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CENTER DISCUSSION PAPER NO. 889

TESTING FOR A SUPPLY CONSTRAINT TO FERTILITY: INTERPRETING THE UP TO GOD RESPONSE TO THE SURVEY QUESTION ON DESIRED FAMILY SIZE

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July 2004

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This is a substantially revised version of my doctoral dissertation paper. I thank Anil Deolalikar, Elaina Rose, Shelly Lundberg and T. Paul Schultz for helpful discussions, comments and suggestions. Comments from seminar participants at University of Washington, Yale University and 2000 Northeastern Universities Development Consortium (NEUDC) are gratefully acknowledged. This paper was supported in part by funding from the Rockefeller Foundation at the Economic Growth Center, Yale University.

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Abstract

The paper outlines a methodology that allows us to determine whether couples' fertility is supply constrained based on the response they give to the subjective desired family size question. The central idea of the paper is that, when faced with the desired family size question, both constrained and unconstrained couples compare their demand for children with knowledge of their biological supply and unconstrained couples respond with a number while constrained couples respond with a qualitative response such as, "It is Up to God" (UTG), that essentially conveys the notion of demanding as many children as the supply function can yield. I then test this interpretation using data from Bangladesh. I find that controlling for demand side characteristics, positive supply shocks (birth of twins) lowers the probability of UTG response while negative supply shocks (wife's infertility) significantly raises the probability of UTG response. Based on the percentage of women giving the UTG response, it can be concluded that fertility of many couples in Bangladesh was constrained by supply.

Key Words: fertility, desired fertility, survey nonresponse

JEL Classification Code: J13, C25

1. Introduction

Economists and other social scientists have long recognized that fertility is determined by demand side and supply side characteristics and that while for most couples demand for births may be less than the biologically determined supply of births, fertility of some couples are constrained by supply.[1] Evidence on the presence of supply constrained couples is important for evaluating the impact of family planning programs on fertility and on contraceptive technology adoption. This evidence is also of direct relevance for evaluating whether family planning programs in developing countries should allocate resources to providing infertility services. [2] Empirical research has been focused on reduced form analyses of fertility and little attention has been paid to testing for the existence of supply constraints to fertility. A main reason for this is that it is difficult to infer from data on children ever born whether a woman is supply constrained or not. This is similar to the problem that arises in disequilibrium models where the observed outcome is the lesser of the quantities demanded and supplied but we may not know which it is when we observe the outcome (Quandt, 1988; Maddala, 1986).[3]

This paper suggests that responses to the subjective desired family size question can be useful instead. The desired family size question, asking about the number of children respondents would choose if they begin their reproductive life again, is commonly asked in fertility surveys. This paper develops a methodology to determine if a couple is supply-constrained based on the idea that when faced with the desired family size question, both

[1] See, for example, Rosenzweig and Schultz (1985).
[2] Whether family planning organizations in high population growth countries should devote scarce resources to infertility services is a widely debated issue (See Jain (2001) for a related discussion). It is difficult to objectively evaluate this issue since evidence on such couples is lacking.
[3] Couples' lifetime fertility, as measured by the children ever born to them, can be represented in a disequilibrium model where observed completed fertility is the lesser of the quantities demanded and supplied. At the end of their childbearing years women could either be constrained by their supply (demand exceeds supply) or unconstrained (supply exceeds demand).

constrained and unconstrained couples will compare their demand for children with their knowledge of their biological supply but unconstrained couples will respond with a number (which equals their demand) while constrained couples will respond with a qualitative response such as Up to God (UTG). The UTG response is considered to be a nonresponse in the demography literature but it is hypothesized here that it conveys a notion of desiring as many children as nature can supply which closely approximates the notion of supply of births.[4] Respondents in developing countries are frequently observed to give the UTG response (see Table 1).

Information on ever use of contraceptives can be used to infer whether a couple's fertility is supply constrained or unconstrained (for example, Montgomery, 1987). However, this can be problematic if, as was found to be the case in the United States by Rosenzweig and Schultz (1985), couples learn about their biological supply and fecundity and adopt appropriate contraceptive technology. In such a case using information on ever use of contraceptive methods can lead to incorrect estimates of the proportion of supply constrained couples in the population. The methodology proposed in this paper is based on the desired family size question, which is a subjective question. Economists have tended to rely less on such subjective data (Betrand and Mullainathan, 2001). For example, using data from the United States, Rosenzweig and Wolpin (1985) showed that data on wantedness of children did not accurately reflect consequences of costly or imperfect contraceptive technology. However, this paper shows that useful information can be derived from the type of response given to the subjective desired family size question. A potential problem with using the methodology is that frequently survey interviewers are asked to

[4] In demography literature concerns have been raised about the potential bias in estimated mean desired family size when UTG responses are dropped from the sample since these responses may be nonrandomly selected from the sample (Lightbourne and Macdonald, 1982; Jensen, 1985).

probe UTG respondents for a numeric response.[5] Such probing might weaken the observed correlation between supply-demand characteristics of couples and the respondents' choice of UTG or numeric response.

The methodology of the paper is tested using data from Bangladesh Demographic and Health Survey (BDHS). Since the desired family size is a subjective report and since the extent of probing can differ between different rounds of the survey, a check for the consistency of the methodology is needed. This paper tests the methodology using data from the 1993-94 round of the BDHS as well as from the 1996-97 round. In order to test the methodology, variables that capture shocks to supply of births are used. In both rounds, controlling for demand side characteristics, positive supply shocks (incidence of twins) lowers the probability of UTG response while negative supply shocks (occurrence of infecundity) significantly raises the probability of UTG response. These results are found in both rounds of the BDHS. Based on the percentage of women giving the UTG response, it can be concluded that fertility of many couples in Bangladesh was constrained by supply.

The paper is organized as follows. Section 2 describes the data and Section 3 sketches the empirical model. Following this, Section 4 presents the results of the test of the proposed methodology. Section 5 concludes.

[5] UTG respondents are typically viewed as those who either perceive fertility to be beyond the calculus of choice or as those who do not have a preference for family size (Van de Walle, 1992; McCarthy and Oni 1987). UTG response is also seen as indicating a preference for a very large number of children (Fapohunda and Todaro, 1989) or as reflecting a pre-modern understanding of fertility issues (McCarthy and Oni, 1987). This view of UTG respondents has influenced the way the desired family size question has been posed to respondents in the World Fertility Surveys (WFS) and Demographic and Health Surveys (DHS). WFS were conducted in developing countries between late 1970s and early 1980s. DHS surveys are similar to the WFS and were initiated in early 1990s and are ongoing. Interviewers in both these surveys were instructed to probe respondents for a numeric answer (Lightbourne and Macdonald (1982) for WFS and Instructions for Interviewers' Manual for DHS). However, the actual extent of the probing for a numeric response varies across surveys. Riley, Hermalin and Rosero-Bixby (1993) discuss the impact of this variation in survey procedure on the percentage of UTG responses in surveys.

2. The Data

The 1993-94 and 1996-97 Bangladesh Demographic and Health Surveys (BDHS) are part of the Demographic and Health Surveys program and are designed to collect nationally representative household level data on fertility, family planning and maternal and child health for a large number of developing countries. One shortcoming of these data is the lack of detailed data on socioeconomic characteristics of the household. The DHS surveys are similar to the World Fertility Surveys (WFS) and the Contraceptive Prevalence Surveys conducted during the 1970s and early 1980s. The DHS and WFS surveys have collected data on the desired family size over time from a large number of low-income countries.[6] Table 1 presents the percentage of UTG response in earlier surveys carried out in Bangladesh. It also presents the percentage of UTG response in selected DHS surveys from other countries. From Table 1 it can be seen that the UTG response is common across surveys and the percentage of women giving this response appears to have declined over time in Bangladesh. In Bangladesh, the percentage of UTG response by women has declined from 29% in the 1975-76 WFS to about 6% in the 1996-97 DHS. Comparing the recent DHS surveys, the percentage giving UTG response varies from 66% of ever married women (Nigeria, 1990 DHS) to 1% (Colombia, 1990 DHS). Compared to the other DHS surveys in other countries in the 1990s, the two BDHS rounds have relatively small percentage of women giving UTG response.

Following the methodology developed in this paper, the percentage of UTG response across surveys provides an estimate of the percentage of women whose fertility is supply

[6] The desired family size question is phrased as follows: "If you could go back to the time you did not have children and could choose exactly the number of children to have in your whole life, how many would that be?" Respondents with no living children were asked: "If you could choose exactly the number of children to have in your whole life, how many would that be?" This variation in phrasing the question was used in order to reduce ex-post rationalization bias in answers by respondents who had living children (ORC Macro, 2002b).

constrained. However, the correlation between women's fertility supply-demand characteristics and their choice of giving UTG response might be weakened if they are probed by interviewers for a numeric response. Both the WFS and the DHS interviewer's instructions manuals state that if a nonnumeric answer such as UTG is given then the respondent should be probed for a numeric response failing which the exact words used by her are to be noted (Lightbourne and Macdonald, 1982; ORC Macro, 2002). The actual extent to which an interviewer does probe for response is not known and it is reasonable to assume that it varies across surveys (Riley et al, 1993).[7] This paper attempts to control for the impact of probing on incidence of UTG response by testing the methodology for each round of the BDHS.

The methodology of this paper is tested using the BDHS of 1993-94 and 1996-97. The surveys were fielded jointly by the National Institute of Population Research and Training in Bangladesh and Macro International Inc. between November and March in the respective years. The respondents in the Bangladesh DHS rounds were ever married women aged 10-49. In the 1993-94 round, 9,640 women were interviewed and in the 1996-97 round, 9,127 women were interviewed. Apart from extra modules fielded in the 1996-97 round (maternal and child anthropometry, AIDS awareness) the core questionnaires were almost identical in the two rounds. There is one change in the regional variables between the rounds.[8] Finally, data on wealth index is available for each household surveyed in the 1996-97 round.[9]

The detailed fertility histories and contraceptive use data collected in the BDHS are used in this paper to construct measures for incidence of multiple births (twinning) and incidence of

[7] In the 1975-76 Bangladesh WFS a large number of interviews were tape recorded and 220 of these that were analyzed show that interviewers did probe for numeric response but many respondents still gave the UTG response (Lightbourne and Macdonald, 1982, Thompson, Ali and Casterline, 1982).
[8] Sylhet division was created in 1994 by dividing Chittagong division.

[9] The wealth index is based on household's ownership of assets. See Filmer and Pritchett (2001) for a description of the construction of this index.

infecundity or infertility. These two variables serve as measures of shocks to couples' supply of births. Following Rosenzweig and Wolpin (1980), the incidence of twinning is measured as the number of twin births divided by the number of pregnancies. In order to identify women who had become infecund by the time of the survey, I use the demographic definition of infecundity which is based on whether a sexually active, non-contracepting woman experiences a live birth (Larsen, 2000; Vaessen, 1984). Using this definition, I classify women as infecund if they have had no births in the five or more years preceding the survey and were not using any contraceptive methods during this period. [10] Several points are worth noting about this measure of infecundity. First, by definition this measure of infecundity is not restricted to the inability to ever have a live birth. It is a broader measure that includes women who have experienced live births.[11] Second, since data on frequency of intercourse is not available in the BDHS, all currently married women are considered to be sexually active. Thus this measure of infecundity could overstate the number of infecund women in the sample if there are fecund women with low frequency of intercourse or women whose husbands were away during the reference period.

The analysis in this paper is based on women aged 35-49 whose cumulative fertility closely approximates completed fertility. The use of the supply shock variables required restricting the sample to currently married women who had experienced at least one birth. The working sample contains data on 2,333 women in the 1993-94 round and 2,238 women in the 1996-97 round.[12] Table 2 presents the means and standard deviation of variables. About 9% of

[10] Data from 18 WFS surveys show that on an average 90 percent of the women who did not use contraceptives had a birth within the following 5 years (Westoff, 1988). Thus, the demographic definition appears to be a valid measure of infecundity.

[11] Women can become infecund from pathological causes such as sexually transmitted diseases, pelvic tuberculosis and HIV infections as well infections arising from unhygienic obstetric practices. The incidence of pathological sterility due to sexually transmitted diseases is high sub-Saharan African countries (Cates et al, 1985; World Health Organization, 1987; Frank, 1993).

[12] In the 1993-94 round, there were 2,711 ever married women aged 35-49 and 88% of these women (2,381) were currently married. Further restricting the sample to those currently married with at least one birth resulted in the loss

women gave the UTG response in both rounds. In both rounds, 28% of the women are infecund. The sample mean twins ratio is also similar across rounds.

A comparison of the characteristics of women who gave UTG response and those who gave numeric response shows that there are significant differences between them. Table 3 presents means of variables between numeric and UTG women. Comparisons in Table 3 show that a significantly higher percentage of UTG respondents are infecund, rural, landless and Muslim. Also, UTG respondents and their husbands have significantly less schooling than numeric respondents do.

3. The Model

The demand-supply model of fertility is used to derive the discrete choice model for giving UTG versus numeric response. The demand for births function can be represented by the following linear equation with an additive error term,

$$D_i = \alpha_d + \beta_d X_{id} + \varepsilon_{id} \qquad (1)$$

Variables included in X_d are woman's education, age, proxies for prices and household income such husband's education and ownership of agricultural land and region dummies. A control for couples' religion is also included as a preference parameter. Woman's education is a proxy for productive value of her time. Increases in her education raises the opportunity cost of time spent by her in childcare and also raises her potential income from market work. The rise in the opportunity cost would reduce the demand for births while the rise in potential income would

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of 28 observations and the final sample contained 2, 353 observations. In the 1996-97 round, there were 2,660 ever married women aged 35-49, 87% of whom were currently married (2,304 women). Restricting the sample to women who had experienced at least one birth resulted in 33 women being dropped from the sample and the final sample size was 2,271. Finally, women for whom data on schooling were missing were dropped from the sample, reducing the sample size to 2,333 in 1993-94 and 2, 238 in 1996-97.

increase the demand for births (assuming that children are normal goods). Only if the opportunity cost effects exceeds the effect associated with rise in income will the demand for children decrease with rise in female education (Schultz, 1997). A large body of empirical evidence shows that female education is associated with lower completed fertility which suggests that the opportunity cost effect associated with female education dominates the income effect.

Since children are less intensive in husband's time, the gain in income due to an increase in husband's education (a proxy for his market wages) is likely to overwhelm the opportunity cost of his time spent in caring for children (Schultz (1997)). Thus, husband's education can be expected to raise the demand for children. Empirical evidence suggests that fertility is positively associated with household income. Ownership of agricultural land is a proxy for income and therefore can be expected to be associated with a higher demand for children. Landowning agricultural households might also demand more children since children can work on household plots (Rosenzweig and Evenson, 1977; Schultz, 1997).

The supply of births function, S_i, represents the couple's biological capacity to bear children. It is independent of couples' preferences and resource constraints and hence of choices made by them. Natural fertility refers to the cumulative fertility of couples who do not regulate their fertility. Occurrence of infecundity is modeled as a negative shock to the supply function. Its effect is to shift the supply function intercept to the left reflecting a decrease in supply. The incidence of multiple births is an exogenous (positive) shock to the supply function. The effect of the incidence of twinning is therefore to shift the supply function to the right.

A linear representation of the supply function is given below.

$$S_i = \alpha_s + \beta_s X_{is} + \varepsilon_{is} = \alpha_s + \gamma_1 I_i + \gamma_2 T_i + \beta_s X_{id} + \varepsilon_{is} \qquad (2)$$

Equation 2 shows that supply of births depends on all the variables that also determine demand for births(X_d). Additionally, the occurrence of infecundity (I) and twinning (T) also affect the supply of births since these are shocks to supply. In the model described by equations 1 and 2, the exclusion of I and T from the demand equation enables the identification of the supply equation. The controls for woman's age and square of age are included in X_s. The error term ε_{is} represents random shocks to the supply function.

Some researchers have argued that woman's education also directly affects the supply of births. This is because higher female education has been shown to be associated with reduced breastfeeding duration (Nag, 1983; Bongaarts and Menken, 1983). The consequent reduction in postpartum amenorrhea may increase supply of children. Thus, operating through this effect the increase in woman's education might be associated with an increase in the supply of births.

Figure 1 depicts demand and supply functions. Female education is a proxy for price of child quantity and demand is shown to decrease as female education increases. For reasons mentioned above, the supply curve is shown to be sloping upwards in female education. For levels of education below E*, woman is supply constrained and for levels above E* she is demand constrained. The solid and broken lines correspond to the demand constrained and supply constrained equilibrium regimes respectively. Figure 1 also shows the effect of a negative supply shock (infecundity). Suppose that women in two different household had identical demand and supply functions and same education E^1 and that for the woman in the second household, supply curve shifts leftwards due to occurrence of infecundity (represented by S'). Then at E^1, woman in the first household would remain demand constrained while the woman in the second household would be supply-constrained. The methodology tested in this paper

suggests that the woman in the second household will be more likely to choose the UTG response.

3.1 UTG Response Rule: Structural Model and Identification

Assume that woman i chooses to give UTG response if $D_i > S_i$ and chooses to report a numeric response if $D_i \leq S_i$. Define a dummy variable, J_i, such that it takes value 1 if the respondent gives UTG response and takes value 0 if the respondent gives a numeric response. Then, this discrete choice can be written as a probit model in terms of a latent variable, J_i^*, such that if $J_i^* > 0$ then respondent i gives UTG response, otherwise i gives a numeric response.

$$J_i^* = \delta_0 + \delta_1 (D_i - S_i) + \varepsilon_i^* \text{; } J_i = 1 \text{ if } J_i^* > 0, \; J_i = 0 \text{ otherwise} \quad (3)$$

The error term reflects unobserved individual characteristics that might influence the propensity to give UTG response. The UTG response rule is given by:

$$\Pr(\text{UTG response}) = \Pr(D > S) = \Pr(J^* > 0) \quad (4)$$

$$\Pr(\text{Numeric response}) = \Pr(D \leq S) = \Pr(J^* \leq 0) \quad (5)$$

A test of the methodology to determine who is supply constrained using choice of UTG response rests on the sign and significance of the regression parameter δ_1. This parameter is identified if there are variables that influence S but not D and vice versa. While there are several variables such as female education and region that can potentially influence both S and D, the supply shock variables (infecundity and twinning) only affect S and hence ensure identification of δ_1. If the methodology is valid, that is, if constrained couples are more likely to choose the UTG response, then δ_1 should be positive and significant.

3.2 Reduced Form Model

Equation 3 is a structural model and in order to obtain an estimate of δ_1 we would have to estimate individual demand equations (1) and supply equation (2), then use their predicted values to estimate a model of UTG response.[13] One problem with estimating the structural probit is that it is difficult to identify the supply equation (equation 2) at the couple level.[14] Instead of the structural approach, this paper estimates a reduced form model that makes it unnecessary to estimate the supply function. Substituting equations 1 and 2 into 3, yields the reduced from equation (Equation 6).

$$J_i^* = \delta_0^* + \delta_1(\beta_d X_{id} - \beta_s X_{is}) + \varepsilon_i = \delta_0^* + \delta_1(\beta_d - \beta_s)X_i + \delta_1(-\gamma_1)I_i + \delta_1(-\gamma_2)T_i + \varepsilon_i \qquad (6)$$

where, $\delta_0^* = \delta_0 + \delta_1(\alpha_d - \alpha_s)$ and $\varepsilon_i = \varepsilon_i^* + \delta_1(\varepsilon_{id} - \varepsilon_{is})$.

3.3 Expected Effects and Sign of δ_1

It can be seen from equation 6 that the sign of δ_1 can be inferred from the reduced form estimates of the effect of the demand side and supply side variables on the probability of UTG response. Consider the marginal effect of woman's education on probability of UTG response,

$$\frac{\partial E(J_i \mid Z)}{\partial X_i} = \delta_1(\beta_d - \beta_s) \times f(Z) \qquad (7)$$

where, Z contains X, I and T and f(z) is the standard normal density. Since woman's education is expected to be associated with lower demand for births and higher supply of births, the term within parenthesis is negative. If the reduced form estimate of woman's education from equation 6 is also negative then it would imply that δ_1 is positive.

[13] This would be a structural equation approach similar to the one estimated by Lee (1978) and Willis and Rosen (1979).

Similarly, consider the effect of infecundity on the probability of UTG response. From equation 6, the marginal effect is

$$\frac{\partial E(J_{ij} \mid Z)}{\partial I_i} = -\delta_1 \gamma_1 \times f(Z) \qquad (8)$$

Since infecundity reduces couples' supply of births, γ_1 is negative. If the reduced form estimate of the effect of I_i on probability of UTG response is positive, then it would imply that δ_1 is positive. In the case of twinning, γ_2 is positive because twinning increases couples' supply of births. If the reduced form estimate of the effect of T_i on probability of UTG response is negative then it would imply that δ_1 is positive.

Thus, reduced form estimates of the effect of demand and supply side variables on the probability of UTG response allow us to test for the sign of δ_1 and hence test the methodology proposed in the paper.

4. Results

Table 4 presents the reduced form estimates of the effect of demand and supply side variables on the probability of UTG response, based on equation 6. Standard errors reported in parentheses are adjusted for within-cluster correlation of error terms and arbitrary heteroscedasticity. Column 1 estimates are based on the 1993-94 round. The estimates from the 1996-97 round are reported in columns 2 and 3. The specification of columns 1 and 2 are the same while in column 3 a wealth index (based on asset ownership) is used as a control for households' non-labor income.

[14] Rosenzweig and Schultz (1985) develop one method of estimating couple level supply function. They use detailed data on conceptions, pregnancies and contraceptive use to extract an estimate of supply of births at the couple level.

From Table 4 it can be seen that, consistent with the proposed methodology, variables that reduce (increase) demand for children and increase (reduce) supply are associated with a lower (higher) probability of UTG response. A negative supply shock, measured by infecundity, significantly increases the probability that UTG response is given. A positive supply shock, measured by the twins ratio, has a negative impact on probability of UTG response. However this effect is statistically not significant at the 5 percent or the 10 percent level in either round.

As discussed earlier, the effect of female schooling on demand for children will be negative if the opportunity cost effect exceeds the positive income effect. Since child rearing is relatively more intensive in female time, it is expected that female schooling will have a more negative impact on demand for children that male schooling (Schultz, 1997). The schooling variables have a negative impact on the probability that UTG response is given, suggesting that the opportunity cost effect dominates the income effect. However, only female schooling is statistically significant at the 5% level in both rounds. Urban residence, which is thought to be associated with higher cost of children and hence reduced demand for children, significantly reduces the probability of UTG response in the 1996-97 round.

Two proxies are used for household's non-labor income – ownership of agricultural land and wealth index. In columns 1 and 2, a dummy for whether household owns agricultural land is used since DHS does not collect data on size of landholdings owned. Ownership of agricultural land is expected to be associated with higher demand for children (assuming that children are normal goods) and hence a higher probability of UTG response (Rosenzweig and Evenson, 1977). However, results in Table 4 show that compared to landless households, those who own agricultural land have a lower probability of giving UTG response. In column 3, dummies indicating household's wealth quintile are used. The quintiles are based on household's wealth

index. While none of the quintile dummies show statistically significant effects, the estimates are negative. These negative effects can arise if children were inferior goods (parents demand fewer children as income increases). However, empirical evidence from Bangladesh shows that completed fertility is positively associated with amount of agricultural land owned by households suggesting that children are normal goods (Sinha, 2003).

Betrand and Mullainathan (2001) point out that a problem with inferring the causal impact of exogenous variables on the subjective response given is that these exogenous variables may influence the reporting of the subjective response. In the present case this implies that schooling or higher household income, for example, may be correlated with characteristics such as fatalistic attitude or religiosity that influence reporting of UTG response. That is, schooling and higher socioeconomic status of the household affects UTG response not only through its effect on the demand for and supply of children but also through its effect on the probability of giving a qualitative response. It is not possible to disentangle these sources of effect of schooling and income on the probability of UTG response. However, the effect of schooling in conjunction with the effects of the supply side shocks on the probability of giving UTG response indicate support for the methodology proposed in this paper.

Overall, the effects of the demand side and supply side variables are significant and in the "correct" direction (except for land ownership) indicating that δ_1 is positive. From equation 3, a positive estimate of δ_1 implies that UTG response is given if demand for children is constrained by supply. As noted earlier, probing for a numeric response can weaken the correlation between demand-supply characteristics of women and the probability of UTG response. It is likely that the extent of probing varied greatly across the two rounds of the BDHS. However this does not

appear to affect the test of the methodology since the effects of the supply and demand side variables on probability of UTG response are similar across the two rounds.

5. Conclusions

While economists and other social scientists studying fertility have analyzed the role of supply side and demand side determinants of fertility, the issue of how to determine if a couple's fertility is supply constrained or unconstrained has been inadequately addressed. A main reason for this is the identification problem. Couples' fertility is the outcome of the interaction of the supply and demand functions and while supply can exceed or constrain demand, it is not possible to infer which it is from the data on fertility.

In this paper a methodology to determine whether couples are supply constrained is tested. This methodology is based on the type of responses, numeric or nonnumeric such as "Up to God" (UTG), given to the subjective desired family size question. According to this methodology, supply constrained couples are more likely to choose to give the UTG response. A test of the methodology using data from Bangladesh shows support for a relationship between probability of UTG response and supply constrained fertility. Variables that reduce (increase) demand for children and increase (reduce) supply are associated with a lower (higher) probability of UTG response.

Several implications of this result are worth noting. First, the result shows that subjective survey questions can be exploited to obtain useful information. The second implication concerns the evaluation of family planning programs. The persistence of UTG responses in fertility surveys from around the world (Table 1) indicates that there are a large number of couples whose fertility is supply constrained. Family planning programs reduce fertility by lowering the price of

new and more effective contraceptive methods and hence reducing unwanted births. However, this effect can be expected to exist only for those couples that are unconstrained. Supply constrained couples may thus bias the estimate of family planning program impact. For instance, if the program impact is estimated by the number of "adopters" of the new contraceptive technology, then the presence of supply constrained couples will downwardly bias the estimate of program impact.

The third implication concerns population policy, particularly in developing countries. Amongst social scientists engaged in studying population issues, there is a debate whether family planning programs in developing countries should divert some resources from fertility control to services that meet the needs of supply constrained couples. This is especially pertinent in regions such as sub-Saharan Africa where infertility caused by disease may be an important source of negative shock to couples' biological supply function that in turn constrains their demand for children. This issue can be meaningfully addressed only if the number of such couples can be reliably estimated. The methodology proposed and tested in this paper provides one such approach to estimating the percentage of couples who are supply constrained. Furthermore, since this methodology is based on microdata, the characteristics of such couples can also be assessed.

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Table 1: Percentage of Ever Married Women giving UTG response

Country	Percent UTG Response
Bangladesh	
1975-76 WFS[1]	29.0
1988-89 BFS[2]	8.0
1993-94 DHS[3]	7.0
1996-97 DHS[4]	6.0
Pakistan 1990-91[5]	61
Egypt 1992[5]	19
Jordan 1990[5]	31
Morocco 1992[5]	4
Turkey 1993[5]	2
Philippines 1993[5]	11
Ghana 1993[5]	8
Kenya 1993[5]	6
Nigeria 1990[5]	66
Tanzania 1991-92[5]	14
Bolivia 1994[5]	9
Colombia 1990[5]	1
Peru 1991-92[5]	21

Source:
1. Lightbourne and Macdonald, 1982
2. Larson and Mitra, 1992
3. Mitra, Ali, Islam, Cross and Saha, 1994
4. Mitra, Al-Sabir, Cross and Jamil, 1997
5. Bankole and Westoff, 1995, Based on respective country Demographic and Health Surveys

Table 2: Descriptive Statistics

	1993-94 (N=2,333)	1996-97 (N=2,238)
	Mean (Std. Dev.)	Mean (Std. Dev.)
Dependent Variable		
UTG Response	0.090 (0.286)	0.093 (0.291)
Independent Variables		
Infecund[1]	0.287 (0.452)	0.275 (0.447)
Twins Ratio[2]	0.007 (0.035)	0.007 (0.039)
Children Ever Born	6.17 (2.45)	5.66 (2.42)
Wife's Schooling (Years)	1.767 (3.023)	2.109 (3.353)
Husband's Schooling (Years)	3.782 (4.511)	3.983 (4.586)
Age	40.658 (4.177)	40.703 (4.150)
Hindu	0.133 (0.340)	0.124 (0.329)
Household Owns Agricultural Land	0.370 (0.483)	0.378 (0.485)
Urban	0.156 (0.363)	0.156 (0.363)
Chittagong	0.222 (0.415)	0.147 (0.354)
Dhaka	0.284 (0.451)	0.282 (0.450)
Khulna	0.144 (0.351)	0.119 (0.324)
Rajshahi	0.243 (0.429)	0.234 (0.424)
Sylhet[3]		0.110 (0.313)

Notes: Based on sample of currently married women aged 35 – 49.1. No births in the five years preceding the survey and no use of contraceptives. 2. Number of twin births divided by the number of pregnancies. 3. Sylhet was part of Chittagong division in 1993.

Table 3: Descriptive Statistics by Type of Response

	1993-94		1996-97	
	(1)	(2)	(3)	(4)
	Numeric (N=2,124)	UTG (N=209)	Numeric (N=2,029)	UTG (N=209)
Variable	Mean (Std. Dev.)	Mean (Std. Dev.)	Mean (Std. Dev.)	Mean (Std. Dev.)
Infecund[1]	0.268 (0.443)	0.478 (0.501)	0.247 (0.431)	0.550 (0.499)
Twins Ratio[2]	0.007 (0.036)	0.004 (0.022)	0.007 (0.040)	0.007 (0.032)
Children Ever Born	6.07 (2.42)	7.25 (2.54)	5.53 (2.37)	6.92 (2.46)
Wife's Schooling (Years)	1.856 (3.097)	0.861 (1.903)	2.244 (3.432)	0.794 (2.029)
Husband's Schooling (Years)	3.893 (4.559)	2.656 (3.820)	4.129 (4.663)	2.560 (3.457)
Age	40.549 (4.156)	41.770 (4.241)	40.556 (4.085)	42.129 (4.504)
Hindu	0.142 (0.349)	0.043 (0.203)	0.131 (0.337)	0.057 (0.233)
Household Owns Agricultural Land	0.372 (0.484)	0.349 (0.478)	0.393 (0.489)	0.225 (0.419)
Urban	0.162 (0.368)	0.091 (0.288)	0.167 (0.373)	0.053 (0.224)
Chittagong	0.201 (0.401)	0.431 (0.496)	0.138 (0.344)	0.234 (0.425)
Dhaka	0.290 (0.454)	0.215 (0.412)	0.285 (0.452)	0.249 (0.433)
Khulna	0.150 (0.357)	0.077 (0.267)	0.123 (0.329)	0.081 (0.274)
Rajshahi	0.250 (0.433)	0.177 (0.383)	0.249 (0.432)	0.091 (0.288)
Sylhet[3]			0.090 (0.287)	0.301 (0.460)

Notes: Based on sample of currently married women aged 35 – 49.1. No births in the five years preceding the survey and no use of contraceptives. 2. Number of twin births divided by the number of pregnancies. 3. Sylhet was part of Chittagong division in 1993.

FIGURE 1: Demand –Supply Model of Fertility

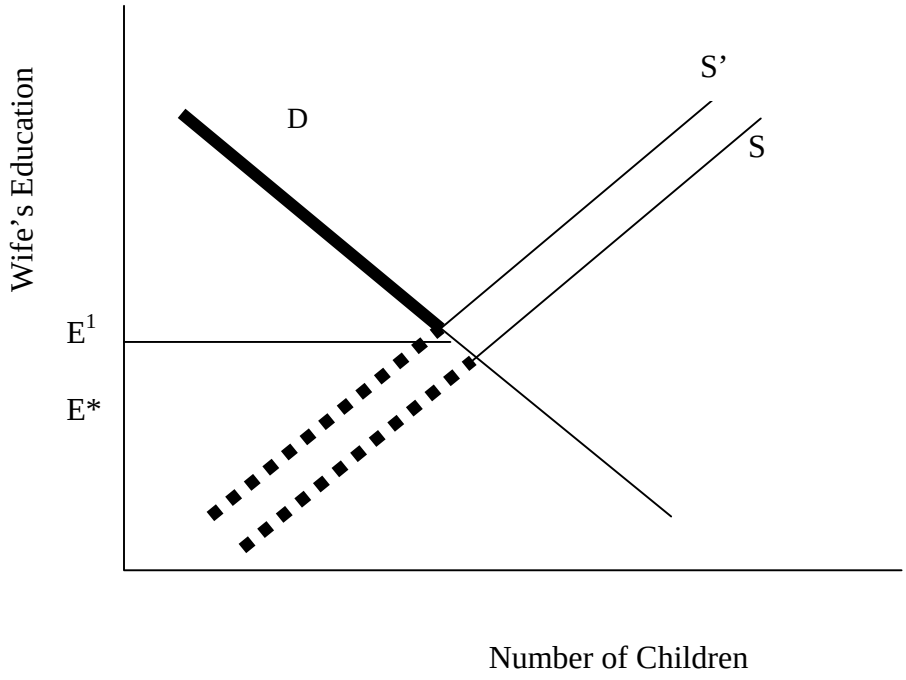

Table 4: Effect of Supply and Demand Side Variables on Probability of UTG Response

	1993-94	1996-97	
	(1)	(2)	(3)
Infecund[1]	0.059 (4.17)	0.071 (5.28)	0.073 (5.37)
Twins Ratio[2]	-0.212 (1.35)	-0.014 (0.11)	-0.010 (0.08)
Wife's Schooling	-0.007 (2.07)	-0.005 (1.77)	-0.005 (1.87)
Husband's Schooling	-0.002 (0.94)	-0.001 (0.53)	-0.001 (0.36)
Wife's Age	0.016 (0.65)	-0.041 (1.77)	-0.039 (1.68)
(Wife's Age)^2	-0.0002 (0.58)	0.0005 (1.91)	0.0005 (1.82)
Hindu	-0.059 (4.16)	-0.044 (2.65)	-0.045 (2.65)
Household Owns Agricultural Land	-0.014 (1.28)	-0.028 (2.65)	--
Second Wealth Quintile[3]			-0.001 (0.08)
Middle Wealth Quintile			-0.017 (1.22)
Fourth Wealth Quintile			-0.011 (0.68)
Richest Wealth Quintile			-0.022 (1.21)
Urban	-0.014 (0.73)	-0.038 (2.50)	-0.037 (2.18)
Chittagong	0.059 (2.04)	0.131 (4.54)	0.128 (4.38)
Dhaka	-0.026 (1.08)	0.059 (2.67)	0.055 (2.52)
Khulna	-0.040 (1.73)	0.043 (1.38)	0.040 (1.29)
Rajshahi	-0.027 (1.18)	0.000 (0.02)	-0.003 (0.16)
Sylhet[4]		0.223 (5.86)	0.224 (5.78)
Observations	2333	2238	2238

Notes: Probit model marginal effects evaluated at sample means. Robust z statistics in parentheses. Based on sample of currently married women aged 35 – 49.
1. No births in the five years preceding the survey and no use of contraceptives.
2. Number of twin births divided by the number of pregnancies. 3. Based on Wealth Index calculated using assets owned by household 4. Sylhet was part of Chittagong division in 1993.