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Bargaining over Fertility in Rural Ethiopia*

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Abstract

The results of the Demographic Health Survey (DHS) reveal that women in Ethiopia prefer fewer children than men, which can be explained by the greater costs that women have to incur from pregnancy, delivery and care for children. In view of differing preferences it is yet not clear which factors determine the final decision. The aim of this study is to shed light on the impact of different bargaining weights on family planning within married couples in rural Ethiopia. Bargaining over fertility can be split into two parts: spacing between births and the number of children. Building on the intrahousehold bargaining framework I investigate both aspects. Applying multistate and count data models I test the hypothesis that women's bargaining power is negatively related to the number of children and positively to the period length between adjacent births using a detailed data set from rural Ethiopia. Both hypotheses find support from the data.

Keywords: Fertility, intrahousehold bargaining, multistate model, Ethiopia

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1 Introduction

Sub-Saharan Africa is characterized by exceptionally high population growth compared to other parts of the world. The Population Reference Bureau (2004) reports estimates, that population growth in sub-Saharan Africa amounts to 2.5% per annum, while for example population in Asia is growing at an annual rate of 1.6% (China excluded). Growing populations exert pressure on resources, thus hampering economic development that is crucially needed. Several policies have been implemented all over the region in order to slow down population growth, although with mixed results. As decisions over the desired number of children are intimatly personal, it is difficult to directly address the demand for children. Hence indirect measures need to be undertaken like for instance the dissemination of contraceptives through public family planning programs. The scope of policy options is further limited because couples may have differing preferences concerning their desired number of children. From the results of a number of studies it turned out that couples are unlikely to use contraceptives if only the woman and not the man wants to limit births (Dodoo 1998, Bankole and Singh 1998, Casterline et al. 1997, Mesfin 2002, Short and Kiros, 2002).

There is an ongoing debate on whether women and men have differing preferences over the number of children in general and if so how large the difference is. In an early review of the literature, Mason and Taj (1987) found that a general conclusion could not be drawn as the differences in preferences appeared to be small. The gap between women and men, however, seems to be greater in countries with high fertility rates, as compared to those where population growth is relatively low. In a more recent investigation, Bankole and Singh (1998) compare 13 African countries and find that in all of them men desire more children than women. The maximum difference is 3.9 children, reported from Niger.

In economic terms, the demand for children originates from the utility that parents derive from children. Different preferences therefore result from different costs that accrue to either women or men. In developing societies women have to carry the burden of pregnancy, delivery and most of the times care for the children. With every birth a woman puts her health (and life) at risk, as the supply of ante- and post-natal medical care is especially in rural areas very low. Women further incur the risk of short or long-term illnesses which are directly related to pregnancy. If the period between two births is not sufficiently long, the body cannot fully recover thus increasing the likelihood of falling sick. The same holds for low nutritional status which is frequent in rural areas (Mason and Taj 1987). Other costs accrue from the opportunity costs of caring for children. Since in the African context, couples often do not have a common budget (Doss 1996, Udry and Duflo 2003), women may not be compensated for income losses by their husbands. Also, Caldwell (1982) reports that the resulting increase of the labor force due to an additional child rather benefits the husband. From a practical point of view, women have therefore a lower payoff from having many children within a short period of time.

Knowledge of differing preferences is however not sufficient to make a statement on the true demand for children. When couples have differing preferences over the number of children, they must somehow come together and finally come up with a decision. The question here is, how large is the number of realized births and how is the decision achieved? How relevant are preferences of women? The answer to this question is important because it can help to shape policies which aim at reducing the fertility rate. If policy makers know whom to address and how, family planning programs can be implemented much more effectively. Any family planning policy not only needs to consider the prevailing desire for children, but also must acknowledge, that this is a weighted average of individual preferences. In order to improve efficiency, the family planning program must take into account how these weights are determined. If indeed, women have lower fertility preferences than men, then increasing the influence of women on household decision making would help to bring down the demand for children. Hogan, Berhanu, and Hailemariam (1999) provide an example from Southern Ethiopia, where indicators of female autonomy are positvely related to the use of contraceptives. Dyson and Moore (1983) and Murthi, Guio, and Dreze (1995) found the same relationship between autonomy and family planning in India.

The anlysis of differing preferences among couples has attracted wide interest in the past. In contrast to the classic Beckerian household model, Manser and Brown (1980), McElroy and Horney (1981), Chiappori (1988, 1992), and Lundberg and Pollak (1993) have developed approaches that allow for modeling and estimating the outcomes of household decision making when preferences are not common. The underlying idea of these models is that household members have different weights in household decision making. The weight reflects the capability of the respective household member to accomplish personal interests. Empirical investigations frequently find support for the hypothesis that the household members' weights influences the outcome of household decision making (see Fortin and Lacroix 1997, Browning et al. 1994, Doss 1996, Browning and Chiappori 1998, Thomas 1990, Maluccio and Quisumbing 1999, Haddad and Hoddinott 1995).

Based on these ideas, Eswaran (2002) introduced a model embedded in the Nash bargaining framework that describes the household decision making over fertility. In accordance with the intrahousehold bargaining models, he concludes that the number of children is a function of (i) the preferences of wife and husband, and (ii) the bargaining weight of each of them. Cain (1983) provides a further reason, why bargaining weights can have an impact on fertility. A widely used measure for bargaining weight is control over assets (Maluccio and Quisumbing, 1999, Beegle, Frankenberg, and Thomas, 2001), whereas low asset ownerhsip is associated with a low weight. In many developing countries, a woman who does not have any assets at her personal disposal is often left without anything in case of divorce or widowhood. Asset-poor women are thus likely to prefer more children as an insurance against extreme poverty, since especially younger children usually stay with the mother.

This study looks at household decision making and fertility goals in rural Ethiopia from two perspectives: (i) the impact of bargaining weights on the decision to space births, which has turned out to be almost as important as limiting births itself (Schultz 1997, Hogan, Berhanu, and Hailemariam 1999) and (ii) the relationship between weights and completed fertility. The first approach is based on a multistate model which is different from the usual static models that aim at predicting the number of children ever born conditional on a range of covariates. The second relies on count data regression which is common in the analysis of fertility. The paper is structured in the following way: Section 2 briefly reviews the current situation regarding fertility in Ethiopia. Section 3 and 4 give an overview of the models and data used, and a description of the results. The paper concludes in section 5 with a summary.

2 Fertility in Ethiopia—the setting

Ethiopia is among the African countries that show the highest population growth rates of the world. At the same time with 72.4 million inhabitants the country has the second largest population in sub-Saharan Africa after Nigeria. The population growth rate is currently estimated to be 2.4%, what translates into a doubling of the population within the next 30 years. By year 2050, the country would then have the 10th largest population of the world. The total fertility rate that measures the number of children born to a woman during her lifetime is 5.9, which is above the sub-Saharan average of 5.6. The prevalence rate of contraceptive use is low: only 8% of all married women between 15 and 49 use any method of contraception. In response to that, the Ethiopian government created in 1993 in the framework of the National Population Policy local population councils with the aim of increasing the use of contraceptives (National Population Policy of Ethiopia 1993, cited from Short and Kiros 2003), but still with a low impact.

Maternal mortality in Ethiopia is high, and hence this is likely to influence the decision on how many children women want. The 2000 Demographic Health Survey (DHS) reports that 871 out of 100,000 births lead to the death of the mother.[1] Among the group of females aged 20 to 29, which is the age group in which most pregnancies occur, more than 30% of all deaths can be ascribed to maternal mortality. In rural areas, about 78% of pregnant women receive no antenatal care.

The DHS also reports large gender differences of the number of desired children. On average women desire 5.3 children while men want to have 6.4 children. Although these numbers vary substantially across individual charateristics like age and education and the number of children already alive, the message remains the same: women prefer fewer children than men.

[1] If we treat every birth event as independent from each other and apply the probability of surviving a birth to the total fertility rate, the probability of surviving six births is 95&.

3 Methodical Problems of Analyzing Determinants of Fertility

The results of analyzing determinants of fertility are dependent on the measure of wanted fertility. The variation of the desired number of children across individual and household characteristics as reported in the DHS suggests that one should be cautious in interpreting these numbers. Young couples' agreement tends to be higher as compared to older couples. Any analysis that relies on the number of desired children must take into account the possible fluctuation of preferences over time. Further, according to Pritchett (1994) parents tend to rationalize the number of children ex-post, even if it actually exceeds their initially desired number of children, because for most people, it is very difficult to state that a child is unwanted once it has been born. Statements on the desired number of children may therefore be flawed.

Another option is to use the observed number of children ever born to analyze fertility behavior. This approach is also subject to potential bias. Younger couples naturally have a lower number of children, as their family planning has just begun. Most studies using children ever born, try to account for this effect through including the age of wife and/or husband as an independent variable. This method disregards that young couples may postpone births instead of limiting the number of children. They may eventually have the same family size as older couples, but the younger couple achieves it at a later point of time. This has been reported to be the case in Africa, where contraceptives are often used for spacing births and not for limiting the number of children (Schultz 1997, Hogan, Berhanu and Hailemariam 1999). When couples achieve their desired family size later, the inclusion of age gives the impression that younger couples prefer smaller families. Hence, studies relying on either the number of desired children or on the number of children ever born while not accounting for spacing effects use potentially biased data.

Economic approaches to investigate fertility rely on either static or dynamic models which impose different data requirements (Arroyo and Zhang 1997). Static models usually rely on information that is available in the current period of observation and are easy to handle, as count data models which are available in most statistical software packages can be applied.

However, these models require information on completed fertility, that is, one needs to be sure that every woman considered in the sample does not get any more children in the future.

Dynamic approaches often apply hazard rate models to estimate the time between two births.[2] An advantage of these models is that they allow for coping with censored data, that is for couples who have not yet completed their family planning. Authors applying hazard rate models ask for the time between marriage and first birth or the time between the nth and $n + 1$th birth (Andres and Urzua 2003, Arnstein and Altankhuyag 2001). This piecewise approach ignores the preceding birth events and is highly vulnerable to violations of a number of maintained assumptions (see Heckman and Walker, 1990a). The model proposed by Heckman and Walker (1987, 1990a, 1990b; see also Newman and McCulloch 1984 for an alternative but less general model) fully accounts for the whole birth history and can handle censored data. A further advantage of this model is that it allows the variables in the conditioning set to vary over time, a feature which is not inherent in static models. In section 5 I apply a count data model to the number of children ever born in households where the fertility cycle is finished.

4 Birth Spacing

4.1 The Model

The model applied here belongs to the hazard rate family and enables to capture the dynamic nature of the birth process as well as the impact of bargaining power on transition from one birth parity to another and is based on Heckman and Walker (1987, 1990a, 1990b).[3] The basic idea is to model the entire birth history of a woman through a series of duration models while simultaneously accounting for (i) the probability that a woman stops her fertility cycle and (ii) the problem of censored observations. The latter aspect is particularly useful in the present study because the data consist

[2]Hazard rate, survival or duration data models are build on the so called hazard function, which gives the probability that an individual remains in a certain state, e.g. the state to have 1 child, the state to have 2 children, and so forth. An increase of the hazard function implies that the time period between entering and leaving the state shortens and a decrease means the opposite.

[3]A parity is in this context the time period between two events, i.e. births.

of a single cross-section of observations from a household survey which was not primarily created to capture fertility.

The birth history is modeled as a finite-state continuous time process which starts at calendar time $\tau(0)$ when a woman enters her fertility cycle. After remaining childless for t units of time, she gets her first child denoted by $Y(\tau)$ at calendar time $\tau(1) = \tau(0) + t$. The set of birth states is discrete, that is $Y(\tau) \in \Gamma = 0, 1, 2, 3, \ldots, C$ and bounded from above ($C < \infty$). The elapsed time between two births is denoted by T, whereas $T_0, \ldots, T_c$ represents the entire duration from the time of entering the fertility cycle up to the last birth c. Note, that due to the right censoring of the data, the final parity is $T_{\bar{c}}$, where $\bar{C}$ denotes the waiting time until the next birth, which may or may not occur. Let $H(\tau)$ be the set of K covariates x_k at calendar time τ. The conditional hazard is then given by

$$h_j(t_j \mid H(\tau(j-1) + t_j)) \tag{1}$$

which gives the probability that a woman leaves the state at time τ. A useful feature of the conditioning set is, that for each period it potentially includes all past information up to t_j, that is all past changes of the social environment and the individual characteristics of the household and the woman herself can be captured.

Integration of (1) with respect to t assuming that it is continuous yields the survivor function

$$S(h_j(t_j|H(\tau(j-1) + t_j))) = \exp\left(- \int_0^{t_j} (h_j(u_j|H(\tau(j-1) + u))du \right) \tag{2}$$

which gives the probability that a woman remains childless up to t, or put differently the probability that she remains in the jth parity j which can be written as

$$P(T_j > t_j|h_j(t_j|H(\tau(j-1) + t_j))). \tag{3}$$

Multiplying the jth hazard by the jth survivor function gives the density of t_j conditional on the covariates

$$g_j(t_j|H(\tau(j-1)+t_j)) = h_j(t_j|H(\tau(j-1)+t_j)) \cdot S_j(t_j|H(\tau(j-1)+t_j)) \tag{4}$$

which forms the basis for the joint density observed at time $\tau(0)+\sum_{i=1}^{J} t_i$

$$g\left(t_1,\ldots,t_k\left(\tau(0)+\sum_{i=1}^{J} t_i\right)\right)=\prod_{j=1}^{\bar{C}} h_j(t_j|H(\tau(j-1)+t_j)) \\ \cdot S_j(t_j|H(\tau(j-1)+t_j)) \tag{5}$$

where $\bar{C}$ denotes the actual observed number of children and C the number of parities. Note that after bearing $\bar{C}$ children a woman made the transition from parity $\bar{C}$ into parity C, which she may or may not finish with another birth.

Modelling the birth history in the duration framework has the advantage that censoring of the data is explicitly accounted for through inclusion of the survivor function. As a woman enters the first parity at time $\tau(0)$ her actual number of children is observed at time $\tau(0)+\sum_{i=1}^{J} t_i$. The survivor function ensures that regardless of how many children a woman has born at the time of observation it is possible that she decides to have one birth more in the future. This feature of the model will be discussed in the section on estimation.

Unobserved Heterogeneity

The investigation of fertility behavior is usually made difficult due to presence of unobservables not captured by the conditioning set. Not accounting for these effects—here subsumed under θ—may severely bias the estimated parameters. Considering unobserved effects is especially appropriate because apart from individual specific characteristics as infecundity, I do not have information on contraceptive practices.[4] Although the neglect of contraceptive use may not be too serious as Sibanda et al. (2003) report that the prevalence of contraceptives is considerably lower in Ethiopia than in comparable countries, the problem of unobserved infecundity remains.

Heckman and Walker (1990a, 1990b) note, that unobserved heterogeneity θ may be divided into two components: (i) one that is observed by the

[4]The 1995 round of the survey provides information on current uses of contraceptives. This however does not necessarily represent past behavior, since the introduction of modern contraceptives is often a recent phenomenon and forced by governmental Family Planning programs which take place with different regional intensity.

woman but which does not appear in the data, and (ii) one that neither the analyst nor the woman observes. The first component may be effects as personal experience with usage of contraceptives or biological infertility. This information is unlikely to be available before the first parity, but in the second and every following transition a woman may build on this experience and change her behavior accordingly. This process may be depicted within the Bayesian framework where in every period θ is updated according to past experience. Define the probability measure of θ as $M(\theta)$ with density $m(\theta)$ and *supp* $M(\theta) = \Theta$, then the density of θ for parity i condtional on the previous duration t_{i-1} is given by

$$m_i(\theta|t_{i-1}, H(\tau-1)) = \frac{m_{i-1}(\theta)g_1(t_{i-1}|H((\tau-1),\theta))}{g_{i-1}(t_{i-1}|H(\tau-1),\theta)}. \quad (6)$$

To account for the Bayesian updating process the mean of previous durations is included in order to capture experience effects that would otherwise be attributed to unobserved heterogeneity. The second part of the heterogeneity is left for specification and is modelled as a mixture distribution given by

$$g(t_j|H(\tau-1)+t_j) = \int_\Theta g(t_j|H(\tau-1)+t_j)dM(\theta) \quad (7)$$

θ in this respect captures any peculiarities which are not covered by the independent variables in the conditioning set.

4.2 Estimation

In their work on fertility in Sweden, Heckman and Walker (1990) extended the survivor function to include the possibility of stopping the birth process. The stopping behavior is modelled as a mixture of the probability that a woman decides to have no more children and the probability that she continuous the transition process up to an unknown time. Denote the probability that a woman stops child bearing for any reason (biological or behavioral) after the jth birth with P_j. Then the conditional survivor function of parity j can be written as

$$S_j(t_j|H(t),\theta) = P_j + (1-P_j)\exp\left\{-\int_0^{t_j} h_j(u|H(t),\theta)du\right\} \quad (8)$$

The densities of t are modeled using a Weibull distribution which has only positive support as required. The Weibull distribution contains an additional parameter α, which measures the duration dependence of the current parity. The hazard function shows duration dependence when it is not constant. In the case of a Weibull distribution, one gets positive duration dependence when for the hazard $h(t)$ one gets $dh(t)/dt > 0$ which holds for $\alpha > 1$. A positive duration dependence implies, that with the time periods getting longer, the probability of exiting the state increases.

In the presence of unobserved heterogeneity, one needs to consider the distribution of θ. In a similar approach as the one presented here, Newman and McCulloch (1984) assume the heterogeneity to pursue a certain parametric distribution and obtain the likelihood by integrating out the θ. This approach, though common in many applications, has been demonstrated by Heckman and Singer (1985) to be vulnerable to the misspecification of $M(\theta)$. To avoid here bias in the estimation of the parameters, the likelihood is maximized as a finite mixture, where no parametric form of $M(\theta)$ needs to be specified. In finite mixture models, one assumes that $m(\theta)$ has a finite set of support points θ, to which the probabilities π are attached (see McLachlan and Peel (2000) and Lesperance and Lindsay (2001) for expositions of the method). In other words one assumes that the population from which the random variable t_j is drawn can be decomposed into m distinct subpopulations. The probability that t is drawn from the mth subpopulation is given by π_i, whereas $\sum_{i=1}^{M} \pi = 1$ and $\pi_i \geq 0$. The θ's can be understood as parameters which capture the subpopulation characteristics. As the number of subpopulations is unknown, it has to be estimated, which is done by adding support points to the model until an information criterion as the Akaike or the Schwartz criterion does not further improve. The log-likelihood is maximized applying an EM-alogrithm proposed by Dempster, Laird, and Rubin (1977). Using the new survivor function given by (8) the contribution of the ith woman to the likelihood is

$$
\begin{aligned}
\mathcal{L}_i = & \sum_{m=1}^{M} \left\{ \prod_{i=1}^{C} \left[-\frac{\partial \ln S_j(t_j|H(\tau)); \theta_i)}{\partial t_j} \right] S_j(h_j(t_j|H(\tau)); \theta_i) \right\}^{b_1} \\
& \times S_{j+1}(t_{j+1}|H(\tau); \theta_i)^{b_2} \pi_m \\
= & \sum_{m=1}^{M} \prod_{i=1}^{C} g(t_j|H(\tau))^{b_1} \cdot S_{j+1}(t_{j+1}|H(\tau); \theta_i))^{b_2} \pi_m
\end{aligned}
\tag{9}
$$

where the b's denote indicator functions $b_1 = 1[\bar{C}]$ and $b_2 = 1[C]$. To implement the EM-algorithm consider the following general format

$$\mathcal{L}_i = \sum_{m=1}^{M} \prod_{i=1}^{N} [f_m(t;\beta)]^{d_{im}} \pi_m^{d_{im}} \tag{10}$$

Assume that the number of components π_m is known and the indicator d_{im} denotes whether t_j was drawn from the mth subpopulation. The true value of π_m is not known, but assuming a given number of π_m its expected value can be calculated by first computing

$$\nu_{im} = \frac{\pi_m f_m(t_i;\beta_m)}{\sum_j^M \pi_m f_m(t_i;\beta_m)} \tag{11}$$

and then taking the expectation of ν_{im} which is the average of ν_{im} over i which yields $E(\nu_{im}) = \pi_m$. Estimation of the parameters of the likelihood function proceeds with a given initial estimate of β_m and π_m from which the log-likelihood is formed as

$$\mathcal{L} = \sum_{j=1}^{M} \sum_{i=1}^{N} d_{im}[\ln f_m(t_i;\beta_m) + \ln \pi_m] \tag{12}$$

d_{im} is also unknown, but one can replace it by its expected value which is equal to ν_{im}. After inserting ν_{im} into (12) one can maximize (12), obtain new estimates of π and β, calculate ν_{im} using these estimates and (11), insert them back into (12) and maximize. These iterations are repeated until a previously defined stopping criterion is met.[5] Unfortunately, the EM-Algorithm is vulnerable to the choice of starting values and it is not sure whether one finds the optimum by repeated random starts. To account for this shortcoming, I apply a simulated annealing global maximization algorithm (Goffe, Ferrier and Williams 1994) in order to find a good set of starting values.[6] For inference on the parameters, McLachlan and Peel (2000) suggest to bootstrap the standard errors. As the model is quite large, the computer needs quite a long time to find a solution and bootstrapping with 100 replications would take a couple of weeks. Hence, I apply the

[5] The stopping criterion used here is based on the predicted final likelihood as described in Lesperance and Lindsay (2001).

[6] I have implemented the MaxSa code provided by Charles Bos.

Huber-White sandwich estimator which is robust to failures of the model assumptions. This completes the estimation process the results of which are presented below. All programming necessary has been done using Ox version 3.40 (see Doornik, 2002).

4.3 Data and Variables

The data are taken from the 4th round of the Ethiopian Rural Household Survey which was conducted in 1997 by the Economics Department of Addis Ababa University, the International Food Policy Research Institute (IFPRI), and the Center for Studies of African Economies (CSAE) of the University of Oxford. The survey covered data from about 1,500 households from 15 sites in rural Ethiopia and accounts for the large cultural and ethnic diversity in Ethiopia.

The dependent variable used in this section is the time elapsed between two births. In accordance to the fertility rate reported for Ethiopia (5.9), I estimate the birth history up to the sixth child. To render the observations comparable, I exclude cases according to a number of criteria: first, I only consider married couples and exclude unmarried relations, polygamous arrangements and single households. Second, couples have to be within their first marriage, that is, neither husband nor wife should have lived in any previous marriage. Unfortunately, a large portion of the respondents report about previous marriages and hence the sample decreases by almost one half due to this exclusion criterion. Third, I also exclude couples where twins have been born, as this may exert an influence on the following durations and the probability to stop the birth process. The resulting sample size amounts to 468 observations. All durations start when the woman gets 14 years old since at roughly that age a woman enters her fertility cycle (see Hotz, Klerman and Willis (1997) and the literature cited therein).

The data also contain information on assets brought to marriage (ABM), including data on land, cattle and jewelry which are used as indicators of individual bargaining weights. In the empirical literature on intra-household bargaining much has been written about the difficulties of measuring bargaining power (see Frankenberg and Thomas 2001, Agarwal 1997). The bargaining weight is defined as the level of influence an individual exerts on household decision making. It may be determined by economic, social or cultural conditions as well as personal characteristics. In empirical studies the bargaining weight is approximated by the level of utility an individual would achieve if she were to leave the household. Income earned by women has been proposed as a measure for female bargaining weight, though it is potentially subject to endogeneity. It may be that a woman who exerts sufficient influence on household decision making decides not to work outside the household, since her bargaining power already ensures a high share of household consumption. The usage of ABM as an explanatory variable circumvents this endogeneity problem, since it is largely independent of current decisions. Further, ABM serve as a characterization of the fall-back position, because assets reflect the means of survival an individual has in case it comes to dissolution of the household. Using ABM as a measure of relative bargaining position is not entirely unproblematic. Its validity crucially depends on the control options in everyday life, the control in case of divorce and finally on the ease to leave marriage. If, for example, the costs to dissolve marriage are prohibitively high, the use of ABM may be extremely low. As the data suggests, divorce is relatively common though the data do not reveal anything about whether it was the man or the woman who initiated divorce. It is likely to be the case that it is much easier for men to leave marriage, even in the more liberal Northern regions Tigray and Amhara, but the sheer number of divorces suggests, that in cases also women seek and accomplish divorce. Dercon and Krishnan (1997) state, while relying on anthropological evidence, that the division of assets upon divorce is largely equal in the Northern and to some extent in the Central regions. Fafchamps and Quisumbing (2000) investigated the relation between ABM and control over resources in case of divorce. Though they do not find a strong relation between dissolution of marriage and control over ABM in general (for example in case of death of the husband), they found support for the hypothesis that control over ABM remains with the person who brought them in in case of divorce. Hence, I treat ABM as a credible exit option. All asset data are expressed in monetary terms while the respective value has been adjusted to prices of the respective parities using a consumer price index.[7] As a further indicator of bargaining power I use the gender of the head of household.

Child mortality needs to be considered in two ways. First, there is the

[7] The consumer price index used is the variable 'cpi97', provided with the data.

need to account for children who died after birth and thus do not appear in the household roster. The birth event naturally prolongs the time between adjacent births of children still alive. A dummy variable captures children who died after birth. Second, as in a number of studies the old-age insurance motive has been found to be a significant determinant of fertility (Cain 1981, 1983, Jensen 1990, Nugent 1985, Nugent and Gillaspy 1983, Benefo and Schultz 1996), high expected child mortality induces an increase of fertility because parents need to ensure that a sufficient number of children who take care of them in old ages survives. One drawback of the model applied is that it is not able to capture the potential endogeneity of child mortality. As Schultz (1997) has pointed out, high fertility may also impact child mortality due to a 'hoarding' effect that overstretches the family's available resources. Expecting a high child mortality rate, couples may decide to have more children than they can afford. I try to remedy this effect through including village and cohort wise mortality rates and use them as a proxy for expected mortality. For each observation i the proxy is calculated as $N^{-1} \sum_{j \in F_v(i), j \neq i} x_j$ where $F_v(i)$ is the set of all women of village and cohort v excluding woman i. x_j takes on the value one for a child who died under the age of 5 and N is the total number of children born in v. I do not include the number of died children in the conditioning sets in order to capture 'hoarding' effects as the birth equations are only estimated up to the sixth birth.

In view of the large number of different ethnic groups and religious beliefs, it is necessary to account for regional differences in terms of cultural diversity that may influence the bargaining position of women. A set of dummy variables capture Muslim and Orthodox beliefs which beside the Protestants represent the largest religious group. In a study on behavior towards family planning, Hogan, Berhanu, and Hailemariam (1999) point out the differences among these groups towards female autonomy and fertility preferences. For example, in contrast to outside restrictions which muslim women face, they enjoy relatively high autonomy within the household. Further, muslim women face greater difficulties when seeking divorce (Dercon and Krishnan 1997). Further, I distinguish between the largest ethnic groups which are Amhara, Oromo, and Tigray. Amhara and Tigreans and to some extent Oromo as well, show a different attitude towards marriage and women as compared to Southern groups. To capture further geographical variation, two dummy variables represent the Southern and Central regions of Ethiopia.

Economic theory predicts that with rising incomes couples desire a smaller number of children and rather invest in the quality of children (Becker and Lewis 1973, Willis 1973). Hence, it is necessary to control for levels of income. Income in a dynamic setting is however difficult to deal with when only a cross-section of data is available. Income derived from agriculture and informal labor is subject to annual fluctuations depending on the climatic, economic and political conditions. As Ethiopia has been experiencing a number of severe famines and a long war, income cannot be assumed to be stable over time. To account for these fluctuations, I divide the households into four income groups and assume that membership to a particular strata does not change over time. This can be justified through the fact that social mobility is low. Land as the major means of income generation is traded rather occasionally, so that marriage serves as a substitute for the land market. This also implies that most households have to derive their living from the current endowment of assets and in most cases do not have the opportunity to accumulate assets or savings (see Fafchamps and Quisumbing 2004).

A crucial assumption in the present estimation framework is that the conditional distribution of t is independent of the time when a woman enters the first parity. This assumption is violated as the women belong to different age cohorts which differ in their epxeriences regarding changed social environments or improvements in medical service provision. In general, one may follow one of two strategies to ensure that the indepence assumption holds. Either the data set is separated into birth cohorts which are assumed to be homogenous, or one introduces cohort specific dummy variables. As the dataset is already relatively small and the number of parameters to be estimated due to six possible birth events relatively large, I have adopted the latter strategy. Two dummy variables representing age cohorts $50-59$ and $60-69$ are included to account for the different points of time when the respective women enter the fertility cycle. To capture the effects of experience from past durations, the mean of all durations previous to the current duration are included.

Finally, I have included two variables for the educational background of the wife and husband. While female education is usually associated with a lower number of children, previous studies revealed that in Africa men's education tends to increase fertility (Benefo and Schultz 1992). In the context of this study, education is important with respect to its effect on bargaining power (Schultz 1999). Female education improves the bargaining position since through additional income earning opportunities her economic contribution to the household increases (Murthi, Guio, and Dreze 1995). However, the impact of women's education on her bargaining weight may be dampened as the wage labor market is not well developed in many of the surveyed villages and the overall level of education among women is very low. Lastly, the choice of variables for the conditioning set is beside some small variations the same across all parities. Each conditioning set includes time specific variables as well as variables which are assumed to be static over time. Table 1 in the appendix gives an overview of the variables included.

4.4 Results

The results of the hazard model are presented in table 2 in the appendix. Using the information criteria, a two component model was selected. The components are not easy to interpret as they may capture combined effects. The probabilities attached to the support points roughly divide the sample into two halfs, which is too large to be explained by contraceptive users and non-users. The components may capture regional differences as well as infecundity. The results presented in Table 2 do further not allow for a clear-cut answer on the impact of female bargaining weights on household decision making. The respective parameters (*BP Wife*) are in four cases negative that is, the probability of an early exit of the parity increases, but only for the third parity the parameter becomes significant. Two parameters are positive and achieve in both cases a 5% -significance level. This finding is unexpected at least for the first parity. This may be explained either through a missing variable reflecting the age of entry into marriage, which may be an important factor in predicting the hazard of the first birth. On the other hand, this finding possibly reflects that younger brides may be given higher bride prices. The positive parameter that is found during the fourth parity may be explained through an early leaver effect. It may be that women with high bargaining weights want to speed up the birth process in order to stop it earlier.

The respective parameters for husband's bargaining weight (*BP Husband*) are almost always significant and except of one case show always a contrasting sign as compared to female bargaining weights. This shows a disparity of reproductive preferences among couples. Interestingly, the parameter increases in magnitude up to the third birth until it starts to decrease again. That is, husbands may want to ensure a certain minimum critical family size as soon as possible and afterwards prefer to slow down the process as more and more mouths have to be fed. Although not significant, the parameter representing female bargaining weights also increases between the fifth and the sixth birth. This suggests, that bargaining power may lengthen the period more and more with later births. Female headed households consistently show negative parameters that achieve a 5% -significance level in three parities. These parameters clearly show, that women as the head of household accomplish their fertility goals and may stop the birth process earlier. They also have the children after much longer time intervals.

The income effects are consistent with economic theory and predict that the probability that a woman leaves a state decreases at higher levels of income. That is, wealthier couples prefer longer periods between adjacent births. Also, one can observe an upward trend of the parameter magnitude at later births. The results of the impact of education are rather mixed. Female education reveals consistently a positive sign, while the respective effect of husbands' education is negative. This is in contrast to findings from other studies conducted in the African context (Anker and Knowles, 1982; Benefo and Schultz 1992), where male education leads to higher fertility and shorter intervals between two births. However, the results obtained may be spurious, due to the very low educational background of the women in the sample.

The impact on duration emerging from the death of a child is as expected. In all cases the sign is negative, indicating that the death of a child lengthens the time interval between adjacent (alive) births. Expected village/cohort child mortality also always reveals the expected positive sign: higher expected mortality rates lead couples to have children earlier and in shorter time periods. However, only the parameters of the first two parities achieve a 5% -significance level. Cohort effects do not reveal any particular consistent pattern, though the older birth cohort show some tendency to have shorter time intervals, which may have to do with a slight erosion of traditional cultural norms defining the position of women in the family. The cultural dummies reveal that Muslim families tend to have children in shorter periods as compared to households with Orthodox beliefs. Tigreans and Oromo have to some extent shorter intervals as the excluded Amhara. The same holds for groups residing in the central region of Ethiopia.

Finally, the α's need to be interpreted. All are highly significant and greater one, which means that all parities are subject to positive duration dependence. As noted above, positive duration dependence implies that with increasing length of time from the last birth, the probability increases of leaving the current parity. This is plausible at early stages of the birth process, as small families are rather rare. At later stages, this is not so easy to explain, especially as the magnitude of the parameter increases with later parities. The quit probabilities are also relatively small, which is conform with the findings of Heckman and Walker (1990a, 1990b).

The several hints combined give a clearer picture on the household decision making process. The constrasting signs of wife's and husband's bargaining weights reflect a clear disparity on the household decision over fertility. Furthermore, female headed households—representing female autonomy—reveal consistent negative signs, which are in two cases significant. Ethnic group membership reveals, that a more liberal household organization is in favor of longer time intervals. Taken together, the time intervals appear to lengthen when women hold a more favorable position in the household. The determinants of this position are however manifold.

5 Number of Children

5.1 The Model and Estimation

In this section, I turn to the estimation of the effects of bargaining weight on the number of children. To arrive at data on completed fertility, I construct a new data set where women under age 45 are excluded. Beyond this age, the likelihood that the woman gives birth to a child is only 2%. A more conservative measure would be to exclude women younger than 49, but in order to save observations the lower threshold appears to be appropriate. The results however hold, when women younger than 49 are excluded. The new sample comprises of 121 observations. As the model is substantially smaller and easier to handle, a number of village dummies have been included to capture village effects. However, due to the village wise construction of the expected child mortality rate, this variable coincides with the village dummies and thus mortality is excluded. The age of wife and husband are also included to account for cohort effects. None of the women included has any reported educational background, which why only husbands' education is considered. Because of lacking observations, the female headed household dummy had to be excluded as well.

Because the dependent variable consists now of the number of children ever born, the data generating process is assumed to be Poisson. Despite its restriction that the mean and variance are implicitly assumed to be equal (the data is said to be equidispersed), the Poisson model has a number of advantages. First, the Poisson MLE is most efficient if the dependent variable y is Poisson distributed, and second even if the assumption that y follows a Poisson distribution is violated, the Poisson MLE is still consistent (Wooldridge 2002, p.649). A violation of the assumption of equidispersion does however harm the estimation of the standard errors of the parameters. In order to obtain robust standard errors, I report the common sandwich estimator.

A first look at the variance of the regression yields a value of $\hat{\sigma}^2 = 0.735$, which is an indication of underdispersion. The application of a regression based test for equidispersion proposed by Cameron and Trivedi (1998) supports this finding [8]. The α-value obtained is -0.066 (with a standard error of 0.017) and is significantly different from zero at the 0.1%-level. In this case, the common flexible alternative to the Poisson model, the Negative Binomial model is not appropriate as it cannot handle underdispersion.

[8] The test procedure tests the validity of the Poisson distribution against the alternative which is a negative binomial distribution and is appropriate to detect either over- or underdispersion. Let $\hat{\mu}_i$ be the predicted value of the dependent variable y. Then the test can be conducet through regressing

$$\frac{(y_i - \hat{\mu}_i)^2 - y_i}{\hat{\mu}_i} = \alpha\hat{\mu}_i + u_i \tag{13}$$

If $\alpha > 0$ the data is overdispersed, and if $\alpha < 0$ the data is underdispersed, which can be tested by using a simple t-test.

5.2 Results

Table 3 reports the estimated parameters of the Poisson model. First of all, the impact of bargaining power on the number of children is striking. The parameter of *BP Wife* is negative while *BP Husband* is positive and both are significantly different from zero at the 1%-level. That is, given the estimate of -1.12 for *BP Wife*, an increase of the woman's bargaining weight by 1 unit, reduces the expected number of children by 11.2%. The contrasting signs reflect the intrahousehold conflict concerning the decision on the realized number of children. This also demonstrates, that female autonomy reduces the number of realized children. Because the mean has been modelled with $\mu = \exp(\mathbf{x}\beta)$ the parameters can be interpreted in terms of a semi-elasticity. The coefficients on age show that younger men have fewer children than older. None of the parameters representing income is significant. Orthodox households have significantly more children than Muslim households. The impact of education of the husband is negative, but not significant.

6 Conclusions

This study looks at the impact of intrahousehold bargaining weights on household decision making over fertility. In view of differing preferences towards the number of children, it was expected that the individual bargaining position determines the leeway to accomplish personal fertility goals. The results clearly show that the bargaining weights impact on the household decision process regarding the birth spacing and the number of children. Female autonomy lengthens the time intervals between adjacent births, although no unique determinant can be identified, as well as it reduces the number of children. On the other hand, the bargaining weight of men increases the number of children and shortens the time intervals between births.

This finding suggests that in order to effectively reduce fertility, public family planning programs need to address women and men simultaneously. Men because their opposition to family planning is an important reason for not using contraceptives to space or limit births. Women, since their low bargaining weight hinders them to accomplish their reproductive goals. The fact that female autonomy is related to lower fertility also opens the door for other means to reduce fertility rates, e.g. through improving the bargaining position of women thus enabling them to push their goals through. This could be achieved via the development of labor markets and improved education for women and girls. Although education did not turn out to be a determinant of prolongation and the number of births, it may be nevertheless important in the presence of income earning opportunities outside the household. As the case of Kerala in India demonstrates, fertility rates decline when women find better outside options in terms of earning income and participation in political decision making (Murthi, Guio and Dreze 1995, Sen 1997).

The results further emphasize the many facets of intrahousehold bargaining, which renders the operationalization of the bargaining weights difficult. Personality, economic environments, or cultural traditions that define the role of the women in family and society appear to influence the women's bargaining position, which makes it unlikely to construct a unique indicator that allows for capturing all determinants.

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Appendix

Table 1: Means and descriptions of variables

Dynamic data

	Timelength	BP Wife	BP Husband	Durat	Died
Parity 1	8.05	0.10	0.84		0.19
Parity 2	4.65	0.12	1.16	8.05	0.06
Parity 3	5.09	0.17	1.39	6.35	0.03
Parity 4	3.66	0.21	1.64	6.07	0.01
Parity 5	3.47	0.22	1.85	5.85	
Parity 6	4.05	0.23	1.99	5.75	0.01

Time invariant data

FHH	0.03	Female headed household
Cohort 50-59	0.54	Age cohort 50 to 59
Cohort 60-69	0.28	Age chohort 60 to 69
Village Mort.	0.06	Expected child mortality rate
Inc. Quart. 1	0.16	Upper income quartile
Inc. Quart. 2	0.24	Medium income quartile
Education Wife	1.64	
Education Husb.	2.50	
Muslim	0.20	
Orthodox	0.49	
Tigray	0.15	
Oromo	0.21	
North	0.28	
Central	0.25	

Table 2: Jointly estimated parameters of all parities

	Estimate	t-value		Estimate	t-value		Estimate	t-value	
	First Birth			Second Birth			Third Birth		
Alpha	1.954	30.145	**	1.895	28.793	**	1.926	27.130	**
Constant	-3.896	-18.372	**	-3.649	-14.047	**	-2.540	-8.626	**
BP Wife	0.072	9.000	**	-0.007	-0.776		-0.023	-2.980	**
BP Husband	-0.043	-1.476		0.096	4.034	**	0.208	8.308	**
Durat				0.029	2.521	**	-0.236	-8.442	**
Died	-0.529	-3.996	**	-0.911	-5.580	**	-1.038	-5.299	**
FHH	-0.269	-1.462		-0.820	-3.512	**	-0.590	-1.522	
Cohort 50-59	0.256	1.980	**	0.570	3.004	**	-0.283	-1.516	
Cohort 60-69	0.180	1.715	*	-0.174	-1.399		0.135	0.830	
Village Mort.	2.589	3.109	**	5.940	6.400	**	0.665	0.721	
Inc. Quart. 1	-1.393	-10.527	**	-0.800	-5.080	**	0.296	1.218	
Inc. Quart. 2	-0.520	-4.605	**	0.098	0.726		0.979	4.711	**
Education Wife	0.033	1.089		0.171	5.597	**	-0.040	-1.138	
Education Husb.	0.031	1.403		-0.030	-1.241		-0.027	-0.876	
Muslim	-0.295	-2.117	**	0.479	3.671	**	0.071	0.341	
Orthodox	0.115	0.470		0.470	2.111	**	0.361	1.744	*
Tigray	0.380	1.447		0.220	1.065		-0.971	-4.130	**
Oromo	0.006	0.042		-0.181	-0.933		-0.248	-1.674	
North	-0.098	-0.636		0.086	0.420		0.125	0.623	
Central	-0.054	-0.354		-0.519	-2.499	**	-0.182	-0.967	
Quit Probabilities		0.039			0.019			0.075	
	Fourth Birth			Fifth Birth			Sixth Birth		
Alpha	2.468	23.221	**	2.667	15.284	**	2.702	12.710	**
Constant	-3.274	-10.480	**	-4.599	-4.428	**	-2.875	-6.629	**
BP Wife	0.029	4.554	**	-0.064	-0.581		-0.287	-0.960	
BP Husband	0.073	3.607	**	0.066	3.747	**	0.059	2.663	**
Durat	0.110	2.464		-0.018	-0.190		0.049	0.345	
Died	-0.686	-1.745	*				0.347	1.420	
FHH	-1.236	-3.373		-0.735	-1.106		-9.230	-0.529	
Cohort 50-59	-0.024	-0.120	**	0.700	2.236	**	0.387	1.226	
Cohort 60-69	-0.042	-0.263		0.269	1.148		-0.378	-0.891	
Village Mort.	1.252	1.157		1.711	1.601		1.110	0.625	
Inc. Quart. 1	-1.474	-5.205		0.525	0.530		-1.862	-4.343	**
Inc. Quart. 2	-0.743	-2.940	**	0.609	0.633		-1.878	-4.376	**
Education Wife	0.105	2.647	**	0.012	0.156		0.207	1.976	**
Education Husb.	-0.068	-1.585	**	0.040	0.687		-0.149	-2.450 **	
Muslim	0.984	3.855	**	1.119	3.950	**	0.625	1.663 *	
Orthodox	0.339	1.069	**	-0.676	-1.639		0.553	1.367	
Tigray	0.618	1.868		0.170	0.376		0.005	0.013	
Oromo	0.314	1.713	**	-0.680	-2.175	**	0.201	0.481	
North	-0.624	-2.690		0.053	0.156		-0.271	-0.485	
Central	-0.806	-3.956	**	0.291	1.292		0.009	0.018	
Quit Probabilities		0.113			0.179				
Log-Likelihood: -4254.12									

**significant at 5% level

Table 3: Estimates of child no model

	Estimates	t-value	
BP Wife	-0.117	-2.565	**
BP Husband	0.039	5.970	**
Age Wife	0.004	0.249	
Age Husband	-0.018	-1.991	**
Educ Husband	-0.152	-0.504	
Inc. Quart. 1	-0.009	-0.046	
Inc. Quart. 2	-0.046	-0.268	
Inc. Quart. 3	-0.206	-1.187	
Muslim	0.415	-0.504	
Christian	0.664	1.418	
Tigray	0.207	3.077	**
Oromo	0.452	0.756	
Constant	2.073	1.366	
Number of observations: 121			
Log-likelihood: -236.790			
Pseudo R-square: 0.196			

** significant at 5% level

* significant at 10% level

Estimates of village dummies not reported