

April 2005

Very Preliminary Fragment

WHY NOT RETIRE?

THE TIME AND TIMING COSTS OF MARKET WORK

Daniel S. Hamermesh*

*Edward Everett Hale Centennial Professor of Economics, University of Texas at Austin, and research associate, NBER and IZA. I am indebted to Leora Friedberg for a clever suggestion. The research reported herein was performed pursuant to a grant from the U.S. Social Security Administration (SSA) to the Michigan Retirement Research Center (MRRC) and a subcontract to the University of Texas. The opinions and conclusions are solely those of the author and should not be construed as representing the opinions or policy of SSA or any agency of the Federal Government or of the MRRC.

ABSTRACT

Despite large and rapid increases in longevity, retirement ages among older Americans have only recently begun to increase after their precipitous fifty-year decline. Early retirement may result from incentives provided by retirement systems; but it may also result from the time costs imposed by market work. Using the American Time Use Survey begun in 2003, I first examine whether additional market work is neutral with respect to the mix of non-market activities. The estimates demonstrate that there are fixed time costs of remaining in the labor market. These costs alter the pattern of non-market activities, reducing leisure time and increasing time devoted to other non-market activities. These costs impose a larger burden on households with lower full incomes, since wealthier households apparently purchase market substitutes that allow them to maintain the mix of non-market activities when they undertake market work. Market work also raises the set-up costs of switching among different non-market activities, thus raising the costs of generating utility-increasing variety. Estimates of this latter effect are forthcoming.

I. Introduction

There is an immense literature in economics and other disciplines on the economic and demographic determinants of the labor supply of older workers (Lumsdaine and Mitchell, 1999). The distinction throughout the literature has been between market work and all other activities, implicitly treating all non-market activities as homogeneous. That implicit assumption has partly been dictated by the amazing paucity of information on how older (and other) workers in the United States divide their time outside the market. This assumption has led us to ignore the likelihood that older people and others do not view these other activities similarly (but see Kooreman and Kapteyn, 1987, and Biddle and Hamermesh, 1990). It is highly unlikely that such mundane activities as eating, washing or sleeping yield the same average satisfaction as leisure or sex, or that their opportunity costs are the same on average. For these reasons alone it is crucial to distinguish among these possible uses of time.

The importance of making distinctions among types of non-market activities seems especially great for older people. One of the most important problems facing the United States over the next few decades is the declining supply of skilled/experienced workers. Retirement ages have not increased, despite rapid increases in longevity even among older Americans (a 2.4 year increase among males age 65 between 1980 and 2002, a 1.1 year increase among women). Indeed, the labor-force participation rate of males 65+ fell from 33.1 percent in 1960 to 16.3 percent in 1990. Even in 2003 the rate was only 18.6 percent, despite the rise over the previous three years in the age of eligibility for full OASI benefits. With the baby-boom generation approaching retirement (and reaching it in the 2010s), the problem will be substantially exacerbated.

The evidence from studies of older workers' labor supply suggests that it is fairly inelastic with respect to wage increases. To encourage that supply, work opportunities may need to be re-structured in such a way as to make them consistent with older Americans' desires to have their free time as unconstrained as possible, both in terms of what is done and when it is accomplished. That this is an increasingly important and increasingly recognized problem is made clear by both governmental attention and media reports. OECD Labor Ministers (2003) have emphasized that increased working-time

flexibility can make an important contribution to lowering unemployment and raising employment rates more broadly. The problem has been discussed at length in Canada, where the data to analyze it exist but have not been exploited.¹ Interestingly, a web-search for “phased retirement” shows that most of the “hits” are on universities’ programs: Academics are one of the few groups whose employers’ allow them the flexibility that meets the workers’ preferences and the employers’ demand for skill!

In this study I examine several aspects of the time allocation of older workers. First, and simplest, I present information on how older Americans use their time, how that allocation differs from that of younger people, and what determines these differences. This discussion is quite straightforward, and its emphasis on non-behavioral time accounting mirrors what constitutes the overwhelming amount of research on the allocation of time outside the market, including the only available examination of older workers (Sayer *et al*, 2001). The bulk of the study focuses on answering the analytical question of how market work—the amount of time devoted to it and its timing—generates an impediment to older Americans’ optimization of the amount and sequencing of their non-market activities. Thus in the second part of the study I analyze how the decision to make the discrete choice of working in the market might alter the mix of non-market activities undertaken. Since relatively few older persons work in the market, I infer the importance of this discrete choice from an analysis of the behavior of younger individuals.

The next part of this study concentrates on discovering **when** older people perform different activities and examining the determinants of this timing. An excellent theoretical study of timing (Winston, 1982) appeared over 20 years ago, and some empirical work has been done (Hamermesh, 1999, 2002) on the general population; but there has been no examination of how older people time their activities and what causes timing to differ. Given the likely importance of scheduling in employers’ demand for labor and the spillovers that these constraints may impose on people’s schedules outside the

¹*The Economist* concludes a discussion of retirement (“Survey of Retirement,” March 27, 2004, p. 10), “The best way to greet old age is surely to go off on that cruise and perhaps buy a holiday home in the sun—but then swap full-time for part-time work, with the regularity, companionship and cash that it brings.” A recent survey of 1000 American workers suggests that many more wish to phase retirement than believe that their employers will allow them to do so (reported in *Wall Street Journal*, March 25, 2004, p. D3). Gustman and Steinmeier (2004) show that in the Health and Retirement Survey relatively few older workers believe that they will be able to reduce hours to the level that they wish as they age.

labor market, discovering what scheduling looks like when the constraint of market work is no longer relevant would seem crucial for understanding how this instantaneous dimension may induce retirement.

In a final analytical section I shall examine how eligibility for and the receipt of Social Security benefits might alter the conclusions in the previous two sections. I then conclude with a discussion of the implications of the results for issues in restructuring the demand for older workers to mesh more closely with the implications of the study for their implied preferences about work and non-work time.

II. The Source of All Data: The American Time Use Survey

The usual retrospective records that form the bases for most of the analysis of labor-force behavior in the economics and sociology literature ask individuals how many hours they worked in some recent time period, be it last week (as in the Current Population Survey) or last year (as in the Panel Study of Income Dynamics and the Census of Population). A number of data sets also provide information on how people divide their hours in a typical day, or the most recent week or month, among a number of non-market activities that are either exhaustive (as in the Health and Retirement Survey) or partial (as in the PSID and the German Socioeconomic Panel), but that are not constrained to equal the total number of minutes or hours in the day or other time period. A time-budget survey gives respondents a log covering the previous 24 hours and asks them to indicate when they started each new activity and what that activity was. These are then coded into a variety of categories for use by researchers and the public generally. Time-budget surveys thus have the virtue of immediacy and exhaustiveness, both of the time period covered and of the panoply of possible activities.

While there is a very long history of time-budget surveys in the United States (Sorokin and Berger, 1939), the U.S. lagged behind many other countries in developing these surveys from the 1970s through 2000. That changed in 2003 with the fielding of the American Time Use Survey. This data set provides time diaries from 1800 individuals each month, one person per household, for a total of nearly 21,000 in 2003. In addition, because the respondents are recent members of the CPS panel, substantial information is also available on their work and earnings, on their families, and on other demographics. Of the respondents 4,679 are age 60 or over, so that the ATUS provides by far the largest number of time

diaries ever completed by older Americans. Moreover, because the ATUS is an on-going survey, each year an additional 3,000 or so older Americans will be providing time diaries (and the 2004 data will be used in the next revision of this study).²

Most time-budget surveys provide information on at least 50 categories of activity, so that both for ease of analysis and ease of presentation the user is usually obliged to aggregate the data into a reasonably smaller number of useful categories. That choice is inherently arbitrary. Here I take two approaches to aggregating the 406 individual activities reported in the ATUS. At the highest level of aggregation I divide activities into four groups: 1) Market work; 2) Secondary activities, those for which the individual might have purchased market substitutes. (These activities satisfy the third-party rule first proposed by Reid, 1934, to define household production.) 3) Tertiary activities, those that one must perform for oneself but that are essentially personal maintenance; and 4) Leisure. Also included is a category "Other," which accounts for a few miscellaneous activities and those few minutes in some respondents' days for which no particular activity is recorded. At a slightly less aggregated level I also break secondary activities down into household work and shopping, and child and other care, including volunteering; and I disaggregate tertiary activities into sleeping, eating and drinking, and personal care.

Table 1 presents the average time allocations by age in the lower level aggregates listed above. I present these separately for individuals below age 55, then by five-year age group. Of course, the biggest change as one ages is the decline in market activity. As is well known, and as the time diaries show, the major declines begin at age 60. What is interesting is how the time that is freed up, roughly 180 minutes among 65-69 year-olds compared to 55-59 year-olds on a typical day, is distributed across the various activities. There is essentially no change in the time devoted to personal care. Household production increases by about 30 minutes, sleeping increases by 25 minutes, and time devoted to eating and drinking increases by 10 minutes across this 10-year age difference. Of the extra three hours that become available, the overwhelming majority, nearly two full hours, are devoted to additional leisure time. Not only is this the largest absolute change generated by the decline in the time devoted to market work in

²See Hamermesh *et al* (2005) for a description of the survey, and Horrigan and Herz (2005) for details on its origins and construction.

these aggregates, it is also by far the largest in percentage terms. Clearly, among the many activities that might be crowded out by market work, leisure activities are the main ones.

The estimates shown in Table 1 do not account for other demographic differences that might be generating the apparent age differences in time allocations. To resolve this potential difficulty, in Table 2 I present least-squares estimates of the determinants of time spent in each of the lower-level aggregates of activities.³ Only people ages 60 and over are included in the regressions, and the excluded age indicator is for people 60-64. If anything, the estimates strengthen the conclusion from Table 1 that most of the decline in market work that occurs after age 60 is made up by an increase in leisure. Accounting for demographic differences (race, ethnicity, gender and marital status), roughly 2 hours of the 2-1/2 hour decline in average daily hours of market work between ages 60-64 and ages 75 and over are taken up by a gain in leisure. Indeed, while the other changes are all statistically significant, only the half-hour increase in sleep time is economically important. Table 2 indicates that there are other interesting demographic differences in time allocation among older Americans too, but they do not merit discussion in this economic study.

III. A Model of the Fixed Time Costs of Market Work

Having observed that an increase in leisure time represents the overwhelming use of the time that is freed up as older people reduce their hours of market, one is faced with the question of why this occurs. That is, why do those who are still active in the labor market apparently wish to expand leisure time so much more than other non-market activities as soon as they have the opportunity? Is this a continuous response; or are there lumpy time costs of market work that have differential impacts on the amounts of time devoted to other activities, impacts whose effects are removed when an individual ceases market work?

To examine these issues consider the simplest possible formulation, in which there are three uses of time: T_M , market work; T_{ST} , secondary and tertiary activities; and T_L , leisure. Assume that the

³One minus the sum of the estimated coefficients in each column will equal the impact of the variable on time spent that is accounted for by the few miscellaneous activities. All of these latter effects are small and statistically insignificantly different from zero.

individual is single and faces a parametric wage w and unearned income I . Each minute devoted to market work must necessarily reduce the time devoted to other activities by one minute. This is obviously true in reality, but it is a requirement imposed by time-budget data (although by no means necessarily by retrospective subjective data). But there may be fixed time costs of market work such that the effectiveness of the remaining time devoted to ST and L is reduced by constant fractions μ_{ST} and μ_L when even a small amount of market work is undertaken.⁴ The fixed time cost might, for example, stem from a need to hurry in one's other activities (e.g., racing through one's breakfast in order to get to work on time, foregoing watching *The Tonight Show* in order to be rested for work the next morning). It might induce workers to engage in a different, and perhaps less satisfying mix of other activities (tying a necktie as personal care rather than enjoying sex or a relaxing bath, work-related socializing with colleagues or clients rather than playing a game of tennis with a close personal friend).

Assuming no saving, the person's utility is:

$$(1a) \quad U(I, T_{ST}, T_L), \quad \text{if } T_M = 0;$$

and

$$(1b) \quad U(I + w[24 - T_{ST} - T_L], \mu_{ST}T_{ST}, \mu_L T_L), \quad \text{if } T_M > 0.^5$$

The utility cost of the first moment of market work, the fixed (utility) cost of market work, is then:

$$(2) \quad V = U(I, T_{ST}, T_L) - U(I, \mu_{ST}T_{ST}, \mu_L T_L) > 0.$$

The individual maximizes utility, choosing maximizing time allocations $T_{ST}^* > 0$ and $T_L^* > 0$, and $T_M^* \geq 0$.

If $T_M^* = 0$ is maximizing:

$$(3a) \quad U_2/U_3 = 1;$$

if $T_M^* > 0$ is maximizing:

$$(3b) \quad U_2/U_3 = \mu_{ST}/\mu_L.$$

Only if:

⁴These differ from the possible fixed money costs of work discussed by Cogan (1981) and assumed to be absent here.

⁵In this formalization I thus ignore Becker's (1965) notion of substituting goods for time, although I bring it in later in the discussion of the role of differences in unearned income.

$$(4) \quad U(I + w[24 - T_{ST}^* - T_L^*], \mu_{ST} T_{ST}^*, \mu_L T_L^*) - U(I, T_{ST}, T_L) > V,$$

for some combination of T_{ST}^* and T_L^* does the individual supply positive hours of market work. If s/he does, and if the effective relative price of secondary/tertiary activities and leisure changes from unity to $\mu_{ST}/\mu_L \neq 1$, we will observe that the very first minute of market work alters the relative amounts of secondary/tertiary and leisure activities chosen. Thus we cannot observe the existence of fixed time costs of work directly; but we can observe whether their impact on the individual's allocation of time across other activities is neutral by observing how patterns of time use change in response to an initial moment of market work.

Unlike prices of market goods, the relative price change generated by the existence of fixed time costs of work can differ among individuals. In particular, those who have higher I might use their additional unearned income to buy market substitute goods and/or services for those secondary activities whose price has risen because the individual has chosen to bear the fixed time costs of working. One benefit of additional unearned income may be to lower the impact of the fixed time costs of work by allowing its recipient to compensate for any shift in the ratio μ_{ST}/μ_L .⁶

This discussion suggests that there may be discontinuous changes in the allocation of individuals' time when they do not engage in market work. It also implies that these potential effects will differ depending on the income in the household to which the worker belongs. Taken together, the model provides guidelines for an indirect test for the presence of fixed time costs of work in order to analyze how market work may impose costs on (older) workers.

IV. Testing for the Presence of Fixed Time Costs of Market Work

A. Basic Results

Ideally we would test for the impact of fixed costs by finding some kind of instrument that might help to identify the determinants of working in the market only a few hours versus not working in the market. No such instrument is available in the ATUS; nor would one even appear to be imaginable were

⁶Fixed money costs of work create a "hole" in the distribution of hours of market work—it is not worthwhile to supply very few hours to the market. So do fixed time costs. The former, however, create a larger hole for those whose market wage rate is smaller. The latter create a bigger gap in the distribution of low wages for workers whose cost of time is greater.

much more data available. While instruments that might determine selectivity into market work have been used with some success (e.g., the now-classic use of the presence of young children by Gronau, 1974), finding an instrument that might convincingly determine selection into only a small amount of market work seems a daunting task.

Given this difficulty, I rely instead on examining how a person's allocation of non-market time changes when s/he crosses the threshold into market work. There clearly are unobserved differences between those who engage in market work and those who do not; but if we still observe an apparent impact of fixed time costs as we restrict the sample to non-workers and those with successively fewer hours of market work, we may be somewhat more confident that we are measuring what the theory indicates. I thus estimate regressions relating minutes spent in each of secondary activities, tertiary activities and leisure to minutes spent in market work and an indicator for whether or not any such minutes are spent. In these three equations the estimated coefficients on the former must, except for tiny differences due to the few minutes unaccounted for or unclassifiable in some diaries, sum to -1 . The estimated coefficients on the indicator for positive market work must (again, with the minor exception) sum to 0 . If the fixed time costs of market work on time allocation outside the market create neutral effects, each of these latter three coefficients will equal zero. Thus a test for neutrality of market work (essentially a test for whether we can treat all non-market activities as separable from market work) is a test of the null hypothesis on these coefficients differing from each other.

In order to have a sufficient number of people who are working in the market and others who are not, I restrict the sample to people under age 60. In addition to the measure of market work time and the indicator for market work I also include in the equations describing the allocation of non-market time a quadratic in age and indicators for whether the respondent is African-American or Hispanic and for the presence of children in various age categories (ages 0-2, 3-5, 6-13, 14-17). In equations describing all individuals indicators for gender and marital status are included, while those equations, and the equations describing married people, also include a measure of spouse's hours of market work (CPS-style retrospective data on usual weekly hours, since the ATUS only contains a time diary for one member in a

household). All the equations are weighted so that the estimates reflect behavior on a representative day of the week.

Table 3 presents the estimates of the three equations for the entire sample of individuals under age 60, and then separately by marital status and gender.⁷ The first column in each panel lists the estimated effects of moving from no market work to an infinitesimal amount of work, while the second column shows the effect on the three non-market activities of adding one additional minute of market work. The results are striking: Clearly, among all these adults the impact of beginning market work is not neutral across secondary activities, tertiary activities and leisure. The estimates suggest a substantial negative effect on leisure activities and much smaller positive effects on secondary and tertiary activities. A test of the equality of the three estimated parameters demonstrates that they are jointly significantly different from each other (and thus *ipso facto* jointly significantly different from zero).

When we disaggregate the sample by marital status and gender, the results change somewhat but still suggest the same basic point. Among all four marital/gender categories beginning market work generates a shift of non-market time away from leisure and toward secondary activities. Among married men and single women both, the two groups for whom the effects are jointly significantly different from one another, there is also a shift away from tertiary activities. Moreover, the negative impacts on time spent in leisure activities are not greatly different from each other across the groups: The 24-minute daily decrease in leisure that I estimated results from beginning market work in the entire sample does a fairly good job of characterizing these subgroups.

B. Extensions and Tests for Robustness

Having demonstrated that the evidence is consistent with non-neutral fixed time costs of market work, we can test whether the change in behavior imposed by these costs can be overcome by purchasing market substitutes. The specifications in Table 3 are thus expanded to include a measure of household income and its interaction with the indicator for market work. Desiring to maintain parsimony in these

⁷In order to examine the impact of differences in family income on the non-neutrality of fixed time costs I restrict the samples to those ATUS respondents for whom a measure of family income is available.

interactions, and because the data on household income are categorical, I form the single indicator variable, income above \$50,000 per annum, and use only it.

The results of re-estimating the equations describing non-market allocations of time are shown for all married individuals, and for married men and women separately, in Table 4. Most important, the interaction terms in each case are of opposite sign from the main effect terms on whether or not the person worked in the market. The interaction terms are jointly significantly different from zero in all three samples. A higher income moderates the non-neutrality of the fixed time costs of market work, allowing the individual to avoid giving up leisure and adding secondary or tertiary activities when he/she enters the labor market. Indeed, the results suggest that having a household income above the \$50,000 threshold (being in the upper 3/5 of the distribution of household incomes of married couples in this sample) suffices to overcome completely the non-neutrality of the fixed time cost of market work. The results for married women, the majority of whose household incomes stems from their husband's earnings and from unearned income, are especially convincing of the impact of fixed time costs and of the ability of higher income to enable the household to offset those costs.⁸

As noted above, one might well be concerned that the average worker differs unobservably from non-workers, and that, rather than demonstrating the non-neutrality of the fixed time cost of market work, all I have shown is that non-workers in the sample have different household productivity than workers. I cannot completely refute that possibility; but some insight into the validity of this counter-argument can be obtained by restricting the sample to non-workers and sets of workers who may be more similar to them, namely those who work relatively few hours in the market (or those longer-hour market workers observed on days they do not work in the market). The upper panel of Table 5 restricts the sample respectively to individuals working fewer than 4 hours in a day, or fewer than 2 hours in a day, in the market. In both cases we observe, as in Table 3, that there is a significant non-neutrality of beginning market work. As in the results based on the unrestricted sample, and excluding the roughly 5000 people

⁸If we restrict the sample to married women observed on weekdays and working fewer than 240 minutes on those days, which cuts the sample by 75 percent, we still observe the same general results—a moderation of the apparent non-neutrality of fixed time costs.

who are observed working 4 hours or more, we again find that beginning market work generates a roughly half-hour reduction in leisure activities. Unlike in the entire sample, however, it also generates a reduction in tertiary activities, and leads to a large increase in secondary activities. The results are nearly identical if we restrict the sample further to exclude the over 500 workers putting in between 2 and 4 hours on the diary-day.

The results disaggregated by gender and marital status, shown in the bottom two panels of Table 5, look remarkably like those presented for the aggregates of short-hours workers and non-workers. Again the impacts of starting work on non-market activities are statistically unequal for married men and single women, but also now among married women too. As observed throughout, leisure activities are diminished, while secondary activities increase. The results suggest that the findings for the entire sample are not an artifact of including workers who are far beyond the margin of deciding whether to enter the labor force.⁹

Yet another possibility is that those with strong preferences for leisure have inherently different set-up costs for different non-market activities from those whose tastes for leisure are weaker. If the ATUS had obtained diaries for the same individuals on two or more days, we would have been able to examine this possibility using individual fixed effects. Absent that, however, we can take advantage of the ATUS over-sampling on weekends and its CPS information on weekly hours of market work to examine how the allocation of time of those did not work on a weekend day is affected by their total time devoted to the market. To do so I use the CPS weekly hours measure along with an indicator of positive weekly hours, substitute these two variables for the two variables that form the focus of Tables 3-5 and re-estimate the equations describing secondary, tertiary and leisure activities over all those ATUS weekend respondents who reported no market work on the weekend diary day.

⁹Nor are they due to the inclusion of individuals who may usually work longer hours but who are observed on weekends. If the sample in the top panel of Table 3 is restricted to individuals observed on weekdays, the estimated impacts of beginning market work on the three aggregates of activities are 1.24, 25.72 and -26.15 minutes respectively, again significantly different from each other and from 0. When the same restriction is applied to the sample in the left half of the upper panel of Table 4, the results are even more strikingly similar to those that include people whose diary-day covers a weekend day.

Table 6 presents the results of this re-estimation. One should first note that each triad of coefficients should nearly (because of the small miscellaneous category) sum to zero. That being the case, the first thing to note is that the vector of coefficients on the indicator of positive market work during the week is not significantly different from zero. On a day when they are not working, those who work on other days have almost the same allocation of time as others who do not work in the market at all. There appear to be no differences in set-up costs between non-workers and others. That said, additional hours of work during the week are not neutral with respect to the allocation of time on a weekend day when the worker is not in the labor market.¹⁰ Additional weekly hours reduce leisure time, and increase time devoted to secondary activities, even on those days when the person is not working. While not due to fixed costs, this may be one more reason for retirement—the first thing workers do with their “free time” on weekends is to catch up on the secondary activities that the rigidities of their market work prevented them from doing during the workweek.

The estimates in this Section do not prove the existence of non-neutral fixed time costs of market work. In several ways, however, in the consistent pattern of a shift from leisure activities to secondary activities when market work hours are few but positive, and in the apparent diminution of that shift as household incomes increase, they are consistent with this type of fixed cost. They suggest that market work imposes some additional constraints on those who choose it, constraints that increase the incentives for complete retirement rather than a gradual reduction in market hours as people become eligible for public and/or private pensions.

V. The Fixed *Timing* Costs of Non-Market Activities

Just as additional hours of market work appear to generate changes in behavior, set-up costs to the non-market activities that people undertake, be they eating, napping, television viewing, or whatever, may also alter behavior. For example, walking from the family room, where one has been watching television, to the kitchen, where one prepares a snack, takes time that does not directly contribute to satisfaction. As Hamermesh (2005) shows, these costs generally reduce the variability of scheduling across days, leading

¹⁰A test of the equality of the three estimated parameters yields $X^2 = 14.52$.

to routine in the timing of activities. A simple model would recognize that in each time period (and the time periods can be made arbitrarily short for this purpose) the consumer must choose whether to continue an activity or to switch to a new one, and that the choice about doing so may be affected by the amount of market work undertaken.

Assume that an individual's marginal cost of switching activities is constant, independent of the nature of the switch or the number of switches made. Then the consumer's daily decision problem is to maximize utility, defined over the T daily time periods as:

$$(5) \quad U = U(s_1 A_1(1), \dots, s_t A_t(1), \dots, s_T A_T(1)) + V(S_2 + \dots + S_T)$$

where S_t is an indicator equaling 1 if the consumer switches activities between periods $t-1$ and t ; each $A_t(t)$ indicates the activity undertaken during time slot t , and $s_t = s(w) < 1$, $s' < 0$, if the activity at time t differs from that at time $t-1$, 0 if not. I make the usual assumptions about U , and assume that $V' > 0$, $V'' < 0$. s_t is the cost of switching activities from one to the other—the cost of temporal variety over the day. Such variety is costly because of the time lost to switching; it is also beneficial to the consumer because of the boredom of doing the same thing for long periods of time (reflected in V). I model the cost of switching as an increasing function of the value of time, proxied here by the wage rate.

The consumer maximizes this function, choosing which activity to consume/produce in each time slot t , subject to the goods budget constraint:

$$(6) \quad \sum_t p_{a1} \sum_a X_{a1} = w \sum_t T_{M,t} + I,$$

where I is the person's unearned income, and the X are the market goods that are complementary with a particular activity A (and assumed, following Becker (1965), to be combined with time using a Leontief-type technology). The maximization of (6) yields a sequence of equilibrium outcomes S_t describing whether the person switches activities at time t . The retired person is assumed to have an opportunity cost of 0 (or at least lower than that of an otherwise identical non-worker). S/he thus has a higher $s(w)$, reducing the cost of switching activities. Also, increases in I (unearned or from the older person's spouse) increase the demand for switching because of the assumption that temporal variety is superior (supported by evidence in Hamermesh, 2005). We should thus expect to observe that retirees will switch activities

more than otherwise identical workers, and that individuals with higher unearned incomes will also enjoy more variety in their scheduling over the day.

The relaxation of scheduling constraints (because a person no longer works in the market) is equivalent in the frequency domain to an income effect. We should expect that non-workers undertake more different activities during the day than will otherwise identical working Americans. Initially using all observations in the ATUS I thus estimate:

$$(7) \quad S = F(T_M, \text{Work?}, Z),$$

where $S = \sum S_t$. Later I will expand (7) to account for the possibility that the same activities will be undertaken more frequently during the day by adding NACTS, the number of different activities that the respondent undertakes, to the estimates. In evaluating the results of estimating (7) I concentrate particularly on the impact of age (included) in the vector Z and the variables T_M and Work? .

The timing of activities is another dimension along which we must evaluate welfare differences between older and other Americans and examine how market work alters non-market behavior. If we find this hypothesized difference between otherwise identical workers and non-workers, we may infer that the relative well being of older people, and the advantage of retirement, are greater than would be indicated merely by looking at monetary outcomes. Finding differences between older and younger people who work the same amount of time in the market would be particularly interesting, as it would indicate the role of taste differences (or other non-quantifiable changes with age). Causation will be addressed, but it is a difficult issue. Even without solving that problem, however, the findings themselves will be sufficiently novel to be of substantial interest, as they allow us to link the results to inferences about the value of restructuring market work to allow for more flexible timing.

VI. Estimating the Impact of the Set-up Costs of Non-Market Activities on the Timing of Activities

Based as it is on time diaries, the ATUS provides information on when a respondent began an activity and what that activity was. Thus within the data set one can readily infer the number of times during the diary day (running from 4AM one day to 3:59AM the next) that the individual switched from

one (very finely disaggregated) activity to another. As a first step in the analysis in this section I simply inquire into how the number of switches changes with age.

The first row of Table 7 lists the mean number of switches by age group in the ATUS. These descriptive statistics suggest that younger people (under age 55) jump among activities more frequently than do older people. However, among the latter there appear to be no significant differences, except that those over age 74 report staying with a particular activity long than those ages 55-74. Whether these differences by age reflect the underlying effects of aging (on the ability or willingness to undertake more activities, or on memory); differences in family circumstances (e.g., we know, Gronau and Hamermesh, 2001, that the presence of young children leads their parents to undertake more different activities in the day), or to differences in incomes and the price of time, is unclear.

We can adjust the raw differences for a number of characteristics, however, including educational attainment, racial/ethnic/gender mix, marital status and the presence of children of various ages, and, most important, for the distribution of time spent in the four major activity types. The results are shown in the bottom row of Table 7. It is clear that the differences between younger people and most groups of older people shown in the top row are illusory. Once we adjust for these covariates, we see that only those respondents ages 75 or over switch activities less frequently than others. There are no significant differences by age in the number of switches between activities among people under 75.¹¹

VII. The Role of Social Security Benefits

¹¹Including an indicator of family income above \$50 thousand does not qualitatively alter this conclusion.

REFERENCES

- Gary Becker, "A Theory of the Allocation of Time," *Economic Journal*, 75 (September 1965): 493-517.
- Jeff Biddle and Daniel Hamermesh, "Sleep and the Allocation of Time," *Journal of Political Economy*, 98 (October 1990): 922-43.
- John Cogan, "Fixed Costs and Labor Supply," *Econometrica*, 49 (July 1981): 945-963.
- Reuben Gronau, "Wage Comparisons—A Selectivity Bias," *Journal of Political Economy*, 82 (Nov. 1974): 1119-1143.
- and Daniel Hamermesh, "The Demand for Variety: A Household Production Perspective," NBER Working Paper No. 8509, October 2001.
- Alan Gustman and Thomas Steinmeier, "Minimum Hours Constraints, Job Requirements, and Retirement," National Bureau of Economic Research, Working Paper No. 10876, November 2004.
- Daniel Hamermesh, "The Timing of Work Time Over Time," *Economic Journal*, 109 (1999): 37-66.
- , "Timing, Togetherness and Time Windfalls," *Journal of Population Economics*, 15 (2002): 601-623.
- , "Routine," *European Economic Review*, 49 (January 2005): 29-53.
- , Harley Frazis and Jay Stewart, "Data Watch: The American Time Use Survey," *Journal of Economic Perspectives*, 19 (Winter 2005): 221-232.
- Michael Horrigan and Diane Herz, "A Study in the Process of Planning, Designing and Executing a Survey Program: The BLS American Time-Use Survey," in Daniel Hamermesh and Gerard Pfann, eds., *The Economics of Time Use*. Amsterdam: North-Holland, 2005.
- Robin Lumsdaine and Olivia Mitchell, "New Developments in the Economic Analysis of Retirement," in Orley Ashenfelter and David Card, eds., *Handbook of Labor Economics*, Vol 3C. Amsterdam: North-Holland, 1999.
- Organization for Economic Cooperation and Development, *Communiqué of Labour Ministers*, 2003.
- Margaret Reid, *Economics of Household Production*. New York: Wiley, 1934.
- Liana C. Sayer, Suzanne M. Bianchi and John P. Robinson, "Time Use Patterns of Older Americans," Report to NIA, University of Maryland, June 30, 2001.
- Pitirim Sorokin and Clarence Berger, *Time Budgets of Human Behavior*. Cambridge: Harvard University Press, 1939.

Gordon Winston, *The Timing of Economic Activities*. New York: Cambridge University Press, 1982.

Table 1. Mean Time Use by Age, ATUS 2003 (Minutes per Representative Day)*

Activity	Age					
	<55	55-59	60-64	65-69	70-74	75+
Market work	263.08 (2.38)	261.31 (7.13)	164.11 (7.20)	78.95 (5.70)	55.58 (5.58)	14.00 (1.80)
Household production	155.82 (1.33)	185.60 (4.45)	206.26 (5.30)	216.02 (5.56)	222.50 (6.46)	204.09 (4.09)
Family care	78.64 (1.04)	41.45 (2.56)	44.93 (2.86)	45.14 (3.17)	40.63 (3.40)	33.15 (2.30)
Sleep	507.06 (1.11)	494.51 (3.16)	510.31 (3.42)	518.67 (3.58)	530.04 (4.03)	537.18 (3.16)
Personal care	45.93 (0.44)	49.42 (1.49)	51.24 (2.19)	52.55 (2.90)	46.28 (2.20)	50.99 (2.01)
Eating and drinking	67.40 (0.50)	75.20 (1.49)	84.41 (1.95)	85.43 (3.17)	90.97 (2.28)	90.52 (1.64)
Leisure	309.72 (1.88)	317.93 (5.36)	364.18 (6.23)	424.03 (6.94)	435.06 (7.44)	485.11 (5.21)
Other	12.34 (0.40)	14.58 (1.24)	14.55 (1.81)	19.20 (1.60)	18.94 (2.06)	24.95 (1.99)
N =	14450	1591	1201	1052	848	1578

*Standard errors of the means in parentheses. The estimates in all tables are weighted to reflect equal numbers of observations on each of the seven days of the week.

Table 2. Impact of Age and Other Demographics on Time Use, 4,679 Individuals 60+, ATUS 2003 (Minutes per Representative Day)*

Activity	65-69	70-74	75+	Black	Hispanic	Male	Married
Market work	-85.45 (7.26)	-108.83 (7.75)	-150.07 (6.76)	-27.74 (8.22)	2.62 (10.37)	54.39 (5.32)	-13.58 (5.42)
Household production	11.16 (7.25)	16.78 (7.78)	-3.09 (6.75)	-57.33 (8.20)	-13.43 (10.36)	-80.40 (5.31)	27.96 (5.41)
Family care	0.32 (4.10)	-3.62 (4.38)	-9.08 (3.82)	-4.71 (4.65)	-12.57 (5.87)	-6.94 (3.01)	14.06 (3.57)
Sleep	8.28 (5.09)	21.08 (5.43)	30.09 (4.74)	31.33 (5.76)	39.09 (7.27)	3.65 (3.73)	3.32 (3.80)
Personal care	1.30 (3.33)	-5.49 (3.56)	-2.56 (3.10)	19.20 (3.77)	4.39 (4.77)	-19.03 (2.44)	-5.39 (2.49)
Eating and drinking	1.21 (2.47)	6.90 (2.93)	7.81 (2.56)	-34.28 (3.11)	-14.84 (3.93)	10.31 (2.01)	8.45 (2.05)
Leisure	58.60 (8.99)	69.34 (9.61)	117.94 (8.38)	71.43 (10.18)	3.88 (12.86)	40.39 (6.59)	-30.98 (6.71)

*Standard errors in parentheses here and in Tables 3-6. The excluded age category is 60-64 years old.

Table 3. Impacts of Market Work on Daily Minutes of Other Activities, ATUS 2003, Individuals <60 (Minutes per Representative Day)

All Individuals						
	Worked?	Minutes of Work	R ²			
Secondary Activities	13.53 (5.06)	-0.370 (0.009)	0.404			
Tertiary Activities	10.35 (4.16)	-0.216 (0.007)	0.172			
Leisure	-24.49 (5.26)	-0.393 (0.009)	0.439			
X ² (2); N =	22.02	14398				
Married Men			Married Women			
	Worked?	Minutes of Work	R ²	Worked?	Minutes of Work	R ²
Secondary Activities	4.65 (9.45)	-0.362 (0.014)	0.347	21.04 (9.90)	-0.501 (0.019)	0.422
Tertiary Activities	26.73 (7.11)	-0.237 (0.011)	0.235	-1.48 (7.18)	-0.176 (0.134)	0.144
Leisure	-33.94 (9.49)	-0.376 (0.014)	0.428	-13.97 (9.05)	-0.312 (0.018)	0.264
X ² (2); N =	20.22	3626		4.07	4225	
Single Men			Single Women			
	Worked?	Minutes of Work	R ²	Worked?	Minutes of Work	R ²
Secondary Activities	17.05 (10.83)	-0.238 (0.019)	0.175	33.24 (10.44)	-0.364 (0.020)	0.293
Tertiary Activities	-2.77 (10.99)	-0.223 (0.019)	0.158	12.95 (9.23)	-0.234 (0.017)	0.140
Leisure	-20.90 (13.41)	-0.511 (0.023)	0.481	-46.44 (11.36)	-0.385 (0.021)	0.437
X ² (2); N =	3.54	2837		17.58	3710	

*All the estimating equations here and in Tables 4-6 include a quadratic in age, and indicators for African-American and Hispanic and the presence of children in various age categories. Those for all workers also include indicators for marital status and gender; they and the equations for married individuals in Tables 4 and 5 also include a measure of spouse's hours of market work.

Table 4. Impacts of Market Work on Daily Minutes of Other Activities, ATUS 2003, Individuals <60, with Income Interactions (Minutes per Representative Day)

All Individuals				
	Worked?	Worked? x Income>50K	Minutes of Work	R ²
Secondary Activities	13.85 (8.28)	-23.46 (7.74)	-0.410 (0.012)	0.451
Tertiary Activities	19.39 64087)	-7.48 (5.68)	-0.211 (0.009)	0.194
Leisure	-31.54 (7.85)	30.70 (7.39)	-0.360 (0.011)	0.348
X ² (3); N =		21.45 7851		
Married Men				
	Worked?	Worked? x Income>50K	Minutes of Work	R ²
Secondary Activities	28.05 (11.77)	-39.05 (11.53)	-0.363 (13.06)	0.352
Tertiary Activities	29.53 (8.89)	-4.33 (8.70)	-0.236 (0.011)	0.236
Leisure	-55.03 (11.83)	35.04 (11.59)	-0.375 (10.44)	0.431
X ² (3); N =		26.09 3626		
Married Women				
	Worked?	Worked? x Income>50K	Minutes of Work	R ²
Secondary Activities	35.45 (12.05)	-23.39 (10.82)	-0.501 (10.83)	0.423
Tertiary Activities	1.53 (8.75)	-5.04 (7.86)	-0.176 (0.014)	0.144
Leisure	-33.89 (10.99)	32.62 (9.87)	-0.310 (0.0180)	0.269
X ² (3); N =		11.85 4225		

Table 5. Impacts of Market Work on Daily Minutes of Other Activities, ATUS 2003, Individuals <60 Working Short or Zero Hours (Minutes per Representative Day)

	All Individuals with <4 Daily Hours of Market Work			All Individuals with <2 Daily Hours		
	Worked?	Minutes of Work	R ²	Worked?	Minutes of Work	R ²
Secondary Activities	61.18 (10.06)	-0.697 (0.078)	0.286	59.15 (13.06)	-0.595 (0.232)	0.283
Tertiary Activities	-23.35 (7.85)	-0.060 (0.061)	0.020	-17.56 (10.67)	-0.212 (0.180)	0.018
Leisure	-35.74 (10.44)	-0.260 (0.081)	0.233	-37.04 (14.24)	-0.256 (0.241)	0.230
X ² (2); N =	37.43	9093		17.94	8532	

Married with <4 Daily Hours of Market Work

	Men			Women		
	Worked?	Minutes of Work	R ²	Worked?	Minutes of Work	R ²
Secondary Activities	64.21 (19.54)	-0.780 (0.159)	0.071	56.51 (18.38)	-0.794 (0.147)	0.130
Tertiary Activities	-22.28 (12.88)	0.017 (0.105)	0.016	-13.66 (12.62)	-0.144 (0.101)	0.037
Leisure	-38.37 (19.67)	-0.304 (0.160)	0.071	-35.85 (16.67)	-0.064 (0.134)	0.084
X ² (2); N =	11.20	1867		8.83	3007	

Single with <4 Daily Hours of Market Work

	Men			Women		
	Worked?	Minutes of Work	R ²	Worked?	Minutes of Work	R ²
Secondary Activities	42.81 (23.14)	-0.410 (0.173)	0.124	84.57 (20.51)	-0.778 (0.154)	0.215
Tertiary Activities	-38.26 (22.38)	-0.078 (0.167)	0.015	-26.01 (17.23)	0.001 (0.129)	0.015
Leisure	-15.78 (28.41)	-0.460 (0.212)	0.104	-54.14 (22.12)	-0.249 (0.166)	0.188
X ² (2); N =	5.45	1781		16.02	2438	

Table 6. Impacts of Market Work on Daily Minutes of Other Activities on Weekends, ATUS 2003, Individuals <60 with No Weekend Work

	Worked During Week?	Weekly Work Hours	R ²
Secondary Activities	-10.54 (11.75)	0.818 (0.275)	0.178
Tertiary Activities	-1.61 (8.96)	0.268 (0.210)	0.028
Leisure	13.85 (12.40)	-1.093 (0.290)	0.126
X ² (2); N =	1.23	5996	

Table 7. Mean Number of Activity Switches by Age, ATUS 2003 (per Representative Day)*

	Age					
	<55	55-59	60-64	65-69	70-74	75+
Switches						
Unadjusted means	19.72 (0.07)	18.83 (0.20)	19.29 (0.25)	18.90 (0.25)	18.46 (0.26)	17.77 (0.18)
Regression estimates	-----	-0.245 (0.21)	0.310 (0.24)	-0.070 (0.26)	-0.415 (0.28)	-1.105 (0.22)

*Standard errors in parentheses. The estimates in all tables are weighted to reflect equal numbers of observations on each of the seven days of the week. The regression estimates are from an equation that also includes each person's distribution of time across market work, secondary activities, tertiary activities, and leisure; and the same sets of indicators that are included in the regressions underlying the results in Table 3.