

# Maternal Autonomy and the Education of the Subsequent Generation: Evidence from three contrasting states in India

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## **Abstract**

This paper makes a significant contribution on both conceptual and methodological fronts to the analysis of the effect of maternal autonomy on school enrolment age of children. The school entry age is modelled using a discrete time duration model in which maternal autonomy enters as a latent characteristic associated with various parental and household characteristics which also conditionally affect school entry age. Model identification is achieved by using proxy measures - economic, decision-making, physical and emotional autonomy of a woman - collected in the third round of the National Family Health Survey of India. We concentrate on three states in India – Andhra Pradesh, Kerala and Uttar Pradesh. Our results indicate first, that in Kerala, female autonomy is a norm and therefore not associated with socio-economic characteristics of the woman or her family, while in the other two states, it is strongly correlated with these characteristics. Second, female autonomy, in its turn, has a different impact in different states. It is significant in influencing the school starting age in UP, is less important in AP and not significant in Kerala. Third, in contrast to AP and Kerala, in UP, the effect of maternal education is found to act only via female autonomy.

**Keywords:** Latent Factor Models; Structural Equation Models; Female Autonomy; School Enrolment Decisions; India; National Family Health Survey.

**JEL:** I2, J12, C35

## **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 autonomy of women within the household. Academic researchers as well as policy makers have long argued that female autonomy will help improve family welfare because women are more altruistic in their decisions with regard to the family than men. Intuitively, a woman's autonomy is likely to affect the education of her children by improving her bargaining power, her mobility and ability to collect and process information regarding schooling and to act on this information. In this paper, we analyse the impact of mother's autonomy on children's starting age in school in India.<sup>1</sup> Although India has made impressive strides in improving its primary schooling record, there is, however, still room for substantial improvement. Data from the UNICEF (2004) suggest that an estimated 42 million children aged 6 to 10 are not in school. Our analysis is based on the third round of the National Family Health Survey of India (NFHS3).

The paper makes a significant contribution on both conceptual and methodological fronts. It is innovative in the way in which it models child school entry age as well as how female autonomy is conceptualised and treated in the model of school entry. First, while most studies within the literature on education have concentrated on enrolment and performance of children in school, in this paper, we study the school starting age (SSA) which provides a new and interesting perspective. To begin with, the SSA may be seen as an early indicator of the educational prospects of the child because it encompasses considerable information relating to the interest taken by parents in the child's education, their priorities and the constraints they face. In addition, different SSAs across children throw up a number of pedagogical challenges since they imply that each class has children of different ages within it. Understanding the factors that influence the SSA therefore is very important from a policy point of view. Modelling this, however, is not very straightforward and the paper makes a methodological innovation by modelling 'entry into school' in the context of duration analysis. This approach allows us to address two issues – right censoring of data and

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<sup>1</sup> We use the terms female autonomy, mother's autonomy and women's autonomy to mean the same thing in our context.

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.

The second significant contribution of this paper is in the way in which we treat and model the impact of female autonomy on school enrolment age. Female autonomy is an end in itself and also an instrument to help achieve household welfare objectives. While some authors have used proxies like female education, employment and wealth, others have used direct responses to questions relating to women's freedom and decision-making power. The latter group of writers has in turn varied in its approach, both using summary indices of responses to these questions and using the responses separately. The concept of autonomy itself is intrinsically vague and faces two main problems in empirical work. First, variables like education which are often used to capture female autonomy have both a direct effect on the outcome variable (like child education, child health or household consumption) and also an indirect effect via autonomy. Secondly, proxies that are often used to measure autonomy do not perfectly capture this concept and produce equations with covariates that are correlated with the equation error term resulting in endogeneity problems.

In this paper, we attempt to address these issues by modelling female autonomy as a latent trait which cannot be directly measured. We then assume that detailed responses to questions relating to economic, decision-making, physical and emotional autonomy of a woman collected in our dataset provide proxy measures of her autonomy. Common variation in these measurement variables are then used to infer the properties of the latent factor of female autonomy.<sup>2</sup> In a country such as India, woman's autonomy is rooted in the customs and traditions of the woman's surroundings. As these cultural factors are hard to shift – at least in the short run, the woman herself does not exert much control over her autonomy. Recognising this, we treat autonomy as an exogenous cultural trait but allow it to be

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<sup>2</sup> 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.

correlated with a number of socio-economic factors pertaining to the woman herself, her partner and the household she lives in.

This methodology<sup>3</sup> improves on past studies in two significant ways. First, it allows us to separate the direct effects of important covariates in the model from their indirect effects, which work through the impact of these factors on female autonomy. Second, our approach allows us to deal with the possible endogeneity of these covariates in the model, due to their correlation with unobservable factors such as autonomy.

We present within-state analysis for three contrasting states in India – Kerala (a progressive, relatively developed state), Andhra Pradesh (one of India's Southern states, often considered to be the median state in India) and Uttar Pradesh (a North Indian state which is traditionally seen as having relatively low levels of female autonomy) (Dreze and Sen, 1996). In a diverse country like India, customs and cultural traditions vary considerably from one state to the next. Interstate comparisons, therefore, are not easy to make and our main focus is on within state variations. Nonetheless, we compare our results across states in an attempt to consider how patterns vary.

The paper is structured as follows. Section 1 lays out the research questions motivating the present analysis. Section 2 describes the issues connected to primary education in India and Section 3 explains the concepts and issues of female autonomy. Section 4 describes the data, measurements and summary statistics. The econometric methodology is laid out in Section 5, the results of which are outlined in Section 6. Section 7 discusses the implications and concludes.

## **1. Research Questions**

This paper concentrates on two main questions – what role does mother's autonomy play in determining the school starting age and what factors are related to mother's autonomy in their turn?

The age at which children start school, has caused considerable debate in public discourse (see Elder and Lubotsky, 2007; Cascio and Schanzenbach, 2007). This literature is of limited relevance for us because it covers relatively developed countries where school enrolment ages vary only at the margin as a result of children being born in different months

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<sup>3</sup> Our approach, which is the latent factor modelling, is similar to the one used by previous studies scrutinising cognitive and non-cognitive abilities (Hansen et al., 2004; Heckman et al., 2006; for instance) although there are some fundamental differences which we point out later.

of the same year. In many developing countries, by contrast, the variation is considerable with starting ages varying by years (as we see in Table 1) and some children never entering school. Such late enrolment delays the accumulation of human capital and also decreases its expected lifetime amount. Angrist and Krueger (1991), for instance, show that earlier enrolment increases lifetime earnings. In such a context, the SSA could be considered as an early indicator of child welfare and adult labour market performance. 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 factors that influence the SSA and the impact that mother's autonomy has on it are the central issues dealt with in this paper. Female autonomy in our study, as in many others, can be seen as the ability of women to be independent in four areas – emotional, decision-making, physical and economic autonomy. 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 reflects the ability of the woman to make independent decisions. 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. 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 obtain and process 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.

Finally, mothers with economic autonomy also have economic freedom and this helps them to prioritise schooling, if they wish. 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 school starting age of children.

Before we empirically analyse the role of female autonomy on the SSA, we will consider the institutional background for schooling in India next.

## **2. Primary Education in India**

In India, the prescribed age of starting primary school is 6 years. For children aged 6-11 in our data at the time of the interview, the school starting age distribution for all-India as well as for the three states under consideration, is given in Table 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 in India. The 'more developed' state Kerala has a smaller window in which children enter school while for AP and UP, this window lasts from 6-8 years and 6-9 years respectively. Thus, 97% of children at school started at the age of 6 in Kerala, the corresponding figure for UP is 57% and for AP is 81%.

In India, children who start late begin at the beginning and enrol 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. In 2004-2005, 14% of children in primary school were not in the 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 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, India's flagship education programme, the Sarva Shiksha Abhiyan, set itself the goal of achieving universal elementary education by 2010. Enrolling out of school children, enforcing the school starting age and improving school quality are all crucial in achieving this objective. 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.<sup>4</sup> Amongst the three states we consider in this paper, Kerala benefited from being in Phase I of the District Primary Education Programme (DPEP), a precursor to the Sarva Shiksha Abhiyan put forward in 1993/4. Andhra Pradesh (AP) and Uttar Pradesh (UP) were covered in Phase II of the programme begun in 1997/8.

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 net primary school enrolment rate for boys was approximately 91% between 2005 and 2009 and approximately 88% for girls (UNICEF, 2008). There is, however, still room for improvement. According to the UNICEF (2004), for instance, an estimated 42 million children aged 6 to 10 in India are still not attending school. Furthermore, gender differences appear widespread, making an analysis of factors influencing schooling crucial.

### **3. Female Autonomy: Concepts and Issues in the Literature**

As indicated above, our main 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; Afridi, 2005; Durrant and Sathar, 2000; and Aslam, 2007). However, the broader literature on autonomy, which scrutinises the influence of female autonomy on a number of welfare outcomes in addition to child schooling, has much to contribute to our analysis in this paper. We will, therefore, first consider the broader literature and then turn our attention to education.

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. Our concern in this paper is with the outcome which determines women's ability to make independent decisions. Attempts to measure female autonomy have relied on two broad categories of variables: variables proxying autonomy through women's characteristics (her age, education and

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<sup>4</sup> Government of India, Annual Report 2007–2008.

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<sup>5</sup> as well as variables capturing the woman's labour market experience.<sup>6</sup> These reduced form measures do not allow us to disentangle the direct influence of these variables on the outcome variable from those indirect influences via their influence on autonomy.

In recent years, Demographic and Health Surveys have started collecting information centred on the woman's direct perceptions of her own autonomy. These relate 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.<sup>7</sup> Although the information contained in these questions can give important insights into the workings of female autonomy, it still remains far from clear how it is to be translated into a measure of autonomy. Two approaches on how to use the information contained in the woman's responses are prominent.

The first approach focuses on specific dimensions of autonomy. This reflects the rationale that female autonomy is context specific and that the importance of different dimensions may vary from one setting to the next. This approach would include answers relating to specific dimensions of autonomy directly into the outcome model. 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), Jejeebhoy (2000) 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. A drawback of this approach is in the underlying assumption that the answers to the questions provide a perfect measure of the underlying unobserved autonomy trait.

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<sup>5</sup> See for example, Quisumbing and Maluccio (2003) and Thomas, Contreras and Frankenberg (2002).

<sup>6</sup> DeRose (2002) uses continuity of woman's work.

<sup>7</sup> Information on gender preferences for children is another variable which is often used for measuring the attitudes of the woman (Yount, Langsten and Hill, 2000).

The second approach employs summary indices constructed from answers to questions mentioned above. For example, 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 as do Chakraborty and De (2011) who create an index from the principal components of a variety of household variables on which the mother of a child takes decisions. This approach, however, has also been criticised on the grounds that it is too simplistic and ignores differences across measures (Agarwala and Lynch (2007)). The addition of qualitative answers into a single index implies that each answer is given an equal weight in determining a woman's autonomy. There are good reasons, however, to believe that some aspects of a woman's life are more important for her autonomy than others.

To allow autonomy to be multi-dimensional while also allowing the weights of the various dimensions to be endogenously determined, we model female autonomy as a latent factor that cannot be observed directly but is assumed to affect a number of measures which can be used to capture the autonomy trait empirically.<sup>8</sup> Common variation in these measurement variables are used to infer the properties of the latent factor of female autonomy. While we allow it to be multi-dimensional, female autonomy itself is assumed to be an exogenous variable in our model determined by the customs and traditions of each woman's surroundings. If any change in these attitudes is achievable, it is likely to take a long time. There is quite a large literature confirming the relative exogeneity of such institutions in the short run. Roland (2004) described social institutions as 'slow moving', while Williamson (2000) argues that they impose constraints on lower level institutions. Gintis (2001) and Bisin and Verdier (2000) see cultural preferences as being transmitted through socialisation, a process that can, once again, be expected to take time. Guiso et al (2006) attempt to explain the slow pace of change of these institutions by arguing that the organisations that play a role in promoting them (the state, church etc) may have a vested interest in the continuation of such institutions. Finally, Gintis (2001) argues that such cultural rules persist because values are internalised making the adoption of other cultural traits psychologically costly. We therefore treat it as exogenous in our model which uses information over a period of 10 years, but allow it to be correlated with covariates such as religion, caste, education etc. This methodology enables us to address the endogeneity of

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<sup>8</sup> A list of variables is provided in Appendix 1.

variables such as the education of the woman, in the outcome equation due to correlation with the unobserved autonomy trait.

### ***Female Autonomy and its Impact on Child Schooling***

While the impact of female autonomy on household welfare has attracted much attention in the literature, in this paper, we are concerned with the impact on child educational outcomes. Quisumbing and Maluccio (2003) and Afridi (2005) 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. Chakraborty and De (2011) find that the children of Mexican mothers with greater autonomy have higher enrolment in and lower probability of dropping out of secondary school. Durrant and Sathar (2000) find that although a higher status for individual women in Pakistan enhances child survival and boys' school attendance, community-level autonomy is more important for improving the chances of girls attending school. Smith and Byron (2005), 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.

## **4. 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. 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 including 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.<sup>9</sup>

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

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<sup>9</sup> 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.

this paper we concentrate on three states (Andhra Pradesh (AP), Kerala and Uttar Pradesh (UP)) in order to keep the discussion focussed. AP, Kerala and UP are interesting to analyse because they cover a range of conditions with regard to both child welfare outcomes and female autonomy. First, while Kerala has very high rates of school enrolment and adult literacy and education levels, UP has one of the lowest in India. AP is in between these extremes and, on many measures, 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 89% of boys and 90% of girls in Kerala. In AP, 77% of boys and 66% of girls aged 6 to 17 are enrolled in school.<sup>10</sup> Again, while 1% of children in Kerala never entered school in our sample, this figure is 8% in AP and 18% in UP (Table 1). More crucially for our analysis, 69% of mothers in UP, 46% in AP and only 3% in Kerala have never attended school (Table 1). In addition, while 16% of women in Kerala have tertiary education, the figure for AP and UP is 6%. The difference in mother's education across the states is crucial because it could influence child education both through its impact on autonomy and, more directly in terms of parental preference for school enrolment. Second, these states also diverge significantly in terms of their prosperity: in 2004/5, UP had a per capita GDP of Rs. 12198 approximately, whereas Kerala's was two and half times as much at Rs. 29,065 approximately and AP was Rs.23755.<sup>11</sup>

Third, the three 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 Kerala 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 patriliney 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 system itself, Kerala and AP present two different cases. Kerala has

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<sup>10</sup> DHS Final Report on India (2006).

<sup>11</sup> Ministry of Finance, Government of India (2009).

a broadly matrilineal system (though this is increasingly being eroded) within which women have significant economic and social rights. AP, on the other hand, like most of the rest of India has a patrilineal system, though its kinship system is broadly South Indian. Once again, therefore, it falls between UP and Kerala. While our analysis highlights intra-state patterns in autonomy, it will also be interesting to compare how our results vary across states.

### ***Female Autonomy in India***

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 1.

Information on economic autonomy in this dataset is captured through questions relating to whether the woman has a say about what should be done with her husband's money and whether she has money for her own use. Table 2 row [1] presents summary measures for the responses to these questions for the three states under consideration. About two-thirds of women at the All-India level (71%) have some say in what happens to the money of their husband. In comparison, this figure is 80% in UP, 56% in AP and 61% in Kerala. A lower percentage, 45%, of women in India have money for their own use and the corresponding figures are 22% in Kerala, 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 2 row [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 had 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. Kerala too is at or above the All-India average on all four decisions though marginally lower on the purchase of small household items. AP is lower than the All-India average on all four measures.

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, followed by those from AP and finally from Kerala. The respective figures are reported in Table 2 row [3].

Finally, emotional autonomy is captured by considering questions on physical violence and sexual relations within the household. Again, UP women fare better than the All-India average on all 10 of these questions whereas in the case of Kerala and Andhra women, emotional autonomy varies according to the question being asked. Summary measures of the responses to these questions can be found in Table 2 row [4].

As mentioned earlier, many studies aggregate qualitative responses into indices. For the purposes of comparison, we also present aggregate responses for each dimension (row [5]) and the overarching concept of autonomy are reported in Table 2 row [6]. The index for female autonomy takes a maximum value of 19 and an average of 13.8 for the All-India sample. The mean value for AP is 12.8 with a standard deviation of 4.0. Compared to All-India average and dispersion, AP has a lower mean and also higher dispersion. The average for Kerala is much closer to the All-India average. Interestingly, the UP average is higher and also the distribution of the index is much less dispersed relative to the All-India index. Given the complexity of the concepts concerned, we do not pool our analysis to use cross-state variations. Instead, we concentrate on within-state variations, which also recognises the fact that women in different states might respond differently to these questions due to cultural and traditional differences.

## **5. Econometric Methodology**

Our estimation methodology uses survival analysis in which female autonomy is treated as a latent construct which is allowed to be correlated with the covariates in the equation. 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 1<sup>st</sup> 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  $k$ th interval ( $k=1,\dots,6$ ) denotes the conditional probability of a child entering school in the  $k$ th interval conditional on not having enrolled in school before,

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

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

$$p_{ij}(d) = h_{ij}(d) \prod_{k=1}^{d-1} \{1 - h_{ij}(k)\} \quad (2)$$

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

$$p_{ij}(d) = \prod_{k=1}^d \{1 - h_{ij}(k)\} \quad (3)$$

The above model consisting of equations (2) and (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

$$h_{ij}(k) = \frac{\exp(x'_{ij}\alpha + \tau_k + \lambda_F\eta_{Fj}^{(3)} + \eta_{Cij}^{(2)})}{1 + \exp(x'_{ij}\alpha + \tau_k + \lambda_F\eta_{Fj}^{(3)} + \eta_{Cij}^{(2)})} \quad (4)$$

$x_{ij}$  is a vector of observable child and family specific characteristics (to be discussed later) that influence  $h_{ij}(k)$  and  $\alpha$  is the vector of parameters associated with  $x_{ij}$ .  $\tau_k$  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  $\lambda_F$  which is known as the factor loading, is our parameter of interest.<sup>12</sup>  $\eta_{Cij}^{(2)}$  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. The superscripts indicate the level of the variable under consideration. In addition, we also allow for an additional cluster at the district level which forms the 4<sup>th</sup> level. However, we do not explicitly show this to keep the notation simpler.

As per our previous 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 (see earlier discussions). In addition, we also allow this latent trait to depend on when the woman was born. For mother  $j$ , this is specified as

$$\eta_{Fj}^{(3)} = \theta'z_j + \zeta_{Fj} \quad (5)$$

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

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<sup>12</sup> For identification and facilitating inter-state comparisons the variance of female autonomy is set equal to one in the estimation.

autonomy and specify the relationship between these spheres of autonomy ( $\eta_{lj}^{(3)}$  with  $l=1,\dots,4$ ) and  $\eta_{Fj}^{(3)}$  as

$$\eta_{lj}^{(3)} = \beta_l \eta_{Fj}^{(3)} + \zeta_{lj} \quad (6)$$

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 ( $\zeta_{lj}$ ).

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 (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 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

$$v_j = \delta_j + \Lambda \eta_j^{(3)} \quad (7)$$

where  $\delta_j$  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  $\Lambda$  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 which is assumed 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 any estimator that does not account for this correlation, inconsistent. By contrast, equation (5) allows us to explicitly incorporate the fact that female autonomy is correlated with a sub-set of the covariates.

Appendix 1 provides further details of the full specifications and the restrictions needed for identification. Figure 1 provides a simple representation of the path diagram associated with the various relationships that are considered here.<sup>13</sup>

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<sup>13</sup> 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

### *Estimation of the Model*

Equations (4) to (7) form the basis of our model and they are estimated jointly using maximum likelihood method under the assumption that  $\zeta$  is normally distributed.<sup>14</sup>

## **6. Results**

The empirical analysis focuses on a sample of children aged 6 to 11. For AP, the sample size is 2419 children born to 1737 mothers. The corresponding figures for Kerala are 1051 and 842 and for UP 6510 and 4160. The model estimated allows a number of additional factors to influence children's entry into school. These comprise characteristics of the child, the mother, the father, the household and the baseline hazard. The child'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, interval specific indicators and indicators for the year the child turned 6 are included. The former make up the baseline hazard and 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.

We estimate four models. Model 1 analyses school entry without allowance for 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. Models 2 and 2a, conversely model female autonomy via an index constructed as a z-score 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 3. Since the latent factor in Model 3 is restricted to have zero mean and unit variance, we enter the aggregate autonomy index in Model 2 as a z-score to facilitate comparison between the

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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.

<sup>14</sup> We use GLLAMM (Rabe-Hesketh, Skrondal and Pickles, 2004) in Stata (StataCorp., 1985) to estimate the model parameters. The programme can be downloaded at [gllamm.org](http://gllamm.org).

models. The approach used in Model 2 corresponds to the usual way of capturing female autonomy. Model 1 includes a random intercept at the child-, mother- and district-level. Model 2 is estimated once with the three aforementioned random intercepts (Model 2) and once only with a random intercept at the child- and district-level (Model 2a).

Finally, Model 3 is our structural equation model specification summarised in equations (4) to (7) where each sphere of female autonomy is captured by a number of fallible measures. 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 1). The socio-economic factors in this figure are represented by the vector  $z_i$  and the arrow to the latent factor of female autonomy indicates their influence on this concept. 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.

### **6.1 Female Autonomy & School Starting Age**

We present the coefficient estimates and the standard errors for our main variables of interest: female autonomy and the baseline hazard variables in Table 3 and the rest in Table 4. 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 picked up by the aggregate index for female autonomy.<sup>15</sup> In Model 3, the mother level unobservable effect is picked up by the ‘autonomy’ variable. The estimates of the variance of the mother-level random effect are reported at the bottom of Table 3.<sup>16</sup> Significant unobserved heterogeneity is found in UP and AP (Models 1 and 2).<sup>17</sup> Only Kerala shows no signs of such heterogeneity. Furthermore, the inclusion of the aggregate index does not seem to help to capture this heterogeneity (Model 2).<sup>18</sup> 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

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<sup>15</sup> 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. Model 3 allows for this correlation.

<sup>16</sup> Note, one cannot identify the variance of the autonomy variable separately from that of the effect of the autonomy in Models 1 and 2. The variance is restricted to be 1 in Models 2a and 3.

<sup>17</sup> Same conclusion is drawn from a comparison of the maximised values of the log likelihood.

<sup>18</sup> Models 1, 2 and 2a are not nested within Model 3 and thus not comparable with Model 3 in terms of log likelihood values.

different from zero in these states. If the index was 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), does not make a significant difference to the results in any of the three 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.<sup>19</sup>

In Kerala, both the effects of female autonomy and its interaction with the girl dummy are insignificant. The estimates for UP paint a different picture. In models 1 and 2, mother level random effects are very significant in determining school entry. In model 3 for UP, the female autonomy variable and its interaction with girls are both highly significant. Our results indicate that, like UP, mother level random effects are significant in AP with the size of the effect being larger 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 marginally significant and only for girls and in Kerala, it is not significant at all. In summary, once allowance for correlation between covariates and female autonomy is allowed for, we find a significant female autonomy effect in UP only.

Comparing the results to Model 2 and Model 2a, we find that the use of the aggregate index does not help 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 and for the final indicator (children's education in our case) 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

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<sup>19</sup> 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)).

well as their interrelations, the effect of female autonomy is attenuated. We discuss this issue further in Section 7 of the paper.

Finally, we estimate that a two standard deviation increase in female autonomy is associated with a 0.4 percentage point increase in primary school enrolment by age six in AP and in Kerala with 0.3 percentage points. In UP, by contrast, the difference in enrolment rates is 2 percentage points, which implies that for every 1000 children in UP, an extra 20 children would have been enrolled by age 6 which is the recommended school starting age, if the mother's autonomy level was higher by 2 standard deviations from the mean.

## **6.2 School enrolment probability age profiles**

We next turn to the age profile of 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  $\tau_k$  coefficients given in equation (6). We allow this to be different for boys and girls. The results are reported in Table 3. The reference case is entry at the recommended age of six.

In Kerala, unsurprisingly, the conditional probability of entering school is not found to vary significantly after 8 years. In Model 3, there is evidence that this probability decreases with age (up to 8 years but not beyond) but no gender differences in this probability are found.

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). In Models 1 and 2, the probability of school entry is found to increase 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) in the 8-9 years age group. Model 3, by contrast, indicates an inverted U-shaped hazard for boys wherein the probability of going to school first increases between 6-7 years but decreases thereafter. For girls in UP, on the other hand, even in Model 3, the probability of going to school keeps decreasing and then becomes insignificant. Thus, our preferred Model 3 leads us to conclude that if children are not in school by 7 years in UP, then the probability that they will enrol 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). 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 significant conditional probability relative to those of boys is at 7-8 years. Thus, in conclusion, the longer the children stay out of school in AP, the less likely they will enter school. In addition, there are no gender differences in the conditional probability of school entry in AP.

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. However, as parents recognise that time is passing and they need to send their children to school, the school entry probabilities increase at the beginning but, beyond a certain age, only the more difficult cases remain and parents may simply decide that it is 'too late'. Our results also seem to confirm that the norm for schooling is very strong in Kerala and the lack of variation in school starting ages.

### **6.3 Female Autonomy and its Correlates (equation (5)-(7))**

Our preferred model is Model 3 where we assume that the answers given to a set of nineteen questions (see Appendix 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 5. Since the autonomy variable is set to 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 across the three states. For Kerala, the only significant correlation with autonomy appears to be for female education. Furthermore, there are no significant differences in female autonomy across cohorts, except for women born in the most recent cohort (the youngest) who have the least autonomy. This is not surprising because they are young and are likely to be less confident. Also, they may have to answer both to husbands and mothers-in-law.

In contrast to Kerala, 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 women's autonomy in both states. 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.

One interesting and noteworthy property of our Model 3 is that it allows us to separate out the direct effect of covariates on autonomy and the effects of these covariates on SSA conditional on autonomy. In AP and Kerala, as we saw above, mother’s education has a significant positive effect on autonomy and also on SSA conditional on autonomy. However both the effects are much smaller in AP compared to Kerala. In contrast, in UP, mother’s education only has an effect on autonomy and not on SSA once we condition on autonomy.

These results emphasise the importance of allowing for the correlation between female autonomy and other characteristics of the woman and the household as we have done in Model 3. The heterogeneity exhibited by these results is noteworthy and emphasises the complexity of the concept of female autonomy. The fact that the correlations between the explanatory variables and the autonomy variable 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.

Our specification in Model 3 also 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 A2.1 in the Appendix. Appendix Table A2.2 reports the estimated factor loadings. In the interest of space, we do not discuss these results. The interested readers can find these discussions in our working paper Alfano et al. (2011).

The structural model specification allows us to estimate the latent autonomy factor score conditional on the data. The Kernel density estimates for each of the three states are reported in Figure 2. The estimated factors have been standardised to have zero mean and variance of 1. The distribution is positively skewed and flatter for AP and UP.

Prima facie, the present findings suggest four conclusions. First, in situations like Kerala where the social ‘norm’ for school entry at 6 years exists and is strong, female autonomy (or any other household and parental characteristics) is not significant in influencing school starting age. Of course, these results can also be interpreted as indicating

that when the norm for schooling is strong, there is little variation left for covariates to explain. Secondly, in situations (like UP) where there is considerably more variation in SSA, female autonomy is extremely significant in influencing school starting age. Third, in some states (like AP), school entry at 6 years is not a norm. It is influenced by a number of factors including household wealth and religion but not female autonomy. Fourth, 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.

## **7. Discussion and Conclusion**

As indicated earlier, female autonomy is an end in itself but also a means to better welfare outcomes within the home. Our results in this paper indicate that mother's education is crucial in all three states, in influencing female autonomy and through this in influencing the SSA. The direct impact of mother's education on SSA is apparent only in Kerala and AP but not in UP. Using mother's education as a proxy for autonomy in the outcome equation, as a number of previous papers have done, would therefore obscure at least part of this picture. The methodology used in this paper enables us to separate the direct effects of important covariates on autonomy from the effects on the outcome of interest conditional on autonomy.

Our more detailed analysis offers greater insight into the role played by female autonomy in influencing school entry in Kerala and AP/UP. First, female autonomy is unaffected by the socio-economic characteristics of the woman (except her education) and her family in Kerala. This confirms that female autonomy is a 'norm' in Kerala, one that is experienced by women of different characteristics. This is in contrast to AP and UP where almost all the socio-economic characteristics (caste, religion, birth cohort, rural abode) influence female autonomy. In UP, for instance, maternal autonomy depends heavily upon the socio-economic characteristics of the woman reflecting the fact that women from groups with certain socio-economic characteristics enjoy autonomy while others do not.

Our second main finding in this paper is that, like female autonomy, starting school at the prescribed age of 6 years is also more of a norm in Kerala. It is not affected by female autonomy or by other household characteristics, except by the level of education of parents. In AP and UP, on the other hand, the school starting age is significantly affected by caste, religion, wealth and initial conditions as well as female autonomy, which influences both boys and girls in UP but only girls in AP. These results indicate that while children from

some families in these states start school at the prescribed age, others do not. It is therefore not surprising that the school starting age window is much longer in AP and UP than in Kerala and that right censoring is also more prevalent in UP than in Kerala.

From the point of view of policy and India's commitment to the second MDG goal of achieving universal primary education, our results therefore indicate that in states like Kerala much less remains to be done with regard to both maternal autonomy and school entry than in states like AP and UP. In the latter, an attempt to target families with certain household characteristics could help to simultaneously improve both female autonomy and school outcomes. Female autonomy is an outcome variable in its own right and is also an important input into the schooling of future generations of children. The crucial importance of schooling, in its turn, is borne out by the fact that the one variable that is significant in all three states in influencing both female autonomy and child education is the parent's education. The estimated average partial effects of maternal education on the probability of children enrolling in school were: 0.03 for AP and Kerala, and 0.11 for UP. Given the average enrolment rate at age 6 of 0.57 for UP, an increase of 0.11 points is a very large increase. This reinforces the point that educating current generations is crucial for the well-being of future generations.

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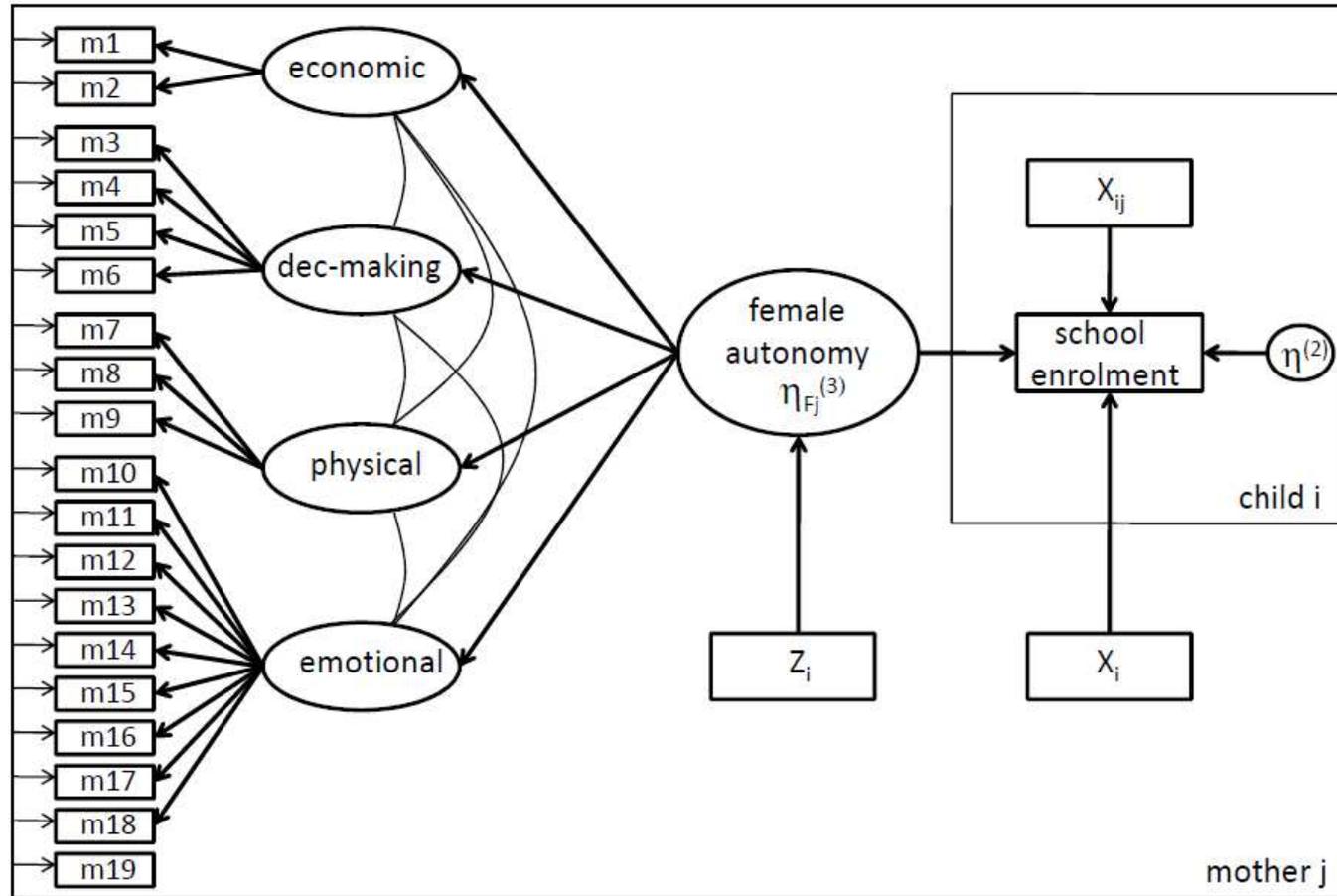
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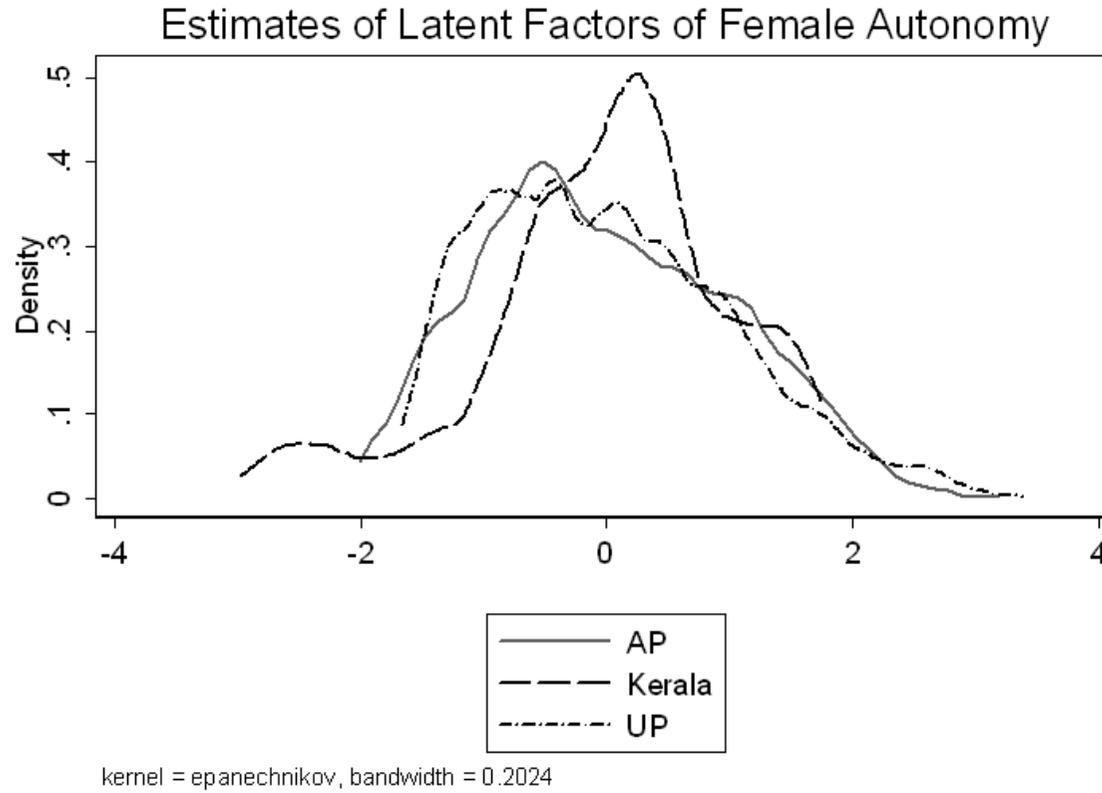
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**Figure 1: Path Diagram**



**Notes:** (i) Path diagram represents workings of our statistical model given in equations (4)-(7). (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.

**Figure 2: Kernel Density Estimates of Female Autonomy from Model 3**



**Notes:** The estimated factor score has been standardised to have 0 mean and variance of 1.

**Table 1: Educational Attainments of Children and Parents (Percentages):**

		<b>India</b>	<b>AP</b>	<b>Kerala</b>	<b>UP</b>
[1]	<b><u>Age When Child Started School</u></b>				
	<b>6</b>	70	81	97	57
	<b>7</b>	10	8	2	14
	<b>8</b>	4	2	0.1	7
	<b>9</b>	1	0.2	0.3	2
	<b>10</b>	0.3	0.04	0	0.4
	<b>11</b>	0.02	0	0	0.02
	<b>Censored</b>	14	9	0.7	19
[2]	<b><u>Child's Educational Attainments (measured at the time of the interview)</u></b>				
	<b>Never Attended School</b>	13	8	1	18
	<b>Entered School</b>	7	4	5	10
	<b>Advanced to the next grade</b>	76	85	93	69
	<b>Repeating the previous grade</b>	2	1	1	2
	<b>Dropped out of school</b>	1	1	0.3	1
[3]	<b><u>Mother's Educational Attainments</u></b>				
	<b>Never Attended</b>	47	46	3	69
	<b>Primary Education</b>	16	14	11	10
	<b>Secondary Education</b>	31	34	71	16
	<b>Tertiary Education</b>	6	6	16	6
[4]	<b><u>Father's Educational Attainments</u></b>				
	<b>Never Attended</b>	26	31	3	31
	<b>Primary Education</b>	19	18	17	16
	<b>Secondary Education</b>	44	39	68	42
	<b>Tertiary Education</b>	11	12	12	11

**Notes:** The percentages are based on the sample of children aged 6-11 at the beginning of the academic year April 2005

**Table 2: Descriptive Statistics of Female Autonomy Measurements**

		<b>India</b>	<b>AP</b>	<b>Kerala</b>	<b>UP</b>
[1]	<b><u>Economic Autonomy: binary indicators</u></b> Woman decides on husband's money - % Woman has money for own use - %	71 45	56 59	61 22	80 65
[2]	<b><u>Decision-Making Autonomy: binary indicators</u></b> Woman decides on own health care - % Woman decides on small household purchases - % Woman decides on large household purchases - % Woman decides on staying with family and friends - %	70 68 60 67	64 62 55 65	75 67 62 78	72 68 64 61
[3]	<b><u>Physical Autonomy: binary indicators</u></b> Woman can go to market - % Woman can go to places outside the community - % Woman can go to health facility - %	91 94 97	87 95 97	80 85 94	91 95 97
[4]	<b><u>Emotional Autonomy: binary indicators</u></b> Woman believes her husband is not justified beating her if... She goes out without telling him - % She neglects house and children - % She argues with him - % She refuses sex - % She burns the food - % She is unfaithful - % She is disrespectful - % Woman believes she is allowed to refuse sex if... Her husband has other women - % Her husband has a sexually transmitted disease - % She is tired - %	67 60 66 82 81 69 54 81 82 80	55 50 61 72 73 57 47 80 78 77	63 55 73 83 78 76 56 75 76 72	75 72 72 90 82 74 62 85 88 89
[5]	<b><u>Traditional female autonomy indices for spheres</u></b> Economic Autonomy: average of the sum from questions in [1] (S.D.) Decision-Making Autonomy: average of the sum from questions in [2] (S.D.) Physical Autonomy: average of the sum from questions in [3] (S.D.) Emotional Autonomy: average of the sum from questions in [4] (S.D.)	1.2 (0.7) 2.6 (1.5) 2.8 (0.5) 7.2 (2.6)	1.1 (0.7) 2.5 (1.7) 2.8 (0.6) 6.4 (3.0)	0.8 (0.7) 2.8 (1.4) 2.6 (0.8) 7.1 (2.4)	1.4 (0.7) 2.6 (1.5) 2.8 (0.6) 7.9 (2.4)
[6]	<b><u>Traditional female autonomy index</u></b> Female Autonomy Index: average of the sum from questions in [1], [2], [3] and [4] (S.D.) Median (Interquartile Range)	13.8 (3.5) 14 (5.0)	12.8 (4.0) 13 (6.0)	13.4 (3.3) 14 (5.0)	14.8 (3.3) 15 (4.0)
[7]	<b>Number of Women</b>	42,282	1,737	842	4,160

**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 definitions of these variables are given in Appendix 1.

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

	AP				KERAL				UP			
	Model 1 [1]	Model 2 [2]	Model 2a [3]	Model 3 [4]	Model 1 [1]	Model 2 [2]	Model 2a [3]	Model 3 [4]	Model 1 [1]	Model 2 [2]	Model 2a [3]	Model 3 [4]
<b>Female Autonomy</b>	-	-0.044 (0.098)	0.024 (0.075)	-0.026 (0.076)		0.327 (0.281)	0.312 (0.250)	0.001 (0.032)		0.007 (0.052)	-0.017 (0.035)	1.315*** (0.066)
<b>Female Autonomy * Girl</b>	-	0.130 (0.132)	0.078 (0.106)	0.206* (0.122)		-0.048 (0.389)	-0.057 (0.358)	-0.002 (0.045)		0.051 (0.066)	0.028 (0.048)	0.082*** (0.026)
<b>Baseline Hazard:</b>												
<b>Age Interval 6-7</b>	0.040 (0.467)	0.028 (0.414)	-0.826 (0.529)	-1.053*** (0.167)	-0.694 (1.155)	-0.722 (1.207)	-1.255 (0.852)	-1.577** (0.652)	0.410*** (0.150)	0.398*** (0.149)	-0.353*** (0.113)	-0.784*** (0.077)
<b>Age Interval 7-8</b>	0.392 (0.763)	0.366 (0.676)	-0.639 (0.875)	-1.014*** (0.280)	-2.041 (1.724)	-2.002 (1.708)	-2.592* (1.430)	-2.854** (1.267)	1.442*** (0.226)	1.423*** (0.223)	0.239 (0.180)	-0.283*** (0.104)
<b>Age Interval 8-9</b>	-1.936** (0.894)	-1.966** (0.820)	-2.931*** (0.983)	-3.291*** (0.495)	1.378 (1.774)	1.465 (1.798)	0.896 (1.523)	0.665 (1.347)	1.817*** (0.300)	1.794*** (0.297)	0.335 (0.242)	-0.317** (0.154)
<b>Age Interval 9-10</b>	-2.680** (1.326)	-2.719** (1.271)	-3.695*** (1.388)	-4.040*** (1.038)	-	-	-	-	0.582 (0.504)	0.555 (0.502)	-0.962** (0.454)	-1.816*** (0.407)
<b>Age Interval 10-11</b>	-	-	-	-	-	-	-	-	1.252 (1.241)	1.227 (1.239)	-0.427 (1.191)	-1.340 (1.188)
<b>Baseline Hazard * Girl:</b>												
<b>Age Interval 6-7</b>	-0.313 (0.301)	-0.315 (0.299)	-0.250 (0.274)	-0.283 (0.257)	2.011 (1.427)	1.987 (1.421)	1.858 (1.375)	1.818 (1.351)	0.077 (0.132)	0.077 (0.132)	0.069 (0.113)	0.232** (0.112)
<b>Age Interval 7-8</b>	-2.049*** (0.585)	-2.044*** (0.581)	-1.995*** (0.574)	-1.940*** (0.539)	-	-	-	-	-0.035 (0.171)	-0.036 (0.170)	-0.080 (0.149)	0.040 (0.149)
<b>Age Interval 8-9</b>	-	-	-	-	-	-	-	-	-0.785*** (0.256)	-0.784*** (0.255)	-0.726*** (0.232)	-0.607*** (0.233)
<b>Age Interval 9-10</b>	-	-	-	-	-	-	-	-	0.406 (0.542)	0.410 (0.541)	0.415 (0.510)	0.753 (0.512)
<b>Age Interval 10-11</b>	-	-	-	-	-	-	-	-	-	-	-	-
<b>Girl</b>	0.447*** (0.162)	0.450*** (0.158)	0.367*** (0.131)	0.454*** (0.124)	0.239 (0.422)	0.190 (0.438)	0.134 (0.401)	0.225 (0.371)	-0.192** (0.081)	-0.189** (0.080)	-0.112* (0.059)	-0.451*** (0.072)
<b>Constant</b>	1.584*** (0.483)	1.616*** (0.485)	1.025*** (0.346)	0.695*** (0.032)	1.915 (1.469)	2.017 (1.550)	1.630 (1.079)	1.587 (0.852)	-0.741*** (0.222)	-0.740*** (0.220)	-0.515*** (0.153)	1.212*** (0.020)
<b>Variance of the Mother Level Random Effect</b>	1.772*** (0.340)	1.789*** (0.335)	-	-	1.080 (0.933)	1.103 (1.097)	-	-	1.508*** (0.106)	1.500*** (0.104)	-	-
<b>Number of mothers</b>	1,737	1,737	1,737	1,737	842	842	842	842	4,160	4,160	4,160	4,160
<b>Number of children</b>	2,419	2,419	2,419	2,419	1,051	1,051	1,051	1,051	6,510	6,510	6,510	6,510
<b>Log Likelihood</b>	1321.17	-1320.66	-1347.59	-26907.18	-149.95	-148.34	-148.78	-502.34	-6402.17	-6230.47	-6401.99	-30501.09

**Notes:** (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.

**Table 4: Estimates of Remaining Coefficients from Models 1, 2a, 2b and 3 (Standard Error)**

	AP				KERALA				UP			
	Model 1 [1]	Model 2 [2]	Model 2a [3]	Model 3 [4]	Model 1 [1]	Model 2 [2]	Model 2a [3]	Model 3 [4]	Model 1 [1]	Model 2 [2]	Model 2a [3]	Model 3 [4]
<b>Caste:</b> Scheduled Caste	-0.207 (0.269)	-0.205 (0.267)	-0.163 (0.214)	-0.080 (0.172)	-0.526 (0.669)	-0.545 (0.661)	-0.540 (0.597)	-0.401 (0.545)	0.024 (0.135)	0.019 (0.135)	-0.002 (0.088)	-0.691*** (0.067)
Scheduled Tribe	-1.016*** (0.375)	-1.019*** (0.365)	-0.781*** (0.262)	-0.738*** (0.192)	-2.521** (1.262)	-2.494* (1.285)	-2.103** (0.969)	-1.961** (0.818)	0.269 (0.790)	0.341 (0.684)	0.393 (0.282)	-1.293*** (0.233)
Other Backward Caste	-0.406* (0.224)	-0.402* (0.221)	-0.336** (0.171)	-0.232* (0.130)	-0.443 (0.466)	-0.443 (0.468)	-0.381 (0.422)	-0.112 (0.390)	-0.131 (0.110)	-0.132 (0.109)	-0.175** (0.071)	-0.661*** (0.055)
<b>Religion:</b> Muslim	-0.968*** (0.324)	-0.970*** (0.302)	-0.704*** (0.224)	-0.687*** (0.141)	-0.081 (0.503)	0.035 (0.506)	0.061 (0.469)	0.079 (0.444)	-0.992*** (0.124)	-0.989*** (0.124)	-0.664*** (0.081)	-1.014*** (0.058)
<b>Highest Education:</b> Ma: Completed Prim.	0.385* (0.205)	0.386* (0.200)	0.282* (0.149)	0.283** (0.129)	1.917*** (0.616)	1.793*** (0.602)	1.643*** (0.494)	1.568*** (0.448)	0.450*** (0.115)	0.442*** (0.115)	0.353*** (0.076)	0.075 (0.071)
Pa: Completed Prim.	0.373* (0.190)	0.359* (0.184)	0.287** (0.135)	0.272** (0.114)	1.244** (0.558)	1.162** (0.540)	1.057** (0.454)	1.082** (0.421)	0.681*** (0.103)	0.678*** (0.102)	0.434*** (0.061)	0.331*** (0.053)
Pa: Completed Sec.	1.202*** (0.353)	1.194*** (0.342)	0.960*** (0.284)	0.989*** (0.240)	1.952** (0.947)	1.726* (0.940)	1.647* (0.887)	1.516* (0.859)	1.272*** (0.166)	1.262*** (0.166)	0.874*** (0.107)	0.762*** (0.096)
<b>Wealth:</b> 2nd Quintile	0.415 (0.338)	0.395 (0.333)	0.265 (0.233)	0.366** (0.175)	0.467 (1.317)	0.520 (1.288)	0.589 (1.078)	0.966 (0.774)	0.264** (0.116)	0.263** (0.115)	0.224*** (0.072)	-0.107* (0.062)
3rd Quintile	0.662** (0.327)	0.641** (0.320)	0.430* (0.226)	0.521*** (0.153)	1.350 (1.306)	1.351 (1.259)	1.222 (1.046)	1.561** (0.736)	0.599*** (0.137)	0.595*** (0.135)	0.414*** (0.085)	-0.064 (0.071)
4th Quintile	0.698** (0.343)	0.685** (0.340)	0.513** (0.240)	0.561*** (0.158)	0.370 (1.194)	0.404 (1.159)	0.364 (0.966)	0.725 (0.604)	0.610*** (0.151)	0.605*** (0.150)	0.475*** (0.099)	-0.145* (0.077)
5th Quintile	1.206*** (0.435)	1.170*** (0.422)	0.927*** (0.312)	0.945*** (0.206)	-0.104 (1.253)	-0.113 (1.219)	-0.106 (1.029)	0.180 (0.691)	1.680*** (0.211)	1.668*** (0.209)	1.180*** (0.139)	0.229** (0.103)
<b>Rural Household</b>	0.443** (0.217)	0.439** (0.214)	0.376** (0.168)	0.393*** (0.117)	-0.405 (0.482)	-0.374 (0.467)	-0.369 (0.431)	-0.230 (0.373)	0.419*** (0.134)	0.431*** (0.135)	0.343*** (0.095)	0.126** (0.054)
<b>Child Characteristics:</b> Birth Order = 2	0.312* (0.176)	0.306* (0.172)	0.271* (0.146)	0.277** (0.120)	0.272 (0.456)	0.260 (0.456)	0.259 (0.424)	0.217 (0.409)	0.004 (0.102)	0.003 (0.102)	0.034 (0.078)	-0.564*** (0.073)
Birth Order = 3	0.234 (0.192)	0.235 (0.189)	0.184 (0.154)	0.208 (0.136)	0.897 (0.739)	0.859 (0.731)	0.840 (0.671)	0.882 (0.646)	-0.095 (0.109)	-0.098 (0.109)	-0.052 (0.080)	-0.479*** (0.061)
Birth order > 3	-0.060 (0.205)	-0.058 (0.203)	-0.015 (0.155)	-0.026 (0.138)	1.014 (0.768)	0.950 (0.758)	0.950 (0.676)	0.967 (0.625)	0.030 (0.100)	0.029 (0.099)	0.026 (0.069)	0.373*** (0.061)

**Table 4 continued**

	AP				KERALA				UP			
	Model 1	Model 2	Model 2a	Model 3	Model 1	Model 2	Model 2a	Model 3	Model 1	Model 2	Model 2a	Model 3
	[1]	[2]	[3]	[4]	[1]	[2]	[3]	[4]	[1]	[2]	[3]	[4]
<b><u>Initial Conditions:</u></b>												
<b>Aged 6 in 2003</b>	-0.172 (0.166)	-0.177 (0.165)	-0.118 (0.136)	-0.131 (0.126)	-0.261 (0.506)	-0.255 (0.504)	-0.213 (0.457)	-0.156 (0.435)	0.760*** (0.097)	0.755*** (0.096)	0.525*** (0.069)	0.479*** (0.071)
<b>Aged 6 in 2004</b>	-0.349** (0.178)	-0.350** (0.176)	-0.264* (0.146)	-0.262** (0.132)	0.293 (0.562)	0.303 (0.557)	0.290 (0.514)	0.494 (0.528)	0.893*** (0.109)	0.889*** (0.108)	0.605*** (0.079)	-0.130 (0.127)
<b>Aged 6 in 2005</b>	-1.506*** (0.380)	-1.514*** (0.362)	-1.173*** (0.292)	-1.069*** (0.199)	0.619 (1.203)	0.602 (1.181)	0.553 (1.100)	0.636 (1.078)	-0.054 (0.173)	-0.054 (0.172)	-0.019 (0.130)	-0.348*** (0.057)

Notes: See Notes to Table 3.

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

FEMALE AUTONOMY	AP	KERALA	UP
<b>Ma: Belongs to Scheduled Caste</b>	1	1	1
<b>Ma: Belongs to Scheduled Tribe</b>	0.705*** (0.198)	-0.265 (0.674)	1.634*** (0.587)
<b>Ma: Belongs to Other Backw. Caste</b>	0.630*** (0.104)	0.101 (0.256)	0.104*** (0.037)
<b>Ma: Muslim</b>	0.737*** (0.136)	-0.165 (0.209)	0.487*** (0.106)
<b>Ma: Completed Primary Educ or More</b>	0.559*** (0.100)	1.439*** (0.563)	0.387*** (0.101)
<b>Ma: Birth Cohort 1968 – 1972</b>	-0.933*** (0.173)	0.184 (0.398)	-1.056*** (0.298)
<b>Ma: Birth Cohort 1973 – 1977</b>	-0.713*** (0.149)	-0.376 (0.465)	-1.745*** (0.309)
<b>Ma: Birth Cohort 1978 – 1982</b>	-1.140*** (0.131)	-0.096 (0.167)	-1.569*** (0.349)
<b>Ma: Birth Cohort 1983 – 1991</b>	-1.321*** (0.151)	-0.598*** (0.101)	-1.834*** (0.509)
<b>Rural</b>	-0.575*** (0.106)	0.108 (0.283)	-0.634*** (0.101)

**Notes:** (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.

## **Appendices:**

### **Appendix 1**

#### **1. Economic Autonomy**

m1: 1 if the woman decides either herself or jointly with her husband on what to do with her husband's money.

m2: 1 if the woman has money of her own that she alone can decide how to use.

#### **2. Physical Autonomy:**

m3: 1 if the woman is allowed to go alone or jointly with someone else to the market.

m4: 1 if the woman is allowed to go alone or jointly with someone else to the health clinic.

m5: 1 if the woman is allowed to go alone or jointly with someone else to places outside the community.

#### **3. Decision-making Autonomy:**

m6: 1 if the woman decides either alone or jointly with her husband on her own health care.

m7: 1 if the woman decides either alone or jointly with her husband on small household purchases.

m8: 1 if the woman decides either alone or jointly with her husband on large household purchases.

m9: 1 if the woman decides either alone or jointly with her husband on visiting family and friends.

#### **4. Emotional Autonomy:**

m10: 1 if woman believes her husband is not justified in beating her if she argues with him.

m11: 1 if woman believes her husband is not justified in beating her if she is disrespectful.

m12: 1 if woman believes her husband is not justified in beating her if she goes out without telling him.

m13: 1 if woman believes her husband is not justified in beating her if he suspects her of being unfaithful.

m14: 1 if woman believes her husband is not justified in beating her if she neglects house or children.

m15: 1 if woman believes her husband is not justified in beating her if she refuses to have sex with him.

m16: 1 if woman believes her husband is not justified in beating her if she does not cook the food properly.

m17: 1 if the woman believes she is justified in refusing sex if husband has sexually transmitted disease.

m18: 1 if the woman believes she is justified in refusing sex if husband has other women.

m19: 1 if the woman believes she is justified in refusing sex if she is tired.

**The Outcome Model – linear predictor for mother  $j$  (equation (7))**

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

**Notes:** The variables  $v_{11}$  to  $v_{410}$  are the linear predictors for the binary indicators associated with the measurements  $m_1$  to  $m_{19}$  laid out above.

## Appendix 2

**Table A2.1**  
**Estimates of Regression of Sub-Spheres on Female Autonomy (Standard Error) Equation (6)**

<b>Dependent Variable:</b>	<b>AP</b>	<b>KERALA</b>	<b>UP</b>
<b>Economic Autonomy</b>	1	1	1
<b>Decision-Making Autonomy</b>	0.863*** (0.024)	0.298 (0.252)	-0.734*** (0.101)
<b>Physical Autonomy</b>	0.124** (0.061)	0.044 (0.098)	0.108 (0.198)
<b>Emotional Autonomy</b>	1.627*** (0.041)	0.356 (0.305)	0.451*** (0.102)

**Notes:** (i) Estimates are based on the sample of women with children aged 6-11 at the beginning of the academic year April 2005. (ii) 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.

**Table A2.2**  
**Estimates of the Factor Loadings of the Measurements of Female Autonomy (s.e) Equation (7)**

		AP	Kerala	UP
[1]	<b><u>Economic Autonomy</u></b> Woman decides on husband's money Woman has money for own use	1 -0.157*** (0.042)	1 1.195*** (0.317)	1 0.419*** (0.066)
[2]	<b><u>Decision-Making Autonomy</u></b> Woman decides on own health care Woman decides on small household purchases  Woman decides on large household purchases  Woman decides on visiting family and friends	1 0.669*** (0.063)  0.771*** (0.069)  0.626*** (0.060)	1 1.831*** (0.434)  -0.094 (0.138)  -0.224 (0.214)	1 0.910*** (0.053)  0.875*** (0.052)  0.775*** (0.049)
[3]	<b><u>Physical Autonomy</u></b> Woman can go to market Woman can go to places outside the community  Woman can go to health facility	1 0.983*** (0.163)  0.931*** (0.158)	1 0.450*** (0.121)  0.504*** (0.040)	1 1.277*** (0.109)  1.060*** (0.099)
[4]	<b><u>Emotional Autonomy:</u></b> Woman believes her husband is not justified beating her if... She goes out without telling him She neglects house and children  She argues with him  She refuses sex  She burns the food  She is unfaithful  She is disrespectful  Woman believes she is allowed to refuse sex if... Her husband has other women  Her husband has a sexually transmitted disease  She is tired	1 0.751*** (0.044)  0.707*** (0.043)  0.789*** (0.049)  0.810*** (0.051)  0.566*** (0.039)  0.582*** (0.039)   0.278*** (0.041)  0.294*** (0.040)  0.278*** (0.039)	1 1.745*** (0.208)  1.827*** (0.246)  1.660*** (0.274)  1.424*** (0.206)  0.988*** (0.165)  1.543*** (0.172)   -0.120 (0.136)  0.059 (0.142)  0.072 (0.131)	1 0.741*** (0.057)  0.673*** (0.056)  0.580*** (0.073)  0.718*** (0.064)  0.824*** (0.060)  0.762*** (0.058)   0.281*** (0.070)  0.279*** (0.070)  0.391*** (0.075)

**Notes:** See Table A2.1 notes.