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THE USE OF TIME AND TECHNOLOGY BY HOUSEHOLDS IN THE UNITED STATES*

Frank Stafford and Greg J. Duncan

The manner in which households organize their activities and particularly their use of non-market time and market goods or choice of home technology has received increasing attention by social scientists, and numerous models have been developed to explain household responses to wages and income.[1] Although a variety of hypotheses about time use have been developed over the years by economists, much of the empirical testing has relied on observations on labor market time, and to date evidence in support of the hypotheses based on non-market time is rather scant. In fact, data on labor market hours suggest relatively minor responses by men to wages and growing labor market income of their wives,[2] and analysis of the available data of housework and child care time by men also suggests a relatively minor response to wages, prices and family circumstances.[3]

Apart from the predictive power of the models, the organization of activities in the home and the labor market has major implications for our assessment of lifetime well-being; it is increasingly clear that a large

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1Jacob Mincer, "Labor Force Participation of Married Women," in Aspects of Labor Economics, NBER, 1962, pp. 63-105; Gary S. Becker, "Theory of Allocation of Time," Economic Journal, September, 1965, pp. 493-517; and H. Gregg Lewis, "Hours of Work and Hours of Leisure," IRRA, Papers and Proceedings of the Ninth Annual Meeting, 1956, pp. 196-206.

2See Glen Cain and Harold Watts, "Toward a Summary and Synthesis of the Evidence," in Cain and Watts, Income Maintenance and Labor Supply, 1973.

3C. Russell Hill and Frank P. Stafford, "Allocation of Time to Preschool Children and Educational Opportunity," Journal of Human Resources, Summer 1974, pp. 323-41.

share of economic activities takes place outside the market and that those activities which take place in the market require some more detailed analysis of time use as well. Hours devoted to the labor market include time used for production of market goods and services but also include time used for the production of individual skills and time used for personal leisure. If (market) work time includes a large amount of training and leisure time for some, but trivial amounts of training and leisure for others our assessment of labor supply models and of the distribution of well-being would involve some reckoning of these differences. In our analysis, for example, we find that net of on-the-job training and leisure time, wage rates of young workers adjusted for non-work time at work are a much higher proportion of the wages of older workers. We also offer some comparisons between men's and women's wages adjusted for non-work time at work.

In this paper we utilize the life cycle and comparative static models of time use to interpret household behavior as measured by data collected in the Time Use Survey, a national probability sample of U. S. households conducted by the Survey Research Center of The University of Michigan in 1975-76. We also make some time-series comparisons through a merger of the 1975-76 file with the file from a similar time-use project conducted by the Survey Research Center in 1965. The 1965-75 time diary changes in labor market activity are compared to changes as recorded by the Current Population Survey.

En route to assessing the empirical validity of the behavioral models we develop some comparisons of hours at work as measured by time diaries and respondent reports of nonwork time at work with conventional question sequences, which rely on respondent reports of labor market hours. We find that the time-diary data combined with respondent reports of nonwork time at work suggest a greater decline in market hours of married men and that the time diary data rather clearly indicate a smaller increase in labor market hours of married women than do the conventional measures. These findings complement time-diary estimates of other time uses which show stable levels of housework time by men between 1965 and 1976 and decreases in housework time by women. In general the hours in market and nonmarket time use of men and women have become more equal, and we interpret this outcome as consistent with models of household time allocation which emphasize the role of market and nonmarket productivity of individual household members in determining the division of labor in the home. Time spent TV viewing by employed American adults has increased by 47 percent between 1965 and 1975 and this has come at the expense of reduced time in several areas including housework and the labor market.

By utilizing unique aspects of the data, notably data on time use at work and detailed information on non-market time, we evaluate the empirical relevance of recent life cycle time-use models; namely, the models of Heckman, Blinder and Weiss, Ghez and Becker and Ryder, Stafford and Stephan.[4] These models imply that, at least for males who participate on a continuous basis over the life cycle, the following patterns of goods and time use should be observed: (1) training time should fall throughout the life cycle or should fall subsequent to an early period during which it may rise, (2) marketable skills or human capital should rise over the life cycle, and as human capital increases market inputs should be used in relatively greater amounts than own

[4] James J. Heckman, "A Life Cycle Model of Earnings, Learning and Consumption," Journal of Political Economy, August 1976 (Part II), pp. S11-S44; Alan Blinder and Yoram Weiss, "Human Capital and Labor Supply: A Synthesis," Journal of Political Economy, June 1976, pp. 449-72; Gilbert R. Ghez and Gary S. Becker, The Allocation of Time and Goods Over the Life Cycle, National Bureau of Economic Research, 1975; Harl E. Ryder, Frank P. Stafford and Paula E. Stephan, "Labor, Leisure and Training Over the Life Cycle," International Economic Review, October 1976, pp. 651-74.

time in selecting a technology to produce various home or non-market outputs, and (3) hours spent in actual productive market activity should increase with increasing marketable skills for some part of the life cycle.

While all the theoretical models agree on these points, empirical work has been limited by available data in a number of ways. First of all training time is usually not observed directly; rather inferences about training are drawn from the shape of age or experience earnings profiles. Profiles which rise precipitously are presumed to reflect a high but declining share of market activity devoted to on-the-job training. Second, as marketable skills rise over the life cycle individuals should reduce their relative use of own time in the production of non-market outputs, but data on own time in non-market activity are rather scarce and empirical testing (e.g. Ghez, Chapter 2 of Ghez and Becker)[5] has been limited primarily to analysis of lifetime patterns of goods and services rather than analyzing the choice of technologies which allow different amounts of goods and services and own time.

Two aspects of this research are open to criticism. First, a very simple current income hypothesis would appear to be consistent with the gross evidence. In Figures 2.2 and 2.3 of their book, Ghez and Becker present age-family earnings and age-family consumption of market goods profiles for three educational levels of household head: more than 12 years, 9-12 years, and 0-8 years. Expenditures are higher when income is higher across groups defined by age and education. It is easy to agree with Ghez and Becker when they conclude that "the absolute income hypothesis seems to explain this body of data remarkably well," and that "it is well known, however, that this hypothesis has been rejected on many grounds and with much evidence."[6]

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[5] Gilbert R. Ghez and Gary S. Becker, _op_. _cit_., pp. 59-60.

[6] _Ibid_., p. 75.

Second, the life-cycle approach implies, as does the comparative static model, that individuals should use a relatively good intensive technology for household production during their peak earnings years, and the relevant empirical tests would seem to require joint information on choice of household technology which implies a choice of the cost minimizing ratio of market inputs to own time. Basically, it would be desirable to have data which contain information on time use as well as use of market goods and the BLS data were not designed to provide this sort of information.

As noted above there are problems with empirical analysis of hours in the labor market based on Census data which, like most data sources, are based on reports of elapsed hours at work as a measure of labor supply. It is clear that people do things at work besides working even if they are at work for the hours they report. They engage in leisure (goof-off time) as well as on-the-job training. If, as the theory predicts, these two activities are more prevalent for younger people,[7] then elapsed time at work would understate the age dependency of work, on-the-job training and leisure. Data on elapsed hours at work will, if the life-cycle hypothesis is valid, tend to show a flatter trajectory or earlier peak in hours than would be the case if better wage rate and hours measures were available. By "better" we mean hours at work net of non-market time and wage rates based on such measures of hours at work.

Our goal is to utilize data from the 1975-76 Time Use Survey to examine these topics that relate to models of time and technology use over the life

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[7]Here we are assuming that work breaks, socializing and on-the-job training are time intensive.

cycle and models which portray time use at a point in time.[8] The unique features of the data as they relate to these topics are:

1. Specific measures of time spent at work in on-the-job training and on-the-job leisure in the form of scheduled breaks as well as time spent in personal business, socializing and relaxing. Adjusting hours at work and wage rates for these variables will permit better analysis of lifetime labor supply and training and will permit a more accurate view of actual wage rates (earnings potential) over the life cycle.
2. Time-diary measures of time spent in various non-market activities. These activities vary in likely time intensity from near 100 percent (for what are classified as passive leisure -- letter writing, reading magazines, watching TV and some organizational activities) to reasonably high levels of market good intensity. We can investigate whether there are patterns to particular time uses outside the market which relate to periods in the life cycle when market wages are highest. Another example of time use which may be wage related is sleeping. Although it is reasonable to assume that time spent sleeping is not dependent on economic factors, it could be that highly educated persons in their peak earnings years actually reduce their sleep to use better their stock of skills!
3. Measures of time and money inputs for certain household outputs which can be produced by using different relative amounts of

[8]For a description of the project see F. Thomas Juster and John P. Robinson, "Incorporating Time Use in Social Accounts," mimeograph, Survey Research Center, 1974.

own time and market inputs. For example, we have measures of use of own time and market goods in routine household chores used to produce some level of household services. Assuming a well-behaved production technology (a production function with homotheticity and no jointness) then the ratio of market inputs to own time is predicted to vary with earnings potential. To test the general hypothesis we also employ measures of the organization of various household tasks and division of labor between the husband and wife. Tasks which require skills unrelated to market productivity and which are unlikely to provide significant mutual consumption benefits as part of the process (e.g. housecleaning, washing clothes, grocery shopping) should be organized on the basis of comparative advantage -- namely the potential wage rates of the husband and wife should be substantial determinants of who puts in the larger amount of time to these activities and the relative use of market goods (dishwashers, vacuums, calculators, microwave ovens, ...) in selecting a technology for producing a given output.

While we plan to restrict our analysis to the aforementioned topics, it seems clear that data on time use at work in conjunction with non-market time use can be used to investigate a far wider range of topics including evaluation of the predictive power of other theories of household behavior and in order to assess the impact of numerous public policy measures. As an example of the former, the static family labor supply model predicts reduced market work of one spouse in response to increased income of the other.

Empirical research on the static labor supply model has generally shown that increased income from the husband's labor market earnings appears to reduce substantially the market work effort of the wife, but the converse is not true. Increased income from the wife's labor market earnings exerts only a small influence on the market work of the husband. Even in households where the wife is highly educated (has completed at least four years of college) and where the husband is less educated (has completed no more than high school) the husband supplies nearly as much time to the labor market as in families where the wife has a lower level of education and, on average, a lower earnings potential. Because market work is almost universally measured as simply hours on the job, it is a clear possibility that in response to income increases, the husband may keep full-time hours on the job but may reduce work effort through on-the-job leisure or consumption time or through a slower work pace.

Research on the impacts of public policy is limited by a lack of information on time spent at work at work. By relying on nominal hours at work the impact of marginal tax rates on work effort may be understated. The steady growth of multiple earner families, reinforced by inflation, has increased the marginal tax rates facing individual household members and thus may affect their labor supply. Empirical work has shown that households do respond to these marginal tax rates by reducing nominal hours.[9]

Since taxes will lower the relative price of market inputs used in on-the-job consumption (and on-the-job training) the increasing numbers of families in higher tax brackets will increase the incentives to consume goods and services while at work. In the context of the household production model

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[9]See the recent paper by Harvey Rosen, "Taxes in a Labor Supply Model With Joint Wage Hours Determination," Econometrica, May 1976, pp. 485-507. One interpretation is that the large apparent effect of husband's income on hours supplied by the wife is really a net wage (tax) effect. See Aline O. Quester, "The Effect of the Tax Structure on the Labor Market Behavior of Wives," Journal of Economics and Business, Spring/Summer 1977, pp. 171-179.

both goods and time are required to produce useful consumption outputs, hence incentives for increased use of market goods for consumption at work also carry incentives for non-work related time use at work, depending on the income elasticity of demand for consumption at work and the elasticity of substitution between goods and time in producing consumption at work. If taxes should encourage a reduction in hours at work actually working, this could explain lower measured productivity per labor hour. Regardless of whether or not taxes are a major factor, imputation for the value of on-the-job leisure would be helpful in evaluation of current cross-section productivity differences as well as future productivity changes. Recent concern over a slow growth in output per labor hour[10] has emphasized factors such as capital vintage or input price changes associated with the dramatic increases in commodity prices during 1971-72, but rising tax rates or other factors increasing non-work time at work may be equally important influences.

If we define the share of elapsed time at work actually spent working as work effort, it is clear that variations in work effort could be a response by workers and firms to statutory increases in the minimum wage. As a result, the search for reduced employment as an outcome of the Fair Labor Standards Act may overlook a major response which is altered working conditions with respect to work effort.[11]

Just as research on on-the-job training has emphasized the heterogeneity of labor and differences in the rate of skill acquisition in different jobs, so can analysis of on-the-job consumption provide a basis for understanding

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[10] From 1965 on the rate of growth of output per labor hour has slowed substantially. See for example, Business Conditions Digest, U. S. Department of Commerce, February 1977, p. 50, Chart B2.

[11] J. Wilson Mixon has investigated the impact of the minimum wage on various aspects of the job package but not work effort.

the great variety of working conditions of individuals. Further, both on-the-job training and some amount of on-the-job consumption may augment productivity. For this reason caution must be exercised to avoid uncritical use of an assumption that leisure on the job is simply a measure of lost output. This is, of course, a widely used assumption -- in the labor-leisure framework consumption time at home is presumed to occur at the opportunity cost of foregone market output. The interdependence between consumption and productivity has been discussed by several authors,[12] but empirical identification of that part of consumption which contributes to productivity versus that part which reflects foregone productivity is a difficult task.

Knowing how job time is actually used would be important for reassessing our views about the personal distribution of income. Are high-paying professional jobs also the ones with greater work effort? If so, observed variation in wages overstates the variation in wages corrected for work effort. The converse could be true for other subgroups of the population. How do workers classified by occupation, industry, sex, age and labor force activity of spouse differ in this dimension? Our planned tests of the implications of recent life-cycle models of variation in time use over the lifetime of individuals should provide a partial answer to this question though the data on time use at work can be used to test alternative models.

The organization of the paper is as follows: Section I presents some descriptive statistics on time use at work and differences between CPS and time-diary estimates of labor market hours are assessed; Section II reviews the basic life-cycle labor supply models and presents some tests of their implications; Section III analyzes non-market time use of those in the labor

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[12] Among these are J. R. Hicks, The Theory of Wages, Chapter 2, pp. 104-108, and Frank P. Stafford and M. S. Cohen, "A Model of Work Effort and Productive Consumption," Journal of Economic Theory, March 1974, pp. 333-47.

market and provides tests of both the life cycle and comparative static models of labor supply. The data suggest that households do respond to wage opportunities and income not only with respect to their labor market responses but also with respect to non-market lifestyles. If anything, the non-market time uses are more responsive to wages rates than are labor market hours. Section IV analyzes the division of labor between husbands and wives in carrying out routine household chores.

I. Break Time, Work Pace and On-The-Job Training -- Some Descriptive Statistics

Actual on-the-job hours are different from respondent reports of normal or average workweek. One interpretation is that the latter represents hours per week for which a person can be obligated, but the time-diary measure of hours at work, which will reflect variations in demand for the firm's product, "partial absenteeism" (late arrival and early departure from work) and other influences, is a reasonable approximation to elapsed time at work. Elapsed time at work or on-the-job hours are greater than actual hours at work, which are reduced by time spent while at work in breaks, either formal or informal, for either training or leisure on the job. These breaks are partial measures of production sacrificed for other goals. Other important measures of labor supply are pace of work or energy and effort devoted to work while at work. It is likely that of the numerous aspects of the implicit or explicit work contract, pace of work is one of the more difficult to enforce unless a mechanism such as piece rates (e.g. journal articles per year) or share-cropping can be utilized.

In this section we report on four kinds of measures of on-the-job time allocation: (1) time spent in formal or scheduled work breaks,[13] (2) time spent informally socializing or any other type of unscheduled work breaks such as phoning to take care of personal business,[14] (3) a scale of energy and effort expended during a typical hour of time at work, and (4) time spent in on-the-job training.[15] The sum of (1), (2), and (4) plus time actually working is total time at work or conventionally defined "labor supply."[16] Further, analysis of time-diary data from four interview averages shows that hours actually on the job are substantially less than hours as estimated by respondent reports of average hours per week, hours at work last week, or by weekly hours implied by report of the scheduled workday, measures which we call nominal hours.

Overall, average hours per week at work were 41.8 hours as measured by respondent reports of hours in the average week and were 39.7 as measured by the reported work schedule (Table 1). The closest time-diary comparison would be time per week on main job less time at lunch. This averages 36.8

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[13] Formal or scheduled work breaks are based on answers to the question: "(In addition to meal or lunch breaks) about how much time do you usually spend on regular coffee breaks or scheduled rest breaks? ______MINUTES."

[14] Time spent informally socializing or in other unscheduled work breaks was measured by answers to the question: "Thinking about the rest of your time at work, about how much (additional) time do you usually spend on things not related to the work that you do -- like talking to friends, doing personal business, or just relaxing? ______MINUTES."

[15] The question sequence was as follows: "Do you feel you are learning skills on your job that could lead to a better job or to a promotion?" (IF YES) "Sometimes people learn these skills as part of their regular work, while others use time at work to learn skills that are not part of their regular job. About how many hours per week do you usually spend learning new things as part of your regular work " "And how many hours per week do you spend learning new things that are not part of your regular work?"

[16] Nominal hours were ascertained from the following question: "About how many hours do you work on your main job in an average week including any paid or unpaid overtime?"

TABLE 1

Weekly Hours on the Job, 1976

	Four Interview Time Diary Average								Non Diary		
	Main Job										
GROUP	Coffee Break	Normal Work	Lunch	Before and After Work	Total	Second Job	Travel to Work	Sample Size	Minutes Per Day on Weekly Basis	Average Week Hours	Sample Size
ENTIRE SAMPLE	0.9	35.2	1.5	0.6	38.3	0.6	3.5	355	39.7	41.8	375
OCCUPATION	**	**	n.s.	**	**				**	**	
Professional	0.7	35.9	1.6	0.5	38.6	0.9	3.6	78	38.7	42.5	81
Manager	0.4	40.2	1.4	0.5	42.5	0.6	3.9	37	41.8	47.1	39
Clerical	0.9	31.5	1.6	0.6	34.5	0.3	3.3	85	38.8	39.3	89
Craftsman	1.2	38.3	1.7	0.6	42.1	0.7	3.9	57	40.9	43.5	59
Operative	1.6	36.1	1.7	1.3	40.6	0.3	3.4	34	40.5	42.4	38
Unskilled	0.8	33.3	1.0	0.4	35.6	0.3	3.1	42	36.5	36.0	45
HOURS WORKED PER WEEK	**	**	**	n.s.	**				**	**	
< 30	0.3	21.4	0.6	0.1	22.4	–	2.8	28	27.0	17.9	29
30–39	0.6	29.3	1.3	0.7	31.9	0.6	3.1	37	35.2	34.4	38
40–49	1.0	35.4	1.7	0.6	38.9	0.6	3.4	224	39.7	41.6	237
50 +	0.7	43.7	1.4	0.6	46.5	0.6	4.1	66	47.3	56.3	71
SEX, MARITAL STATUS	n.s.	**	*	**	**				**	**	
Male,married	1.0	39.7	1.7	0.5	43.0	1.0	3.9	147	41.5	46.1	154
Male,unmarried	0.8	36.2	1.1	0.9	39.0	0.6	3.8	48	42.3	44.2	54
Female,married	0.9	29.2	1.4	0.4	32.0	0.3	2.9	93	37.5	37.0	96
" ,unmarried	0.7	33.3	1.6	0.7	36.3	–	2.9	67	36.8	37.3	71
UNION MEMBER	**	n.s.	n.s.	**					n.s.		
Yes	1.3	35.2	1.6	0.8	39.3	1.1	3.4	78	40.2	42.1	82
No	0.7	35.4	1.5	0.5	38.0	0.4	3.5	277	39.6	41.7	293
EDUCATION	*	n.s.	n.s.	n.s.					n.s.	*	
0–8 Grades	1.0	34.0	1.3	0.8	37.2	–	3.7	23	39.4	40.0	26
9–11 Grades	1.4	32.8	2.0	0.8	37.4	1.0	3.4	34	40.6	41.6	36
H.S. Diploma	1.0	35.5	1.6	0.5	38.8	0.2	3.4	67	39.3	41.1	72
H.S. + Non-Academic training	0.9	36.1	1.5	0.6	39.1	0.7	3.4	72	38.8	42.5	75
Some College, Jr. College	0.7	34.3	1.2	0.4	36.8	0.4	3.5	74	39.9	39.7	80
College, B.A. (B.S.) or Adv.	0.6	36.6	1.5	0.5	39.2	0.8	3.8	83	40.4	44.4	85
AGE	n.s.	n.s.	n.s.	n.s.					n.s.		
< 25	0.4	33.1	1.3	0.4	34.7	0.2	3.3	47	38.7	40.1	50
25–34	0.6	35.3	1.6	0.6	38.5	0.9	3.5	134	40.5	42.3	139
35–44	0.7	37.8	1.5	0.7	41.1	0.5	3.3	72	39.7	42.8	80
45–54	0.5	34.2	1.4	0.5	36.8	0.5	3.4	55	40.0	41.1	56
55–64	0.5	36.3	1.5	0.5	39.4	0.3	4.1	39	38.4	42.8	42
MONTHLY INCOME	**	**	*	*	**				**	**	
$0–249	0.4	19.7	0.9	0.2	21.1	0.1	2.3	19	27.5	20.7	20
$250–499	0.6	30.6	1.1	0.5	33.2	0.3	3.3	52	37.4	36.2	55
$500–749	1.1	32.4	1.7	0.7	35.8	0.6	3.0	84	39.3	41.6	88
$750–999	0.9	36.5	1.5	0.6	39.7	0.8	3.0	56	40.8	43.0	61
$1000–1499	1.2	39.6	1.7	0.8	43.4	0.6	3.9	76	41.1	44.5	79
$1500–9996	0.6	41.2	1.7	0.4	43.9	0.4	4.7	51	44.3	50.3	55

hours. However, the time diary can include days of added work (whether paid or not) work at home, or partial or full absence from work, and the average includes seven observations with no time at work. Excluding these seven cases increases the estimate to 37.5 hours, which is still 11 percent less than reported average hours.

Although across the various subgroups the ranking of work hours from time diaries is comparable to that from our sequence on elapsed time from the work schedule or from average reported hours, there are notable quantitative differences. Across occupations, those who are managers, craftsmen and operatives report the most time at work under either time measure, but the variation across the groups in total time at normal work is greater on the time diary. Similarly, there is a comparable ranking of the two measures across educational, sex and marital status, age and monthly income groups under either measure but the time diary typically shows a greater variation in hours across the subgroups. For example, there is a somewhat greater sex-marital status and age dependency to hours in the labor market under the time-diary measure. The extent of overreporting of work hours varies by sex and marital status. Specifically, the ratio of Average Week Hours to Total Time at Main Job less Time at Lunch is 1.08 for unmarried females, 1.12 for married males, 1.17 for unmarried males, and 1.21 for married females.

The time-diary measure results in implied hours per week of 39 and 46 for the 40-49 and 50 or more categorization of the responses to the average hours per week question. What this suggests is that people overstate their hours in response to a general question on hours of work, but that recall of specific workdays by the time-diary approach allows a more objective assessment of elapsed time at work. In part, the data may also reflect a simple regression fallacy in combination with measurement error. Namely, those who report long hours on one measure will, on average, have positive errors in their estimate (either reporting errors in the case of the average week measure or both reporting error and transitorily high hours on the time diary) but will, on average, have a smaller error on some alternative measure. Note that this could happen even if both estimates were unbiased.[17] To check on possible measurement error, we defined hours of work categories by the time diary and then looked at the distribution of hours in the "average week." The results in Table 2 show that the two measures are not highly correlated, and this is consistent with measurement error either because of reporting errors or because hours at work vary from one (week)day to the next and from month to month.

TABLE 2

Comparison of Alternative Hours at Work Measures

Reported Hours per week in an average week	Time Diary Report of Mins. Worked Per Week: Under 1770	1770-2369	2370-2969	2970 or more	No Diary Time
Under 30	13	10	2	1	2
30-39	12	12	10	1	2
40-49	45	35	105	36	3
50 or more	6	10	23	27	0

For our sample of 375 employed respondents the mean time per day spent in formal work breaks was 16 minutes and the mean time spent in unscheduled

[17] In previous methodological work time-diary estimates were compared to estimates from recorded time use at random intervals indicated by a signal from a beeper carried by the respondent. The mean beeper and diary estimates matched quite well except for time uses away from home. Presumably respondents were reluctant to make public explanations of the beeper signal. See John P. Robinson, "Methodological Studies," draft, Survey Research Center, 1976.

breaks was 27 minutes. Adding these two plus time spent beyond an hour for lunch yields a mean of 45 minutes with a standard deviation of 42 minutes (see Table 3).[18] Time spent in breaks is a substantial share of time at work — in particular, it averages on the order of 9 percent of time at work and varies from as low as 1.5 percent to as high as 16.5 percent within the limits of a standard deviation on either side of the mean. Craftsmen, operatives, married males, and those with less than high school education spent the most time in either formal or informal work breaks.

While the time diary and reported work schedule yield comparable rankings of groups in terms of break time, the diary tends to show less break time. In part this is because some of the break time is included in the category of before and after work at the workplace which can include "conversations," "sitting around" and "having coffee before work," and in part this is because the time diary may not provide a very accurate measure of events which occur in a short space of time spent at work.

On-the-job training is reported by 60 percent of those working and varies most significantly by age and education[19] (Table 2). Of those under 25 years of age about three-quarters report on-the-job training and this proportion declines monotonically with only about one-quarter of those age 55-64 reporting on-the-job training. Across education groups those with some college or junior college education are most likely to report on-the-job training and those with less than high school education are least likely to report on-the-job training.

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[18] This is presumably an underestimate given that 31 percent of the sample report no informal breaks.

[19] Separate on-the-job training is reported by 27 percent and joint on-the-job training is reported by 45 percent of those working.

Table 3

Time Use at Work, 1976

	Minutes At Work Per Day (Elapsed Time Less Lunch Time	Hourly Wage Rate	TIME IN WORK BREAKS: Coffee and Other Scheduled Breaks: Proportion With Some	Coffee and Other Scheduled Breaks: Average Minutes Per Day	Informal Breaks Socializing, Personal Business Lunch Hours More Than 60 Minutes: Proportion With Some	Informal Breaks: Average Minutes Per Day	Total Break Time: Average Minutes Per Day	Total Break Time: Standard Deviation	Percent Work Time In Breaks	Hourly Work Effort Index	ON-THE-JOB TRAINING: Whether Any	Mean Weekly Hours For Those With Some: Joint	Mean Weekly Hours For Those With Some: Separate	Sample Size
E SAMPLE	476	$5.53	.65	16	.69	27	45	42	9.5	.72	.60	6.8	1.8	375
ATION	**	**	**	**								*		
FESSIONAL	464	7.35	.56	15	.73	23	40	40	8.2	.78	.61	5.9	2.5	81
AGER	501	7.11	.38	10	.74	24	36	30	8.2	.66	.59	8.1	1.1	39
RICAL	465	4.63	.74	17	.68	28	46	35	10.0	.71	.65	3.9	1.1	89
FTSMAN	491	5.83	.71	20	.71	39	58	61	12.2	.71	.63	7.2	1.6	59
RATIVE	486	4.41	.92	24	.66	29	53	45	10.9	.71	.50	8.8	0.7	38
KILLED	438	3.59	.60	14	.58	19	33	32	8.2	.75	.49	7.0	3.9	45
WORKED WEEK	**	**	**	*			**		*				**	
30	324	3.96	.41	8	.55	11	19	23	5.2	.80	.38	3.7	0.8	29
-39	422	5.31	.66	17	.74	30	47	36	12.0	.67	.68	4.9	2.7	38
-49	477	5.04	.72	13	.69	29	47	43	9.9	.72	.60	6.8	1.2	237
+	567	8.27	.52	15	.70	28	45	46	8.7	.75	.65	8.8	3.4	71
MARITAL US	**	**				**	**		*				**	
LE, MARRIED	498	7.02	.67	18	.71	34	53	51	10.9	.70	.62	7.1	1.5	154
LE, NOT MARRIED	507	6.75	.57	15	.81	34	50	45	10.3	.68	.63	8.9	3.9	54
MALE, MARRIED	450	4.12	.71	17	.60	19	36	27	7.9	.76	.58	5.3	1.4	96
MALE, NOT MARRIED	442	3.84	.59	14	.66	20	34	32	8.0	.78	.55	6.2	1.3	71
MEMBER			**	**						**				
S	462	5.62	.54	21	.65	26	48	45	10.0	.80	.54	7.1	1.6	82
	475	5.61	.60	15	.70	28	44	42	9.4	.70	.61	6.7	1.9	293
ATION		**	*											
8 GRADES	473	4.08	.73	18	.50	26	44	70	9.0	.65	.39	2.8	0.3	26
12 GR	487	4.47	.53	21	.75	35	56	51	11.5	.82	.56	6.9	1.3	36
S. DIPLOMA	472	4.69	.67	16	.64	29	45	39	10.0	.75	.57	8.3	1.6	72
S. + NON-ACAD. TRAINING	466	4.89	.68	17	.68	26	43	40	9.1	.71	.61	8.1	1.2	75
ME COLLEGE, JR. COLLEGE	47	5.44	.61	15	.76	30	47	38	10.0	.69	.71	6.5	3.2	80
LL., BA OR ADV.	485	8.33	.54	16	.71	22	40	36	8.4	.74	.58	5.7	1.5	65
		**							*		**	*		
25	464	3.68	.64	16	.86	39	55	43	12.6	.72	.76	9.5	3.2	50
-34	486	5.55	.68	18	.75	29	48	38	10.1	.72	.72	7.5	1.8	139
-44	477	6.19	.66	16	.69	28	45	42	9.5	.74	.58	6.4	1.7	80
-54	480	6.69	.61	16	.48	19	37	55	7.6	.73	.48	2.1	0.4	56
-64	461	6.26	.62	13	.60	20	35	34	7.2	.73	.29	2.6	1.3	42
HLY INCOME	**	**	**			*	**		*					
-249	330	2.35	.55	14	.50	9	22	25	6.0	.77	.40	3.3	1.1	20
50-499	449	2.66	.71	16	.62	20	36	27	7.9	.72	.62	6.8	1.3	55
00-744	471	3.56	.72	18	.67	30	48	48	10.6	.72	.63	5.7	2.4	88
50-999	490	4.75	.72	16	.74	25	42	41	8.7	.76	.61	8.8	1.6	61
000-1499	493	6.32	.72	19	.73	32	52	46	11.1	.70	.60	6.1	2.3	79
500-9996	531	13.00	.44	14	.78	35	54	44	10.6	.73	.53	8.3	1.4	55

urce: Wave III of Time Use Study, May-June 1976. The sample consists of working adults with regular work schedules

significant at .05 level

significant at .01 level

Life-cycle time-allocation models have emphasized the incentives for increased labor effort during the years when individuals have their greatest stock of human capital. Data on labor market hours by age show some of this, but our data on break time in combination with on-the-job training time show rather large differences between young and older workers in hours actually working. With the assumptions that one-third of joint training time represents foregone production time and that people all have five-day workweeks, minutes per day in break time and training average 63 minutes or 13.2 percent of the total 476 minutes per day at work for the whole sample. Disaggregating by age results in the greatest differences in non-work time at work with those under 25 averaging 107 minutes or about 23 percent of their total 464 minutes at work per workday and those age 55-64 averaging only 42 minutes or about 9 percent of their total 461 minutes at work per workday.

If the time diary is viewed as providing a good estimate of elapsed time at work and the reported typical break and on-the-job training time are viewed as the best measures of time at work in such activities, then the diary information combined with reports of nonwork time at work may be used to measure hours of actual work. This will allow us to assess the age dependency to hours actually working. In this case those under 25 work 24.5 hours per week (34.7 hours at work as measured by the diary less 1.3 hours at lunch less leisure and on-the-job training of 8.9 hours),[20] whereas on the same basis those age 35-44 and 45-54 average 32.0 and 31.2 hours, respectively. The comparable nondiary figures on the basis of reported average hours per week are 40.1, 42.8 and 41.1 which are 1.64, 1.34, and 1.32 times greater than the adjusted hours for the respective age groups. Overall, adjusted hours average 30.2 in comparison to 41.8 reported average hours.

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[20] If 107 minutes for five days is converted to hours the estimate is 8.9 hours per week.

One speculation is that over the long run, as real wages have risen, the disparity between reported (nominal) hours and actual work hours has grown, resulting in a lower rate of growth of output per labor hour. Another speculation is that output per labor hour as conventionally measured may be far more sensitive to the business cycle than output per actual labor hour because firms' labor utilization rates may vary in a more pronounced fashion than suggested by cyclical variations in hours per week. However, from time diary and work schedule information one could construct a more sensitive index of labor utilization. One current measure of labor utilization, over-time hours, may be a better measure on the expansionary side but may not reflect slack in the labor market when output falls and firms and workers report "hours worked last week" as scheduled hours.

Comparisons between the Current Population Survey estimates from Employment and Earnings and the Time Use Survey show that, as in Table 1, hours from the diary are uniformly lower than hours as estimated by reports of total hours worked last week. Conceptually, the CPS definition and the time diary definition are close in that the CPS asks for total hours actually at work including overtime and excluding time paid for but not worked, such as vacation or sick days.

To make comparisons of hours of work between 1965 and 1975 from the time diaries we had to restrict the 1975 sample to urban households and use only the first interview rather than four interview averages (e.g., as in Tables 1, 2, and 3) because the 1965 study had only one time diary per respondent. The 1965 diary data are available only for respondents reporting that they worked 10 hours or more a week in the labor market and we applied this same restriction to the 1975-76 data. While this will tend to result in lower relative hours levels for the CPS measures, which include anyone working for pay for one hour or more a week, it should have a minor effect on comparisons of rates of change between 1965 and 1975. The effect should be toward an understatement in the decline in hours worked in the time diary estimates because of the growth in shorter hours which would presumably exclude more part-time respondents in the 1975 time-use study. As a final methodological note, the data were weighted by day of the week of interview so that each kind of day (Sunday, Monday) received a one-seventh weight.

Between 1965 and 1976 changes in hours worked by all four of the sex-marital status subgroups are negative for the time-diary estimates (Table 4). For the relevant CPS time-diary comparison groups, married men and married women, the time-diary data show somewhat larger percentage reduction in hours for married men, -7.6 percent for married men (-2.9 for the CPS); but far larger reduction for married women, -22.7 for married women (-1.4 for the CPS). Comparisons between the not married are not possible because the CPS includes teenagers (14 or older in 1965-66 and 16 or older in 1975-76) and the time-use data are only for individuals who work in the labor market, 18 or older. Overall, married persons who work reduced their hours by about 2 percent based on CPS data and by about 12 percent based on time diary data.

One ambiguity in the 1965-1975-76 comparisons is whether the changes reflect primarily cyclical or primarily secular trends. (The unemployment rate for 1965 averaged 4.5 percent while in 1976 it averaged 7.7 percent.) If the recorded changes in hours represent cyclical forces then one implication is that time-diary data could be useful in measuring labor utilization over the business cycle, but if they reflect longer-run forces, then the data appear consistent with the changing orientations of women to greater labor-market commitment, corresponding adjustments in nonmarket time use (including

TABLE 4

Weekly Hours at Work in the United States, 1965-1976

	Time Diary Estimates for Those Working*					
	Normal Work			Travel to Work		
	1965[a]	1975[a]	% Change	1965[a]	1975[a]	% Change
rried Men	44.7(448)	41.3(244)	-7.6	5.0	4.5	-10.0
t Married Men	46.0(73)	35.2(78)	-23.5	3.9	4.4	+12.8
l Men	44.9(521)	39.9(322)	-11.1	4.8	4.2	~~-12.5~~
rried Women	34.3(190)	26.5(117)	-22.7	3.2	2.3	-28.1
t Married Women	34.9(152)	35.6(102)	+ 2.0	3.6	3.7	+ 2.8
l Women	34.6(343)	30.8(219)	-11.0	3.4	2.9	-14.7

	CPS Estimates					
	Normal Work (Hours Worked Last Week)			Participation Rates		
	1965[c]	1975[d]	% Change	1965[e]	1976	% Change
rried Men[b]	44.2[c]	42.9[d]	-2.9	95.5	92.2[f]	-3.5
rried Women[b]	34.5[c]	34.0[d]	-1.4	38.7	49.0[f]	26.6
n 20-64	43.9	42.6	-3.0	94.6	92.2[g]	-2.5
men 20-64	35.7	35.0	-2.0	51.7	58.5	13.2

Sample size in parenthesis.

Source: 1965-75/76 Time Use Comparison Tape. Hours of normal work were defined to include regular work for pay outside the home or brought home, overtime, waiting, or interruption during worktime (e.g., machine breakdown), and coffee breaks. Data are weighted using day of the week as a stratification variable, and are available only for those reporting at least 10 hours per week in the labor market.

Married, spouse present.

November, 1965.

November, 1975.

November, 1965.

May, 1976.

April, 1976.

adjustments by the husbands), and increased divorce rates. (Note the greater relative member of unmarried women.)

Whether or not cyclical influences are of major significance in explaining the 1965-76 changes, it appears that market hours of adult men have declined both through somewhat lower particiaption rates and through fewer hours per week. From the CPS married men age 20-64 have reduced their labor force participation rates by 3.3 percent age points from 95.5 to 92.2 percent and, from time diaries, have reduced their hours conditional on participation by 7.6 percent. This implies an overall decline in average hours (including those not participating) of 10.8 percent for married men. On this same basis, married women have actually decreased their labor-market hours (by 2.2 percent) with participation rates going up by 10.3 percent age points over this same period and with time-diary estimates showing 22.7 percent decline in hours of work for those working.[21]

The data on declining hours of married women who work are at first glance quite surprising, but given the growth of divorced women in the labor market and the postponement of marriage by career oriented women, the change between 1965 and 1975 is less puzzling. The unmarried women put in somewhat longer hours than they did in 1965 and other research has demonstrated that divorce is associated with greater labor market hours for women.[22]

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[21] Increased participation and shorter hours of those working are consistent with the growth of part-time employment recorded in CPS data.

[22] Work by Gary S. Becker, Elizabeth M. Landes, and Robert T. Michael has indicated that for married women labor market commitment, as indexed by numbers of children in given age groups, is associated with higher divorce rates. See Gary S. Becker, Elizabeth M. Landes, and Robert T. Michael, "Economics of Marital Stability," Working Paper No. 153, National Bureau of Economic Research, October 1976, pp. 35-38. Analysis of the Panel Study of Income Dynamics shows that women who are divorced have labor force participation and hours of work which rise dramatically. See Saul D. Hoffman and John Holmes, "Husbands, Wives and Divorce," in Duncan and Morgan (eds.) Five Thousand American Families Patterns of Economic Progress. Ann Arbor Institute for Social Research, 1976, pp. 23-76.

Commuting time appears to have declined overall and particularly for married women. This is consistent with studies which indicate a disproportionate increase in jobs outside the central cities during 1965-75. In some sense jobs appear to have followed the earlier suburbanization of housing and this would be consistent with reduced commuting time and the increased labor market difficulties of minority growth.[23]

The differences in changes in hours per week of those working in the market as estimated by diary and reported hours have potential implications for productivity statistics although the exact impact is difficult to assess. The productivity statistics (output per labor hour) are based largely on establishment data which we hypothesize to have a similar bias in terms of reporting hours to be consistently forty or some scheduled amount when in fact they have declined substantially as measured by the CPS and (particularly for married women) as measured by the diary.[24] The index of output per labor hour increased from 1955 to 1965 by 3.0 percent per year (from 70.4 to 94.6) but increased from 1965 to 1976 at a rate of 1.9 percent per year (from 94.6 to 116.2). A part of this sluggish growth pattern in the latter 10 years may reflect increased growth of on-the-job breaks and training as indicated in Table 3. However, the 1965 data do not include such measures ~~as~~ so this is just a conjecture.

If our interpretation is correct, then a good share of this slower productivity growth could be explained by a tendency for conventional labor

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[23]See, for example, Bennett Harrison, Urban Economic Development, Urban Institute, 1974. His analysis (based on work by Charlotte Freeman) shows that while there has been growth in employment in a number of SMSA's, there has been a decline in jobs held by central city residents. (See p. 48-49).

[24]Between 1965 and 1976 there are no significant declines in hours per week in industries which employ the highest proportions of men such as mining, construction, and manufacturing. See Table C1, Establishment Data, Employment and Earnings, September 1976, p. 73.

hour measures to understate the declining workweek when in fact the workweek (for males) has continued the secular pattern of steady decline in hours per week from about 60 at the turn of the century down to about 40 in the late 'forties and early 'fifties,[25] and the workweek for married woman has declined substantially in the last ten years.

If across all labor market groups, actual hours of those working declined at the same rate as for marrieds--a 12.5 percent greater rate (or increased at a 12.5 percent slower rate) than reported hours between 1965-76, this would explain virtually all of the 1.1 percent decline in the rate of growth of productivity. As noted, our estimates suggest a great deal of nonwork time at work and small departures from trend in changes (presumably increases) in nonwork time at work could also account for some of the 1.1 percentage point differences in rates of growth in productivity.[26] If these labor supply factors operate as we suggest, then a slower rate of per worker hour productivity growth could be the result of household decisions combined with poor labor hours measures rather than limited investment opportunities for firms or other capital related explanations.

To support our argument that reported hours provide a less responsive measure of labor market activity we were able to make some comparisons between the U.S. and Japan.[27] The official statistics show virtually no

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[25] To obtain a feel for the potential bias in reported hours it can be noted that of those 155 respondents reporting exactly forty hours as their hours in an average workweek, the time-diary average of minutes at work per week was 2196 or 36.6 hours (defined to include total time at main job as in Table 1 less lunch hours).

[26] For example, the increase in young workers would imply an increase in on-the-job break and training time (See Table 3.) This would not be reflected in average hours at work as conventionally measured nor as measured by our diary definition.

[27] We would like to thank Gary Saxonhouse for guidance and advice with respect to Bureau of Statistics data.

decline in hours per week for those Japanese adults in the labor market (Table 5), and the only substantial decline in hours is reflected in reduced participation rates of women, particularly married and younger women (under 40). If we believe income effects to have a dominant influence on labor-market hours, and this is the usual explanation of the secular decline of hours per week in the United States, then we would expect the phenomenal productivity growth in Japan to result in less hours in the labor market.

Fortunately, there have been time diaries conducted in Japan during the last 15 years. The time diaries show large declines in hours of adult men (16.4 percent from 1965 to 1975) and even larger declines in hours of adult women (26.7 percent from 1965 to 1975). The larger declines are for younger women and hence the pattern of change in labor-market hours of women in Japan is exactly the opposite of that in the United States where the largest increases in labor-market hours have been for younger women.[28] If behavior of younger women is an index of the lifetime labor-market commitment then Japanese women have made a pronounced shift away from the labor market while women in the United States are now approaching the Japanese women in average hours per adult (18.1 hours per week[29] versus 23.6 hours per week).[30]

Measurement of work intensity while at work is more ambiguous than measurement of formal or informal but identifiable periods of non-work. Our

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[28] In particular, the labor force participation rate of young married women has increased from 33.1 percent to 49.9 percent for those in the 35-34 age cohort and from 39.8 percent to 55.6 percent for those in the 20-24 age cohort.

[29] The larger increase in the cohorts of childbearing ages are consistent with increased costs of children as a variable increasing the supply of hours of married women. It should be noted that not only smaller families but smaller expected families should increase labor market hours. Evidence on this is in C. Russell Hill and Frank P. Stafford, "Time Inputs to Children," in J. N. Morgan, ed., 5,000 American Families -- Patterns of Economic Progress, Volume II (Ann Arbor: Institute for Social Research, 1974).

[30] From Table 4. 18.1 = (.585)(30.9).

TABLE 5

Weekly Hours of Market Work in Japan 1965-1974/75

	Time Diary Estimates for Adults (Including Non-Participants)[a]			
	1965	1970	1975	% Change 1965-1975
Adult Men	54.1	51.2	45.0	-16.4%
Adult Women	32.2	26.4	23.6	-26.7

	Bureau of Statistics Estimates[b]						
	1965	page and volume year	1970	page and volume year	1974	page and volume year	1965-1974
Men							
LFPR(%)							
All	81.7	9 (1965)	81.8	81 (1974)	81.6	90 (1974)	-0.1
20-54	94.5	9 (1965)	94.0	23 (1974)	94.0	23 (1974)	-0.5
Hours/Week	49.8	62 (1965)	51.3	101 (1970)	49.8	111 (1974)	0.0
Women							
LFPR(%)							
All	50.5	14 (1965)	49.9	79 (1974)	46.6	79 (1974)	-7.7
45-54	58.4	27 (1974)	61.0	27 (1974)	60.2	27 (1974)	3.1
Married	49.9	15 (1965)	48.3	45 (1970)	45.8	79,91(1974)	-8.2
Hours/Week	43.1	65 (1965)	43.6	109 (1970)	42.2	103 (1974)	-2.3

[a]Source: Masayuki Furukawa, "How Japanese People Spend Their Time, 1960-75," manuscript, Public Opinion Research Institute, Japan Broadcasting Corporation, December 1976, Table 3, p. 11.

[b]Annual Report on the Labor Force Survey, 1974, 1970, 1965.

approach was to rely on a ten-point scaling of a typical hour at work.[31] We also measured the same energy scale for TV watching since this is virtually a universal activity (diary estimates from the entire sample of respondents averaged 138 minutes per day) and is likely to be comparable across individuals in required energy and effort, though one respondent mentioned that TV effort depends on how close the game is. The mean scale for energy and effort at work (X_1) was 8.2 while the mean on the scale for watching TV (X_2) was 3.4. We defined an index of work intensity by comparing the energy and effort scale at work with energy and effort in watching TV. The scale was $(X_1 - X_2)/(10 - X_2)$ and ranged from one to a lower bound of zero since for those few cases where $X_2 > X_1$ we set the scale to zero.[32] On this basis, professionals, union members, part-time employees (those employed less than 30 hours per week) and married women report the greatest effort per hour at work.

Formal or informal rules for resource allocation within a firm are substitutes for market transactions. One of the important aspects of a labor

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31 The question was: "Now I'd like you to think of a 10-point scale for the amount of energy and effort you put into an activity, with 10 representing all your energy and effort, and zero representing hardly any at all. Five would be about half-way in between ..."

32 The scale may require some additional explanation. A simple 10-point scale assessment of work effort can be faulted because of respondent-to-respondent differences in use of the scale. Some tend to cluster their responses around the midpoint of the scale regardless of the activity, while others place their responses at the extremes of the scale. Since television watching is a nearly universal activity which requires nearly uniform (lack of) effort, the effort rating of television was used to anchor the zero point of our work effort variable. In the small number of instances that the work effort rating was less than or equal to television effort, the ratio was set equal to unity.

contract is explicit or implicit rules governing the level of effort, and level of work effort is a more critical aspect of labor input the larger the capital stock per worker. Then there are incentives to work the capital intensively and continuously.[33] Hence the firm would be willing to offer a wage premium to elicit a greater and more consistent level of on-the-job effort from its work force.

If union contracts represent greater use of formal rules for resource allocation[34] we would expect this to show up in greater reliance on formal rules for work breaks as well. Further, if unions are more prevalent in capital-intensive production processes, we would expect higher wages and a greater work pace to utilize better the capital stock. The data in Table 3 are consistent with this view of union contracts. There is somewhat greater time in scheduled breaks for union members and somewhat less in unscheduled, informal breaks even though overall break time is about the same for members and non-members. There is a higher reported level of work effort on the part of union members despite the fact that blue-collar workers, who are organized in the highest proportions, report work effort slightly below the sample mean. Whether adjustment for work effort will alter our beliefs about the reasons for observed union/non-union wage differentials that adjustments for work effort and flexibility of work schedule are important.[35]

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[33] By using shifts, for example. See Deardorff and Stafford, "Compensation of Cooperating Factors," Econometrica, July 1976, pp. 671-84.

[34] If union organization can be thought of as representing, in part, a larger allocation of resources to the development of and compliance with a work contract, both labor and management are likely demanding more resources devoted to contract compliance. Alchian and Demsetz emphasize unions as ascertaining employer compliance with the contract. See their, "Production, Information Costs and Economic Organization," American Economic Review, December 1972.

[35] Analysis of differences in work pace, hours flexibility and capital intensity implies that such adjustments are important. See our working paper, "Do Union Members Receive Compensatory Wage Differentials?" forthcoming, American Economic Review. There we argue that certain work settings give rise to a greater payoff to workgroup rules which coordinate effort. Unions arise because they represent mechanisms for reaching agreement on these rules.

The implication of the data presented in Tables 1 and 3 is that non-work time is an important component of time at work and that jobs (or individuals) are heterogeneous in their requirements (or preferences) for time and energy while at work and that jobs (or individuals) are heterogeneous in the extent of on-the-job training. This heterogeneity bears on a number of substantive issues in the analysis of household behavior and labor markets, including male-female differences in wages and hours of work.

Descriptive statistics on male-female differences in time use at work, both unadjusted and adjusted for years of education, experience and hours worked per year are provided in Table 6. The data indicate that women spend less time at work in non-work activities (lines 2-6) and work harder while at work (line 10). Accordingly, male-female wage differences are proportionately larger when hours are adjusted for non-work time (lines 7-9). However, preliminary analysis of time-diary data reveals that married women who work full-time and part-time spent averages of 178 minutes and 75 minutes per week, respectively, in travel to and from work whereas married men who work spent an average of 253 minutes per week in travel to and from work.

In addition data from Table 1 show a larger difference between non-diary and diary estimates of hours at work per week for married women than for married men. While work hours of married men as estimated from the work schedule (Minutes Per Day on Weekly Basis) are 0.5 percent greater than time at main job less lunch (41.5 versus 41.3 hours) work hours of married women based on the work schedule are 22.5 percent greater (37.5 versus 30.6 hours). The corresponding percentages for not married men and not married women are 11.6 and 6.1 percent.[36]

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[36] Hours per week based on reported average hours per week are 11.6 percent and 20.9 percent greater than time-diary hours for married men and married women, respectively. The corresponding figures for not married men and not married women are 16.6 and 7.5 percent.

TABLE 6

Male-Female Differences in Work Breaks, Training, Work Effort and Wage Rates

	Unadjusted Mean		Unadjusted % Difference (women/men)	Adjusted[a] % Difference (women/men)	Significance Level of Difference in Adjusted Means
	Men	Women			
Nominal work hours per week	45.6	37.1			
Time spent in coffee & scheduled rest breaks (minutes/day)	17.3	15.4	90%	90%	n.s.
Time spent relaxing (minutes/day)	33.7	19.3	57	51	$p<.001$
Total non-work time (= 2. + 3. + lunch time > 60 minutes) (minutes/day)	52.1	35.1	67	65	$p<.001$
$\frac{\text{Non-work time}}{\text{Total time at work}}$ (in %)	10.8	7.9	74	66	$p<.001$
Time spent in on-the-job training (hrs/week)	2.6	1.7	68	61	$p<.05$
Nominal wage rate ($/nominal hours)	$7.00	$4.34	62	74	$p<.001$
Nominal wage rate adjusted for time spent in breaks and relaxing.	$7.97	$4.74	59	69	$p<.001$
Nominal wage rate adjusted for breaks, relaxing and training	$8.48	$4.86	57	65	$p<.001$
Work effort (0-100 scale)	68.4	76.8	112	115	$p<.01$

[a] Adjusted for years of education, work experience and nominal work hours

Note: The sample consists of 208 males and 168 females who had regular work schedules. From Wave III of Time Use Survey, May-June, 1976.

Without attempting an explanation of the differences in hours measures between married men and married women, taken by themselves, the hours differences would imply that for those married the conventionally measured ratio of female to male wage rates would be .82 of the diary based wages and for those not married 1.05 of the diary-based ratio. The ratio of the nominal wage of married men to that of married women is .60 and adjusting it by the diary hours of work results in a ratio of .73. For not married the comparable statistics are .91 and .87. Full analysis of work-related time-use differences between men and women would require a framework for interpreting job search strategies, time use at work,[37] and some attention to the difference between reported average hours and time-diary estimates of hours.

II. Life Cycle Variations in Time Use While at Work

A central and universal prediction of existing life-cycle models of leisure, labor supply and human capital is that, ignoring complications of interest rates and time preference, hours actually working in the labor market show a direct relation to potential wage during at least a part of the "middle years," which we define operationally as ages 25-54. In the basic Ghez-Becker model this wage-hours-working relation over the life cycle is unequivocal because human capital is exogenous,[38] but if investment time is added en route to endogenizing skill, then the relation requires qualifications

[37] If there are pecuniary external economies from centralized business and production districts then commuting time can be regarded as an input to "producing" central business districts just as well as it can be regarded as an input for "producing" housing space.

[38] See Ghez and Becker, op.cit., Chapter 1, Section 2.

including those related to depreciation and other relevant parameters which determine the rate at which (on-the-job) investment declines.[39]

To define hours actually working, our empirical measures net out leisure at work and time investments. This time investment approach relies on the notion that individuals desiring more learning have time uses at work which differ from those desiring less learning and that on-the-job training can therefore be measured by time use (Heckman and Ryder, Stafford and Stephan). It does seem likely that opportunities to transform time into new skills differ across jobs (Blinder and Weiss). In the extreme case only job choice matters for learning, time use while at work is not important, and learning occurs by doing.[40] We believe that the data on separate training are consistent only with the time investment view, whereas the data on joint training are consistent with some blend of the time investment and learning-by-doing views. Skill acquisition of the pure learning-by-doing variety would not be measured by our current empirical approach.

Because the life-cycle models referred to above do not explicitly treat childrearing as part of the dynamic problem, their predictions seem more

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[39] In particular see Heckman, op. cit., pp. S18-S21 (especially Figures 7 and 8); Ryder, Stafford and Stephan, op. cit., pp. 669-70 (especially equations 34a and 34b); and Blinder and Weiss, op. cit., pp. 463-66 (especially Figure 4). In the Blinder-Weiss specification hours at work (h) and learning opportunities (X) which are defined across jobs, are the separate decision variables which along with earnings capacity, determine actual earnings and rate of skill acquisition.

[40] For a discussion of training components of jobs see Sherwin Rosen, "Learning and Experience in the Labor Market," Journal of Human Resources, 7, Summer, 1972, pp. 326-42. The distinction between time investments and learning through the structure of the job is set out in his "income Generating Functions and Capital Accumulation" Discussion Paper No. 306, Harvard Institute of Economic Research, June 1973. On the one hand "individuals can be treated as self-producers of learning in which previously acquired knowledge is split (in the sense of 'time') between work and learning activities ..." and "[a]nother way of looking at it is to regard learning as a joint product of work experience. Different arrangements of work activity provided by firms give rise to different learning opportunities, and the labor market establishes a set of equalizing wage differentials on alternative work-learning combinations." p. 12.

relevant for males, who usually participate in the labor market on a continuous basis. Our empirical work will be restricted to males and family variables will be added to hours equations as a crude check on the possibility that increased work hours are primarily the response by husbands to increased financial pressures from marriage and children[41] rather than reflecting anything resembling a life cycle "strategy" of relating training to future wages and then increasing labor supply to coincide with the periods of high earnings potential.[42]

Using our measures of break time and on-the-job training time described in Section I, we regressed alternative hours measures on age and education for our sample of 208 male respondents. Equations (1) - (3) of Table 7 and the hours graphs on Figure 1 demonstrate an increasing age dependency to hours of work as non-work time components are subtracted from nominal hours. The age variable was introduced in log form since this allows an elasticity interpretation of the coefficient and since, for males, hours rise throughout the age group (except for the very small numbers of workers age 65 or older). With work hours measured in the conventional way, the estimated effect of an increase in age on work hours is small (an elasticity of .098) and barely statistically significant. As the hours measure is refined by subtracting on-the-job leisure and training, the estimated elasticity becomes larger (.13 and .30 percent, respectively) and quite significant. Our cross-sectional estimates of age elasticity of the various hours measures are quite stable when the simple

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[41]With imperfect planning and rising marginal borrowing costs, labor supply adjustments assume a greater significance.

[42]Although, for some, the life-cyle models may connote implausible amounts of rationality to decision makers, one can argue that simple imitation of other individuals in comparable circumstances but of different ages is a low cost mechanism which individuals can use to formulate a lifetime plan. For example, assistant professors were willing to accept lower wages at prestigious schools even before the development of models of on-the-job training.

TABLE 7

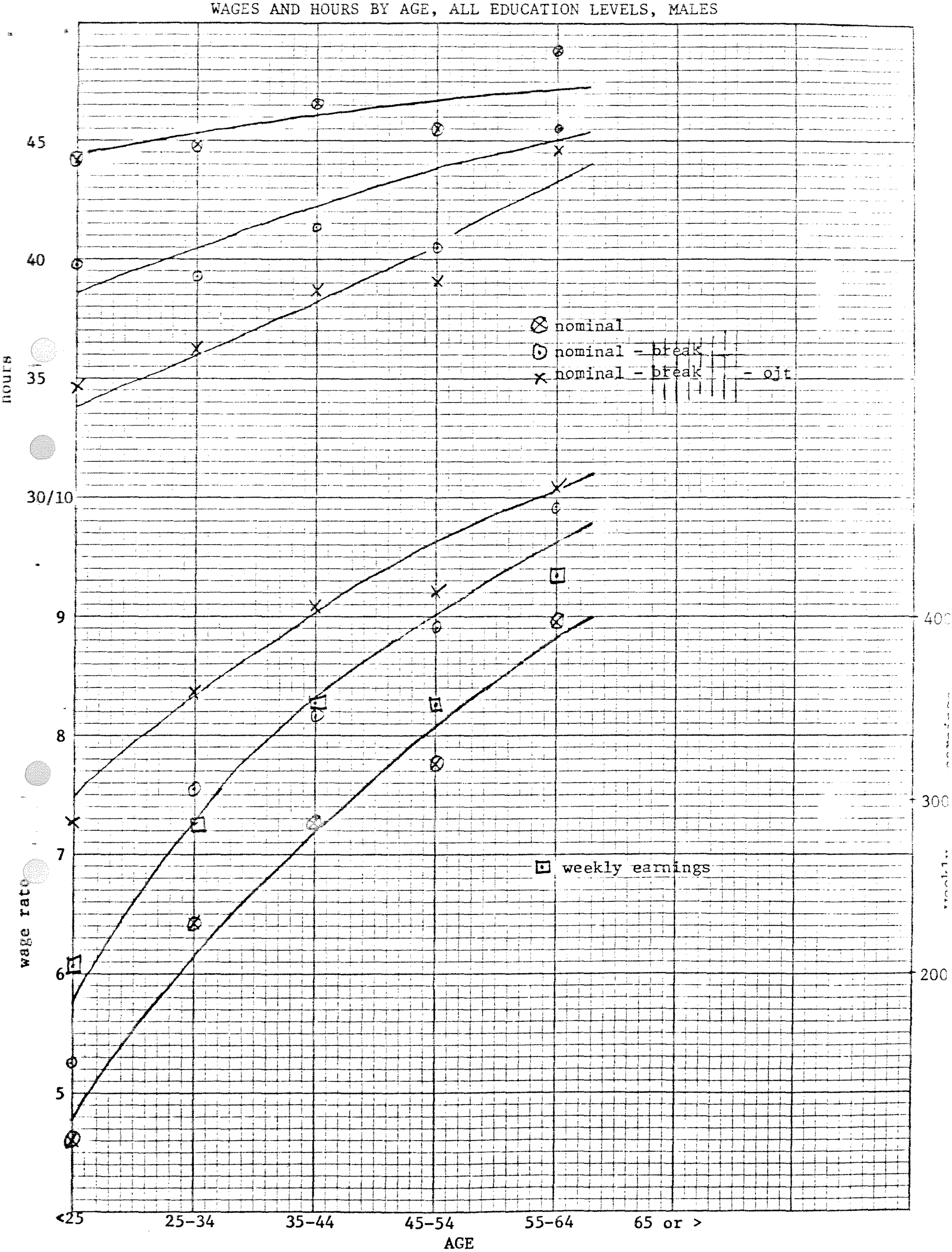
Life Cycle Labor Market Hours of Men
(Dependent Variable is Log_E of Alternative Hours Measures)

VARIABLE	(1) Ln (Nominal Hours)	(2) Ln Nominal Hrs. Less Break Time)	(3) Ln Nominal Hrs. Less Break-OJT	(4) Ln (Nominal Hours)	(5) Ln Nominal Hrs. Less Break Time)	(6) Ln Nominal Hrs. Less Break-OJT)	(7) OJT Time (Hrs/Wk)	(8) Break Time (Mins/Day)
ED	.0083 (.0050)	.0140 (.0063)	.0117 (.0084)	.0081 (.0050)	.0134 (.0064)	.0122 (.0084)	.096 (.121)	-1.61 (1.22)
LN AGE	.098 (.044)	.130 (.056)	.300 (.075)	.085 (.046)	.118 (.058)	.272 (.077)	-3.46 (1.10)	-12.0 (11.2)
WHETHER MARRIED	—	—	—	.042 (.035)	.033 (.044)	.100 (.059)	-1.30 (0.84)	4.2 (8.5)
# CHILDREN UNDER 18	—	—	—	-.005 (.010)	-.009 (.013)	-.00085 (.01664)	-.244 (.238)	0.155 (2.418)
CONSTANT	3.33 (0.22)	2.97 (0.28)	2.39 (0.38)	3.36 (0.18)	3.06 (0.23)	2.41 (0.31)	15.0 (4.4)	112.9 (44.5)
R^2/S.E.E.	.024/.204	.030/.258	.071/.342	.040/.203	.048/.257	.092/.340	.087/4.86	.014/49.4
N	208	208	208	208	208	208	208	208

Note: Standard errors are given in parentheses.

FIGURE 1

WAGES AND HOURS BY AGE, ALL EDUCATION LEVELS, MALES



demographic variables, whether married and number of children under 18 are added into the equation.

The elasticity of hours of on-the-job training and of minutes of break time with respect to age are both negative, and equal -1.46 and -.21 at their respective means. As in the case of the work hours variables, neither of the demographic variables has a statistically significant relation to time use at work, although marriage does result in a rather substantial reduction in training time. Training time has a mean of 2.57 hours per week and the point estimate of the reduction associated with marriage is 1.30 hours.

Our analysis suggests that previous research on life-cycle labor supply has found a rather weak age dependency to hours at work because the nominal hours elasticity is the result of offsetting positive and negative elasticities of work and non-work time at work with respect to age. The elasticity of total time at work with respect to age can be defined as the weighted sum of the various component elasticities with respect to age.[43] This can explain the rather constant nominal hours per year in the labor market, particularly over the age range 25-60, for men.[44]

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[43]In this case w have $\eta_{N\cdot A} = \Theta_W \eta_{W\cdot A} + \Theta_B \eta_{B\cdot A} + \Theta_T\ _{T\cdot A}$ where N is nominal hours at work, W is actual work hours, B is break time, T is training time, and the Θ's are time shares. The share values at the mean are: $\Theta_W = .848$, $\Theta_B = .095$, $\Theta_T = .057$. Evaluating break and training elasticities at the mean one can calculate $\eta_{N\cdot A}$ from equations (6)-(8) as .125, which is comparable to the value of .118 from (5).

[44]See Figures 3.2-3.8 and Tables 3.9 and 3.10 of the Ghez-Becker volume. T. Aldrich Finegan finds a significant age and education effect on hours worked. See his, "Hours of Work in the United States: A Cross-Sectional Analysis," Journal of Political Economy, October 1962, pp. 452-70.

From the life-cycle theory reviewed above another implication is a greater age dependency to hours at work for more able persons.[45] Suppose that early home environment and school quality have the effect of improving an individual's ability to learn rather than simply increasing the labor market human capital. Then the steady state capital stock will be greater and there will be a stronger relation between age and hours actually working at work (even though nominal hours could be less age dependent since training takes place at work). Regressing hours on age categories separately for those with college and others, one can reject the null hypothesis of equal slopes across the two education groups at nearly conventional levels of significance in the case of effective hours ($p = .119$) but not in the case of nominal hours ($p = .372$).

Regardless of the hours measure used, our data do not provide another example of the commonly observed cross-section age peak to hours (Figure 1). We suspect that this is in part related to the trend to early retirement and the general decline in labor force participation or workers age 65 or older, who usually work fewer hours.[46] Even though cross-section earnings never turn down with age (by reason of few workers 65 or older), our data confirm

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[45]See Heckman, op. cit., p. S29 and Ryder, Stafford and Stephan op. cit., p. 670 (discussion of Zone II). Since persons with greater ability to learn will have a more pronounced age-capital profile they will have, correspondingly, a more pronounced age-hours relationship in some part of the middle years. The Blinder/Weiss model also appears consistent with such age hours differences across ability levels. In contrast a simple increase in initial human capital would not be likely to increase the age dependency to hours save the cases discussed on pp. 662-66 of Ryder, Stafford and Stephan.

[46]See Table 34, p. 114, Economic Report of the President, 1976. We have so few males age 65 or older (less than 2 percent of the sample) that hours worked cannot be measured for this group. See also Burkhauser and Turner, who argue that since preretirement wages should include the added future social security benefits we would expect the pre-62 workers to reduce their labor effort by less than they would in the absence of Social Security. Richard V. Burkhauser and John A. Turner, "A Time Series Analysis on Social Security and Its Effect on the Market Work of Men of Younger Ages," Journal of Political Economy, August 1978, p. 701-715.

the human capital prediction that age-capital profiles (as represented by age-effective-wage profiles) are flatter than age-earnings profiles.

III. Nonmarket Time Use of Those in the Labor Market

A. Descriptive Statistics

Nonmarket time use or "lifestyles" of those in the labor market varies across the different groups in the labor market. Using the time diaries from the 1965 study and the first wave of the 1975-76 study, average daily minutes spent in various types of primary time use[47] were calculated for various demographic groups in 1965 and in 1975. The data are based on a special 1965-75 comparison file and are restricted to those in urban areas who report working at least 10 hours per week in the labor market. Time at work entries are the same as Table 4 but are on a minutes per day basis. Overall, work at home in 1975 averaged about forty percent of market time, namely 136 minutes per day or 15.9 hours per week. (Market time at main job averaged 316 minutes per day or 36.9 hours per week.) Personal care (sleeping, resting, bathing) averaged 662 minutes per day or 77.2 hours per week; active leisure averaged 34 minutes per day or 4.0 hours per week, and passive leisure averaged 172 minutes per day or 20.1 hours per week.

There are substantial differences (and in plausible directions) between various occupational groups in their nonmarket time use. For example, craftsmen spend far less time in housework and, not surprisingly, more time in household repairs, maintenance and gardening. They are also more likely to be involved in physically active leisure. Managers have the most labor

[47] Secondary time use is defined as other activities which take place in addition to the major (primary) activity. Listening to a radio, is, for example, almost always a secondary activity.

market time and have less time in personal care, passive leisure other than TV, and shopping.

In our sample of labor market participants married men and married women work about equal total time at home and in the market (about 8 1/2 hours per day) but with differences in the composition between and within market and nonmarket activities. Other calculations from the 1975-76 data show that married women under the age of 65 who do not work in the market report 36 percent less work time or a total of 2730 minutes per week in work at home and in the labor market.[48] It is unclear whether, in utility terms, married women who do not participate in the labor market are better off in light of reduced total work time. This is because most respondents report market work for the typical (average) hour as enjoyable or providing satisfaction while housework is rated quite low.

The time-diary data are consistent with the life-cycle pattern to leisure observed in our section on on-the-job time use. As noted there, hours at work as measured by the time diary have a more pronounced age relation than do hours as conventionally measured by respondent reports of average hours per week. The prediction of less leisure time for those in their peak earnings years is given reasonable support by the data in Table 8, particularly for the 1975 data where there is a peak in total work time in the 35-44 year old age group. In 1975 young people (those under age 35) spent the most time in active leisure (such as sports participation, hobbies and games) and social events, and spent somewhat more time than those age 35-54 in passive leisure pursuits, such as watching television and listening to radio or records. Television watching, the largest component in passive leisure, rises somewhat

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[48]Total work at home in housework, household repairs and maintenance was 1614 minutes, baby and child care average 488 minutes, shopping and financial services 461 minutes and time in the labor market 169 minutes. Apparently, those who report not being in the labor market do spend some time in market work.

TABLE 8

Minutes Per Day at Home and in the Labor Market
For Those in the Labor Market,[a] 1965 and 1975
(data for 1975 in parentheses)

GROUP	Labor Market Time: Total Work Time[b]	Labor Market Time: Main Job Time	Labor Market Time: Second Job	Labor Market Time: Travel To Work	Work at Home: House-work	Work at Home: Household Repairs, Maint., Gardening	Work at Home: Baby, Child Care	Work at Home: Shopping, Financial	Personal Care	Educa-tion	Organiza-tions	Social Events	Active Leisure	Passive Leisure: Non-TV	Passive Leisure: TV	Sample Size
ENTIRE SAMPLE	409(367)	350(316)	7(3)	37(33)	76(64)	8(13)	19(19)	47(40)	647(662)	11(20)	16(15)	39(34)	24(34)	60(55)	84(117)	864(557)
Occupation																
Professional	408(341)	348(293)	9(5)	33(29)	70(65)	7(20)	17(24)	47(39)	632(666)	28(13)	23(18)	50(34)	27(41)	77(66)	52(112)	169(99)
Managers	456(476)	400(410)	0(6)	46(45)	54(37)	10(19)	18(16)	35(31)	653(634)	4(2)	10(6)	38(36)	14(30)	70(41)	75(111)	89(78)
Clerical and Sales	389(317)	328(272)	8(1)	36(31)	112(96)	6(7)	19(21)	51(48)	650(690)	11(24)	16(11)	39(33)	22(19)	54(59)	69(116)	215(150)
Craftsmen	430(398)	366(347)	10(1)	36(37)	34(37)	14(22)	17(16)	52(39)	640(622)	5(34)	19(90)	36(27)	26(52)	66(56)	101(127)	140(87)
Operatives	434(411)	376(351)	5(9)	38(34)	45(48)	10(7)	15(11)	44(36)	647(686)	1(11)	12(20)	39(23)	31(14)	46(47)	116(126)	141(65)
Service and Labor	345(332)	295(288)	6(2)	32(30)	127(63)	2(8)	30(22)	43(46)	670(663)	9(22)	10(20)	30(55)	14(49)	52(50)	108(109)	110(74)
Sex, Marital Status																
Male, Married	451(428)	383(365)	9(7)	43(40)	23(25)	13(18)	17(15)	44(37)	639(642)	10(18)	16(15)	35(29)	26(31)	62(51)	103(132)	448(248)
Male, Unmarried	454(353)	394(309)	8(2)	33(34)	37(38)	2(10)	5(5)	36(29)	636(667)	20(34)	15(12)	76(48)	27(59)	57(66)	73(118)	73(86)
Female, Married	337(276)	294(242)	2(0)	28(21)	181(143)	4(10)	29(31)	51(55)	652(685)	4(7)	9(16)	30(35)	23(24)	62(53)	59(105)	190(119)
Female, Unmarried	350(353)	300(305)	5(0)	31(32)	121 (89)	2(7)	19(27)	56(41)	671(684)	17(20)	23(10)	46(36)	16(24)	54(55)	66(94)	152(104)
Education																
0-8 Grades	401(407)	341(351)	6(3)	38(37)	72(37)	10(4)	19(6)	43(23)	678(695)	0(9)	16(24)	20(46)	19(29)	51(55)	112(104)	119(49)
9-11 Grades	419(404)	360(341)	7(9)	36(37)	73(66)	7(6)	15(13)	49(35)	641(646)	2(25)	13(15)	37(19)	33(36)	49(42)	100(132)	153(75)
High school	412(339)	356(295)	6(3)	35(28)	94(77)	7(14)	21(22)	43(50)	642(675)	3(2)	16(15)	40(36)	20(31)	59(56)	84(122)	297(219)
Some College	430(375)	371(328)	6(0)	39(33)	53(55)	5(17)	14(22)	57(32)	641(634)	40(49)	15(9)	39(36)	26(38)	55(51)	65(123)	135(91)
B.A. (B.S.) or more	377(388)	316(328)	10(4)	36(41)	72(53)	12(18)	23(21)	48(38)	646(656)	18(25)	18(10)	57(35)	25(32)	84(62)	60(101)	152(123)
Age																
19-24	408(331)	348(290)	5(0)	36(29)	54(38)	2(11)	14(4)	44 (60)	673(664)	45(56)	8(6)	65(63)	24(29)	37(63)	66(115)	123(74)
25-34	415(388)	353(337)	12(5)	34(33)	61(52)	8(14)	33(34)	43(33)	628(638)	10(22)	15(11)	41(31)	29(44)	53(48)	103(126)	191(186)
35-44	409(390)	351(336)	8(4)	36(36)	83(77)	9(10)	23(23)	52(28)	638(657)	3(12)	18(17)	47(44)	22(21)	60(61)	77(100)	208(123)
45-54	397(376)	341(320)	4(5)	38(36)	91(85)	12(14)	11(11)	48(54)	665(672)	5(4)	15(15)	25(23)	21(28)	69(42)	82(113)	202(97)
55-64	415(323)	356(272)	5(2)	39(33)	86(67)	7(18)	9(3)	46(41)	642(718)	2(2)	22(23)	22(14)	21(33)	78(67)	90(131)	136(75)
Annual Income (1965 $)																
$ 0-3500	415(459)	353(388)	13(9)	35(44)	93(51)	3(1)	25(14)	44(18)	631(660)	27(19)	16(19)	37(18)	9(30)	53(35)	88(117)	79(41)
3501-5500	368(395)	313(351)	8(0)	30(28)	92(59)	5(5)	22(15)	51(40)	666(645)	5(20)	18(15)	48(53)	17(34)	46(39)	101(122)	147(40)
5501-8000	399(366)	345(321)	3(0)	35(29)	78(72)	7(4)	15(18)	47(40)	664(683)	8(37)	16(5)	36(30)	34(39)	51(45)	85(101)	131(47)
8001-8750	424(355)	361(306)	12(3)	36(31)	73(70)	9(7)	19(25)	49(34)	640(656)	11(28)	20(15)	30(35)	23(39)	58(53)	84(123)	206(117)
8750 or more	425(363)	367(313)	3(5)	41(34)	67(67)	10(21)	16(19)	45(46)	636(654)	12(10)	12(14)	45(32)	25(31)	77(57)	71(124)	285(255)

[a]Being in the labor market was defined by 10 hours or more work per week.

[b]Including time at lunch.

[c]Subgroup sample sizes may not add to totals due to missing data.

beyond age 35-44. Also, time spent in meals at home (not shown in Table 8) which is separate from preparation or clean-up, increases with age and this can be treated as a form of passive leisure.

In summary, time-intensive activities outside the market are greatest for younger and older persons but the composition changes from active to passive leisure as people in the work force grow older. People in their peak earnings years spend the least time in such time-intensive activities and spend more time in the labor market in actual work.

Certain time uses are rather obviously related to home ownership. Since the probability of home ownership is greater in older age groups of the working population, and, since home maintenance does require some skills which may be built up with experience, there is a reasonably strong age dependency to household repairs and maintenance and to housework.

Some of the other major time use categories have patterns which one would expect. For example, TV watching is somewhat more prevalent among groups likely to be characterized by lower wages. This is an activity which is very time intensive and for which no specialized stock of skills is required (unlike home repairs). Hence it should be (negatively) wage related, and, thus, people with college education, high income ($8750 or more), and those in the middle age groups will be predicted to watch less TV quite apart from any explanation which relies on different or "more elevated" tastes among such groups. However, TV appears to have made its largest relative gains among the more skilled occupations and the college educated between 1965 and 1975.

For the sample of respondents age 65 or older, activity in the personal care category (sleep, resting, washing) averages about 800 minutes per day in comparison to about 650 minutes per day for the labor force sample. In our labor force sample personal care is not related to the obvious variable of age.[49] Of those in the labor force, time sleeping is negatively related to time working (not shown in Table 8). Those who work 50 or more hours per week and those with high monthly income (who also work long hours) sleep the least. One interesting possibility is that those with the greatest labor market income have more energy and a greater preference for labor market time rather than simply being more skilled.

The major overall changes in time use between 1965 and 1975 of those in the labor market is a decline in total market work time of about 40 minutes, a decline in total time in work at home of 14 minutes coupled with increases in time devoted to personal care of 15 minutes, education 9 minutes and TV time of 33 minutes; in short a switch away from work to nonwork activities. Part of this may be a cohort affect since the 1975 cohort of 19-24 year olds has a far smaller amount of total labor market time (328 minutes per day) in comparison to the 1965 cohort of 19-24 year olds (408 minutes per day). However, the 25-34 and 35-44 year olds of 1965 who are 1975's 35-44 and 45-54 year olds, respectively, exhibited declines in total market work time of 415 to 387 minutes per day and of 409 to 373 minutes per day. Further the 45-50 year olds of 1965, who worked 397 minutes per day in the labor market were working 323 minutes per day as the 55-64 year olds of 1975. Hence, the decline in labor market time appears to hold across all age cohorts rather than simply being less hours worked by fresh cohorts of young people.[50]

Other notable changes in time use between 1965 and 1975 include the very dramatic rise in time spent viewing TV by the college educated, higher income, professional and female respondents; a large percentage rise in

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[49] A similar result is reported by Robinson, Converse and Szalia, p. 129.

[50] Note that the largest absolute decline for the 1965 cohort of 45-54 year olds provides additional evidence for the hypotheses discussed in Section II.

active leisure and household repairs maintenance and gardening. However, the groups with the largest increases in active leisure and household repairs, maintenance and gardening are quite different. For the former those with the largest increase are in the lowest income groups and for the latter the largest increases are for managers, professorials, craftsmen and operatives. Women in the labor market have reduced their hours of housework substantially. For married women hours of housework have declined by 4.4 hours per week and for unmarried women hours of housework have declined by 3.7 hours per week. They have had large percentage increases in TV time and modest increases in time devoted to child care.

B. Substitution and Income Effects on Market and Non-Market Time Use for Married Men

Conventional wisdom on labor supply of married men is that hours supplied to the market are quite unresponsive to variations in wage rates and non-labor income. Hours to market equations have typically been estimated from aggregated data, such as data for entire labor markets, or from microeconomic data. For the latter it is common to estimate hourly wage rates by dividing labor income by hours. As we have seen in Section II, hours estimated by respondents appear to be quite unreliable (though the time-diary estimates can be shown to have some validity) in the sense that alternative measures such as the time diary averaged over several days or recall of the work schedule yield hours estimates which correlate about .5 with the respondent reports of average hours per week.

If there is substantial positive error in the hours report this will result in a lower wage rate and conversely for underreported hours. As a consequence, simple measurement error will reduce the algebraic value of the correlation between hours and wages and combined with the aforementioned negative error covariance the resulting labor supply elasticity will likely be understated[51] and may even appear to be of the wrong sign. Of course instrumental variable techniques or other methods of dealing with errors-in-variables can be employed. In this section we attempt to avoid this problem of measurement errors by utilizing as the dependent variable an hours-to-market variable which is separate from the hours variable used to calculate the wage rate. In particular, our dependent variable is minutes per week in market activities from the four time diary average[52] and the wage rate is the one estimated by dividing labor income by respondent reports of average hours.[53] We also investigate income and substitution effects for various non-market uses of time.

To summarize our results we find that, using our procedure, a reasonable positive substitution elasticity is estimated for labor market time but using as a dependent variable the same hours measure used to calculate wage rate results in an estimated negative substitution elasticity as one would expect if there is substantial measurement error in any given hours measure. Another important result is that hours spent by married men in non-market activities appears to be often more responsive to wages and income than are labor market hours. Taken literally our results for married males imply that an income support system such as food stamps would, through the "income guarantee" component induce more time for meals out and that lowering marginal

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[51] This result depends on error covariances between hours and estimated family or "other" income.

[52] The four diaries include two weekdays, a Saturday and a Sunday for each respondent.

[53] An alternative approach would be to use reported hours from the initial interview to estimate wages and to use reported hours from a subsequent reinterview as the dependent variable in an hours supplied equation. If, as seems likely, there is a positive correlation of the errors in the hours estimates (i.e. overreporters tend to overreport in both interviews) then this will not be as effective as using time-diary hours as the dependent variable.

welfare benefit reduction schedules for labor income would increase hours in the labor market and time spent in meals out of the home.[54]

Although we have avoided the most obvious pitfall of having a wage variable which has a large negative error covariance between the dependent and independent variables, our wage measure still has a substantial error variance and on this basis we would expect a bias toward zero in the estimated substitution elasticity.[55]

Estimates of substitution and income effects on time use to different activities were developed for males. In choosing non-market time-use categories we selected two obviously time-intensive activities, namely watching television and sleeping, but identifying any other particular time uses as _a priori_ good intensive was more difficult, although on the basis of our estimates meals out appear to be good intensive. Time in the labor market is consistent with existing estimates, though the substitution elasticity of

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[54] This prediction is more likely to be valid for the "near poor" since the voucher-like aspects of food stamps are rather modest for recipients who are above the lowest income groups. This is particularly true in light of changes in effect as of January 1979 which give recipients the "bonus value" of the Food Stamps without the purchase requirement.

[55] If the model estimated is $\mathcal{H}_i = \alpha_0 + \alpha_1 \mathcal{W}_i + \alpha_2 \mathcal{Y}_i + E_i$ and if $H = \mathcal{H} + v$, $W = \mathcal{W} + u$, $Y = \mathcal{Y} + w$ where v, u and w are measurement errors with covariances and variances: $\text{cov}(uw) = \lambda_1$, $\text{cov}(u,v) = \delta$, $\text{cov}(wv) = \lambda_4 = 0$, $\text{var } u = \lambda_2$, $\text{var } w = \lambda_3$. Then the estimate of α_1, $\hat{\alpha}_1$ is given as

$$\hat{\alpha}_1 = \frac{(M_{HW} - \delta) - \dfrac{(M_{HY})(M_{HY} - \lambda_1)}{(M_{YY} - \lambda_3)}}{(M_{WW} - \lambda_2) - \dfrac{(M_{WY} - \lambda_1)^2}{(M_{YY} - \lambda_3)}}$$

It is clear that if our procedure does reduce δ (and we believe it does) it will result in a higher estimated value of α_1. However, our wage measure will still have substantial error variance (λ_2) and this will clearly result in an understatement of the estimated substitution elasticity.

11 percent (Table 9) is higher than contended by some analysts. In contrast to the positive substitution elasticify on hours in the labor market from the time diary, estimated substitution elasticities for reported average hours on the dependent variable were negative and statistically significant (-.11 at the mean), a result consistent with our errors in variables interpretation. Under this interpretation there should still be high error variance in each independent hours (and income) measure and this is consistent with the low R^2 in the regression equations.

In contrast to the positive substitution elasticity for hours at work, substitution elasticities for television and sleeping, both very time-intensive activities, were found to be negative. To interpret sleeping as a response to low wage rates may be far fetched if sleepers simply have less energy and hence less time in the market, less training and lower wage rates. Consequently, the relation between wage rates and sleep may be more a reflection of general energy level than a response by individuals to exogenous wage variations.

Meals out are substituted for meals at home with rising wage rates, though time spent in either increases with family income. The point estimate of the income elasticity at the mean is .20 for meals out and .057 for meals at home.[56] Note that time spent preparing meals and clean-up is not included in our meals at home variable, which is restricted to dining time.[57] Marriage results in a dramatic substitution of meals-at-home time for meals-out time, and restaurant owners should be pleased by rising divorce rates as well as by rising incomes and wage rates.

[56] Mean family income ($10,000's) is 1.797.

[57] Married men who work report only one hour per week in meal preparation and clean-up in contrast to 8.1 hours per week for women who work. Preliminary analysis shows a substitution elasticity for meal preparation and clean-up time of -.17 for married women who work.

TABLE 9

Time Supplied to Market and Nonmarket Activities, by Males, 1976 (minutes/week)[a]

Dependent Variable (In Natural Log of Min. per Week)	(1) ln Hourly Wage	(2) Family Income in 1974 ($10,000)	(3) If Married	(4) Constant	(5) R^2/S.E.E.	(6) ln Adjusted Hourly Wage
Main Job	.108* (.055)	-.030 (.034)	.077 (.069)	7.58 (.010)	.028/.406	.038 (.052)
Television	-.220 (.201)	.045 (.124)	.337 (.249)	6.14 (0.36)	.015/1.481	-.093 (.119)
Hobbies, Games, Classes	.162 (.346)	-.141 (.214)	-1.283* (0.428)	3.81 (0.61)	.050/2.544	-.073 (.201)
Housework (Married)	-.172 (.189)	1.549 (1.116)	--	4.99 (0.32)	.016/.098	-.168 (.174)
Meals Out	.456 (.300)	.345* (.185)	-.854* (.371)	3.21 (.053)	.075/2.205	.271* (.137)
Meals at Home	-.146 (.107)	.102 (.066)	.841* (.133)	5.07 (0.19)	.191/.790	-.024 (.076)
Sleeping	-.048* (.019)	.008 (.012)	-.002 (.023)	8.20 (0.03)	.036/.139	-.040* (.018)

[a]minutes were measured by four time diaries with two on weekdays and one on Saturday and one on Sunday.

*Significant at the .10 level or less.

Note: Standard errors are given in parentheses.

Hobbies, games and adult education classes appear to be wage related although the standard error is large relative to the coefficient. For married men family income increases the demand for housework time, most likely a derived demand from demand for housing services associated with homeownership, whereas rising wages reduces the demand for housework.

While the relation between men's hours in various time uses and wage rates and family income can be interpreted in the context of the comparative static model of hours supplied, it is also possible to interpret substantial amounts of the variation in hours as consistent with life-cycle time-allocation models. Wages, particularly what we have called nominal wages (see Sections I and II) vary with age, rising continuously with age or perhaps reaching a peak after the mid-thirties. Wage rates which are calculated net of on-the-job training and break time show less variation over the life cycle but can be thought of as better measures of an individual's hourly earning capacity. If wage rates so adjusted are used in the regressions in Table 9 in each case the absolute value of the wage coefficient is closer to zero. These coefficients and their standard errors are given in column (6). An alternative approach is to add age variables to the time supplied equations. When this is done the wage variable has a reduced effect on time supplied (a value closer to zero). While some time uses which are positively related to wage rate (hobbies and, notably, labor market hours) or income (housework) are also greater in periods of the life cycle characterized by higher wages or higher family income there are notable exceptions, including meals-out time, which seem better explained by wage rates and income _per se_. In contrast some time uses which are negatively related to wage rates (TV watching and sleeping) are reduced in periods of the life cycle characterized by higher wages. Watching TV declines from the 25-34 age group to a minimum for those age 35-44, and then rises for those approaching retirement. Data from the full sample for 1975 indicate that married men age 65 or older and out of the labor market spent an average of 1,497 minutes per week watching TV while married men working watch an average of 747 minutes per week.

Our interpretation of the hours supplied equations that they are consistent with both life cycle and comparative static models. Those who believe strongly in the comparative static model could argue that since wages are measured with considerable error, age can be a reasonable proxy for wage rates and hence, hours supplied to market and nonmarket activities are quite responsive to wage rates. On the other hand, if the effects of wage rates on hours operate through life cycle human capital and labor supply decisions, although analytic results for models which attempt to represent this decision are sparse, one could believe that if a change in say, tax rates were to offset labor supply, the effect may occur mostly in the long run as people adjust their longer-run training and labor supply. Our cross-section data do not permit efforts to distinguish between long and short-run adjustments.

IV. Organization of Household Production

As we have seen in comparisons for the U.S. between 1965 and 1975, there have been substantial changes in time to market and housework by adult men and women with men reducing their hours in the labor market and increasing their housework time, and women, particularly not married women, decreasing their housework time and increasing their labor market time. One interpretation is that these changes are largely a result of changed attitudes about women's roles in society. Another is that households are simply responding to relative price, wage, and income changes. Evidence of improved job prospects for women relative to men are scarce, and one study suggests that between 1959 and 1969 the wage rates of women relative to men have improved some despite the large supply response implied by increased participation rates.[58] (Our discussion suggests that skepticism is appropriate for any wage calculations based on nominal hours.) Another comparison based on earnings shows no change within the female/male ratio being .52 in 1969 as well as in 1959.[59] On the other hand, the service producing industries have grown far more rapidly than the goods producing industries over this period and the former are relatively greater employers of women.[60]

The important factors increasing hours in the labor market of adult women include the trend toward smaller families in part occasioned by the higher cost of children,[61] better timing of births, and continued improvements in the technology for household production which increases

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[58] Victor R. Fuchs, "Recent Trends and Long-Run Prospects for Female Earnings," American Economic Review, May 1974, p. 236-242. His evidence also suggests larger relative gains for the more educated women. If the new entrants in each cohort are less productive (for a given set of observed characteristics) than those already participating, the quality adjusted wage gains of women would be larger.

[59] See John McNeil and Douglas Sater, "Recent Changes in Female to Male Earnings Ratios," paper presented at the Annual Meeting of the Population Association of America, Seattle, Washington, April 1975.

[60] Data from the BLS Establishment Survey show that in June 1976 the index of aggregate weekly hours and payrolls of nonfarm production or nonsupervisory workers was 98.0 in the goods producing sector and was 123.3 in the service producing sector (1967=100). See Table C-6 Employment and Earnings, September, 1976.

[61] See Peter H. Lindert, "The Relative Cost of American Children," working paper, Department of Economics, University of Wisconsin, Madison, Wisconsin, March 1973. In the case of Japan, it could be argued that the rate of increase in child costs has been less since Japan has been urbanized for a longer period of time.

the possibilities of substituting market goods for own time.[62] Since the timing of births is becoming more widespread, this qualitative aspect of fertiltiy needs to be accounted for along with the normal practice, which is to simply count up the number of children in different age intervals and analyze the relation with labor supply.

As a complement to the 1965-76 "time series" comparisons of sections I and III, we designed special question sequences on the organization of household production. This permits a test of whether routine household tasks (washing clothes, cooking, cleaning the house, grocery shopping) get assigned to the husband or wife on the basis of variables which can be thought of as representing their wage rates. Analysis of time-use in the household tasks which are not likely to be intrinsically enjoyable reduces problems associated with joint production; that is, household members wash dishes as a part of producing home meals but washing dishes provides little satisfaction *per se*. In contrast, household projects

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[62] In the household production model with two consumption activities, two market inputs and a linearly homogeneous production technology in goods and time for both activities and unitary income elasticities of demand form the activities, the labor hours(H), supply elasticity with respect to the wage (ω), $E_H \cdot \omega$, is given as

$$E_H \cdot \omega = \frac{T - H}{T} \{-1 + \sigma_1 \; [\lambda_{M1}\Theta_{L1} + \lambda_{L1}\Theta_{M1}]$$

$$+ \sigma_2 \; [\lambda_{M2}\Theta_{L2} + \lambda_{L2}\Theta_{M2}] + \sigma_D \; [(\Theta_{L1}-\Theta_{L2}) \quad (\lambda_{L1}-\lambda_{M1})]\}$$

where T is total time available per day (say, 16 hours), the λ's are fractions of nonmarket time and goods allocated to each activity and θ's denote shares of these inputs in the costs of these activities to the consumer. The elasticity of substitution between the two activities in the utility function is σ_2 and the substitution elasticities between time and market goods in the production of the two activities denoted by σ_1 and σ_2. Since the values of σ_1 and σ_2 and the fractions (λ) and shares (θ) are non-negative there is a positive relation between the substitution elasticities and the elasticity of hours supplied to the market. The weighted elasticities relative to -1 determine whether the latter elasticity is positive or negative. See Alan V. Deardorff and Frank P. Stafford, "Compensation of Cooperating Factors," *Econometrica*, July 1976, p. 679 (footnote 10).

such as carpentry work are likely to be valued for the process as well as the finished product (and judging from the quality of the product, some household projects must be valued only for the process!). If enjoyment of the process is a normal good, then high wages may be associated with relatively greater use of own time in the activity.

Another aspect of routine housework is that skills are less likely to accumulate over time (though cooking is enjoyed by some and the relevant skills can have capital-like properties). If some nonmarket skills build up over time as in the example of carpentry, then the coincident rise in market wages can appear to be associated with greater use of own time in the activity as wages rise. There is some suggestion of this in the descriptive statistics of Table 8 wherein craftsmen and higher income groups put in more time in household repairs.

If we view routine chores as intermediate goods in the household production process, households can produce them with time of household members or with market inputs, such as durable goods or paid help. Conceptually, one can think of a three factor production function with husband's time, wife's time, and market goods as the arguments. Rather than asssume a specific functional form, we are simply hypothesizing that the three factors are substitutes and are testing the prediction that cost minimization by the family will require greater relative use of an input which has a lower relative price. We assume that households face identical market prices for goods but have differing wage rates of the spouses. We are also assuming homotheticity which implies that the technical possibilities of substitution across the inputs are independent of the level of production by the household. This permits us to ignore income or other factors which could affect the level of production.

Our empirical tests consist of regressions predicting 1) regular use of paid help for housework from someone outside the household, 2) whether the respondent has primary responsibility for specific routine household chores, 3) the ratio of own time to spouse's time in routine household chores, and 4) ownership of time saving durables. In each case, the predictor variables include own wage, spouse's education, and presence of preschool children.

Although the proportion of married men who have primary responsibility for any routine household chores is quite low (only about 16 percent), the likelihood of having primary responsibility for a given or for any household chore is, in general, negatively related to own wage and positively related to wife's education as a proxy for her longer run potential wage regardless of current labor market status. (See line 1-5 in Table 10). Similarly, for married women who work, the probability of having major responsibility for any of the set of routine housework tasks is less the higher is own wage and greater the higher is husband's education.

Regular use of paid help characterizes only about seven percent of the sample of working married respondents. The probability of making regular use of paid help is positively related to own wage. The presence of preschool children in the household increases the probability of the husband having primary responsibility for cooking and has a positive (but statistically insignificant) effect on the probability of making regular use of paid help. In general, the presence of preschool children does not result in a consistent pattern of changed household production as measured by the routine chore variables.

TABLE 10

Assigned Responsibility, Use of Paid Help, and Own Time for Routine Household Chores[a]

Dependent Variable	ln Adjusted Hourly Wage	Spouse's Education (years)	If Children Under 6	Group
Responsibility For:				
(1) Cooking	-1.053* (0.462)	.105 (.077)	1.411* (0.662)	Married Men
(2) Washing Clothes	-0.467 (0.308)	.042 (.043)	0.188 (0.387)	"
(3) Cleaning	-0.263 (0.544)	.027 (.073)	0.700 (0.684)	"
(4) Grocery Shopping	-0.061 (0.235)	.050 (.034)	-1.239* (0.581)	"
(5) Any of Above (1) - (4)	-0.192 (0.199)	.063* (.031)	-0.113 (0.264)	"
(6) Cooking	-0.747* (0.263)	.017 (.024)	-0.265 (0.350)	Married Women
(7) Washing Clothes	-0.325 (0.269)	.022 (.025)	-0.261 (0.366)	"
(8) Cleaning	-0.071 (0.211)	-.006 (.020	0.174 (0.303)	"
(9) Grocery Shopping	-0.270 (0.220)	-.016 (.024)	-0.260 (0.304)	"
Regular Use of Paid Help				
(10)	0.614* (0.331)	.014 (.035)	0.225 (0.386)	Married Men
(11)	0.522 (0.401)	-.025 (.038)	0.473 (0.512)	Married Women
Own Time/Spouse's Time				
(12)	0.016 (0.043)	.0081* (.0049)	-0.036 (0.052)	Married Men

[a]Logit equations used for equations (1) - (11) and OLS used for equation (12).

*Significant at the .10 level or less.

While the small sample size does not permit definite conclusions, it does appear that a higher own wage reduces own time and responsibility for routine household tasks and increases spouse's time or the use of market goods in the form of paid help. One exception is the ratio of husband's own time to spouse's time in routine chores[63] which has a positive (and statistically insignificant) relation to husband's wage (equation 12). Another general result is that own time to, or responsibility for routine housework is increased by spouse's education, which we interpret as a index of spouse's productivity in both the market and in nonmarket activity requiring greater skill.

In addition to paid help, households can use durables to substitute for own time in the production of household outputs. Focusing on durables for routine household tasks (dishwasher, washer and dryer) rather than for leisure, we found that ownership of such equipment is positively related to income (which is a very conventional result) but that ownership is also positively related to wage rate variables (the one exception is the negative but statistically insignificant relation between own wage and ownership of a clotheswasher). Our results suggest some effect of wife's wage and husband's earning capacity on ownership of time saving durables. This is consistent with results of Lucy Mallen[64]

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[63] Defined as the sum of time in meal preparation, meal cleanup, indoor cleaning and laundry.

[64] The Mallen results (based on an unpublished dissertation, Northwestern University, 1968) are reviewed by Myra Strober and Charles Weinberg in their paper "Wives' Labor Force Behavior and Major Family Expenditures," working paper, Graduate School of Business, Stanford University, April 1977. Reconciliation of the Strober/Weinberg results and our results can be possible because 1) our results aren't that strong, 2) Strober and Weinberg use annual dollar outlays and the elasticity of time savingness with respect to incremental durable costs may be quite low, with added durable costs reflecting aesthetic or nonfunctional characteristics, 3) annual purchases reflect flows and adjustment, whereas ownership reflects stocks (and more likely, long run equilibrum). See also Myra H. Strober, "Wives' Labor Force Behavior and Family Consumption Patters, <u>American Economic Review</u>, February 1977, p. 410-417.

TABLE 11

Logit Equations Predicting
Ownership of Time Saving Appliances by
Husband-Wife Families Where the Wife Works

Dependent Variable	ln Adjusted Hourly Wage	Husband's Education	If Children Under 6	Family Income in 1974 ($10,000)
(1) Whether Owns Dish-washer	.444 (.280)	.044 (.025)	-.270 (.336)	.128 (.155)
(2) Whether Owns Washer	-.058 (.376)	.030 (.030)	6.100 (73.300)	.806* (.352)
(3) Whether Owns Dryer	.370 (.356)	.057* (.026)	.016 (.384)	.833* (.314)
(4) Whether Owns Microwave Oven	-.034 (.447)	-.036 (.035)	-5.800 (84.700)	.320 (.223)

*Significant at the .10 level or less.