The Allocation of Time to Household Work

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This paper is based on material in my Ph.D. dissertation, "The Allocation of Time to Market and Non-Market Work Within a Family Unit," (Stanford University, 1973). I would like to thank the members of my reading committee, Mordecai Kurz, John Pencavel, Michael Hurd, and Michael Boskin, for their assistance. I am also grateful to Orley Ashenfelter for helpful discussions. Mark Kuskin assisted in the calculations.
I. Introduction

The objective of this paper is to examine empirically the allocation of time to non-market work within American family units. The data to be analyzed, originally compiled for the Productive Americans study (Morgan et. al. [1966]), contain information on hours worked in both the labor market and the household, thereby permitting an investigation of time allocation beyond the "labor-leisure" dichotomy. The housework data are particularly valuable because they permit more detailed assessments than can be obtained with labor market data alone of (1) the total productive activity taking place in the American economy, (2) the impact on work effort of government income support programs, and (3) the time allocated by individuals to leisure (non-work) activities.

Some aspects of these data are described in Section II. Then, in Section III, methodology applied in the market labor supply literature is used to examine the allocation of time to housework for American husbands and wives. Of particular interest are the calculated income effects and substitution effects of wage rate changes on the time allocated to housework for which, so far as I am aware, no other estimates exist.
II. Data

The data source for the equations estimated below is the National Study of Working and Planning, Project 745, compiled at the University of Michigan Survey Research Center in January-February 1965. These data were originally collected for the Productive Americans study by Morgan et al. (1966) and were obtained through personal interviews with 2214 family heads living in the conterminous United States. Observations refer to the year 1964.

The analysis of this paper is focused on a subset of these 2214 families, namely, those families consisting of a married couple and their children, if any, in which the husband is employed and neither spouse is a student, disabled, or a recipient of transfer income.1/ Eight hundred and fifty families satisfy these criteria.

The data provide information on annual hours of market work, regular housework, and irregular housework. Regular housework consists of meal preparation, cleaning, and straightening up. Irregular housework includes painting, redecorating, major housecleaning, sewing, mending, growing own food, canning, freezing, and "other irregular work."2/

Table 1 gives the mean number of hours spent on these three activities by husbands and wives for the 850 families in the sample. Husbands spend much more time at labor market work, and wives much more time doing regular housework. The time allocated to all work activities is slightly greater for wives than for husbands.

Considerable variation is present in these hours data. For example, the standard deviation for husband's market work is 658 hours per year;
that for wives' regular housework is 1226 hours per year. Perhaps the most natural way to try to explain this variation is to regress these hours variables on non-labor income, the wage rates of husbands and wives and, possibly, a set of control variables. An obvious extension of the Hicksian labor-leisure choice model presumes that an increase in non-labor income will induce a shift of time to leisure (defined as total time available minus total hours of work) and away from all three work activities and predicts that the substitution effect of an increase in the own-wage rate will engender a shift to market work and away from all non-market activity. Presumably, the income effect on each work activity and the own-substitution effect on each non-market activity will be negative. The signs of uncompensated own-wage coefficients in the hours equations cannot be predicted from this theory. Nor can the signs of cross-substitution effects and cross-wage effects when factors other than husband's and wife's labor are employed in household production.

Average hourly earnings observations are available for all husbands and for working wives, but induce inconsistent estimates of wage coefficients in hours of market work equations. An alternative procedure used in this paper is to regress (price-corrected) average hourly earnings observations on variables indicating age, education, race, occupation, and industry for husbands and wives separately and then to incorporate wage rates imputed from these regressions in the hours of work equations. A non-working wife is assigned a wage rate equal to that of a working wife with otherwise identical observable characteristics and all wage rates and non-labor income observations are corrected for the federal personal income tax.
Also included in the hours equations are control variables indicating number of children in the family, age of worker, number of rooms in the house, and dummy variables indicating presence of pre-school age children, rural residence, and home-ownership. When these variables are correlated with either the non-labor income or the wage rate observations and have non-zero coefficients in the hours equations, then their omission will induce biased and inconsistent estimation of the income and wage coefficients in these (structural) hours equations.\footnote{6}

The same control variables are included in each hours equation for males and in each hours equation for females. The only difference between the explanatory variables in the male and female regressions is that own-age and not spouse's age observations are included among the independent variables in each equation.
III. Empirical Results

This section contains an analysis of the time allocated by husbands and wives to regular and irregular housework. These results, along with estimated equations for market work based on the same data, permit inferences concerning the time allocated to leisure (non-work) activities. The partial participation by individuals in the three work activities ensures that estimates of the time allocated to leisure obtained residually from the estimates for market and non-market work will not correspond to estimates obtained from a regression equation incorporating as a dependent variable a leisure observation equal to a constant minus the sum of the hours allocated to the three work activities.

Equations are estimated for both the probability that husbands and wives participated in a particular category of housework (using a zero-one dependent variable) and hours worked for participants. The linear probability functions used for the participation equations fit the data well. A participation equation is not estimated for regular housework because all wives participated in this productive activity. Further details, particularly on the coefficients of the control variables, can be found in Bloch (1973).

The participation and hours equations are then combined to approximate the response of expected hours of work to a unit shift in an independent variable \(x\). When \(p\) is the probability of participation in a given activity and \(H\) is hours worked for participants in that activity, then expected hours of work are given by \(pH\) and the change in expected hours of work resulting from a unit shift in an independent variable \(x\) is given
by \( \frac{\partial H}{\partial x} + \frac{\partial p}{\partial x} \), where \( \frac{\partial H}{\partial x} \) and \( \frac{\partial p}{\partial x} \) are taken from the hours and participation equations, respectively. When \( p \) is set equal to \( \bar{p} \), the fraction of individuals who are participants, and \( H \) set equal to \( \bar{H} \), mean hours worked for participants, then the change in expected hours of work, referred to below as total response of hours, is equal to \( \frac{\partial H}{\partial x} + \frac{\partial p}{\partial x} \). 6

A. Husbands' Non-Market Work

The time allocated by husbands to regular housework does not respond significantly to non-labor income, varies inversely with their own wage rate, corroborating the negative own-substitution effect presumed in Section II, varies directly with their wives' wage rate, suggests that husbands' and wives' time are competitive in household production. The income-compensated total response of husbands' hours of regular housework to a dollar increase in the husbands' wage is \(-44.70\) with standard error \(16.18\) and to that in the wives' wage is \(170.45\) with standard error \(28.95\). These estimated effects imply an own-substitution elasticity of \(-.63\) and a cross-substitution elasticity of \(1.22\).

Participation in regular housework is a decreasing function of age, rural residence, and the number of children living at home. Hours of regular housework, however, is an increasing function of age, the number of children living at home, and the presence of pre-school age children. The sign of the children coefficient in the participation equation may indicate that children, rather than fathers, perform certain household tasks in large families. The sign of the rural residence coefficient
perhaps indicates that some non-market work is recorded as market work, it being difficult to discriminate between production for household consumption and production for the formal market.

The significant wage effects observed for regular housework no longer obtain for irregular housework. Perhaps because irregular housework is performed so infrequently (with a mean of 138 hours for workers, compared with a corresponding 343 hours of regular housework) and is subject to indivisibilities, the response of irregular housework to wage rates cannot be captured in a period as short as one year.

The probability of participation in irregular housework activities varies inversely with non-labor income (with elasticity at the means of -.01), suggesting that high income individuals are slightly more likely than others to patronize painters, redecorators, gardeners, and kindred workers. The income-insensitivity of hours of irregular housework, and, for that matter, of regular housework, is consistent with the hypothesis that the derived demand for housework induced by the purchase of goods with an increase in income is nearly exactly counterbalanced by the direct negative income effect on housework.

The probability of participation in irregular housework also varies directly with the number of rooms in the house and home-ownership, and inversely with age, perhaps indicating that strenuous work activity is not very likely to be undertaken by older men. Home-ownership also increases hours of irregular housework, again consistent with the observation that much irregular housework maintains and increases the value of the house and is a desideratum only for home-owners.
B. Wives' Non-Market Work

The time allocated by wives to regular housework varies inversely with non-wage income and the wife's wage rate and directly with the number of rooms in the house and the children variables. The income and own-wage coefficients imply an own-substitution effect of -638.31 with standard error 114.86 and corresponding elasticity (calculated at mean hours 2131 and mean wage 1.26) of -.38, strongly supporting the negative sign presumed in Section II. The positive coefficients on the number of rooms and the children variables are consistent with the results of previous research on the time allocated to housework.9/

None of the other coefficients in this equation are significant and, in particular, the coefficient on the husband's wage does not imply that husbands' and wives' time are competitive in regular household production (the cross-substitution effect is 8.02 with standard error 58.40), as was the case with the corresponding estimate for husband's hours. Furthermore, the hypothesis of equal cross-substitution effects is strongly rejected at the 5% level: \[ \hat{z} = \frac{170.45 - 8.02}{65.18} = 2.49 > 1.96 = z_{.975} \]

Many more coefficients are significant in the regressions estimating the allocation of time by wives to irregular housework. The probability of participation in irregular housework increases by .02 with a dollar increase in the husband's wage rate and decreases by .137 with a dollar decrease in the wife's wage rate. In addition, the probability of participation is a decreasing function of income, an increasing function of the number of rooms in the house, and a concave function of age with a peak at age 47.2. Hours of irregular housework vary inversely with
non-wage income and the wife’s wage rate and directly with rural
residence, home-ownership, and the number of children in the family unit.

The total response of female irregular housework to income is
-6.85 hours per year with standard error 2.02, implying an income
elasticity (evaluated at mean non-wage income $2,064, and mean hours
146.62) of -.10. The total response to the husband’s wage rate
Using the corresponding cross-substitution effect from the husband’s
equation of -.02 with standard error 20.49, it is clear that the hypothesis
of equal cross-substitution effects cannot be rejected at conventional test
levels ($\hat{\lambda} = .658$), a result not obtaining for regular housework. On the
other hand, the total response own-substitution effect is -62.21 with standard
error 24.23, supporting the negative sign presumption of Section II. The
own-substitution elasticity at the means is equal to -.53. The general
conclusion with respect to the control variables is that characteristics
of the house appear to be much more important than characteristics of
the family in determining hours allocated to irregular housework.

C. The Allocation of Time to Leisure

The estimated income and substitution effects on the time allocated
to non-market work are summarized in Table 2. Estimated income and
substitution effects on the time allocated to market work for the same
individuals are reported in Table 3. Together, these estimates permit
inferences concerning the time allocated to leisure (non-work) activities.

The hours of market work estimates for husbands are obtained from
a single hours equation for the 850 husbands, all of whom worked a
positive number of hours in 1964. The corresponding calculations for wives are obtained analogously to the "total response" estimates for non-market work: they are based on an hours equation for the 410 women who worked in 1964 and a participation equation for all 850 wives. The substitution effect estimates are first obtained directly from the regression equations, and are then modified to take account of the decreasing post-tax wage rates induced by additional hours of work (and therefore additional income) under a progressive income tax system.\textsuperscript{10}.

The income and substitution effects on the time allocated to leisure (Table 4) are equal to minus the sum of the income and substitution effects on the time allocated to market and non-market work. The substitution effects are again corrected for the simultaneity bias obtaining in the labor market equations. Elasticity estimates are computed under the assumption that sixteen hours per day are available for leisure and work activities. The mean annual hours of leisure are then 3203 for husbands and 2953 for wives.

The income effects on the time allocated to leisure, roughly .025 hours per year per dollar, are virtually identical for husbands and for wives. The negative own-substitution effects support hypotheses of the model presented in Section II and are much larger for wives than for husbands. The cross-substitution effects are roughly equal in magnitude but opposite in sign, contradicting the hypothesis of equal cross-substitution effects on the time allocated to leisure. This last result may be attributed to the heterogeneity of leisure activities, as may the similar result obtained for regular housework.
The most important control variable affecting the time allocated to leisure is the number of children in the family. An additional child reduces husbands' leisure by 71 hours per year and wives' leisure by 161 hours per year. The greater inhibition of wives' leisure results from the much greater positive effect of children on wives' rather than husbands' housework more than counterbalancing children's negative effect on wives' market work and positive effect on husbands' market work.\textsuperscript{11/}
V. Conclusions

Estimated income and substitution effects on time allocated to non-market work have been presented and have been used, in conjunction with cited estimates of time allocated to market work, to obtain income and substitution effects on the time allocated to leisure. Hypotheses based on a simple extension of the Hicksian labor-leisure choice model are generally supported. Negative income and own-substitution effects are observed for housework. Positive income effects and negative own-substitution effects are observed for leisure. The income effects on leisure have virtually identical magnitudes for husbands and for wives. The positive own-substitution effect on market work and negative own-substitution effects on housework and leisure are much greater for wives than for husbands.
References


Footnotes

1. The model does not consider the allocation of time to human capital investment and, consequently, is inapplicable to students. Disabled individuals, *ipsa facto*, are seriously constrained in their hours of work and are properly the subject of a separate study. The data do not differentiate between income-dependent and income-independent transfer payments, thus precluding calculation of effective post-tax wage rates for transfer income recipients.

2. Annual market work is the product of annual weeks worked and hours typically worked per week in the formal labor market. Interviewees were asked how much time they allocated to regular housework and their answers were converted to annual equivalents, e.g., a response of 10 hours per week was coded as 520 hours per year. They were also asked how many hours per year they participated in each of the irregular housework activities listed above.


4. The imputation of wage rates to non-working wives is a good procedure only when the value of non-workers' time is approximately equal to that of the wage rate of workers with similar characteristics. This assumption can be avoided if the sample is limited to families with working wives, but this limitation entails a significant reduction in degrees of freedom. On the valuation of non-workers' time, see Gronau (1973).
5. Although the federal personal income tax is not levied separately on non-wage and wage income, it is possible to distribute the tax between these two sources of income without changing the local characteristics of the family opportunity set. First assume that the wage income tax is proportional with tax rates equal to those obtaining for the last hour of work. Then calculate a post-tax non-wage income variable equal to family disposable income minus the product of hours worked and post-tax wage rates under the proportional tax assumption for each spouse. The amount of income tax paid by the family is given in the data source so that marginal tax rates can be calculated by assuming that each family files a joint tax return.

6. A more complete model would incorporate the many interrelationships between non-wage income and wage rates and these control variables. For example, the number of children may be inversely correlated with the wives' wage rate both because children inhibit wives' labor market experience and because high wage rates indicate a high opportunity cost of child care.

7. For 100% of the observations, the estimated probabilities of husbands' participation in both regular and irregular housework lie between .1 and .9. For 96.3% of the observations, the estimated probability of wives' participation in irregular housework lies between 0 and 1 and for 86.2% of the observations between .1 and .9. The lack of an explicit constraint in the estimation procedure limiting these estimates to the unit interval thus does not appear to be an important
shortcoming. The large number of estimates between .1 and .9 implies that probit and logit functions, which are approximately linear in this interval, would yield results very similar to those obtained here. Fifty-one percent of all husbands participated in regular housework, eighty percent of all husbands participated in irregular housework, and 91 percent of all wives participated in irregular housework.

8. Total response elasticity estimates are evaluated at mean income, wage rates, and hours averaged over participants and nonparticipants. Total response standard errors are obtained from both participation and hours equations and are biased and inconsistent because the estimated standard errors in the participation equations are based on least squares formulas that do not incorporate the heteroskedasticity of the disturbance terms. However, given the partial weighting from the participation equations, total response standard error estimates and significance tests are quite robust with respect to rather large variation in the participation equation standard errors.


10. See Bloch (1973), Appendix B.

11. An additional child in the family is estimated to induce a 58 hour increase in husband's market work, 13 hour increase in husband's regular housework and no significant change in husband's irregular housework; and a 110 hour decrease in wife's market work, 256 hour increase in wife's regular housework and 15 hour increase in wife's irregular housework.
Table 1

Annual Hours of Work for Husbands and Wives

<table>
<thead>
<tr>
<th></th>
<th>Husbands</th>
<th>Wives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Work</td>
<td>2351</td>
<td>609</td>
</tr>
<tr>
<td>Regular Housework</td>
<td>176</td>
<td>2131</td>
</tr>
<tr>
<td>Irregular Housework</td>
<td>110</td>
<td>147</td>
</tr>
<tr>
<td>Total Work</td>
<td>2637</td>
<td>2887</td>
</tr>
<tr>
<td>Equation</td>
<td>Own-</td>
<td>Cross-</td>
</tr>
<tr>
<td>-----------------------------------</td>
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<td>--------</td>
</tr>
<tr>
<td></td>
<td>Income</td>
<td>substitution</td>
</tr>
<tr>
<td>Husband's regular housework</td>
<td>-1.77</td>
<td>-44.70</td>
</tr>
<tr>
<td></td>
<td>(1.81)</td>
<td>(16.18)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Husband's irregular housework</td>
<td>-.51</td>
<td>.06</td>
</tr>
<tr>
<td></td>
<td>(1.27)</td>
<td>(14.96)</td>
</tr>
<tr>
<td>Wives' regular housework</td>
<td>-9.48</td>
<td>-638.31</td>
</tr>
<tr>
<td></td>
<td>(5.13)</td>
<td>(114.06)</td>
</tr>
<tr>
<td>Wives' irregular housework</td>
<td>-6.85</td>
<td>-62.21</td>
</tr>
<tr>
<td></td>
<td>(2.02)</td>
<td>(24.23)</td>
</tr>
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Income effects are given in units of annual hours per thousand dollars. Substitution effects are given in units of annual hours per dollar. Estimated standard errors of income and substitution effects are given in parentheses. Elasticity entries are evaluated at the means and are given only for effects that are significant at the 5% level, using a one-tailed test for income and own-substitution effects and a two-tailed test for cross-substitution effects.
<table>
<thead>
<tr>
<th>Equation</th>
<th>Income effect</th>
<th>Own-substitution effect</th>
<th>Cross-substitution effect</th>
<th>Income elasticity</th>
<th>Own-substitution elasticity</th>
<th>Cross-substitution elasticity</th>
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<tr>
<td>Husbands' hours of market work</td>
<td>-23.74</td>
<td>115.64 [180\textsuperscript{a}]</td>
<td>-17.42 [20\textsuperscript{a}]</td>
<td>-0.02</td>
<td>0.13 [0.20\textsuperscript{a}]</td>
<td>--</td>
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<tr>
<td></td>
<td>(5.36)</td>
<td>(33.94)</td>
<td>(63.94)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Wives' hours of market work</td>
<td>-6.03</td>
<td>1431.85 [1460\textsuperscript{a}]</td>
<td>-256.41 [-220\textsuperscript{a}]</td>
<td>--</td>
<td>2.96 [3.02\textsuperscript{a}]</td>
<td>-1.05 [-0.90\textsuperscript{a}]</td>
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<tr>
<td></td>
<td>(7.15)</td>
<td>(306.92)</td>
<td>(94.40)</td>
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Income effects are given in units of annual hours per thousand dollars. Substitution effects are given in units of annual hours per dollar. Estimated standard errors of income and substitution effects are given in parentheses. The estimates in brackets incorporate approximate corrections for the simultaneity bias arising from the progressive income tax structure. Elasticity entries are evaluated at the means and are given only for effects that are significant at the 5% level, using a one-tailed test for income and own-substitution effects and a two-tailed test for cross-substitution effects.
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<th>Income elasticity</th>
<th>Own-substitution elasticity</th>
<th>Cross-substitution elasticity</th>
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<tr>
<td>Husbands' hours of leisure</td>
<td>26.02</td>
<td>-71.00</td>
<td>-153.85</td>
<td>.02</td>
<td>-.06</td>
<td>-.12</td>
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<td></td>
<td>[26.02]</td>
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<td>[26.02]</td>
<td>.02</td>
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<tr>
<td>Wives' hours of leisure</td>
<td>22.36</td>
<td>-731.33</td>
<td>229.12</td>
<td>.02</td>
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<td>.19</td>
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<td>.02</td>
<td>[.32]</td>
<td>[.19]</td>
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Entries are derived from Tables 2 and 3. Income effects are given in units of annual hours per thousand dollars. Substitution effects are given in units of annual hours per dollar. Elasticities are computed under the assumption that leisure hours equal 16 hours per day minus the sum of the hours allocated to market work, regular housework, and irregular housework.