the coefficients in these models are negative and decreasing in absolute magnitude, albeit not monotonically. For Model 3, for instance, the estimates are -1.509 for τ_5, -0.916 for τ_6 and -1.664 for τ_9. Furthermore, there is weak evidence for girls having a higher probability of dying in the very first day of their lives. The coefficient on the girl dummy is negative for Model 3. In addition to this, the coefficient for the interaction of the dummy for the second time period and the girl dummy is negative and significant in these two Models. This suggests that, in WB, girls have lower chances of dying in the second day of their lives, *ceteris paribus*.

In UP, by contrast, the duration dependence appears the most pronounced. The conditional probabilities of children dying – *ceteris paribus* – decrease, as it gets older. The coefficients on the time dummies are negative, significant and increasing in absolute magnitude. For Model 4, for instance, the estimates range from -1.389 for time period τ_2 to -2.260 for τ_9. This increase, however, is not monotonic. Furthermore, UP appears to be characterised by gender differences in child survival. The chances of girls dying in the first day of their lives are not significantly different from the ones of boys. The estimates on the girl dummies are insignificant across all four models. Some of the interaction terms of the time interval with the girl dummies, however, are positive and significant. This applies mainly to the last time periods: τ_7, τ_8 and τ_9. These results suggest that between the ages of one month and five years, girls have a higher chance of dying *ceteris paribus* – see equation (3.1). This finding is supported by the descriptive evidence laid out above. As mentioned before, this pattern is likely to be the result of discrimination against girls. The importance of environmental factors for survival increases, as a child gets older. The decrease in girls' survival chances towards the end of the period under consideration is, therefore, likely to arise because of parental neglect of girls. In this sense the estimates confirm the picture already painted by the descriptive evidence. Decreasing baseline hazards have already been found for India (van der Klaaw and Wang, 2008, for instance) and indicate that a child's probability of dying decreases as he or she gets older. This fact fits descriptive evidence well. See section 3.5.1. The conclusion drawn from this is that hypothesis e) finds support in the state of UP only.

3.7.4. Autonomy variables and female characteristics – Equations (3.6) to (3.8)

In Models 3 and 4, female autonomy is assumed to be measured via 19 fallible measures. In Model 3, these variables measure a single underlying concept, whereas in Model 4 they capture the four sub-spheres of autonomy, which in turn are determined by a single underlying concept. In these two models, we also allow the latent factor of female autonomy be correlated with a number of female characteristics. The estimated associations are reported in Table 3.9. The female autonomy variable is set to have mean 0. Consequently, the reference case in these two models is assigned value 0 for autonomy. For identification purposes, the coefficient on the variable that the mother belongs to scheduled caste has been set equal to 1. Hence the coefficients on other variables are measured relative to this. Note that the coefficient on the woman's autonomy is positive. One would expect more educated women to enjoy more autonomy and consequently the positive sign on this variable indicates that the directions of all other covariates are correctly signed. Overall, the results are mixed and vary according to state.

In WB, more educated women appear to have higher and younger individuals lower autonomy levels than the base category. In Model 3, however, women from scheduled castes and other backward classes appear to have more autonomy – ceteris paribus. Finally, in UP the correlations between female autonomy and the covariates appear stronger than in the other two states. In this state, Muslim women, individual not belonging to the four major castes show higher levels of autonomy. The same holds for educated women and individuals living in rural areas.

Finally, Model 4 allows us to specify correlations between the various latent factors specified in the econometric framework. Table 3.10. reports the results of the regression of the various sub-spheres of autonomy on their overarching concept. The estimates vary to some extent. For WB and UP, the influence of female autonomy on emotional autonomy is negative and significant. Furthermore, for the latter state the correlation between female and physical autonomy is significantly negative.

3.7.5. <u>Effects of other covariates on child survival</u>

A subset of the covariates included in the empirical analysis is significantly correlated with mortality. The parameter estimates are reported in Appendix 3.3. Maternal education has often been argued to have a negative effect on mortality (van der Klaaw and Wang, 2008, for instance). Our results partly confirm these findings. For WB, the indicator variable for the woman having complete primary education or more has a significant and negative influence on child mortality. The magnitude of the estimates in Models 1, 2 and 3 are -0.627, -0.629 and -0.340 respectively . This result is consistent across the different models. For UP, by contrast, all coefficient estimates are insignificant.

Furthermore, a child's birth order seems to be significantly connected to its survival chances. For Models 1 and 2, the birth order of the child does not seem to matter. The parameters across all three states are insignificant. Model 4, however, suggests that the child's birth order is connected to its survival chances in UP. For this state, the coefficient for the child being of birth order four or above is positive and significant with a magnitude of 0.649. These results indicate that – for UP – as the birth order of the child increases its survival chances decrease.

Biological factors like the age of the mother at birth have already been found to be important (Pebley and Strupp, 1987). Our results partly confirm these findings. The age of the mother at birth of the indexed child appears to be negatively connected with child mortality. For both states, the coefficients in Model 3 are negative and significant. Furthermore for this model, the square of the variable is also positive and significant across both states. Finally, it seems worth mentioning that wealth does not appear important for child survival. Only in UP, there is a very weak negative connection between the household's wealth and child mortality.

3.8. Discussion and Conclusion

A major result of the empirical analysis is that in UP a higher level of female autonomy exerts a positive influence on the hazard for boys and a negative on the hazard for girls. In other words: a higher degree of female autonomy appears to increase the conditional probability of boys dying in a given time period whereas the opposite is true for girls. This finding can be the results of two possible behaviours. In a first instance, girls with more autonomous mothers might receive preferential treatment. They may be allocated a disproportionately higher share of food and medicines, for instance. This behaviour would increase girls' survival rates. Sons, by contrast, would face a higher mortality risk. Although perhaps probable, this behaviour is not the only one explaining the above mentioned results. In the Indian context, a mother does not necessarily have to give preferential treatment to girls to increase their survival rates whilst at the same time decreasing rates for boys. In a context where the mortality rates of girls exceed the ones of boys, an equal treatment of sons and daughters might result in the same survival pattern as the one found by the present analysis. In a developing country, moving from a state where boys are preferred to a more equitable distribution implies shifting resources from boys to girls. This net decrease in the proportion of medicines or nutrition received by boys is likely to increase their mortality rates. This is reinforced by the fact that – from a biological perspective – boys are more susceptible to diseases in the very early parts of their lives.

There are a number of reasons for why more autonomous women might be more likely to treat sons and daughters equally. First tentative explanations for mothers not discriminating against girls comprise the following. In a first instance, the mother's preferences might differ from the father's. In less developed countries, children are seen as intrinsically valuable as well as to be investments for old age or as insurances against sickness. Due to an overall discrimination in society, daughters will have a lower expected lifetime income. Their dowry will further decrease the return on the "investment" in girls. If a high value is placed on the investment aspect of children, less resources are likely to be allocated to girls. If, however, child welfare is the first concern, these considerations will become irrelevant. If women do place a higher value on their children's welfare and if female autonomy is a proxy for the decision-making power of the spouse, households with more autonomous women will treat boys and girls equally. In addition to this, women will have experienced the disadvantages of unequal treatment of sons and daughters first hand in their childhood. Due to this reason, they will be more likely to internalise all the ramifications of treating their children differently. Consequently, they are more likely to make no distinction between their offspring. Alternatively – from a more emotional point of view – in light of their past experiences, women might be more likely to empathise with their daughters' situation and therefore be more likely to change it. Due to their experiences, women might also have developed a resentment towards the patriarchal society they grew up in. Treating all their children equally, irrespective of their sex, might be a way to change these habits and attitudes.

The fact that the parameter estimates for WB are insignificant and highly significant for UP might be seen as an indication for women treating daughters and sons equally rather than preferring the former to the latter. As outlined above, UP is characterised by larger gender gaps in child survival as well as in other socio-economic indicators. The discrepancies in child survival for UP can be seen in Table 3.1. as well as in Figure 3.1. An often-adopted indicator for the latter concept is the sex ratio between men and women. In 2001, WB had a sex ratio of 107 men per 100 women. The corresponding figure for UP is 111. For the whole country, the sex ratio is 107 men per 100 women.[75] The natural ratio at birth is commonly assumed to be 105. UP clearly shows the most pronounced gender disparities and is the only state with a sex ratio significantly higher than the natural rate. In summary, the influence of female autonomy appears particularly pronounced in the area characterised by the highest gender disparities. This fact suggests that the "effectiveness" of a woman's autonomy is strongest when the gap in child survival between boys and girls is the largest. This indicates that more autonomous women treat their children equally. Under such equal treatment, the negative influence on mortality will be larger for the most disadvantaged children. Since girls' survival rates in Northern states are very low, equal treatment will, therefore, benefit girls particularly in this area. The same

[75] Census of India (2001). http://www.censusindia.net/

point can be seen from another perspective: if more autonomous women generally treated girls more favourably than boys, the influence of female autonomy should not vary with the gender gap. In this case, one would expect such an effect also to be present in WB. The fact that this is not the case can be seen as evidence against the first explanation for female autonomy to have a positive influence on boys' and a negative influence on girls' mortality.

The positive connection between female autonomy and female child survival is an encouraging result. In a first instance, this relation creates a "positive externality" for policy makers. In this sense, endeavours to improve a woman's position within the household and society at large will have a positive spillover effect on the survival of her children. In addition to this reasoning, knowledge about the interrelations considered here provides policy-makers with a further tool for tackling child mortality. Policies to improve survival rates should consequently also take the mother's autonomy into account. In other words: efforts to reach the third (promoting gender equality) and the fourth MDG (reducing child mortality) should be coordinated as well as connected. The results presented here further suggest that improving female autonomy will decrease the gender gap in child survival, which in the long run might improve India's exceedingly skewed sex ratio.

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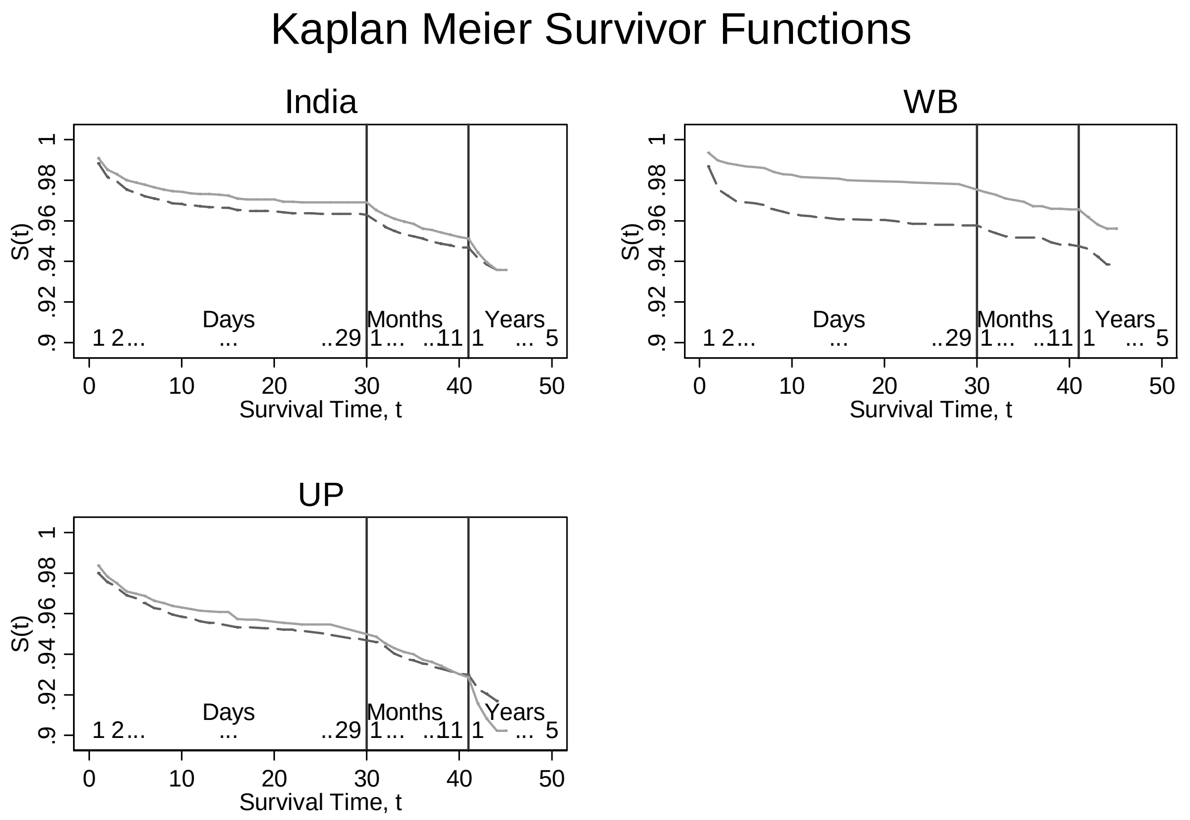
Figure 3.1.

Estimates of Survival Functions

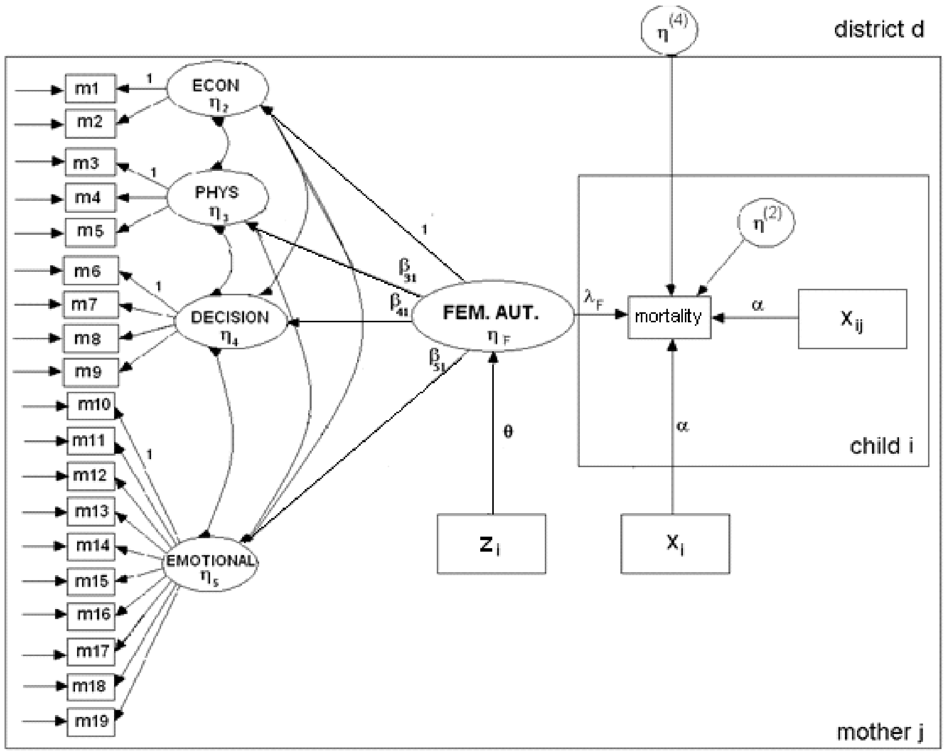


Solid Line: Girls; Dashed Line: Boys

Notes: (i) Survival times 1 to 29 refer to 1 to 29 days. (ii) Survival times 30 to 41 refer to 1 to 11 months. (iii) Survival times between 42 and 45 refer to 1 to 5 years.

Figure 3.2.

Path Diagram of the Structural Equation Model:



Notes: (i) Path diagram represents workings of our preferred model consisting of equations (3.6), (3.8) and (3.9). (ii) m1 to m19 refer to female autonomy measurements laid out in Appendix 1. (iii) Squares refer to observed variables and circles to latent variables. (iv) Single-headed arrows refer to coefficients or factor loadings, double-headed arrows to correlations (v) district d, family j and child I refer to clusters at district, mother and child levels.

Table 3.1.

Children's Mortality Rates

Children's Mortality Rates			
	India	**WB**	**UP**
Child (Under-Five)			
Total	74.9	54.0	92.9
Boys	74.3	62.8	85.5
Girls	75.4	45.1	100.3
Of Which:			
1-28 days (Neonatal)			
Total	34.0	32.1	46.9
Boys	36.8	42.4	48.4
Girls	31.1	21.8	45.4
1-12 months			
Total	16.9	11.5	22.7
Boys	16.3	10.3	21.9
Girls	17.5	12.6	23.5
1 day - 12 months (Infant)			
Total	50.9	43.6	69.6
Boys	53.1	52.7	70.3
Girls	48.6	34.4	68.9
1-5 years			
Total	24.0	10.4	23.3
Boys	21.1	10.1	15.2
Girls	26.9	10.7	31.4

Notes: (i) Mortality rates refer to children born between 1996 and 2006. (ii) Mortality rates are deaths per 1000 children born. (iii) Neonatal Mortality: Number of deaths of children during the first 28 completed days of life. Infant Mortality: Number of deaths of children aged 1 month to 12 months. Child Mortality: Under-Five Mortality.

Table 3.2.

Female Autonomy, Percentages

Binary indicators	**India**	**WB**	**UP**
Economic Autonomy			
[1] Has Say on What to Do with Husband's Money	68	56	71
[2] Has Money for Own Use	43	40	64
Decision Making Autonomy			
[3] Has Say on Own Health Care	66	60	67
[4] Has Say on Small Household Purchases	56	38	56
[5] Has Say on Large Household Purchases	62	46	59
[6] Has Say on Visiting Family and Friends	64	49	54
Physical Autonomy			
[7] Does not Need Permission to go to Market	90	78	90
[8] Does not Need Permission to go to Health Facility	97	96	96
[9] Does not Need Permission to go to Places Outside Community	93	89	94
Emotional Autonomy			
Believes Her Husband is Justified in beating Her if…			
[10] She goes out without telling him	32	17	24
[11] She neglects house and children	40	24	26
[12] She argues with him	32	21	26
[13] She refuses sex	16	11	9
[14] She burns the food	20	12	16
[15] She is unfaithful	29	14	23
[16] She is disrespectful	45	31	35
Believes she is justified in refusing sex if…			
[17] Husband has sexually transmitted disease	81	78	86
[18] Husband has other women	83	71	89
[19] She is tired	81	77	90

Notes: (i) Percentages refer to women with children born between 1996 and 2006. (ii) Row [1]: Woman decides either herself or jointly with her husband on what to do with husband's money. Row [2]: Woman has money for her own that she alone can decide how to use. Row [3]: Woman decides alone or jointly with her husband on own health care. Row [4]: Woman decides alone or jointly with her husband on small household purchases. Row [5]: Woman decides alone or jointly with her husband on large household purchases. Row [6]: Woman decides alone or jointly with her husband on visiting family and friends. Row [7]: Woman is allowed to go alone or jointly with someone else to the market. Row [8]: Woman is allowed to go alone or jointly with someone else to the health facility. Row [9]: Woman is allowed to go alone or jointly with someone else to places outside the community.

Table 3.3.

Female Autonomy, Aggregate Indices (Standard Deviation)

Indices			
	India	**WB**	**UP**
[1] Economic Autonomy	1.11 (0.69)	0.96 (0.71)	1.35 (0.69)
[2] Decision-Making Autonomy	2.48 (1.57)	1.93 (1.56)	2.36 (1.55)
[3] Physical Autonomy	2.80 (0.58)	2.64 (0.74)	2.80 (0.60)
[4] Emotional Autonomy	7.31 (2.59)	7.96 (2.54)	8.05 (2.37)
[5] Female Autonomy (Aggregate)	13.70 (3.55)	13.49 (3.73)	14.57 (3.34)

Notes: (i) Figures refer to women with children born between 1996 and 2006. (ii) Row [1]: addition of dummy variables from rows [1] and [2] in Table 3.2, maximal value of 2. Row [2]: addition of dummy variables from rows [3] to [6] in Table 3.2, maximal value of 4. Row [3]: addition of dummy variables from rows [7] to [9], maximal value of 3. Row [4]: addition of dummy variables from rows [10] to [19] in Table 3.2, maximal value of 10. Row [5]: addition of rows [1], [2], [3] and [5] maximal value of 19.

Table 3.4.

Covariates Employed in the Empirical Analysis, Percentages and Means

Covariates			
	India	**WB**	**UP**
Children's Covariates			
Female	48%	49%	48%
Number of Children	1.92 (1.01)	1.68 (0.84)	2.24 (1.15)
Parental Covariates:			
Ma: Scheduled Caste	17%	22%	23.4%
Ma: Scheduled Tribe	16%	4%	1%
Ma: Other Backward Caste	34%	3%	50%
Ma: Muslim	14%	32%	22%
Ma: Primary Education	52%	48%	36%
Ma: Age at birth of first child in sample	20.1 (3.9)	19.3 (3.85)	19.1 (3.2)
Pa: Primary Education	32%	32%	24%
Pa: Secondary Education	30%	21%	35%
Rural Household	27%	29%	28%

Notes: (i) Children's characteristics refer to children born between 1996 and 2006. (ii) Parental characteristics refer to women with children born between 1996 and 2006. (iii) Standard Deviations given in parentheses.

Table 3.5.

Maximum Likelihood Estimates of the Conditional Probability of Dying: The Effect of Economic, Decision-Making and Physical Autonomy (Standard Errors)

WB	Economic Aut.		Decision-Making Aut.		Physical Aut.	
	All	Interaction with Girl	All	Interaction with Girl	All	Interaction with Girl
<u>Economic Autonomy</u>						
Say on What to Do with Husband's Money	-0.077	0.361				
	(0.268)	(0.407)				
Has Money for Own Use	0.127	0.015				
	(0.276)	(0.407)				
<u>Decision Making Autonomy</u>						
Has Say on Own Health Care			0.439	-0.585		
			(0.327)	(0.496)		
Small Household Purchases			0.036	-0.043		
			(0.356)	(0.541)		
Large Household Purchases			-0.156	-0.197		
			(0.329)	(0.507)		
Visiting Family and Friends			-0.067	0.409		
			(0.340)	(0.508)		
<u>Physical Autonomy</u>						
Does not Need Permission to Go to Market					-0.320	0.283
					(0.335)	(0.488)
To go to Health Facility					-0.032	0.112
					(0.705)	(1.089)
To go Places outside Community					0.303	-0.659
					(0.542)	(0.755)
UP						
<u>Economic Autonomy</u>						
Say on What to Do with Husband's Money	0.322*	-0.548**				
	(0.166)	(0.215)				
Has Money for Own Use	0.031	-0.166				
	(0.131)	(0.176)				
<u>Decision Making Autonomy</u>						
Has Say on Own Health Care			0.072	-0.255		
			(0.165)	(0.223)		
Small Household Purchases			-0.118	0.091		
			(0.162)	(0.221)		
Large Household Purchases			0.083	-0.228		
			(0.169)	(0.230)		
Visiting Family and Friends			0.117	-0.131		
			(0.150)	(0.203)		
<u>Physical Autonomy</u>						
Does not Need Permission to Go to Market					0.275	-0.549
					(0.261)	(0.334)
To go to Health Facility					-0.408	0.874
					(0.461)	(0.644)
To go Places outside Community					-0.344	0.124
					(0.381)	(0.510)

<u>Notes:</u> (i) Estimates are based on the sample of women with children born 1996 to 2006. (ii) Dependent variable is the dummy whether child dies and the reference case for the baseline hazard is the child dying at the first day of its life. (iii) * $p<0.1$, ** $p<0.05$, *** $p<0.01$. (iv) The remaining coefficient estimates are reported in Appendix 3.2.

Table 3.6.

Maximum Likelihood Estimates of the Conditional Probability of Dying: The Effect of Emotional and Female Autonomy (Standard Errors)

	WB				UP			
	Emotional		**All**		**Emotional**		**All**	
	All	**Interaction with Girl**	**All**	**Interaction with Girl**	**All**	**Interaction with Girl**	**All**	**Interaction with Girl**
Economic Autonomy								
Say on What to Do with Husband's Money			-0.098	0.595			0.435**	-0.527*
			(0.330)	(0.490)			(0.202)	(0.271)
Has Money for Own Use			0.171	0.055			-0.028	-0.155
			(0.284)	(0.431)			(0.151)	(0.209)
Decision Making Autonomy								
Has Say on Own Health Care			0.467	-0.675			-0.025	-0.160
			(0.338)	(0.510)			(0.188)	(0.259)
Small Household Purchases			-0.088	0.082			-0.259	0.252
			(0.371)	(0.561)			(0.187)	(0.262)
Large Household Purchases			-0.129	-0.440			0.053	-0.261
			(0.344)	(0.530)			(0.189)	(0.266)
Visiting Family and Friends			-0.067	0.325			0.120	-0.112
			(0.353)	(0.522)			(0.170)	(0.235)
Physical Autonomy								
Does not Need Permission to Go to Market			-0.296	0.213			0.318	-0.613
			(0.341)	(0.499)			(0.297)	(0.399)
To go to Health Facility			-0.038	0.191			-0.578	1.063
			(0.719)	(1.125)			(0.538)	(0.767)
To go Places outside Community			0.217	-0.467			-0.350	0.189
			(0.538)	(0.772)			(0.440)	(0.599)
Emotional Autonomy								
Wifebeating not justified if								
She goes out without telling him	0.261	-0.529	0.259	-0.573	-0.120	-0.282	-0.104	-0.346
	(0.516)	(0.699)	(0.515)	(0.708)	(0.223)	(0.294)	(0.256)	(0.340)
She neglects house and children	0.124	-0.273	0.128	-0.260	0.269	0.028	0.323	0.056
	(0.471)	(0.694)	(0.470)	(0.694)	(0.223)	(0.296)	(0.255)	(0.341)
She argues with him	0.544	-0.456	0.582	-0.486	-0.124	0.249	-0.116	0.221
	(0.487)	(0.716)	(0.486)	(0.719)	(0.192)	(0.264)	(0.219)	(0.301)
She refuses sex	-0.151	0.481	-0.124	0.568	0.456*	0.117	0.553*	0.142
	(0.581)	(0.789)	(0.573)	(0.803)	(0.277)	(0.368)	(0.304)	(0.411)
She burns the food	0.255	-1.266	0.224	-1.347*	-0.044	-0.469	-0.083	-0.489
	(0.600)	(0.792)	(0.607)	(0.814)	(0.218)	(0.289)	(0.248)	(0.338)
She is unfaithful	-0.150	-0.369	-0.131	-0.250	0.100	0.156	0.114	0.201
	(0.517)	(0.733)	(0.514)	(0.749)	(0.198)	(0.264)	(0.225)	(0.306)
She is disrespectful	0.080	0.831	0.012	0.833	0.064	-0.207	0.038	-0.180
	(0.377)	(0.625)	(0.388)	(0.634)	(0.186)	(0.249)	(0.213)	(0.289)
Believes she is justified refusing sex if								
Husband has Disease	-0.556	-0.074	-0.557	-0.215	-0.060	-0.355	-0.118	-0.425
	(0.433)	(0.618)	(0.437)	(0.634)	(0.218)	(0.292)	(0.247)	(0.342)
Husband has other women	0.554	-0.348	0.543	-0.270	0.019	0.050	0.037	-0.013
	(0.416)	(0.601)	(0.414)	(0.616)	(0.276)	(0.374)	(0.313)	(0.428)
She is tired	-0.629*	0.752	-0.616*	0.731	-0.006	-0.008	0.012	0.061
	(0.372)	(0.560)	(0.373)	(0.573)	(0.262)	(0.345)	(0.302)	(0.398)
Constant	-4.422*	-	-4.405*	-	-2.659**		-7.852	-
	(1.987)		(2.077)		(0.893)		(95.119)	
Mother Level Variance	0.000	-	-0.000	-	0.742***		0.838***	-
	(0.671)		(0.497)		(0.148)		(0.159)	
Log Likelihood	-568.36	-568.36	-621.6	-621.6	-2,875.89	-2,875.89	-2,999.02	-2,999.02

Notes: (i) Estimates are based on the sample of women with children born 1996 to 2006. (ii) Dependent variable is the dummy whether child dies and the reference case for the baseline hazard is the child dying at the first day of its life. (iii) * p<0.1, ** p<0.05, *** p<0.01. (iv) The remaining coefficient estimates are reported in Appendix 3.2.

Table 3.7.

Maximum Likelihood Estimates of the Conditional Probability of Dying: Main Coefficients from Model 2 (Standard Errors). Interaction Terms

Model 2	WB	WB	UP	UP
	Child Survival	Child Survival	Child Survival	Child Survival
	All	Interaction	All	Interaction
Child Characteristics				
Birth Order 2	-0.971**	0.321	-0.228	-0.019
	(0.385)	(0.578)	(0.223)	(0.323)
Birth Order 3	-1.061**	0.780	0.004	-0.048
	(0.495)	(0.728)	(0.236)	(0.343)
Birth Oder 4 or Above	-0.273	0.704	-0.041	0.702*
	(0.475)	(0.753)	(0.255)	(0.359)
Girl	2.521	-	1.309	-
	(3.903)		(1.653)	
Born 2000	0.140	-0.376	-0.886***	0.681**
	(0.417)	(0.699)	(0.254)	(0.324)
Born 2001	0.170	-0.517	-0.180	-0.058
	(0.396)	(0.685)	(0.206)	(0.291)
Born 2002	-0.453	1.004	-0.217	0.274
	(0.498)	(0.660)	(0.212)	(0.285)
Born 2003	-0.300	0.974	-0.286	-0.521
	(0.550)	(0.717)	(0.217)	(0.341)
Born 2004	0.271	-0.974	-0.398	0.142
	(0.470)	(0.893)	(0.245)	(0.338)
Born 2005	-0.676	0.563	-0.583**	-0.269
	(0.747)	(0.983)	(0.297)	(0.437)
Parent Characteristics				
Ma: Age at Birth	0.125	-0.215	-0.031	-0.164
	(0.208)	(0.334)	(0.096)	(0.129)
Ma: Age at Birth Squared	-0.003	0.002	0.000	0.003
	(0.004)	(0.007)	(0.002)	(0.002)
Ma: Belongs to Schleduled Caste	-0.593	-0.025	0.027	0.238
	(0.455)	(0.690)	(0.206)	(0.279)
Ma: Belongs to Scheduled Tribe	0.911	-0.673	1.061**	-0.778
	(0.560)	(0.835)	(0.503)	(0.801)
Ma: Belongs to Other Backw. Caste	0.051	-0.112	0.041	-0.006
	(1.066)	(1.500)	(0.176)	(0.239)
Ma: Muslim	0.084	-0.026	-0.160	-0.080
	(0.354)	(0.523)	(0.167)	(0.232)
Ma: Complete Prim Educ or More	-1.056***	0.043	-0.433**	0.229
	(0.404)	(0.593)	(0.195)	(0.259)
Pa: Complete Prim Educ or More	-0.138	-0.020	-0.018	-0.105
	(0.340)	(0.523)	(0.152)	(0.208)
Pa: Complete Sec Educ or More	-0.283	0.585	-0.104	0.144
	(0.537)	(0.746)	(0.164)	(0.225)
Rural	0.164	-0.140	0.079	-0.002
	(0.403)	(0.619)	(0.184)	(0.249)
Wealth Quintile 2	-0.131	0.102	0.046	-0.054
	(0.389)	(0.545)	(0.162)	(0.223)
Wealth Quintile 3	0.429	-1.422*	-0.090	0.295
	(0.409)	(0.737)	(0.205)	(0.269)
Wealth Quintile 4	0.530	-1.030	0.111	-0.333
	(0.530)	(0.822)	(0.231)	(0.329)
Wealth Quintile 5	0.004	-0.259	-0.547	-0.298
	(0.814)	(1.162)	(0.362)	(0.506)

Table 3.7. Continued:

Baseline Hazard				
t2	0.114	-0.693	-1.853***	0.662
	(0.422)	(0.702)	(0.312)	(0.424)
t3	0.052	-0.619	-0.578***	0.248
	(0.431)	(0.708)	(0.195)	(0.292)
t4	-1.236*	-0.246	-1.041***	-0.115
	(0.654)	(1.021)	(0.229)	(0.368)
t5	-1.641**	0.163	-1.725***	0.948**
	(0.771)	(1.100)	(0.302)	(0.393)
t6	-0.941	0.163	-1.389***	0.259
	(0.587)	(0.843)	(0.264)	(0.390)
t7	-1.220*	1.015	-0.595***	0.481*
	(0.655)	(0.828)	(0.199)	(0.288)
t8	-0.927	0.586	-0.447**	0.811***
	(0.587)	(0.792)	(0.192)	(0.269)
t9	0.187	-0.119	-1.148***	1.156***
	(0.433)	(0.655)	(0.254)	(0.330)
Constant	-5.336**	-	-2.929**	-
	(2.505)		(1.237)	
Mother Level Variance	0.000	-	0.793***	-
	(0.474)		(0.152)	
Log Likelihood	-623.93	-	-3,136.25	-

Notes: (i) Estimates are based on the sample of women with children born 1996 to 2006. (ii) Dependent variable is the dummy whether child dies and the reference case for the baseline hazard is the child dying at the first day of its life. (iii) * p<0.1, ** p<0.05, *** p<0.01. (iv) The remaining coefficient estimates are reported in Appendix 3.2.

Table 3.8.

Maximum Likelihood Estimates of the Conditional Probability of Dying: Main Coefficients from Models 1, 2, 3 and 4 (Standard Errors)

	Model 1	Model 2	Model 3	Model 4
	Child Survival	Child Survival	Child Survival	Child Survival
WB				
Female Autonomy	-	0.124	0.037	0.099
		(0.140)	(0.099)	(0.096)
Female Autonomy * Girl	-	-0.291	-0.223*	0.102*
		(0.197)	(0.134)	(0.059)
Baseline Hazard				
τ2	0.108	0.109	0.035	0.091
	(0.421)	(0.421)	(0.255)	(0.348)
τ3	-0.419	-0.418	-0.299	0.029
	(0.487)	(0.487)	(0.287)	(0.357)
τ4	-0.156	-0.155	-0.077	-0.050
	(0.453)	(0.453)	(0.267)	(0.368)
τ5	-0.958	-0.957	-1.509***	-2.446**
	(0.586)	(0.586)	(0.473)	(1.022)
τ6	-1.238*	-1.238*	-0.916**	-1.051*
	(0.654)	(0.654)	(0.367)	(0.543)
τ7	-0.946	-0.946	-0.708**	-1.043*
	(0.587)	(0.587)	(0.338)	(0.543)
τ8	0.072	0.073	-0.362	-0.243
	(0.442)	(0.442)	(0.309)	(0.413)
τ9	-1.984*	-1.987*	-1.664***	-2.112**
	(1.048)	(1.048)	(0.599)	(1.023)
Baseline Hazard * Girl				
τ2	-0.690	-0.690	-0.972**	-1.117*
	(0.701)	(0.701)	(0.413)	(0.575)
τ3	-0.667	-0.666	-0.632	-1.047*
	(0.827)	(0.827)	(0.433)	(0.580)
τ4	-0.412	-0.411	-0.215	-0.553
	(0.721)	(0.721)	(0.344)	(0.511)
τ5	0.394	0.396	0.817	1.443
	(0.811)	(0.811)	(0.551)	(1.120)
τ6	1.022	1.025	0.569	0.620
	(0.827)	(0.827)	(0.432)	(0.629)
τ7	0.588	0.591	0.033	0.281
	(0.790)	(0.791)	(0.441)	(0.673)
τ8	-0.172	-0.165	-0.208	-0.235
	(0.672)	(0.672)	(0.419)	(0.544)
τ9	0.155	0.171	-0.288	0.044
	(1.487)	(1.487)	(0.916)	(1.416)
Girl	-0.149	-0.184	-0.861***	-0.659
	(0.453)	(0.455)	(0.329)	(0.657)
Constant	-4.053**	-3.992**	-1.287***	-0.120***
	(1.903)	(1.906)	(0.067)	(0.033)
Mother Level Variance	-0.000	0.000	-	-
	(0.677)	(0.718)		
Log Likelihood	-637.56	-636.46	-40202.16	-50453.02

Table 3.8. continued

	Model 1	Model 2	Model 3	Model 4
	Child Survival	Child Survival	Child Survival	Child Survival
UP				
Female Autonomy	-	0.122*	0.109	0.500***
		(0.067)	(0.080)	(0.146)
Female Autonomy * Girl	-	-0.243***	-0.151	-0.049**
		(0.087)	(0.100)	(0.022)
Baseline Hazard				
τ2	-1.853***	-1.853***	-1.671***	-1.389***
	(0.312)	(0.312)	(0.354)	(0.402)
τ3	-0.681***	-0.681***	-0.717***	-0.373
	(0.201)	(0.201)	(0.240)	(0.267)
τ4	-0.534***	-0.533***	-1.068***	-0.355
	(0.193)	(0.193)	(0.277)	(0.267)
τ5	-1.393***	-1.392***	-1.804***	-1.505***
	(0.264)	(0.264)	(0.289)	(0.431)
τ6	-0.739***	-0.739***	-0.827***	-1.211***
	(0.209)	(0.209)	(0.253)	(0.379)
τ7	-0.349*	-0.348*	-0.629***	-0.504*
	(0.186)	(0.186)	(0.236)	(0.285)
τ8	-1.448***	-1.448***	-1.411***	-1.222***
	(0.285)	(0.285)	(0.338)	(0.403)
τ9	-2.345***	-2.346***	-1.762***	-2.260***
	(0.464)	(0.464)	(0.336)	(0.721)
Baseline Hazard * Girl				
τ2	0.662	0.661	0.821*	0.517
	(0.424)	(0.424)	(0.425)	(0.478)
τ3	0.202	0.200	-0.011	0.030
	(0.303)	(0.303)	(0.326)	(0.324)
τ4	0.400	0.399	0.352	0.172
	(0.283)	(0.283)	(0.354)	(0.313)
τ5	0.258	0.257	-	0.143
	(0.390)	(0.390)		(0.558)
τ6	0.493	0.493	0.129	0.480
	(0.300)	(0.300)	(0.336)	(0.452)
τ7	0.773***	0.773***	0.539*	0.797***
	(0.262)	(0.262)	(0.285)	(0.305)
τ8	1.071***	1.074***	0.533	0.986**
	(0.368)	(0.368)	(0.427)	(0.448)
τ9	1.369**	1.372**	-	1.270
	(0.558)	(0.558)		(0.804)
Girl	-0.287	-0.276	-0.345	-0.456
	(0.182)	(0.183)	(0.265)	(0.387)
Constant	-2.169**	-2.138**	-0.210***	-0.448***
	(0.847)	(0.846)	(0.065)	(0.037)
Mother Level Variance	0.790***	0.777***	-	-
	(0.152)	(0.150)		
Log Likelihood	-3131.71	-3131.70	-330,002.06	-350,122.54

Notes: (i) Estimates are based on the sample of women with children born 1996 to 2006. (ii) Dependent variable is the dummy whether child dies and the reference case for the baseline hazard is the child dying at the first day of its life. (iii) Model 1: duration specification without female autonomy variable; Model 2: duration specification with female autonomy indices; Model 3, covariate measurement error model, Model 4, structural equation model specification. (iv) * p<0.1, ** p<0.05, *** p<0.01. (v) Log likelihood values for Model 3 are not comparable to the other Model values. (vi) Log likelihood values for Model 4 are not comparable to other Models values. (vii) The remaining coefficient estimates are reported in Appendix 3.2.

Table 3.9.

Estimates of the Regressions of Female Autonomy on Female Characteristics, Equation (3.6.), (Standard Errors)

	WB	WB	UP	UP
	Model 3	Model 4	Model 3	Model 4
	Female Autonomy	Female Autonomy	Female Autonomy	Female Autonomy
Ma: Schleduled Caste	1	1	1	1
Ma: Scheduled Tribe	0.329***	0.309	-0.160	0.253
	(0.057)	(0.439)	(0.214)	(0.209)
Ma: Other Backw. Caste	0.271***	-0.001	0.255***	0.307***
	(0.081)	(0.000)	(0.034)	(0.098)
Ma: Muslim	-0.041	-0.432***	0.256***	0.322***
	(0.030)	(0.099)	(0.035)	(0.098)
Ma: Compl. Prim. Educ	0.684***	0.945***	0.610***	0.669***
	(0.033)	(0.209)	(0.034)	(0.101)
Rural	-0.132**	-0.104	0.119**	0.082
	(0.065)	(0.187)	(0.059)	(0.101)
Ma: Birth Cohort 1968 - 1972	-0.003	-0.004	0.154***	0.308***
	(0.062)	(0.019)	(0.055)	(0.103)
Ma: Birth Cohort 1973 - 1977	-0.104*	-0.298	0.032	-0.015
	(0.057)	(0.309)	(0.057)	(0.080)
Ma: Birth Cohort 1978 - 1982	-0.561***	-1.078***	-0.153**	-0.638***
	(0.061)	(0.208)	(0.072)	(0.209)
Ma: Birth Cohort 1983 - 1991	-0.301***	-0.108***	0.022	-0.092
	(0.029)	(0.008)	(0.035)	(0.101)

Notes: (i) Estimates are based on the sample of women with children born 1996 to 2006. (ii) Correlations between the scheduled caste dummy and the spheres have been set to one for identification (iii) * p<0.1, ** p<0.05, *** p<0.01.

Table 3.10.

Estimates of Regressions of Sub-Spheres on Female Autonomy,

(Standard Errors)

	WB	UP
Economic Autonomy	1	1
Decision-Making Autonomy	-0.176	0.108
	(0.209)	(0.207)
Physical Autonomy	-0.154	-0.792***
	(0.298)	(0.106)
Emotional Autonomy	-0.578***	-0.487***
	(0.099)	(0.097)

Notes: (i) Estimates are based on the sample of women with children born 1996 to 2006. (ii) Estimates are derived from Regression of sub-spheres on concept of female autonomy (8). (iii) Coefficient of female autonomy on economic autonomy has been set equal to one for identification. (iv) * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Appendices for Chapter Three:

Appendix 3.1.

1. Economic Autonomy:

- m1: takes the value of 1 if the woman decides either herself or jointly with her husband on what to do with her husband's money.
- m2: takes the value of 1 if the woman has money of her own that she alone can decide how to use.

2. Decision-making Autonomy:

- m3: takes the value of 1 if the woman decides either alone or jointly with her husband on her own health care.
- m4: takes the value of 1 if the woman decides either alone or jointly with her husband on small household purchases.
- m5: takes the value of 1 if the woman decides either alone or jointly with her husband on large household purchases.
- m6: takes the value of 1 if the woman decides either alone or jointly with her husband on visiting family and friends.

3. Physical Autonomy:

- m7: takes the value of 1 if the woman is allowed to go alone or jointly with someone else to the market.
- m8: takes the value of 1 if the woman is allowed to go alone or jointly with someone else to the health clinic.
- m9: takes the value of 1 if the woman is allowed to go alone or jointly with someone else to places outside the community.

4. Emotional Autonomy:

- m10: takes the value of 1 if woman believes her husband is not justified in beating her if she argues with him.
- m11: takes the value of 1 if woman believes her husband is not justified in beating her if she is disrespectful.
- m12: takes the value of 1 if woman believes her husband is not justified in beating her if she goes out without telling him.
- m13: takes the value of 1 if woman believes her husband is not justified in beating her if he suspects her of being unfaithful.
- m14: takes the value of 1 if woman believes her husband is not justified in beating her if she neglects house or children.
- m15: takes the value of 1 if woman believes her husband is not justified in beating her if she refuses to have sex with him.
- m16: takes the value of 1 if woman believes her husband is not justified in beating her if she does not cook the food properly.
- m17: takes the value of 1 if the woman believes she is justified in refusing sex if husband has sexually transmitted disease.
- m18: takes the value of 1 if the woman believes she is justified in refusing sex if husband has other women.

- m19: takes the value of 1 if the woman believes she is justified in refusing sex if she is tired.

The Outcome Model – linear predictor for mother *j* (equation (3.7))

$$\nu = \begin{bmatrix} \nu_{11} \\ \nu_{12} \\ \nu_{21} \\ \nu_{22} \\ \nu_{23} \\ \nu_{24} \\ \nu_{31} \\ \nu_{32} \\ \nu_{33} \\ \nu_{41} \\ \nu_{42} \\ \nu_{43} \\ \nu_{44} \\ \nu_{45} \\ \nu_{46} \\ \nu_{47} \\ \nu_{48} \\ \nu_{49} \\ \nu_{410} \end{bmatrix} = \begin{bmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \\ \delta_4 \\ \delta_5 \\ \delta_6 \\ \delta_7 \\ \delta_8 \\ \delta_9 \\ \delta_{10} \\ \delta_{11} \\ \delta_{12} \\ \delta_{13} \\ \delta_{14} \\ \delta_{15} \\ \delta_{16} \\ \delta_{17} \\ \delta_{18} \\ \delta_{19} \end{bmatrix} + \begin{bmatrix} 1 & 0 & 0 & 0 \\ \lambda_{12} & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & \lambda_{22} & 0 & 0 \\ 0 & \lambda_{23} & 0 & 0 \\ 0 & \lambda_{24} & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & \lambda_{32} & 0 \\ 0 & 0 & \lambda_{33} & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & \lambda_{42} \\ 0 & 0 & 0 & \lambda_{43} \\ 0 & 0 & 0 & \lambda_{44} \\ 0 & 0 & 0 & \lambda_{45} \\ 0 & 0 & 0 & \lambda_{46} \\ 0 & 0 & 0 & \lambda_{47} \\ 0 & 0 & 0 & \lambda_{48} \\ 0 & 0 & 0 & \lambda_{49} \\ 0 & 0 & 0 & \lambda_{410} \end{bmatrix} \begin{bmatrix} \eta_{1j}^{(3)} \\ \eta_{2j}^{(3)} \\ \eta_{3j}^{(3)} \\ \eta_{4j}^{(3)} \end{bmatrix}$$

Notes: The variables ν11 to ν410 are the linear predictors for the binary indicators associated with the measurements m1 to m19 laid out above.

Appendix 3.2.

Estimates of All Coefficients from Duration Model Estimated in Tables 3.5. and 3.6.:

	A	B	C	D	E
	WB	WB	WB	WB	WB
	Child Survival	Child Survival	Child Survival	Child Survival	Child Survival
Child Characteristics					
Birth Order 2	-0.367	-0.361	-0.359	-0.378	-0.367
	(0.280)	(0.280)	(0.280)	(0.281)	(0.283)
Birth Order 3	-0.240	-0.244	-0.234	-0.259	-0.242
	(0.351)	(0.352)	(0.352)	(0.357)	(0.361)
Birth Oder 4 or Above	0.440	0.394	0.411	0.471	0.488
	(0.369)	(0.372)	(0.369)	(0.373)	(0.379)
Girl	-0.377	0.131	0.124	0.944	1.075
	(0.543)	(0.531)	(1.026)	(0.758)	(1.220)
Born 2000	-0.007	0.006	-0.029	-0.047	-0.051
	(0.329)	(0.330)	(0.329)	(0.331)	(0.334)
Born 2001	-0.010	0.008	0.002	-0.040	0.001
	(0.320)	(0.320)	(0.321)	(0.322)	(0.326)
Born 2002	0.070	0.070	0.083	0.133	0.168
	(0.319)	(0.320)	(0.320)	(0.323)	(0.326)
Born 2003	0.138	0.185	0.107	0.135	0.106
	(0.344)	(0.345)	(0.345)	(0.345)	(0.349)
Born 2004	-0.082	-0.074	-0.106	-0.083	-0.042
	(0.392)	(0.394)	(0.393)	(0.396)	(0.398)
Born 2005	-0.311	-0.347	-0.360	-0.311	-0.360
	(0.481)	(0.481)	(0.481)	(0.482)	(0.485)
Parent Characteristics					
Ma: Age at Birth	0.023	0.017	0.024	0.046	0.037
	(0.160)	(0.161)	(0.160)	(0.165)	(0.165)
Ma: Age at Birth Squared	-0.002	-0.002	-0.002	-0.003	-0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Ma: Belongs to Schleduled Caste	-0.624*	-0.592*	-0.601*	-0.619*	-0.596*
	(0.345)	(0.345)	(0.344)	(0.348)	(0.349)
Ma: Belongs to Scheduled Tribe	0.673	0.637	0.695	0.618	0.665
	(0.430)	(0.432)	(0.431)	(0.435)	(0.447)
Ma: Belongs to Other Backw. Caste	-0.019	-0.002	-0.021	-0.030	-0.046
	(0.755)	(0.755)	(0.753)	(0.758)	(0.761)
Ma: Muslim	0.090	0.074	0.066	0.100	0.061
	(0.268)	(0.270)	(0.268)	(0.269)	(0.273)
Ma: Complete Prim Educ or More	-0.632**	-0.640**	-0.628**	-0.674**	-0.706**
	(0.291)	(0.293)	(0.291)	(0.294)	(0.298)
Pa: Complete Prim Educ or More	-0.119	-0.154	-0.136	-0.116	-0.108
	(0.258)	(0.259)	(0.258)	(0.262)	(0.265)
Pa: Complete Sec Educ or More	0.015	0.019	0.013	-0.013	0.015
	(0.366)	(0.366)	(0.366)	(0.369)	(0.371)
Rural	0.146	0.139	0.102	0.023	-0.009
	(0.317)	(0.317)	(0.317)	(0.315)	(0.321)
Wealth Quintile 2	-0.004	-0.034	0.003	0.047	0.025
	(0.273)	(0.275)	(0.275)	(0.275)	(0.279)
Wealth Quintile 3	-0.007	-0.037	0.012	0.048	0.068
	(0.333)	(0.337)	(0.335)	(0.340)	(0.344)
Wealth Quintile 4	0.142	0.130	0.173	0.176	0.226
	(0.408)	(0.413)	(0.408)	(0.409)	(0.416)
Wealth Quintile 5	0.026	0.042	0.075	0.105	0.090
	(0.573)	(0.580)	(0.568)	(0.575)	(0.587)

<u>Baseline Hazard</u>					
t2	0.109	0.109	0.110	0.114	0.118
	(0.421)	(0.421)	(0.421)	(0.421)	(0.422)
t3	0.039	0.041	0.041	0.044	0.052
	(0.430)	(0.430)	(0.430)	(0.430)	(0.431)
t4	-1.254*	-1.253*	-1.253*	-1.246*	-1.239*
	(0.654)	(0.654)	(0.654)	(0.654)	(0.654)
t5	-1.657**	-1.656**	-1.656**	-1.647**	-1.639**
	(0.771)	(0.771)	(0.771)	(0.771)	(0.771)
t6	-0.957	-0.955	-0.957	-0.946	-0.939
	(0.587)	(0.587)	(0.587)	(0.587)	(0.587)
t7	-1.237*	-1.236*	-1.238*	-1.229*	-1.222*
	(0.654)	(0.654)	(0.654)	(0.654)	(0.654)
t8	-0.945	-0.944	-0.945	-0.936	-0.929
	(0.587)	(0.587)	(0.587)	(0.587)	(0.587)
t9	0.173	0.174	0.169	0.188	0.199
	(0.431)	(0.431)	(0.431)	(0.432)	(0.433)
<u>Baseline Hazard * Girl</u>					
t2	-0.691	-0.692	-0.692	-0.692	-0.697
	(0.701)	(0.701)	(0.701)	(0.702)	(0.702)
t3	-0.611	-0.613	-0.613	-0.604	-0.604
	(0.706)	(0.707)	(0.706)	(0.707)	(0.708)
t4	-0.232	-0.233	-0.234	-0.229	-0.227
	(1.021)	(1.021)	(1.021)	(1.021)	(1.022)
t5	0.173	0.172	0.171	0.174	0.176
	(1.099)	(1.099)	(1.099)	(1.100)	(1.100)
t6	0.171	0.170	0.170	0.173	0.178
	(0.842)	(0.842)	(0.842)	(0.842)	(0.843)
t7	1.023	1.022	1.022	1.027	1.034
	(0.827)	(0.827)	(0.827)	(0.828)	(0.829)
t8	0.590	0.591	0.590	0.594	0.600
	(0.791)	(0.791)	(0.791)	(0.791)	(0.792)
t9	-0.138	-0.136	-0.133	-0.144	-0.141
	(0.652)	(0.652)	(0.652)	(0.653)	(0.653)

	A	B	C	D	E
	UP	UP	UP	UP	UP
	Child Survival	Child Survival	Child Survival	Child Survival	Child Survival
Child Characteristics					
Birth Order 2	-0.219	-0.212	-0.212	-0.215	-0.242
	(0.160)	(0.160)	(0.159)	(0.159)	(0.178)
Birth Order 3	-0.011	0.008	-0.011	-0.010	-0.026
	(0.171)	(0.171)	(0.171)	(0.171)	(0.191)
Birth Oder 4 or Above	0.313*	0.340*	0.325*	0.316*	0.376*
	(0.182)	(0.182)	(0.182)	(0.181)	(0.206)
Girl	0.254	0.075	-0.748	0.254	0.348
	(0.270)	(0.245)	(0.477)	(0.423)	(0.696)
Born 2000	-0.516***	-0.518***	-0.520***	-0.516***	-0.602***
	(0.156)	(0.156)	(0.156)	(0.156)	(0.173)
Born 2001	-0.216	-0.218	-0.224	-0.229	-0.294*
	(0.144)	(0.144)	(0.144)	(0.144)	(0.164)
Born 2002	-0.067	-0.067	-0.062	-0.078	-0.109
	(0.140)	(0.140)	(0.140)	(0.140)	(0.163)
Born 2003	-0.499***	-0.508***	-0.511***	-0.522***	-0.569***
	(0.166)	(0.166)	(0.166)	(0.166)	(0.185)
Born 2004	-0.335**	-0.340**	-0.343**	-0.341**	-0.394**
	(0.168)	(0.168)	(0.168)	(0.168)	(0.188)
Born 2005	-0.714***	-0.717***	-0.724***	-0.707***	-0.783***
	(0.217)	(0.217)	(0.217)	(0.217)	(0.235)
Parent Characteristics					
Ma: Age at Birth	-0.115*	-0.114*	-0.112*	-0.106	-0.135*
	(0.066)	(0.065)	(0.066)	(0.066)	(0.076)
Ma: Age at Birth Squared	0.002	0.002	0.002	0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ma: Belongs to Schleduled Caste	0.139	0.142	0.136	0.151	0.155
	(0.145)	(0.145)	(0.145)	(0.145)	(0.167)
Ma: Belongs to Scheduled Tribe	0.669*	0.741*	0.692*	0.753*	0.939*
	(0.406)	(0.409)	(0.408)	(0.407)	(0.521)
Ma: Belongs to Other Backw. Caste	0.031	0.041	0.038	0.038	0.046
	(0.124)	(0.124)	(0.124)	(0.124)	(0.142)
Ma: Muslim	-0.202*	-0.203*	-0.216*	-0.202*	-0.256*
	(0.120)	(0.121)	(0.121)	(0.120)	(0.138)
Ma: Complete Prim Educ or More	-0.173	-0.169	-0.165	-0.168	-0.171
	(0.133)	(0.133)	(0.133)	(0.133)	(0.151)
Pa: Complete Prim Educ or More	-0.067	-0.070	-0.075	-0.037	-0.063
	(0.109)	(0.109)	(0.109)	(0.109)	(0.126)
Pa: Complete Sec Educ or More	-0.041	-0.035	-0.045	-0.022	-0.032
	(0.117)	(0.116)	(0.117)	(0.117)	(0.134)
Rural	0.073	0.065	0.070	0.061	0.047
	(0.129)	(0.130)	(0.129)	(0.129)	(0.150)
Wealth Quintile 2	0.022	0.017	0.024	0.028	-0.005
	(0.117)	(0.116)	(0.117)	(0.116)	(0.134)
Wealth Quintile 3	0.079	0.080	0.082	0.092	0.128
	(0.139)	(0.139)	(0.139)	(0.139)	(0.161)
Wealth Quintile 4	-0.046	-0.039	-0.030	-0.036	-0.022
	(0.169)	(0.169)	(0.170)	(0.170)	(0.195)
Wealth Quintile 5	-0.698***	-0.703***	-0.695***	-0.723***	-0.765***
	(0.257)	(0.257)	(0.258)	(0.257)	(0.282)

Baseline Hazard					
t2	-1.852***	-1.853***	-1.854***	-1.853***	-1.846***
	(0.312)	(0.312)	(0.312)	(0.312)	(0.314)
t3	-0.578***	-0.579***	-0.578***	-0.579***	-0.538***
	(0.195)	(0.195)	(0.195)	(0.195)	(0.198)
t4	-1.043***	-1.044***	-1.043***	-1.043***	-0.981***
	(0.229)	(0.229)	(0.229)	(0.229)	(0.233)
t5	-1.727***	-1.728***	-1.728***	-1.728***	-1.654***
	(0.302)	(0.302)	(0.302)	(0.302)	(0.304)
t6	-1.392***	-1.392***	-1.391***	-1.393***	-1.302***
	(0.264)	(0.264)	(0.264)	(0.264)	(0.267)
t7	-0.598***	-0.599***	-0.597***	-0.600***	-0.482**
	(0.199)	(0.199)	(0.199)	(0.199)	(0.204)
t8	-0.452**	-0.453**	-0.450**	-0.454**	-0.302
	(0.192)	(0.192)	(0.192)	(0.192)	(0.198)
t9	-1.156***	-1.158***	-1.154***	-1.159***	-0.987***
	(0.254)	(0.254)	(0.254)	(0.254)	(0.259)
Baseline Hazard * Girl					
t2	0.661	0.662	0.664	0.663	0.664
	(0.424)	(0.424)	(0.424)	(0.424)	(0.428)
t3	0.246	0.247	0.248	0.249	0.246
	(0.291)	(0.291)	(0.291)	(0.292)	(0.297)
t4	-0.115	-0.114	-0.113	-0.113	-0.117
	(0.368)	(0.368)	(0.368)	(0.368)	(0.372)
t5	0.947**	0.948**	0.950**	0.951**	0.960**
	(0.393)	(0.393)	(0.393)	(0.393)	(0.397)
t6	0.258	0.258	0.259	0.263	0.271
	(0.390)	(0.390)	(0.390)	(0.390)	(0.394)
t7	0.479*	0.479*	0.480*	0.488*	0.507*
	(0.288)	(0.288)	(0.288)	(0.288)	(0.294)
t8	0.806***	0.807***	0.806***	0.816***	0.862***
	(0.268)	(0.268)	(0.269)	(0.269)	(0.276)
t9	1.161***	1.161***	1.159***	1.171***	1.250***
	(0.329)	(0.329)	(0.329)	(0.329)	(0.336)

Notes: (i) Estimates are based on the sample of women with children born 1996 to 2006. (ii) Dependent variable is the dummy whether child dies and the reference case for the baseline hazard is the child dying at the first day of its life. (iii) Columns A, B and C refer to Table 3.5. Columns D and E refer to Table 3.6 (iv) * p<0.1, ** p<0.05, *** p<0.01.

Appendix 3.3.

Estimates of All Coefficients from Models 1, 2 and 3: (Standard Errors):

WEST BENGAL	Model 1 Child Survival	Model 2 Child Survival	Model 3 Child Survival	Model 4 Child Survival
Female Autonomy	-	0.124	0.037	0.099
		(0.140)	(0.099)	(0.096)
Female Autonomy * Girl	-	-0.291	-0.223*	0.102*
		(0.197)	(0.134)	(0.059)
Child Characteristics				
Birth Order 2	-0.364	-0.369	-0.008	0.238
	(0.279)	(0.280)	(0.179)	(0.240)
Birth Order 3	-0.238	-0.247	-0.120	-0.048
	(0.351)	(0.352)	(0.239)	(0.343)
Birth Oder 4 or Above	0.415	0.384	0.428*	0.468
	(0.368)	(0.369)	(0.247)	(0.360)
Girl	-0.149	-0.184	-0.861***	-0.659
	(0.453)	(0.455)	(0.329)	(0.657)
Born 2000	-0.014	-0.024	0.034	-0.045
	(0.329)	(0.329)	(0.230)	(0.328)
Born 2001	-0.010	-0.014	0.118	0.263
	(0.319)	(0.320)	(0.214)	(0.293)
Born 2002	0.067	0.060	0.008	0.359
	(0.319)	(0.319)	(0.224)	(0.294)
Born 2003	0.173	0.178	0.062	-0.003
	(0.343)	(0.345)	(0.231)	(0.355)
Born 2004	-0.077	-0.089	-0.380	-0.467
	(0.393)	(0.393)	(0.290)	(0.439)
Born 2005	-0.323	-0.321	-0.361	-0.192
	(0.480)	(0.480)	(0.300)	(0.413)
Parent Characteristics				
Ma: Age at Birth	0.024	0.020	-0.202***	-0.385***
	(0.160)	(0.161)	(0.023)	(0.031)
Ma: Age at Birth Squared	-0.002	-0.002	0.003***	0.006***
	(0.003)	(0.003)	(0.001)	(0.001)
Ma: Belongs to Schleduled Caste	-0.617*	-0.610*	-0.512**	-0.656**
	(0.344)	(0.344)	(0.216)	(0.297)
Ma: Belongs to Scheduled Tribe	0.650	0.642	0.091	0.455
	(0.427)	(0.428)	(0.285)	(0.390)
Ma: Belongs to Other Backw. Caste	-0.030	-0.008	0.034	-0.151
	(0.754)	(0.755)	(0.430)	(0.606)
Ma: Muslim	0.085	0.098	-0.074	-0.014
	(0.267)	(0.271)	(0.173)	(0.231)
Ma: Complete Prim Educ or More	-0.627**	-0.629**	-0.340*	-0.340
	(0.291)	(0.292)	(0.187)	(0.247)
Pa: Complete Prim Educ or More	-0.135	-0.135	-0.195	-0.149
	(0.257)	(0.257)	(0.173)	(0.241)
Pa: Complete Sec Educ or More	0.013	0.031	-0.243	-0.150
	(0.365)	(0.366)	(0.233)	(0.323)
Rural	0.142	0.141	-0.072	-0.037
	(0.315)	(0.316)	(0.163)	(0.225)
Wealth Quintile 2	-0.005	-0.023	-0.187	0.202
	(0.273)	(0.273)	(0.240)	(0.322)
Wealth Quintile 3	-0.005	-0.015	-0.225	0.064
	(0.334)	(0.334)	(0.256)	(0.340)
Wealth Quintile 4	0.145	0.144	-0.200	0.066
	(0.406)	(0.407)	(0.250)	(0.319)
Wealth Quintile 5	0.064	0.074	-0.343	-1.144
	(0.570)	(0.571)	(0.384)	(0.734)

Baseline Hazard				
τ2	0.108	0.109	0.035	0.091
	(0.421)	(0.421)	(0.255)	(0.348)
τ3	-0.419	-0.418	-0.299	0.029
	(0.487)	(0.487)	(0.287)	(0.357)
τ4	-0.156	-0.155	-0.077	-0.050
	(0.453)	(0.453)	(0.267)	(0.368)
τ5	-0.958	-0.957	-1.509***	-2.446**
	(0.586)	(0.586)	(0.473)	(1.022)
τ6	-1.238*	-1.238*	-0.916**	-1.051*
	(0.654)	(0.654)	(0.367)	(0.543)
τ7	-0.946	-0.946	-0.708**	-1.043*
	(0.587)	(0.587)	(0.338)	(0.543)
τ8	0.072	0.073	-0.362	-0.243
	(0.442)	(0.442)	(0.309)	(0.413)
τ9	-1.984*	-1.987*	-1.664***	-2.112**
	(1.048)	(1.048)	(0.599)	(1.023)
Baseline Hazard * Girl				
τ2	-0.690	-0.690	-0.972**	-1.117*
	(0.701)	(0.701)	(0.413)	(0.575)
τ3	-0.667	-0.666	-0.632	-1.047*
	(0.827)	(0.827)	(0.433)	(0.580)
τ4	-0.412	-0.411	-0.215	-0.553
	(0.721)	(0.721)	(0.344)	(0.511)
τ5	0.394	0.396	0.817	1.443
	(0.811)	(0.811)	(0.551)	(1.120)
τ6	1.022	1.025	0.569	0.620
	(0.827)	(0.827)	(0.432)	(0.629)
τ7	0.588	0.591	0.033	0.281
	(0.790)	(0.791)	(0.441)	(0.673)
τ8	-0.172	-0.165	-0.208	-0.235
	(0.672)	(0.672)	(0.419)	(0.544)
τ9	0.155	0.171	-0.288	0.044
	(1.487)	(1.487)	(0.916)	(1.416)
Mother Level Variance	-0.000	0.000	0.000	-0.000
	(0.677)	(0.718)	(0.700)	(0.658)

	Model 1	Model 2	Model 3	Model 4
UTTAR PRADESH	**Child Survival**	**Child Survival**	**Child Survival**	**Child Survival**
Female Autonomy	-	0.122*	0.109	0.500***
		(0.067)	(0.080)	(0.146)
Female Autonomy * Girl	-	-0.243***	-0.151	-0.049**
		(0.087)	(0.100)	(0.022)
<u>Child Characteristics</u>				
Birth Order 2	-0.216	-0.219	-0.367*	-0.131
	(0.159)	(0.160)	(0.196)	(0.215)
Birth Order 3	-0.008	-0.004	0.135	0.213
	(0.171)	(0.171)	(0.190)	(0.221)
Birth Oder 4 or Above	0.318*	0.321*	0.333*	0.649***
	(0.182)	(0.182)	(0.194)	(0.214)
Girl	-0.287	-0.276	-0.345	-0.456
	(0.182)	(0.183)	(0.265)	(0.387)
Born 2000	-0.511***	-0.513***	-0.459**	-0.565**
	(0.156)	(0.156)	(0.197)	(0.227)
Born 2001	-0.214	-0.215	-0.518**	-0.296
	(0.144)	(0.144)	(0.213)	(0.216)
Born 2002	-0.049	-0.051	-0.058	-0.018
	(0.140)	(0.140)	(0.186)	(0.207)
Born 2003	-0.460***	-0.464***	-0.081	-0.410*
	(0.166)	(0.166)	(0.183)	(0.242)
Born 2004	-0.303*	-0.308*	-0.510**	-0.456*
	(0.168)	(0.168)	(0.229)	(0.254)
Born 2005	-0.704***	-0.698***	-0.648**	-0.210
	(0.217)	(0.217)	(0.266)	(0.256)
<u>Parent Characteristics</u>				
Ma: Age at Birth	-0.111*	-0.113*	-0.236***	-0.358***
	(0.066)	(0.066)	(0.020)	(0.022)
Ma: Age at Birth Squared	0.002	0.002	0.004***	0.006***
	(0.001)	(0.001)	(0.000)	(0.000)
Ma: Belongs to Schleduled Caste	0.147	0.148	0.320*	0.265
	(0.144)	(0.144)	(0.184)	(0.210)
Ma: Belongs to Scheduled Tribe	0.693*	0.684*	0.126	-0.244
	(0.407)	(0.407)	(0.155)	(0.451)
Ma: Belongs to Other Backw. Caste	0.039	0.041	-0.296**	0.221
	(0.123)	(0.123)	(0.145)	(0.188)
Ma: Muslim	-0.199*	-0.201*	-0.321**	-0.521***
	(0.120)	(0.120)	(0.163)	(0.177)
Ma: Complete Prim Educ or More	-0.171	-0.170	-0.254*	-0.357*
	(0.133)	(0.133)	(0.139)	(0.185)
Pa: Complete Prim Educ or More	-0.060	-0.061	-0.366***	-0.161
	(0.108)	(0.108)	(0.140)	(0.149)
Pa: Complete Sec Educ or More	-0.034	-0.039	0.039	-0.538***
	(0.116)	(0.116)	(0.138)	(0.161)
Rural	0.083	0.073	0.051	0.139
	(0.128)	(0.130)	(0.183)	(0.146)
Wealth Quintile 2	0.022	0.020	0.064	-0.080
	(0.116)	(0.116)	(0.208)	(0.205)
Wealth Quintile 3	0.077	0.077	0.043	0.062
	(0.139)	(0.139)	(0.214)	(0.237)
Wealth Quintile 4	-0.034	-0.041	-0.072	-0.165
	(0.169)	(0.169)	(0.278)	(0.262)
Wealth Quintile 5	-0.698***	-0.706***	0.101	-0.136
	(0.257)	(0.257)	(0.283)	(0.346)

<u>Baseline Hazard</u>				
τ2	-1.853***	-1.853***	-1.671***	-1.389***
	(0.312)	(0.312)	(0.354)	(0.402)
τ3	-0.681***	-0.681***	-0.717***	-0.373
	(0.201)	(0.201)	(0.240)	(0.267)
τ4	-0.534***	-0.533***	-1.068***	-0.355
	(0.193)	(0.193)	(0.277)	(0.267)
τ5	-1.393***	-1.392***	-1.804***	-1.505***
	(0.264)	(0.264)	(0.289)	(0.431)
τ6	-0.739***	-0.739***	-0.827***	-1.211***
	(0.209)	(0.209)	(0.253)	(0.379)
τ7	-0.349*	-0.348*	-0.629***	-0.504*
	(0.186)	(0.186)	(0.236)	(0.285)
τ8	-1.448***	-1.448***	-1.411***	-1.222***
	(0.285)	(0.285)	(0.338)	(0.403)
τ9	-2.345***	-2.346***	-1.762***	-2.260***
	(0.464)	(0.464)	(0.336)	(0.721)
<u>Baseline Hazard * Girl</u>				
τ2	0.662	0.661	0.821*	0.517
	(0.424)	(0.424)	(0.425)	(0.478)
τ3	0.202	0.200	-0.011	0.030
	(0.303)	(0.303)	(0.326)	(0.324)
τ4	0.400	0.399	0.352	0.172
	(0.283)	(0.283)	(0.354)	(0.313)
τ5	0.258	0.257	0.000	0.143
	(0.390)	(0.390)	(0.000)	(0.558)
τ6	0.493	0.493	0.129	0.480
	(0.300)	(0.300)	(0.336)	(0.452)
τ7	0.773***	0.773***	0.539*	0.797***
	(0.262)	(0.262)	(0.285)	(0.305)
τ8	1.071***	1.074***	0.533	0.986**
	(0.368)	(0.368)	(0.427)	(0.448)
τ9	1.369**	1.372**	0.919	1.270
	(0.558)	(0.558)	(0.873)	(0.804)
Mother Level Variance	0.790***	0.777***	0.834***	0.856***
	(0.152)	(0.150)	(0.161)	(0.161)

<u>Notes:</u> (i) Estimates are based on the sample of women with children born 1996 to 2006. (ii) Dependent variable is the dummy whether child dies and the reference case for the baseline hazard is the child dying at the first day of its life. (iii) Model 1: duration specification without female autonomy variable; Model 2: duration specification with female autonomy indices; Model 3, covariate measurement error model, Model [4], structural equation model specification. (iv) * $p<0.1$, ** $p<0.05$, *** $p<0.01$. (v) Log likelihood values for Model 3 are not comparable to the other Model values.