7-1-1992

Education and Women's Time Allocation to Non-Market Work in an Urban Setting of India

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CENTER DISCUSSION PAPER NO. 683

EDUCATION AND WOMEN'S TIME ALLOCATION TO NON-MARKET WORK IN AN URBAN SETTING OF INDIA

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July 1992

Note: Center Discussion Papers are preliminary materials circulated to stimulate discussion and critical comments. Dr. Malathy was a Postdoctoral Fellow during the period September 1988 through December 1991 and is an Assistant Professor of Economics at the Department of Humanities and Social Sciences, Indian Institute of Technology, Madras. An earlier version of this paper was presented at the 1989 Winter Meetings of the Econometric Society, Atlanta, Georgia. This paper is forthcoming in *Economic Development and Cultural Change*.

Financial support for this research was provided by the Rockefeller Foundation.

I am indebted to T.Paul Schultz for many helpful comments and suggestions. I have also benefitted from the comments of Mark R. Rosenzweig, Tom Mroz, Robert Evenson, P. Duraisamy and two anonymous referees of *Economic Development and Cultural Change*. I am thankful to the Economic Growth Center for the research facilities.

ABSTRACT

This paper studies the determinants of women's time allocation to different categories of work at home using household level data from one of the urban centers of India. The focus is on the effects of wages, income and education on time allocations and the problem of endogeneity of children and hired help variables. Alternative approaches to handle the simultaneity problem are discussed and two approaches have been used to study the sensitivity of the parameter estimates to alternative assumptions about the endogenous variables. The empirical results suggest that women would spend less time in home production as their wage increases by withdrawing time spent in teaching children. An increase in household's assets leads to an increase in time spent in teaching children at the expense of other nonmarket activities. Higher female education reduces the amount of time spent in all nonmarket activities except teaching children which implies a tremendous relative reallocation of mother's time to children's education. The inclusion of potential endogenous variables does not appear to add any more useful information than the quasi-reduced form estimates.

KEY WORDS: Women's Time Allocation, Determinants, Endogeneity, India

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1. Introduction

In the last few decades, the allocation of time by individuals and households has been an important issue of concern among economists. Initially, attention was almost entirely focused on time allocation to market work and as such a great deal is known about the household's labor force behavior. In contrast, relatively little is known about how household members allocate their time within the home. The development of the 'new home economics' approach, which has formalized housework, has enabled the economist to analyze the non-market component of time allocation.[1]

Evenson has made an international comparison of time allocation by men and women.[2] An interesting observation is that women in developing countries spend a substantially higher amount of time in housework compared to their counterparts in developed countries. Men do very little housework in both the developing and developed economies. Housework is thus an important activity for women, particularly in developing countries, and ignoring this component of time use can seriously distort our measurement of their productive role.[3] Yet very little data are available on time allocation in the household in these countries. Among the few studies that have estimated the determinants of demand for time to housework in the less developed countries' context are, Evenson, et al. for

Philippines, Mueller for Botswana, and Khandker for Bangladesh.[4] These works however refer only to rural households. To my knowledge there is no published analysis of time allocation to home production of urban women in developing countries. This paper constitutes such a study.

This study focuses attention on time allocation to non-market work of urban women in Madras, India. Even though market work hours may be an important dimension of time use, I do not consider it here as this forms the subject of a separate paper.[5] In the present study, I estimate the derived demand for certain disaggregated measures of household work and child care hours. The primary goal of this exercise is to examine the responsiveness of various categories of non-market time allocations to economic incentives, namely wages and income, and to understand the role of education on time allocations. Yet another objective of this paper is to examine the exogeneity assumption on children and hired help variables which are among the other covariates included in the time allocation functions.

The remainder of this paper is organized as follows: In Section 2, a brief overview of the model of time allocation is presented. Section 3 outlines the econometric specification of the model and discusses the measurement of variables and certain methodological issues associated with some of the variables. The results of the empirical analysis are reported in Section 4. Section 5 provides the

summary and conclusions of the study.

2. Allocation of Time: Conceptual Framework

The framework of analysis is based on the new home economics approach developed by Becker and extended by Gronau.[6] It is assumed that households derive utility from a vector of commodities, and leisure time of members. The commodity set consists of final goods which are thought of as being produced by market inputs and time of household members. Assuming further that utility is maximized subject to income and time budget constraints, it is easy to derive demand functions for the arguments in the utility function (home goods and household members' leisure time) and the inputs used in the production of home goods (market purchased goods and time of members). The reduced form equations for the demand for non-market time of the wife, which is of interest in this study, can be written as:

(1) $D_{if} = D(W_f, W_m, V; E)$

where D_{if} denotes non-market time of wife to the ith activity, W_f and W_m are the wages of the wife and husband, V is the non-labor income of the household, and E signifies the environmental variables like wife's education, age, number of children, etc., which are likely to affect the productivity in the home. It is expected that the education variable also takes into account the variation in the taste for certain types of activities over others.

The comparative static properties of the model can be easily derived and are elaborately discussed in Gronau.[7] Table 1 presents the sign predictions of the major determinants of the allocation of time.

The non-labor income represents a pure income effect on time allocations.[8] An increase in household's non-labor income increases the demand for leisure which is a normal good. This demand is by and large met by reducing work at home and for working women by also reducing market work.

Ceteris paribus, an increase in wife's wage, which denotes her labor market productivity, lowers the price of goods (and others' time) relative to her time, thereby making home production activity less profitable for her. This leads to a substitution of goods (others time) for her own time in domestic work.[9] Thus wife's wage is expected to have a negative effect on non-market time allocation.

An increase in husband's wage exerts both an income effect which is negative and a substitution effect whose sign is indeterminate. The net effect depends on the substitution - complementarity relationship between the spouses' times. If the two are substitutes, the sign of husband's wage is determined by which effect-the income or the substitution effect- dominates. They may even tend to cancel out leaving wife's time unaffected. If the spouses' times are complements, then the sign of husband's wage would be negative.

The above discussion relates to non-market work in general. An interesting question is whether these variables affect all types of activities at home in a similar fashion or are there differences, and what explains the differential impact if any. The empirical analysis that follows tries to find answers to these questions. In addition, I also consider the effect of other variables (E), such as wife's education, age, children, hired help, other members in the household, and labor saving devices in the home, on time allocations.

3. Empirical Specification and Methodological Issues

Taking a linear approximation and adding a stochastic disturbance term (u_i), the wife's time allocation function to various activities at home (equation 1) may be written as:

(2) $$D_{if} = a_{oi} + a_{1i}W_f + a_{2i}W_m + a_{3i}V + a_{4i}E + u_i$$

where D_{if}, W_f, W_m, V, E and u_i are as defined earlier and a_{ji}'s are the parameters to be estimated. The measurement of the variables, the problems associated with some of these variables and alternative approaches to tackle them are discussed below.

The dependent variables are annual hours spent in (i) non-market work which includes time spent in all the domestic activities (housework and child care); (ii) two categories of household work, namely, (a) total housework consisting of meal preparation, cleaning and washing,

laundry, etc. and (b) meal preparation considered separately, and (iii) two types of child care activities (a) teaching children and (b) other (physical) care of children.

The independent variable, wife's wage, is the predicted log hourly wage rate. A problem associated with this variable is that it is not observed for women who do not work. This necessitates imputing a wage rate based on estimates of earnings function obtained from a sample of working women. Such a procedure however leads to the now familiar problem of sample selection bias. Hence I use a wage rate that is corrected for selectivity bias using Heckman's method. One obvious difficulty with this approach is that it creates a wage estimate for non-workers conditional on their working in the market which is contrary to what they actually do. A better strategy may be to predict a market wage offer for workers and a reservation wage for non-workers. Using predicted, instead of actual, wage for working women eliminates the measurement errors and transitory components in the hourly wage rate. The market wage equation corrected for selectivity bias, and the reservation wage equation obtained from a Tobit labor supply equation, are provided in the Appendix Table A1.[10]

The husband's wage is also a predicted log hourly wage.[11] The use of predicted wage removes the bias due to measurement errors and transitory components in the reported wages. All husbands in the sample are wage earners and

hence there is no sample selection bias in predicting their wages.

The household's non-labor income is measured as a stock variable and is defined as the money value of the net assets owned by the family (henceforth referred to as assets).

The effect of wife's schooling on time inputs to home production has not been so far studied in the Indian context. In order to isolate the other effects of education from its effect through the wage rate, I include this variable, measured as number of completed years of schooling, directly in the regressions. An increase in education is likely to increase the time spent in home production if it increases efficiency in work at home. Eduction may also capture the taste factor and could lead to a reduction in time spent in work at home if more educated women have a lower taste for non-market work.

Age of the wife is introduced to capture the productivity effect. If age raises market productivity it would pull her into market work and reduce work at home. On the other hand, if it augments home productivity relative to market productivity, then it would orient the woman towards home production. A squared term in age is included to examine the non-linear effect of age.

The other variables in the equation are the presence of other males and females at home, home technology, number of children, and hired help. The home technology variable is

defined as a dummy variable equal to one if households possessed at least one of the labor saving devices like a pressure cooker, gas stove, electric grinder, and refrigerator. It may be argued that this variable merely captures a part of the effect of assets, as it represents ownership of specific assets.[12]

The number and age of children are known to be associated with women's time allocation decision. Children represent time intensive goods and an increase in the demand for child services may be expected to be positively related to wife's time input and the effect may weaken as the children grow older. To test for the differential effect by age of children, I measure children in two age groups viz 0-7 years when the children's demand on mother's time may be expected to be highest, and 8-17 when they demand less of the mother's time. A set of dummy variables defining whether the households hire any help for teaching and other child care activities are also included to understand the effect of market substitutes on women's time allocation.

The number of children should be treated as a choice variable in a household demand framework since time allocation decisions are jointly determined with the household's demand for number of children.[13] Similarly hired help is also a potential endogenous variable. Previous studies on women's time allocation have not paid much attention to this issue of simultaneity. The problem

of endogeneity of the children and hired help variables may be handled in several ways. First, one may estimate the time allocation functions omitting the potential endogenous variables and thus obtain quasi-reduced form estimates. These estimates need not be biased and may even be useful in assessing the long run effects of the changes in wage rates, and other exogenous determinants. Second, the children and hired help variables may be included as exogenous determinants of time allocations. Thus one obtains estimates that yield short run responses holding children and hired help constant. However, this leads to biased and inconsistent parameter estimates if children and hired help variables are correlated with the stochastic disturbance term in the time allocation functions. A third approach would be to estimate time use per child. In this case, the children variables are on the left hand side and the problem of endogeneity does not arise. This assumes that the time demanded per child is constant irrespective of the age of the child. However, this procedure may be appropriate for child care activites but not for housework and meal preparation. Further, this method requires that the sample be restricted to households with children. Such an approach would lead to the familiar selectivity bias problem. In any case, this does not eliminate the problem of endogeneity of the hired help variables. Last, one could go beyond such reduced form or quasi reduced form estimates and estimate

the time allocation functions using simultaneous equation methods. This procedure requires apriori identifying restrictions which are more often arbitrary and do not follow from theory. In the absence of identifying variables in the data set, I do not attempt to instrument these variables.[14]

In this study, the first and second estimation methods, discussed above, are adopted. The sensitivity of the results to the alternative specifications are examined.

The time allocation functions for non-market work and for the specific household tasks such as housework and meal preparation, are estimated by the method of ordinary least squares (OLS). However, in the case of child care activities OLS cannot be applied since a substantial number of women spend no time on these activities and hence the dependent variables are truncated and bounded at zero. For instance, only 332 (50 percent) women participate in teaching children, while the number engaged in other care of children is around 568, which is about 85 percent. Hence Maximum Likelihood Tobit (TOBIT) method is used to estimate the two child care equations.

4. Data and Empirical Results

The data used for this study are from a primary survey of households in Madras City, a metropolitan area in Tamil Nadu, India, conducted by me in 1980-81.[15] The survey is restricted to nuclear households with or without dependents,

with married women aged 20-59, husband present and employed in the year preceding the survey. Data on time allocations include both market work and various tasks performed in the home. The respondents were women, and hence time use data was recorded only for them. Data on non-market work was collected using the recall method. About twenty activities were listed and the number of hours spent by the women on these activities in a normal week were recorded.[16] The data set also contains information on working women's salaries, husband's earning, net assets owned by the household, and demographic particulars like age, education, etc. The sample used in this study consists of 244 working women and 422 women who did not participate in labor market work.

On the average, women in the sample spend about 43.5 hours a week on non-market work including child care and consume about 108 hours of leisure time. Whereas an employed woman devotes on the average 70 hours a week to work - 34 hours a week in market work and 36 hours of home production work - and enjoys 85 hours of leisure, women not in the labor force, perform 43 hours of work at home and have 120 hours of leisure hours, which is about 50 percent more leisure compared to working women. The means and standard deviations of the variables used in the analysis are given in table 2.

The reduced form parameter estimates of the various time allocation regressions without and with the children

and hired help variables are presented in tables 3 and 4. The elasticities of the important variables, namely, wife's wage, husband's wage, asset, and wife's education, for the corresponding specifications without and with the potential endogenous variables are given in table 5.

Non-market Work:

The OLS estimates for non-market work are presented in Table 3, columns 1 and 2. The quasi-reduced form estimates in column 1 show that our apriori expectations are by and large borne out by the data. The own wage effect and the income effect captured by the asset variable are negative and statistically significant at 5 percent level. An increase of one standard deviation in the wife's wage, i.e Rs. 1.82, leads to a decrease in non-market work by 59 hours per year. A similar one standard deviation increase in assets from its sample mean reduces non-market work by 86 hours per year. The sign of the husband's wage effect shows that the spouses' times are substitutes in non-market work. Wife's education is negatively and significantly associated with the time spent in non-market work implying that it has an effect distinct from its effect through the wage rate. An increase of one standard deviation in wife's education (4.08 years) reduces the non-market work by 165 hours a year. Time allocation to non-market work is observed to increase with age at a diminishing rate which implies that age augments non-market productivity relative to market

productivity and that with aging there is no transferability to market work. Other females in the home and labor saving devices decrease the demand for woman's time to home production activities.

The specification including the children and hired help variables, given in column 2, suggests that the number of children in both age groups increase, while hired help reduce the demand for mother's non-market time. The wage and income elasticities given in Table 5 for the two specifications indicate the sensitivity of the core economic variables to the treatment of the endogenous variables. Including the children and hired help variables leads to a doubling of the wife's wage elasticity, to a three-fold increase in husband's wage elasticity, and to a one-third reduction in the asset elasticity.

Housework and Meal Preparation:

We proceed to the examination of whether the same variables exert differential effects on time allocation to different activities. Table 3 provides the estimates of the time spent in housework and meal preparation for the two specifications. The effect of wife's wage is not statistically significant in either activity. An increase in husband's wage significantly increases while an increase in assets significantly reduces wife's time in both housework and meal preparation. An increase in husband's wage by one standard deviation above the sample mean results

in an increase in wife's time spent in housework by 97 hours and in meal preparation by 101 hours per year. A similar one standard deviation increase in assets reduces wife's time input to housework and meal preparation by 97 hours and 71 hours per year respectively. More educated women appear to be less efficient in performing the household chores and also to have a lower taste for these activities. Women whose education is one standard deviation higher than the sample mean exhibit a tendancy to withdraw 158 hours from housework and 139 hours from meal preparation compared to women with average education.

The estimates in the equation with the children and hired help variables show that children in the younger age group increase mother's time in household tasks. Whereas hired help to teach children increases the demand for time in housework only, the presence of market substitute in the other care of children reduces women's time input to both housework and meal preparation activities. The latter effect is possibly because the physical care of children and some household tasks are indistinguishable and are performed simultaneously. The inclusion of these potentially endogenous variables overstates the effects of husband's wage and understates the effect of education. However, the asset elasticities are close to each other across the two specifications in both time allocation functions.

Teaching and Other child care:

The maximum likelihood Tobit estimates of the two types of child care time allocation functions are shown in table 4. The parameter estimates of the teaching equation suggest that the own wage effect is negative and the husband's wage effect is positive, as observed in the other equations, and these effects are also statistically significant. A one standard deviation increase in own wage reduces teaching time by 45 hours a year while a similar increase in husband's wage increases time inputs to teaching by 40 hours a year. A striking difference is observed in the effect of assets and wife's education variable on child teaching. Whereas these variables exert a negative effect on housework and meal preparation, they turn out to be significantly positive in the teaching equation. It may be inferred that the income effect on the demand for time relative to goods is more in teaching compared to the other activities and households which are wealthier do not substitute goods or others' time for mother's time in this specific child care task. The effect of education suggests that a better educated woman has a greater taste for educating her children and is also perhaps more efficient in performing this activity compared to her less educated counterpart. Women whose education is one standard deviation higher than the mean spend 61 hours more per year in teaching children compared to women with average education. An increase in

wife's age increases time spent in teaching at a declining rate. The effects of wages and assets are not independently significant but jointly significant (likelihood ratio test $\chi^2(3)=6.17$) in the other child care equation. Mother's education has a significant effect on time input to other child care. A one standard deviation increase in mother's education above the sample mean reduces the time devoted to other care of children by 37 hours a year.

The estimates in the equation including children and hired help show that children in the two age groups increase mother's time in both teaching and other child care activities, however, the younger children demand more by way of physical care compared to teaching. Hired help like tutors etc., have a significant negative impact only in the teaching activity. A look at the table of elasticities reveals that including children and hired help overstates the responsiveness of all the important variables in teaching activity.

In general, the estimates of the time allocation functions reveal that the core economic variables do not have the same effect on the different categories of non-market activity. The negative effect of wife's wage on non-market time comes primarily through its effect on teaching children. That is, an increase in own wage leads to a reduction in time spent in non-market work by reducing the time spent in teaching children. An increase in

household's assets leads to a reduction in time spent in housework and meal preparation but increases substantially the time spent in teaching children. An interesting result is the impact of female education on time allocations. Figure 1 plots the effect of an exogenous increase in female education, holding other variables at their sample means, in the quasi-reduced form estimates of the time allocation functions. A striking finding is that higher female education has an absolute effect of reducing the quantity of time devoted to all categories of non-market work other than teaching children.[17]

5. Summary and Conclusion

In this paper an attempt has been made to study the determinants of time allocation to different categories of work at home, focussing on the effect of wages, income and education on time allocations.

The problem of endogeneity due to the inclusion of children and hired help variables in the time allocation functions and alternative approaches to handle this issue are discussed. Two sets of estimates, namely, excluding the potential endogenous variables (quasi-reduced form), and including them in the equation but treating them as exogenous, are obtained. The sensitivity of the parameter estimates to these alternative specifications are examined. The inclusion of the potential endogenous variables in the time allocation functions does not appear to add any more

useful information than the quasi-reduced form estimates. Rather, the responsiveness of the economic variables such as wages, assets, and education are found to be biased. The empirical results indicate that the inclusion of the potential endogenous variables, in general, leads to an upward bias in the wage effects whereas the coefficients of assets and education variables are biased downward in the housework and meal preparation equations and biased upward in the teaching equation. The quasi-reduced form estimates, on the other hand, need not be biased[18] and hence seem more believable.

The study demonstrates that women in Madras City spend considerable amount of time in home production. If the results of this study can be taken as some kind of indicator of the future trend, we may infer that women would spend less time in home production as their own wage increases by withdrawing time spent in teaching children. Husband's wage effect is indicative of the substitutability between the roles of spouses in all activities. An increase in household's assets leads to an increase in time spent in teaching children at the expense of the other non-market activities. Higher female education reduces the amount of time spent in all non-market activities except teaching their children. This implies a tremendous relative reallocation of mother's time to children's education. This has important implications if the time spent on children is

approximately viewed as investment in children's achievement in schools and thereby contributes to the educational attainment of children and to their (children's) future earnings capacity.[19]

Despite the usefulness of the quasi-reduced form estimates, a more realistic approach would be to model time allocation taking account of the joint determination of other household choice variables such as number of children, hired help, etc., Instrumental variable methods can be applied to control for the effects of the potential endogenous variables and to analyze the impact of the exogenous determinants on time allocation. Such an approach would require information on the identifying instruments. Data on women's residential orgin prior to marriage and religion may help to account for exogenous differences only in fertility. Similarly, community level data on school teacher's salary, wages of unskilled female workers etc., may serve to identify the choice of hired help. Future data collection efforts to include such information would be more rewarding.

Notes

*This paper was prepared while I was a Visiting Fellow in the Economic Growth Center, Yale University. An earlier version of the article was presented at the 1989 winter meetings of the Econometrics Society, Atlanta. I wish to express my gratitude to T. Paul Schultz for many useful suggestions. I have also benefitted from the comments of Mark R. Rosenzweig and Tom Mroz, discussants at the session. Comments from Robert E. Evenson, P. Duraisamy, and two anonymous referees of this journal are acknowledged. I am thankful to the Rockefeller Foundation and to the Economic Growth Center, Yale University, for the research support and facilities provided. I am alone responsible for any errors and shortcomings in the paper.

1. Farell E. Bloch, "The Allocation of Time to Market and Non-Market Work Within a Family Unit," (Technical Paper No. 114, Standford University, Institute for Mathematical Studies in Social Sciences, 1973); W.L. Gramm, "The Demand for the Wife's Non-Market Time," Southern Economic Journal, 41 (July 1974): 124-133; Reuben Gronau, "The Allocation of Time of Israeli Women," Journal of Political Economy, 84, Part 2 (August 1976): S201-220; Rueben Gronau, "Leisure, Home Production and Work: The Theory of the Allocation of Time Revisited," Journal of Political Economy, 85 (December 1977): 1099-1123; Arleen Leibowitz, "Education and Home Production," American Economic Review, (May 1974): 242-250;

T. J. Wales and A. D. Woodlands, "Estimation of the Allocation of Time for Work, Leisure, and Housework," Econometrica, 45 (January 1977): 115-132.

2. Robert E. Evenson, "The Allocation of Women's Time: An International Comparison," Behavior Science Research, 17 (Spring-Summer 1983): 196-215.

3. Attempts have been made in recent years to measure the value of home production. These estimates reveal that even in countries such as U.S.A. the household sector contributes to over a third of the output produced in the market. Estimates for the developing countries is more recent. One study shows that it is about 47 percent of GNP for India. See R. Malathy, "The Value of Household Services of Women in India," Artha Vijnana, 30 (March 1988): 89-106.

4. Robert E. Evenson, B.M. Popkin and E.K. Quizon, "Nutrition, Work and Demographic Behavior in Rural Philippine Households: A Synopsis of Several Laguna Household Studies," in Rural Household Studies in Asia, ed. Hans P. Binswanger, Et al. (Singapore, Singapore University Press, 1980); S.R. Khandker, "Determinants of Women's Time Allocation in Rural Bangladesh," Economic Development and Cultural Change, 37 (October 1988): 111-126; Eva Mueller, "The Value and Allocation of Time in Rural Botswana," Journal of Development Economics, 15 (October 1984): 329-360.

5. See R. Malathy, "Estimating Substitution and Income

Effects of Female Labor Supply," Journal of Quantitative Economics, 7 (January 1991): 43-63; and R. Malathy, "Labor Supply Behavior of Married Women in Urban India," (Discussion Paper No. 585, Yale University, Economic Growth Center, October 1989).

6. Gary S. Becker, "A Theory of the Allocation of Time," Economic Journal, 75 (September 1965): 493-517; Reuben Gronau, "Leisure, Home Production, and Work - "Theory of the Allocation of Time Revisited." (n. 1 above).

7. Reuben Gronau (n. 6 above).

8. Recently, the household utility maximization problem is being cast in Nash cooperative game theoretic framework. The bargaining approach relaxes the restriction that nonlabor income of husband and wife has the identical efect on time allocation demand functions. See T. Paul Schultz, "Testing the Neoclassical Model of Family Labor Supply and Fertility," The Journal of Human Resources, 25 (Fall 1990): 599-634. The data available for the present study does not permit test of the bargaining model.

9. A substitution of goods which are cheaper relative to wife's time reduces work at home of the woman who participates in market work. In the case of women who do not work, a rise in market wage rate may either leave time allocation unaffected or may induce them to enter the labor force in which case it may reduce their work at home. Hence, on the whole, wages and non-market time allocation are

are negatively related.

10. For deriving the reservation wage equation from the Tobit labor supply equation see T. Paul Schultz, "Estimating Labor Supply Functions for Married Women," in Female Labor Supply : Theory and Estimation, ed J.P. Smith (Princeton, Princeton University press, 1980); for an application of this method in the case of fertility, see Katherine H. Anderson, "The Sensitivity of Wage Elasticities to Selection Bias and the Assumption of Normality: An Example of Fertility Demand Estimation," The Journal of Human Resources, 17 (Fall 1982): 594-604.

11. Husband's wage is predicted using the following equation:

$$\ln \text{Husband's Wage} = -1.219 + \underset{(11.97)}{0.164} * \text{Education} + \underset{(3.65)}{0.025} * \text{Experience} - \underset{(-1.21)}{0.003} * \text{Experience}^2; \; R^2 = 0.49; \; N=666$$

Figures in parentheses are the t ratios. Experience is defined as Age-Education-6.

12. One could argue that home technology is endogenous. However, given the limited information in our data I presently set aside this complication.

13. See T. Paul Schultz, "The Influence of Fertility on Labor Supply of Married Women: Simultaneous Equation Estimates," in Research in Labor Economics, Vol. 2, 1978, pp.273-351.

14. I attempted to instrument the number of children using wife's religion and place of residence while in school as identifying instruments. These variables turned out to

be not statistically significant at the 10 percent level. The collinearity between the predicted children and other explanatory variables in the time allocation functions led to imprecise parameter estimates.

15. For a discussion of the sampling procedure etc., see R. Malathy, " Women's Allocation of Time to Market and Non-market Work : A Study of Married Women in Madras City," (Ph.D thesis, University of Madras, 1983).

16. The list of activities are: helping children with school work, reading books, visits to schools to monitor the children are included in the activity teaching; playing with the kids, feeding and bathing them, changing clothes, administering medicines, visits to doctors, putting children to sleep and taking children for outings are components of physical and other care of children; cooking (including related preparatory work), grinding, kitchen gardening, serving meals on the meal preparation activity; and shopping, washing dishes, cleaning the house, washing, ironing and sewing/mending of clothes plus meal preparation are included in 'housework'.

17. Evidence for the U.S. shows that time inputs to child care and housework increase with education. See C.R. Hill and E.P. Stafford, "Allocation of Time to Preschool Children and Educational Opportunities," The Journal of Human Resources, 9 (Summer 1974): 323-341; Arleen Leibowitz, (as in n. 1 above).

18. T. Paul Schultz (n. 13 above).

19. See L.D. Loury, "Effects of Mother's Home Time on Children's Schooling," The Review of Economics and Statistics, LXX (August 1988): 367-373.

Table 1

Expected Signs of Important Determinants of Time Allocation

Activity	Non-labor Income (V)	Wife's Wage (W_f)	Husband's Wage (W_m)
Non-market work (all activities)	-	-	±

Table 2

Variables Means and Standard Deviations, Time Allocation to Non-market Work of Married Women in Madras City, India

Variable	Mean	Standard Deviation
Dependent variables:		
Annual hours spent in:		
Non-market work	2262.00	876.52
Housework	1462.01	577.03
Meal Preparation	1244.02	492.51
Teaching children	188.87	258.10
Other care of children	611.66	538.93
Independent Variables:		
Log Wife's hourly wage*	0.89	0.60
Log Husband's hourly wage*	1.27	0.49
Value of assets (x 1000 Rupees)	48.56	59.34
Education of the wife (years)	10.82	4.08
Age of the wife (years)	32.80	6.80
Age square	1122.20	461.47
Number of children <= 7 years	0.85	0.93
Number of children 8-18 years	0.90	1.15
Hired help-teaching (dummy)	0.07	0.25
Hired help-other care (dummy)	0.05	0.22
Number of other Males	0.24	0.55
Number of other females	0.32	0.58
Home technology (dummy=1 if possessed labor saving devices,else =0)	0.43	0.50
Number of households	666	

* predicted wage, see text for explanation.

Table 3

Regression Estimates of Demand for Time to Nonmarket work, Housework and Meal Preparation, Married Women in Madras City, India

Variable	Non-Market work		Housework		Meal Preparation	
Constant	328.12	668.57	249.70	506.11	207.27	435.13
	(0.08)	(0.92)	(0.52)	(0.97)	(0.49)	(0.95)
Wife's wage	-98.74	-186.75	-58.47	-89.81	8.37	-34.29
	(2.11)	(1.83)	(1.23)	(1.71)	(0.24)	(0.48)
Husband's wage	150.31	437.36	197.73	244.93	206.77	240.05
	(1.47)	(4.06)	(2.65)	(2.79)	(3.14)	(3.54)
Assets	-1.49	-0.52	-1.64	-1.45	-1.20	-1.06
	(2.91)	(0.85)	(3.71)	(3.28)	(3.12)	(2.72)
Wife's Education	-40.32	-10.25	-38.62	-31.26	-34.02	-28.27
	(2.64)	(0.78)	(4.41)	(3.36)	(4.40)	(3.44)
Wife's age	211.23	89.79	107.60	80.09	81.72	59.11
	(4.64)	(1.96)	(3.73)	(2.46)	(3.21)	(2.06)
Wife's age square	-3.80	-1.70	-1.71	-1.27	-1.24	-0.89
	(5.71)	(2.57)	(4.04)	(2.70)	(3.34)	(2.14)
Other males	-59.91	-65.00	1.80	0.63	12.41	11.45
	(0.85)	(1.04)	(0.40)	(0.01)	(0.32)	(0.29)
Other females	-247.12	-242.24	-192.10	-189.85	-190.41	-188.35
	(3.79)	(4.18)	(4.65)	(4.21)	(5.23)	(5.17)
Home technology	-63.91	-116.45	-174.17	-184.73	-85.00	-93.45
	(0.80)	(1.64)	(3.46)	(3.66)	(1.91)	(2.10)
Children < 8		480.56		66.05		46.77
		(3.27)		(2.56)		(2.05)
Children 8-18		77.38		28.25		25.09
		(2.44)		(1.25)		(1.26)
Help - Teach		-82.32		173.65		115.60
		(0.75)		(2.21)		(1.67)
Help - other		-344.39		-310.11		-274.24
		(2.67)		(3.38)		(3.38)
$\bar{R}^2$	0.18	0.34	0.18	0.23	0.17	0.18
F	12.93	27.46	13.52	16.27	10.52	11.86

Absolute 't' values in parentheses.

Table 4

Maximum Likelihood Tobit Estimates of Demand for Child care Time of Married Women in Madras City, India

Variable	Teaching		Other care	
Constant	-3497.11 (-9.93)	-4093.30 (10.00)	1026.53 (1.95)	1741.71 (3.60)
Wife's wage	-150.83 (2.17)	-246.84 (3.90)	57.36 (1.45)	22.03 (0.69)
Husband's wage	164.45 (2.75)	281.70 (4.82)	52.72 (0.97)	108.08 (1.52)
Assets	0.88 (2.74)	1.39 (4.52)	-0.35 (1.02)	0.22 (0.54)
Wife's Education	30.10 (4.09)	46.85 (6.17)	-10.72 (3.54)	0.67 (0.07)
Wife's age	201.37 (10.51)	244.54 (8.46)	22.20 (0.69)	-87.83 (2.89)
Wife's age square	-2.68 (10.83)	-3.75 (8.73)	-0.85 (1.82)	1.02 (2.32)
Other males	-41.02 (1.21)	-47.20 (1.46)	-52.94 (1.08)	-57.68 (1.39)
Other females	-40.86 (1.28)	-36.37 (1.20)	-38.12 (0.84)	-33.07 (0.86)
Home technology	78.41 (2.04)	56.38 (1.53)	57.08 (1.64)	14.01 (0.30)
Children <= 7		157.86 (8.33)		396.84 (16.42)
Children 8- 18		53.23 (2.98)		72.84 (3.46)
Help - Teaching		-184.01 (3.18)		-109.99 (1.55)
Help - other care		-169.99 (2.68)		119.45 (1.44)
Sigma	338.27 (23.78)	316.98 (23.97)	545.48 (32.49)	456.27 (32.73)
Log L	-2579.00	-2544.20	-4489.00	-4369.80

Asymptotic (Absolute) 't' values in parentheses.

Table 5

Elasticities of Time Allocation to Non-market Work of Married Women in Madras City, India : by Activity

Activities	Wife's Wage	Husband's Wage	Asset	Wife's Education
Nonmarket work	-0.044 [-0.082]	0.066* [0.193]	-0.032 [-0.011]*	-0.193 [-0.049]*
Housework	-0.040* [-0.061]	0.135 [0.167]	-0.054 [-0.048]	-0.286 [-0.231]
Meal preparation	0.007* [-0.028]*	0.166 [0.193]	-0.047 [-0.041]	-0.296 [-0.246]
Teaching children	-0.399 [-0.651)	0.435 [0.752]	0.113 [0.179]	0.862 [1.346]
Other care	0.080* [0.030]*	0.118* [0.152]*	-0.024* [0.015]*	-0.161 [0.010]*

Note: Elasticities in brackets correspond to the specification including the potential endogenous variables. Elasticities are calculated at the sample means. The elasticities of the child care equations are derived from the Tobit expected value locus of the variables.

* Underlying coefficient not statistically significant at 10 percent level or better.

Appendix Table A1

Estimates of Wage Equation Corrected for Selectivity Bias and the Derived Reservation Wage Equation

Explanatory Variable	Labor Force Participation PROBIT	Log Wage OLS[d]	Hours of Work TOBIT	Reservation wage calculated from TOBIT[e]
Wife's Education	0.143 (5.81)[a]	0.193 (14.94)[b]		
Wife's Experience	0.136 (5.16)	0.087 (4.30)		
Wife's Experience square(x 10^{-1})	-0.256 (4.11)	-0.161 (3.32)		
Wife's Wage[c]			2401.382 (11.00)	
Husband's Wage[c]	-0.633 (3.74)		-1875.124 (8.38)	0.781
Asset(x 10^{-2})	-0.328 (3.34)		-8.957 (7.61)	0.004
Children <= 7	-0.149 (2.40)		-396.545 (4.55)	0.165
Children 8-18	-0.268 (4.55)		-29.571 (0.41)	0.012
Wife's age			95.240 (0.81)	-0.040
Wife's age square			-1.465 (0.89)	0.001
Inverse of Mills Ratio (participation)		0.404 (2.37)		
Constant	-1.931	-2.314	-317.238	0.132
Log likelihood	-396.090		-2247.100	
$\bar{R}^2$		0.546		
N	666	244	666	666

a. Asymptotic (absolute) 't' values in parentheses
b Absolute 't' values in parentheses
c. Instrumental variables.
d. Standard errors are corrected for heteroskedasticity.
e. Derived from the TOBIT estimates of the Hours of Work Equation given in column 3.

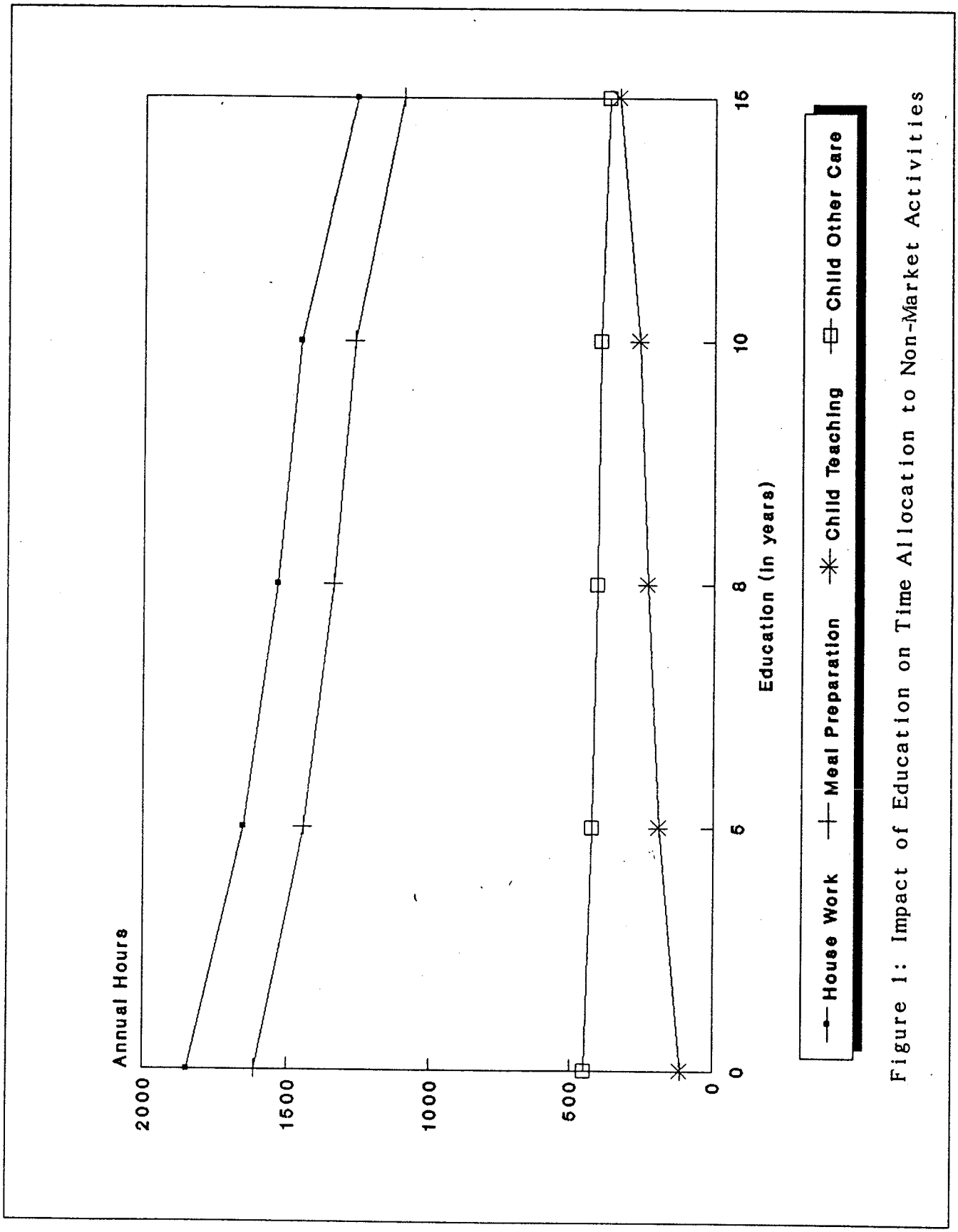

Figure 1: Impact of Education on Time Allocation to Non-Market Activities