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The Effect of Children on the Housewife's Value of Time

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Much recent economic literature on the socioeconomic factors affecting fertility has focused on the "price" of children. A good bit of attention has been paid to the effect of the price the woman assigns to her time. It is argued that these time inputs constitute a predominant part of the costs of production of "child services," in particular while the child is young.[1] The price of time has figured as a main determinant of almost every dimension of fertility: the amount of child services produced, the trade off between the quality of children and the number of children, the timing of the first child, and the spacing of the various children.

The first endeavors were to associate the woman's price of time with the wage rate of working women who have the same market characteristics. An objection to this procedure is that the wage rate of working women is net of her general on-the-job training costs and that a true measure of the price women have to pay for having children should include the costs of depreciation of their market skills as well as the value of appreciation of their nonmarket skills (Michael and Lazear 1971). Furthermore, over three-fifths of all American married women as yet abstain from entering into the labor force in any given week, implying in their behavior that they reject the wage offered to them by the market as an adequate compensation for the loss of nonmarket productivity (Willis 1969 [rev. 1971]; Gronau

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[1] An incomplete list of the studies analyzing the effect of the price of time on fertility includes Ben-Porath (1970*b*), De Tray (1972*b*), Michael (1970, 1971), Willis (1969 [rev. 1971]), and of course Mincer's seminal paper (1963).

1973). This is particularly true in the case of mothers of young children. Thus, while 68 percent of all urban white American married women stayed out of the labor force during the 1960 census week, over 85 percent of all white mothers with one child and over 90 percent of all white mothers with two or more children under 3 years old found that their value of marginal product at home exceeded that of the market.[2] Any evaluation of the price of children has to start, therefore, with the evaluation of the price of time of those mothers who devote their whole time to the home, the housewives.

There is little direct evidence on the price families place on the housewife's time. Admittedly, one may find some indirect evidence in studies of the labor-force participation of married women (e.g., Mincer 1962*a*; Cain 1966); but most of these studies, though recognizing the importance of children to the participation decision, did not investigate the effect of children in sufficient detail to allow any inference on the effect of children on the housewife's value of time. Some more recent studies (Smith 1972*b* and, in particular, Leibowitz 1972) contributed significantly to the discarding of the notion that children can be treated as a homogeneous commodity, but these studies still did not provide direct evidence on the price of the women's inputs in the production of child services. Likewise, an attempt to measure directly the change, explained by presence of children, in time inputs involved in housework (Hill and Stafford 1974; Leibowitz 1972) is only circumstantial evidence, serving as a complement rather than a substitute to a direct evaluation of the housewife's value of time.

I have tried in the past to estimate the price of time of nonworking women (Gronau 1973, 1974). These estimates were based on aggregate data, a method that proved expensive both in computation and in terms of loss of information. Thus, I was able to examine only the effect of income and young children on the housewife's shadow price of time, leaving out variables such as the woman's age, education, and number and age composition of children. The inclusion of these variables in the analysis called for a method of estimation utilizing disaggregate data. The description of this method and the new estimates of the factors effecting the shadow price of time occupy most of this paper.

I analyze herein the woman's age and education, her family income, her husband's age and education, and the number and the age composition of her children. It is found that education has a considerable effect on the woman's value of household productivity: the shadow price of time of college graduates exceeds that of elementary school graduates, other things being equal, by over 20 percent. Husband's characteristics (age and education) have a much smaller effect on the price of a wife's time (e.g., the

[2] These data are based on the 1960 Census 1/1,000 sample and refer to urban white married women belonging to primary families only. These rates would, of course, have been somewhat higher had they referred to annual participation rates.

price of time of women married to college graduates exceeds the price of time of those married to elementary school graduates, other things being equal, by less than 10 percent). The income elasticity of the price of time is relatively low (less than 0.15) but seems to increase with income. The effect of children on the shadow price of time of their mothers seems to vary with the child's age and the mother's education. The existence of children tends to increase the value placed on their mother's time, but this effect diminishes with the child's age. Moreover, given the child's age, the effect of a child on his mother's value of time is not uniform but varies with her education. The effect of a young child (less than 3 years old) increases with the mother's level of education. A child older than 3 years seems not to have any effect on the price of his mother's time if her formal schooling ended at the elementary level, and has almost the same effect on his mother's price of time regardless of whether she finished only high school or whether she continued her studies in college. A child over 11 years old maintains his positive effect if his mother is a high school graduate but may have even a negative absolute effect if his mother is a college graduate. These last results are highly tentative and call for additional investigation.

Economic theory is of little help in predicting the direction and magnitude of the effects of most of the variables discussed above. The evaluation and interpretation of our results must, therefore, rest to a large extent on the indirect evidence, on the evidence collected by scientists in some related fields of social science (e.g., educational psychology), and, at least partly, on intuitive observations.

I. The Shadow Price of Time

The adage "time is money" has, since Becker's pathbreaking article of 1965, become a part of economic theory. The answer to the question, "How much money is time?" leads, however, a shaky life within the framework of economic analysis. More and more economists, in particular those interested in transportation, have come to question the traditional answer that the value one places on his time is equal to the person's marginal wage rate. This contention drew increasing fire from two directions—from those arguing that this equality ignores any possible differentials between the direct utilities associated with work and nonwork activities, and from those attacking the presupposition that time can be shifted freely between the market and nonmarket sector. Addressing ourselves to the latter reservation, if the number of working hours is fixed institutionally, or, in particular, if the person does not work at all, one is faced with a "dual economy" in which input prices in the two sectors need not necessarily be equal.

Formally, let there be two commodities (or activities), say "standard of living" (S) and "child services" (C),[3] each being produced by combining the household members' time (T_i) and market goods (X_i)

$$S = S(X_s, T_{sm}, T_{sf}),$$
$$C = C(X_c, T_{cm}, T_{cf}), \tag{1}$$

where it is assumed for simplicity that the family consists of two adults, husband (m) and wife (f), and that children do not contribute to household production. Given perfect foresight, the family maximizes its intertemporal welfare function U:

$$U = U(Z_1, \ldots, Z_n), \tag{2}$$

where the utility in any given period Z_j is a function of the quantities of S_j and C_j consumed during that period:[4]

$$Z_j = Z_j(S_j, C_j). \tag{3}$$

The maximization of welfare takes place under two kinds of constraints: (a) the intertemporal wealth constraint,

$$\sum_{j=1}^{n} \alpha_j(X_{sj} + X_{cj}) = \sum_{j=1}^{n} \alpha_j(W_{mj} T_{wmj} + W_{fj} T_{wmj}) + V, \tag{4}$$

where T_{wij} denotes the time spent in work by person i in period j, W_{ij} is the wage rate, V is the initial endowment of nonhuman capital, and α_j is a discount factor; and (b) the temporal time constraints

$$T_{sij} + T_{cij} + T_{wij} = T \qquad i = m, f \qquad j = 1, \ldots, n. \tag{5}$$

The maximization of the welfare function subject to these constraints yields the optimal life-cycle pattern of consumption—for example, the optimal timing and spacing of children—as well as the optimal combination of inputs required in the production of each commodity. One of these interior equilibrium conditions is the familiar equality of the value of the marginal productivity of time in all its uses with price-time charges in the market, namely, the wage rate W_{ij}.[5]

There is nothing, however, in the model that will rule out corner solu-

[3] Both S and C are in effect vectors of commodities. In particular, C is a vector describing the "quality" of the children in the various age groups.

[4] In this formulation the utility derived from a child may vary over time both because of the aging of the parents (a change in the function Z_j) and because of the aging of the child (a change in the composition of the vector C_j).

[5] Note that this method commits the same sin I mentioned earlier. The utility derived from S and C is independent of the way these commodities are produced, and T_{wi} does not figure in the welfare function altogether. Thus, I rule out any psychic income (positive or negative) associated with work or child care.

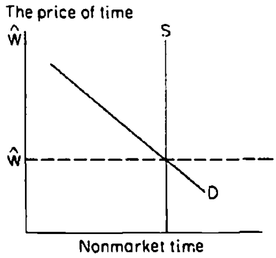

Fig. 1

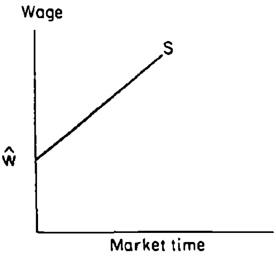

Fig. 2

tions, and in particular the corner solution $T_{wfj} = 0$, that is, the wife does not work in the market in period j. It can be easily shown that in this case the woman's price of time $(\hat{W}_j)$ becomes an endogenous variable being determined by the familiar equation stating that the input price should equal its value of marginal product:

$$\hat{W}_{fj} = \hat{\pi}_{sj} S_{Tfj} = \hat{\pi}_{cj} C_{Tfj}, \tag{6}$$

where S_{Tfj} and C_{Tfj} denote the marginal product of the wife's time in the production of S and C in period j, respectively, and the commodity price $\hat{\pi}_{ij}$ is itself an endogenous variable:

$$\hat{\pi}_i = x_i + W_m t_{im} + \hat{W}_f t_{if} \qquad i = S, C, \tag{7}$$

x_i, t_{im}, and t_{if} being the marginal inputs of goods, husband's time, and the wife's time in the production of commodity i, and the subscript j being omitted for clarity.[6] The price of time changes over the life cycle. For some periods, when the woman works, it equals the marginal wage rate, and for other periods, when the woman stays out of the labor force, it exceeds the wage rate.

The supply of women's time is infinitely inelastic (fig. 1). The shadow price of her time, in the absence of market opportunities, is therefore demand determined. The demand for her time consists of the derived

[6] Differentiating U with respect to T_{if} subject to the time and budget constraints yields

$$U_{sj}\, S_{Tfj} = U_{cj}\, C_{Tfj} = \lambda_{Tfj}, \tag{6'}$$

where U_{ij} is the marginal utility of commodity i and λ_{Tfj} denotes the marginal utility of T_f in period j. Equilibrium in the commodity "market" implies

$$U_{ij} = \lambda_x\, \pi_{ij}, \tag{6''}$$

λ_x being the marginal utility of wealth. Combining (6′) and (6″) yields (6) where $\hat{W}_{fj} = \lambda_{Tfj}/\lambda_x$ is the shadow price of the wife's time in period j.

demand for T_{tf} in each of its uses, which in turn depends on the commodity prices ($\hat{\pi}_s$ and $\hat{\pi}_c$), the price of other inputs (W_m), and the technology employed. A change in any one of these parameters will shift the derived demand curve D_{Tf} and change the shadow price of time.

Assuming that the production functions (eq. [1]) are linear homogeneous, it has been shown that an increase in the initial endowment of nonhuman capital V increases the demand for both commodities (ruling out inferior commodities and inferior outputs) and raises the demand for all inputs and the shadow price $\hat{W}_f$ (Willis 1969 [rev. 1971]; Gronau 1973).

An increase in the husband's wage rate W_m gives rise to a substitution of market goods and the wife's time for the husband's time. An increase in the demand for the wife's time is enhanced by an income effect and, possibly, by a substitution between commodities. The wage increase raises both full income and real full income and, thus, increases the demand for all commodities and inputs. The same change raises the relative price of the activity that is husband's-time-intensive and leads to a substitution of the less husband's-time-intensive commodity for the more time-intensive commodity. This substitution increases the demand for the wife's time to the extent that husband's time intensity and wife's time intensity are negatively correlated.

The most ambiguous of all changes is the change in productivity. This change may take many forms. It may be commodity biased, input biased, both commodity and input biased, or neutral in all respects. Moreover, even if the nature of the technological change is known, one can rarely predict its effect on the value of the wife's time without making additional assumptions about factor intensities and the income and substitution elasticities. The analysis of these factors becomes quite elaborate. Sufficient, therefore, to say that, in general, the tendency of an increase in the wife's productivity to be accompanied by an increase in the demand for her time is greater when there is a positive correlation between the commodities' time intensities and their income elasticities, and when there is a negative correlation between the husband's time intensities and the wife's time intensities.

Formal education is considered the prime source of changes in productivity in the market sector and may very well play a similar role in the nonmarket sector (though it would be difficult to isolate the contribution of education to home productivity from that of "natural ability"). "Home experience" is the variable one would like to use to capture the effect of on-the-job training on the wife's value of time. In the absence of this information one may have to revert to a measure of "years married," or simply "age." Given the ambiguity surrounding the productivity effect, it would be difficult, however, to predict the effect of age and education on the wife's value of time.

Age and education assume an additional dimension if one considers the intertemporal aspects of our model. The present value of the commodity prices changes over time because of (1) changes in input prices and technology and (2) the existence of a positive interest rate. The change in commodity and input prices gives rise to a substitution both in production and in consumption, resulting in changes in the demand for inputs over time (Ghez and Becker 1972). If the husband's wage rate is held constant, the demand for the wife's time and her shadow price of time will change with her age both because of the effect age may have on productivity and because of the family's incentive to delay its consumption activity when the rate of interest exceeds the rate of time preference. Moreover, in this context husband's education not only plays the role of a proxy for nonmarket productivity but also assumes some of the explanatory power of the missing "permanent income" variable.

Finally, it is often claimed that women's behavior is dictated by their environment. To the extent that the wife's environment is associated with her husband's age and education, one would like to control these factors so as to isolate, at least partially, this taste effect.

A natural question at this point is, What role do children play in determining their mother's price of time? In a world where all families have the same welfare function, where the production functions are sole functions of age and education, and where the measurement of all variables is not marred by errors, the answer to this question, which is the crux of this paper, is that children have no independent effect on $\hat{W}_f$. In this model, the shadow price of time and the amount of child services are mutually determined. Given the age and education of the parents, the husband's wage rate and the family's nonhuman wealth, the family's rate of interest, and its rate of time preference, all families are supposed to consume the same amount of "child services," have the same number and quality of children, and the same price of time $\hat{W}_f$.

In a less deterministic world where one allows for differences in the utility function and the production functions among families with seemingly identical characteristics, differences in the number of children may reflect differences in underlying factors that may also have some bearing on the wife's value of time. Other things being equal, the difference in the number of children may be associated with a difference in tastes for "child services" and a difference in the efficiency of production of this commodity, either because of more efficient methods of controlling quantity (information about methods of contraception) or because of more efficient methods of producing quality. An increase in the consumption of child services due to tastes or productivity is associated with a higher value of the mother's shadow price of time if the production of child services is more intensive in wife's time than the other commodity. An increased consumption (or production) of child services does not necessarily imply a larger number of children. On the other hand, given the parents' characteristics and family income, a larger number of children would imply, in general, a greater consumption of child services. A positive correlation between child services and the price of time implies, therefore, a positive correlation between the number of children and price of time. Since the size of the correlation depends on the time intensity of the production of child services, we should expect the correlation between number of children and $\hat{W}_f$ to weaken the less time-intensive child services become. Thus, if the time intensity changes with the child's age, so should his mother's price of time.

II. The Estimation of the Price of Time

Figure 1 suggests that in estimating the housewife's price of time one has to trace her derived demand for time D_{Tf}. Alternatively, if one is ready to contend that there is no inherent difference between housewives and their counterparts who work in the market as long as they share the same socioeconomic characteristics, one should be able to impute the housewife's value of time from data on women's supply of hours to the market. A woman's labor supply is the mirror image of her derived demand for time at home, and hence her price of time in the absence of market opportunities $\hat{W}$ corresponds to her "entry wage"—the wage at which she is ready to supply the first unit of labor (see fig. 2). Thus, by estimating women's labor supply, one should be able to derive the "entry wage" and the housewife's value of time. To estimate the effect of, say, income or children on the housewife's value of time, one has to measure the effect of shifts in the labor supply function due to these factors on the "entry wage."

This method, so alluring in its simplicity, runs into some overwhelming difficulties. Economic theory does not specify which of the following is the "true" dimension of labor supply: weekly hours, weeks worked, annual hours, and so on. Furthermore, theory supplies very few clues as to the mathematical function providing the best description of labor supply.[7] The estimates turn out to be very sensitive both as to the nature of the dependent variable and to the choice of functional form.[8] Finally, one has to reject the underlying assumption concerning the lack of difference be-

[7] One would expect the "entry wage" to be positive. Thus, the intercept in a regression of the amount of labor on the wage rate is supposed to be negative. This prior assumption rules out a certain class of mathematical functions (e.g., the double-log used in the estimation of some aggregate supply functions) but still leaves a wide scope for choice.

[8] Fitting a linear reciprocal function and a semilog function to data on weekly hours, weeks worked, and annual hours of working women resulted in extremely low values of the price of time (about 10 percent of the wage rate) and a large dispersion in the estimates. (The data were derived from the 1960 Census 1/1,000 sample.) The use of a linear function resulted in significant positive estimates of the intercept even when the data were restricted to women who worked only part time (say less than 35 hours a week or less than 1,000 hours annually).

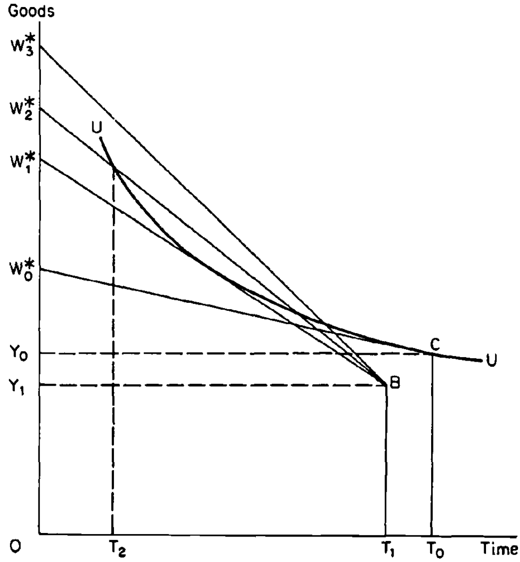

FIG. 3

tween working and nonworking women with the same characteristics. The mere fact that they differ in their labor-force behavior indicates that there are some unobserved fundamental differences between the two groups, and there are good reasons to suspect that these differences may be related to the price the women assign to their time (Ben-Porath 1973; Gronau 1974). Because of these difficulties it seems advisable to reject this simple method in favor of a method which focuses on a different dimension of labor supply—labor-force participation.

Let it be assumed that the family is fully aware of the wife's potential wage in the market, W^*; that this wage is insensitive to the number of hours worked; and that the search for the employer who will offer this wage is costless in terms of both time and pecuniary costs.[9] A necessary and sufficient condition for search (the necessary and sufficient condition for the wife's entry into the labor force) is that her potential wage (W^*) exceeds her value of time in the nonmarket sector ($\hat{W}$).[10]

Let family income when the woman abstains from entering the labor force be $0Y_0$ (fig. 3); then the housewife's value of time can be measured by the slope of her indifference curve UU at the point C. Assuming other

[9] The analysis will not change significantly if I adopt a somewhat more sophisticated search model (McCall 1970; Mortensen 1970) where the job-offer distribution consists of more than one point and the optimal strategy consists of a determination of a critical value W^*, so that the job seeker accepts a job if the wage offer exceeds W^* and continues his search otherwise.

[10] For a more general discussion of the labor-force participation decision, see Lewis (1971).

sources of income (including husband's earnings) do not change as a result of her decisions, the woman will decide to look for a job actively if her potential wage exceeds CW^*_0 and will decline to enter the labor market otherwise. Comparing the reactions of women who are supposed to have the same price of time but who have different potential wages should give some indication as to the potential wage at which these women are indifferent to whether they enter the market, thus yielding an estimate of their price of time.

This method may yield a biased estimator if some of our basic assumptions are violated. For example, if work involves a fixed cost (such as search costs) consisting of T_0T_1 units of time and Y_0Y_1 units of income the woman does not enter the labor force unless her potential wage exceeds BW^*_1. This wage overstates the woman's value of time. This overestimate may be inflated by deviations of the measured wage rate from the "true" wage. Discrepancies of this kind may originate in taxes, variable costs associated with work, and psychic income. For example, given a proportional tax rate, the net wage affecting the woman's participation decision may be BW^*_1 but the measured wage before taxes is BW^*_3. Similarly, if work involves time and pecuniary costs (such as commutation) that vary proportionally with the amount of work, or if work involves a proportional negative psychic income component, the measured wage exceeds the true wage (psychic income has an opposite effect when it is positive). Further distortions in the measurement of the "true" wage rate occur when the average wage deviates from the marginal wage because of an increasing marginal wage rate, progressive taxation, changes in the psychic income, and costs per unit of work, or changes in the husband's supply of work, resulting in a nonlinear price line. Finally, there may exist a minimum amount of work demanded by the employers (say, T_0T_2). This minimum requirement may increase the wage rate at which women enter the labor market (BW^*_2) and the upward bias in the estimated price of time. Bearing these reservations in mind we continue the analysis.

It is clear that even women who seem to have the same market characteristics (say education and age) may differ randomly in their potential wage. Similarly, women who seem to have the same nonmarket characteristics may differ in the price they place on their time. Let it be assumed, for the sake of exposition, that the potential wage W^*_i is known, and that the women's price of time is

$$\hat{W}_{ik} = \hat{\mu}_k + \hat{\epsilon}_{ik}, \tag{8}$$

where $\hat{\mu}_k$ is the mean value of time of all women sharing the set of nonmarket characteristics k, and $\hat{\epsilon}_{ik}$ is the ith random deviation from this mean. The woman participates in the labor market if $W^*_{ij} \geqslant \hat{W}_{ik}$, that is, if

$$W^*_i - \hat{\mu}_k \geqslant \hat{\epsilon}_{ik}, \tag{9}$$

and she remains a full-time homemaker otherwise.

Variable $\hat{\mu}_k$ is an unobserved variable. However, one can conjecture about the variables that affect it. In the preceding section, the mean price of time of a woman was associated with her age (A_f), education (E_f), family income (Y), number of children (C), and husband's age (A_m) and education (E_m). Let it be assumed that these variables affect $\hat{\mu}$ in an additive fashion:[11]

$$\hat{\mu} = \beta_0 + \beta_1 A_f + \beta_2 E_f + \beta_3 Y + \beta_4 C + \beta_5 A_m + \beta_6 E_m. \quad (10)$$

Furthermore, let us define $\hat{\hat{\epsilon}} = \hat{\epsilon}/\hat{\sigma}$ where $\hat{\sigma}$ is the standard deviation of $\hat{W}$. The woman participates in the labor force if

$$\frac{1}{\hat{\sigma}} [W^* - (\beta_0 + \beta_1 A_f + \beta_2 E_f + \beta_3 Y + \beta_4 C + \beta_5 A_m + \beta_6 E_m)] \geq \hat{\hat{\epsilon}}_i \quad (11)$$

and stays out of the market otherwise.

When $\hat{\hat{\epsilon}}$ has a normal distribution,

$$\hat{\hat{\epsilon}} \sim N(0, 1), \quad (12)$$

the probability that a given woman participates in the labor force equals

$$P(X_i = 1) = (2\Pi)^{-1/2} \int_{\infty}^{(1/\hat{\sigma})[W^*_i - (\beta_0 + \beta_1 A_{fi} + \ldots + \beta_6 E_{mi})]} \exp(-U^2/2)\,dU, \quad (13)$$

where a value $X = 1$ is assigned to every woman participating in the labor force and a value of $X_i = 0$ is assigned to full-time housewives. The logarithm of the likelihood of observing a sample of n independent observations consisting of r women participating in the labor force and $(n - r)$ nonparticipants equals

$$L = \sum_{i=1}^{r} \log P(X_i = 1) + \sum_{i=r+1}^{n} \log[1 - P(X_i = 1)].$$

Given the n values of W^*_i, A_{fi}, E_{fi}, Y_i, C_i, A_{mi}, and E_{mi}, the likelihood function depends on the parameters $\beta_0, \beta_1, \ldots, \beta_6$ and $\hat{\sigma}$. Using the probit iterative method (Tobin 1955), one can obtain the maximum-likelihood estimators,

$$X_i = b_0 + b_1 A_{fi} + b_2 E_{fi} + b_3 Y_i + b_4 C_i + b_5 A_{mi} + b_5 A_{mi} + b_6 E_{mi} + b_7 W^*_i, \quad (14)$$

b_7 serving as an estimator of the coefficient of W^* in the likelihood function, that is, of $1/\hat{\sigma}$, and $b_l (l = 0, 1, \ldots, 6)$ serving as an estimator of

[11] There is nothing in the analysis of the preceding section to indicate that this relationship is linear, and I will not try to justify it by imposing on the model a specific set of utility and production functions. The assumption of linearity is adopted merely for simplicity's sake.

$-\beta_l/\hat{\sigma}$. A consistent estimator of $\hat{\sigma}$ is therefore $1/b_7$, and a consistent estimator of β_l is $-b_l/b_7$.

The analysis is not much affected when W^*_i is unknown, but one knows the mean potential wage μ^*_j where

$$W^*_{ji} = \mu^*_j + \epsilon^*_{ji}, \tag{15}$$

ϵ^*_{ij} denoting the random deviation of the potential wage of woman i with market characteristics j from its mean. In this case the prerequisite for entry into the labor force is

$$\mu_{jk} = \mu^*_j - \hat{\mu}_k \geq \hat{\epsilon}_{ki} - \epsilon^*_{ji} = \epsilon_{kji}. \tag{16}$$

If ϵ has a normal distribution ($\epsilon \sim N[0, \sigma]$), one can still apply the probit analysis to obtain consistent estimators of $\beta_0, \beta_1, \ldots, \beta_6$ and σ by replacing W^* in equation (14) by μ^*.[12] Note, however, that in this case one cannot estimate separately the standard deviation of the price of time $\hat{\sigma}$, but rather σ which reflects dispersions both of the price-of-time distribution and of the wage-offer distribution.

Unfortunately, one knows neither W^* nor its mean μ^*. An inherent difficulty in the estimation of labor-supply functions is the nonexistence of data on the wage offers received (or expected) by those women who do not work. The same problem plagues our study. This problem has received very little attention in the economic literature.[13] In the past economists opted for one of two routes of escape. One way is to postulate the relationship between the mean wage offer and some measurable market characteristics, say the woman's age and education,

$$\mu^* = \alpha_0 + \alpha_1 A_f + \alpha_2 E_f, \tag{17}$$

and the introduction of these variables in equation (14). Alternatively, it was assumed that the mean wage offer (μ^*) equals the average wage of working women with the same market characteristics ($\overline{W}$). Either one of these methods is sizzling with problems which mar the reliability of the estimates of the determinants of the price of time.

If one opts for the first method, the wife belongs to the labor force if

$$\mu/\sigma = \frac{1}{\sigma}\,[(\alpha_0 - \beta_0) + (\alpha_1 - \beta_1)\,A_f + (\alpha_2 - \beta_2)\,E_f - \beta_3 Y - \beta_4 C - \beta_5 A_m - \beta_6 E_m] \geq \epsilon', \tag{18}$$

[12] The assumption of normality is a common one in economics and does not call for much justification. It does not necessarily call for an assumption that W^* and $\hat{W}$ have an independent bivariate normal distribution. However, if one opts for that line of explanation, one can argue that the assumption of independence is justified on the ground that any positive correlation between W^* and $\hat{W}$ due to natural ability may be offset by the negative effect of specialization in the investment in human capital. It would be more difficult to justify in this case the assumption of homoscedasticity, since heteroscedasticity in the wage-offer distribution should imply heteroscedasticity of ϵ.

[13] The only exception is Lewis (1971).

where $\epsilon' = \epsilon/\sigma$ (i.e., $\epsilon' \sim N[0, 1]$). One can still apply the probit method to estimate

$$X = a_0 + a_1 A_f + a_2 E_f + a_3 V + a_4 C + a_5 A_m + a_6 E_m \qquad (19)$$

to obtain the maximum-likelihood estimators $a_l =$ est $[1/\sigma(\alpha_l - \beta_l)]$ for $l = 0, 1, 2$, and $a_l =$ est $(-\beta_l/\sigma)$ for $l = 3, 4, 5, 6$. However, one cannot estimate the absolute effects on $\hat{\mu}$ of income, children, and husband's characteristics but only their relative effects (β_l/σ), since $\beta_l (l = 3, 4, 5, 6)$ can be estimated only up to a factor of proportionality $1/\sigma$. Moreover, one cannot separate in this case the effect of the woman's characteristics (age and education) on the mean price of time from their effect on the mean wage offer.[14]

Given the adverse circumstances, one may be ready to forego an estimate of the effect of the wife's age and education on her price of time as long as one can obtain an estimate of the (relative) effect of the other factors (income, children, and husband's characteristics). But even these estimates are not free of criticism. Objection may be raised to the specification of the wage function. A case can be made for including in the wage function all the variables that affect the price of time. Husband's income may affect the wife's potential wage in various ways. Progressive taxation makes the wife's wage rate after taxes a function of her husband's income. Income also affects the probability of the wife's past and future participation in the market, and thus affects the profitability of the investment in market skills versus nonmarket skills. The same holds for children. The number of children affects the marginal tax rate and hence the net wage rate. It may also be negatively correlated with the mother's market experience and, hence, her potential wage rate (Michael and Lazear 1971). Given age and education, variations in the husband's income may reflect variations in his natural ability. Husband's and wife's natural ability seem to be positively correlated (Becker 1971*a*), and thus one would expect that, other things being equal, the husband's age and education may affect his wife's asking wage.

If one expands equation (17) to include also the rest of the variables appearing in equation (10), one cannot estimate even the relative effect of income, children, and husband's characteristics on the woman's price of time. The estimates of these factors based on equation (19) should, therefore, be regarded as merely a first approximation, assuming that the effects of income, children, and husband's age and education on the wife's expected wage offer are negligible.

Some of these difficulties are removed if one opts for the alternative

[14] Note that the inclusion of a term in the wage-offer function (17) that does not appear in the price-of-time function (10) does not solve this problem and allow "identification."

method, assuming $\mu^*_j = \overline{W}_j$, but this hypothetical "gain" may be offset by acquiring new difficulties. Admittedly, the equation $\mu^*_j = \overline{W}_j$ involves a very strong assumption. Different patterns of participation behavior of women with seemingly identical market and nonmarket characteristics may be the result of different potential wages and not necessarily of different values of time (Ben-Porath 1973; Gronau 1974). A low rate of participation in group jk may be due not to a high price of time but rather to a low mean wage rate. Under these circumstances the average wage of working women clearly overestimates the mean wage offer of nonparticipants. The danger of this kind of bias is accentuated by our measure of market experience. Market experience is presented in the wage function (eq. [17]) by a proxy age. This far from ideal choice is forced upon us by the lack of a better measure. The possibility of a bias in the measurement of the mean wage offer increases the greater the variation in wages of women with a given market experience and the greater the variation in market experience of women of the same age. Thus, this bias may be relatively small for young women who are quite homogeneous in terms of their market experience but may be considerable for women beyond the age of 50.[15] This bias will enforce the upward tendency in the bias discussed above. Moreover, errors in the measurement of μ^* may result in inconsistent estimates of the other coefficients ($\beta_1, \ldots, \beta_6$) and bias the estimated effects of the explanatory variables on the price of time. Thus, it is only with great forbearance that one would adopt the simplistic assumption $\mu^* = \overline{W}$.

However, if one is ready to overcome these misgivings, one can estimate equation (14) replacing W^* by $\overline{W}$. The mean value of time at the point of means can be estimated by

$$\hat{\mu} = -\frac{1}{b_7}(b_0 + b_1\bar{A}_f + b_2\bar{E}_f + b_3\bar{Y} + b_4\bar{C} + b_5\bar{A}_m + b_6\bar{E}_m); \quad (20)$$

$-b_l/b_7$ measures the absolute effect of factor l on $\hat{\mu}$, and $-b_l/b_7\ \hat{\mu}$ measures its relative effect.

Fortunately, if one assumes that $\hat{W}$ and W^* are independently normally distributed, one can use the information on the labor-force participation rate and the average wage of working women to obtain an estimate of μ^*_j.[16] Equations (14) and (20) provide in this case a consistent estimate of $\beta_1, \ldots, \beta_6$ and of the mean price of time.

[15] It was found that teen-agers who have been asked what wage they expect to receive when they start working quoted a wage that was almost equal to the average wage of working people of the same age.

[16] It can be shown (Gronau 1973, 1974) that if $\overline{W}_j = \mu^*_j + \overline{X}_j\sigma^*$,

$$\overline{X}_j = (\sigma^*/\sigma)\frac{1}{P_j\sqrt{2\pi}}e^{-z_j^2/2} = X^*(\sigma^*/\sigma), \quad (16')$$

where σ^* is the standard deviation of W^*, $\sigma^2 = \hat{\sigma}^2 + \sigma^{*2}$, P_j is the labor-force partici-

Finally, one can replace the assumption that $\hat{\mu}$ is an additive function of $A_f, E_f, \ldots, E_m$ by the assumption that this function is multiplicative

$$\hat{\mu} = B_0 B_1^{A_f} B_2^{E_f} B_3^{Y} B_4^{C} B_5^{A_m} B_6^{E_m}, \tag{21}$$

where $\beta_l = \log B_l$.[17] Moreover, let it be assumed that ϵ has a log-normal distribution $[\epsilon \sim \Lambda(0, \sigma)]$. Equation (14) can be estimated by substituting $\log \overline{W}$ for W^*, where $\overline{W}$ denotes the geometric rather than the arithmetic average wage rate.[18] Let M denote the mean of the logarithm of $\hat{W}$ and Σ denote the standard deviation of the logarithm of ϵ; then $(1/b_7) = \text{est}(\Sigma)$, and M can be estimated from equation (20). Variable e^M is the median of the log-normal distribution of $\hat{W}$. To obtain an estimate of the mean one has to know the dispersion of $\log \hat{W}$ (Aitchison and Brown 1963, p. 9). This calls for the additional assumption that $\epsilon^* = 0$, that is, that there is no within-group dispersion of the potential wage, the standard deviation of ϵ^* is equal to zero, and Σ measures the standard deviation of $\log \hat{W}$. Thus, the estimate of the mean price of time is

$$\hat{\mu} = e^{M + (\Sigma^2/2)}, \tag{22}$$

and the estimate of the standard deviation is

$$\hat{\sigma} = (e^{\Sigma^2} - 1)^{1/2} \hat{\mu}. \tag{23}$$

In this case $-(b_l/b_7)$ measures the percentage change in $\hat{\mu}$ as a result of a unit increase in factor l.

III. The Data and the Results

To estimate the price of time of housewives we return to the 1960 Census 1/1,000 sample. The sample consists of 975 observations selected randomly from all urban white married women, spouse present, who belonged to primary families (not to subfamilies) in households with no nonrelatives. The dependent variable is defined as a dummy variable (zero, one) accord-

pation rate in group j, and Z_j satisfies Prob $(Z < Z_j) = P_j$ where Z is a standardized normal variable. Given P_j one can compute X^* and regress over different income groups

$$\overline{W}_j = b'_0 + b'_1 x^*, \tag{16''}$$

where b'_0 is an estimate of μ^*_j and b'_1 is an estimate of (σ^{*2}/σ).

17 An alternative assumption is

$$\hat{\mu} = B_0 A_f^{B_1} E_f^{B_2} Y^{B_3} C^{B_4} A_m^{B_5} E_m^{B_6}.$$

18 Alternatively, one has to replace $\overline{W}$ by $\log \overline{W}$ in eq. (16″) to obtain an estimate of μ^*.

ing to whether the wife participated in the labor force (was employed or looked actively for a job) in the week preceding the 1960 census. By choosing this dependent variable I focus on the participation decision in the short run. To obtain some estimates of the price of time in the long run, one should use a variable that reflects the woman's participation experience over a longer period of time. Thus, a second dependent variable is defined describing the wife's work status in the previous year. This variable assumed a value of one if the woman worked at least 1 week and a value of zero otherwise.

The income variable is a continuous variable measuring family income (wife's earnings excluded) in the year 1959. It is argued that husband's earnings and other sources of income should affect the woman's price of time differently. Given the unreliability of the data on "other income" and the husband's wage rate, I did not try to ascertain these differences. The wife's age and education are defined as dummy variables so as to allow nonlinear effects of years of age and schooling on the wife's value of time. The wife's age is described by a set of three dummy variables according to whether she belonged to the age group "less than 30," "30–49," or "50 plus."[19] Similarly, education is defined in terms of whether one belonged to one of three groups: "elementary education," "high school," or "college" (the latter included people with graduate education). An identical definition is used in the case of the husband's education, while the husband's age was measured, for simplicity, as a continuous variable.

Children are not a homogeneous commodity. Their effect on their mother's price of time depends on both their number and their age composition. Thus, children were subclassified into four groups: number under age 3, number aged 3–5, number 6–11 years old, and number in the age group 11–17.[20] In some of the regressions I included a variable "children" describing the total number of children less than 18 years old, omitting the variable "number of children 6–11." In this case the coefficient of the variable "children" describes the effect of an addition of one child 6–11 years old, while all other coefficients measure the differential effect of an additional child in group l as compared with an additional child in the age group 6–11 (the net effect of an addition of one child of age l and a subtraction of one child of age 6–11).

Allowing for returns to scale in child care, I adopted a second measure of the effect of children. Using a set of 16 dummy variables, all women were classified according to whether they had zero, one, two, or three or more children under age 6, and whether they had zero, one, two, or three or more children belonging to the age group 6–11. In a second subclassifica-

[19] The iterative probit method is too expensive to allow for a greater detail in the subclassification.

[20] Note that the measure is the number of children in a given age group and not a dummy variable describing the existence of children in that age group.

tion into a set of 12 dummy variables, women were classified according to whether they had a child less than 3 years old, had a child age 3–5, and had zero, one, or two or more children belonging to the age group 6–11.

The 1960 Census does not allow for a direct estimate of the hourly wage rate. However, it provides data on the woman's annual earnings in 1959, the number of weeks she worked that year, and the number of hours she worked during the week that preceded the Census. In the absence of a better measure, the hourly wage rate of a working woman is defined as her earnings in 1959 divided by the product of weeks worked (in 1959) and weekly hours (in 1960). All white working women in the 1960 Census 1/1,000 sample were subclassified into four age groups (less than 30, 30–49, 40–49, and 50 plus) and four education groups (elementary, high school, college, and graduate education).[21] For each of the 16 classes, I computed the arithmetic and the geometric average of the hourly wage rate (see table 1), and these values were assigned to all (working and nonworking) women belonging to that class. Alternatively, I assigned to each of the 16 classes the estimated mean wage offer μ^*.[22]

To allow for comparison with past studies of labor-force participation, I estimated the determinants of the housewives' price of time using all three methods described in the previous section: (*a*) assuming μ^* is a function of the woman's age and education, (*b*) assuming $\mu^* = \overline{W}$, and (*c*) estimating μ^* from data on wage rates and labor-force participation rates. Since the assumption that ϵ is normally distributed led to results very similar to those obtained under the assumption that ϵ has a log-normal distribution, and since the latter assumption seemed to have a greater explanatory power, I have omitted the former results.[23]

The estimates of equations (14) and (19) for the weekly rate of participation are presented in table 2.[24] Equation (19) yields familiar results. As expected, education has a positive effect on labor-force participation; its effect on market productivity and the asking wage exceed its effect on nonmarket productivity and the housewife's price of time. Age has its custom-

[21] I ignored the effect children may have on the women's wage since, contrary to one's expectations (Michael and Lazear 1971), working women with children usually have a higher (and not a lower) arithmetic average wage rate than childless women. The explanation may be that they have a higher price of time and hence may be more selective in the wage offers they accept. The greater selectivity of these mothers may offset their lower wage-offer distribution. An attempt to include the number of young children as a determinant of the asking wage yielded estimates that were inferior to the one I have described.

[22] See n. 16. Additional information about the means of the variables in the sample is in the Appendix.

[23] The log-normal assumption may also be more appealing on theoretical grounds, since it rules out negative estimates of $\hat{\mu}$.

[24] To evaluate the reliability of the estimates, table 2 includes the likelihood-ratio statistic to test for the hypothesis $H_0: \beta_l = 0$ for all $l = 1, 2, \ldots$, and the t scores derived as the ratio of the coefficient and its standard error. The former has a χ^2 distribution while, given the size of the sample, the latter have a normal distribution.

TABLE 1

AVERAGE HOURLY WAGE RATE OF WHITE MARRIED WOMEN BY AGE AND EDUCATION

Education and Age	Arithmetic Average Wage	Arithmetic Average Log (Wage)	Geometric Average Wage
Total	2.01	0.4559	1.58
Elementary school:			
Total	1.78	0.3064	1.36
<30	1.53	0.1565	1.17
30–39	1.67	0.3168	1.37
40–49	1.70	0.3107	1.36
50+	1.98	0.3317	1.39
High school:			
Total	1.87	0.4147	1.51
<30	1.75	0.3540	1.42
30–39	1.85	0.4332	1.54
40–49	1.93	0.4346	1.54
50+	2.03	0.4494	1.57
College:			
Total	2.62	0.6897	1.98
<30	2.48	0.6308	1.88
30–39	2.55	0.6441	1.90
40–49	2.75	0.7377	2.09
50+	2.72	0.7756	2.17
Graduate:			
Total	3.17	0.9834	2.67
<30	2.70	0.8699	2.39
30–39	3.32	0.9967	2.71
40–49	3.09	0.9400	2.56
50+	3.58	1.1628	3.20

SOURCE.—1960 Census 1/1,000 sample.

ary inverted U-shape effect.[25] Income and the husband's age and education have the expected positive effect on the mean price of time (i.e., negative effect of labor-force participation), though the effect of husband's education seems to be insignificant. An increase in the number of children has a significant effect on the mother's value of time, but this effect diminishes the older the child (the differential effect of children in any two adjoining age groups is usually significant, using a one-tailed test and a level of significance of $\alpha = 0.05$).

These conclusions are reaffirmed when $\overline{W}$ and the estimated μ^* are introduced into the regression equation. An increase of $1,000 in husband's income increases the value of time of his wife (if she does not work) by 1.0–1.8 percent.[26] The elasticity of the mean price of time with respect to income estimated at the point of means equals 0.07–0.12.

[25] Note, however, that the broad classification of age groups may conceal a large part of the variation taking place within these groups (Leibowitz 1972).

[26] The lower limit refers to the estimate where W is inserted in eq. (14), and the

TABLE 2

DETERMINANTS OF THE HOUSEWIFE'S VALUE OF TIME

Explanatory Variables	Units	$\mu^* = \alpha_0 + \alpha_1 A_f + \alpha_2 E_f$		$\mu^* = \overline{W}$			$\mu^* =$ est μ^*		
		Probit Coeffi-cients	t-Scores	Probit Coeffi-cients	t-Scores	Marginal Effects on $\hat{\mu}$ (%)	Probit Coeffi-cients	t-Scores	Marginal Effects on $\hat{\mu}$ (%)
Constant	...	1.651	3.07	−1.782	−1.61	...	0.879	1.50	...
Income	$10,000/year	−0.868	−4.10	−0.852	−3.91	10.0	−0.838	−3.88	17.9
Age $<$ 30	Dummy (0, 1)	−0.378	−1.33	0.140	0.43	−1.6	−0.356	−1.23	7.6
Age $\geqslant$ 50	Dummy (0, 1)	−0.670	−2.63	−0.885	−3.35	10.4	−0.266	−0.95	5.7
Education-elem.	Dummy (0, 1)	−0.680	−3.14	0.419	1.12	−4.9	0.239	0.71	−5.1
Education-coll.	Dummy (0, 1)	0.632	2.90	−1.865	−2.59	21.8	−0.972	−1.95	20.8
Husband's age	10 years	−0.250	−2.32	−0.308	−2.75	3.6	−0.224	−2.04	4.8
Husband's educ.-elem.	Dummy (0, 1)	0.372	1.89	0.403	2.03	−4.7	0.392	1.99	−8.4
Husband's educ.-coll.	Dummy (0, 1)	−0.094	−0.45	−0.123	−0.57	1.4	−0.129	−0.60	2.8
Child $<$ 3 (net)	No.	−0.871	−3.54	−0.870	−3.50	10.2	−0.879	−3.54	18.8
Child 3–5 (net)	No.	−0.329	−1.47	−0.312	−1.39	3.6	−0.314	−1.40	6.7
Child 12–17 (net)	No.	0.355	2.02	0.265	1.49	−3.1	0.298	1.70	−6.4
Child	No.	−0.377	−3.31	−0.325	−2.83	3.8	−0.343	−3.00	7.3
Potential wage	Dollars/hour	...	...	8.560	3.56	...	4.676	3.53	...
Likelihood ratio test	...	138.1	...	157.1	...	...	152.5	...	...
Degrees of freedom	...	12	...	13	...	...	13	...	...
σ	Dollars/hour	...	...	.206	...	...	.298	...	...
Housewives' mean value of time ($\hat{\mu}$)	Dollars/hour	...	...	1.75	...	...	1.38	...	...
Mean wage offer (μ^*)	Dollars/hour	...	...	1.55	...	...	1.13	...	...
$\hat{\mu}/\mu^*$	...	...	...	1.13	...	...	1.22	...	...

When it is assumed that $\mu^* = \overline{W}$, the housewife's value of time seems to increase with her age. There seems to be only a slight increase during the years up to the age of 50 and a sharp increase thereafter. This pattern is consistent with the life-cycle theory of consumption (when the interest rate exceeds the rate of time preference) and with the hypothesis that non-market human capital depreciates at a slower rate than market human capital, but it may also reflect a cohort effect (the older cohorts having a greater demand for home commodities relative to market commodities). However, replacing $\overline{W}$ by the estimate of μ^* indicates that these findings are merely due to an overstatement of the potential wage (the wage of working women over age 50 considerably exceeds the potential wage of nonparticipants in this age group), age having no significant effect at all on the housewife's value of time.

Education is a major determinant of the housewife's value of time, but its effect is not distributed equally among all levels of education. In the absence of market opportunities, high school graduates would not have differed significantly from elementary school graduates in terms of their price of time. It seems that if high school graduates are more productive, then the increase in productivity is offset by lower commodity prices, leaving the demand for their time unchanged. There exists, however, a significant difference (over 20 percent) between the price of time of college and high school graduates.

The education effect measures the shift in the demand function when income and husband's age and education are held constant. By holding income constant one controls the amount of goods used by the family. When "other income" is proportional to total income, and the husband's age and education determine his wage rate, then by holding income and husband's age and education constant one controls, at least partly, the amount of time the husband spends in the market and, consequently, the amount of time he spends at home. The shifts in the demand for the wife's time are measured where the total amount of other inputs is maintained constant, and reflect, therefore, the change in the "economy" productivity —the change in productivity where output prices are allowed to vary but the total amount of inputs is given. The increase in the price of time due to college education can be regarded as a lower limit of the contribution of college education to home productivity. This contribution constitutes a substantial part of the benefits of higher education and should be incorporated in the computation of the rate of return to women's education.

A husband's age has a positive effect on his wife's value of time for somewhat similar reasons to those brought to explain the correlation between the wife's age and her price of time (i.e., the life-cycle patterns of

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upper limit is obtained when $\overline{W}$ is replaced by the estimate of μ^*. Income entered into the regression in its original form. An attempt to introduce this variable in a logarithm form resulted in inferior results.

consumption, a productivity effect, and a cohort effect). The husband's education has the positive effect one has come to expect if education is a proxy for permanent income. It is noteworthy that in this case the college/high school differential is small and insignificant, while there is a significant difference in the price of time of women married to high school graduates versus those married to elementary school graduates. This difference may be explained by the smoothening of the life-cycle pattern of income associated with an increased level of education, and the decline in the importance of the transitory component in income, resulting in a decline in the explanatory power of education when current income is held constant. Alternatively, the difference can be explained by a larger differential in market and nonmarket productivity in the case of college-educated husbands due to specialization in the investment in human capital, reflecting a greater tendency of husbands of little education to participate in home production (Leibowitz 1972).

The positive effect of the number of children and the decline in the demand for the mother's time as the child grows older are again apparent. While one additional child younger than 3 years increases the value of his mother's time by 14–26 percent, an additional child 3–5 years old results in a gross increase of only 7–14 percent; a child of 6–11 years results in an increase of 4–7 percent, and if the child is older than 11 he does not affect his mother's price of time at all (any increase in the demand for her time is offset by the child's contribution to home production).[27]

The decline in the demand for the mother's time with the age of the child may be explained by several factors which are difficult to separate. (*a*) The technology of production of child services may be such that the marginal product of C of a given input unit (time and goods) increases with the child's age. Since it may be difficult to change the output per child of child services (the child's "quality") as he grows older, this technology should lead to a decline in inputs with the child's age. (*b*) An increase in the elasticity of substitution between the mother's time and market goods and services as the child grows, and a greater incentive to substitute goods for time if mother's age has a positive effect on her price of time, may lead to replacing the mother's time by market goods. (*c*) An increase in the mother's productivity in the production of child services due to on-the-job training and formal schooling (formal schooling, for instance, may contribute to a greater increase in productivity the older the child) may allow her to produce the same level of services with ever-decreasing time inputs. (*d*) The utility derived from a child may be directly related to the amount of time spent in the production of child services. If the psychic income associated with the production of child services declines as the child grows older, so would his mother's value of time.

[27] All the age differentials (except for the difference between a child of 3–5 years and one 6–11 years old) are significant at $\alpha = .05$ applied in a one-tailed test.

Finally, the estimated mean price of time exceeds the mean potential wage, when it is assumed that $\mu^* = \overline{W}$, by 13 percent. This margin increases to 22 percent when $\overline{W}$ is replaced by an estimate of μ^*. However, since the estimated μ^* is only two-thirds of the (geometric) average wage rate ($\overline{W}$), the estimated value of $\hat{\mu}$, adopting the latter method, falls short of the average wage rate by more than 20 percent.

The effect of education on the woman's productivity may depend on the number and age composition of her children. To investigate the interaction between children and education, I distinguish within each age group of children between children whose mothers have (1) elementary education, (2) high school education, and (3) college education. The regression results are presented in table 3.

The new specification affects neither the price-of-time/wage ratio nor the estimated effects of income, age, education, and the husband's age and education (except for a slight change in the estimated effect of elementary education on the wife's value of time).

Strictly speaking, the only statistically significant result concerning the children variable is the decline in the effect a child has on his mother's value of time as he grows older. There is a significant difference between the effect of a child less than 3 years old and the effect of a child older than 11 years within each education group. Neither the difference in the effects of children in adjoining age groups within a given education group nor the difference between the effects of children in the same age group with mothers in adjoining education groups is statistically significant (at $\alpha = .05$). Still, the differences in the implict patterns of behavior of the three education groups are such that they deserve some further discussion, even if this discussion is speculative.

The effect of additional children on the price of time of mothers with elementary education dissipates as soon as the children reach the age of 3 years. Thus, while a child less than 3 years old increases the value of his mother's time by 10 percent, children beyond that age do not have any consistent effect on $\hat{\mu}$. The effect of a child younger than 3 years on a mother's value of time when she has high school education is somewhat (though not significantly) higher than the effect in the case of a mother with elementary education (12 percent), but then the decline in this effect is much more gradual, so that even children over 11 years old exert a positive effect on their mother's value of time. Young children have the largest effect on their mother's evaluation of her time when she has a college education (an increase of over 20 percent), but this effect diminishes to the same rate as high school mothers as the child grows older, with children over 11 years of age having no effect on (or perhaps even reducing) the value of their mother's time.

To verify these impressions I ran separate regressions in each education group. Table 4 contains the results where $\overline{W}$ is omitted from the regres-

TABLE 3

DETERMINANTS OF THE HOUSEWIVES' VALUE OF TIME (AN INTERACTION MODEL)

Explanatory Variables	Units	$\mu^* = \alpha_0 + \alpha_1 A_f + \alpha_2 E_f$: Probit Coefficients	$\mu^* = \alpha_0 + \alpha_1 A_f + \alpha_2 E_f$: t-Scores	$\mu^* = \overline{W}$: Probit Coefficients	$\mu^* = \overline{W}$: t-Scores	$\mu^* = \overline{W}$: Marginal Effect on $\hat{\mu}$ (%)	$\mu^* =$ est μ^*: Probit Coefficients	$\mu^* =$ est μ^*: t-Scores	$\mu^* =$ est μ^*: Marginal Effect on $\hat{\mu}$ (%)
Constant	...	1.667	3.04	−1.894	−1.58	...	0.870	1.44	...
Income	\$10,000/year	−0.858	−4.07	−0.850	−3.91	9.5	−0.823	−3.86	17.1
Age < 30	Dummy (0, 1)	−0.446	−1.54	0.159	0.46	−1.8	−0.346	−1.18	7.1
Age ⩽ 50	Dummy (0, 1)	−0.676	−2.60	−0.870	−3.24	9.7	−0.249	−0.85	5.1
Educ. = elem.	Dummy (0, 1)	1.048	−3.95	0.081	0.19	−0.9	−0.072	−0.18	1.5
Educ. = coll.	Dummy (0, 1)	0.742	2.52	−2.138	−2.43	23.8	−1.135	−1.82	23.3
Husband's age	10 years	−0.235	−2.15	−0.296	−2.60	3.3	−0.206	−1.84	4.2
Husband's educ. = elem.	Dummy (0, 1)	0.403	2.04	0.418	2.10	−4.6	0.410	2.08	−8.4
Husband's educ. = coll.	Dummy (0, 1)	−0.077	−0.36	−0.126	−0.58	1.4	−0.128	−0.59	2.6
Child < 3:									
Educ. = elem.	No.	−1.030	−1.66	−0.861	−1.31	9.6	−0.868	−1.32	17.8
Educ. = h.s.	No.	−1.052	−4.16	−1.077	−4.20	12.0	−1.071	−4.2	22.0
Educ. = coll.	No.	−2.028	−3.86	−1.880	−3.49	20.9	−2.012	−3.71	41.4
Child 3–5:									
Educ. = elem.	No.	0.008	0.01	0.114	0.20	−1.3	0.106	0.18	−2.2
Educ. = h.s.	No.	−0.768	−3.55	−0.768	−3.53	8.5	−0.783	−3.61	16.1
Educ. = coll.	No.	−0.735	−1.64	−0.443	−0.99	4.9	−0.536	−1.19	11.0
Child 6–11:									
Educ. = elem.	No.	−0.183	0.78	−0.186	−0.79	2.1	−0.215	−0.92	4.4
Educ. = h.s.	No.	−0.377	−2.71	−0.382	−2.71	4.3	−0.389	−0.28	8.0
Educ. = coll.	No.	−0.689	−2.47	−0.364	−1.22	4.0	−0.390	−1.32	8.0
Child 12–17:									
Educ. = elem.	No.	0.356	1.37	0.275	1.05	−3.1	0.235	0.88	−4.8
Educ. = h.s.	No.	−0.253	−1.56	−0.291	−1.78	3.2	−0.256	−1.58	5.3
Educ. = coll.	No.	−0.232	0.68	0.337	0.96	−3.8	0.369	1.06	−7.6
Potential wage	Dollars/hour	...	...	8.982	3.35	...	4.866	3.29	...
Likelihood-ratio test	...	151.7	...	169.0	...	...	165.0	...	...
Degrees of freedom	...	20	...	21	...	...	21	...	...
σ	Dollars/hour	...	...	.195	...	...	.278	...	...
Housewives' mean value of time ($\hat{\mu}$)	Dollars/hour	...	...	1.74	...	...	1.38	...	...
Mean wage offer (μ^*)	Dollars/hour	...	...	1.55	...	...	1.28	...	...
$\hat{\mu}/\mu^*$	...	...	...	1.12	...	...	1.08	...	...

TABLE 4

DETERMINANTS OF MARRIED WOMEN'S LABOR-FORCE PARTICIPATION BY EDUCATION GROUPS: $\mu^* = \alpha_0 + \alpha_1 A_f + \alpha_2 E_f$

Explanatory Variables	Units	Elementary Education		High School Education		College Education	
		Probit Coefficients	t-Scores	Probit Coefficients	t-Scores	Probit Coefficients	t-Scores
Constant	...	0.852	0.68	1.715	2.41	1.550	1.15
Income	$10,000/year	−0.098	−0.25	−0.981	−3.11	1.380	−2.74
Age < 30	Dummy (0, 1)	−0.907	−1.05	−0.540	−1.55	0.269	0.34
Age ⩾ 50	Dummy (0, 1)	−0.075	−0.15	−1.339	−3.60	0.094	0.14
Husband's age	10 years	−0.522	−2.22	−0.153	−1.04	−0.120	−0.44
Husband's educ. = elem.	Dummy (0, 1)	1.156	2.54	0.200	0.08	3.330	2.35
Husband's educ. = coll.	Dummy (0, 1)	0.646	0.48	−0.910	−0.34	0.044	0.11
Child < 3 (net)	No.	−0.972	−1.39	−0.600	−2.06	−1.925	−2.68
Child 3–5 (net)	No.	0.093	0.13	−0.361	−1.35	−0.176	−0.28
Child 12–17 (net)	No.	0.460	1.10	0.117	0.54	0.820	1.62
Child	No.	−0.114	−0.45	−0.467	−3.19	−0.389	−1.22
Likelihood-ratio test (df = 10)	...	21.4	...	85.1	...	62.3	...

sions, and table 5, where $\overline{W}$ is included. The three separate regressions suggest that σ is increasing with education, implying that the variation in the price of time and/or the asking wage varies with education (and income). Similarly, the income effect becomes more pronounced the higher the woman's level of education is. Since education and income are positively correlated, this may indicate that the elasticity of the price of time with respect to income (0.03, 0.07, and 0.17, respectively) increases with income. There exist only slight differences among the three groups in the effect of the woman's age and her husband's age and education on $\hat{\mu}$,[28] but, as was observed earlier, there are considerable differences with respect to the child effect.

The importance of the effect of an additional child on the mother's value of time declines significantly with the child's age in all three education groups. However, the extent of this decline varies widely among the three groups. A child under age 3 increases the value of his mother's time by 5 percent if she has only elementary education, by 11 percent if she possesses high school education, and by almost 30 percent if she is a college graduate. On the other hand, a child older than 11 years decreases $\hat{\mu}$ if the mother has elementary or college education (by 3 and 6 percent, respectively) but increases it if the mother is a high school graduate (neither of the first two results is statistically significant).

Further evidence on the child effect can be found in the patterns of annual labor-force participation. Thus, I recomputed the interaction equation, replacing the previous dependent variable by a dummy variable reflecting annual participation. The evidence presented in table 6 supports our previous findings concerning the effect the husband's and wife's age and education, their family income, and the child's age have on the housewife's value of time. These findings, however, blur somewhat the observed interaction between the child's age and the mother's education.

It is still evident, however, that a child affects his mother's price of time if she is an elementary school graduate only when he is very young. However, the prior observed difference between high school and college graduates in the effect of a young child on his mother's value of time almost disappears. The decline in the child effect as he grows older where the mother is a college graduate is a little less sharp, and the decline of this effect where the mother is a high school graduate is even more gradual.[29]

Given the shaky nature of our findings about the interaction between the child's age and his mother's education, one could have dismissed them as a flicker of chance—an offspring of sampling variability. Still, it is

[28] Of particular interest is the strong negative effect husband's education has on $\hat{\mu}$ when the husband has attended only elementary school while his wife is a college graduate. This may suggest a reversal of roles in the household consistent with the principle of comparative advantage.

[29] Replacing the probit method by the tobit method and estimating the equations for weekly hours and annual weeks reproduced the same two distinctive patterns.

TABLE 5

DETERMINANTS OF THE HOUSEWIFE'S VALUE OF TIME BY EDUCATION GROUPS: $\mu^* = \overline{W}$

		Elementary Education		High School Education		College Education		Marginal Effect on $\hat{\mu}$ (%)		
Explanatory Variables	Units	Probit Coefficients	*t*-Scores	Probit Coefficients	*t*-Scores	Probit Coefficients	*t*-Scores	Elem.	H.S.	Coll.
Constant	...	−4.432	−0.51	−2.134	−0.59	−3.247	−1.47	...	...	...
Income	$10,000/year	−0.088	−0.23	−0.977	−3.09	−1.555	−2.69	0.5	10.5	20.3
Age < 30	Dummy (0, 1)	1.615	0.37	0.090	0.13	0.494	0.59	−9.5	−1.0	−6.4
Age ⩾ 50	Dummy (0, 1)	−0.382	−0.54	−1.427	−3.74	−0.459	−0.64	2.2	15.3	6.0
Husband's age	10 years	−0.530	−2.25	−0.191	−1.26	−0.229	−0.78	3.1	2.1	3.0
Husband's educ. = elem.	Dummy (0, 1)	1.147	2.52	0.400	0.16	3.072	2.22	−6.7	−4.3	−40.0
Husband's educ. = coll.	Dummy (0, 1)	0.965	0.67	−0.071	−0.27	−0.155	−0.36	−5.7	0.8	2.0
Child < 3 (net)	No.	−0.754	−1.03	−0.596	−2.04	−2.099	−2.79	4.4	6.4	27.3
Child 3–5 (net)	No.	0.088	0.13	−0.352	−1.30	−0.195	−0.30	−0.5	3.8	2.5
Child 12–17 (net)	No.	0.442	1.03	0.079	0.36	0.651	1.22	−2.6	−0.9	−8.5
Child	No.	−0.119	−0.47	−0.450	−3.05	−0.191	−0.56	0.7	4.8	2.5
Potential wage	Dollars/hour	17.066	0.62	9.299	1.09	7.679	2.79	...	...	...
Likelihood-ratio test (df = 11)	...	22.1	...	86.3	...	72.9	...	...	...	...
σ	Dollars/hour	0.0270	...	0.179	...	0.297	...	...	...	...
Housewife's mean value of time ($\hat{\mu}$)	Dollars/hour	1.48	...	1.66	...	2.27	...	...	...	...
Mean wage offer (μ^*)	Dollars/hour	1.36	...	1.51	...	2.03	...	...	...	...
$\hat{\mu}/\mu^*$	...	1.08	...	1.10	...	1.12	...	...	...	...
No. of observations	...	237	...	566	...	172	...	...	...	...

tempting to rationalize these patterns even at the risk that these patterns do not exist.

It was argued earlier that an increase in education increases the productivity of the woman in the household sector. This increase in productivity favors the production of child services if the technological improvement is "child-services biased" or if it is biased in favor of inputs which constitute a large fraction of child services' costs of production, such as the mother's time. Under these circumstances, other things being equal, the consumption of child services tends to increase with the wife's education. In particular, we should expect that given the number of children, the quality of the child is positively correlated with the mother's education (the amount of child services represented by each child increases with the mother's education). The increased demand for child services is reflected in an increased demand for the mother's time when the child is young for one or more of the following reasons:

a) The mother's productivity differential changes with the age of the child. There may be only very small differences in productivity between high school and college graduates when the child is young, but these differences widen as the child grows older and the production of quality calls for ever increasing inputs of human capital services. An increase in the demand for child services leads, therefore, to an increase in the demand for the mother's time when the child is young; but the increase in the demand for time becomes less and less pronounced as the differences in productivity increase.

b) There is a low elasticity of substitution between the mother's time and other inputs when the child is young. The production function of child services may call for some invariant amounts of the mother's time that are proportional to output, the mother having to establish herself as the prime figure in the baby's life in order to be an efficient producer of quality in the future.

c) Baby care may involve a large positive psychic income component when the baby is one's own, and considerable negative psychic income when the baby belongs to someone else. Thus, a college graduate may find it cheaper to care for her baby herself, rather than enter the labor force and hire a high school graduate to fill in her post. This psychic income component may change with the child's age, giving rise to a different reaction as the child grows older.

d) Finally, it can be argued that the production function of child services varies with education, because of imperfect information. This argument has been applied in the analysis of the effect of education on the quantity of children (Michael 1970), but it may equally hold true in the case of quality, college-educated mothers being more aware of the importance of infancy to the future development of the child.

All of our findings are based on the implicit assumption that the demand

TABLE 6

DETERMINANTS OF THE HOUSEWIVES' VALUE OF TIME (AN INTERACTION MODEL):
DEPENDENT VARIABLE = ANNUAL PARTICIPATION

Explanatory Variables	Units	$\mu^* = \overline{W}$ Probit Coefficients	$\mu^* = \overline{W}$ t-Scores	$\mu^* = \overline{W}$ Marginal Effect on $\hat{\mu}$ (%)	$\mu^* =$ est μ^* Probit Coefficients	$\mu^* =$ est μ^* t-Scores	$\mu^* =$ est μ^* Marginal Effect on $\hat{\mu}$ (%)
Constant	...	−1.962	−1.48	...	1.298	2.17	...
Income	$10,000/year	−0.907	−4.37	8.5	−0.893	−4.33	15.3
Age < 30	Dummy (0, 1)	0.620	1.80	−5.8	0.018	0.06	−0.3
Age ⩾ 50	Dummy (0, 1)	−0.960	−3.64	9.0	−0.215	−0.73	3.7
Educ. = elem.	Dummy (0, 1)	0.411	0.88	−3.9	0.252	0.61	−4.3
Educ. = coll.	Dummy (0, 1)	−2.791	−2.85	26.3	−1.653	−2.51	28.2
Husband's age	10 years	−0.344	−3.08	3.2	−0.239	−2.20	4.1
Husband's educ. = elem.	Dummy (0, 1)	0.680	0.86	−8.2	0.164	0.85	−2.8
Husband's educ. = coll.	Dummy (0, 1)	−0.005	−0.02	0.0	−0.009	−0.04	0.2
Child < 3:							
Educ. = elem.	No.	−1.512	−1.86	14.2	−1.517	−1.86	25.9
Educ. = h.s.	No.	−0.898	−4.17	8.4	−0.892	−4.18	15.2
Educ. = coll.	No.	−1.057	−2.97	10.0	−1.196	−3.26	20.4
Child 3–5:							
Educ. = elem.	No.	−0.004	−0.01	0.0	−0.006	−0.01	0.1
Educ. = h.s.	No.	−0.987	−4.87	9.3	−0.998	−4.95	17.0
Educ. = coll.	No.	−0.252	−0.69	2.4	−0.356	−0.98	6.1
Child 6–11:							
Educ. = elem.	No.	−0.346	−1.46	3.2	−0.386	−1.61	6.6
Educ. = h.s.	No.	−0.330	−2.51	3.1	−0.341	−2.62	5.8
Educ. = coll.	No.	−0.262	−0.98	2.5	−0.284	−1.07	4.8
Child 12–17:							
Educ. = elem.	No.	0.309	1.19	−2.9	0.261	0.99	−4.5
Educ. = h.s.	No.	−0.406	−2.54	3.8	−0.363	−2.29	6.2
Educ. = coll.	No.	0.113	0.33	−1.1	0.162	0.48	−2.8
Potential wage	Dollars/hour	10.616	3.44	...	5.855	3.60	...
Likelihood ratio	...	189.6	...	...	186.9	...	...
Degrees of freedom	...	21	...	...	21	...	...
σ	Dollars/hour	.156	...	...	.193	...	...
Housewives' mean value of time ($\hat{\mu}$)	Dollars/hour	1.65	...	...	1.25	...	...
Mean wage offer (μ^*)	Dollars/hour	1.56	...	...	1.13	...	...
$\hat{\mu}/\mu^*$	...	1.06	...	...	1.11	...	...

TABLE 7

EFFECT OF CHILDREN ON THEIR MOTHER'S VALUE OF TIME

No. of Children <6 Years		No. of Children 6–11 Years			
		0	1	2	3+
0	No. of observations	518	102	49	12
	Probit coefficients	...	−0.628	−1.300	−0.659
	t-scores	...	−2.49	−3.53	−1.02
	Marginal effect on $\hat{\mu}$ (%)	...	7.8	16.2	(10.7)
1	No. of observations	81	50	26	4
	Probit coefficients	−0.856	−1.492	−2.439	−0.850
	t-scores	−2.30	−3.76	−3.12	−0.70
	Marginal effect on $\hat{\mu}$ (%)	10.7	18.6	30.2	(10.6)
2	No. of observations	52	30	12	4
	Probit coefficients	−2.063	−2.320	−0.860	0.562
	t-scores	−3.59	−2.92	−1.16	0.51
	Marginal effect on $\hat{\mu}$ (%)	25.7	28.9	(10.7)	(−7.0)
3	No. of observations	21	8	3	3
	Probit coefficients	−2.588	−1.414	−0.315	−12.451
	t-scores	−2.33	−1.21	−0.23	−0.06
	Marginal effect on $\hat{\mu}$ (%)	32.3	(17.6)	(3.9)	(155.2)

NOTE.—Terms in parentheses are insignificant at $\alpha = .05$.

for the mother's time increases uniformly with the number of children in a given age group.[30] To test this assumption, a set of 16 dummy variables was defined, specifying whether the women had zero, one, two, or three or more children younger than 6 years old and whether she had zero, one, two, or three or more children in the age group 6–11. The estimated effects of income, age, education, and husband's characteristics are almost identical with those presented in table 2 and thus are not reproduced here. Estimated effects of the new children variables on the weekly rate of participation are presented in table 7. These findings demonstrate once again the effect of the child's age on his mother's value of time, but contain very little evidence to refute our prior hypothesis. Similarly, an attempt to test the validity of the assumption within the various education groups, using a somewhat different definition of the children variable, did not come up with any persuasive evidence that will call for a reformulation of the

[30] I would hesitate to interpret any change in the time input per child associated with a change in the number of children within a given age group as evidence for returns to scale in the production of child services. Even if one adheres to the traditional assumption that, other things such as parents' income, education, and age being equal, an increase in the number of children does not result in a decline in the optimal quality of the child, quality being exogeneously determined, it is dangerous to claim that an observed decline in inputs per child in families with a larger number of children attests to increasing returns to scale. Other things being equal, the difference in the number of children may be explained in terms of differences in efficiency in the production of child services. Under these circumstances the observed decline in inputs per child is a spurious result.

TABLE 8

EFFECT OF CHILDREN ON THEIR MOTHER'S VALUE OF TIME: MOTHER'S EDUCATION = HIGH SCHOOL

No. of Children <3 Years	No. of Children 3–5 Years		No. of Children 6–11 Years		
			0	1	2+
0	0	No. of observations	254	71	38
		Probit coefficients	...	−0.816	−1.465
		t-scores	...	−2.63	−3.48
		Marginal effect on $\hat{\mu}$ (%)	...	7.2	12.9
0	1+	No. of observations	33	33	12
		Probit coefficients	−1.154	−2.034	−2.874
		t-scores	−2.71	−4.07	−2.67
		Marginal effect on $\hat{\mu}$ (%)	10.1	17.9	25.2
1+	0	No. of observations	49	9	10
		Probit coefficients	−2.091	−1.100	−2.368
		t-scores	−4.52	−1.46	−2.13
		Marginal effect on $\hat{\mu}$ (%)	18.4	(9.7)	20.8
1+	1+	No. of observations	30	17	10
		Probit coefficients	−2.269	−3.199	−0.912
		t-scores	−3.78	−3.01	−1.21
		Marginal effect on $\hat{\mu}$ (%)	19.9	28.1	(8.0)

NOTE.—Terms in parentheses are insignificant at $\alpha = .05$.

estimation procedure (the estimates of the regression for mothers with a high school education are presented in table 8).[31]

IV. Some Concluding Remarks

Given our tentative conclusions, it is of interest to compare them with the indirect evidence contained in other studies of the labor-force participation behavior of married women. Leibowitz (1972) used the same body of data I did (the 1960 Census 1/1,000 sample) but focused only on the number of weeks worked. Not surprisingly, there is a great similarity between her results and the results reported in table 6. Leibowitz reports that children under 3 years old seem to be an equally forceful deterrent to the market-labor supply of women of all three education classes (elementary, high school, and college), that the labor supply of high school and college graduates is more sensitive to the existence of children older than 3 years than is that of elementary school graduates, and that there exists no significant difference between high school and college graduates in this regard. Smith (1972*b*) using the Survey of Economic Opportunity data, reports

[31] Table 8 does not include the estimated effects of income, age, and the husband's characteristics, since they are almost identical with those produced in table 5. I do not present the results for the other education groups because most of the "children" coefficients are insignificant.

that he could find little to support the notion that the effect of children on time inputs at home varies with education (it is, however, worth noting that Smith investigated the difference among husband's education classes).

Hill and Stafford used in their study the University of Michigan Survey Research Center's 1965 *Productive American* survey (Morgan, Sirageldin, Baerwaldt 1966). These data allowed them to investigate not only the effect of children on the hours mothers worked in the market but also the effect of children on time spent on "housework." They observe that while the effect of children on mother's market time is usually insignificant, children have a significant effect on the amount of "housework." This effect varies with socioeconomic status groups. While for the lowest socioeconomic group only children under 3 years old have any effect on their mother's "housework," older children also have an effect when the mother belongs to the higher status groups. It seems that the effect of a young child on time spent in "housework" is greater when the mother belongs to the highest status group than when she belongs to the second highest, but that these differences tend to diminish as the child grows older (it is difficult to tell whether this result is significant).

The record does little to confirm, but also does not directly contradict, the findings reported in the last section. There is no way to strengthen the claim that the effect of a child depends on the mother's education but by further research. A sample excluding families who do not have children less than 12 years old, and data, such as those from the Ohio Survey, containing a better measure of labor-force experience should help in sharpening the conclusions.

In summary, it seems that this paper poses more new questions than the old ones it answers. What, for instance, is the production function of child services and how does it change with the age of the child? What are the elasticities of substitutions in production between time and goods and how are they affected by the child's age? How does this productivity vary with the child's age?

Economists tend to regard children as a consumption (or production) durable, but in economic literature the tendency has been to analyze the demand for child services as demand for nondurables. I hope this paper may help in reversing this trend.

Appendix

CHARACTERISTICS OF WOMEN IN THE SAMPLE BY EDUCATION GROUP

	Total	Elementary School	High School	College
No. in sample	975	237	566	172
Percentage distribution	100.0	24.3	58.1	17.6
Wife's age distribution (%)	100.0	100.0	100.0	100.0
<30	22.3	7.2	28.6	22.1
30–49	49.8	37.5	53.9	53.5
50+	27.9	55.3	17.5	24.4
Husband's average age	45.1	54.8	41.8	42.6
Husband's education distribution (%)	100.0	100.0	100.0	100.0
Elementary school	32.4	75.9	21.9	7.0
High school	44.6	22.4	58.5	29.6
College	23.0	1.7	19.6	63.4
Average no. of children:				
<18	1.29	0.81	1.47	1.34
<3	0.25	0.11	0.28	0.32
3–5	0.24	0.10	0.30	0.27
6–11	0.46	0.30	0.50	0.49
12–17	0.34	0.30	0.39	0.26
Families with child (%):				
<18	46.9	24.1	55.1	51.2
<3	19.4	8.4	41.1	25.6
3–5	19.7	8.9	23.9	20.9
6–11	31.1	19.4	35.3	33.1
Average income*	6,774	5,667	6,756	8,356
Average potential wage:				
Arithmetic mean	1.998	1.836	1.868	2.653
Geometric mean	1.551	1.363	1.508	2.032
Participation rate (%)	31.6	23.2	32.7	39.5

* Wife's earnings excluded.

Comment

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Most of the papers in this volume consider the value of time as one of the determinants of the size of the family, but Reuben Gronau takes the opposite view in his paper. In part, this reflects different notions of the value of time. In the economic theory of fertility, the value of time is a predetermined parameter of the family's intertemporal budget constraint, a measure of the consumption foregone by having a child. In Gronau's terminology, the value of time is at least partly a measure of the location on the budget constraint chosen by the family and is therefore a measure of preferences of the family. It is important to keep this terminological distinction in mind in comparing his paper with the others.

An important feature of Gronau's paper is its explicit treatment of variations in preferences among the population. Although the other authors generally admit the existence of a diversity of preferences with regard to childbearing and working in the market, they develop the theory and empirical applications as if all families had the same preferences. The effects of variations in preferences appear only in the random disturbance which is added to the model almost as an afterthought. Gronau treats variations of tastes (in the form of variations in the value of time) as an integral part of his model from the start. He assumes that the value of time, $\hat{w}$, has a normal distribution whose mean depends on certain observed characteristics including the number of children in the family. He then estimates the parameters of this dependence by the statistical method of maximum likelihood, using data on participation in the labor force. The results are clearly suitable for predicting whether a woman is in the labor force given her characteristics, especially the number and ages of her children. A question which deserves more attention is whether the estimated equation can be given a structural interpretation. For example, could the equation be used to predict the effect on labor-force participation of a subsidy for childbearing? Gronau's introductory remarks seem to suggest that his results might answer this question, but I think considerable caution is necessary.

In my view, a better way to account for variations in preferences would recognize that the size of the family and the labor-force participation of the wife are jointly determined. Suppose, for example, that there is a single axis along which tastes vary. One end of the axis is traditional, valuing large families and domestic activities, and the other is modern, valuing activities outside the home for both wife and husband. Suppose, further, that all families face the same prices and wages. Even then we will find a strong negative relation between family size and labor-force participation of the wife. Since no part of this relation is caused by variations in prices, we cannot give a structural interpretation to the results at all.

Now, in fact, not all of the variation in Gronau's sample is caused by variations in preferences along a single axis. To the extent that other sources of variation in the number of children are independent of the sources of variation in the decision to enter the labor force, the estimates will be closer to the underlying structural relation. As Gronau pointed out in the discussion, purely random variations in family size reduce the bias in his results. Unfortunately, we do not know how much bias remains.

Gronau has made an important contribution in this and a related paper by developing a method for estimating the true mean of the wage distribution facing a group of potential workers. The naïve estimate obtained by taking the average of the wages of those who work has a serious upward bias for any group with a rate of labor-force participation much less than one. The exclusion of nonparticipants generally eliminates observations of low wages from the average.