Intrahousehold Bargaining and Fertility

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Abstract

This paper empirically tests the family bargaining model of collective decision-making within the household. The key issue in empirical analyses of such models is to quantify the bargaining power of wives relative to their husbands. Previous empirical studies have used wage income, nonwage income, current assets, assets brought to marriage, education and measures generated from responses to questions on household decision-making. All these measures are prone to endogeneity since they are correlated with individual and household characteristics and may also be subjected to measurement error. In particular, previous research on intrahousehold bargaining and fertility that use measures based on household decision-making do not instrument for their bargaining power measures and do not find any impact of female bargaining power on fertility. The OLS results in this study are consistent with the findings in the previous literature. However, the instrumental variables estimates reject the unitary model of household decision-making. Using the second wave of Indonesia Family Life Survey, this study analyzes the impact of female bargaining power on total number of births. A measure of power generated from binary responses to questions on wife's participation in expenditure related decision-making within the household is used to proxy for the true female bargaining power. This measure is instrumented using environmental variables, specifically; relative wage, types of credit institutes available and relative education in the community where the couple resides. The findings suggest that female bargaining power has a negative impact on total number of births. Furthermore, this negative impact of power on total births is stronger for younger women than it is for older women who are more likely to have completed their child bearing. This paper also incorporates a method (Latent Trait Model) appropriate for the construction of the latent power measure using binary response variables instead of techniques used in previous papers which include either summing the responses or using factor analysis.

Keywords: intrahousehold bargaining, fertility, latent trait model, female bargaining power

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1 Introduction

This paper empirically tests the family bargaining model of collective decision-making within the household. The key issue in empirical analyses of such models is to quantify the bargaining power of wives relative to their husbands. Previous empirical studies have used wage income, nonwage income, current assets, assets brought to marriage, education and measures generated from responses to questions on participation in household decision-making. All these measures are prone to endogeneity since they are correlated with individual and household characteristics and are also subjected to measurement error. Hence, the measure of female bargaining power must be instrumented for.

In particular, previous research using measures based on women's participation in household decision making to study the impact of bargaining power on fertility do not control for the endogeneity of the bargaining power measure and find no statistically significant impact of female bargaining power on family size (see Section 2). However, this measure of power is prone to measurement error and may be correlated with income and assets of wife relative to her husband. Hence, it is imperative to account for endogeneity associated with the measure of female bargaining power. The OLS results in this study are consistent with the findings in the previous literature which suggest that the decision-making process in the household is unitary.

However, when the measure of power is instrumented for, the estimates are consistent with the family bargaining model of collective decision-making within the household. The instruments used are environmental variables which are most likely to influence the economic and social position of wives relative to her husband and hence her participation in decision-making within the household. Women who participate in decision-

making within the household are also most likely to have a say regarding the important choices made within the family including number of children to have.

The findings in this study suggest that the female bargaining power within the household can be increased by promoting policies that increase economic opportunities for women and advocate gender equity in the community. These policies may especially benefit younger women than older women and may make it possible for younger wives to assert their preferences on family size within their households.

The paper uses data from the Indonesia Family Life Survey (IFLS) fielded in 1997. Indonesia makes a good study site for investigating issues of fertility and intra-household decision making because TFR declined from 5.7 births per woman in 1955 to 2.8 births per woman in 1997 (figure 1 shows the UN and DHS (Demographic Health Survey) estimates of TFR in Indonesia from 1955-1997). This decline is primarily attributed to the implementation of the National Family Planning Coordinating Board (BKKBN) by the Indonesian government in 1970 to educate households about small family size, expand access to cost effective contraceptives and promote continued use by acceptors of contraception (Gertler and Molyneaux, 1994). However, it is well documented in the family planning literature that only couples who have a 'preference' toward small family size will avail of existing family planning programs in their community (Tsui 2001, Freedman 1979).[2] Hence, this paper studies the impact of female bargaining power on fertility controlling for variations in access to family planning services as well as for individual and community level factors that may affect fertility.

[2] Tsui (2001) analyzes the fertility levels in the absence of family planning programs using data from 80 countries and finds that the TFR would have been only 0.28 births higher than the observed average of 4.33 if there was no family planning program effort (FPE) experienced for all the regions. By region, FPE has negligible negative impact for Latin America, Near East and positive impact for Africa. Freedman (1979) points out that motivation to limit family size existed and translated to lower fertility even before the advent of industrial era.

Fertility rates continue to be high in some parts of the world (see figure 2). The UN World Population Prospects: 2006 revision ranked countries by fertility rates, the highest TFR is at 7.45 in Niger.[3] The risk of maternal mortality increases for births at high parity (Chen et al. 1974)[4] and increase in fertility decreases human capital investments (namely schooling and health) in children (Rosenzweig and Wolpin 1980, Glick et al. 2007)[5]. Furthermore, bearing several children, most likely, at short birth intervals takes a toll on mother's health and also all the surviving children fight for family resources leading to a "crowding out" effect of high fertility on high child mortality (Birdsall 1991).

There is evidence in developing countries that husbands want more children than their wives (Bankole and Singh 1998)[6]. This is because, in developing countries, the marginal benefit accruing from having an additional child is probably the same for both husband and wife (which is primarily support during their old age) but the marginal cost of having an additional child is much higher for the wife due to risks of maternal morbidity and mortality; costs of pregnancy, delivery, care of children and a subsequent loss in their productivity. Hence, one of the issues policy makers are interested in is if wives can assert their preferences regarding small family size as their bargaining power relative to their husbands within the household increases.[7]

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[3] http://www.un.org/esa/population/publications/wpp2006/WPP2006_Highlights_rev.pdf

[4] Chen at al. (1974) using data from Bangladesh find that the rate of maternal mortality increases steadily from parity two to parity five and is the highest for parities seven and above. Trusell and Pebley (1984) use estimates from different multivariate studies in developing countries and explore changes in maternal and child mortality rates when birth parities are altered; they find that eliminating of 4th and higher parity births may reduce child mortality by about 8%. They also find that child mortality may be reduced by 21% if births are spaced at least two years apart.

[5] Rosenzweig and Wolpin (1980) use twin pairs from India to estimate the effect of family size on school progress. Glick et al. (2007) use twins data from Romania and find that a first-birth twins shock has negative impact on human capital investments for children, especially those who are later born.

[6] Bankole and Singh (1998) use Demographic and Health Survey data from 18 developing countries collected between 1990 and 1996 and find that husbands want more children than their wives and also prefer to have the next child sooner. They also find that the percentage of couples where the husband and wife's ideal family size differs by 2 or more ranges from 30% in Bangladesh to 70% in Niger.

[7] One of the Millennium Development Goals identified by the United Nations is to "Promote Gender Equality and Empower Women" and they advocate that this is a "prerequisite to achieving other MDG's" – two of

In this paper, a measure of female bargaining power is generated from binary responses to questions on wife's participation in expenditure related decision-making within the household and this measure is used to proxy for the true female bargaining power. The bargaining power measure is instrumented using environmental variables, specifically; relative wage (female to male) at the community level, types of credit institutes available and a measure of gender equity in the community where the couple resides. Relative education (ratio of women to men with at least primary schooling in the community) is a proxy for the gender equity measure in the community since the more gender equal a community is, the more acceptable it may be for females to participate in the decision-making process within the household[8]. A technique called latent trait model (LTM), which is appropriate for generating latent measures from binary response variables, is used to construct the measure of female bargaining power. This paper also examines the impact of bargaining power on total births by age; the interaction term of power and age is instrumented with the above three instruments and with the interaction of relative wage with age.

The findings in this study suggest that female bargaining power has a negative impact on total number of births which is statistically significant only when the power measure is instrumented. The IV estimates imply that an increase of one standard deviation in the power measure may decrease the total number of births by 0.8 for the entire sample of women and by 0.9 for the sub-sample of women with at least one child. Furthermore, this negative impact of power on total births is stronger for younger women than it is for older women who are more likely to have completed their child bearing. The IV estimates suggest that an increase of one standard deviation in the measure of power may decrease the total

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which are – reduction in child mortality and maternal mortality ("Progress towards the Millennium Development Goals,1990-2005" http://unstats.un.org/unsd/mi/goals_2005/goal_3.doc)

[8] Ackerson et al. (2008) using data from Indian National Family Health Survey (INFHS, 1998, 1999) find that proximate educational context (measured as percent of educated women and men in the community) has a significant negative impact on intimate partner violence within the household.

number of births by about 2.8 births for a 15 year old woman but only by 1 birth for a 29 year old woman and have no effect for women over 36 years old.

The bargaining power effect is net of the substitution and income effect on total births as well as net of the impact of family planning programs on total births since these estimations control for wife's education, total household income and assets, husband's education and access to family planning clinics and family planning worker visits. The first stage results in all specifications reveal that the bargaining power measure is endogenous and must be instrumented for; it also indicates that relative wage, types of available credit, relative education (and interaction of relative wage with age) at the community level have a positive and statistically significant impact on the measure of power (and its interaction with age).

This paper makes the following contributions to the modest intrahousehold bargaining and fertility literature. First, it accounts for the endogeneity in the bargaining power measure by estimating the child demand equation using the instrumental variables methodology. Second, it is the only study in the household bargaining literature, to my knowledge, to use latent trait model to generate the measure of power using binary responses to household decision-making questions. Previous studies either sum the responses or use factor analysis which may be problematic and give misleading results (see section 4). Latent trait model is a generic technique and can be used to generate latent measures for any study using binary response variables. Third, it examines the heterogeneous impact of female bargaining power on total number of births by age.

The rest of the paper is organized as follows. Section 2 presents a review of the intrahousehold bargaining and fertility literature, section 3 presents a simple model of collective bargaining within the household, section 4 discusses the data and variables, section

5 discusses the empirically methodology, section 6 presents the results and section 7 concludes the paper.

2 Review of intrahousehold bargaining power and fertility literature

2.1 Intrahousehold decision making

Research on intrahousehold resource allocation[9] attempts to understand how decisions regarding wellbeing of individuals are made within a household or family. Early research in this area regarded the family as a single entity where all the members of the family pool their resources ('unitary model"), for example: income, capital, land and labor, with the underlying assumption that either all individuals within the family have same preferences (Samuelson 1956) or that the household head acts as the "altruistic dictator" (Becker 1981) and takes decisions on behalf of all the members of the family. Several empirical studies have tested the "income pooling hypothesis[10]" using data from both the developed and developing countries; in order to check the validity of the unitary model; and have rejected the hypothesis (See Strauss and Thomas 1995 for review).

On the contrary, the collective model (Chiappori 1992, 1997) takes into account differing preferences that individuals within the family may have for resource allocations and assumes that these allocations are Pareto optimal[11]. This model maximizes a weighted utility function where weight captures the decision-making process within the household and is a function of prices of goods and other individual (relative income, relative assets etc.) and contextual factors (gender equity within the community, sex ratio, divorce laws etc.) that can impact the distribution of power among individuals in the household. Cooperative and non-

[9] Intrahousehold resource allocation involves the distribution of resources among the members of the family and the impact of these distributions on economic and demographic outcomes of the members (Quisumbing (2007)).

[10] In unitary model, after controlling for total household income, individual income must not have an impact on demand for private or public goods.

[11]Pareto optimal allocations ensure that a family member can only be made better off at the cost of another family member

cooperative bargaining models offer more information on the process of decision-making between individuals in the family[12]. Irrespective of the nature of decision making process, collective models provide a framework to analyze the impact of differing preferences of individuals and hence differing allocations of household resources on outcomes like family size, child education, child health and nutrition etc. Of special interest is the female bargaining power relative to her husband since autonomous women are more likely to take charge of regulating their fertility, their own illness or their sick children, travel alone to health clinics for treatment, interact with "male" doctors and clinic staff and follow up with the treatment without waiting for their husband's approval (Caldwell 1986). Hence, the next section focuses on measurement bargaining power of wife relative to her husband even though bargaining processes within a family may take other forms.

2.2 Review of measures of bargaining power

The fundamental problem in the empirically analysis of collective models of household decision making is to construct a measure of bargaining power of wives relative to their husbands. The measures that have been used in the existing literature can be divided into two categories, namely, 'determinants' of bargaining power and 'self-rated measures' of bargaining power. Another concept that is integral to measuring bargaining power is that power measures both at the individual and at the community level impact women's participation in decision-making within the household. These facets of bargaining power are discussed below in more detail.

[12] In cooperative bargaining model (Manser and Brown, 1980, McElroy and Horney, 1981), individuals compare the payoffs from entering and remaining in a union to that from being single or divorced (external threat point) with the union generating a surplus. In non-cooperative bargaining or "separate spheres" model, the threat point is internal to the marriage (Lundberg and Pollak, 1993), where the reservation utility is gender specialization in production of household public good – for example- wife contributes only time and husband contributes only money towards child care. See, Ermisch (2003) for details about bargaining models.

The determinants of bargaining power that capture the wife's control of economic resources relative to her husband are measures such as relative income (Hoddinott and Haddad 1995)[13], relative unearned income (Thomas 1990; Schultz 1990)[14], share of assets brought to marriage (Thomas et al. 1997)[15], current assets share accumulated through marriage (Beegle et al. 2001)[16], maternal education (Thomas 1994 and Handa 1996)[17] and exogenous welfare receipts (Lundberg et al. 1997)[18]. However endogeneity is a potential problem associated with most of these measures. Relative income and current asset share depend on labor force participation and time allocation decisions which are also influenced by wives' bargaining power. Unearned income is a characteristic of past savings behavior or receipt of pension, unemployment benefits, inheritance etc. Share of current assets and assets brought to marriage can serve as indicators of bargaining power in contexts where wives have control over assets acquired by them before and after marriage and also where they can take possession of their assets in the eventuality of a divorce (credible threat point in cooperative bargaining model). Studies that try to model the underlying bargaining process by using relative education levels or differences in ages of spouses are problematic due to assortative mating and marriage-market selection issues (Foster 2002). Hence, any determinant of bargaining power other than exogenous transfer payments has to be instrumented suitably.

As an alternative to using determinants of bargaining power, several papers use self-reported or direct measures of empowerment either individually or jointly as an

[13] Hoddinott and Haddad 1995 study the impact of relative income share on household expenditure.
[14] Thomas (1990) examines the effects of unearned income of men and women on nutrient intakes, fertility and child survival, and child anthropometrics, while Schultz(1990) analyzes the differential effects of men's and women's unearned income on labor supply and fertility in Thailand.
[15] They examine whether assets brought to marriage by husband and wife have a differential impact on child health in Indonesia
[16] Beegle et al. (2001) use current share of assets acquired by wives relative to their husband as an indicator of power and examine its impact on prenatal care and delivery care in Indonesia
[17] Thomas (1994) finds that mother's education level has a greater impact on daughter's height and father's education level has a greater impact on son's height using data from Brazil, Ghana and the US.
[18] Lundberg, Pollak, and Wales (1997) examine the effect of a policy that effectively transferred the child allowance from men to women in the United Kingdom in the late 1970s.

empowerment index. These are usually answers to questions posed directly to women in the household survey on decisions related to several spheres in their life. For example, Mason and Smith (2003) conducted a survey in five Asian counties (India, Pakistan, Malaysia, Thailand and the Philippines) and collected responses to a series of questions on decision making in the economic, family size, freedom of mobility and coercive control spheres to emphasize the multidimensional nature of women's empowerment. Other papers employing self-reported measures as a proxy for empowerment include Ahmed (2006) to analyze the impact of women's empowerment on child health in Nigeria, Ghuman (2003) to investigate the effect on women's empowerment on child survival in Muslim and non-Muslim countries in Asia and Jejeebhoy and Sather (2001) to examine the impact of religion and region in determining female autonomy in India and Pakistan. To summarize, measuring bargaining power is a challenging task.

2.3 Female bargaining and fertility

Becker (1960) primarily study the factors responsible for shifts in demand for children by applying the theory of consumer demand to fertility. The demand for children depends on household permanent income, price of bearing and raising a child relative to other goods and tastes or preferences. This demand function is obtained when joint utility of the couple is maximized subject to income and price constraints assuming both the husband and wife have similar preferences on family size. Schultz (1997) provides a survey of empirical work that studies demand for children in developing countries. According to these papers, some of the factors that impact the demand for children include the quantity-quality tradeoff decisions made by parents, wife's education, husband's education, household income and assets, child mortality, sex preference and access to family planning services.

However, these hypotheses are tested in the unitary framework of household decision making where individual preferences within a household are ignored. There is evidence that even in developing countries, women and men do not share the same preferences on family sizes and establishing reproductive goals (Bankole and Singh 1998). Hence, fertility decisions within households have to be examined in the context of collective decision making models where spousal preferences are taken into account. Of particular interest is whether wife's preferences on family size dominate over the husbands' as her bargaining power within the family increases, controlling for household wealth, demographics of the couple and the household and for supply side factors that enable women with regulating their fertility if they wish to do so. The studies that take into account individual preferences in modeling fertility decisions vary in measures of bargaining power used and these are discussed below.

Thomas (1990), using data from Brazil, finds that non-wage income of wife's has a significant and negative effect on the number of children. On the contrary, Shultz (1990), using Thailand data, finds that wife's non-wage income significantly increases fertility. Klawon and Tiefenthaler (2001) examine the effect of wife's non-wage income and its interaction with her educational status on fertility using data from Brazil. They find that an increase in wife's non-wage income lowers the number of children and this effect is strongest for women with the least education. However, non-labor income is endogenous and is not instrumented for in these papers. Seebens (2005), using data from Ethiopia, finds that assets brought to marriage has a negative and statistically significant impact on total number of births.

A series of papers use survey data collected on married women (1993-94) from communities in India, Pakistan, Malaysia, Philippines and Thailand to study the impact of women's autonomy on family size, desire to stop bearing children and contraceptive use.

Female autonomy is measured by summing responses (binary) to questions on areas of freedom of physical movement, say in economic decisions and control exercised by husband (if husband gets angry when wife disagrees with him and if he beats her). Morgan et al. (2002) use this dataset and find that Muslim and non-muslim women's autonomy differentials do not account for the higher fertility, demand for more children, and less use of contraception among Muslim wives. Smith and Mason (1999) also use the above measures of female autonomy in addition to decisions on fertility and analyze the impact of female autonomy both at the individual and community level on the above three fertility measures and find that female autonomy at the individual level has no statistically significant impact on the fertility measures and in some instances has an impact contrary to what is expected – positive impact on total number of children and negative impact on contraceptive use. Mason and Smith (2000) analyze the influence of gender context (measured as variation in religion, ethnicity, location of residence being rural/urban and type of agricultural activity[19]) within these countries on desire for additional children and contraceptive use. They find the more gender stratified a community the more a husband's fertility preferences control whether the wife uses contraception; however, they find this effect to be a small percentage of unmet need of contraception in most communities and hence this result could as well be due to lack of supply side factors responsible for fertility regulation. However, the drawback in these papers is that the measure of bargaining power in these papers is computed by summing the responses to decision-making questions and this measure is not instrumented.

Abadian (1996) uses community level measures such as singulate mean age at marriage, mean spousal age difference and female enrollment in secondary school as

[19] In Pakistan, where people are predominantly Muslim, gender stratification was based on type of crop grown and type of irrigation available since these two primarily determine the value of women's labor, for example, rice is more labor intensive than wheat.

empowerment measures for 54 countries and finds that female autonomy has a negative impact on fertility. Dyson and Moore (1983) use percentages of female labor force participation, women practicing *purdah*, female literacy, births medically attended and index of son preference using data from India and find that kinship patterns have a strong influence on women's autonomy and fertility levels. Rasul (2007) studies the impact of fertility preferences on fertility outcomes across different ethnic groups in Malaysia and finds that in Malay households, both husband and wife's fertility preferences have a positive and significant impact on fertility outcomes whereas in Chinese households, only wife's fertility preferences have an impact on fertility outcomes. The problem with these papers is that they do not account for variation in individual bargaining power within communities.

3 Model

This section specifies a collective model of household bargaining between a wife and a husband wherein factors at the community level influence the female bargaining power within the household which, in turn, has an impact on the demand for children. The model motivates the empirical work in subsequent sections using IFLS2 and is based on discussion of collective models of intrahousehold decision-making in Ermisch (2003).

Consider a two person household where preferences of the husband and wife are given by $U^j = U^j\left(x_j, N\right); j = 1$ being wife and 2 being husband. N represents the number of children which is a public good to both wife and husband and x_j denotes private consumption by parent j. The maximization problem in the collective intrahousehold bargaining model is to maximize the weighted utility of the two-person household subject to the following constraints –

$$\max_{t_1, t_2, g_1, g_2} \mu U^1\left(x_1, N\right) + \left(1 - \mu\right) U^2\left(x_2, N\right)$$

The home production function is given by -

$$pN = h_1 t_1 + h_2 t_2 + g_1 + g_2$$

where,

t_j = time parent j spends in raising children

h_j = productivity of parent j's time

g_j = financial contribution made by parent j towards children expenditure $\quad j = 1, 2$

p = price of child good (relative to that of private goods)

The private consumption of husband and wife are given by -

$$x_1 = w_1(T - t_1) - g_1; \quad x_2 = w_2(T - t_2) - g_2$$

where,

$(T - t_j)$ = time parent spends working

w_1 = female wage in the community of residence

w_2 = male wage in the community of residence

μ is the true bargaining power of the wife relative to her husband. The bargaining power measure constructed from responses to decision-making within the household is used to proxy for μ. Wife's bargaining power relative to her husband is a function of relative wage and other environmental factors and hence μ is given by -

$$\mu = \mu\left(w^r, Z\right)$$

$w^r = \frac{w_1}{w_2}$ = relative wage at the community level

$Z = \text{'extra - environmental parameters'} = \{mf, ge\}$

mf = types of microfinance institutions

ge = measure of gender equality in the community = e^r is used to proxy for ge

$$e^r = \frac{e_1}{e_2} = \frac{\text{Percentage of women with at least primary education in the community}}{\text{Percentage of men with at least primary education in the community}}$$

It is assumed that μ is increasing in w^r and Z[20]. Solving the above maximization problem subject to the constraints gives the following demand function for the number of children-

[20] This is empirically tested in the first stage of the IV estimations. The choice of instruments – relative wage, types of microfinance institutions and relative education at the community level as the gender equity measure is explained in detail in the next section.

$$N = N\left(y_F, p, \left(w_1/h_1\right), \left(w_2/h_2\right), \mu\left(w^r, Z\right)\right)$$

where,

y_F = total household income=$w_1\left(T - t_1\right) + w_2\left(T - t_2\right)$

In this cooperative model, an increase in the average female wage at the community level (w_1) and hence an increase in w^r results in the following effects - (1) income effect, since y_F increases with w_1, which may increase or decrease N depending on the couples' preference for quantity-quality of children. (2) substitution effect, since the cost of raising children $\left(w_1/h_1\right)$ goes up for the mother, which will result in a decrease in N. (3) bargaining effect since μ is increasing in w^r and this can enable the wife to assert her preferences on family size. Since women prefer to have fewer children than men especially in developing countries (as discussed in the previous section), the bargaining power hypothesis is $\frac{\partial N}{\partial \mu} < 0$, that is, total number of births decreases with increase in wife's bargaining power relative to her husband. This hypothesis is empirically tested using IFLS data in this paper controlling for household income, demographic variables of wife and husband and other community level variables.

4 Data and variables

This paper uses data from the second wave of the Indonesia Family Life Survey (IFLS2) fielded in 1997. The Indonesia Family Life Survey is a continuing longitudinal socioeconomic and health survey. It is based on a sample of households representing about 83% of the Indonesian population living in 13 of the nation's 26 provinces in 1993. These provinces are located in Java, Bali, Sumatra, Kalimantan, Sulawesi and West Nussa Tenggara. Within each of the 13 provinces, enumeration areas (EAs) or communities are randomly chosen from a nationally representative sample frame used in the 1993 SUSENAS, a

socioeconomic survey of about 60,000 households. The IFLS randomly selected 321 enumeration areas in the 13 provinces.

The survey collects data on individual respondents, their spouses, children and parents, their households, the communities in which they live, and the health and education facilities they use. The first wave (IFLS1) was administered in 1993 to individuals living in 7,224 households and detailed individual-level data were collected from over 22,000 individuals. IFLS2 was fielded in 1997 and 94.4% of IFLS1 households were re-contacted (Frankenberg and Thomas, 2000).

The sample is restricted to married couples who have been living in the same household for at least 6 months. Table 1 provides the descriptive statistics of the variables used in the analysis. The dependent variable is total number births which includes live, still births and miscarriages and has an average of 3 births per woman. This information is acquired from the cumulative number of births reported by women in IFLS1 and IFLS2. The average age at marriage for women is lower at 19 years. Men are slightly more educated, on average, than women but average schooling for these women is 6 years which means they have completed primary school. About 50% of the sample is Javanese and about 50% is rural. These groups are over-sampled in IFLS to permit urban-rural and Javanese-non-Javanese comparisons. Also, majority of the sample is Muslim (about 90%) while the rest of the 10% are Hindu, Christian and Buddhist.

At the community level, number of family planning clinics and number of family planning worker visits to the community provide measures of access to fertility regulation for women who want to limit their family size; on average there are 4 family planning clinics per community and 38 family planning worker visits per community per year. Number of health posts is included to measure the incidence of child mortality in the community since these health posts (*posyandu*) attend to the health care needs of 0 to 5 age children – this

includes providing pre-natal nutritional supplements, immunization, nutritional and food supplements to children on a monthly basis; there are 7 health posts per community on average. Other community level infrastructure variables included are percentage of household with pipe or pump water, percentage of households with electricity and percentage of people in the community having some schooling. The key explanatory variable is the measure of bargaining power which is explained in detail in the next section.

4.1 Measure of bargaining power

The measure of bargaining power is constructed using 'Latent Trait Model' (LTM). When a variable is unobserved or difficult to quantify such as ability, consumer preferences or bargaining power we use a set of observable variables to generate the underlying latent trait. Factor analysis is the statistical technique used when the observable variables are continuous. Latent trait analysis is an analogue of the factor analysis model and is used when the observable variables are binary. The factor analysis model is problematic for binary observable variables since these variables are bounded and take values of 0 or 1 whereas the underlying latent variable is continuous and can take any value on the $[-\infty, \infty]$ space[21]. Hence, LTM is the appropriate technique to use to construct the measure of female bargaining power since the observable variables are responses (0/1) to questions provided by wives on decision-making related to expenditure within the household (see appendix A for details on LTM).

The fundamental assumption of the latent trait model is that the correlations among the observables can be explained by one or more latent variables. In other words, given the latent variables, the probability of a positive response to a question is independent of the

[21] The reasoning is similar to why logistic regression is used instead of OLS when the dependent variable is binary.

probability of positive responses to any other questions. This assumption is satisfied if the observable variables are highly correlated with each other so that conditional on the common covariate (latent variable), these observables are independent. This is known as the conditional independence assumption and it forms the basis for estimating the weights or factor loadings that are associated with each observable variable.

These weights or loadings are used to assign factor scores to each individual woman and are also known as discrimination parameters since higher the weight, easier it is to distinguish two women located at some distance apart in the latent scale (say low and high power). The bargaining power score for each woman is computed as the sum of factor loadings associated with the observable variables for which the woman gives a positive response (Bartholomew et al. 2002). This factor score is the measure of bargaining power which is used as the main explanatory variable in the estimation of the reduced form child demand equation.

To evaluate if the observable variables satisfy the conditional independence assumption, LTM computes the 'expected' frequency for each response pattern assuming conditional independence among the observable variables and then compares this with the frequency of this response pattern 'observed' in the data. The expected frequency calculation is explained in detail in appendix B. By convention, if the residuals computed using expected and the observed frequencies are greater than 4 then it is termed as a discrepancy and the conditional independence assumption does not hold for some or all observable variables (Bartholomew et al. 2002). In this case, a subset of observable variables that maybe highly correlated is used and the conditional independence assumption is evaluated again. This is carried out until the expected and the observed frequencies of different responses patterns match closely. The set of observable variables for which the conditional independence assumption holds are the ones which are used to construct the underlying latent variable/s.

All the expenditure related questions asked in the decision-making module in IFLS (Indonesia Family Life Survey) are listed in appendix C. A binary variable is created for each question and is equal to '1' if a woman participates in the decision-making (either solely or with others - spouse, in-laws, parents etc.) and '0' otherwise; these binary variables have missing values if the questions are not answered by the wives. Table 2 shows the frequency distribution of all the decision-making questions. Two questions related to money put aside for savings lottery and monthly savings had over 40-60% of the responses indicating that they never used money for this purpose and hence these two questions are not included in the bargaining power measure. Also, the child related decision making questions (child clothes, health and education) were answered only by women who have children which is about 90% of the sample. This creates a potential problem since the total measure of bargaining power is automatically lowered for women with no children. Hence, the estimation of the child demand equation is done first with the entire sample and then with the sub-sample of women who have at least one child. While using the entire sample, the child-related expenditure questions are excluded from the power measure; however, the power measure for the sub-sample includes the child related questions. The bargaining power measure for the entire sample is discussed first and then the power measure for the sub- sample is discussed.

4.2 Measure of bargaining power for the entire sample

After excluding the questions related to saving and children related expenditures, there are 8 expenditure variables and the latent trait model using all the variables results in several discrepancies between expected and observed frequencies which are a violation of

the assumption of conditional independence of observables[22]. For the 8 binary variables, there are 256 possible response patterns, however, only 161 patterns are observed in the data of which there are 39 response patterns where the observed and expected frequencies do not match.

Table 3 shows the correlation matrix of all 8 expenditure variables which indicate that the four questions (on durable goods[23]) are correlated with each other. Hence, the expenditure decisions are split into 2 categories – durable goods and non-durable goods[24]. The decisions related to expenditure on durable goods has no discrepancy between expected and observed frequencies as shown in table 4 which indicate that the responses provided to expenditure decisions on durable goods are highly correlated and the underlying common covariate among these variables is the bargaining power measure. It is generated using factor loadings on observable variables related to durable goods and is named 'BP1'. This measure of power is used to estimate the child demand equation for the entire sample of women[25].

Table 5 lists the factor loadings (discrimination parameters) for the observable variables related to bargaining power measure BP1. The loadings indicate that, 'Money given to parents' best discriminates a woman with low bargaining power compared to woman with high bargaining power in the latent power scale; followed by money given to in-laws, expenditure for gifts at weddings/parties and expenditure on large expensive purchases for

[22] The two factor latent trait model using all the 8 variables indicates that all the observable variables load only one factor.

[23] These are decisions on large expensive purchases for household (TV/fridge), on money given to parents, on money given to in-laws, on gifts for weddings/parties.

[24] These are decisions on food eaten at home, routine household purchases, own clothes and spouse clothes.

[25] The responses to questions on non-durable goods had some patterns for which there were differences in expected and observed frequencies and hence these decisions are further split into questions related to household non-durable goods (expenditure on food eaten and routine purchases in the household) and personal non-durable goods (expenditure on own and spouse clothes). Tables D1.1 and D1.2 (in Appendix D) show the expected and observed frequencies for household and personal non-durable goods respectively and they indicate there are no discrepancies between them. The bargaining power measures constructed using factor loadings on household non-durable goods is called 'BP2' and on personal non-durable goods is called 'BP3'. The child demand equation is estimated using these power measures for the entire sample, however, they do not provide significant evidence of the impact of bargaining power on total births and hence, the results are provided in Appendix D.

household. The standardized discrimination parameters (which range from 0.8 to 0.99) indicate that the latent power measure BP1 explains most of the variation in the four observable variables. The average power score for the bargaining power measure is 11 with the standard deviation of 2.6.

4.3 Measure of bargaining power for the sub-sample

The above LTM analysis is repeated for the sub-sample of women with at least one child using responses to 11 expenditure related decisions (all the 8 expenditure variables which are used in the entire sample plus the 3 variables on child expenditure)[26]. The one factor latent trait model using all the 11 variables indicated that out of 309 observed response patterns, 154 had differences in the expected and the observed frequencies. Hence, following the previous analysis, table 5 shows the correlation matrix of all the 11 expenditure variables and based on this matrix, 4 different LTM models are analyzed, first using responses to questions on durable goods, second using responses to child related goods, third using responses to questions on household non-durable goods and fourth using responses to personal non-durable goods. Table 6 list the expected and observed frequencies for all possible response patterns for decisions related to durable goods and they indicate no significant differences which imply that the conditional independence assumption holds. The factor loadings are shown in Table 7 and the power measure constructed using these loadings is named 'BPC1'. For the restricted sample, the average power score for the bargaining power measure is 12.2 with the standard deviation of 2.9 and this measure of power is used to estimate the child demand equation for the sub-sample[27].

[26] The two factor latent trait model using all 11 variables indicates that all the observable variables load only one factor.

[27] Tables D2.1-D2.3 (in Appendix D) show the expected and observed frequencies for child related expenditure, household and personal non-durable goods respectively and they indicate there are no discrepancies between them. The bargaining power measures constructed using factor loadings on child goods, household non-durable goods and personal non-durable goods are called BPC2, BPC3 and BPC4 respectively.

5 Empirical Specification

The child demand equation estimated is as follows –

$$N_i = \beta_0 + \beta_1 BP_i + \beta_2 X_i + \beta_3 C_{ij} + \varepsilon_i \qquad (1)$$

where subscript 'i' refers to the individual (woman) and 'j' refers to the community she resides in. N_i is the total number of children borne by the ith woman residing in the jth community. BP_i is the true measure of female bargaining power within the household and the measure of power discussed in the previous section is used as a proxy. X_i includes the demographic variables of the ith woman and her husband such as their ages, years of schooling, ethnicity, household socio-economic status, location of residence (rural or urban) and religion. C_{ij} incorporates all the community level characteristics such as access to family planning services, access to health services, percentage of households with electricity, percentage of households with pump or pipe water facility and percentage of people in the community with some education. Equation (1) can be written as –

$$N_i = \mathbf{X_i'}\boldsymbol{\beta} + \varepsilon_i \qquad (2)$$

where, $\mathbf{X_i} = \left(1, BP_i, X_i, C_{ij}\right)$

$\boldsymbol{\beta}$ = vector of coefficients

The power measure is prone to both measurement error as well omitted variable bias as it is correlated with both individual and community level characteristics. For example, a woman's participation in household decision making is most likely influenced by her income and assets relative to her husbands and also by the extent of gender equality in the community she resides in. Hence, to overcome the biases due to measurement error and omitted variables, the above equation is estimated with instrumental variable approach, specifically

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The child demand equation is estimated using these measures of power for the restricted sample, however, they do not provide significant evidence of the impact of bargaining power on total births and hence the results are provided in Appendix D

IV/GMM. If Z_i is the vector of included exogenous variables and of excluded instruments – relative wage, types of credit institutes and relative education in the community, then moment conditions are given by –

$$E\left[Z_i\varepsilon_i\right]=0\Rightarrow E\left[\mathbf{Z_i}\left(N_i-\mathbf{X_i}\boldsymbol{\beta}\right)\right]=0$$

$$\text{Let } g\left(\beta\right)=\frac{1}{n}\sum_{i=1}^{n}\mathbf{Z_i}\left(N_i-\mathbf{X_i}\boldsymbol{\beta}\right)$$

Then, to obtain the GMM estimator, the weighted average of moment conditions is minimized and is given by -

$$J\left(\beta,W\right)=g\left(\beta\right)Wg\left(\beta\right) \qquad (3)$$

The GMM estimator is given by -

$$\hat{\beta}=\left(\mathbf{X'Z}\hat{W}\mathbf{Z'X}\right)^{-1}\left(\mathbf{X'Z}\hat{W}\mathbf{Z'}N\right) \qquad (4)$$

where, $\hat{W}$ = optimal weight matrix and is the inverse of the covariance matrix of moment conditions Using the estimated parameters, the Hansen J-statistic is computed and is given by –

$$J\left(\hat{\beta},\hat{W}\right)=g\left(\hat{\beta}\right)\hat{W}g\left(\hat{\beta}\right)$$

5.1 Endogeneity test, instrument relevance and test of overidentifying restrictions

To confirm that the measure of bargaining power is endogenous, the J-statistic is computed for two different models, first where the power measure is assumed to be exogenous $\left(J_{full}\right)$ and second, where the power measure is assumed to be endogenous $\left(J_{restricted}\right)$. These statistics are used to test the following hypothesis –

$H_0: E\left(BP_i\varepsilon_i\right)=0$ (measure of bargaining power is exogenous)
$H_1: E\left(BP_i\varepsilon_i\right)\neq 0$ (measure of bargaining power is endogenous)
A C-statistic is defined as
$C=J_{full}-J_{restricted}$
and $C\sim\chi^2\left(\text{number of instruments}\right)$, in this case $C\sim\chi^2\left(1\right)$

So if C-statistic is greater than $\chi^2\left(1\right)$, then we reject the null of exogeneity of the measure of bargaining power. The first stage results for all specifications indicate that we can reject the

null of exogeneity for the measure of power and hence it has to be instrumented to obtain unbiased and consistent estimates of the child demand equation.

To test for the relevance of the three instruments used, the measure of bargaining power is regressed with the included exogenous variables and the excluded instruments as shown below -

$$BP_i = \mathbf{X_i}\beta + \mathbf{Z_{1i}}\alpha + \nu_i \qquad (5)$$

where, $\mathbf{Z_i} = (\mathbf{X_i}, \mathbf{Z_{1i}})$

$\mathbf{Z_{1i}}$ = vector of excluded instruments

$\mathbf{X_i}$ = vector of exogenous variables (included instruments)

The first criteria for instruments to be valid is that they are strongly correlated with the endogenous variable, that is, α the vector of coefficients associated with the instruments be statistically significant and in this case also positively correlated with the measure of power. The IV/GMM estimates are asymptotically biased if the instruments and measure of power are only weakly correlated. There are two tests for weak instruments as suggested by Stock et al. (2002) and Stock and Yogo (2005) - relative bias test and relative size test.

The first test of whether a set of instruments is strong is if the F-stat of excluded instruments from first stage is large enough such that the IV relative bias is at most x%. Stock and Yogo (2005) indicates what the F-stat from the first stage should be for one endogenous regressor and 'n' excluded instruments for a relative bias of at most 5%, 10%, 20% and 30%. The second test of whether a set of instruments is strong is if the F-stat of the excluded instruments from the first stage is large enough such that a hypothesis test with a 'true' rejection rate of 5% rejects no more than say (x%) of the time.

Stock and Yogo (2005) indicates what the F-stat from the first stage should be for one endogenous regressor and 'n' excluded instruments for rejection rates of at most 10%, 15%, 20% and 25%. The first stage regression results provides the critical values for relative

bias test and relative size test in all specifications to identify the relevance of the instruments used for the bargaining power measure.

The second criterion for instruments to be valid is that they are not correlated with the error term ε_i. However, this error term is not observed, hence testing this requirement is not possible. Hence, a test of overidentifying restrictions is carried out if the number of instruments (excluded and included) is greater than the number of explanatory variables. The Hansen-J statistic is used to test the hypothesis -

$$H_0 : E[Z_i \varepsilon_i] = 0$$
$$H_1 : E[Z_i \varepsilon_i] \neq 0$$

If the J-statistic of the above model is less than chi-square (excluded instruments), then we cannot reject the null of exogeneity of the instruments. In other words, both the exogenous variables (included instruments) and excluded instruments are not correlated with the error term in which case the above moment conditions can be used to obtain the IV/GMM estimator.

5.2 Instruments

To account for the potential endogeneity of bargaining power measure, three environmental variables are considered - female wage relative to male wage in the community, types of credit institutes within the community and the percentage of females to males with at least primary education in the community.

The first instrument is the relative wage at the community level. It is computed as the average female hourly wage to male hourly wage using data from IFLS 1(1993) since the wage information is not public in IFLS 2 (1997). Higher relative wages may positively impact decision-making within household in two ways - first, higher the relative wage, more beneficial is the wife's participation in the labor force and higher will be her earnings relative

to her husband's which increases her participation in expenditure decisions made within the household. Second, higher the relative wage, greater are the wife's outside options which increases her threat point and hence her participation in household decision-making.

The second instrument is the types of micro-credit institutions[28] available within the community where the couple resides. The microfinance institute (MFI) in Indonesia is one of the most successful in the world. The most widespread is the microfinance divisions of the Bank Rakyat Indonesia, set up as an independent profit-making center in 1984. This division has established over 4000 branches at the community/village level called Unit Desa (BRI-UD) and reported 31.3 million savers and 3.2 million borrowers in 2004 (Helms, 2006)[29]. Micro-credit institutions not only provide people (and especially women) with loans to start their own business but also provide financial options to save their earnings; a survey conducted by BRI (Bank Rakayat Indonesia) find that women are especially keen to save their earnings in these credit institutes without their husbands knowledge (Charitonenko and Afwan 2003). Furthermore, there is evidence in the anthropology literature (Wolf 1991) and in the IFLS (Frankenberg and Thomas 2001) that women in Indonesia are allowed to own land and businesses by herself after marriage. So having more types of such credit institutes in the community of her residence increases a woman's options to take out loans to start businesses, accumulate assets and save her earnings separately from her husband which then enables her to participate in the decision-making within the household and bargain with her husband about her preferences.

The third instrument is the measure of gender equity in the community that the wife and husband reside in. I use the ratio of number of females with at least primary schooling

[28]Bank Rakyat Indonesia (BRI), Bank Perkreditan (BPR), Lembaga Kredit Desa (LKD), Lembaga Dana Kredit Pedesaan (LDKP), KUD (Koperasi Unit Desa), Other Formal Cooperative, Private Bank

[29]Other types of MFIs include the locally owned people's credit banks (Bank Perkreditan Rakyat), village owned village credit organizations (Badan Kredit Desas or BKDs which particularly provide microfinance in rural Java) and several other rural credit institutes called the Lembaga Dana Kredit Pedesaan (LDKPs) which have been established by the provincial (state) governments.

to males with at least primary schooling (6 years of education) as the measure of gender equity in the community. The more gender equal a community is, the more acceptable it maybe for females to participate in the decision-making process within the household. There is also evidence in IFLS2 that over 75-90% of the women who participate in community level activities and groups[30] have completed at least primary schooling, which one of the channels in the 'social sphere' for wives to acquire information and support outside of their marriage.

Since the instruments are all at the community level, it is reasonable to assume that they are exogenous to each individual woman's or couple's decision to have children, hence they are unlikely to have any direct impact on total number of births which is the dependent variable. Hence, these community variables will most likely impact a woman's earnings and asset accumulation relative to her husband and hence her participation in decision making process within her household but not the number of births she has.

6 Results

Tables 10-13 show the results of estimating the child demand equation using the variables discussed above. The standard errors reported in the parenthesis are robust to presence of heteroskedasticity in the error term. Table 10 reports the OLS and IV results respectively using the entire sample. Table 11 report the first stage regression results for the entire sample. Tables 12 and 13 are analogous to tables 10 and 11 and report the results for the sub-sample of women who have had at least one child.

[30] There are 4 community activities that IFLS lists in which both men and women can participate. These are community meetings, voluntary labor, co-operatives and program to improve neighborhood.

The OLS (column1, table 10) results indicate that an increase in wife's years of education has a statistically significant impact on lowering the total number of births which is accordance to what has been found in almost all previous analysis of impact of women's education on fertility (see Schultz 1997 for survey). The estimate suggests women with college level or higher education (16 years or more) have about 1 birth lower than women with no education. The presence of family planning clinics also lowers the total number of births which is also consistent with results of previous studies on impact of family planning clinics on fertility (Rosenzweig and Schultz 1982b, Schultz 1997)[31].

Increasing age at marriage for women has a negative impact on total number of births; a one standard deviation increase in age at marriage (about 5 years) decreases total number of births by 0.6. Also, Javanese women have lower number of births (about 0.6) compared to women of other ethnicities in Indonesia which supports the ethnographic evidence that Javanese women are an important part of the household economy and a common Javanese saying is that, "women are the minister of the interior," which means that women play a key role in household decision-making (Frankenberg and Thomas 2001). The OLS results also indicate a negative impact of female bargaining power on total births but this effect is not statistically significant.

The IV estimates reported in column 2 in table 10 suggest that female bargaining power has a statistically significant impact on lowering the total number of births. A one standard deviation increase in female bargaining power results in a reduction in total number of births by 0.8. This negative effect of bargaining power on total number of births is net of the impact of wife's education (substitution effect), household income (income effect) and net impact of access to family planning services on total number of births. The first stage results (shown in table 11) indicate that the instruments – relative wage, types of credit

[31] Rosenzweig and Schultz (1982b) find availability of family planning clinics are associated with lower fertility in Columbia.

institutes and relative education at the community level – have a positive and statistically significant impact on bargaining power. The joint F-statistic of excluded instruments is 31.6 which indicate that there is no weak instrument problem (see Stock-Yogo (2005) weak id critical values in table 11). The Hansen J-statistic indicates that the null that all instruments, both included exogenous regressors and excluded instruments, are not correlated with the error term cannot be rejected.

Also, the endogeneity test indicates that the null hypothesis that the measure of female bargaining power is exogenous is rejected which provides evidence that the power measure must be instrumented. The other control variables that have a statistically significant and negative impact on total births are age at marriage, own education, number of family planning clinics and number of family planning worker visits to the community and percentage of households with pipe and pump water facility in the community.

Columns 3 (OLS) and 4 (IV) in table 10 analyze the impact of bargaining power on total number of births by age. Figure 3 shows the age specific fertility rates for Indonesia from 1967-1997 for each 10 year period. Total fertility rates increase for women in the 15-24 age group, then remain more or less the same until 29 after which it starts to decline and becomes very small after age 40. Hence, the impact of female bargaining power on total births may be higher for younger women than it is for older women since the latter have most likely completed their (and/or their husband's) desired child bearing. To test this, columns 3 and 4 include the interaction term of bargaining power with wife's age. OLS results indicate both power and its interaction with age do not have a statistically significant impact on total number of births; furthermore, the estimates suggest that the effect of power on lowering total births is higher for women of older ages than for those of younger ages which is contrary to what we would expect. The IV results indicate bargaining power has a statistically significant impact on the total number of children, however, this impact is

negative only for women who are 36 years and younger. An increase of one standard deviation in bargaining power results in a reduction of 2.8 births for 15 year old women and 1 birth for 27 years old women. This marginal impact of bargaining power on fertility by age is shown in figure 4 and the negative impact of power on fertility decreases with increase in age. The first stage results (shown in table 11) indicate the joint F-statistic of excluded instruments is statistically significant for both bargaining power and the interaction term of power and age. The interaction of relative wage with age is included as an additional instrument to account for the endogeneity of the interaction of power with age[32]. The is because relative wage at the community level may have a differential impact on decision to work for wives due to the age-earnings profile (earnings rise over time as age increases but with decreasing rate).

Table 12 shows OLS and IV results for the sub-sample of women who have at least one child. Similar to the results of the entire sample, the OLS results indicate that bargaining power has a negative impact on total births which is not statistically significant. The other control variables also have the expected signs. The IV estimates indicate that the measure of bargaining power has a statistically significant impact in lowering total number of births and an increase of one standard deviation in power results in lowering the total births for women with at least a child by 0.9. The first stage results are shown in table 13; the joint F-statistic of excluded instruments is 24.9 which indicate that the instruments have a significant and positive impact on female bargaining power. The Hansen J-statistic indicates that the null that all instruments, both included exogenous regressors and excluded instruments, are not correlated with the error term cannot be rejected.

[32] Interactions of credit institutes and relative education at the community level with age were also used as instruments but those specifications result in weak instrument problems and Hansen J-statistics indicate that some of the instruments (excluded or included) may be correlated with the error term.

In columns 3 and 4 (OLS and IV respectively), the interaction of power with age is included. OLS results indicate that power and its interaction with age do not have a statistically significant impact on number of births; however, IV estimates suggest that bargaining power has a significant negative impact on total births for women who are 38 and younger. A one standard deviation increase in power reduces the number of births by 4 for 15 year old women and by 1 for 32 year old women. Hence, the negative impact of bargaining power on total births is larger for women in the sub-sample than for those in the entire sample since these women already have at least one child. This impact of bargaining power on total births by age for sub-sample of women with at least one child is shown in figure 5.

The above results imply that the IFLS data rejects the unitary model of household decision making and that bargaining power of wives relative to their husbands has a differential impact on total number of births in the family. Furthermore, the impact of power on total number of births is stronger for younger married women than it is for older women.

6.1 Robustness Checks

The above analysis is repeated by using only live births as the dependent variable since there may be measurement errors in reporting miscarriages or still births. The results are similar in nature to when total number of births is used as the dependent variable as shown in tables 14 and 15 for the entire sample and for the sub-sample respectively – the IV estimates indicate that the measure of power has a negative and statistically significant impact on live births and this impact declines with age of the women. Figures 6 and 7 show the marginal impact of bargaining power on live births by age.

Since the dependent variable (total births) is a non-negative count variable ranging from 0 to 10, the child demand equation is also estimated using poisson and negative binomial estimation techniques. Again, the impact of bargaining power on total births is significant only when instruments are used similar to results in tables 10 and 12; however, IV poisson and IV negative binomial estimates indicate a stronger impact of power on total births (shown in tables 16 and 17 respectively). A one standard deviation increase in power results in a decrease of about 2.3 births for the entire sample and 2.5 births for the sub-sample of women. The impact of power on births by age is stronger for younger women than it is for older women and is shown in figures 8 and 9.

Table 18 shows the results of estimating child demand equation using two measures of power that are frequently used in the intrahousehold bargaining literature – columns 1 and 2 show results using the measure of power generated by adding the responses to all expenditure questions (excluding questions on children and savings). Both OLS and IV/GMM estimates indicate a negative impact of power on total births, the latter being stronger, however, both are statistically not significant. Columns 3 and 4 show results using factor analysis on the binary responses to expenditure questions, both OLS and IV/GMM indicate that bargaining power does not have a statistically significant impact on total births. However, measures generated by summing (and factor analysis on) the responses to expenditure questions only on durable goods indicate that bargaining power has a negative and statistically significant impact on total births as shown in columns 6 and 8 (IV/GMM estimates). This underscores the importance of using latent trait model technique to first, determine the set of binary response variables for which the conditional independence assumption holds and then use these response variables to generate the common latent covariate.

Table D1.4 in appendix D shows results of estimating the child demand equation using measures of power generated using expenditure questions on household non-durable goods and personal non-durable goods for the entire sample. Table D2.5 shows the same for the sub-sample of women with at least one child, in addition, is also shows the estimation results using a measure generated from expenditure questions on children. Both the measures indicate that power does not have a statistically significant impact on total births for both the entire sample and the sub-sample of women; in addition, the first stage results indicate weak instrument problems. One of the potential problems in using measures generated using household and personal non-durable goods is that the number of questions is 2 in each measure and hence the potential number of response patterns is 4 (86% of women answered 1 to both questions related to expenditure on household non-durable goods and 67% answered 1 to both questions related to expenditure on personal non-durable goods) and hence the variability in these measures of power is lower. Alternatively, it may be that the community level instruments do have positive and statistically significant impact on expenditure decisions related to durable goods than they do on expenditure decisions related to non-durable goods (household and personal) and hence the latter has weak instrument issues but not the former. Columns 5 and 6 in table D2.5 report results using a measure of power generated from responses to expenditure on child services and goods. The IV estimates indicate that increasing the power measure by one standard deviation can result in reduction of 1 birth for women who already have at least one child. However, when this power measure is interacted with age, the IV estimates do not provide statistically significant evidence of declining negative impact of power on total number of births by age. The first stage also reveals weak instrument problems.

7 Conclusion

This paper analyses the impact of female bargaining power on total number births for Indonesian women. A measure of bargaining power is constructed from responses to expenditure related decision-making questions within the household and this measure is used to proxy for the true female bargaining power within the household. A contribution of this paper is to use LTM to generate the latent measure of power; this technique identifies the response variables for which the conditional independence assumption holds and then generates the common covariate among these variables. This methodology is generic can be applied to construct other latent measures from binary response variables.

Furthermore, to account for the endogeneity of this power measure, instrument variables approach is used. Only when the power measure is instrumented, the negative impact of power on total births is significant and is stronger than the OLS estimate. Hence, previous studies that do not instrument their bargaining power measures (that are generated from responses to household decision-making questions) provide misleading results of no impact of power on fertility. The IV results also suggest that the negative impact of power on births decreases with increase in age of wives. This impact is net of substitution and income effects as well as impact of access to family planning programs in the community on total births.

The empirical evidence in this paper suggests that increasing economic opportunities for women within the community may empower wives to participate in household decision-making and hence enable them to assert their preferences on family size, particularly for younger wives who have not completed their child-bearing. The gender equity measure also has a significant positive impact on female participation in household decision-making which suggests that educating the entire community about the importance of female participation in all household decisions including family size can enable wives to assert their preferences

as well. The empirical analysis also indicates that increasing age at marriage, years of education for women and the number of family planning clinics and worker visits in the community may have a significant impact in lowering total number of births.

However, to address the problems of maternal mortality and morbidity (which is prevalent in many countries) in more detail, we need empirical studies that identify the impact of female bargaining power on age at first birth, birth spacing and contraceptive use.

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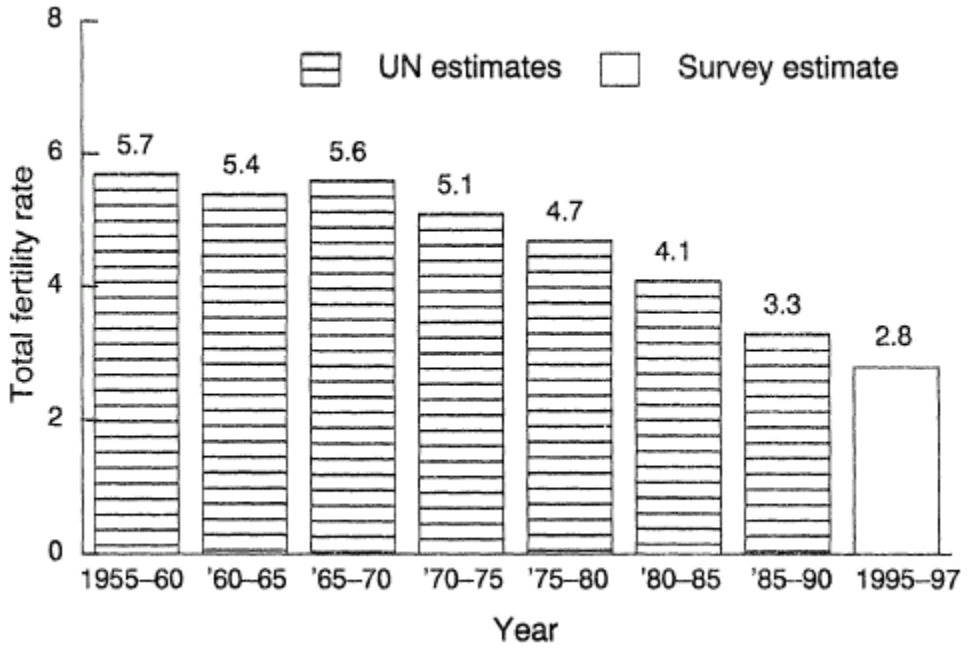
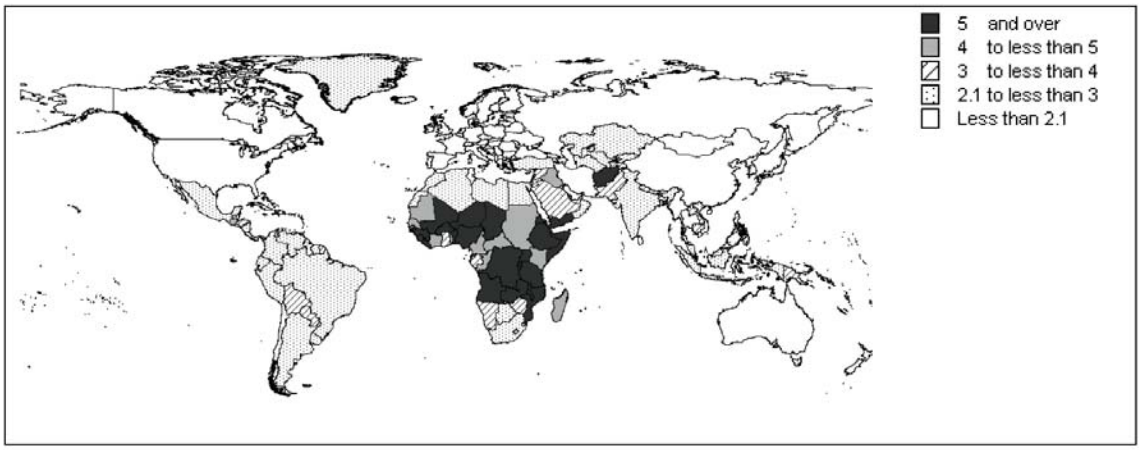
Figure 1: Fertility Decline in Indonesia (1955-97)



Source: 'Indonesia 1997: Results from the Demographic and Health Survey'
Studies in Family Planning, Vol. 30, No. 3, (Sep., 1999), pp. 254-258, Population Council

Figure 2: Total Fertility in 2005-2010 (children per woman)



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2007). World Population Prospects: The 2006 Revision, Highlights. New York: United Nations.

Figure 1: Age Specific Fertility Rates in Indonesia

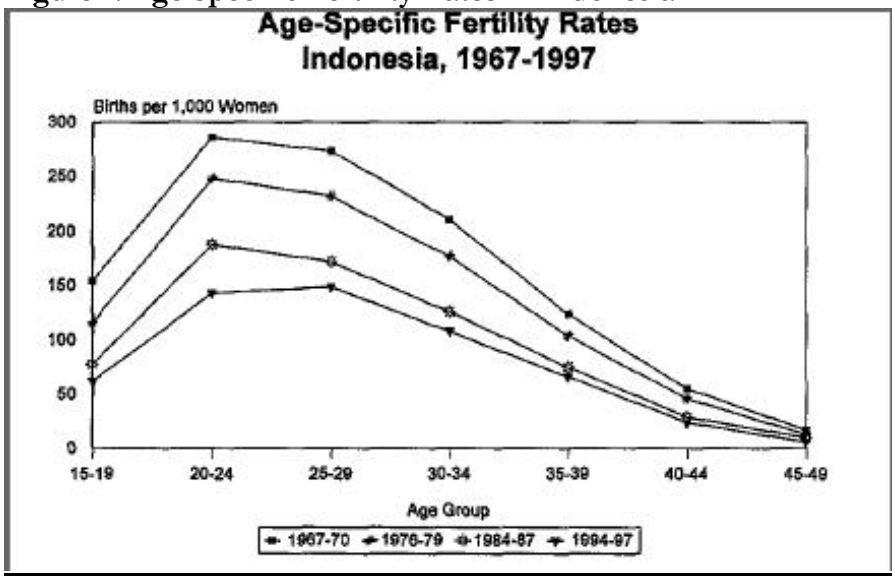


Table 1: Descriptive Statistics

	Entire Sample (N=3400)		Sub-Sample (N=2880)	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Total Births	2.90	2.13	3.30	2.02
Live Births	2.93	2.06	3.25	1.97
Age	32.91	7.73	33.93	7.21
Age at Marriage	19.65	4.91	19.39	4.72
Years of Educ.	6.53	4.03	6.43	4.05
Husbands Age	38.05	9.12	39.11	8.64
Husbands Years of Educ	7.69	5.02	7.63	4.98
Log of HH Assets and Income (1000 INR)	8.89	1.42	8.99	1.39
Ethnicity				
Javanese	0.53	0.50	0.53	0.49
Balinese	0.06	0.23	0.05	0.24
Minang	0.04	0.20	0.04	0.20
Sumatran	0.07	0.25	0.07	0.26
Outer Islands	0.13	0.33	0.12	0.33
Modern	0.17	0.38	0.18	0.38
Rural	0.55	0.50	0.54	0.49
Muslim	0.88	0.33	0.87	0.33
Community				
Number of FP Clinics	4.35	7.04	4.33	6.99
Number of FP worker visits	39.23	75.03	39.27	74.42
Number of Health Posts	7.43	6.13	7.47	6.21
% of HH with pipe/pump water	36.86	41.22	37.21	41.50
% Educated	71.48	23.33	79.72	27.12
Instruments				
Relative Wage	0.12	0.89	0.12	0.87
Types of Microfinance Institutions	3.14	1.44	3.20	1.45
Relative Education at Community Level	0.88	0.34	0.89	0.34

Source: IFLS 1997 and 1993

Table 2: Frequency of distribution of household decision making (entire sample)

Q. Who makes expenditure decision on	Wife Does Not	Wife Does	Not Answered*
Food eaten at home	10.3	89.6	0.1
Routine purchases	10.4	89.6	0.0
Clothes	11.8	88.3	0.0
Spouse clothes	27.6	72.4	0.0
Child clothes	9.5	84.1	6.4
Child education	9.7	78.6	11.7
Child health	6.3	87.2	6.5
Durable goods	22.0	77.7	0.3
Money to parents	7.8	92.2	0.0
Money to in-laws	9.2	90.9	0.0
Gifts at wedding	5.8	94.1	0.1
Money for monthly arisan (savings lottery)	4.5	58.0	37.5
Money for monthly savings	6.9	40.4	52.8

Notes:
*Reasons for Not Answering the Question are the following
- No Children (for child clothes, education and health)
- Never Used Money for this purpose
- Can't answer

Table 3: Correlation matrix of binary response expenditure decision-making variables (entire sample)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) food	1.0							
(2) routine purchases	**0.7**	1.0						
(3) own clothes	**0.2**	**0.2**	1.0					
(4) spouse clothes	**0.1**	**0.1**	**0.2**	1.0				
(5) large expensive purchases	0.1	0.1	0.1	0.1	1.0			
(6) money given to parents	0.1	0.1	0.2	0.1	**0.3**	1.0		
(7) money given to in-laws	0.1	0.1	0.1	0.2	**0.2**	**0.5**	1.0	
(8) gifts at wedding/parties	0.2	0.2	0.2	0.2	**0.2**	**0.4**	**0.3**	1.0

Table 4: Observed and expected frequencies for measure of bargaining power using responses to questions on durable goods/services – (entire sample)

Var 1	Var 2	Var 3	Var 4	Observed Frequency (O)	Expected Frequency (E)	(O-E)^2/E	Bargaining Power Score
0	0	0	0	59	50.4	1.5	0.0
1	0	0	0	14	19.3	1.4	1.2
0	0	0	1	58	59.2	0.0	1.9
0	0	1	0	12	14.3	0.4	3.0
1	0	0	1	37	34.2	0.2	3.1
1	0	1	0	9	10.2	0.1	4.3
0	0	1	1	39	42.7	0.3	5.0
0	1	0	0	10	10.3	0.0	6.0
1	0	1	1	42	39.0	0.2	6.2
1	1	0	0	7	10.5	1.2	7.2
0	1	0	1	44	54.1	1.9	7.9
0	1	1	0	37	29.9	1.7	9.0
1	1	0	1	85	75.1	1.3	9.1
1	1	1	0	55	57.0	0.1	10.2
0	1	1	1	494	491.2	0.0	10.9
1	1	1	1	2398	2402.8	0.0	12.1

Notes:

Var 1: Expenditure on durable goods
Var 2: Money given to parents
Var 3: Money given to in-laws
Var 4: Expenditure on gift for parties and weddings

Table 5: Factor loadings of observable variables, mean and standard deviation of measure of bargaining power (entire sample)

Observable Variables	Discrimination Parameters/ Factor Loadings	Standardized Factor Loadings
Durable Goods (BP1)		
Expensive Purchases	1.2	0.8
Money to parents	6.0	0.98
Money to in-laws	3.0	0.95
Gifts at wedding/parties	1.9	0.9
Bargaining Power Measure	**Mean**	**Std. Dev.**
BP1	11.0	2.6

Table 6: Frequency of distribution of household decision making (sub-sample)

Q. Who makes expenditure decision on	Wife Does Not	Wife Does	Not Answered*
Food eaten at home	9.0	91.0	0.1
Routine purchases	9.0	91.0	0.0
Clothes	11.8	88.2	0.0
Spouse clothes	27.1	72.9	0.0
Child clothes	9.8	89.7	0.5
Child education	10.9	88.7	0.5
Child health	6.6	92.9	0.5
Durable goods	20.9	79.1	0.0
Money to parents	8.0	92.0	0.0
Money to in-laws	9.2	90.8	0.0
Gifts at wedding	5.7	94.3	0.0
Money for monthly arisan (savings lottery)	4.6	59.8	35.6
Money for monthly savings	7.1	41.5	51.4

Table 7: Correlation matrix of binary response expenditure decision-making variables (sub-sample)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) food	1.0										
(2) routine purchases	**0.7**	1.0									
(3) own clothes	**0.2**	**0.3**	1.0								
(4) spouse clothes	**0.1**	**0.1**	**0.2**	1.0							
(5) child clothes	0.3	0.3	0.4	0.3	1.0						
(6) child education	0.2	0.1	0.2	0.2	**0.4**	1.0					
(7) child health	0.2	0.2	0.3	0.2	**0.4**	**0.6**	1.0				
(8) large expensive purchases	0.1	0.1	0.1	0.1	0.2	0.3	0.2	1.0			
(9) money given to parents	0.1	0.1	0.2	0.1	0.2	0.2	0.2	**0.3**	1.0		
(10) money given to in-laws	0.1	0.1	0.1	0.2	0.2	0.2	0.2	**0.3**	**0.6**	1.0	
(11) gifts at wedding/parties	0.2	0.2	0.2	0.2	0.3	0.3	0.3	**0.2**	**0.4**	**0.3**	1.0

Table 8: Observed and expected frequencies for the measure of bargaining power using responses to durable goods and services (sub-sample)

Var 1	Var 2	Var 3	Var 4	Observed Frequency (O)	Expected Frequency (E)	(O-E)^2/E	Bargaining Power Score
0	0	0	0	53	42.0	2.9	0.0
1	0	0	0	12	17.0	1.5	1.2
0	0	0	1	46	50.5	0.4	2.0
0	0	1	0	8	11.4	1.0	3.1
1	0	0	1	34	31.0	0.3	3.2
1	0	1	0	8	8.6	0.0	4.3
0	0	1	1	34	35.1	0.0	5.1
1	0	1	1	35	33.4	0.1	6.3
0	1	0	0	6	7.4	0.3	7.1
1	1	0	0	4	8.4	2.3	8.3
0	1	0	1	37	42.7	0.8	9.0
0	1	1	0	25	22.3	0.3	10.2
1	1	0	1	72	63.7	1.1	10.3
1	1	1	0	48	45.4	0.1	11.4
0	1	1	1	394	390.4	0.0	12.2
1	1	1	1	2064	2070.6	0.0	13.4

Table 9: Factor loadings of observable variables, mean and standard deviation of measure of bargaining power (sub-sample)

Observable Variables	Discrimination Parameter	Standardized Factor Loadings
Durable Goods/Services		
Expensive Purchases	1.22	0.8
Money to parents	7.09	0.99
Money to in-laws	3.12	0.95
Gifts at wedding/parties	1.95	0.9
Bargaining Power Measure	**Mean**	**Std. Dev.**
BPC1	12.2	2.94

Table 10: OLS and IV/GMM estimates of child demand equation (entire sample)

Dependent Variable=Total Births	OLS (1)	IV (1)	OLS (2)	IV (2)
Measure of Female Bargaining Power	-0.01	-0.3*	0.002	-1.83*
	(0.01)	(0.17)	(0.037)	(0.99)
Bargaining Power*Age			-0.0005	0.05*
			(0.001)	(0.03)
Age	0.26***	0.27***	0.26**	-0.20
	(0.03)	(0.03)	(0.032)	(0.30)
Age at Marriage	-0.13***	-0.12***	-0.13**	-0.12***
	(0.01)	(0.01)	(0.009)	(0.01)
Years of Educ.	-0.05***	-0.05***	-0.05**	-0.07***
	(0.01)	(0.01)	(0.011)	(0.02)
Javanese	-0.62***	-0.64***	-0.62**	-0.63***
	(0.07)	(0.08)	(0.065)	(0.09)
Number of FP Clinics	-0.01*	-0.01**	-0.006	-0.01*
	(0.004)	(0.004)	(0.004)	(0.01)
Number of FP worker visits	-0.0004	-0.001**	-0.0004	-0.0004
	(0.0003)	(0.001)	(0.000)	(0.001)
% of HH with Pipe/Pump Water	-0.004***	-0.003***	-0.004**	-0.005***
	(0.001)	(0.001)	(0.001)	(0.002)
Observations	3158	3079	3158	3079
Endogeneity Test of endogenous regressors		3.61		8.51
chi-sq(endog. regressors) p-val		0.05		0.01
F-Stat of Excluded Instruments		31.6		15.98
p-value		0.0		0.0
Hansen J Statistic		1.3		0.43
chi-sq(excess instruments) p-val		0.5		0.81
excess Instruments		2		3

Notes: Additional controls for the all specifications include age square, husband's age and education, household assets and income, religion, location of residence and community variables – number of health posts for children, percentage of households with electricity and percent educated in the community. In all specifications, robust standard errors are reported in parenthesis. *** significant at 1%, ** significant at 5%, * significant at 10%

Table 11: Test of instrument relevance (first stage results) for the entire sample

Dependent Variable	IV (1) Measure of Female Bargaining Power	IV (2) Measure of Female Bargaining Power	IV(2) Measure of Female Bargaining Power*Age
Relative Wage	0.13***	0.15***	0.94
	(0.01)	(0.04)	(1.32)
Types of Credit Institutes	0.08**	0.08**	2.22*
	(0.03)	(0.04)	(1.24)
Relative Educ. Comm.	0.36**	0.36**	11.4**
	(0.15)	(0.15)	(5.00)
Relative Wage*Age		-0.001	0.097**
		(0.001)	(0.04)
F-stat. of excluded instruments	31.6	24.2	23.3
p-val	0.0	0.0	0.0
Stock-Yogo weak id critical values			
Bias			
5% maximal IV relative bias	13.91	11.04	11.04
10% maximal IV relative bias	9.08	7.56	7.56
20% maximal IV relative bias	6.46	5.57	5.57
30% maximal IV relative bias	5.39	4.73	4.73
Size			
10% maximal size	22.3	16.87	16.87
15% maximal size	12.83	9.93	9.93
20% maximal size	9.54	7.54	7.54
25% maximal size	7.8	6.28	6.28
Source: Stock-Yogo (2005)			

Notes: In all specifications, robust standard errors are reported in parenthesis. *** significant at 1%, ** significant at 5%, * significant at 10%

Figure 4: Marginal impact of bargaining power on total births by age (entire sample)

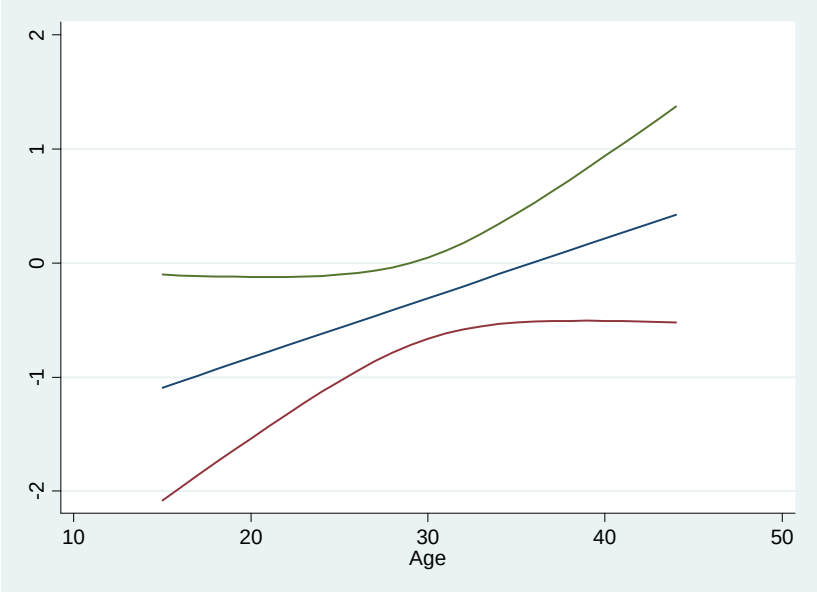


Table 12: OLS and IV estimates of child demand equation for the sub-sample

Dependent Variable=Total Births	OLS (1)	IV(1)	OLS (2)	IV (2)
Measure of Female Bargaining Power	-0.01	-0.30**	-0.02	-2.6**
	(0.01)	(0.14)	(0.04)	(1.27)
Bargaining Power*Age			0.0004	0.07*
			(0.0014)	(0.04)
Age	0.19***	0.17***	0.18***	-0.62
	(0.03)	(0.04)	(0.04)	(0.44)
Age at Marriage	-0.11***	-0.10***	-0.11***	-0.09***
	(0.01)	(0.01)	(0.01)	(0.01)
Years of Educ.	-0.06***	-0.06***	-0.07***	-0.08***
	(0.01)	(0.01)	(0.01)	(0.02)
Javanese	-0.68***	-0.76***	-0.68***	-0.69***
	(0.07)	(0.08)	(0.07)	(0.10)
Number of FP Clinics	-0.01***	-0.01***	-0.01***	-0.01**
	(0.003)	(0.004)	(0.003)	(0.01)
Number of FP worker visits	-0.009	-0.001*	-0.0004	-0.0003
	(0.0004)	(0.0005)	(0.0004)	(0.001)
% of HH with Pipe/Pump Water	-0.004***	-0.003***	-0.004***	-0.01***
	(0.0008)	(0.001)	(0.0008)	(0.002)
Observations	2702	2644	2702	2644
Endogeneity test		6.6		6.9
chi-sq(endog. regressors) p-val		0.01		0.03
F-statistic of excluded instruments		24.9		14.1
p-val		0.0		0.0
Hansen J Statistic		3.9		2.99
chi-sq(excess instruments) p-val		0.14		0.22
excess Instruments		2		2

Notes: Additional controls for the all specifications include age square, husband's age and education, household assets and income, religion, location of residence and community variables – number of health posts for children, percentage of households with electricity and percent educated in the community. In all specifications, robust standard errors are reported in parenthesis. *** significant at 1%, ** significant at 5%, * significant at 10%

Table 13: Test of instrument relevance (first stage results) for the sub-sample

Dependent Variable	IV(1) power	IV(2) power	IV(2) power*age
Relative Wage	0.14***	0.14***	0.98
	(0.02)	(0.05)	(1.90)
Types of Credit Institutes	0.123***	0.12***	3.55**
	(0.05)	(0.05)	(1.52)
Relative Educ. Comm.	0.44**	0.44**	14.19**
	(0.18)	(0.18)	(6.29)
Relative Wage*Age		-0.0001	0.11**
		(0.001)	(0.05)
F -stat. of excluded instruments	24.9	18.7	18.6
	0.0	0.0	0.0
Stock-Yogo weak ID test critical values			
Bias			
5% maximal IV relative bias	13.91	13.97	13.97
10% maximal IV relative bias	9.08	8.78	8.78
20% maximal IV relative bias	6.46	5.91	5.91
30% maximal IV relative bias	5.39	4.79	4.79
Size			
10% maximal size	22.3	4.72	4.72
15% maximal size	12.83	3.39	3.39
20% maximal size	9.54	2.99	2.99
25% maximal size	7.8	2.79	2.79
Source: Stock-Yogo (2005)			

Notes: In all specifications, robust standard errors are reported in parenthesis. *** significant at 1%, ** significant at 5%, * significant at 10%

Figure 5: Marginal effect of bargaining power on total births by age (sub-sample)

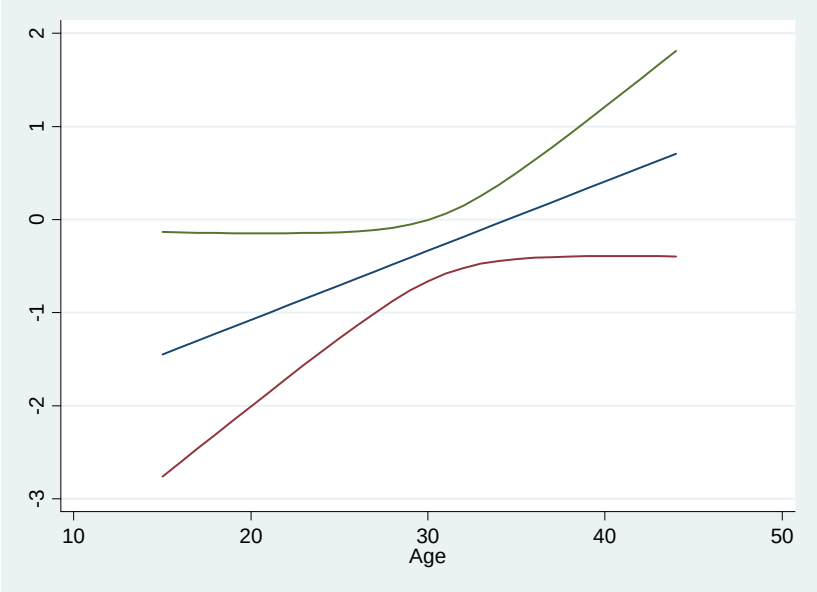


Table 14: OLS and IV/GMM estimates of child demand equation – live births (entire sample)

Dependent Variable=Live Births	OLS (1)	IV(1)	OLS (2)	IV(2)
Measure of Female Bargaining Power	-0.006	-0.27*	-0.016	-1.90**
	(0.010)	(0.15)	(0.036)	(0.91)
Bargaining Power*Age			0.0003	0.05*
			(0.001)	(0.03)
Age	0.248***	0.25***	0.245***	-0.26
	(0.027)	(0.03)	(0.030)	(0.29)
Age at Marriage	-0.119***	-0.11***	-0.119***	-0.11***
	(0.008)	(0.01)	(0.008)	(0.01)
Years of Educ.	-0.052***	-0.05***	-0.052***	-0.07***
	(0.010)	(0.01)	(0.010)	(0.02)
Javanese	-0.597***	-0.62***	-0.597***	-0.60***
	(0.061)	(0.07)	(0.061)	(0.08)
Number of FP Clinics	-0.005*	-0.01**	-0.005*	-0.01*
	(0.003)	(0.003)	(0.003)	(0.005)
Number of FP worker visits	-0.0003	-0.008*	-0.0003	-0.0006
	(0.0004)	(0.004)	(0.0004)	(0.0007)
% of HH with Pipe/Pump Water	-0.004***	-0.003***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	3088	3009	3088	3009
Endogeneity Test of endogenous regressors		4		7.4
chi-sq(endog. regressors) p-val		0.03		0.02
F-statistic of excluded instruments		30.5		17.1
p-val		0		0
Hansen J Statistic		4.4		2.9
chi-sq(excess instruments) p-val		0.12		0.23
excess Instruments		2		2

Figure 6: Marginal impact of bargaining power on live births by age (entire sample)

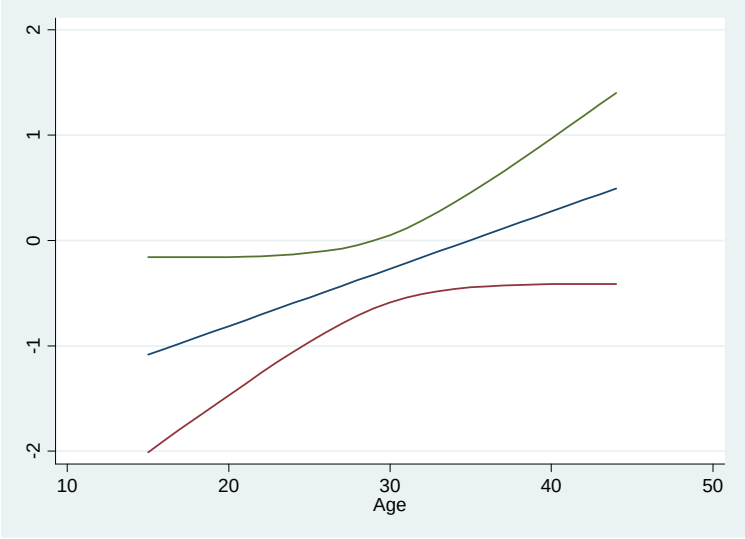


Table 15: OLS and IV/GMM estimates of child demand equation – live births (sub-sample)

Dependent Variable=Live births	OLS (1)	IV(1)	OLS (2)	IV (2)
Measure of Female Bargaining Power	-0.007	-0.27**	-0.025	-2.42**
	(0.009)	(0.13)	(0.041)	(1.24)
Bargaining Power*Age			0.001	0.07*
			(0.001)	(0.04)
Age	0.186***	0.17***	0.180***	-0.58
	(0.031)	(0.04)	(0.035)	(0.43)
Age at Marriage	-0.106***	-0.10***	-0.106***	-0.09***
	(0.009)	(0.01)	(0.009)	(0.01)
Years of Educ.	-0.058***	-0.05***	-0.058***	-0.08***
	(0.011)	(0.01)	(0.011)	(0.02)
Javanese	-0.670***	-0.74***	-0.670***	-0.68***
	(0.065)	(0.08)	(0.065)	(0.10)
Number of FP Clinics	-0.009***	-0.01***	-0.009***	-0.01**
	(0.003)	(0.004)	(0.003)	(0.01)
Number of FP worker visits	-0.0003	-0.001*	-0.0003	-0.0002
	(0.0004)	(0.0005)	(0.0004)	(0.0008)
% of HH with Pipe/Pump Water	-0.004***	-0.003***	-0.004***	-0.01***
	(0.001)	(0.0009)	(0.001)	(0.002)
Observations	2701	2643	2701	2643
Endogeneity test		5.64		6.82
chi-sq(endog. regressors) p-val		0.01		0.03
F-statistic of excluded instruments		24.9		14.1
p-val		0		0
Hansen J Statistic		3.9		2.3
chi-sq(excess instruments) p-val		0.15		0.31
excess Instruments		2		2

Figure 7: Marginal impact of bargaining power on live births (sub-sample)

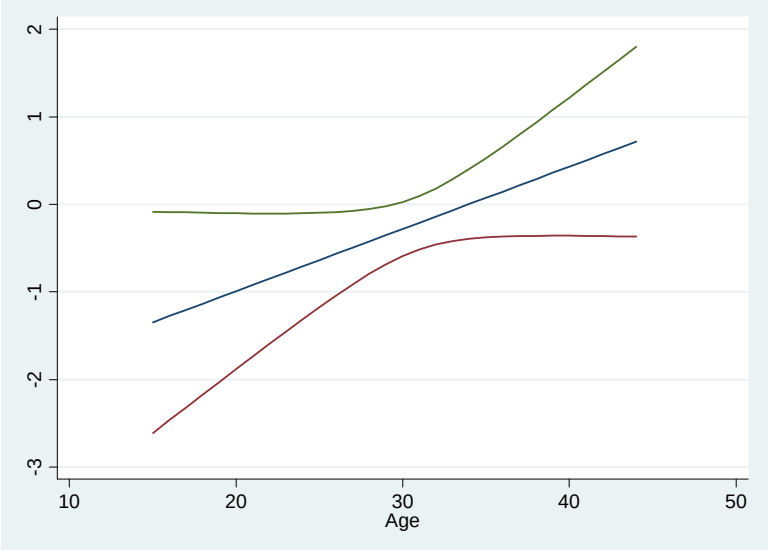


Table 16: Poisson estimates of child demand equation for the entire sample

Dependent Variable=Total births	Poisson (1)	Poisson/IV(1)	Poisson (2)	Poisson/IV (2)
Measure of Female Bargaining Power	-0.003	-0.114**	-0.005	-0.7**
	(0.004)	(0.05)	(0.020)	(0.29)
Bargaining Power*Age			0.000	0.018**
			(0.001)	(0.01)
Age	0.221***	0.226***	0.221***	0.061
	(0.013)	(0.01)	(0.014)	(0.07)
Age at Marriage	-0.038***	-0.04***	-0.038***	-0.035***
	(0.003)	(0.004)	(0.003)	(0.003)
Years of Educ.	-0.018***	-0.018***	-0.018***	-0.023***
	(0.004)	(0.005)	(0.004)	(0.01)
Javanese	-0.218***	-0.230***	-0.218***	-0.226***
	(0.022)	(0.03)	(0.022)	(0.03)
Number of FP Clinics	-0.002*	-0.003**	-0.002*	-0.004**
	(0.001)	(0.001)	(0.001)	(0.002)
Number of FP worker visits	-0.0001	-0.0004*	-0.000	-0.0003
	(0.0001)	(0.0002)	(0.000)	(0.0002)
% of HH with Pipe/Pump Water	-0.001***	-0.001***	-0.001***	-0.002***
	(0.0003)	(0.0004)	(0.000)	(0.0004)
Observations	3158	3079	3158	3079

Figure 8: Marginal impact of bargaining power on total births by age (entire sample) – based on poisson IV estimation

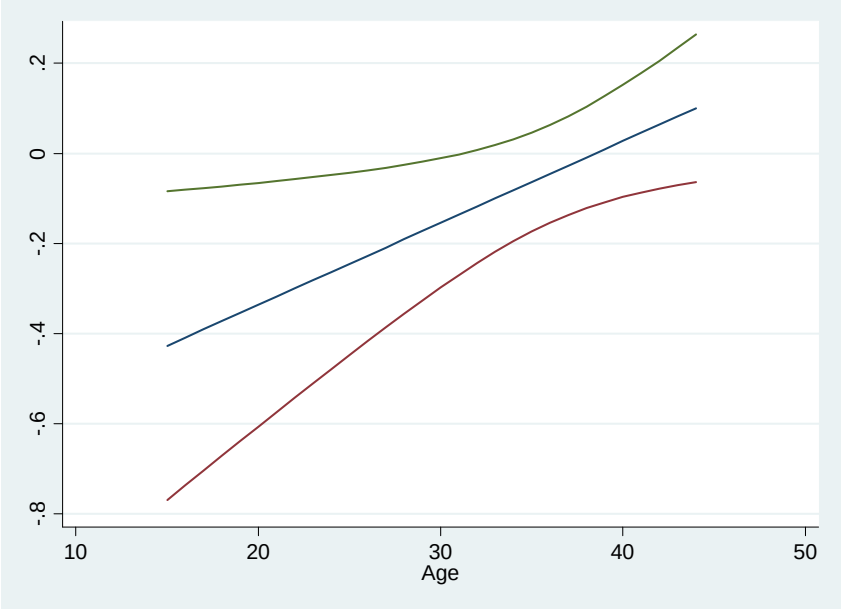


Table 17: Negative binomial estimates of child demand equation for entire sample

Dependent Variable=Total births	Neg. Binomial(1)	Neg. Bin./IV(1)	Neg. Binomial(2)	Neg. Bin./IV(2)
Measure of Female Bargaining Power	-0.003	-0.101*	-0.005	-0.62**
	(0.004)	(0.06)	(0.020)	(0.32)
Bargaining Power*Age			0.00004	0.017*
			(0.001)	(0.01)
Age	0.221***	0.248***	0.221***	0.097
	(0.013)	(0.02)	(0.014)	(0.09)
Age at Marriage	-0.038***	-0.041***	-0.038***	-0.040***
	(0.003)	(0.004)	(0.003)	(0.004)
Years of Educ.	-0.018***	-0.018***	-0.018***	-0.023***
	(0.004)	(0.004)	(0.004)	(0.01)
Javanese	-0.218***	-0.211***	-0.218***	-0.207***
	(0.022)	(0.02)	(0.022)	(0.03)
Number of FP Clinics	-0.002*	-0.004**	-0.002*	-0.004**
	(0.001)	(0.001)	(0.001)	(0.001)
Number of FP worker visits	-0.0001	-0.0003	-0.0001	-0.0002
	(0.0001)	(0.0002)	(0.0002)	(0.0002)
% of HH with Pipe/Pump Water	-0.001***	-0.001***	-0.001***	-0.001***
	(0.0003)	(0.0003)	(0.0003)	(0.0004)
Observations	3158	3079	3158	3079

Figure 9: Marginal impact of bargaining power on total births by age (entire sample) – based on negative binomial IV estimation

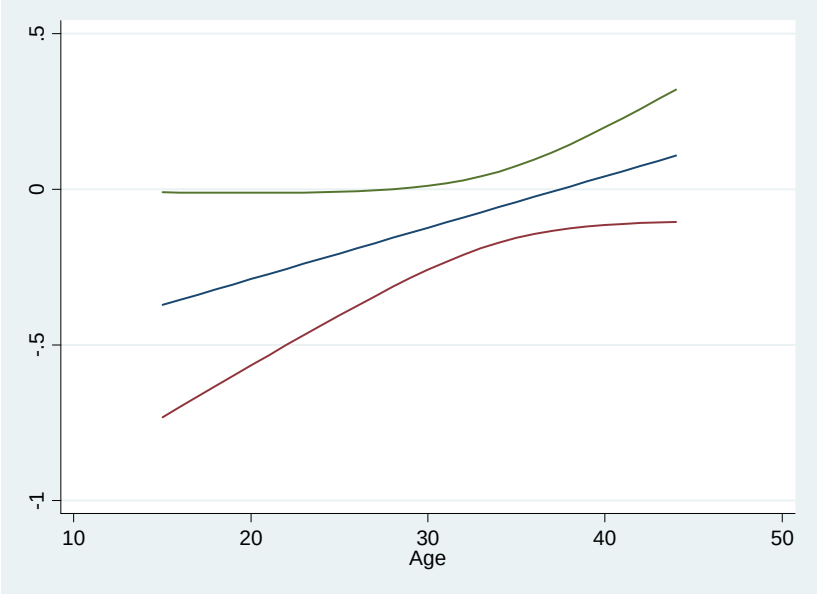


Table 18: Estimates of child demand equation for entire sample using measures generated by summing responses and by factor analysis of response variables

Dependent Variable=Total births	Using all response variables				Using responses to exp. on durable goods			
	OLS (sum)	IV (sum)	OLS (FA)	IV (FA)	OLS (sum)	IV (sum)	OLS (FA)	IV (FA)
Measure of bargaining power	-0.018	-0.353	-0.025	-0.525	-0.058	-0.853**	-0.037	-1.02**
	(0.021)	(0.34)	(0.033)	(0.66)	(0.036)	(0.35)	(0.036)	(0.44)
Age	0.260***	0.311***	0.259***	0.312***	0.186***	0.182***	0.186***	0.172***
	(0.029)	(0.06)	(0.029)	(0.07)	(0.031)	(0.04)	(0.031)	(0.04)
Age at Marriage	-0.125***	-0.123***	-0.125***	-0.123***	-0.106***	-0.105***	-0.106***	-0.105***
	(0.009)	(0.01)	(0.009)	(0.01)	(0.009)	(0.01)	(0.009)	(0.01)
Years of Educ.	-0.049***	-0.049***	-0.049***	-0.051***	-0.064***	-0.057***	-0.065***	-0.060***
	(0.011)	(0.01)	(0.011)	(0.01)	(0.011)	(0.01)	(0.011)	(0.01)
Javanese	-0.616***	-0.621***	-0.616***	-0.639***	-0.675***	-0.700***	-0.677***	-0.744***
	(0.065)	(0.07)	(0.065)	(0.08)	(0.067)	(0.07)	(0.067)	(0.08)
Number of FP worker visits	-0.000	-0.001	-0.000	-0.001	-0.000	-0.001*	-0.000	-0.001*
	(0.000)	(0.00)	(0.000)	(0.00)	(0.000)	(0.00)	(0.000)	(0.00)
% of HH with Pipe/Pump Water	-0.004***	-0.003***	-0.004***	-0.003***	-0.004***	-0.003***	-0.004***	-0.003***
	(0.001)	(0.00)	(0.001)	(0.00)	(0.001)	(0.00)	(0.001)	(0.00)
Observations	3158	3079	3158	3079	2702	2644	2702	2644
Endogeneity test		1.1		0.59		6.1		6.53
chi-sq(endog. regressors) p-val		0.3		0.44		0.01		0.01
F-statistic of excluded instruments		13.4		19.8		23.1		28.4
p-val		0.0		0		0		0
Hansen J Statistic		4.1		4.52		4.3		4.1
chi-sq(excess instruments) p-val		0.13		0.1		0.12		0.13
excess Instruments		2		2		2		2

Appendix

A. Latent Trait Model

In generic latent variable models, the goal is to find one or more latent variables $(z_1 \ldots z_q)$ that completely explain the dependence between a set of observables $(x_1 \ldots x_p)$. The generic latent variable regression model can be specified as (Bartholomew et al. (2002), Bartholomew and Knott (1999) and Rizopoulos, 2006), since the measure of female bargaining power is captured by one latent variable, the discussion below assumes that there is one underlying latent trait z -

$$E(x_i|z) = g(\lambda_{i0} + \lambda_{i1} z) \qquad (1)$$

where,

x_i = observables; $i = 1, \ldots, p$

z = latent measure of bargaining power

$g(.)$ is the known as the link function

λ_{i0} = difficulty parameter for the ith observable

λ_{i1} = discrimination parameter for the ith observable

x_i is independent of x_j given z; $i \neq j$ (conditional independence assumption)

In factor analysis, x_i's are continuous variables with a normal distribution and the link function is an identity link. In LTM, the x_i's are binary or ordinal variables and the link function is an inverse logit or probit and $E(x_i|z)$ is the conditional probability of a positive response given the latent variables. The factor analysis model is not valid for binary variables since the x's are bounded and take values from 0 to 1 whereas z is continuous and can take any value in the $[-\infty, \infty]$ space. Hence, LTM specifies a relationship between the probability of a correct response and the latent variables instead of the response and the latent variables itself (as is the case in factor analysis). The logit link function maps the [0,1] space onto to the $[-\infty, \infty]$ space and is also a monotonic function which means that increasing the latent trait z (power in this case) increases the probability of a positive response (wife's participation in decision-making within the household). We can rewrite equation (1) as –

$$\text{logit}\left[P(x_{im} = 1|z_m)\right] = \log_e\left(\frac{P(x_{im} = 1|z_m)}{1 - \left[P(x_{im} = 1|z_m)\right]}\right) = \lambda_{i0} + \lambda_{i1} z_m \qquad (2)$$

where,

x_{im} = observable binary response variable for the ith question on participation in expenditure related decisions within the household by the mth woman

z_m = measure of bargaining power (factor score) for the mth woman

We can rearrage equation (2) to get the expression -

$$P\left(x_{im}=1\middle|z_m\right)=\frac{\exp\left(\lambda_{i0}+\lambda_{i1}z_m\right)}{1+\exp\left(\lambda_{i0}+\lambda_{i1}z_m\right)} \qquad (3)$$

The parameters λ_{i0} and λ_{i1} are called difficulty and discrimination parameters respectively. λ_{i0} conveys the difficulty of the question since the higher λ_{i0}, higher is the probability (for all individuals ordered along the latent scale) of a positive response for that question. λ_{i1} is called the discrimination parameter since the higher the value of λ_{i1}, easier it is to distinguish two individuals located at some distance apart in the latent scale (say low and high power) since the difference in the probabilities of getting a positive response between these two individuals is greater.

These parameters are estimated using Marginal Maximum Likelihood Estimation (MMLE). MMLE assumes that the trait (bargaining power) of individuals is a randomly distributed according to the standard normal distribution F(z) and the model parameters are $\left(\lambda_{i0},\lambda_{i1}\right)$ estimated by maximizing the observed data log-likelihood obtained by integrating out the latent variable (z); the contribution of the mth woman is (Rizopoulos, 2006) –

$$l_m\left(\boldsymbol{\theta}\right)=\log p\left(\mathbf{x_m};\boldsymbol{\theta}\right)=\log\int p\left(\mathbf{x_m}\middle|z_m;\boldsymbol{\theta}\right)p\left(z_m\right)dz_m \qquad (4)$$

where,

$p(.)=$ pdf

$x_m=$ vector of responses for the mth individual

$\theta=\left(\lambda_{i0},\lambda_{i1}\right)$

z_m is assumed to follow standard normal distribution

The integral in the above equation is estimated using Gauss-Hermite quadrature rule and the number of quadrature points used is 21. A quadrature rule provides an approximation to a definite integral and this approximation is an weighted sum of function values evaluated at these 21 points over the domain of the integral $\left(-\infty,\infty\right)$ –

$$\int_{-\infty}^{\infty} f\left(z\right)dz\approx\sum_{i=1}^{21} f\left(z_i\right)w_i$$

We can rewrite equation (4) as -

$$l_m\left(\boldsymbol{\theta}\right)=\log\int p\left(\mathbf{x_m}\middle|z_m;\boldsymbol{\theta}\right)p\left(z_m\right)dz_m=\log\left(\sum_{i=1}^{21} p\left(\mathbf{x_m}\middle|z_{im};\boldsymbol{\theta}\right)*w_i\right) \qquad (5)$$

If we assume there are 'p' observable variables, then the log-likelihood function for the mth individual after integrating out the latent variable z and assuming conditional independence of the binary response variables is given by –

$$l_m(\boldsymbol{\theta}) = \log \int p(\mathbf{x_m}|z_m;\boldsymbol{\theta}) p(z_m)\, dz_m = \log \int \prod_{j=1}^{p} p(\mathbf{x_m}|z_m;\boldsymbol{\theta})\, p(z_m)\, dz_m$$

$$\Rightarrow l_m(\boldsymbol{\theta}) = \log \left[\sum_{i=1}^{21} \prod_{j=1}^{p} \left\{ \left(\frac{\exp(\alpha_{0j} + \alpha_{1j} z_{im})}{1+\exp(\alpha_{0j} + \alpha_{1j} z_{im})} \right)^{x_{jm}} \left(\frac{1}{1+\exp(\alpha_{0j} + \alpha_{1j} z_{im})} \right)^{1-x_{jm}} \right\} * w_i \right] \quad (6)$$

Assuming the individuals are independently distributed, we can write the log-likelihood function for all individuals as –

$$L(\boldsymbol{\theta}) = \log p(\mathbf{x};\boldsymbol{\theta}) = \log \left[\prod_{m=1}^{N} \left[\sum_{i=1}^{21} \prod_{j=1}^{p} \left\{ \left(\frac{\exp(\alpha_{0j} + \alpha_{1j} z_{im})}{1+\exp(\alpha_{0j} + \alpha_{1j} z_{im})} \right)^{x_{jm}} \left(\frac{1}{1+\exp(\alpha_{0j} + \alpha_{1j} z_{im})} \right)^{1-x_{jm}} \right\} * w_i \right] \right]$$

$$= \sum_{m=1}^{N} \left[\log \sum_{i=1}^{21} \prod_{j=1}^{p} \left\{ \left(\frac{\exp(\alpha_{0j} + \alpha_{1j} z_{im})}{1+\exp(\alpha_{0j} + \alpha_{1j} z_{im})} \right)^{x_{jm}} \left(\frac{1}{1+\exp(\alpha_{0j} + \alpha_{1j} z_{im})} \right)^{1-x_{jm}} \right\} * w_i \right] \quad (7)$$

The above function is maximized to give us the difficulty and discrimination parameters α_{0j} and α_{1j} respectively. The factor (bargaining power) scores are computed as (Bartholomew et al., 2002) –

$$X = \sum_{j=1}^{p} \alpha_{1j} x_j \quad (8)$$

B. Expected Frequency Calculation

The estimation of factor loadings in latent trait analysis is based on the assumption of conditional independence of responses to questions which are used to capture the underlying latent variable. Consider a single latent factor z constructed using two questions A (if wife participates in decision related to purchases of durable goods) and B (if wife participates in decision related to money given to husband's parents). Then the estimation of factor loadings or weights are carried out with the assumption that –

$$\Pr(A=1, B=1 \mid z;\theta) = \Pr(A=1 \mid z;\theta) * \Pr(B=1 \mid z;\theta)$$

LTM computes the estimates for the intercept and slope parameters by maximizing the approximate marginal log-likelihood under the conditional independence assumption, i.e., conditional on the latent structure the items are independent Bernoulli variates under the logit link. The required integrals are approximated using the Gauss-Hermite rule. Then it uses the estimates of these parameters to compute the probability of a positive response to each question.

$$\Pr\left(A=1,B=1\mid z;\hat{\boldsymbol{\theta}}\right)=\int \Pr\left(A=1,B=1\mid z;\hat{\boldsymbol{\theta}}\right)*\phi(z)\,dz$$

$$=\int \Pr\left(A=1\mid z;\hat{\boldsymbol{\theta}}\right)*\Pr\left(B=1\mid z;\hat{\boldsymbol{\theta}}\right)*\phi(z)\,dz$$

$$=\int\left\{\frac{\exp\left(\hat{\alpha}_{0A}+\hat{\alpha}_{1A}z\right)}{1+\exp\left(\hat{\alpha}_{0A}+\hat{\alpha}_{1A}z\right)}\right\}*\left\{\frac{\exp\left(\hat{\alpha}_{0B}+\hat{\alpha}_{1B}z\right)}{1+\exp\left(\hat{\alpha}_{0B}+\hat{\alpha}_{1B}z\right)}\right\}\phi(z)\,dz$$

$$=\sum_{i=1}^{21}\left\{\frac{\exp\left(\hat{\alpha}_{0A}+\hat{\alpha}_{1A}z_i\right)}{1+\exp\left(\hat{\alpha}_{0A}+\hat{\alpha}_{1A}z_i\right)}\right\}*\left\{\frac{\exp\left(\hat{\alpha}_{0B}+\hat{\alpha}_{1B}z_i\right)}{1+\exp\left(\hat{\alpha}_{0B}+\hat{\alpha}_{1B}z_i\right)}\right\}*w_i$$

z_i = quadrature point

w_i = weight associated with the ith quadrature point

$\hat{\boldsymbol{\theta}}$ = are the estimated parameters

The latent factor is assumed to have a standard normal distribution and the probability of a positive response is computed for each quadrature point and multiplied with the corresponding quadrature weight. These points and weights are computed according to the same Guass-Hermite rule which is used in the estimation of the parameters. The probability of a response pattern is the weighted sum of probabilities at each of these quadrature points. This probability is then multiplied with the number of observations to give the expected frequency for a given response pattern. If the expected and the observed frequencies are different by more than 3.5 then it is termed as a discrepancy and the conditional independence assumption does not hold for some or all observable variables.

C: Decision-Making Questions

1. Who makes decision about expenditure on food eaten at home?
2. Who makes decision about expenditure on routine household purchases?
3. Who makes decision about expenditure on your clothes?
4. Who makes decision about expenditure on your spouses clothes?
5. Who makes decision about expenditure on children's clothes?
6. Who makes decision about expenditure on children's education?
7. Who makes decision about expenditure on children's health?
8. Who makes decision about large expensive purchases for household (TV/fridge)?
9. Who makes decision about giving money to parents/family?
10. Who makes decision about giving money to parents-in-law/family?
11. Who makes decision about gifts for parties/weddings?
12. Who makes decision about money for monthly arisan (savings club?)
13. Who makes decision about money for monthly savings?

D: Tables for other measures of power

Table D1.1: Measure of Bargaining Power using responses to questions on household non-durable goods – full sample (N=3400)

Var 1	Var 2	Observed Frequency (O)	Expected Frequency (E)	(O-E)^2/E	Bargaining Power Score
0	0	270	270.0	0.0	0.0
0	1	97	97.1	0.0	7.2
1	0	97	97.0	0.0	7.2
1	1	2936	2935.9	0.0	14.4

Notes:
Var 1: Expenditure on food eaten
Var 2: Expenditure on routine purchases

Table D1.2: Measure of Bargaining Power using responses to questions on personal non-durable goods – full sample

Var 1	Var 2	Observed Frequency (O)	Expected Frequency (E)	(O-E)^2/E	Bargaining Power Score
0	0	185	185	0	0.0
1	0	746	746	0	0.7
0	1	208	208	0	4.6
1	1	2261	2261	0	5.3

Notes:
Var 1: Expenditure on own clothes
Var 2: Expenditure on spouse clothes

Table D1.3: Summary of Bargaining Power Measures for full sample

Bargaining Power Measure	Mean	Std. Dev.
BP (HH non-durable	12.9	4.1
BP (Personal non-durable)	3.9	2.1

Table D1.4: OLS and IV estimates of child demand equation using measures of power generated from responses to expenditure on household and personal non-durable goods (entire sample)

Dependent Variable=Total births	OLS (BPNDH)	IV (BPNDH)	OLS (BPNDP)	IV (BPNDP)
Measure of Female Bargaining Power	0.001	0.251	0.011	0.428
	(0.007)	(0.18)	(0.014)	(0.37)
Age	0.256***	0.098	0.256***	0.223***
	(0.029)	(0.13)	(0.029)	(0.05)
Age at Marriage	-0.125***	-0.119***	-0.125***	-0.121***
	(0.009)	(0.01)	(0.009)	(0.01)
Years of Educ.	-0.049***	-0.050***	-0.049***	-0.057***
	(0.011)	(0.01)	(0.011)	(0.01)
Javanese	-0.614***	-0.511***	-0.615***	-0.612***
	(0.065)	(0.10)	(0.065)	(0.07)
Number of FP Clinics	-0.006*	-0.008*	-0.006*	-0.007
	(0.004)	(0.00)	(0.004)	(0.00)
Number of FP worker visits	-0.000	-0.000	-0.000	-0.001
	(0.000)	(0.00)	(0.000)	(0.00)
Number of Health Posts	-0.003	-0.002	-0.003	-0.004
	(0.005)	(0.01)	(0.005)	(0.01)
% of HH with Pipe/Pump Water	-0.004***	-0.004***	-0.004***	-0.004***
	(0.001)	(0.00)	(0.001)	(0.00)
Observations	3158	3079	3158	3079
F Statistic of Excluded Instruments from First Regression		5.83		3.14
p-value		0.0		0.02
Hansen J Statistic		1.82		3.04
Chi-sq(excess instruments) P-val		0.40		0.22
Excess Instruments		2		2

Table D2.1: Measure of Bargaining Power using responses to questions on children goods for sub-sample (N=2880)

Var 1	Var 2	Var 3	Observed Frequency	Expected Frequency	((O-E)^2)/E	Bargaining Power Score
0	0	0	97	90.8	0.4	0.0
1	0	0	54	57.5	0.2	2.1
0	1	0	10	13.9	1.1	4.7
0	0	1	47	50.5	0.2	5.3
1	1	0	32	28.4	0.5	6.8
1	0	1	117	114.0	0.1	7.4
0	1	1	132	128.9	0.1	10.0
1	1	1	2391	2395.9	0.0	12.1

Notes:
Var 1: Expenditure on children's clothes
Var 2: Expenditure on children's education
Var 3: Expenditure on children's health

Table D2.2: Measure of Bargaining Power using responses to questions on household non-durable goods – restricted sample (N=2880)

Var 1	Var 2	Observed Frequency	Expected Frequency	((O-E)^2)/E	Bargaining Power Score
0	0	188	184.2	0.1	0.0
0	1	71	78.1	0.6	14.7
1	0	70	77.0	0.6	14.7
1	1	2551	2540.7	0.0	29.4

Table D2.3: Measure of Bargaining Power using responses to questions on personal non-durable goods – restricted sample

Var 1	Var 2	Observed Frequency	Expected Frequency	((O-E)^2)/E	Bargaining Power Score
0	0	158	158	0	0.0
1	0	621	621	0	0.7
0	1	181	181	0	4.6
1	1	1920	1920	0	5.2

Table D2.4: Summary of Bargaining Power Measures for the sub-sample

Bargaining Power Measure	Mean	Std. Dev.
BP(Children)	11.0	2.8
BP (HH non-durable	26.7	7.7
BP (Personal non-durable)	3.9	2.1

Table D2.5: OLS and IV estimates of child demand equation using measures of power generated from responses to expenditure on household and personal non-durable goods (sub-sample)

Dependent Variable=Total births	OLS (BPNDH)	IV (BPNDH)	OLS (BPNDP)	IV (BPNDP)	OLS (Children)	IV (Children)
Measure of Female Bargaining Power	-0.003	0.21	0.020	0.55	0.003	-0.41**
	(0.004)	(0.19)	(0.015)	(0.49)	(0.012)	(0.19)
Age	0.190***	0.02	0.188***	0.20***		
	(0.031)	(0.18)	(0.031)	(0.04)		
Age at Marriage	-0.106***	-0.11***	-0.106***	-0.11***	-0.000	-0.0005
	(0.009)	(0.02)	(0.009)	(0.01)	(0.000)	(0.001)
Years of Educ.	-0.065***	-0.07***	-0.065***	-0.07***	0.001	0.003
	(0.011)	(0.02)	(0.011)	(0.02)	(0.007)	(0.01)
Javanese	-0.677***	-0.53***	-0.674***	-0.66***	-0.026	0.03
	(0.067)	(0.18)	(0.067)	(0.09)	(0.027)	(0.05)
Number of FP Clinics	-0.009***	-0.01	-0.009***	-0.01	0.339***	0.38***
	(0.003)	(0.01)	(0.003)	(0.01)	(0.096)	(0.13)
Number of FP worker visits	-0.000	-0.00	-0.000	-0.00	-0.009***	-0.01
	(0.000)	(0.00)	(0.000)	(0.00)	(0.003)	(0.004)
% of HH with Pipe/Pump Water	-0.004***	-0.00**	-0.004***	-0.00***	-0.002	-0.004
	(0.001)	(0.00)	(0.001)	(0.00)	(0.005)	(0.01)
Observations	2702	2644	2702	2644	0.410	4.56**
					(0.550)	(2.11)
F Statistic of Excluded Instruments from First Regression		3.42		1.82		13.3
p-value		0.01		0.14		0.0
Hansen J Statistic		1.2		5.2		4.4
Chi-sq(excess instruments) P-val		0.54		0.07		0.11
Excess Instruments		2		2		2