Leisure, Home Production, and Work--the Theory of the Allocation of Time Revisited

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Leisure, Home Production, and Work— the Theory of the Allocation of Time Revisited

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The paper tries to formalize the trichotomy of work in the market, work at home, and leisure. Time is used at home to produce home goods that are perfect substitutes for market goods, where home production is subject to diminishing marginal productivity. An increase in the market wage rate is expected to reduce work at home, while its effect on leisure and work in the market is indeterminate. An increase in income increases leisure, reduces work in the market, and leaves work at home unchanged. These conclusions are supported by empirical tests based on the Michigan Income Dynamics data, as well as by previous time budget studies. Further implications for labor supply, fertility, gain from marriage, demand for child care, and the measurement of home output are investigated.

I. Time Budget Evidence—Data in Search of a Theory

The household production function is by now an established part of economic theory. As formulated by Becker, Lancaster, Muth, and others, the new consumption theory emphasizes the fact that market goods and services are not themselves the agents which carry utility but are rather inputs in a process that generates commodities (or characteristics) which, in turn, yield utility. A second feature, introduced into the analysis by

Becker, is that market goods and services are not the only input in this process, the other input being the consumer's time. According to this approach (Becker 1965) the consumer maximizes welfare subject to the time and budget constraints where welfare is a function of commodities, which are produced using market goods and time.

The new approach has been put to wide use in the analysis of fertility, health, consumption, labor supply, and transportation demand (to name just a few). A fact that seemed to have been overlooked is that the theory does not really deal with household production in the common sense of the term.[1] It does deal with (to use Lancaster's terminology) consumption technology, but has very little to say (in its current form) on home production. It was Mincer (1962) who first pointed out that, at least in the case of women, one should distinguish between work at home and leisure, but this distinction (so common in everyday language) disappeared in Becker's more general formulation. This omission was partly due to practical difficulties in distinguishing between the two, given the large number of borderline cases (e.g., is playing with a child leisure or work at home?), but partly because it has not been shown that our understanding of household behavior would be enriched by the distinction. Whatever the reason, the theory of the allocation of time in its current form is of little help where it is most needed, namely, in the analysis of time-budget data.

From the theoretical point of view, the justification for aggregating leisure and work at home into one entity, nonmarket time (or home time), can rest on two assumptions: (a) the two elements react similarly to changes in the socioeconomic environment and therefore nothing is gained by studying them separately; and (b) the two elements satisfy the conditions of a composite input, that is, their relative price is constant and there is no interest in investigating the composition of the aggregate since it has no bearing on production and the price of the output. Both assumptions are suspect. Recent time-budget findings have established that work at home and leisure are not affected in the same way by changes in socioeconomic variables, and this paper shows that the composition of the aggregate affects many facets of household behavior, such as labor supply, specialization in the household, and demand for children.

A great deal is known about the household's labor force behavior but only little about how the family allocates its time within the home. It therefore seems worth recapitulating some of the major findings on the latter. The time-use patterns of American and Israeli families have been

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[1] One exception is Perlman (1969, chap. 1). Since writing the first draft of this paper, I have become aware of two others, Bloch (1973) and Sharir (1975). Both suggest models that are in many respects similar to the one suggested here but do not analyze all the implications.

TABLE 1

THE DETERMINANTS OF THE ALLOCATION OF TIME: UNITED STATES AND ISRAEL

	WIFE			HUSBAND		
	Work in the Market	Work at Home	Leisure	Work in the Market	Work at Home	Leisure
U.S. (1964):[a]						
Husband's wage	−	0	+	+	−	+(?)
Wife's wage	+	−	−	0	+	−(?)
Nonwage income.........	−(?)	−	+	−	0	+
Total N children.........	−	+	−	+	+(?)	−
Existence of preschool children......	−(?)	+	0	+	+(?)	−
Israel (1968):[b]						
Husband's schooling......	...	...	...	0	0	0
Wife's schooling..........	+	−	+(?)			
Total N children.........	−	+	−	+	+	−
N preschool children .....:	−	+	−	0(?)	0(?)	0(?)

[a] The results are based on Bloch (1973). Question marks denote cases where the direction of the effect depended on the functional form of the regression equations.
[b] Based on Gronau (1976a). Question marks denote cases where the regression coefficients are barely significant.

studied by Bloch (1973) and myself (Gronau 1976a). These findings are summarized in table 1, which presents the signs of the regression coefficients of the major determinants of the allocation of time. In spite of the differences in methodology and in the nature of the data used,[2] the two studies agree in pointing out that changes in the socioeconomic environment (e.g., changes in the wage rate, income, education, and the number of children) differ in their effects on work at home and leisure and on the allocation of time of husbands and wives.

According to the Israeli data, an increase in the wife's education results in an increase in the time she spends in the labor market. This time is withdrawn primarily from work at home, leaving leisure unaffected (and perhaps even increased). The U.S. findings are much more specific, distinguishing between income and price effects. An increase in the wife's wage rate increases her supply of labor and reduces both work at home

[2] The U.S. and Israeli data differ both in the nature of the dependent variables and in the degree of detail of the explanatory variables. In the American survey (the 1964 *Productive American* study), people were asked how much time they spent annually in regular and irregular housework and how much in market work. Leisure was defined in this study as the residual. In the Israeli survey (conducted by the Israel Institute of Applied Social Research in Jerusalem), people were asked how they had spent each hour of the preceding day. The survey included 48 activities which I classified into four major groups (work in the market, work at home, leisure, and physiological needs, only the first three of which are reported in table 1). The respondents' background data are much more detailed in the American survey. The Israeli survey does not contain any information on the person's wage rate, and one has to use education as a very imperfect proxy.

and leisure. A change in the wife's wage does not affect her husband's work in the market but is positively correlated with his work at home and, as a result, negatively correlated with his leisure. An increase in the husband's wage rate increases his own supply of labor (mainly at the expense of his work at home), but reduces his wife's. This change does not affect the wife's work at home, and consequently it increases her leisure. An increase in unearned income reduces the supply of labor of both husband and wife, it reduces work at home (at least in the case of women), and it thus increases leisure.

Finally, both studies concur that children cause their mother to transfer time from the market to home tasks. However, the amount of time transferred falls short of the additional time required to care for children, so that leisure is reduced. Children have the same downward effect where the father's leisure is concerned, but in this case the father increases both work at home and work in the market.

The total time available for work at home and leisure depends to a large extent on the person's employment status. Comparing the allocation of time of employed and nonemployed Israeli married women (table 2), one can observe that, when education is controlled for, the employed have less leisure than the nonemployed. The employed Israeli married woman worked on the average 4.3 hours in the market. She saved 2.8 hours by cutting her work at home, but 1.5 hours had to come at the expense of leisure and time spent on physiological needs.

Married men work more in the market than the unmarried, and married women spend more time than the unmarried in work at home (and somewhat less in the market). Consequently, it is observed (Gronau 1976a) that married people have less leisure than the unmarried, and the difference is greater for men than for women. These differences are explained by two factors—marriage and the existence of children. To isolate the effect of marriage, I ran separate regressions for all men and for all women who had no young children (i.e., children in age group 0–5, or alternatively in the age group 0–12). The dependent variable is the time spent on the activity, and the explanatory variables include the person's age, schooling, continent of birth, length of residence, and number of older children; marital status is represented by a dummy variable. (For lack of space, I do not present the detailed regressions here.)

Controlling for the number of children (and the other socioeconomic variables), I found that marriage reduces the Israeli wife's supply of work to the market and increases her work at home. The decline in work in the market (about 1.5 hours a day) is somewhat smaller than the increase in work at home (about 2 hours), but the difference is too small to be significant (time spent on physiological needs and, to a lesser extent, time spent on leisure decline, but the decline is not statistically significant).

TABLE 2

Time-Budget Survey—Average Time Uses of Israeli Married Women, by Education and Employment Status (1968)

	Years of Schooling											
	0–8			9–12			13+			Total		
	Employed	Not Employed	Total	Employed	Not Employed	Total	Employed	Not Employed	Total	Employed	Not Employed	Total
Age (years)	40.2	42.8	42.1	40.2	40.2	40.2	38.5	38.2	38.4	39.8	41.4	40.8
Schooling (years)	4.80	4.92	4.89	10.63	10.52	10.56	14.13	13.57	13.94	9.58	7.83	8.46
Continent of birth[a]	61	58	59	19	28	25	4	8	6	29	42	38
Number of children:												
Aged 0–5	0.46	0.74	0.66	0.41	0.68	0.58	0.44	0.70	0.53	0.43	0.71	0.61
Aged 6–12	0.98	0.93	0.94	0.24	0.51	0.42	0.34	0.49	0.39	0.51	0.73	0.65
Aged 13–17	0.85	0.90	0.89	0.38	0.35	0.36	0.34	0.35	0.34	0.53	0.64	0.60
Monthly income (IL)	670	546	578	990	843	896	1,380	915	1,221	983	694	797
Labor force participation (%)	...	...	26	...	...	36	...	...	66	...	...	36
Time use (hours):[b]												
Total work	9.18	7.79	8.15	8.82	6.84	7.55	7.87	6.28	7.32	8.70	7.29	7.79
Work at home	4.85	7.67	6.94	4.30	6.71	5.84	3.97	6.26	4.75	4.40	7.18	6.19
Work in the market	4.34	0.12	1.21	4.52	0.13	1.71	3.90	0.02	2.57	4.30	0.11	1.60
Physiological needs	9.95	10.30	10.21	9.49	10.36	10.04	9.78	10.62	10.06	9.71	10.35	10.12
Leisure	4.63	5.27	5.10	5.16	6.14	5.78	5.86	6.50	6.08	5.16	5.71	5.52
N observations	93	265	358	117	208	325	71	37	108	281	510	791

[a] Percent of cell born in Asia-Africa.
[b] Because of missing data the time uses do not always add up to 24 hours.

As for men, they hardly increase their work at home but significantly increase their supply of labor to the market (by about 2 hours). This results in a significant drop in married men's leisure.

These findings give rise to several questions: Why do education, the wage rate, and income differ in their effect on work at home and leisure? What explains the effect of children? What explains the differences in the allocation of time between labor force participants and nonparticipants? What explains the differences between men's and women's time-use patterns? How can one explain the effect of marriage, and what is the source of the asymmetry in the effect of marriage on the husband's and wife's time-use patterns? In answering these questions, we shall see that the distinction between consumption time and production time (i.e., leisure and work at home) has implications reaching far beyond the analysis of home time use, embracing such topics as labor supply, fertility, marital stability, consumption (and in particular the demand for substitutes for the person's home services), and the reevaluation of the contribution of housewives to total economic welfare.

The paper opens with a description of a theoretical model that seems to provide us with a unifying explanation of the observed time-use patterns. Some of the crucial assumptions of this model are tested in Section III. The implications of the model for the analysis of fertility, marital stability, the demand for housemaids and child care, and the evaluation of the output of the home sector are investigated in Section IV. A summarizing section discusses some qualifications and suggests some future research.

II. The Model

An intuitive distinction between work at home (i.e., home production time) and leisure (i.e., home consumption time) is that work at home (like work in the market) is something one would rather have somebody else do for one (if the cost were low enough), while it would be almost impossible to enjoy leisure through a surrogate. Thus, one regards work at home as a time use that generates services which have a close substitute in the market, while leisure has only poor market substitutes. In the extreme, though by no means unusual, case, work at home and work in the market are perfect substitutes as far as the direct utility they generate is concerned, and a person is indifferent to the composition of the goods and services he consumes, that is, to whether they are produced at home or purchased in the market.

Formally, let there be a single-person household. The person maximizes the amount of commodity Z, which is a combination of goods and services

(X) and consumption time (L),

$$Z = Z(X, L). \tag{1}$$

The goods can either be purchased in the market or produced at home, but the composition of X does not affect Z.[3] I shall measure the value of home goods and services (X_H) in terms of their market equivalents (i.e., the cost of the quality-corrected good in the market). Let X_M denote market expenditures; then total consumption is composed of the consumption of goods purchased in the market and those produced at home,

$$X = X_M + X_H. \tag{2}$$

Home goods are produced by work at home (H),

$$X_H = f(H), \tag{3}$$

subject to decreasing marginal productivity $(f' > 0, f'' < 0)$.[4] The decline in the value of marginal productivity at home is due not only to fatigue or changes in input proportions but also to a change in the composition of X_H—a shift, as H increases, toward activities that have a cheaper market substitute.

The maximization of Z is bound by two constraints: the (endogenous) budget constraint

$$X_M = WN + V, \tag{4}$$

where W is the person's wage rate (assumed to be constant), N denotes market work, and V other sources of income; and the time constraint[5]

$$L + H + N = T. \tag{5}$$

The necessary conditions for an interior optimum call for the marginal product of work at home to equal the marginal rate of substitution between goods and consumption time, which in turn equals the shadow price of time, W^* (eq. [6]). If the person works in the market $(N > 0)$, they

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[3] This assumption is crucial to the model and distinguishes it from previous formula tions such as $Z = Z(X_M, X_H, L)$ which had only very limited predictive power (Grona 1973).

[4] For simplicity I ignore the market goods that enter into the production of home good

[5] Thus one can easily rewrite eq. (1) as

$$Z = Z(X, L) = Z'(X, L, T - L) = Z'(X, L, H + N), \tag{1a}$$

i.e., eq. (1) does not imply that work at home and work in the market do not affe welfare, but merely that H and N are perfect substitutes as far as the consumption tecl nology (Z) is concerned.

will also equal the real wage rate, W (eq. [6a]).[6]

$$\frac{\partial Z/\partial L}{\partial Z/\partial X} = f' = W^*, \tag{6}$$

$$\frac{\partial Z/\partial L}{\partial Z/\partial X} = f' = W^* = W. \tag{6a}$$

These conditions are depicted in figure 1. The home production function is described by the concave curve $TB'_0 A_0 C_0$. The more time the individual spends working at home (as measured by the horizontal distance from point T), the greater the amount of home goods produced. If the individual spends all his time in work at home, he can produce an amount of OC_0 units of goods. In the absence of market opportunities, the curve $TB'_0 A_0 C_0$ is the opportunity frontier enclosing the set of all feasible combinations of X and L. The existence of a market where the person can sell his working time and buy market goods expands this set. Thus, given the real wage rate W (described by the slope of the line $A_0 E_0$), the person can trade his time for goods along the price line $A_0 E_0$ (the line tangent to the production curve $TB'_0 A_0 C_0$). At the optimum the person may choose a goods-intensive combination of X and L, such as B_0, where he enjoys OL_0 units of consumption time, spends $L_0 N$ time units on work in the market, and spends NT time units on work at home. Alternatively, the person may have a high preference for leisure (i.e., a leisure-intensive consumption technology), choosing as his optimum combination the point B'_0. In this case he does not work in the market, but splits his time between leisure (OL'_0) and work at home ($L'_0 T$).

Note that the person may adopt a goods-intensive technology, such as B_0, but it may still be home-time intensive in the sense that a large part of the goods are produced at home. Thus, leisure intensive and home-time intensive are not synonymous. Note further that if the marginal productivity of work at home at the point T falls short of the real wage rate, there is no home production and we are faced with the familiar Robbins diagram and the dichotomy of work (in the market) and leisure.

To analyze the properties of this model, let it be assumed that there is an increase in other sources of income by an amount of ΔV. An increase in other sources of income secures for the person the amount of OX_0 of

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[6] Eqq. (6) and (6a) are derived by maximizing the Lagrangian function $G = Z\{[X_M + f(H)], L\} + \lambda(WN + V - X_M) + \mu(T - L - H - N)$ with respect to L, H, N, and X_M. The shadow price of time (measured in real terms) equals $W^* = \mu/\lambda$, where μ and λ are the marginal utilities of time and income, respectively. The wage rate may fall short of the value of marginal productivity at home ($W < f'$), either because of the person's reluctance to perform the home services outside of his own home or because of differences in the value of marginal productivity between home and the outside, due to transport costs, monitoring costs, and efficiency (the person being self-employed in his own home).
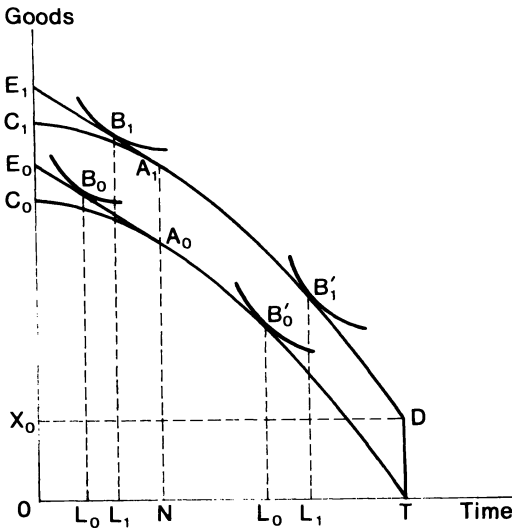
FIG. 1

market goods even if he spends all his time in consumption. The change is reflected, therefore, in a vertical shift of the production curve $TB_0'A_0C_0$ to $TDB_1'A_1C_1$. The change does not affect the marginal productivity of work at home—it does not affect the shape of the curve but only its location. Since the real wage rate is given, there is no change in the point at which the person finds it cheaper to buy the goods in the market than to produce them at home. If the person prefers a goods-intensive consumption technology which makes him work in the market (combination B_0), he does not change the amount of time he spends working at home (NT) and, given the pure income effect, he increases his amount of leisure (if leisure is not an inferior input) at the expense of work at the market (consumption time increases from OL_0 to OL_1 and work in the market is reduced from L_0N to L_1N).[7]

If, on the other hand, the person does not initially work in the market (point B_0'), the increase in income and the resulting increase in Z call for an increase in consumption time which can come only at the expense of work at home.

Let there be an increase in the real wage rate W (fig. 2). If the person works in the market (point B_0), a change in wages affects both the rate of substitution between consumption time and goods and the profitability of home production. The increase in wages lowers the price of goods in terms of time, thereby making home production less profitable and

[7] The decline in work in the market may result in the person's dropping out of the labor force altogether.
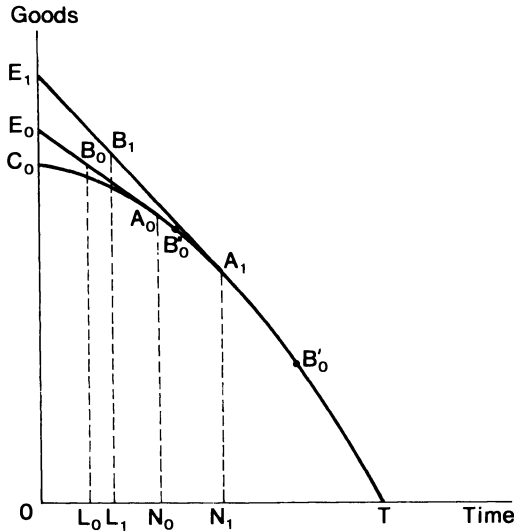
FIG. 2

inducing substitution of goods for consumption time. This change will, therefore, definitely cut work at home (from $N_0 T$ to $N_1 T$), while its effect on leisure is indeterminate. The substitution effect tends to reduce leisure, while the expansion effect tends to raise it. As for work in the market, it depends on the extent of the reduction of work at home and on the change in consumption time. If the reduction in work at home exceeds the increase in leisure (if there is one), the supply of work to the market increases. The tendency of this supply curve to be positively sloped increases, the greater the rate of substitution between goods and consumption time, the less sensitive the marginal productivity in home production to changes in the amount of work, and the smaller the income elasticity of leisure.

If the person initially does not work, the change in wages may lure him into the market (point B_0''), or he may be completely unaffected (point B_0').

A third kind of change worth examining is a change in productivity. It is impossible to predict the implications of this change without specifying the exact nature of the changes in home productivity (i.e., changes in f) and consumption technology (i.e., changes in Z). In the absence of the necessary information, one's predictions are limited to the case where the person works in the market. In this case a change in consumption technology would affect work in the market and leisure but would leave work at home unchanged. On the other hand, an increase in the productivity of work at home is associated with an increase in real income and an
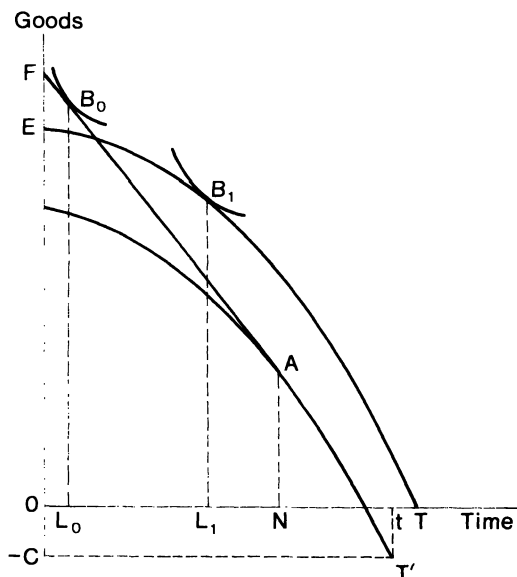
FIG. 3

increase in leisure, but its effect on work at home and work in the market is indeterminate.

Up to this point, it has been assumed that entry into the market is costless. In practice, work in the market involves costs in terms of both money and time. Let these costs be C and t, respectively, and let them be independent of the amount of work N (e.g., transportation costs and time).[8] The introduction of these costs calls for some modification of the budget and time constraints

$$X_M + \delta C = WN + V, \tag{4a}$$

$$L + H + N + \delta t = T, \tag{5a}$$

where δ is a dummy variable that describes the person's employment status

$$\delta = \begin{cases} 1 \text{ when } N > 0 \\ 0 \text{ when } N = 0. \end{cases} \tag{7}$$

The person is faced by two alternative opportunity sets (fig. 3). If he stays out of the labor force and confines himself to home production, he can choose any point on the boundary TB_1E. On the other hand, if he decides to join the labor force, he suffers a loss of t units of time and C

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[8] Variable time and money costs (i.e., costs that vary with N) can easily be treated by an appropriate modification of the wage rate.

units of X, but his opportunity locus becomes $T'AF$. Given these opportunity sets, a person with a greater preference for goods will join the labor force (point B_0), spending OL_0 units of time on leisure, working in the market for L_0N units, working at home for Nt units, and, say, traveling to work for tT units of time. A person with a greater taste for leisure will decide to stay out of the market (point B_1), dividing his time between leisure and work at home (OL_1 and L_1T, respectively). Given the opportunity set, labor force participation is therefore associated with a decline both in leisure and in work at home.[9] The existence of entry costs does not, however, affect our previous conclusions about the effect of changes in the socioeconomic characteristics on the allocation of time.

The predictions of this simple model are by and large consistent with the reported findings. An increase in the wage rate should not affect the allocation of time of the nonemployed but should reduce the work at home of the employed. Thus, on the whole, one would expect the wage rate and work at home to be negatively correlated. The effect of a change in the wage rate on leisure depends on the relative magnitudes of the income effect and the substitution effect. The tendency for the income effect to dominate increases with the number of hours worked in the market. Thus, it is not surprising that the substitution effect is the dominant factor in the case of the wife's leisure, but the two effects cancel out (or even the income effect dominates) in the case of the husband's. An increase in nonwage income should not affect the work at home of employed persons but should reduce the work at home of the nonemployed. Consequently, one expects nonwage income and the wife's work at home to be negatively correlated. On the other hand, in the case of men, who are mostly employed, the negative effect should be much less pronounced and may be nonsignificant. In either case, one expects nonwage income and leisure to be positively correlated. Finally, in the presence of market entry costs, employed persons should spend less time on work at home than the unemployed, but this difference is swamped by the difference in the market hours. Consequently, one expects the employed to work longer hours (in the market and at home) and enjoy less leisure, other things being equal.

The model can easily be extended to the case of two commodities. In this case the person maximizes the welfare function $U(Z_1, Z_2)$ subject to the constraints imposed by the transformation curve between the two commodities. The latter depends on the consumption technology of each commodity (eq. [1]), the home production function (eq. [3]), and the time and budget constraints. The comparative-static properties of the extended model are very similar to those of the one presented earlier and

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[9] An alternative interpretation of the different patterns of time use of the employed and nonemployed traces them to differences in productivity at home, the less productive person having a stronger inclination to join the labor force.
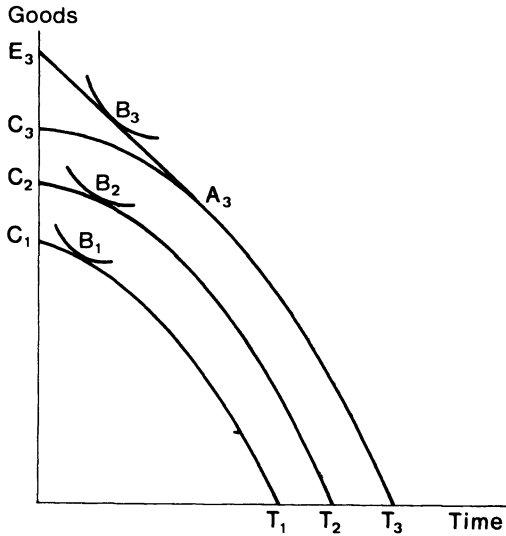
Goods

Fɪɢ. 4

will therefore not be discussed here.[10] However, the extended model sheds new light on the effect of children on the allocation of time.

An increase in the number of children (or the introduction of children) is associated with a transfer of time to child-related activities. The additional time units devoted to children are spent on work at home and leisure (a horizontal shift from $T_1B_1C_1$ to $T_2B_2C_2$ in fig. 4). Eventually the opportunities for profitable home production are exhausted, and any additional units of time spent on the commodity of children will be spent on work in the market (which will permit the purchase of child-related market goods) and leisure, leaving work at home unchanged (curve $T_3A_3B_3E_3$).

When the person participates in the labor force, the time withdrawn from other activities is initially withdrawn from work in the market and leisure, curtailing the market goods and consumption time associated with these activities. If the person is not a labor-force participant, the entire time is naturally withdrawn from work at home and leisure.

The overall effect on the allocation of time of introducing children (or of an increase in their number) depends on the leisure intensity of child-related in comparison with other activities and on the profitability of home production of child-related services. It is my contention that children are less leisure intensive (i.e., more goods intensive) than other activities. Thus an increase in the number of children at the expense of other

[10] For a detailed discussion see an earlier version of this paper (Gronau 1976*b*).

activities should reduce the person's leisure. The effect of children on work at home and in the market depends on the profitability of home production. Women are, usually, offered lower wages than their husbands, and they may also be more productive in home production. An increase in the number of children therefore leads working mothers to work less in the market and more at home. Similarly, nonparticipants shift time from less goods-intensive to more goods-intensive activities, increasing their work at home. The scope for profitable child-related home production is much more limited for the husband. In his case one can therefore expect to observe that the shift to the more goods-intensive commodity (i.e., children) results primarily in increased work in the market (though there may also be an increase in work at home).

The price of market substitutes (maids, nursery school, kindergarten, school) declines as the child grows older. Put differently, as the child grows older, the real wage of the mother (in terms of market substitutes) increases. This increase leads to a decline in work at home and an increase in work at the market, but need not increase the demand for leisure much.[11]

Similarly, it seems that in Israel the prices of market substitutes (maids, nursery school) are cheaper than in the United States.[12] Thus, an Israeli mother should find it less profitable than an American one to divert time from work in the market to work at home when she has a child. The supply of labor of Israeli women, in particular the more educated ones, should therefore be less affected by young children than that of their American counterparts (Gronau 1976a).

Additional insights are gained by extending the model to the multi-person case and, in particular, the case of the married couple. Marriage introduces into people's choice set a new activity, "married life." The new activity uses home-produced goods in its production and thus involves an increase in work at home at the expense of work in the market. Furthermore, to the extent that this loosely defined activity is more goods intensive than the other activities, it should also reduce leisure. Marriage may, however, have a more fundamental effect on household members' allocation of time by allowing for specialization within the family. Much of the preceding discussion is based on the proposition that a person is reluctant (or finds it unprofitable) to sell his home goods outside the household. This assumption is, however, relaxed in the family context. Greater market involvement and discrimination result in the husband's

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[11] The goods intensity of children may decline and thus leisure may increase as the child grows older. However, as long as children are more goods intensive than other activities, they should be associated with a decline in leisure.

[12] In Israel many of the 2-year-olds and most of the 3–4-year-olds attend a nursery for at least 4 hours a day. In 1968 over 40 percent of the working mothers with a child of less than 3 years old employed a maid (the fraction for working mothers with 13+ years of schooling was two-thirds).

wage rate being higher than his wife's; on the other hand, on-the-job training may make women more efficient in home production. There is therefore an incentive within the family to trade goods for time. Leisure is, by definition, an input which the person has to provide himself. Thus, there is no way in which the wife can save leisure for her husband. She can, however, save him work-at-home time. Indeed, the woman who is reluctant to sell her home goods (e.g., serve as a maid) is willing to exchange them within the family for market goods. The extent to which such an exchange takes place and the terms of the exchange depend to a large degree on her marginal costs of producing these goods.

If before marriage a woman obtained some of the goods solely through home production, the price she places on them is below that paid by her husband in the market. Specialization and trade within the family should increase the family members' welfare. The wife expands her home production while the husband increases his work in the market.[13] On the other hand, if both participate in the labor force and there is no good or service which is supplied solely though home production (i.e., $X_M > 0$ for all goods for both husband and wife), then it can be shown (Gronau 1976b) that before marriage both members face the same set of prices and marriage does not yield any gains of trade.

III. Some Empirical Tests

The model gives rise to a wealth of testable hypotheses. Although many of these hypotheses could have been generated also by other models, which use a weaker set of assumptions (e.g., the models discussed in my 1973 and 1976a papers), none of them generates this model's prediction concerning the income effect on work at home. A crucial test of our analysis focuses, therefore, on this effect: Does an increase in unearned income reduce the work at home of the nonemployed while leaving the work at home of the employed unaffected? The examination of this hypothesis is the subject of this section.

The data used are the 1972 panel of the Michigan Study of Income Dynamics. Given the peculiar characteristics of the subsample of non-employed men (e.g., a mean age of 68), I confine the discussion to the time usage of white married women. The sample included 1,281 women, of whom 660 were employed at some time during the preceding year and 621 reported that they did not work in 1971. The dependent variables consisted of the time spent working in the market (including travel to

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[13] The wife's tendency to specialize in work at home is reinforced if work in the market involves fixed entry costs. Marriage offers the woman a job which does not involve these fixed costs at terms which may not be much inferior to her market wage rate. As a result, the wife may be tempted to drop out of the labor force and concentrate on work at home.

work), the time spent in housework, and leisure.[14] The explanatory variables included the wife's age, education, and labor force experience (i.e., full-time work) since the age of 18, the husband's education and wage, the family's unearned income, the number of children below the age of 18, the number of children at school, and the number of rooms in the home. The regressions were estimated for the whole sample and separately for the employed and the nonemployed.[15]

The findings for the whole sample closely resemble those reported earlier in Section I and are therefore not presented here. Table 3 presents the results for the two subsamples separately. The results confirm the predictions of the model. When the wife is not employed, her work at home is negatively affected (and her leisure is positively affected) by her unearned income and her husband's wage rate. Children tend to increase her home tasks, but schoolchildren less so than younger ones. Her work at home is negatively associated with her education, but positively associated with the size of her house. As predicted, her potential wage rate (as approximated by her past labor force experience) does not affect her allocation of time.

When the woman is employed, a major determinant of her allocation of time is her wage rate. This variable explains the negative effect of labor force experience on work at home and leisure and the negative effect of the wife's education on her work at home (education and leisure are positively correlated in this regression, but the regression coefficient is nonsignificant). Children have a negative effect on their mother's leisure, the time withdrawn from the market falling short of the increase in housework. As the child grows older and enters school, housework diminishes, but this change results in hardly any gains in leisure—the time saved in work at home is diverted back to the market.[16] Most important for our analysis is the income effect. The husband's wage has a significant positive effect on leisure, but no effect on work at home.

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[14] The families reported on the number of weeks worked, the number of hours the wife worked per week, and the number of hours spent in housework in an average week. (Housework is not defined in the questionnaire, but the examples mentioned are cooking, cleaning, and other work around the house. Thus, it is not known whether the families included such activities as child care and shopping in housework.) I defined leisure as the difference between 8,760 hours per annum and the number of hours reported worked in the market and at home.

[15] Separating the sample by employment status may give rise to selectivity biases. I tried to correct for these, but had very little success because of the strong multicollinearity between the correction coefficient and the rest of the explanatory variables. It is comforting to learn that a recent attempt to correct selectivity biases in labor supply (Cogan 1976) has generated results that do not differ much from simple OLS estimates based on a sample of working wives.

[16] The effect of children on leisure, as presented in table 3, is significant at the conventional 5 percent level only if one uses a one-tailed test. However, if one removes the variable schoolchildren from the regression, the variable number of children turns out to be highly significant by any standard (i.e., t-values that exceed 3).

TABLE 3

The Determinants of the Allocation of Time of Married Women in the United States, by Employment Status[a]

	Not Employed		Employed					
	Work at Home		Work in the Market	Work at Home	Leisure	Work in the Market	Work at Home	Leisure
Constant	1,669.40	1,677.29	1,953.51	1,155.30	5,651.19	−9,310.70	3,213.34	14,857.36
	(6.74)	(6.69)	(8.44)	(5.32)	(21.37)	(9.14)	(3.30)	(12.61)
Wife's age	−1.165	−1.312	−15.745	3.895	11.850	−14.965	4.084	10.881
	(0.37)	(0.41)	(5.01)	(1.32)	(3.30)	(5.08)	(1.45)	(3.19)
Wife's education	−53.469	−53.811	20.740	−36.262	15.522	−241.312	11.883	229.429
	(3.28)	(3.29)	(1.36)	(2.53)	(0.89)	(8.47)	(0.44)	(6.97)
Husband's education	22.668	22.511	−32.781	14.412	18.369	−31.028	14.000	17.028
	(1.82)	(1.81)	(2.38)	(1.12)	(1.17)	(2.30)	(1.09)	(1.09)
Husband's wage ($/hour)	−16.129	−16.199	−24.017	−8.048	32.065	-151.896	15.264	136.632
	(2.21)	(2.22)	(1.80)	(0.64)	(2.11)	(8.89)	(0.93)	(6.91)
Unearned income ($10/year)	−0.441	−0.445	−0.660	0.210	0.451	−0.598	0.197	0.401
	(2.23)	(2.24)	(2.39)	(0.81)	(1.43)	(2.21)	(0.76)	(1.28)
Children aged 0–17	327.654	327.843	−198.781	278.141	−79.359	−189.559	276.025	−86.466
	(6.94)	(6.94)	(4.94)	(7.37)	(1.73)	(4.81)	(7.31)	(1.90)
Children at school	−125.196	−124.926	123.216	−104.465	−18.752	98.394	−100.098	1.704
	(2.86)	(2.85)	(3.24)	(2.93)	(0.43)	(2.64)	(2.81)	(0.04)
Rooms	83.251	83.207	6.446	27.467	−33.912	−3.502	29.148	−25.646
	(3.17)	(3.16)	(0.28)	(1.29)	(1.31)	(0.16)	(1.37)	(1.00)
Wife's experience	...	0.808	38.498	−6.244	−32.254	...	...	...
		(0.21)	(9.57)	(1.65)	(7.02)			
Wife's expected wage (log; ¢/hour)	...	...	...	...	...	2,810.95	−514.77	−2,296.18
						(11.11)	(2.13)	(7.85)
R^2	.26	.26	.19	.17	.11	.23	.17	.12
N observations	621	621	660	660	660	660	660	660

[a] Numbers in parentheses = t-ratios.

Similarly, work at home is not affected by changes in unearned income; their effect on leisure is positive, though weak. It is also worth noting that the work at home of employed women is not correlated with the size of their house—presumably any extra work associated with extra rooms is done by maids (or other market substitutes).

To isolate the wage effect from other effects associated with education, I introduced this variable directly into the regression. Since the survey does not include direct information on the hourly wage rate, hourly earnings are computed by dividing annual earnings by annual hours (i.e., by the product of weeks worked and weekly hours). This procedure generates serious measurement errors which bias the estimate of the wage effect. To overcome this problem, I used an indirect approach: At the first stage I estimated the wage function; at the second stage I introduced the imputed (log) wage in the time use functions. The estimated wage function was of the semilog variety, the explanatory variables being the wife's education (ED), her labor force experience (EX), and her husband's wage rate (W_h)

$$\log W = -0.5955 + 0.0905ED + 0.0302EX - 0.0006(EX)^2$$
$$ (9.18) \qquad (4.72) \qquad\quad (2.99)$$
$$+ 0.0442W_h$$
$$ (4.75)$$

$$R^2 = .20$$

where the wages are measured in dollars and the numerals in parentheses denote the corresponding t-values.

The results of the second stage (table 3) do not diverge much from our previous findings. The wage rate has a strong negative effect on both leisure and work at home. Education is positively correlated with leisure, but its effect on work at home (though positive) is not significant. (The direct effect of education on number of hours worked in the market is therefore negative.) Finally, the pure income effect is as predicted: neither unearned income nor the husband's wage rate affect the employed woman's work at home.[17] Our model also passes this test successfully.

IV. So, What's New?

The model has been shown to yield a comprehensive yet concise interpretation of the findings on the allocation of time between work in the market, work at home, and leisure. It explains the different behavior

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[17] Comparing the regression coefficients of unearned income in the work-at-home, leisure, and work-in-the-market equations, one observes that the first two are nonsignificant while the last is significant. This difference is explained by the better fit of the last equation. The difference between the husband's wage effect and the effect of unearned income is due primarily to differences in the units of measurement (dollars per hour and dollars per annum, respectively).

patterns of people with different incomes, wages, and education, and the effect of children on the allocation of time. It accounts for the different patterns observed for men and women, the married and unmarried, the employed and nonemployed; and it appears, on the whole, to provide the economist with more refined tools for analyzing time-budget data. But does the theory extend our understanding of household behavior beyond this goal? In this section I shall try to show that the ramifications of the theory reach far beyond the analysis of time use.

The Supply of Labor

The most direct application of our model is, of course, to the analysis of labor supply. In the short run the two most important economic factors affecting the supply of labor of married women are income and wage rates. According to our analysis, the income effect works primarily through its effect on leisure. On the other hand, wage increases tend to increase the supply of labor by reducing work at home, but their effect on leisure is indeterminate. Given the wage effect on leisure, the labor supply is more elastic the greater the sensitivity of work at home to changes in the wage rate (i.e., the smaller the effect of H on f'). For that reason alone, one would expect the supply of labor of married women to be more elastic than that of men. But the analysis brings up a further point: A wage increase may result not merely in a shift from work at home to work in the market but also in reduced leisure—employed women have less leisure than the nonemployed. Indeed, according to the estimates presented in table 3, the marginal effect of a wage change on the leisure of the employed is more than four times that on work at home, although the wage elasticities are almost identical (about 0.4). Admittedly, some of these changes in leisure may be due to changes in activities which are normally regarded as work at home but were not defined as housework by the respondent,[18] but it is hard to believe that this misclassification explains such a great difference.

Recent decades have witnessed a great expansion in the labor supply of married women. Still, with only about half of married women participating in the labor force, and with the number of working hours of employed women equaling the number of hours they put in on work at home, it looks as if this resource has only been partly tapped for future expansion. A natural question is to what extent will the labor-supply function of married women resemble that of their husbands once they reach similar labor force participation rates? Right now any answer to this question should be regarded as sheer speculation, since so much depends on changes in role differentiation and on reallocation of work

[18] See n. 14. According to the Israeli data, housework (not including child care) accounts for only two thirds of the time defined by me as work at home.

at home within the family. It is, however, worth noting that right now women are more willing to dispense with leisure in response to wage increases than men (the change in leisure induced by a 1 percent change in wages is almost twice as great for employed wives as for their husbands) and that men are apt to increase their leisure in response to an increase in income much more than women (the ratio of the income effects is about 5:1).[19]

In the long run, changes in wages are associated with changes in education. But while in the short run wage increases, education given, reduce both work at home and leisure, changes in education (when the wage is not held constant) affect only work at home. The long-run prospects for increased labor supply due to increases in education are therefore much more limited. On the other hand, one can expect further expansion in labor supply if the increase in education and wages is associated with a decline in fertility.

The Demand for Children

It is customary for economists (e.g., Willis 1973) to argue that children are a home-time-intensive activity and that an increase in children therefore reduces work in the market. A corollary of this contention is that since children are time intensive, an increase in their mother's wage rate should raise their price relative to that of other commodities. Given our analysis, one has to distinguish between home-time intensity and leisure intensity (or average and marginal home-time intensity). Children may be home time intensive when they are introduced into the household, since some of the goods used in the activity can be profitably produced at home. However, as the activity increases, the profitability of home production diminishes and eventually the family relies solely on market goods (on the margin). At this point the goods-intensive nature of children becomes apparent. Thus a wage increase raises the price of children in the range where children's goods are produced at home; but when these goods are market produced, the price of children is reduced by a wage increase. The tendency to replace home goods by market goods increases with the mother's wage rate. Thus, one would expect that the price of children increases with the mother's wage for low-wage mothers but that this relationship is reversed as the mother's wage increases. Ben-Porath (1973) observes a transposed J-shaped relationship between fertility and education for Israeli women: Fertility declines with education, but there is a slight inflection at the top. These findings are consistent with the

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[19] The findings for the employed married men (not presented here) are based on the same sample as those for the women.

prediction of the model.[20] The price of housemaids relative to the wife's wage seems to be lower in Israel than in the United States, and the tendency to substitute housemaid services for wife's time is therefore greater in Israel. Consequently, the transposed J-shaped relationship between fertility and wife's education should be more pronounced in the Israeli data.

The price of market substitutes relative to the wife's wage declines as the child gets older, and the goods-intensive nature of children therefore becomes more explicit. The relative price of "older children" has a greater tendency to decline as the parent's wage increases. The overall effect of changes in the wage rate on the present value of the cost of children is therefore indeterminate and depends on the price of market substitutes, the rate of discount, etc.

Gains from Marriage

Previous studies (e.g., Becker 1973) have asserted that gains from marriage depend on the husband-wife wage ratio. Other things being equal, the higher the husband's wage rate relative to his wife's the greater the opportunity for specialization within the household and the greater the gains from trade. This conclusion must be somewhat modified if one realizes that there exists no direct way of trading leisure and that the exchange is confined to home goods. The scope for gains from exchange within the household is limited by the profitability of home production. The latter in turn depends on the wife's home productivity and the price of market substitutes. Given the wife's home productivity and the price of market substitutes, the higher the wife's wage the greater the probability that any change in her activities will not affect her home production. In this case the prices of goods confronting men and women are the same and there are no gains to be reaped from trade. The gains from trade therefore decline as the wife's wage increases irrespective of the husband's. The increase in marital instability which has accompanied the increase in women's real wage rates and their increased labor-force participation is consistent with the prediction of the model, though one does not observe any substantial narrowing of the sex wage gap (Fuchs 1974).[21]

[20] Ben-Porath (1973) explained this relationship in a somewhat similar fashion, arguing that if the elasticity of substitution between time and goods in the production of children exceeds unity, children may be a time-intensive commodity for low-wage mothers but a goods-intensive commodity for high-wage mothers.

[21] Fuchs (1974) reports that the sex differential in hourly earnings of white nonfarm employed hardly changed in the last decade (from 0.61 in 1959 to 0.64 in 1969). Moreover, the differential for the young (below 35) married (the group most prone to divorce) has even slightly increased (from 0.73 to 0.70).

Taxes, Child-Care Programs, and the Demand for Domestic Help

It is often claimed that the wife's entry into the labor force involves costs such as child-care and housemaid services which by far exceed the husband's cost of entry. According to this argument, child-care services should be tax deductible, as are books or other costs a person must undertake in order to work. This argument has been accepted by many legislators and incorporated into the tax laws.

The economic validity of such deductions apart, it seems that this popular argument is wrong. An increase in expenditures on child-care services is associated with the wife's work in the same way an increase in the expenditures on a gardener is associated with the husband's work. Unlike expenditures on books or commuting costs (and time), which are a prerequisite for work, they are a cost which the family willingly undertakes because it finds that it is unprofitable for the wife to spend her time in child-care activities.

The analysis emphasizes, however, an additional point. In evaluating the various child-care programs which have been proposed or enacted in recent years, one has to distinguish between their effect on the marginal rate of substitution between goods and leisure and their effect on the profitability of home production. Assume a one-commodity world where the only commodity is children. A program which gives the mother a fixed child-care subsidy for every hour worked is equivalent to a wage increase and affects both the profitability of home production and the price of leisure. On the other hand, a fixed cash rebate or free child-care services which are conditional on a minimum number of working hours do not affect the profitability of home production of working women and may only affect their demand for leisure. When it comes to non-employed women, this kind of program encourages labor force participation (in particular if entry into the market involves fixed costs) and may affect both home production and leisure. Finally, a tax deduction for child-care expenditures which declines gradually with earnings may affect home production but need not affect the price of leisure.

It has been argued (Heckman 1974) that to evaluate and compare the impact of various programs on labor supply and welfare it is sufficient to know the indifference curves between market goods and nonmarket time. Our analysis indicates that this knowledge may not be sufficient and that a thorough evaluation may require specific information on both the household production function $f(H)$ and consumption technology (Z).[22]

Finally, it seems at first puzzling that work at home is so insensitive

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[22] One can easily incorporate in the analysis additional proposals (e.g., a subsidy confined to institutional forms of child care) and complicate it by introducing additional activities or exchange within the household, but this would not change our basic conclusion.

to changes in income, given the high income elasticity of the demand for housemaids.[23] The puzzle is solved, however, if one realizes that the demand for housemaid services (like that for many other services) is an excess demand. An increase in income does not increase the profitability of producing these services at home when a person is employed and reduces the profitability when he is not employed (the shadow price of time increasing). Thus, changes in income may have a strong effect on the excess demand for these market services and no effect (or even a negative one) on home services.

The Evaluation of Home-Sector Output

A long-standing complaint against the current national accounting system is its omission of the output of the nonmarket sector and, specifically, the output of wives at home, which according to some estimates (Morgan, Sirageldin, and Baerwaldt 1966) constitutes close to 40 percent of measured GNP. Several attempts have been made to correct this shortcoming (Morgan et al. 1966; Nordhaus and Tobin 1973; Sirageldin 1969), but these attempts were accompanied by controversy over which prices should be used to evaluate the wife's output. Should one infer the value women assign to their time and use that (Gronau 1973), or should one use the market prices of the services rendered by the wives (Walker and Gauger 1973)? The present model provides an analytical tool to resolve this controversy.

If the wife works in the market and at least some of each good is purchased ($X_{Mi} > 0$), her value of marginal productivity at home equals her wage rate ($f_i' = W$). Since most of the goods produced at home are services, she assigns to them a value that equals the wage she would have to pay somebody else to do the work for her divided by the average productivity of that person ($= W_H/AP_{Hi}$). The value placed on the last unit of work at home is therefore $W = W_H f_i'/AP_{Hi}$. Using the wage W_H of the services worker who can replace the wife in home production serves as a good approximation for the value of her time only if his or her average productivity equals the wife's marginal productivity. If $f_i' > AP_{Hi}$, the wage of the services worker will understate the price the wife assigns to her marginal unit of time in work at home.

Similarly unsatisfactory seems to be the method that uses the person's wage rate for the imputation. Women who do not participate in the labor force assign to their time a price that exceeds the wage they expect to get in the market. More important, the wage rate may serve as a close approximation to marginal, but not average, productivity at home. The

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[23] Using Israeli data (the Family Expenditure Survey 1968–69), I found that even when one controls for the wife's education and employment status, the income elasticity of housemaids exceeds unity.

product of the average wage rate and the number of hours worked at home therefore understates the value of home production to the extent that diminishing marginal productivity prevails. This imputation does not account for the rent (i.e., the producer's surplus) accruing to a person who is self-employed in his own home.

V. What Next?

I believe that this paper provides ample evidence for establishing the distinction between work at home and leisure as an integral part of the theory of the allocation of time and household production. It has been shown that this distinction is a prerequisite for any further investigation of time-use patterns and is highly useful in the analysis of fertility, marriage, child-care programs, labor force participation, and the evaluation of the output of the nonmarket sector. I am confident the model will also be found fruitful for the analysis of problems in other fields, such as medical economics or transport demand, in which the household production model has been put to good use.

It is clear that the model is incomplete. I expect major criticism to be launched against the assumption that work at home involves the same marginal utility as work in the market. Child care, cooking, gardening, etc., clearly create direct utilities (positive or negative). The psychic income derived from these activities relative to that derived from work in the market may vary with the person's socioeconomic characteristics and affect his behavior. Admitting the validity of this criticism, I contend that it is not more serious than in the case of the dichotomy of home time versus work in the market. Psychic income (or leisure on the job) is an important determinant of investment in human capital, occupational choice, and the supply of labor. Economists so far have not been able to derive a satisfactory method of isolating this factor. This has not prevented research on the determinants of the supply of work to the market, and it should not block research on the supply of work at home.

A second point of criticism may focus on the neglect of joint production and joint consumption. These are important features of human behavior which are not adequately treated by our analysis.[24] But in this respect our model does no worse (and no better) than the current model of household production (Pollak and Wachter 1975).

Finally, in the empirical part of this paper I have explored only a small fraction of the implications of the model for the allocation of time and consumption patterns of the household. Topics such as the interaction

[24] It may very well be that the observed goods intensity of children can be traced to joint consumption and production. Much of the satisfaction derived from children and much child-care activity involves just having children around while doing other things, such as cooking or watching TV.

between work at home and substitute market services or the interaction between entry costs (time and money) and time use have only been touched upon. More ambitious endeavors, such as the estimation of the household production function and the value of home output, are still in a preliminary stage. However, given the right data, it is hoped that this paper will facilitate their realization.

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