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Preliminary—Comments Welcome

Why Not Retire? The Time and Timing Costs of Market Work

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Abstract

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 rigidities imposed by market work schedules. Using the American Time Use Survey of 2003, I first examine whether additional market work is neutral with respect to the mix of non-market activities. The estimates indicate that there are fixed time costs of remaining in the labor market that alter the pattern of non-market activities, reducing leisure time and mostly increasing time devoted to household production. 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 alters the daily distribution of a fixed amount of non-market activities, away from the distribution chosen when the constraint of a work schedule is not present. All these effects are mitigated by higher family income, presumably because higher-income people can purchase market substitutes that enable them to overcome the fixed time costs of market work.

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 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) Americans divide their time outside the market. This assumption has led us to ignore the likelihood that older people and others do not view non-market activities as homogeneous (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 2004 the rate was only 19.0 percent, despite the rise over the previous four 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 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 examinations of older workers (Gauthier and Smeeding, 2000; 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 first part of the study I analyze how the decision to make the discrete choice of working in the market alters the mix of non-market activities. 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 second 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 labor market, discovering what scheduling looks like when the constraint of market

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.

work is no longer relevant would seem crucial for understanding how this instantaneous dimension may induce retirement.

The Source of All Data: The American Time Use Survey, 2003

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 (with no information on timing), 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 daily log 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. The surveys 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. 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. Each year an additional 3,000 or so older Americans will be providing time diaries.²

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

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 Reid's (1934) third-party rule defining 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 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 with age 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. 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 these aggregates, it is also by far the largest in percentage terms. Clearly, among the activities that might be crowded out by market work, leisure is the main one.

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, 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+ 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.

A Model of the Fixed Time Costs of Market Work

Why does an increase in leisure time represent the overwhelming use of the time that is freed up as older people reduce their hours of market? That is, why do those who are 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 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). 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

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.

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

time costs 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). They 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

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

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 $T_M^* = 0$. 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:

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

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 $\mu_{ST}/\mu_L > 1$, we will observe that the very first minute of market work alters the relative amounts of secondary/tertiary and leisure activities chosen. Thus while we cannot observe the existence of fixed time costs of work directly, 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.

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.

Unlike prices of market goods, the relative price change generated by the existence of fixed time costs of work can differ among individuals. Those who have higher I might use their additional unearned income to substitute purchased 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.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.

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. No such instrument is available in the ATUS; nor would one even appear to be imaginable were 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 Heckman, 1976), 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 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

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 lower. The latter create a bigger gap in the distribution for workers whose value of time is greater.

somewhat more confident that we are measuring what the theory indicates. I thus estimate regressions relating minutes spent in secondary activities, tertiary activities and leisure to minutes spent in market work and an indicator WORK 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). 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 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 of adding one additional minute of market work. The results are striking: Among all these adults the impact of beginning market work is not neutral across secondary activities, tertiary activities and leisure. The

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.

estimates suggest a substantial negative effect on leisure activities and 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).

Disaggregating the sample by marital status and gender changes the results somewhat, but they 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 characterizes these subgroups fairly well.⁸

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 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 people, and for married men and women separately, in Table 4. The interaction terms in each case are of opposite sign from the main effect terms on WORK and 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

⁸Freeman and Schettkat (2005) compare older U.S. and German time-budget data and argue that longer U.S. hours of market work are offset by reductions in their home production. This may be true in the aggregate; but the results here make it absolutely clear that market and home production are complements at the margin of work at the individual level, with both substitutes for leisure.

household income above the \$50,000 threshold (being in the upper 3/5 of the distribution of household incomes) 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 role of higher income in enabling the household to offset those costs.⁹

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. Some insight into the validity of this counter-argument can be obtained by restricting the sample to people who may be more similar, namely those who work zero or relatively few hours 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 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. The impacts of starting work 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

⁹If 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 as income increases.

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.¹⁰

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. 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 over weekend respondents who reported no market work on the diary day.

Table 6 presents the results. One should first note that each triad of coefficients should nearly (because of the small miscellaneous category) sum to zero, since there is no market work. 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. There appear to be only small differences in set-up costs between non-workers and others on days when no market work is performed. Additional hours of work during the week are not neutral with respect to the allocation of time on a non-working weekend day, however.¹¹ They reduce leisure time on weekends and increase time devoted to secondary activities among those who do no market work on weekends. 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 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, particularly the consistent pattern of a shift from leisure activities to secondary activities when market work hours are few but

¹⁰Nor 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.

¹¹A test of the equality of the three estimated parameters yields $\chi^2 = 14.52$.

positive and 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.

The Timing of Activities

Yet another potential non-neutral effect of additional market work and the fixed cost of beginning market work on time use at home is on the temporal pattern of daily activities. That is, conditional on the amount of an activity (secondary, tertiary or leisure) undertaken over the day, are the times at which those non-market activities are undertaken affected by the amount of market work and by the fixed cost of beginning market work? In other words, is there an *instantaneous* non-neutrality of market work on household activities analogous to the *integrative* impacts I demonstrated in Section IV?

To examine this possibility I estimate equations:

$$(5) \quad P_{At} = H(T_A; \text{WORK}; T_M; Z), \quad A = S, T, L; t=1, \dots, 96,$$

where P_{At} is an indicator equaling one if activity A was performed during quarter-hour t. These equations are analogous to those estimated in Section IV, except that here I am holding constant the total amount of time spent in activity A to concentrate on how its diurnal distribution is affected by market work. The sum of the coefficients on the T_A across the t should equal zero, since total time spent in A over the day is $15SP_{At}$. Thus conditional on T_A the coefficient estimates of T_M show whether an additional minute of market work alters the temporal pattern of the activity A. Similarly, again conditional on T_A , the estimated coefficients on WORK show whether the discrete choice to begin market work alters the temporal pattern of the activity A and thus provide a test of the impact of the fixed costs of market work on the timing of household activities.

The raw ATUS data are presented in sequence, with each activity having a particular starting time (coded to the minute). For purposes of analysis, as is implicit in (8) I combine the data into periods of 96 quarter-hours, examining what each respondent was doing during each quarter-hour beginning at 4AM and ending at 3:59AM the next

day.¹² Before proceeding to the estimation, and analogous to the presentation in Section IVA, I first provide information on the temporal patterns of activities for people under age 55 and 55 or over, then examine how these patterns differ among groups of older Americans. Clearly, there is a massive amount of information here; the only useful approach is to present it graphically, which I do throughout the rest of this Section.

Figures 1a-1d show the daily patterns of market work, secondary activities, tertiary activities and leisure for people under 55 and those 55+.¹³ (The graphs present the mean fractions of people in the group engaged in the activity at the particular quarter-hours.) Most of the differences between the two age groups are the unsurprising result of the higher incidence of market work among the younger sub-sample. The diurnal patterns of market work are identical between the two age groups, with the downward shift among the older group at each point being nearly directly proportional to their lower market participation.¹⁴

The time patterns of tertiary activities differ little across these two groups; and even the timing of leisure differs little once we account for differences in market work, a mainly daytime activity. The main interesting difference is in the temporal pattern of secondary activities. Younger people perform their secondary activities (household production) disproportionately during the late afternoon and evening when they are less likely to be working; older people, perhaps to avoid congestion costs at times when more younger people are at their workplaces, perform these activities disproportionately during the prime daytime hours.

Strikingly, the difference in the pattern of the timing of secondary activities by age exists even among those whose time diary showed no market work and who responded to the CPS question about usual hours of work by saying theirs were zero, as Figure 2a shows. Even non-working younger people engage in household production

¹²Where more than one activity was in progress during a quarter-hour, I included the one which comprised the majority (or plurality) of the 15 minutes. In the very few instances where more than two activities were in progress for the same length of time I coded the first of them as representing the quarter-hour.

¹³All the data and coefficients presented in the Figures in this Section are based on statistics that have been weighted to provide information on a representative day of the week.

¹⁴This finding is consistent with the evidence in Hamermesh (1999) on self-reported work patterns by age in the CPS.

disproportionately in the late afternoon and early evening, at times when older Americans disproportionately engage in leisure activities, as shown in Figure 2c. Since the main difference in the kinds of leisure undertaken across age groups is that older people watch more television, the differences reflect the greater attractions of prime-time television to older audiences. Differences in the timing of tertiary activities (Figure 2b) by major age group are slight—those under or over 55 sleep, eat, etc. at roughly the same times. The only significant differences are that older Americans are more likely to engage in tertiary activities between 11PM and 4AM, and less likely to do so from 8AM to 11AM. Since sleep accounts for most tertiary time use, these differences reflect older Americans going to bed and waking up earlier than younger people.

Figures 3a-3d depict the coefficients and confidence intervals around them on indicators of age from regressions describing each of the four main types of activities for samples of individuals age 60 and over. In each equation the total time spent in the activity over the day is held constant, so that the coefficients illustrate temporal variety adjusted for the intensity of the activity. The horizontal line at zero indicates the effect for the base group, persons ages 60-64. Figure 3a shows that people older than this base group are more likely to do what market work they accomplish during afternoons and less likely to do it during mornings. The differences are rarely significant, however. The main differences (which occur chiefly between those 75+ and those 60-64) are in the timing of secondary activities and leisure. The oldest group engages in relatively few secondary activities during prime daytime hours compared to people a few years younger. Obversely, they engage in leisure activities disproportionately during those times compared to people 60-64 and even to those ages 65-69. Quite different from the results in Section IV for the total amounts of time devoted to different activities, the major differences in the diurnal distribution of time among older Americans are between their use of time in secondary activities and leisure; there are few significant differences in the timing of tertiary activities across the population ages 60+.

In Figure 4a I present the temporal patterns of the coefficients on the variable WORK from the three sets of equations (5). Each point represents a regression coefficient at a particular quarter-hour of the day, and around each point is a 95-percent confidence interval. The very fact of being in the labor market, even for only a few hours

in a day, causes significant displacement in the timing of activities conditional on the total amounts undertaken. Particularly interesting are the displacement of leisure away from prime working hours and the displacement of secondary activities to late afternoon and early evening. In addition to the increase in the amount of secondary activities and reducing leisure shown in Section IV, the presence of labor-market activity also causes temporal displacements in the performance of these other activities.

Figure 4b presents the same kind of information, but for the coefficients on T_M from the estimates of equations (5). It shows that additional time devoted to market work, conditional on being in the labor market, has especially large effects on the timing of tertiary activities. The marginal effect of another minute of market work is biggest on sleeping, eating, etc. during normal waking hours. The effects on leisure are also large and significant, and indicate that additional minutes of market work shift leisure away from prime daytime working hours. The impacts of an additional minute of work time on the timing of secondary activities are smaller, with the biggest shift being toward conducting secondary activities during evening hours.

For each of the three non-market activity aggregates Figures 5a-5c show the coefficients at each quarter-hour on $WORK$ and an interaction of $WORK$ with the indicator of family income above \$50,000 per year. The underlying regressions and samples are identical to those partly described in Figures 4a and 4b, except for the addition of this interaction and a main-effect term in the indicator. The question is whether the impact of labor-market participation differs between otherwise identical workers who are in higher- or lower-income households. A test of that possibility is whether the confidence intervals around dotted lines in Figures 5 include the zero line. While they do in many cases, in many others they do not. More often than not, however, the coefficients on the interaction term between higher income and $WORK$ are of opposite signs, suggesting that additional family income mitigates the disturbance to the timing of household activities generated by labor-force participation. The correlation of the coefficients on $WORK$ and its interaction with family income is +0.19 (48 of 96 opposite signs); the correlation of the two coefficients in the equation for tertiary activities is -0.61 (63 opposite signs); that for leisure is -0.38 (53 opposite signs). The correlation and number of opposite-signed coefficients in the equations describing

tertiary activities are significantly different from what is expected under the null hypothesis of randomness, as is the correlation coefficient for the estimates for leisure. These results suggest that people in higher-income households are able to use their income to overcome some of the set-up costs that market work imposes on the timing of non-market activities.

The final set of figures, 6a and 6b, are analogous to Figures 4a and 4b, except the sample is restricted to individuals whose diaries describe weekend days when they did no market work, but who report positive hours of market work for the week. Here, analogous to the integrative analysis in Section IV, the purpose is to examine whether it is market work *per se* that alters schedules, or whether workers' home schedules differ from others' schedules for reasons not having to do with time spent in the market on the particular day. Comparing these figures to Figures 4a and 4b, there are only slight effects of having worked in the market on weekdays on the timing of a given amount of other activities over the weekend. What matters most for the determination of timing is work on the particular day. As in Section IV, there is only weak evidence that those who work only on weekdays behave on the weekends any differently from otherwise identical people who do not work in the market at all.

Conclusions (Incomplete)

Suffice it to note that the mere fact of participation in the labor market, even for a short while, alters both the distribution of non-market activities and their timing. Neither the discrete move to participation nor marginal increases in hours of work are neutral with respect to the kinds of activities undertaken outside the market, even when we confine the analysis to the three broad aggregates secondary activities, tertiary activities and leisure. Working in the market increases the amount of secondary activities performed relative to the amount of leisure consumed; and the diurnal distributions of these three major aggregates are altered on working days when a person enters the labor market and when/s/he increases hours of market work.

More to follow.

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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						
	WORK	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			
? ² (2); N =	22.02	14398				
Married Men			Married Women			
	WORK	Minutes of Work	R ²	WORK	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
? ² (2); N =	20.22	3626		4.07	4225	
Single Men			Single Women			
	WORK	Minutes of Work	R ²	WORK	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
? 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				
	WORK	WORK x Income>50K	Minutes of Work	R²
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
? ² (3); N =		21.45	7851	
Married Men				
	WORK	WORK x Income>50K	Minutes of Work	R²
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
? ² (3); N =		26.09	3626	
Married Women				
	WORK	WORK x Income>50K	Minutes of Work	R²
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
? 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					
	<4 Daily Hours of Market Work			<2 Daily Hours of Market Work		
	WORK	Minutes of Work	R ²	WORK	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
? ² (2); N =	37.43	9093		17.94	8532	
Married with <4 Daily Hours of Market Work						
	Men			Women		
	WORK	Minutes of Work	R ²	WORK	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
? ² (2); N =	11.20	1867		8.83	3007	
Single with <4 Daily Hours of Market Work						
	Men			Women		
	WORK	Minutes of Work	R ²	WORK	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
? 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

	WORK	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
$\chi^2(2); N =$	1.23	5996	

Figure 1a: Fraction Doing Market Work by Age, Qtr. Hours
(means with 95% confidence intervals)

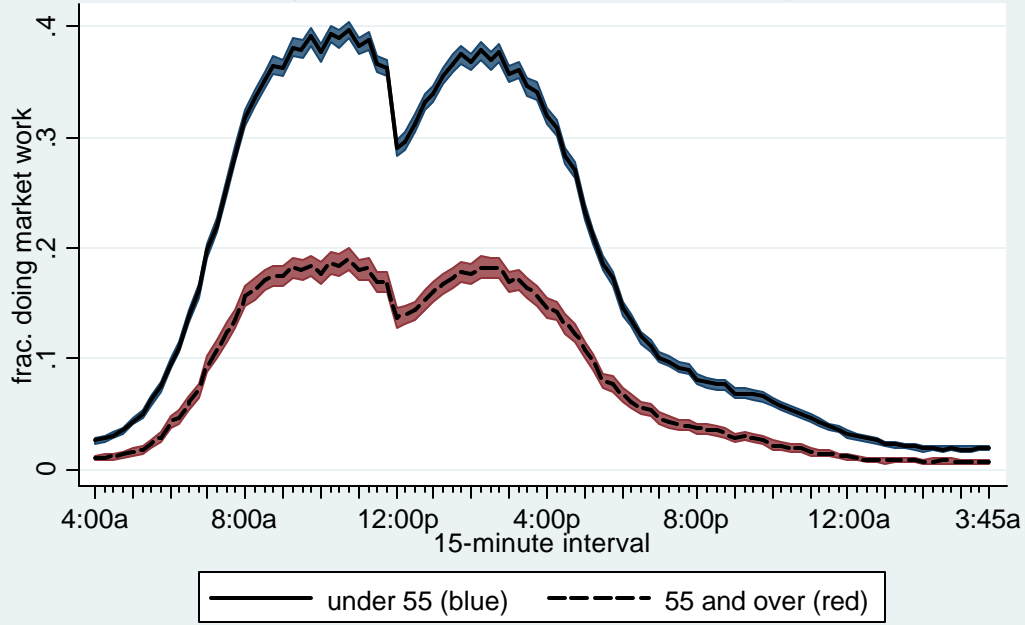


Figure 1b: Fraction Doing Secondary Activities by Age, Qtr. Hrs.
(means with 95% confidence intervals)

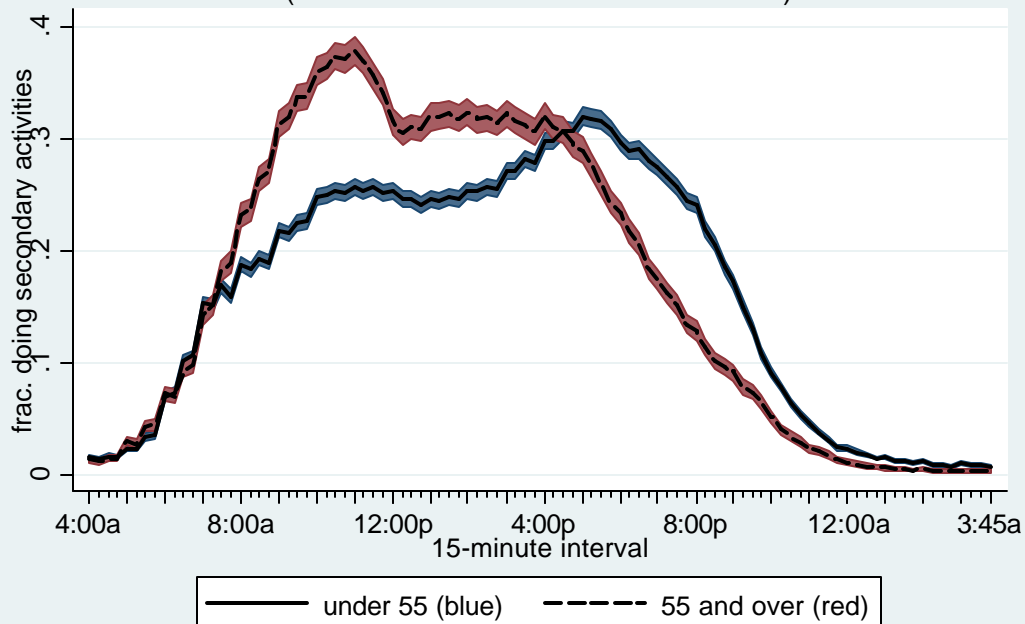


Figure 1c: Fraction Doing Tertiary Activities by Age, Qtr. Hours
(means with 95% confidence intervals)

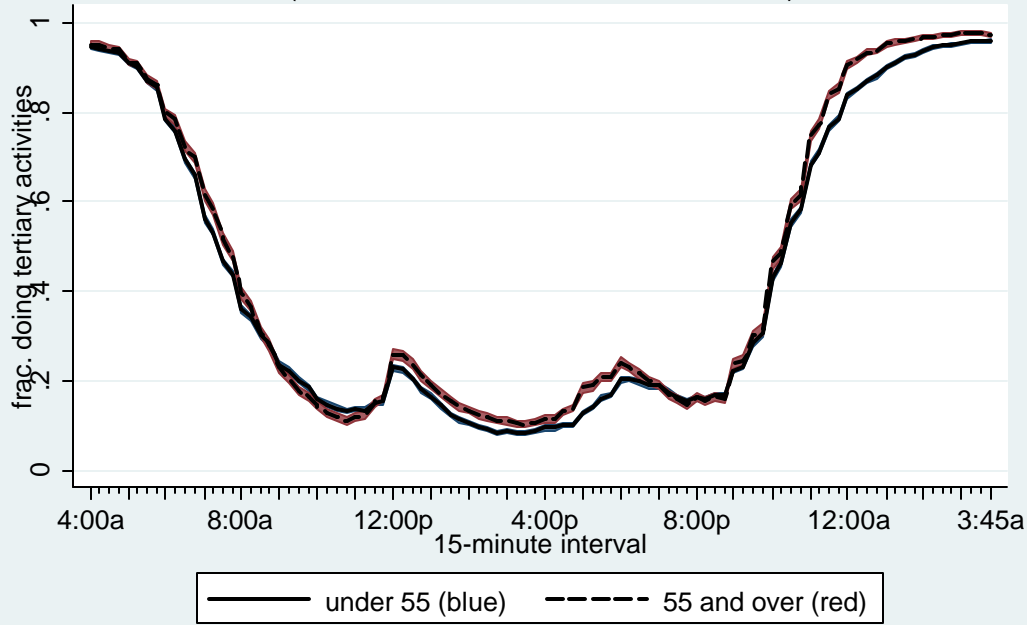


Figure 1d: Fraction Doing Leisure Activities by Age, Qtr. Hours
(means with 95% confidence intervals)

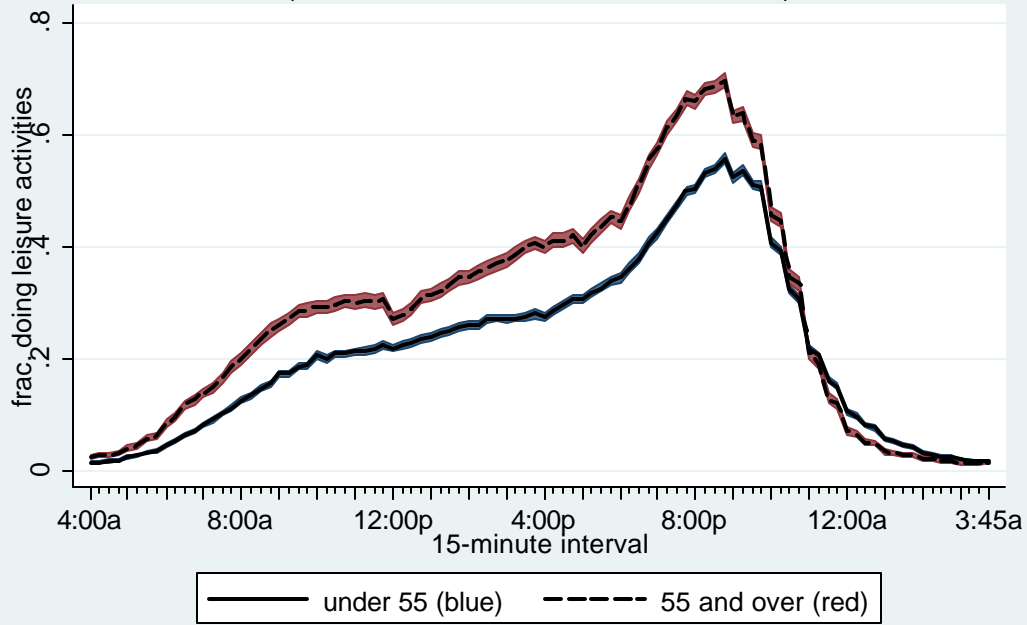


Figure 2a: Fraction Doing Secondary Activities Who Don't Work by age and quarter hours (means with 95% confidence intervals)

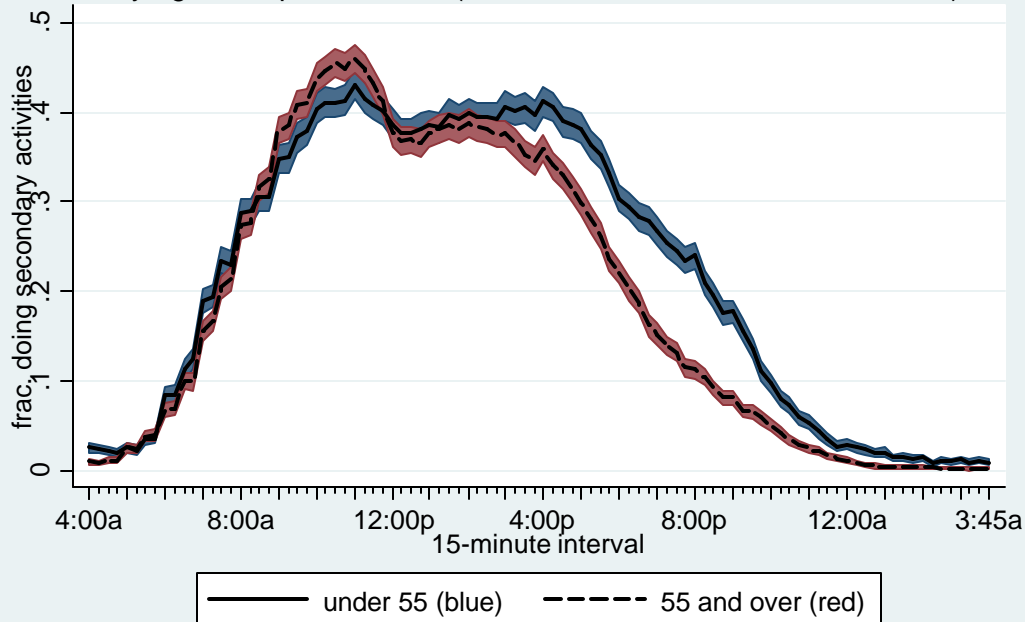


Figure 2b: Fraction Doing Tertiary Activities Who Don't Work by age and quarter hours (means with 95% confidence intervals)

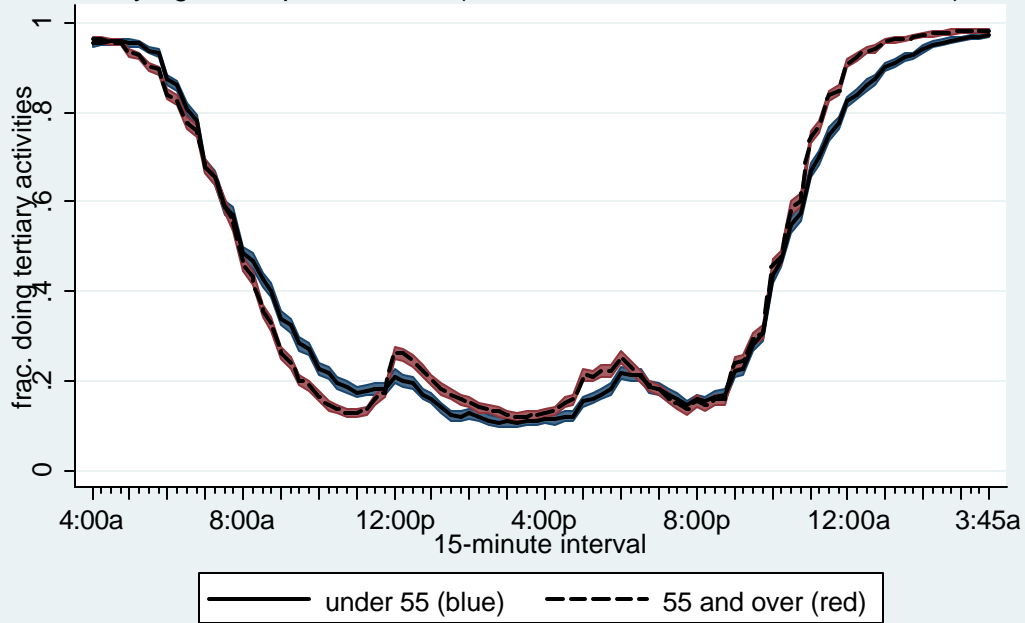


Figure 2c: Fraction Doing Leisure Activities Who Don't Work
by age and quarter hours (means with 95% confidence intervals)

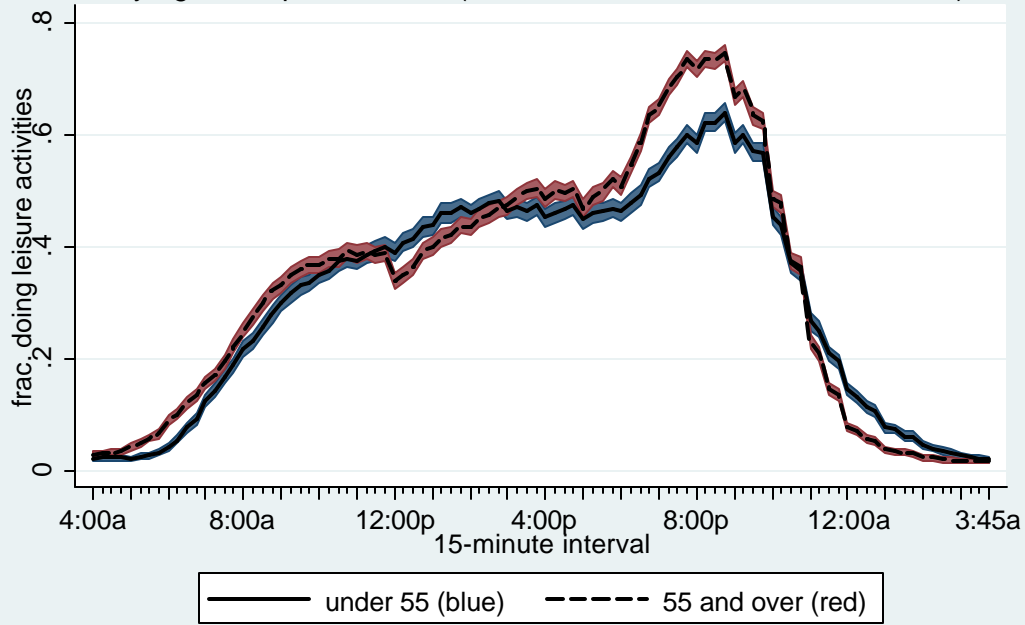


Figure 3a: Effect of Older Age on Market Work
by age and quarter hours (est. coef. with 95% confidence intervals)

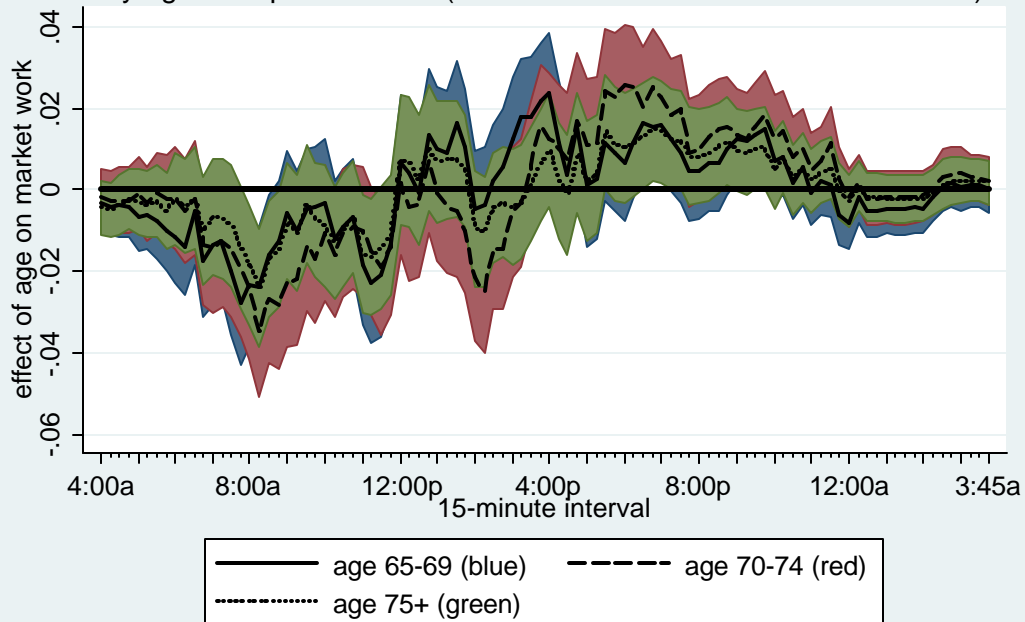


Figure 3b: Effect of Older Age on Secondary Activities by age and quarter hours (est. coef. with 95% confidence intervals)

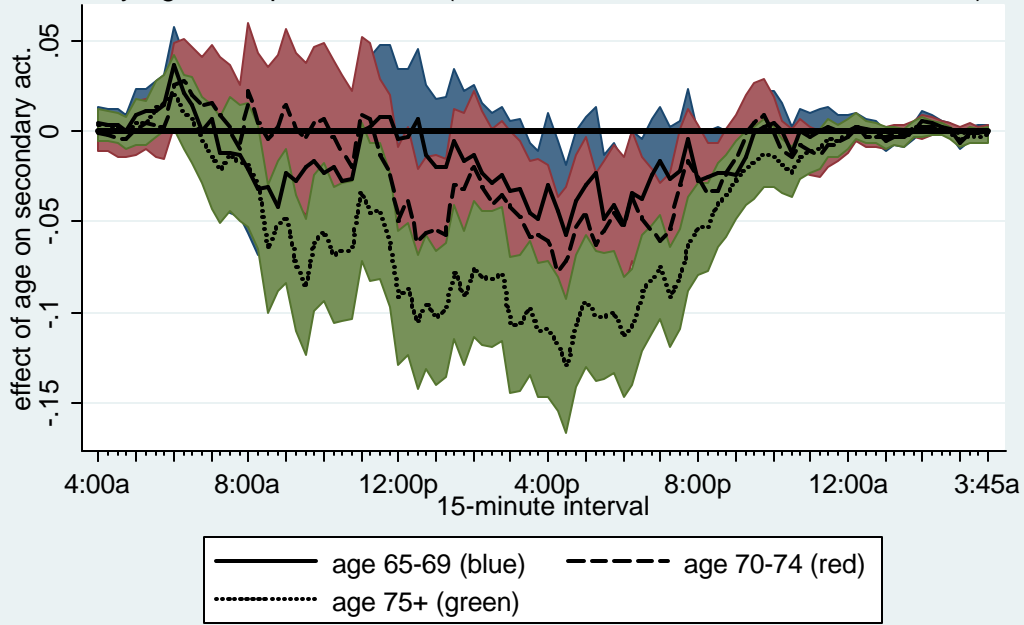


Figure 3c: Effect of Older Age on Tertiary Activities by age and quarter hours (est. coef. with 95% confidence intervals)

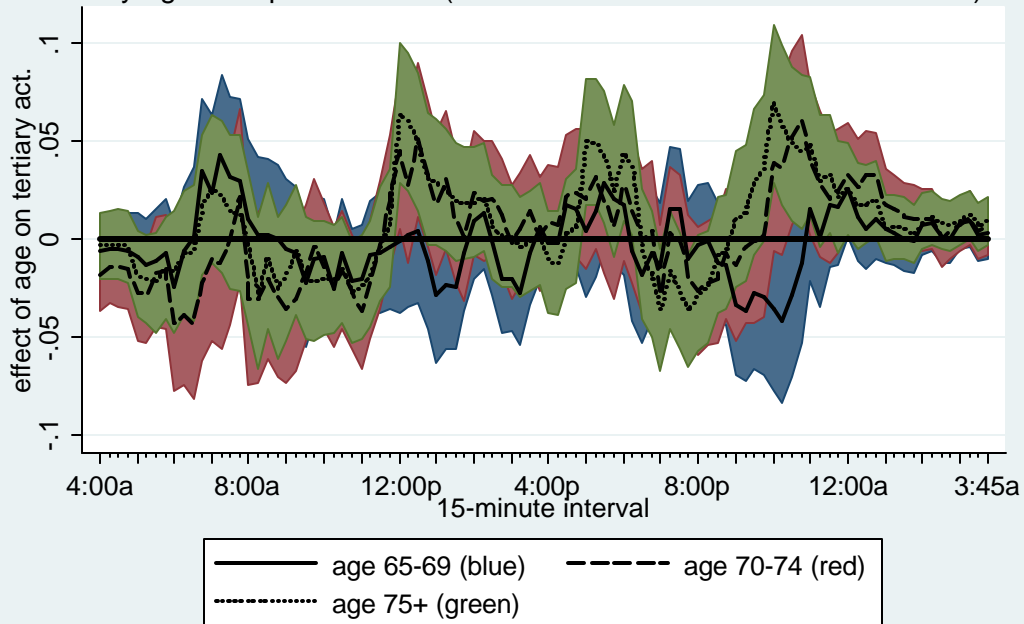


Figure 3d: Effect of Older Age on Leisure Activities

by age and quarter hours (est. coef. with 95% confidence intervals)

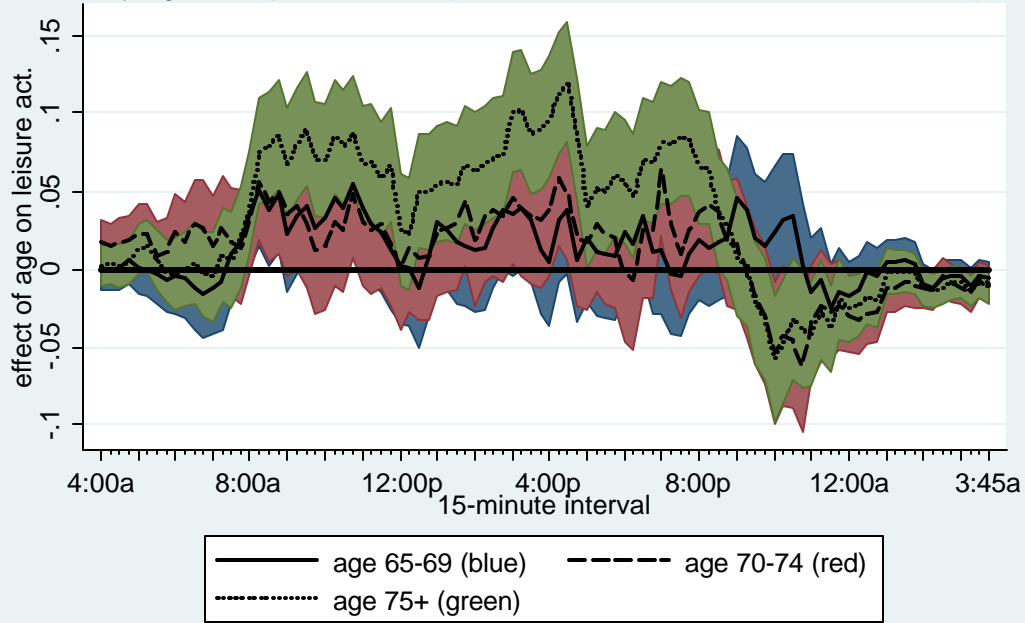


Figure 4a: Effect of Working Status on Activity Type

by type and quarter hours (est. coef. with 95% confidence intervals)

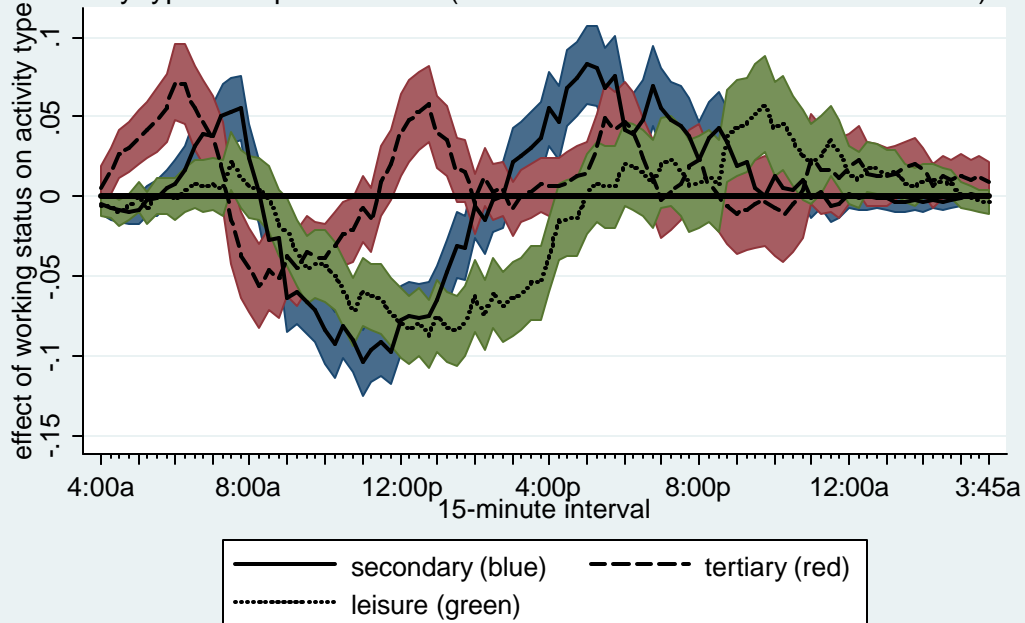


Figure 4b: Effect of Work Time on Activity Type

by type and quarter hours (est. coef. with 95% confidence intervals)

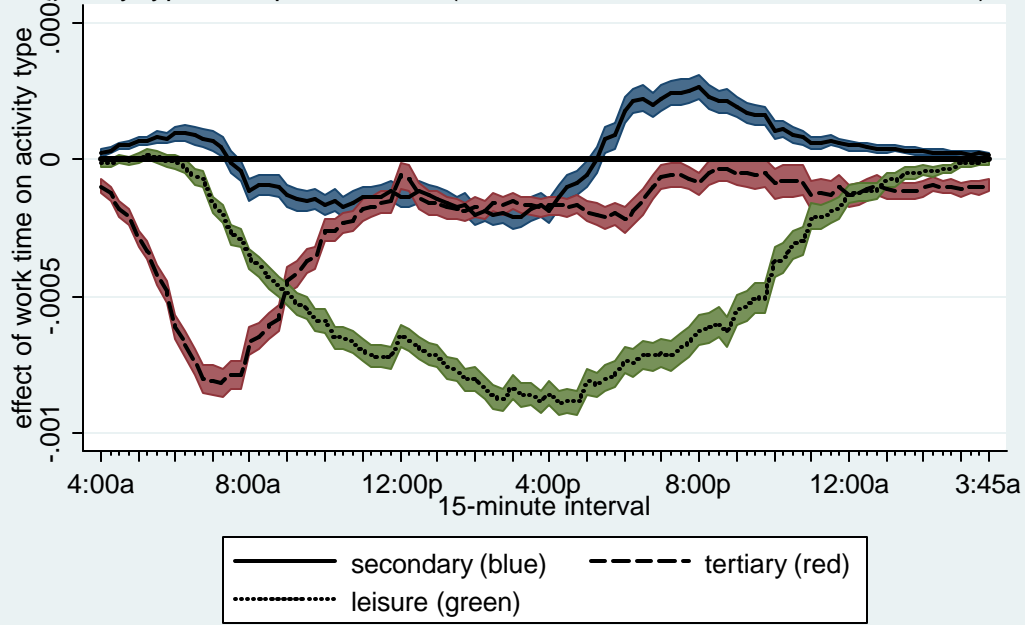


Figure 5a: Effects of Work and Fam. Inc. on Secondary Acts.

by quarter hours (est. coef. with 95% confidence intervals)

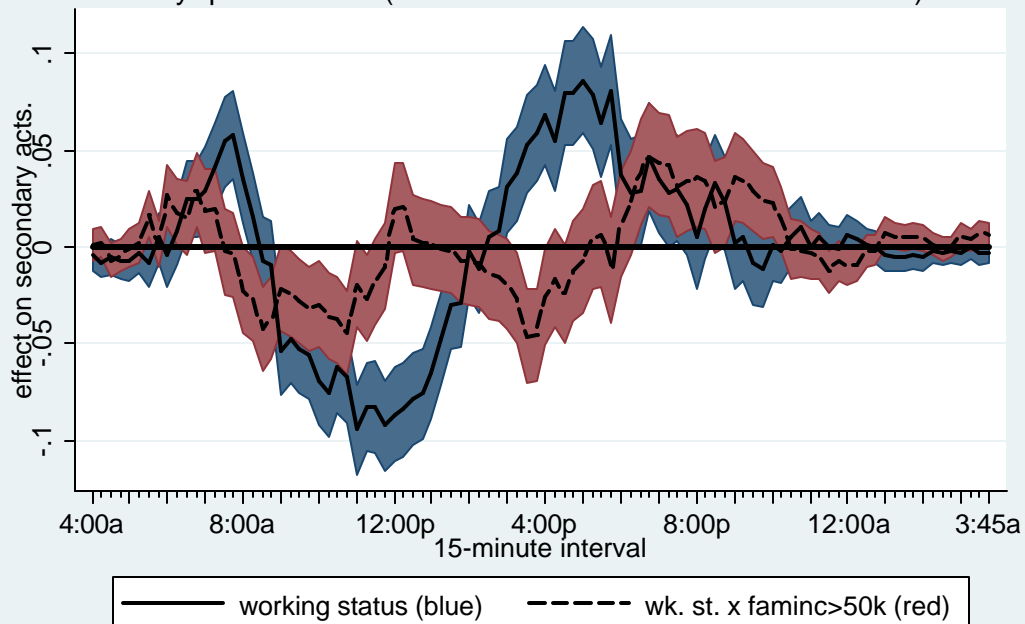


Figure 5b: Effects of Work and Fam. Inc. on Tertiary Acts.
by quarter hours (est. coef. with 95% confidence intervals)

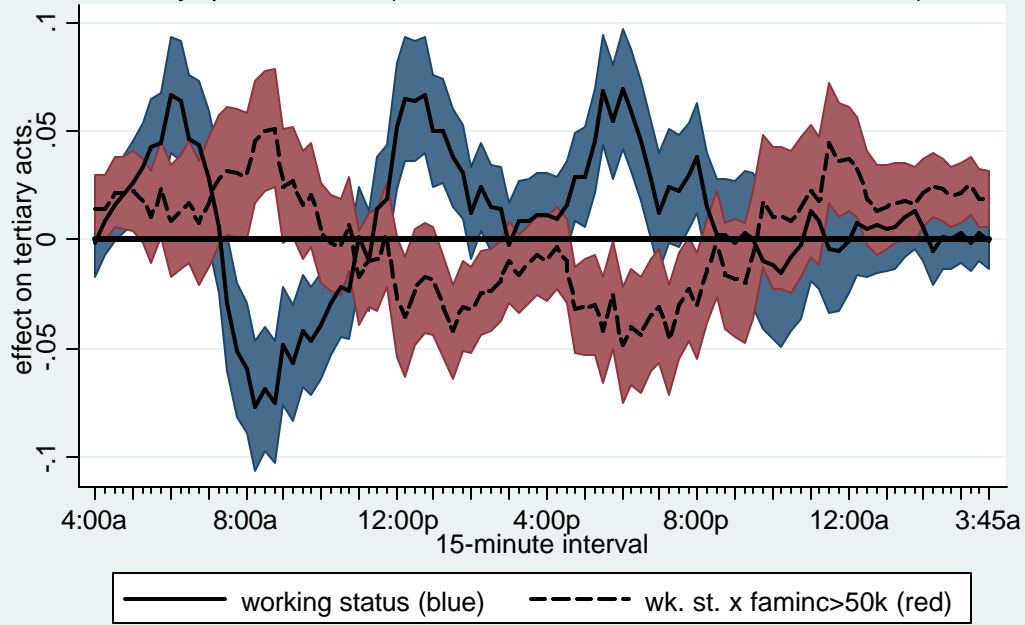


Figure 5c: Effects of Work and Fam. Inc. on Leisure Acts.
by quarter hours (est. coef. with 95% confidence intervals)

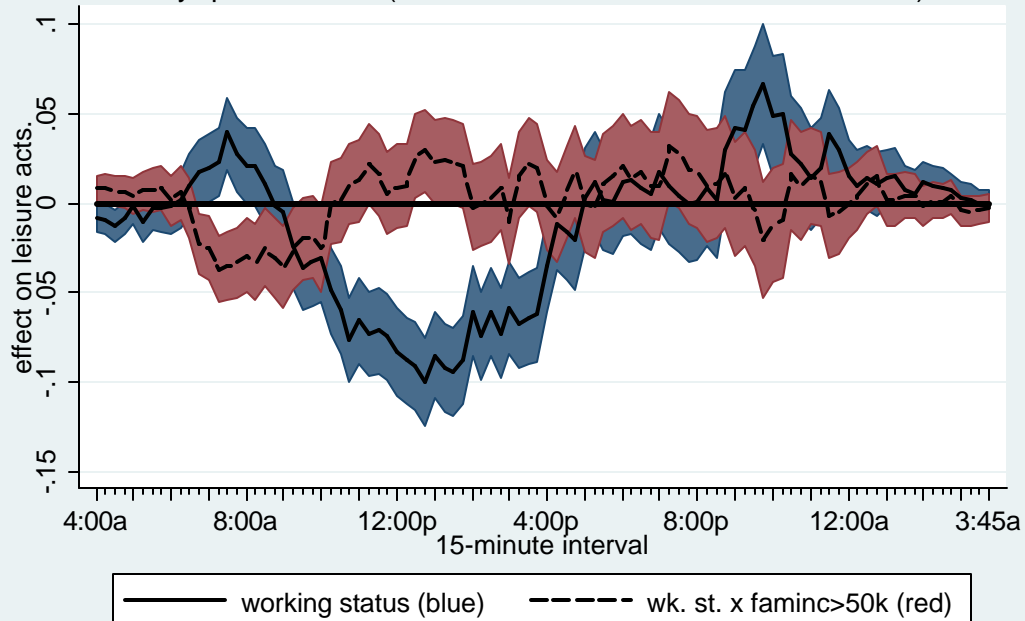


Figure 6a: Effect of Pos. Weekly Hours on Activity Type by type and quarter hours (est. coef. with 95% confidence intervals)

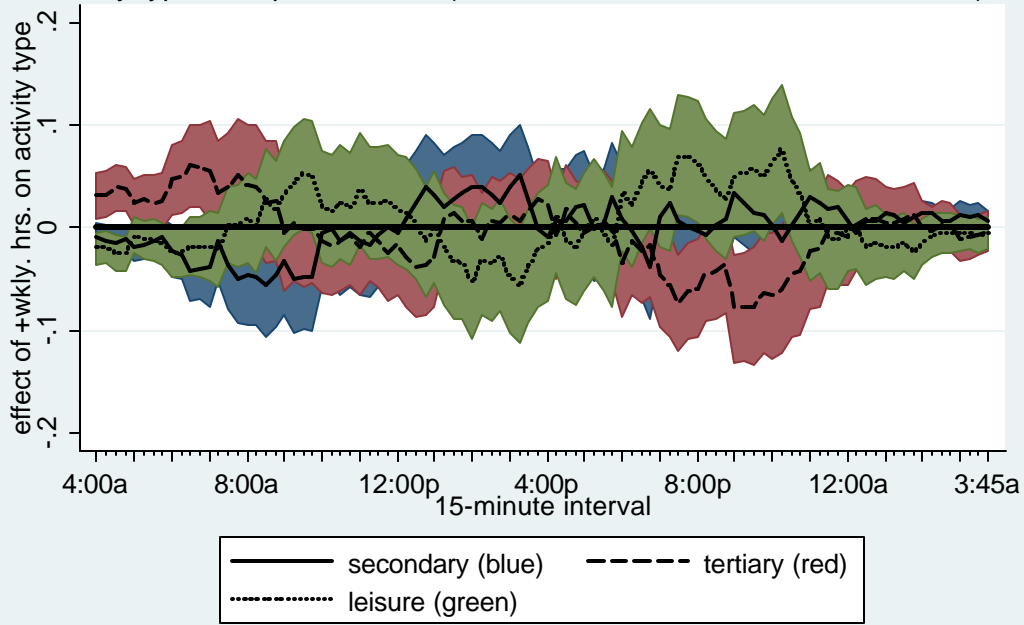


Figure 6b: Effect of Weekly Hours on Activity Type by type and quarter hours (est. coef. with 95% confidence intervals)

