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WOMEN'S CHOICE OF WORK AND FERTILITY IN URBAN TAMIL NADU, INDIA

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Abstract

This paper examines the joint determinants of women's choice of work and fertility within the Nash-bargaining framework using household survey data from urban Tamil Nadu, India. The labor force participation decision is formulated in a dichotomous and trichotomous choice framework. Alternative estimation methods are used to estimate the parameters of the wage and the choice of work equations. The empirical results show that women do not regard the decision to participate in wage work as identical to self employment. The trichotomous model emerges as the preferred formulation of women's work decision. The results suggest that an increase in women's wage would draw more women into wage work and self employment and concomitantly reduce fertility. The neoclassical common preference model of the family is rejected in the choice of work but not in the fertility decisions. The estimates of the wage equations indicate a private rate of return to education of 13 percent for women and 11 percent for men.

KEY WORDS: Women' work, wages, fertility, India.

Women's Choice of Work and Fertility in Urban Tamil Nadu, India

I. Introduction:

A voluminous literature on labor supply in both developed and developing countries has treated the number of children as an exogenous determinant of women's labor force participation decision (Heckman 1974, Smith 1980, Killingsworth 1983, Malathy 1991). In contrast to these studies, a vast literature treats fertility as a choice variable (Becker 1960, Willis 1973, T.W. Schultz 1974, and the studies reviewed in Schultz 1988b,1993). Attempts have also been made to model and estimate female labor supply and fertility in a simultaneous equation framework (Cain and Dooley 1976, Schultz 1977, Fleisher and Rhodes 1979). It is increasingly recognized that identifying the underlying structural relationships is difficult and empirical studies often use arbitrary identifying restrictions. It is possible to estimate the simultaneous relationship between labor supply and fertility only under special situations such as the occurrence of twins as demonstrated in Rosenzweig and Wolpin (1980). Hence, a number of studies estimate the joint determinants of labor supply and fertility using a common set of exogenous variables and try to elucidate the inherent association between these two variables (McCabe and Rosenzweig 1976, Schultz 1990). In this paper, I present estimates of the joint determinants of labor force participation of women and fertility in the context of a developing country namely India.

Most of the studies on women's labor supply have considered only the work-nowork distinction. This may be appropriate in the context of developed countries where women's participation in the informal or self employed activities is low. In the developing countries, in contrast, a large proportion of women engage in occupations such as household industries, family enterprises, own

farms, etc., which are characterized by flexibility of work hours, absence of fixed costs of working etc.,. Hence, the decision to enter the labor market as a wage worker may be distinct from the decision to be self employed. It is important to understand the role of economic factors such as wages and income on the choice of work - no work, wage work and self employment.[1]

A small number of studies examine women's participation decision in formal-informal or wage work-self employment activities (Hill 1983, Behrman and Wolfe 1984, Blau 1985, Vijverberg 1986, 1990, Rees and Shah 1986,Khandker 1987). The differences in these occupations not only affect the choice of occupation itself but may also play an important role in fertility decisions because the informal/self employment sector is characterized, among other things, by the compatibility of the job with child care. However, no attempt has been made to study the joint determination of choice of work and fertility in the developing country context.

High fertility and low level of female participation in labor market activities are distinguishing characteristics of the Indian economy. The available evidence indicates that the crude worker to population ratio for urban women has increased from 13.2 percent in 1972-73 to 15.3 percent in 1977-78 and has remained more or less stable thereafter. That is, the ratio is 14.9 and 15.2 percent in 1983 and 1987-88 respectively (Visaria and Minhas 1991).[2] The data also suggest that the proportion of working women in self employed activities has declined from 49.5 percent in 1977-78 to 45.8 percent in 1983. During the same period, the female share of regular/salaried and casual workers has increased from 24.0 and 25.6 percent to 25.8 and 28.4 percent respectively (Sarvekshana 1988). There has also been a steady decline in the total fertility rate between 1972 and 1988. The total fertility rate has come down from 5.17 in 1972 to 4.2

in 1988 (World Bank, World Development Report (various issues). We may infer from the aggregate evidence that with the process of development, more women may participate in the labor force and more of them may enter into wage work. The declining fertility, though by no means dramatic, may also be associated with the changing productive roles of women.

It would be instructive, in this context, to examine the factors determining women's choice of work and family size. The available Indian studies on labor supply (Rosenzweig 1978,1980,1982, Bardhan 1984) and fertility (Rosenzweig and Evenson 1977, Rosenzweig 1982, Duraisamy 1988, Duraisamy and Malathy 1991) are confined to rural areas. No attempt has been made to study the determinants of fertility of urban women. In the earlier works, I have analyzed the labor supply behavior of urban women using a dichotomous (work, nowork) model (Malathy 1983, 1989, 1991).[3] In this paper, I also study the trichotomous choice of no work, wage work and self employment using a large and representative household survey data for urban Tamil Nadu. Another concern of this paper is to investigate the role of women's status measured by women's control over resources, on the choice of work and fertility using the Nash bargaining approach (Manser and Brown 1979,1980, McElroy and Horney 1981, McElroy 1990).

The remainder of the paper is organized as follows. A brief outline of the theoretical framework is presented in Section II. In section III, the data, empirical specification and estimation strategies are discussed. Section IV provides the estimation results. Section V summarizes the findings.

II. Theoretical Framework:

The household's decision regarding labor supply and demand for child services are usually analyzed within a neoclassical household utility maximization framework in the tradition of Becker (1965,1981). The individual's

(husband or wife) preference over number of children (N), leisure of the wife (L_w) and a composite consumption commodity (C) can be represented as

(1) $U_i = U_i(N, L_w, C)$, $i = h, w$

where U_i is the utility function of the ith individual. The children are produced within the household using individual's time input (T_{Ni}), and market purchased goods (X). The production function for N can be specified as

(2) $N = N(X, T_{Ni})$, $i = h, w$

The family is assumed to maximize the utility function subject to the production function (2), the time constraint (3)

(3) $T_i = T_{Ni} + L_i + H_i + M_i$, $i = h,w$

where T_i is the total available time and H and M are the total time spent in market work and housework respectively, and a budget constraint (4)

(4) $PX = W_hH_h + W_wH_w + V$

where W_i is the wage rate (i=h, w), and V is the total family nonearned income. The demand functions arising out the utility maximization process can be written as

(5) $D_{ij} = D_{ij}(P, W_w, W_h, V_i)$, $i = h, w$; $j = N, L_w, C$

The indirect utility function based on the demand function (5) can be written as

(6) $V_{ij} = V_j(P, W_w, W_h, V_i)$, $j = N, Lw, C$; $i = h, w$

The Nash-bargaining model assumes that partners co-operatively maximize the product of the differences in each individual's utility from belonging to the family (1) and a threat-point utility, the individual indirect utility (6), which represents the utility to the individual if she/he quits the family union:

(7) $\prod_i [U_i(N, L, C;\mu)-V_i(P,W_w, W_h)]$, $i=h,w$

The family demand function's arising out of the maximization process of (7)

can be written as

(8) $Y_j = Y_j\ (P_j,\ W_w,\ W_h,\ V_w,\ V_h;\ \mu)$

where j = C,H are the demand for number of children C, and H is labor supply (converse of leisure demand that is the argument in the welfare function); W_w, W_h, V_w, and V_h are the wages and non-earned incomes of the wife and husband respectively, and P_j is price of market goods.

The non-earned incomes V_i, i = w,h are individual specific and are assumed to enhance the individual member's bargaining strength. If the behavioral effects of spouse specific non-earned income are identical, then pooling of family resources assumed in the common preference model can be accepted. On the other hand, if individual specific non-earned income exert different effects, then this evidence favors the bargaining approach. The equality of these effects are tested empirically in this study.

III. Date, Empirical Specification and Estimation Strategies:

The data source is the 1990-91 primary survey of urban households in Tamil Nadu, India, conducted by me. The survey was funded by a grant from the Rockefeller Foundation Program at the Economic Growth Center, Yale University.

Tamil Nadu has a relatively large urban population of about 33 percent in 1981 which is much higher than the all India average of about 23 percent. Further, the urban population in the state is spread among various size classes of urban agglomerations and towns.

The first stage in the sampling process is the choice of districts for which I have used the National Sample Survey classification of the entire state into four agroclimatic regions, and randomly selected two districts from each region. The districts chosen as our study areas have urban population ranging between 23 and 50 percent of the total population in the district. Four of these

districts are major urban agglomerations.

The second stage is the choice of towns from each district. For this purpose the towns in each district were classified according to population size classes: Class I towns with population of 100,000 and over, Class II with 50,000 to 100,000 population, and Class III with 20,000 to 50,000 population. One town from each population size class has been randomly selected.

In selecting the households from each town, I used the census classification of towns into divisions. The list of divisions, the streets in each division, and number of households are published in district census handbooks. Ten percent of the divisions in each town has been taken and ten households from each division were taken by a systematic sampling procedure. A household was included if it had at least one married couple with wife aged 15-50. Thus the sample size consist of 1276 husband-wife households.

The linear approximation of the demand functions (8) for fertility and labor supply can be specified as

(9) $N = \alpha'Z + e$

(10) $H_w = \beta'Z + u$

where $Z = [P, Ww, Wh, Vw, Vh, B]$ is a vector of prices, wages, nonlabor income and a set of control variables (B), and e and u denote the stochastic disturbance terms.[4]

The reduced form labor supply equation (10) denotes total labor supply which is composed of the decision to participate in market work and the number of hours conditional on participation. The participation and conditional hours of work equations can be specified as

(11) $P = \gamma'Z + \varepsilon_1$

(12) $H^* = \delta'Z + \varepsilon_2$

where H* is the hours of work conditional on participation, E(H| H>0). By estimating equations (11) and (12) we can retrieve the implied total labor supply parameters.

In the above participation equation, P is usually defined as a dichotomous variable taking the value of one if a woman participates (work) in the labor market and zero if she does not work (no work). This however imposes the restriction that the woman views all types of work as the same. As indicated earlier, this is not true where the size of the self employed activities is substantial and where these two sectors, wage work and self employment, are distinct due to flexible working hours and compatibility with child care in self employment. It is important to test whether the decision to participate is distinct from the decision to participate in wage work or self employment activities that is, whether the trichotomous model simply collapses to the dichotomous model.

The estimation strategy involves the following steps. First, market wage rates are estimated for men and women correcting for selectivity bias (Heckman 1974). Alternative wage imputation procedures are developed in the literature. The widely used procedure consists of estimating participation in wage work and wage equation by joint maximum likelihood methods. However, this method treats the self employed and non workers alike. Another method is the extension of Heckman (1976) procedure to control for possible selectivity due to labor force participation and sectoral sorting decisions (Behrman and Wolfe 1984, Schultz 1990). A problem with this method is that the two selection correction terms are likely to be collinear and could yield misleading conclusions about the selectivity problem. A third procedure involves estimating a trichotomous participation decision model (nowork, wage work, self employment) and using the

parameter estimates for selectivity correction in the wage equation for the sample of wage workers .

Second, alternative specifications of the labor force model, namely the dichotomous and the trichotomous models, are analyzed using probit, logit and multinomial logit models. The specification test, namely log likelihood ratio test, is applied to choose between the dichotomous and trichotomous logit models.

Third, the fertility decision of the women is analyzed. The number of children ever born equation is estimated by Ordinary Least Squares (OLS) method.[5] Since women in the sample belong to different stages in the life cycle, the children ever born equations are re-estimated for three age cohorts - 20-29, 30-39 and 40-49 to examine the different effect by age of woman.

The measurement of the endogenous and exogenous variables are discussed below. The description of the variables and their means and standard deviations are given in Table 1.

The dependent variable, labor force participation, is defined as dichotomous and trichotomous variables. The participation dichotomous variable takes the value of 1 if a woman participates in market work or self employment activities and zero if she does not. Additionally a dichotomous variable in wage work is defined as a dummy taking the value of 1 if the women is a wage worker and zero otherwise. The trichotomous measure of the labor force participation variable takes the value of 0 if she does not work, 1 if she is self employed and 2 if she is a wage worker. The fertility variable is measured as children ever born to a woman 20-50 years. This is a stock variable measuring cumulative or completed fertility. Many women in the sample have not completed their fertility and restricting analysis to older women reduces the sample size, lowers the precision of estimates, and also entails a problem of incorrect reporting

especially common to older women (Boulier and Rosenzweig, 1978). To overcome this problem and to include women who have not completed fertility, some researchers have included wife's age at marriage or duration of marriage as conditioning variables. But these variables are themselves endogenous and will hence bias parameter estimates. A second procedure is to adjust cumulative fertility of incomplete families, as was done by Boulier and Rosenzweig (1978) which considers the ratio of children ever born to the number a women could have according to some natural fertility schedule, assuming fertility control commences immediately after marriage. Anderson (1983) makes a biological adjustment by estimating demand for children constrained by a non-linear biological supply function. This function itself is fit to the observed pattern of fertility growth that is implied by cross-age sample and hence does not depend on a natural fertility schedule which is itself an average measure derived on the basis of another country's birth rates. I have not attempted any such standardization in this study. However, I report estimates for three age cohorts of women - less than 29, 30-39, and 40-49 years. This permits the variables to have different impacts since women in different age groups may have faced different environments. Additionally, such a stratification of the sample may reduce biases arising from the incomparability of the fertility measures across age cohorts. Among the older women, who will have completed their fertility, the estimates are easier to interpret.

The list of explanatory variables include wage rates, non earned income of wife and husband, and wife's age. Non-linearity in the effects of wages, non earned income and wife's age are expected and interactions among the variables are explored.

The wages of wife and husband are predicted from the regression estimates

reported in Tables 2 and 3. The own wage effect on labor force participation is expected to be positive on the assumption that the substitution effect outweighs the income effect. The sign of husband's wage (cross wage) effect is expected to be negative on wife's labor force participation (Killingsworth, 1983). We may expect the own and cross wages to have the same response in wage employment and self employment as on labor force participation. Whether more women would be drawn into or out of wage work or self employment as the wage rates change cannot be predicted and is an empirical question. The effects of wages of husband and wife are expected to be negative on fertility on the assumption that children are intensive in parents' time and the income effects are dominated by the substitution effects. However, the effect of mother's wage would be larger (negative) than the father's wage since children are more intensive in mother's time.

The non-earned income variables of the wife and husband are included separately and are measured as the money (rupee) value of the total stock of assets held individually by them. It is generally expected that the pure income effect due to an increase in assets will reduce labor supply (increase leisure which is a normal good), and increase the demand for children if children are assumed to be a normal good. However, the response of woman's labor supply and fertility to the asset variable may be systematically different depending on who owns the assets. The responsiveness to increases in her wealth may be more negative on labor supply and more positive on child services than the responsiveness to an increase in her husband's assets.

Age of wife is included to capture the cohort effect and as a sample biological adjustment factor. To allow for non-linear effects of age, I also include a squared term in age.

V. Empirical Results:

A. Estimates of Wage Equations:

Tables 2 and 3 present the results for the sample selection corrected wage equations for women and men respectively. In both the tables, column (1) presents the estimates of reduced form participation equation and column 2 and 3 are the joint Maximum likelihood estimates of the wage work status and log hourly wage equations. The dual selection correction terms computed from the participation and wage work equations are introduced in the Heckman two step method in column 4. Columns 5 and 6 present the multinomial logit estimates of self employment and wage work status and the selection correction term from the wage work parameter estimates is introduced in the wage equation given in the last column. The reduced form dichotomous and trichomotous participation parameter estimates given in columns 1,2,5 and 6 show that all the variables significantly affect the probability that a woman would participate in market work and be in the wage sector but not being self employed. More schooling and experience (defined as age minus schooling minus six) significantly increase the returns from market relative to non-market activities and is strongly associated with working and being a wage worker. The income effect operating through the spouse specific asset coefficients reduce the likelihood of working and also entering the wage sector. The corresponding estimates for men are reported in table 3. The Wald test rejects the null hypothesis of equal asset effect at 5 percent level of significance only in the equations for women. A likelihood ratio test is performed on the dichotomous versus the trichotomous model. The reported χ^2 test statistics with 7 degrees of freedom is 68.56 and is significant at the 1 percent level, indicating that the trichotomous model is preferred to the dichotomous model for women. Men's labor force behavior is also preferably

represented by the trichotomous model for which the relevant χ^2 test statistic is 66.12.

The parameter estimates of the semi logarithmic wage equations show that wage increases with education and increases at a decreasing rate with experience for both women and men. Both education and experience coefficients are statistically significant at 1 percent level for women and men except the experience squared terms in the equation with the double selection terms. The private rate return to education of women is 13 percent and 11 percent for men. This finding of higher returns to women's education is found in several other developing countries such as Indonesia, Columbia, Brazil, Taiwan, India (Andhra Pradesh), and Ivory Coast (Schultz, 1988a).

The joint maximum likelihood probit and multinomial logit estimates given in columns 3 and 7 show that the selectivity bias is important for women but not for men. The estimated rho, which represents the correlation between the error terms of the probit and the log wage equation, is positive and significantly different from zero for women but not for men. This implies that estimating the wage equations on a selective sample of workers would yield biased estimates for women. The double selection correction terms are not statistically significant for women, probably due to the high correlation. However, the selection term on wage earner status is statistically significant for males. The education and experience coefficients are stable across specifications for women but not for men for whom the double selection correction increases the returns to education and reduces the returns to experience.

B. Estimates of Labor Force Participation and Choice of Work Equations :

Table 4, presents the estimates of the labor force participation equations for women. Even though the trichotomous model emerges as the preferred

formulation, estimates of the dichotomous models are also presented for comparison. Columns 1 and 2 provide the probit estimates of the dichotomous characterization of labor force participation and participation in wage work. The corresponding partial derivatives are provided in brackets below the coefficients. The predicted log hourly wages obtained from the estimates given in tables 2 and 3 are correlated with the assets and wife's age variables. The predicted log hourly wage are converted into hourly wage and used in the women's work and fertility equations. This considerably improve significance of the effects assets and women's age variables.

The results are as expected and in line with those reported in the literature. The own wage has a positive effect and the cross wage has a negative effect on both measures of labor force participation. Both wife's and husband's assets significantly reduce the probability of participation. The Wald test is performed to test the equality of the asset coefficients. The null hypothesis of equality is rejected at the 5 percent level of confidence or better where the χ^2 statistics is 22.07 and 5.23 with 1 degree of freedom, respectively in the participation and wage work equations.

The parameter estimates of the trichotomous logit model of women's choice of work and their corresponding marginal values are presented in columns 3 and 4 of Table 4. A likelihood ratio is computed to test whether the women's work choice is dichotomous or trichotomous. The Chi-square test statistics of 63.46 with 7 degrees of freedom is statistically significant at the 1 percent level. This implies that the trichotomous formulation of women's choice of work is more appropriate. Women's wage exhibits a positive relationship with the likelihood of participating in both wage employment and self employment. However, as the own wage increases the probability of entering into wage work is higher than

being self employed implying that women with high wages are more attracted to the formal sector of the labor market. An increase in the husband's wage reduces more the probability of participation in wage work than in self employment. This seems reasonable considering that self employment may be compatible with housework. The implied own wage and cross wage elasticities are 0.42 and 0.39 for self employed women and 0.56 and 0.40 respectively for wage workers. The income effects exerted through the asset coefficients suggest that as assets increase, irrespective of who owns it, women tend to be less likely to be a labor market participant and the negative effect comes through significantly only in the wage earner equation. The pattern of the asset coefficients suggest that the women's own asset exerts a bigger work reducing effect. The Wald test statistics, given in the last row of table 4, rejects the null hypothesis that the effect of assets of husband and wife are equal.[6]

C. Estimates of Fertility Equations:

Table 5 provides the OLS regression estimates of the fertility equation. Column 2 presents the estimates including the quadratic terms in the asset variables. An increase in the wage of husband and wife reduces the demand for number of children ever born, but the effect is much larger for the wife's wage. This suggests that child care is a more mother's time intensive commodity and is perceived as a cost of bearing and rearing children. The computed own and cross wage elasticities are 0.273 and 0.126 respectively. Earlier we observed that female wages have a positive effect on labor force participation and choice of wage or self employment work. This suggests that as the attractiveness of a job (whether inside the home as a family worker or outside as a wage worker) increases, other things remaining the same, there will be a decline in birth rates. An increase in women's wage is associated with a reallocation of women's

time to market work and especially to wage work, with a concomitant reduction in fertility.

The income effects are positive and in line with a priori prediction but are significant only in the specification including the squared terms in assets. This suggests that child services are normal goods. Our results indicate that women's assets are associated with a bigger positive demand for children compared to her husband's assets. In addition to viewing children as a normal good women may consider children also as a productive investment as a potential source of support in sickness or old age. The test of equality of asset effect is not rejected at any conventional level of significance and implies that the distribution of the ownership of nonearned income between the spouses is irrelevant for fertility decisions. Interestingly, Schultz(1990) and Thomas (1990), reject the income pooling hypothesis in fertility decisions in Thailand and Brazil where women's assets exert a larger positive effect than men's assets.

The OLS estimates of the fertility equations by age cohorts of women are presented in Table 6. For the oldest cohort of women the measured fertility corresponds to the completed fertility implied by the definition of children ever born. If women in the middle cohort 30-39 years stop having children by age 39, then for this sample current fertility also corresponds to their completed fertility. There is a remarkable consistency in the statistically significant fertility reducing effect of women's own wage across the three age cohorts. The effect is largest among the oldest age group namely women aged 40-49 years. The women's asset effect is statistically significant only among the middle age cohorts while the husband's asset effect is significant and positive only among the youngest age group, and suggests assets relax the credit restraint effect on

starting childbearing, but not an effect on the completed lifetime number of births.

V. Conclusions

This paper presents estimates of the joint determinants of women's choice of work and fertility in the context of urban Tamil Nadu, India. Women's choice of work is formulated in a dichotomous and trichotomous framework. The results confirm that women in urban Tamil Nadu do not regard the decision to engage in wage work as identical to self employment. The empirical results suggest that, in general, wife's wage increases the probability of participation more in wage employment compared to self employment. An increase in husband's wage is associated with a reduction in the wife's probability of participation in both wage employment and self employment. The positive effect of the own wage however exceeds the participation reducing effect of the husband's wage in wage employment. A 10 percent increase in the wage of wife would increase the woman's participation in self employment by 4 percent and in wage work by 6 percent. A similar increase in her spouse's wage leads to a reduction in her participation in both self employment and wage work by 4 percent. Both husband's and wife's wage significantly reduce the demand for children. A ten percent increase in wife's and husband's wage rates leads to a reduction in fertility by 3 and 1 percent respectively. The results imply that with development and a general growth in wage of women, more women would be drawn into wage work compared to self employment and fertility would decline. The assets owned by the women exert a distinct and significant negative effect on participation in wage work and positive effect on fertility. The equality of asset effects is rejected in all the labor force participation and choice of work equations but not in the fertility equations. This implies that women with more bargaining power prefer

to consume more leisure but the distribution of assets does not have any impact on fertility.

Experiments with alternative procedures to correct for sample selection bias found that the multinomial logit model seems to be appropriate since the choice decision is trichotomous rather than dichotomous. The estimates of the wage equations indicate a private of returns to education of 13 percent and 11 percent respectively for men and women.

Footnotes

1. Japan is an exception among the developed countries. See Hill (1983) for an analysis of the women's participation in the informal sector.

2. The data are from the various quinquennial surveys on employment and unemployment conducted by the National Sample Survey Organization (NSSO). From 1972-73, the NSSO has maintained comparable and consistent definition of workers. It should be noted that the worker population ratio is computed population of all ages which includes children and aged dependents.

3. Malathy (1989) estimates the parameters of the labor supply function correcting for endogeneity of children. Location of residence before marriage, number of rooms in the house and religion are used as identifying variables. However, these turn out to be not statistically significant.

4. The demand functions includes price of goods as an exogenous variable. As the households face same price in a cross section data like ours, the price variables are not included in the regressions.

5. The dependent variable is discrete and takes nonnegative integer values. To take into account this nature of the dependent variable, a poisson model is applied. The sign and significance of the parameter estimates are similar to the OLS results. However, the poisson model is more appropriate for shorter constant period of about 5 years before the survey. In that case it captures the more recent pattern of fertility (see Schultz, 1992). In our sample about two-thirds of the women report no children ever born in the last 5 years. For this definition of the dependent variable, most of the explanatory variables turn out to be insignificant. I also tried to apply the ordered probit model since it takes into account the right censoring, as many women have still not completed fertility. The sign and significance of the ordered probit estimates are similar to the OLS estimates reported in the text. Hence the ordered probit estimates are not reported.

6. Squared terms in the asset variables were introduced but they turned out to be not statistically significant.

References

Anderson, K.H. (1983), "The Determination of Fertility, Schooling, and Child Survival in Guatemala," International Economic Review, Vol 24, No. 3: pp 367-589.

Bardhan, P.K. (1984), "Determinants of Supply and Demand for Labor in a Poor Agrarian Economy: An Analysis of Household Survey Data from Rural West Bengal", in H.P. Binswanger and M.R. Rosenzweig (ed), Contractual Arrangements, Employment, and Wages in Rural Labor Markets in Asia, New Haven: Yale University Press.

Becker G.S. (1960), "An Economic Analysis of Fertility," in Demographic and Economic Change in Developed Countries, NBER, N.J: Princeton.

_____ . (1981), A Treatise on the Family, Cambridge, Mass: Harvard University Press.

Behrman, J.R and B. L. Wolfe (1984), "Labor Force Participation and Earnings Determinants for Women in the Special Conditions of Developing Countries," Journal of Development Economics, Vol.15, No. pp.259-288.

Blau, D.M. (1985), "Self Employment and Self Selection in Developing Countries Labor Markets," Southern Economic Journal, Vol.52, No. 2, pp.351-363.

Boulier, B. and M.R. Rosenzweig, (1978), "Age, Biological Factors, and Socioeconomic Determinants of Fertility: A New Measure of Cumulative Fertility for Use in the Empirical Analysis of Family Size", Demography, Vol. 15, No. 4: pp 487-497.

Cain, G.C., and M.D. Dooley, (1976), " Estimation of a Model of Labor Supply, Fertility, and Wage of Married Women", Journal of Political Economy, Vol. 84, pp S179-S199.

Census of India, (1981), Series I, India, Port II B.C. (1), Primary Census Abstract: General Population, New Delhi.

Duraisamy, P. (1988), "An Economic Analysis of Fertility, Child Schooling, and Labor Force Participation of Women in Rural Indian Households", Journal of Quantitative Economics, Vol. 4, No. 2, pp 293-316.

_____ . and R. Malathy. (1990), "Impact of Public Programs on Fertility and Gender Specific Investment in Human Capital of Children in Rural India,"in T. P.Schultz (ed.) Research in Population Economics", Vol. 7, pp 157-186.

Fleisher, B. M., and G. F. Rhodes, (1979), "Fertility, Women's Wage rate and Labor Supply", American Economic Review, Vol. 69, pp. 14-24.

Heckman, J. (1974), "Shadow Prices, Market Wages and Labor supply,"Econometrica Vol.42, pp 679-694.

_____ . (1976), "The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Dependent Variable and a Simple Estimator for Such Models," Annals of Economic and Social Measurement, Vol.5, No.4, pp.475-502.

Hill, A.M. (1983), "Female Labor Force Participation in Developing and Developed Countries: Considerations of the Informal Sector," Review of Economics and Statistics, Vol. 65, pp.459-468.

Khandker, S.R. (1987), "Labor Market Participation of Married Women in Bangladesh," Review of Economics and Statistics, Vol. 69, pp.536-549.

Killingsworth, M. (1983), Labor Supply. Cambridge: Cambridge University Press.

Malathy, R, (1983), Allocation of Time to Market and Non Market Work: A Study of Married Women in Madras City, Ph.D thesis, University of Madras.

_____ .(1989) "Labor Supply Behavior of Married Women in Urban India", Discussion Paper No. 585, Economic Growth Center, Yale University.

_____ . (1991), "Estimating Substitution and Income Effects of Female Labor Supply", Journal of Quantitative Economics, Vol. 7, No. 1, pp 43-63.

_____ . (1992), "Education and Women's Time Allocation to Non-market Work in an Urban Setting of India," Economic Development and Cultural Change, forthcoming.

Manser, M. and M. Brown (1979), "Bargaining Analysis of Household Decisions," in C.B. Lloyd., E.S.Andrews and C.L. Gilroy (eds.) Women in the Labor Force, New York: Columbia University Press.

_____ and _____ (1980), "Marriage and Household Decision Making," International Economic Review, Vol. 21, No.1, pp.31-44.

McCabe, J.L. and M.R. Rosenzweig (1976), "Female Labor Force Participation, Occupational Choice, and Fertility in Developing Countries", Journal of Development Economics, Vol. 3, pp 141-160.

McElroy, M.B. (1990), "The Empirical Content of Nash-Bargained Household Behavior," Journal of Human Resources, Vol.25, No.4, pp.559-583.

_____ and M. J. Horney (1991) Nash-Bargained Household Decisions," International Economic Review, Vol 22, No. 2, pp.333-350.

Rees, H. and A. Shah (1986), "An Empirical Analysis of Self Employment in the U.K.," Journal of Applied Economics, Vol.1, pp. 95-108.

Rosenzweig, M.R. (1978), "Rural Wages, Labor Supply, and Land Reform: A Theoretical and Empirical Analysis," American Economic Review, Vol. 68, No.5, pp. 847-861.

_____ . (1980), "Neo-Classical Theory and the Optimizing Peasant: An

Econometric Analysis of Market Family Labor Supply in a Developing Country," The Quarterly Journal of Economics, Vol. XCIV, No. 1, pp. 31-55.

_____ . (1982), "Educational Subsidy, Agricultural Development and Fertility Change," The Quarterly Journal of Economics, Vol. XCVII, No. 1, pp.67-88.

_____ and R.E. Evenson, (1977), "Fertility, Schooling, and the Economic Contribution of Children in Rural India: An Econometric Analysis", Econometrica, Vol. 45, No. 5, pp 1065-1079.

_____, and K.I., Wolpin, (1980), "Life Cycle Labor Supply and Fertility: Causal Inferences from Household Models", Journal of Political Economy, Vol. 88, pp. 328-348.

Schultz, T. P. (1977), " The Influence of Fertility on Labor Supply of Married Women: Simultaneous Equation Estimates", in R.C. Ehrenberg (ed.) Research in Labor Economics, Vol. 1. Greenwich, Conn: JAI Press.

_____ .(1988a), "Educational Investments and Returns," in H. Chenery and T.N. Srinivasan (eds.) HandBook of Development Economics, Vol.1, Amsterdam: North-Holland.

_____ .(1988b), "Economic Demography and Development: New Directions in an Old Field," in G. Ranis and T.P. Schultz (eds.) State of Development Economics : Progress and Perspective, Cambridge, MA:Basil Blackwell Ltd.

_____ ., (1990), "Testing the Neoclassical Model of Family Labor Supply and Fertility", The Journal of Human Resources, Vol. XXV, No. 4, pp 599-634.

_____ (1992), "The Relationship Between Local Family Planning Expenditures and Fertility in Thailand, 1976-1981," Center Discussion paper No. 662, Yale University.

_____ . (1993), "Demand for Children in Low Income Countries," in M.R. Rosenzweig and O. Stark (eds.) Handbook of Population and Family Economics, Amsterdam: North-Holland Pub. Co.,

Schultz, T.W., (1974),(ed). Economics of the Family, Chicago: University of Chicago Press.

Smith, J., (1980),(ed), Female Labor Supply: Theory and Estimation, Princeton:Princeton University Press.

Thomas, D. (1991), "Intra-Household Resource Allocation : An Inferential Approach," Journal of Human Resources, Vol. XXV, No. 4, pp. 635-664.

Vijverberg, W. P.M. (1986), "Consistent Estimates of the Wage Equation When Individuals Choose Among Income-Earning Activities," Southern Economic Journal, Vol.52, No.4, pp. 1028-1041.

_____ . (1990), "Non Farm Self Employment and the Informal Sector in Cote d'Ivoire: A Test of Categorical Identity," Journal of Developing

Areas, Vol.24, No.4, pp. 523-542.

Visaria, P and B.S. Minhas (1991), "Evolving an Employment Policy for the 1990's: What Do the Data Tell Us ?," Economic and Political Weekly, April 13, 1991.

Willis, J.R. (1973), "A New Approach to the Theory of Fertility Behavior", Journal of Political Economy, Vol. 81, pp S14-S64.

World Bank (various years) World Development Report, World Bank: Washington D.C.

Table 1

Variable Description, Means and Standard Deviations

Variable	Mean	Standard Deviation
Endogenous Variable		
Labor Force Participation		
Wife participation (dichotomous)	0.300	0.459
Wife wage work (dichotomous)	0.163	0.370
Wife self employed (dichotomous)	0.137	0.344
Husband participation (dichotomous)	0.925	0.264
Husband wage work (dichotomous)	0.582	0.493
Husband self employed (dichotomous)	0.342	0.474
Fertility		
Number of children ever born	3.125	1.515
Exogenous Variables:		
Wife's hourly wage (predicted)	4.915	3.009
Husband's hourly wage (predicted)	9.486	4.388
Wife's education (in years)	5.761	4.694
Husband's education (in years)	9.082	4.644
Wife's assets (in 1000 rupees)	16.470	19.623
Husband's assets (in 1000 rupees)	50.863	68.954
Wife's age (in years)	36.066	8.080
Husband's age (in years)	42.735	8.453
Wife's experience(age-education-5)	25.306	9.741
Husband's experience (age - education - 5)	28.653	10.038
Sample size	1276	

Table 2

Reduced Form Labor Force Participation and Wage Equations Estimates for Women

	Parti -cipate	Wage Earner	ln(hourly) wage	ln(hourly) wage	Self Employed	Wage Earner	ln(hourly) Wage
	(Probit)	(MLE)		(OLS with λ)	(Mlogit)		(OLS with λ)
	1	2	3	4	5	6	7
Constant	-1.254	-2.232	-.786	-0.918	-1.720	-3.638	-.777
	(4.87)[a]	(6.84)	(2.18)	(0.95)[b]	(3.00)	(6.66)	(2.85)[b]
Wife's education	.0706	0.112	0.133	0.135	.0288	.209	.133
	(7.10)	(9.06)	(10.83)	(7.09)	(1.30)	(9.16)	(16.23)
Wife's experience	.0607	0.0708	0.0724	0.0770	.0620	0.127	.0715
	(3.15)	(2.97)	(4.89)	(2.27)	(1.41)	(3.18)	(5.85)
Experience square	-.00136	-0.00114	-0.000714	-0.000857	-.00214	-0.00223	-.000695
	(3.56)	(2.37)	(2.24)	(0.85)	(2.39)	(2.71)	(2.81)
Husband's assets	-.00166	-0.00445			-.0000181	-0.00767	
($X10^{-3}$)	(2.20)	(3.22)			(-.01)	(3.68)	
Wife's assets	-.0112	-0.0198			-.008205	-0.0388	
($X10^{-3}$)	(4.38)	(4.70)			(1.65)	(5.01)	
Lambda (Wage Earner status)				0.252			.202
				(0.15)			(2.13)
Lambda (Participate)				0.0839			
				(0.11)			
Sigma			.371				
			(7.68)				
Rho			.540				
			(2.21)				
Log likelihood	-715.54		-551.45		-945.34		
LR Test: Dichotomous Versus Trichotomous (χ_7^2)					68.56		
Test of equality of asset effect (χ_1^2)	10.98	12.56			2.180		13.80

a. Asymptotic 't' values in parentheses
b. Absolute 't' values in parentheses

Table 3

Reduced Form Labor Force Participation and Wage Equations Estimates for Men

	Parti -cipate	Wage Earner	ln(hourly) Wage	ln(hourly) Wage	Self Employed	Wage Earner	ln(hourly) Wage
	(Probit)	(MLE)		(OLS with λ)	(Mlogit)		(OLS with λ)
	1	2	3	4	5	6	7
Constant	2.327	-.0836	-.0568	-0.0787	4.357	4.013	.0531
	(5.79)[a]	(-.28)	(-.38)	(0.52)[b]	(4.93)	(4.85)	(.345)
Husband's education	-0.107	.205	.110	0.138	-.273	-.190	.1095
	(7.04)	(2.16)	(7.65)	(3.80)	(8.21)	(6.07)	(8.11)
Husband's experience	0.0526	.192	.0578	0.0421	.0673	.0856	.0569
	(2.13)	(1.01)	(8.34)	(4.50)	(1.29)	(1.77)	(7.37)
Experience square	-.00138	-.000208	-.000548	-0.000170	-.00243	-.00233	-.000539
	(3.21)	(-.65)	(4.58)	(0.92)	(2.69)	(2.78)	(4.13)
Husband's assets ($x10^{-3}$)	-.000601	-.00338			.00123	-.00446	
	(.83)	(5.38)			(.82)	(2.71)	
Wife's assets ($x10^{-3}$)	.00136	-.00494			.00936	-.00089	
	(.46)	(2.56)			(1.57)	(-.14)	
Lambda (Wage Earner status)				-1.151			-.0428
				(2.94)			(-.406)
Lambda (Participate)				0.144			
				(1.30)			
Sigma			0.416				
			(2.75)				
Rho			.210				
			(0.76)				
Log Likelihood	-309.56	-1234.7			-1051.1		
LR Test: Dichotomous Versus Trichotomous (χ_7^2)					66.12		
Test of equality of asset effect (χ_1^2)	0.40	0.59			0.51	0.73	

a. Absolute (Asymptotic) 't' values in parentheses
b. Absolute 't' values in parentheses

Table 4

Estimates of Labor Force Participation of Women

	Parti -cipate (Probit) 1	Wage Earner (Probit) 2	Multinomial Logit	
			Self Emp. 3	Wage earner 4
Constant	-2.504 (-2.40)[a] [-0.700][b]	-0.844 (-0.62) [-0.040]	-5.276 (-2.57) [-0.385]	-4.357 (-2.11) [-0.282]
Wage of wife[c]	0.687 (18.39) [0.192]	1.026 (15.82) [0.049]	1.098 (13.53) [0.0781]	1.202 (14.90) [0.0802]
Wage of Husband[c]	-0.0502 (-9.43) [-0.014]	-0.424 (-12.03) [-0.020]	-0.664 (-11.99) [-0.0480]	-0.620 (-12.31) [-0.0407]
Wife's assets ($x10^{-3}$)	-.0214 (-6.09) [-0.00599]	-.0284 (-4.60) [-0.00136]	-.00909 (-1.56) [-0.000457]	-.0379 (-4.34) [-0.00270]
Husband's assets ($x10^{-3}$)	-.00296 (-2.95) [-0.000827]	-.0124 (-5.59) [-0.000589]	.000331 (.19) [0.0000889]	-.00921 (-3.64) [-0.000675]
Wife's age	0.107 (1.74) [0.030]	0.0376 (0.48) [0.00179]	.373 (3.03) [0.0274]	.2735 (2.29) [0.174]
Wife's age square	-0.00271 (-3.07) [-0.00760]	-.00144 (-1.30) [-0.000068]	-.00689 (-3.87) [-0.000508]	-.00497 -2.97) [-0.000316]
Log likelihood	-408.97	-217.69	-736.08	
LR Test: Dichotomous Versus Trichotomous (χ_7^2)			63.46	
Test of equality of asset effect (χ_1^2)	22.07	5.23	2.02	8.76

a. Asymptotic 't' values in parentheses
b. Marginal values in brackets.
c. Predicted values (see text for explanation).

Table 5

Regression Estimates of Fertility Equations

	OLS	
	1	2
Constant	-3.229	-3.241
	(-4.59)[a]	(-4.62)
Wage of Wife[b]	-0.174	-0.178
	(-9.96)	(-10.15)
Wage of Husband[b]	-0.0451	-0.0435
	(-3.78)	(-3.65)
Wife's assets	0.00309	0.00848
($x10^{-3}$)	(1.68)	(2.20)
Wife's assets square		-0.657
($x10^{-10}$)		(-1.77)
Husband's assets	0.000894	0.000223
($x10^{-3}$)	(1.71)	(2.62)
Husband's assets square		-0.0327
($x10^{-10}$)		(-2.16)
Wife's age	0.312	0.307
	(7.71)	(7.60)
Wife's age square	-0.00272	-0.00264
	(-4.88)	(-4.74)
χ^2/ $\bar{R}^2$	.366	.366
Tests of Equality of asset effects (χ^2 /F)	1.122	1.417

a. 't' values in parentheses
b. Predicted values (see text for explanation).

Table 6

OLS Estimates of Fertility Equations by Age Group

	Age 20-29		Age 30-39		Age 40-49	
	1	2	1	2	1	2
Constant	2.181 (0.25)[a]	1.899 (0.46)	-2.519 (-0.29)	-2.897 (-0.34)	-40.879 (-2.67)	-42.035 (-2.76)
Wage of Wife[b]	-0.250 (-6.33)	-0.2534 (-6.36)	-0.210 (-6.05)	-0.208 (-5.98)	-0.168 (-6.59)	-0.173 (-6.76)
Wage of Husband[b]	-0.0607 (-2.63)	-0.0584 (-2.51)	-0.0596 (-2.84)	-0.0612 (-2.91)	-0.0284 (-1.52)	-0.0263 (-1.41)
Wife's assets ($x10^{-3}$)	0.00389 (1.50)	0.00225 (0.434	0.00765 (2.42)	0.0143 (2.28)	0.000159 (0.05)	0.0111 (1.50)
Wife's assets square ($x10^{-10}$)		-0.142 (-0.28)		-0.824 (-1.31)		-11.192 (-1.73)
Husband's assets ($x10^{-3}$)	0.00259 (2.65)	0.00485 (2.22)	0.000228 (0.25)	0.000863 (0.55)	0.000607 (0.73)	0.00196 (1.34)
Husband's assets sq. ($x10^{-10}$)		-0.11368 (-1.14)		-0.0232 (-0.65)		-0.0275 (-1.26)
Wife's age	-0.174 (-0.53)	0.154 (-0.47)	0.303 (0.61)	0.321 (0.64)	2.035 (2.96)	2.079 (3.03)
Wife's age square	-0.00837 (-1.28)	0.00799 (1.22)	-0.00292 (-0.40)	-0.00319 (-0.44)	-0.0224 (-2.91)	-0.0228 (-2.98)
$\bar{R}^2$	0.404	0.403	.234	.235	.209	.214
Test of Equality of asset effects(F)	0.178	0.124	4.307	2.079	0.0154	1.598
Sample Size	350	350	438	438	488	488

a. 't' values in parentheses

b. Predicted values (see text for explanation).