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INTRODUCTION

Since the initial work of Becker {1} and Mincer {9} it has been recognized that the allocation of time should be conceptualized as a trichotomy amongst home work, market work, and leisure rather than as a dichotomy between market work and leisure as traditional labor supply studies have specified. The existence of role expectations in the division of labor within the family unit makes the explicit consideration of housework and leisure components of non-market time particular crucial in examing female labor market behavior. Empirical efforts to identify the economic incentives confronting females and their resulting time allocation behavior have recognized this proposition to varying degrees. These efforts may be broadly grouped into three distinct approaches.

The first might be termed the implicit function approach. It is assumed that the value of alternative time uses may be captured by the introduction of a set of conditioning variables in regressions explaining female labor supply. Thus, for instance, Cain {2} and Sweet {11} use the number and ages of children as an indicator of the value of a women's home time. It would be expected that small children take up a disproportionate amount of a mother's time, and that alternative forms of care for them are hard to procure, while older children take less care and ultimately reduce the value of time at home by releasing the mother from household tasks. The list of variables that might potentially proxy for the value of non-market time is reflected in the extensive list of regressors to be found for instance in the female labor supply studies contained in Cain and Watts {3} or that of Kalacheck and Raines {6}. In this approach no attempt is made to identify value of home product and leisure, or to differentiate between their separate effects on labor supply.

A second approach is represented by variants of the opportunity cost of time theorem. Maximizing behavior should imply that time devoted to housework or to leisure be evaluated at its opportunity cost - typically the market wage rate. Sophisticated versions of this proposition with application to labor supply decisions of females have been developed by Heckman {5} and Gronau {4} and more recently in a husband-wife joint decisions context by Wales and Woodland.{13} We will argue below that the presence of constraints on the woman's time acts as a wedge between valuation of market and non-market time, and thus alters the labor market participation decision that would obtain under equality.

A third direction of research has been to attempt to measure directly the value of home production of women. Thus, for instance, Morgan Serageldin and Baerwalt {10} utilized time budget estimates for the work done at home. Leibowitz {8} attempted to establish the role of education in determining the value of home product, while Whitman {14} approached the problem by estimating the cost of purchasing home services in the market. The direct estimation approach has much to recommend it, and we attempt to exploit a variant of this procedure. But by its nature it is quite likely to fail to capture important aspects of home productivity, and hence needs to be integrated into a more general framework.

It is not the intent of this study to choose among these various methodologies. Indeed, our approach incorporates aspects of each of them. However, we feel that existing work has failed to appreciate certain important implications coming out of the theory of time allocation when that theory is confronted with some real world constraints. If activities in home, market and leisure production were perfectly divisible the female could always

equalize the marginal value of time in each pursuit by adjusting time inputs. This will usually not be the case, however. The decision to engage in market work will in general impose restrictions on adjustment both by requiring minimum blocks of time input and by requiring time input at certain specified hours. Nor are home production and leisure activities free from these constraints. This is not to say that household schedules are completely inflexible; simply that most activities engaged in require minimum continuous time inputs, and some of these at exogenously specified times. These factors gain in importance when it is realized that home work and leisure activities will be characterized - as time allocation theory predicts - by diminishing returns to time input. Thus, the woman's value of homework and leisure time are not constant functions of time, and they may not even be smooth functions. Hence it is quite possible for no two of home, market and leisure wage to be equal, for participation decisions to be distorted, and for dead weight losses to occur.

In this study we attempt to introduce some of these constraints on time input into a time allocation framework, and to exploit the National Longitudinal Survey (NLS) tapes for Mature Women to test the implications of the theory for female labor force participation. A key feature of the present study is the estimation of separate functions for market wage, home wage and value of leisure. Market wage is viewed as a potential concept, and following the expanded structure of wage determining factors developed by Wachtel and Betsey {12} and Kalacheck and Raines {7}, embodies both a rich vector of human capital attributes as well as market structure factors. Home product wage includes a set of variables generally associated with a woman's household productivity, such as number and ages of children, information on marital status, home ownership and health, as well as some data on attitude,

background and training specifically relevant to home productivity. Value of leisure is defined in terms of a set of income and asset variables, together with a set of variables that are hypothesized to condition the woman's leisure, such as health, marital status, urban residence and a specific attitudinal question on leisure preference.

The following section develops the theoretical structure, specifically the relationship between the home and leisure wage functions and the reservation wage the woman requires in order to enter the labor market. This permits a theoretical interpretation of the equation explaining labor force participation in terms of the parameters of the underlying time value functions. In Section 3 the market, home and leisure wage functions are specified and estimated, and results of using these functions in a model of female labor force participation are presented and interpreted. The final section draws some policy implications.

2. THEORETICAL FRAMEWORK

2.1. Time Allocation under Constraints and the Determination of Reservation Wage.

We assume that women engage in market, home and leisure activities so as to maximize the value of their time. This assumption will not be synonomous with utility maximization unless further conditions are met, in particular, constant marginal utility of income. However, time value maximization is not too extreme a departure from utility maximization given that the implicit self-evaluation of home and leisure times that characterize our methodological approach should be reasonably faithful approximations to marginal utilities derived from these activities. Our approach is restrictive in that the woman's time valuations are not assumed to be jointly determined with those of other household members which are treated as exogenously determined. To relax this assumption would imply empirical propositions which we cannot readily test in this study.

Given a set of preferences, budgetary requirements, health factors, and market opportunities, allocation of a woman's time between market work, home work, and leisure is made on the basis of three parameters: potential market wage (W_m); the value of time spent on home activities (W_h); and the implicit value of leisure (W_l). The appropriate measure of W_m would take account of longer-run earnings potential rather than simply current market wages, would include non-pecuniary as well as pecuniary returns, and would allow for that fact that wage rates might vary with the intensity of participation (if for instance employers offer lower wages to part-time as opposed to full-time employees because their productivity is perceived as less).

Our construct strictly meets only the first of these requirements, although the second will be captured to the extent that both pecuniary and non-pecuniary returns are correlated with human capital investments. However, it is assumed both in the theoretical and empirical parts of this study, that market wage is independent of time spent at market work. Home wage and leisure wage are assumed to be non-increasing functions of time. Thus,

$$(1) \qquad W_h = W_h(T_h) \quad , \quad W_h' \leq 0$$

$$(2) \qquad W_l = W_l(T_l) \quad , \quad W_l' \leq 0$$

where T_h and T_l are respectively time spent in home work and leisure. The functions described by equations (1) and (2) could be highly non-linear. Thus the need for certain minimal amounts of time devoted to bodily maintenance or home upkeep will be associated with extremely high values of W_h and W_l; not so with the twenty-fourth hour of the day devoted to housekeeping or TV viewing. The functions might be discontinuous given the existence of activities requiring more or less fixed amounts of time that are not easily divisible. The exact shape of the functional forms appropriate to any particular individual will of course be conditioned by that person's environment and preferences.

The decision as to whether or not to work depends on the calculus of gains and losses by so doing. This calculus is complicated by the fact that the decision to become a labor force participant implies a commitment to a finite, generally non-trivial block of times devoted to holding a job. The minimum value for this block of time we will denote by $\bar{T}_m$. This does not imply that the woman might not choose to work more than $\bar{T}_m$ hours.

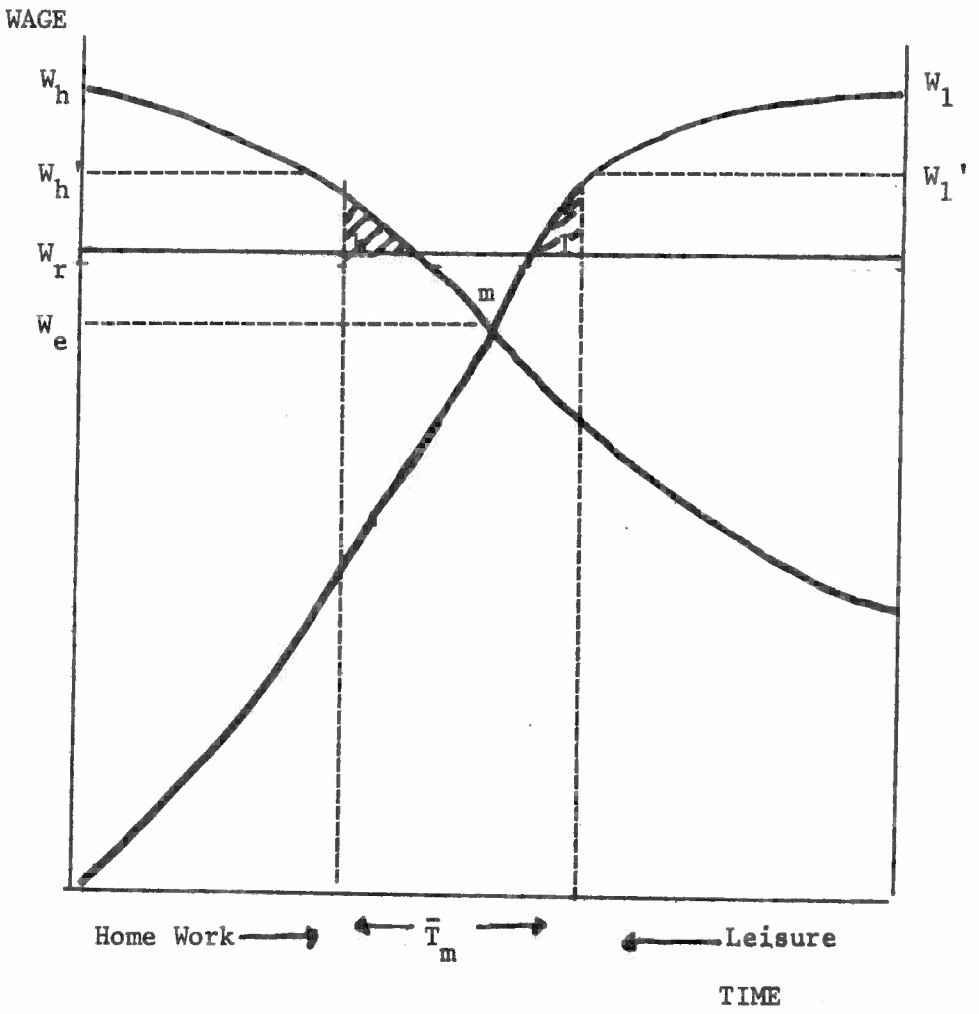
(a decision not directly addressed in this study but readily deducible from the following analysis); only that she cannot work, and prepare for and travel to and from work, less than $\bar{T}_m$ per period. The problem then becomes one of selecting a reservation wage, W_r, such that $W_r\bar{T}_m$, the gain from labor force participation for the minimum time input, just equals the value of home and leisure time foregone. Then labor force participation is determined by the following inequality:

$$(3) \qquad W_r \begin{cases} < W_m & \text{participate} \\ \geq W_m & \text{do not participate} \end{cases}$$

The solution to W_r is most easily seen graphically. Shown in Figure 1 are W_h (with T_h increasing left to right) and W_l (with T_l increasing right to left). The point where these two functions cross, W_e, would determine W_r *if market time were infitely divisible*. Given the existence of T_m, however, the reservation wage must be set at a higher level as shown. Note that the condition of equality of gains and losses which determines W_r is just met when the sum of areas h plus l equals area m. A little reflection will make evident that the working time block $\bar{T}_m$ is cut out of the center so as to equate the marginal values of home and leisure time, $W_h' = W_l'$; since if they were unequal an adjustment of $\bar{T}_m$ block would be available to reduce total losses of foregone home and leisure time. Note also that the existence of $\bar{T}_m > 0$ always will imply that W_h' and W_l' are greater than W_r. The reservation wage is set below the value of the last hour devoted to home work and to leisure.

Figure 1

Determination of Reservation Wage With a Minimum Market Work Time



The analytic solution for W_r follows from the equality of gains from labor force participation at the reservation wage for the minimum time input, $W_r\bar{T}_m$, and the combined value of home and leisure time foregone. Denote the latter two quantities by H and L. Thus,

$$H = \int_{T_h'}^{T_h^*} W_h(t)dt \,, \qquad L = \int_{T-\bar{T}_m-T_h'}^{T-T_h^*} W_l(t)dt$$

where T_h' is home work time at W_h' in Figure 1, T_h^* is home work time if no market work is engaged in (i.e., at the intersection of the W_h and W_l functions in Figure 1), and T is total time. Then the reservation wage is determined by $W_r\bar{T}_m = H + L$, or

$$(4) \qquad W_r = \frac{\int_{T_h'}^{T_h^*} W_h(t)dt + \int_{T-\bar{T}_m-T_h'}^{T-T_h^*} W_l(t)dt}{\bar{T}_m}$$

Equation (4) provides only limited insight into the role of the shapes of the home and leisure time curves in determining W_r, or even the role of $\bar{T}_m$ (since it enters both the numerator and denominator of (4)). To make further progress we will assume that both W_h and W_l are linear functions of time, at least in the range relevant to plausible values of $\bar{T}_m$. Thus equations (1) and (2) become:

$$(1a) \qquad W_h = a - bT_h \,, \qquad (2a) \qquad W_l = c - dT_l$$

where a, b, c and d are distinct non-negative parameters. Equation (4) then becomes:

$$(4a) \qquad W_r = \frac{\int_{T_h'}^{T_h^*} (a - bt)dt + \int_{T-\bar{T}_m-T_h'}^{T-T_h^*} (c - dt)dt}{\bar{T}_m}$$

The interpretation of equation (4a), upon integration of the right hand side, is facilitated if the limits of integration are expressed entirely in terms of the two predetermined time quantities, T and $\bar{T}_m$, and the parameters of the functions. To do this we make use of the fact that $W_h' = W_l'$. Hence:

$$a - bT_h' = c - d(T - \bar{T}_m - T_h')$$

or $$T_h' = \frac{a - c + d(T - \bar{T}_m)}{b + d}$$

And since W_h and W_l are identical where the functions cross,

$$a - b(T_h^*) = c - d(T - T_h^*)$$

or $$T_h^* = \frac{a - c + dT}{b + d}$$

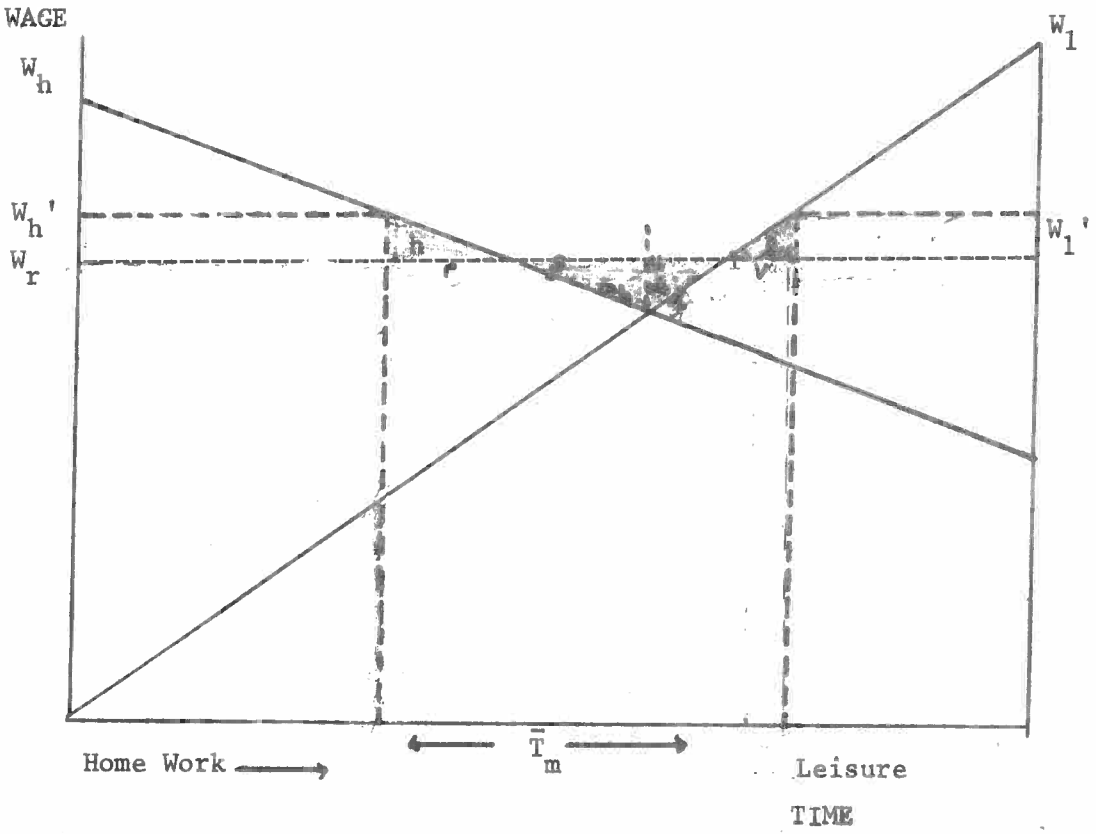
Substituting for T_h' and T_h^* in (4a) and shifting the origin so that the lower limit of integration in both integrals is zero, the upper limits become $d\bar{T}_m/b+d$ and $b\bar{T}_m/b+d$ respectively. Evaluation of the integrals in the numerator of (4a) then yields linear and square terms in $\bar{T}_m$ which upon division by $\bar{T}_m$ in the denominator and simplication yields the following expression for W_r.

$$(5) \qquad W_r = \frac{ad+bc}{b+d} - \frac{bdT}{b+d} + \frac{bd\bar{T}}{2(b+d)}$$

Equation (5) is readily interpretable and its intuitive appeal is made clear in Figure 2 which reproduces Figure 1 with substitution of straight line functions for W_h and W_l. An increase in either intercept term, a or c, increases area h or l while reducing gains from market work (areas m_h plus m_l in Figure (2)), hence must lead to a higher W_r as implied by equation (5). Similarly, increasing the minimum market work requirement, $\bar{T}_m$, leads to an increase in both h and l, hence requires a higher W_r to offset the home and leisure time losses. The negative coefficient associated with total time, T, in equation (5) is transparent. If time available was endless, or, more realistically if the W_h and W_l functions were sufficiently steep, women would work for nothing, or even pay to engage in market work. This suggests what seems intuitively clear from Figure 2 but ambiguous from equation (5); namely, that the steeper is the slope of W_h or W_l (the larger is b or d), the lower is W_r.

Figure 2

Determination of Reservation Wage Assuming Linear Home and Leisure Wage Functions



Again it is seen in Figure 2 that the value of the last hour of home work and leisure, W_h' and W_l', is greater than the reservation wage. If the woman has a potential market wage, W_m, greater than W_r she will enter the labor market. If $W_m > W_h' = W_l'$ the woman will seek to expand her market work hours beyond the minimum $\bar{T}_m$ and thereby equate $W_m = W_h = W_l$. If $W_r \leq W_m < W_h' = W_l'$, she will work the minimum number of hours but earn a lower return on market work than her marginal return on home work or leisure. This implies a dead weight loss since she is giving up some home and leisure production (the area in h + 1 lying above where the W_m line crosses) but society gains no corresponding increment of market production.

In the empirical part of this study we impute home and leisure wages to all of the woman in the sample, both those in and out of the labor force, on the basis of self evaluation of reservation wage for women out of the labor force. It is therefore pertinent to investigate the relationship between W_h' and W_l' and W_r. For straight line W_h and W_l functions the relationship is easily derived. Using equations (1a) and (1b) substitute for the intercept terms, a and c, in equation (5). Then making use of the fact that at W_h' and W_l', $T_h' + T_l' = T - \bar{T}_m$, we get after cancelling out terms in T,

$$(6) \qquad W_r = \frac{dW_h' + bW_l'}{b + d} - \frac{bd\bar{T}_m}{2(b+d)}$$

Consider the values of home product and leisure time for which W_r provides exact information. These would be determined by the intersection of the W_r line with the W_h and W_l curves, at points denoted, say, by W_h'' and W_l''. By construction $W_r = W_h'' = W_l''$. Then equation

(6) implies the following relationships

$$(7a) \quad W_h'' = W_h' - \frac{bd\bar{T}_m}{2(b+d)}, \qquad (7b) \quad W_l'' = W_l' - \frac{bd\bar{T}_m}{2(b+d)}$$

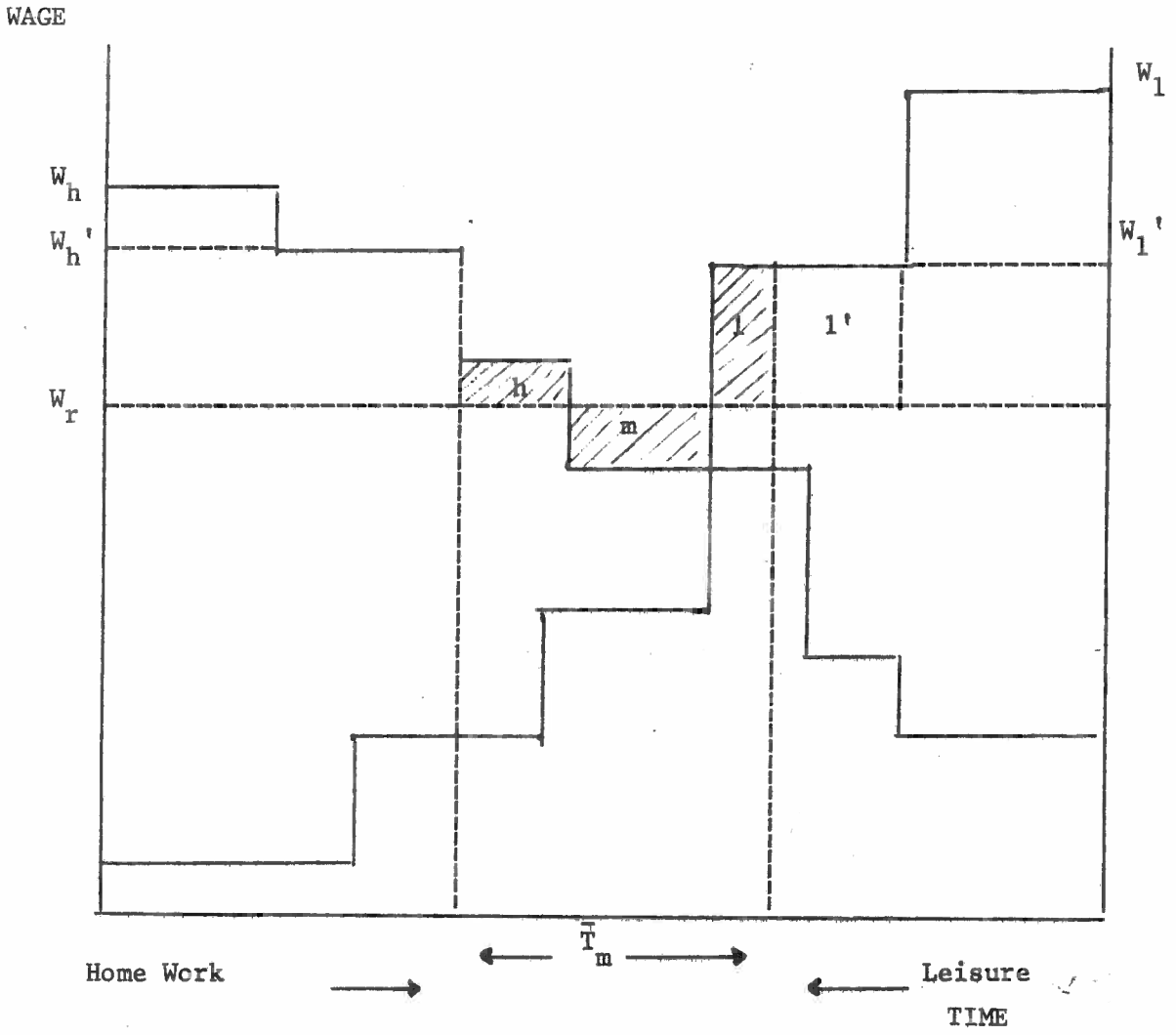
Thus the reservation wage provides estimates of home product and the value of leisure that understate the values pertinent to a woman contemplating or engaged in market work for $\bar{T}_m$ hours. The extent of underestimation will be identical for W_h and W_l for continuous functions, and will depend on the minimum hours requirement and the slope coefficient for straight line W_h and W_l functions. To complete the set of pertinent relations among W_r, W_h and W_l equations (7a) and (7b) may be used to substitute for W_h' and W_l' in (6), yielding the following simple expression:

$$(8) \quad W_r = \frac{dW_h''}{b+d} + \frac{bW_l''}{b+d}$$

Suppose now we introduce discontinuities in the time functions for W_h and W_l. These discontinuities could arise due to the existence of a finite number of home work and leisure activities, each with a distinct marginal product of time. The problem of selecting a reservation wage under these circumstances is illustrated in Figure 3, where it has been assumed that W_h and W_l can be approximated by step functions.

Figure 3

Determination of Reservation Wage with Discontinuities in the W_h and W_l Functions



Again we have assumed a minimum market work requirement of $\bar{T}_m$ hours. The reservation wage is, therefore, determined by the equality, $h + 1 = m$, but $W_h' = W_1'$ no longer holds, although, in general, both will be greater than W_r. Due to the presence of discontinuities, the optimum strategy will attempt to arrange $\bar{T}_m$ so as to include complete steps so far as this is possible. [1/] Such behavior has strong intuitive appeal. Cleaning half a floor or entertaining dinner guests for part of an evening may prove unesthetic, awkward or impossible. In Figure 3, the sacrifice of 1 may effectively entail the sacrifice of 1'. In that case W_r must be increased to take account of the additional loss of 1'. Still, substitutions among family members may be possible (we have all been to get-togethers where one of the hosts retires before all the guests leave).

While acknowledging the additional complexities created by discrete home work and leisure activities, it will be seen that step functions lead to a reservation wage with properties similar to continuous linear functions:

(a) Shifting an entire step function up or down leads to a corresponding change in W_r.

(b) Moving the vertical segments in the $\bar{T}_m$ range outward or inward, (in effect, raising or lowering the "slope" of the step function in the relevant range) produces a

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[1/] This implies an ambiguity in the interpretation of W_h or W_1. Thus, is W_h' as shown, greater than W_1' or should it be interpreted as corresponding to the beginning of the next step, less than W_1' ?

corresponding upward or downward movement in W_r.

(c) Increasing or decreasing. $\bar{T}_m$ results in a corresponding adjustment in W_r.

Thus, even where the home product and leisure functions are characterized by discontinuities, a linear approximation will at least capture the correct qualitative properties. Further, while use has been made of the assumption that $W_h' = W_l'$ (in deriving equation (5)), neither equation (6) nor (8) explicitly introduce this constraint, hence provide an empirical means of relaxing it.

2.2. The Labor Force Participation Decision

The woman's decision whether or not to participate in the labor force is determined by inequality (3) between W_r and W_m. Since in this study we are interested from an empirical point of view in the processes by which values of home work and leisure are determined, rather than W_r which in any case is generally not available for predictive purposes, we first impute values of W_h and W_l derived from regressions defining the systematic determinants of W_r, then use the imputed W_h and W_l values together with an imputed market wage, W_m, to predict participation.

The values of home productivity and leisure that are coincident with W_r have been defined as W_h'' and W_l''. Thus, in general,

$$W_r = W_h(T_h'') = W_h'' \qquad W_r = W_l(T_l'') = W_l''$$

In the case of linear continuous W_h and W_l functions T_h'' and T_l'' are uniquely determined by the parameters of the functions and

$T = \frac{1}{2} \bar{T}_m$ [1/]. If we assume that $\bar{T}_m$ is more or less constant over the cross-section of women in the sample then W_h'' and W_l'' vary with the parameters of the functions.

Suppose that the parameters of the home productivity function, a and b, are systematically related to determinant vectors X, and leisure parameters c and d systematically related to vectors Z. The form assumed for the relationships is log-linear:

(9a) $\ln W_h'' = X\alpha + \mu_h$ (9b) $\ln W_l'' = Z\gamma + \mu_l$

where μ_h and μ_l stand for vectors of random error terms.

Unbiased regression estimates of the coefficient vectors α and γ requires that X and Z be uncorrelated (i.e., the factors determining a and b be uncorrelated with the factors determining c and d). For many of the variables this assumption appears quite good; the sample correlations, if not zero, are quite low. One severe violation is the presence of race dummy variable in the W_h regression which is significantly negatively correlated with income and asset variables in the W_l regression. In two instances the assumption of uncorrelatedness between regressors is violated totally. Dummy variables for married, spouse present, and poor health appear in both regressions. Given that any factor that lowers W_l'' must also lower W_h'',

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1/ Thus $W_h'' = W_l''$ implies $a - bT_h'' = c - dT_l''$. But $T_h'' + T_l'' = T - \frac{1}{2}\bar{T}_m$. This last proposition can be read directly from Figure 2. Note that by equal triangles line segments r = s and u = v, hence $s + u = \frac{1}{2} \bar{T}_m$.

and conversely, variables common to both specifications will tend to capture the direct effect plus in attenuated fashion the indirect effect on the other function. Thus, consider poor health, which presumably lowers both value of leisure and home productivity. Its inclusion in both regressions implies that its partial contribution is overstated in each. The combined effect in each regression need not be identical; that will depend on the relative slopes of the two functions and on the role of the variable in affecting slope or intercept.

The functional forms determining W_h and W_l could in fact be non-linear or discontinuous. But we have seen that in these cases the basic qualitative properties of the functions in determining reservation wage will continue to hold. With that in mind we will derive some implications for the coefficients of the labor force participation model as if straight line functions for W_h and W_l were appropriate.

Assume, following equation (3), that the participation decision obeys a linear probability model of the following sort;

$$(10) \qquad P = \lambda(W_m - W_r) + C\beta + \theta$$

where the participation variable P has, ex poste, ones corresponding to women in the labor force, and zeros for those out; C is a matrix if variables assume to condition the participation decision (including an intercept term) such as constraints imposed by health, child care arrangements, welfare regulations, or labor market imperfections; and θ represents the error term. Suppose now in place of W_r its equivalent in terms of W_h'' and W_l'' as given by equation (8) is introduced into (10). Then

(10) becomes:

$$(11) \qquad P = \lambda W_m - \frac{\lambda d}{b+d} W_h'' - \frac{\lambda b}{b+d} W_l'' + C\beta + \theta$$

This is the form of the regression actually estimated, and it provides some fairly strong predictions regarding the coefficients of W_m, W_h'' and W_l''. The sign of the coefficient of W_m is positive, while those of W_h'' and W_l'' are negative. The absolute magnitude of the coefficient of both W_h'' and W_l'' is less than that of W_m. And the ratio of the coefficient of W_h'' to that of W_l'' is an estimate of d/b - the slope of the leisure function to that of the home productivity function. Our a priori beliefs are that for women of the middle age group included in this study, the time value of leisure will decline more sharply than that of home work in the relevant range of $\bar{T}_m$ hours; hence the ratio of W_h'' to W_l'' coefficient is expected to be greater than one. 1/ There is of course a further constraint on the coefficients in (11); namely, that the algebraic sum of the coefficients of W_m, W_h'' and W_l'' equal zero. We have not imposed this constraint in the empirical work, for reasons having to do with potential bias in our measures of W_h'' and W_l'' that will be dealt with later .

1/ We can provide no theory requiring this outcome. However, for a woman with family responsibilities and responsible for the operation of a relatively larger domicile, the home productivity gradient must be fairly shallow. Despite the evolution of so-called labor saving devices, much home work remains labor intensive.

3. EMPIRICAL RESULTS

In order to estimate P, operational measures of W_m, W_h, and W_l must be developed for each person in the sample. Dollar estimates for these wage constructs were obtained by using the data available from the National Longitudinal Survey of Mature Women 30 - 44 in 1967. This survey afforded the unique opportunity to analyze the determinants of non-market time by its inclusion of data in which each woman who was out of the labor force at the time of the survey was asked the hourly wage she required to enter the labor market. The data also includes job and family histories permitting estimation of the market wage equation using a rich vector of human capital and market structure variables.

Our potential wage formulation is constructed by regressing the natural logarithm of actual hourly wage for those working [1/] on the set of human capital and market related factors which we hypothesized to be predictors of wage rates. The results of the potential wage regression are reported in Table 1. The results provide support for our contention that both human capital and market factors are important determinants of the wage that a woman can earn. Education level attained and whether or not a woman had vocational training are important as are other human capital variables such as prior work experience, which has a positive effect, and the existence of health limitations which reduce market wage. Interestingly there are several important geographical and demographic factors which are probably proxying for industrial concentration and differences

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1/ This is current wage in the primary job if more than one is held. Wage data reported on other than an hourly basis are adjusted to an hourly basis by means of data on usual weekly hours on primary job and number of weeks worked.

in unionization in different areas of the country. Thus relative to workers in the highly industrialized Northeast, workers in the West get a wage premium; however, those living in other areas get lower wages. Similarly living in a standard metropolitan statistical area has a significant positive effect on market wages. Strong support is given to the theory that wage differentials are related to industrial and occupational structure.

Most research on wage determination has indicated that being black has a significant negative effect on wages. However, our results suggest that the magnitude,and sign, of the effect vary with educational level. The inclusion of race and education interaction variables means that the overall education dummies refer to white groups, relative to whites with not more than a grade school education. Then blacks with some high school education earn 3 percent more than grade school whites, blacks with high school diplomas earn 14.8 percent more, while college graduate blacks earn 48.2 percent more. This sharp gradient, much steeper than that for whites, implies that blacks with a college diploma earn an estimated 6.9 percent more than whites with a college diploma, even after adjustment for the catch-all race dummy variables.

The overall goodness of fit of our wage measure is attested by the highly significant F value (60.93) and $\bar{R}^2$ of .554, and the large number of highly significant variables or variable groups.

The NLS data on Mature Women includes information on the reservation wage of females not working at the time of the survey. This reservation wage is the response to the question asked in 1967: "What wage or salary would it take for you to accept a job in this area?" Using the subsample of those

TABLE 1

Potential Wage Regression

Dependent variable is the natural logarithm of hourly wage rate

Variable	Definition	B value (t-statistic)
Edd 5[1]	1 if college diploma	.351* (8.10)
Edd 4[1]	1 if some college	.186* (5.15)
Edd 3[1]	1 if high school diploma	.112* (3.98)
Edd 2[1]	1 if some high school	.078* (2.66)
Resf 15	1 if grew up on a farm	-.047* (3.08)
Expcj	No. years experience in current job	.019* (5.32)
Expcjsq	No. years experience in current job squared	-.0006* (3.10)
HLIM	1 if health limitation	-.049** (2.22)
TRINGV	1 if had vocational training	.050* (2.68)
ROTP69	Score on personal items of Rotter Externally - Internally Index	-.003 (1.46)
RACE	Externally-Internally. 1 if black	-.062** (1.67)
Censd 1[2]	1 if lived in Pacific Census Div.	.102* (4.49)
Censd 2[2]	1 if lived in Mountain Census Div.	-.044 (1.25)
Censd 3[2]	1 if W.S.Central	-.175* (7.31)

[1] Relative to omitted group grade school education.

[2] Relative to omitted group N.Atlantic

Table 1 cont.

Variable	Definition	B value (t-statistic)
Censd 4[2]	1 if E.S.Central	-.139* (4.31)
Censd 5[2]	1 if S.Atlantic	-.104* (5.56)
Censd 6[2]	1 if W.N.Central	-.078* (2.72)
Censd 8[2]	1 if N.England	-.010 (0.28)
Expt	Total years work experience	.006 (1.64)
Exptsq.	Total years work experience squared	-.00005 (0.39)
SMSA	1 if living in SMSA	.107* (7.01)
GLWG	1 if government worker	.048** (1.95)
REDD 5[3]	1 if black and holds college degree	.131** (2.20)
REDD 4[3]	1 if black and some college	.020 (0.31)
REDD 3[3]	1 if black and high school diploma	-.036 (0.82)
REDD 2[3]	1 if black and some high school	-.048 (1.06)
RTRNG	1 if black with some vocational training	.00014 (0.00)
OCC 1[4]	1 if professional	.127* (4.15)
OCC 2[4]	1 if manager	.058 (1.45)
OCC 3[4]	1 if retail sales worker	-.133* (4.16)

[3] Relative to omitted group black with less than high school education.

[4] Relative to clerical workers.

Table 1 cont.

Variable	Definition	B value (t-statistic)
OCC 4^4	1 if craft worker or operative	-.111* (4.59)
OCC 5^4	1 if private household worker	-.411* (9.51)
OCC 6^4	1 if service worker	-.230 (10.18)
OCC 7^4	1 if laborer	-.138 (1.56)
INDD 1^5	1 if agriculture	-.155** (1.70)
INDD 2^5	1 if mining, construction, manufacturing.	.217* (8.64)
INDD 3^5	1 if transportation, public utilities	.204* (4.85)
INDD 5^5	1 if finance, business	.154* (4.74)
INDD 6^5	1 if personal services	.016 (0.52)
INDD 7^5	1 if public administration	.233* (5.71)
INDD 8^5	1 if professional	.104* (4.07)
Constant		.317
$\bar{R}^2$		.554
F		60.93
No. of obs.		1976

Note: Absolute values of t statistic given in parentheses.

* implies significant at the 1 percent level.

** implies significant at the 5 percent level.

[5] Relative to retail workers.

who responded to the reservation wage question, we predicted home and leisure wage by alternatively regressing the natural logarithms of W_r on a vector of home productivity and leisure variables.

From a more extensive list of candidates the factors ultimately arrived at to explain home productivity (see Table 2) are marital status, home ownership, number of children in each of three age groups, an index reflecting attitude toward home work, and dummy variables for race, growing up on a farm, poor health, and having taken non-market oriented training. These explain an adjusted 15.1 percent of the variation in W_r, which however is highly significant.

Marriage, home ownership and non-market training as expected all significantly increase the value that a woman places on her home time. Poor health has the expected sign but falls short of significance. The presence of small children raises home productivity in our results, but the effect is small and insignificant. In contrast the availability of children 14 - 17 years old has a significant negative effect on the value of a woman's home time. The negligible effect of small children could possibly be related to the fact that the women in our sample were older (30 - 44) than most mothers of young children, hence nominally unrepresentative of this population.

A potentially more severe source of unrepresentativeness derives from the fact that a reservation wage was not obtained for fully two-thirds of those not in the labor force, primarily because the woman stated that there were no circumstances under which she would currently be interested in working, or because there was "no reservation wage" at which she would work, or the respondent could not assign a value to her reservation wage.

TABLE 2

Home Wage Regression

Dependent variable is natural logarithm of reservation wage

Independent Variables	B value (t-statistic)
Married, spouse present	.075** (2.02)
Owns home	.071* (2.64)
Number of children 1-6 years old	.011 (0.87)
Number of children 6-13 years old	-.014 (1.51)
Number of children 14-17 years old	-.042* (2.73)
Scale of liking housework (-2 hates to +2 likes)	-.032* (2.80)
Nonvocational training	.074* (4.44)
Race, 1 if black	-.155* (5.39)
Lived on farm at age 15	-.113* (4.35)
Health is poor	-.044 (1.45)
Constant	.463
$\bar{R}^2$	.151
F	17.32
N	916

Note: Absolute value of t statistic shown in parentheses.

* implies significant at the 1 percent level.

** implies significant at the 5 percent level.

The first two reasons at least suggest very high values of home time (or leisure) for non-responders, either in absolute terms or possibly to be interpreted as relative to what the woman might reasonably expect to earn in the market. The third reason is not inconsistent with this explanation, although it may simply reflect a random inability to make a precise discrimination. Since the characteristics of reservation wage non-responders are, overall, not that different from those of responders it is likely that the estimated coefficients will tend to be biased downward in absolute terms. This bias may be particularly acute for the children 1 - 6 years variable since for a relatively large proportion of women the presence of small children may mean non-labor force participation is mandatory (i.e., the reservation wage is indeterminately high); for the remainder the presence of small children may only be a mild deterrent towards working. A number of procedures were explored in an attempt to make use of the information on non-responders (such as assigning them an arbitrarily large W_r and including them in the W_h and W_l regressions with a dummy control variable that effectively adjusts this W_r), but on balance these alternative procedures seemed more arbitrary and potentially more susceptible to bias than the option of dropping the non-responders from the sample.

In three instances of variables that were highly significant either the magnitude of the coefficient or its sign came as a surprise. Being black is estimated to reduce the value of home work by 15.5 percent. Is this a true valuation, or does it partly reflect the typically lower market wages for blacks? Living on a farm at age 15 and the positively oriented scale of liking housework are both significantly negatively related to home productivity. A possible explanation for the surprising negative coefficient on these two variables is that both may reflect a positive orientation towards household

chores and thus probably a greater time input doing them, hence possibly resulting in a lower marginal home product for farm background and "likes housework" women.

It is much more difficult to empirically specify the determinants of marginal value of leisure than the other wage constructs. Personal attitudes and preferences play a large part in determining the valuation of leisure time, but there are few adequate quantitative proxies for these subjective factors. Fortunately, the NLS contains questions on the types of non-market activities the women prefers to do, from which a leisure preference dummy (mainly leisure or entertainment oriented responses) was constructed. Certainly higher family income and assets implies greater availability of market inputs with which to increase the productivity of leisure activities. The presence of a spouse should, if leisure is complementary, enhance its value. Living in an SMSA provides a greater diversity of potential leisure activities. Poor health should limit a person's productivity in home, market or leisure, so it again is included here. Table 3 presents the end result of our attempt to specify variables which are determinants of the value of leisure. The adjusted explained variation is 13.9 percent, slightly less than f for the home productivity regression. With the exception of the coefficient of liquid assets, which is insignificant, the coefficients of the income and asset variables are all significant at the 5 percent level or better and are of the expected sign. The significant positive coefficient for liabilities may at first appear to be a contradiction. However, the acquisition of liabilities provides a means of subsidizing current consumption at the expense of future income. Poor health reduces the value of leisure and SMSA residence increases it as hypothesized. The leisure preference dummy is positively significant at the five, but not the one percent level. Being married has a mildly positive, but not significant

TABLE 3

Value of Leisure Regression

Dependent variable is natural logarithm of reservation wage.

Independent Variable	B value (t-statistic)
Married, spouse present	.034 (0.84)
Health is poor	-.070* (2.33)
Lives in SMSA	.122* (4.67)
Leisure preference dummy	.057** (2.12)
Total other family income 1/	.009* (3.90)
AFDC income 1/	.057** (2.25)
Liabilities 1/	.007** (2.20)
Liquid Assets 1/	-.001 (0.54)
Illiquid Assets 1/	.004* (4.57)
Constant	.194
$\bar{R}^2$	.139
F	17.45
N	916

1/ in thousands of dollars.

Note: Absolute value of t statistic shown in parentheses.

* implies significant at the .01 level.

** implies significant at the .05 level.

effect on the value of leisure. It is interesting to note that the married spouse present, and poor health variables, reverse importance between the W_h and W_l regressions, the presence of a spouse being much more important for home productivity, while poor health acts more adversely on the value of leisure. Given the dependent variable is identical in the two regressions, this intuitive result seems reassuring.

The methodological approach adopted in this study has been to restrict the list of potential determinants of W_h and W_l to variables believed to have a tangible direct effect. Thus, for instance, income which affects leisure, only indirectly affects home productivity in that income level determines the effective price the household must pay in terms of goodsforegone if the household wishes to substitute a market produced good or service for one produced at home. If meals out represent an insignificant financial burden, the value of home meals (holding quality constant) is thereby diminished. Thus the indirect effect of income on home productivity is negative. However, there is no way of restricting the coefficient of income to just the indirect effects on home productivity. Similarly, the presence of small children directly increases the value of a mother's time at home and more indirectly may enhance the value of her leisure. But in the absence of more specific information it is not possible to differentiate these separate functions. It therefore was decided to exclude variables having both direct and indirect effects from the regression in which the indirect effects appeared to be pre-eminent.

Having constructed instruments for home wage (W_h), leisure wage (W_l) and market wage (W_m), we proceed to test their relevance in explaining labor force participation. The first step was to assign values of W_h, W_l

and W_m, based on the calculated regression values, to each woman in the sample, whether labor market participant or not. The sample consists of the 5083 women interviewed in 1967, 53 percent of whome were in the labor market at some time during 1966. These were assigned a participation of value of 1, and the remainder of value of 0. Participation was then predicted by ordinary least squares regression. The results for two variants are shown in Table 4. In regression 1 the three values of time parameters, W_h, W_l and W_m are included together with variables reflecting health status,(the same dummy variable used in the W_h regression, indicating a self evaluation of health as fair or poor relative to good or excellent); bugetary needs (number of children, a dummy variable indicating positive husband's earnings and a dummy variable indicating whether a respondent is a welfare recipient); and differences in taste for market work between blacks and whites. All of the variables are highly significant, and have the a priori correct sign. As a comparison, regression 2 explains participation using only the time value parameters. The $\bar{R}^2$ drops considerably but the variables are highly significant and their coefficients are of the same order of magnitude as in the more fully specified model, suggesting that the findings with respect to the relative effects on participation of the time value parameters for this demographic group are fairly robust. Considering regression 1 we note that the three wages have different order of magnitude effects, with W_h being about five times as great and W_m twice as great as W_l. In terms of elasticities, $\epsilon_{p,W_h} = -.80, \epsilon_{p,W_l} = -.15$, $\epsilon_{p,W_m} = .40$.

Since our empirical specification has assumed the form of a linear probability model we are potentially vulnerable to the well known criticism of such models that because the predicted values are not constrained to lie in the (0,1) interval, the interpretation of coefficients as conditional

TABLE 4

Female Labor Force Participation Regressions

Independent Variable	Regression 1 B value (t-statistic)	Regression 2 B value (t-statistic)
Home wage, W_h	-.244 (5.96)	-.307 (9.28)
Leisure wage, W_l	-.045 (4.00)	-.052 (4.53)
Market wage, W_m	.109 (8.13)	.148 (10.71)
Health is poor	-.181 (9.47)	
Number of children	-.052 (14.92)	
Husband's earnings > 0	-.054 (3.75)	
Welfare recipient	-.115 (4.02)	
Race, 1 if Black	.189 (9.50)	
Constant	.978	.883
$\bar{R}^2$	.1135	.0291
F	82.33	51.78
N	5083	5083

Note: Absolute value of t statistic shown in parentheses.
All variables are significant at the 1 percent level.

probabilities is incorrect. Alternatively, a large number of predicted probabilities lying outside the (0,1) range is suggestive of a poor specification, and resulting biased coefficients. Fortunately, this does not appear to be a problem with the present results as the following tabulation of calculated values for regression 1 indicates.

TABLE 5

Calculated Values $(\hat{P})$ for Regression 1

	$\hat{P} < 0$	$0 \leq \hat{P} < .5$	$.5 < \hat{P} \leq 1.0$	$\hat{P} > 1.0$
	Number (percent of total in parentheses)			
In labor force 1966	3 (0.1)	896 (17.6)	1756 (34.5)	16 (0.3)
Outside labor force 1966	11 (0.2)	1457 (28.7)	944 (18.6)	0 (0.0)

Thus only 14 of 5083 observations or 0.3% of the total have predicted values less than zero, while only 16 observations are above 1.0. We conclude that the participation model has passed an important necessary test in order to be considered well specified.

As noted earlier, equation (11) implies that the ratio of the coefficient of W_h to that of W_l provides an estimate of the slope of the leisure function to that of the home productivity function. Based on regression 1 this ratio is 5.4 (5.9 for regression 2), which is in qualitative agreement with our expectation that the value of leisure declines more steeply with time input. However, this finding is thrown into jeopardy because the

estimated coefficient for W_h is in absolute terms greater than that for W_m, contradicting equation (11) which implies W_m have the largest time value coefficient. It is of course possible that the assumption of linear time value functions which underlies equation (11) proves to be grossly inappropriate. But we suspect the explanation for this discrepancy between theory and evidence does not reside here. Rather, it is more likely that the omission of reservation wage non-responders, which as argued earlier will tend to bias estimated values of W_h (and hence W_l) downward, is the main culprit. The mean for W_h across the full sample is \$1.74; for W_l it is \$1.77, and for W_m it is \$1.95. Given that perhaps two-fifths of the entire sample indicated or at least implied that the value of their non-market time was exceedingly high, an overall average non-market wage of \$1.74 (or \$1.77) strikes us as unrealistically low, even taking into account that fact that our estimated non-market wages are of W_h'' and W_l'', which given a minimum market time constraint must be less than the marginal value of home product or leisure.

Can a downward bias in the calculated values of W_h and W_l reconcile our results with theory? Suppose that the biased estimates, $\tilde{W}_h''$ and $\tilde{W}_l''$, were constant fractions of the true values, W_h'' and W_l'', as follows:

$$\tilde{W}_h'' = \gamma_h W_h'' \quad , \quad \tilde{W}_l'' = \gamma_l W_l''$$

where γ_h, $\gamma_l < 1$. Substituting the above for W_h'' and W_l'' in equation (11) we obtain a relationship in terms of the variables actually used in the participation regression, and their corresponding coefficients.

$$(12) \qquad P = \lambda W_m - \frac{\lambda d}{\gamma_h (b+d)} \tilde{W}_h'' - \frac{\lambda b}{\gamma_l (b+d)} \tilde{W}_l'' + C\beta + \epsilon$$

Note that the sum of the coefficients of the wage variables is no longer zero; hence, to attempt to introduce this constraint into the regression would be inappropriate. Assume further that $\gamma_h = \gamma_l = \gamma$, i.e., the biases in the non-market wages are equal. Then the sum of the coefficients of $\tilde{W}_h''$ and $\tilde{W}_l''$ is an estimate of λ/γ, which according to regression 1 is equal to -.299. Since the coefficient of W_m is an estimate of λ(.109 in regression 1), we have $\hat{\gamma} = .109/.299 = .365$. This would imply non-market wages that were underestimated by two-thirds; thus, an unbiased estimate of the mean W_h'' becomes \$1.74/.365 = \$4.77. This may strike the reader as too large, but perhaps not if non-responders truly value their non-market time highly. For instance, the result is roughly consistent with non-responders having an average reservation wage of nine dollars an hour, while responders and labor market participants have an average reservation wage of \$1.74 per hour.

The assumption that $\gamma_h = \gamma_l$ preserves the result that the slope of the leisure function is between 5½ and 6 times as large as the slope of the home productivity function [1/] If we accept this result the women in our sample, whether or not in the labour force, were not devoting a great deal of time to leisure activities. Given the demographic group involved this should not

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1/ For smooth W_h and W_l functions we have shown $W_h'' = W_l''$. How close $\tilde{W}_h''$ is to $\tilde{W}_l''$ (hence, in an average sense, $\gamma_h = \gamma_l$) will depend on differences in the distribution of home productivity and leisure determinants between the reservation wage responders and the full sample. For our sample, where the overall means differ by only 3 cents, these differences appear to be minor. Of course, the W_h and W_l functions might not be smooth and γ_h and γ_l based on average values might yield a very misleading picture for subgroups. How much difference this would make for the ratio of slopes is unknown.

come as a surprise. Further, the relatively large participation elasticity with respect to W_h is due to the large implied value for d, the leisure slope. [1/] Increased participation comes about when W_r's fall below W_m's (or W_m's rise above W_r's). Numerous authors have cited the evolution of "labor saving" devices for housework together with tastes for smaller families, and hence smallerhouses, as the prime factors responsible for the rising trend of female labor force participation. What this explanation fails to take into account and what our results suggest is that the upward participation trend has been greatly enhanced by a pronounced diminishing marginal utility for leisure among women. Some experimentation with Figures 1 and 2 should convince the reader that the steeper is the W_l function, the greater is the decline in W_r for a given downward shift in the W_h function. [2/] Conversely, the shallower is the W_h function, the more market work hours are released for a given rise in W_m (or,alternatively, the smaller is the rise in W_m required to release a given block of time for market work.) Thus, the shallow gradient of the W_h function compared to that of W_l has meant that women have been reallocating their time from home work to market work, rather than from leisure to market work. The traditional work-leisure dichotomy simply does not apply here.

1/ Biases in the magnitude of W_h and W_l will tend to generate offsetting biases in their regression coefficients, thus leaving elasticities computed at the mean relatively immune.

2/ The assumption of parallel shifts in the W_h function is of course purely for illustrative purposes. The introduction of labor saving household appliances might raise the intercept while increasing the slope. The qualitative results, however, are likely to be the same.

4. CONCLUSION

In this paper we have attempted to explore some theoretical and empirical implications of the process by which a woman allocates her time among three competing uses: home work, market work, and leisure. We have tried to develop a framework that is tractable yet realistic and this has involved compromises on both sides. We have tested our theory as it pertains to the labor force participation decision using the NLS Mature Females data set and found the major premeses substantiated.

We choose not to engage the reader in a lengthy summary of the many caveats and qualifiers that are most appropriate to this particular research undertaking, a number of which have already been discussed. Instead, we post the blanket qualification:

> "the data could have been better and the theory could have been better."

There is little we can do for the time being about the data. Were we seeking to refine the theory, the most pressing area and the richest terrain are probably located by extending the optimization process over multiple time periods. Presumably one implication of doing this is that the impact of the minimum market time input constraint is lessened, although we suspect more so in principle than in fact. Another implication is that our constructed time value parameters, which we have assumed functions of exogenous factors, are realized to have endogenous components. Thus, for instance, home wage depends importantly on the number of children, and this may be jointly determined with the participation decision. However, we do not believe that

a formulation which makes all decisions mutually determined is a very useful approach, unless it were to lead to a more analytically tractable model than a formulation which did not make this assumption. Obviously any movement to a full time horizon is going to entail difficulties, and so it is worth stating what we believe our single period analysis has to offer.

Our principal conclusion is that among females in the 30 - 44 years of age bracket, a cohort with the fastest rising rates of labor force participation in recent years, increased time in the labor market has been drawn primarily from home production time, rather than leisure time. Put otherwise, the costs to society of increased female labor force participations have been primarily foregone home product rather than foregone leisure. It seems to us that this finding has rather strong implications for social policy.

1. If society deems the trend towards greater labor force participation among middle aged females desirable, the adjustment process could be more readily accommodated and the foregone home product reduced by the development, either through the private or the public sector, of economical and attractive house-keeping and child-caring services, such as was once the province of two institutions, hardly with us any longer, domestics and the extended family.

2. Similarly, Employment Policy, and the policies of employers, should take account of the particular distribution of skills and aptitudes of labor force entrants among this demographic group, characterized as they are, by work and management orientation, and some deterioration of formal educational skills.

3. The divergence between the marginal productivity of home time, and the reservation wage is reduced, and the dead weight loss of foregone home product is lessened, as the minimum market time input, $\bar{T}_m$, is decreased. This is accomplished by designing jobs with lower, more varigated, more flexible time inputs. It seems to us that the market has been slow to evolve in this direction, despite at least one strong economic incentive: reservation wage declines with $\bar{T}_m$ (see equation (5)), thus making a woman with a given potential market wage more readily available to employers, and on cheaper terms. There may be sound cost efficiency reasons for maintaining standard, relatively inflexible time schedules, but we suspect the rigidity is as much mental as it is structural.

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