Here Comes the Rain Again: Weather and the Intertemporal Substitution of Leisure

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Abstract

Weather conditions impact everyday life in many ways. This paper proposes a model of intertemporal labor supply in which good weather increases the enjoyment of leisure. If today's weather is better than tomorrow's, a worker will want to marginally increase the quantity of leisure enjoyed today, and reduce it tomorrow, thus working less today and more tomorrow. I test the model empirically using data from the 2003 and 2004 American Time Use Survey, supplemented with daily weather reports from over 8,000 individual weather stations across the United States. I define a rainy day as a day with at least 0.10 inches of rain in 24 hours. I find that, on rainy days, men work an average of 14 minutes more, and therefore have less leisure. The findings for women are mixed. The magnitude of the response varies by region, with men in the South and the Sunbelt working 38 and 45 minutes more, respectively. The impact of the previous day's weather is also examined to test for intertemporal substitution. Indeed, rain yesterday reduces time at work today for men by an average of 25 minutes. For women, rain yesterday as well as today induces a shift of 33 minutes from work to leisure.

Keywords: time use, ATUS, intertemporal substitution, labor supply, leisure, weather, rain

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1 Introduction

Weather, and climatic conditions more generally, affect everyday life considerably. Some activities can only be engaged in, or are more enjoyable, in particular

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weather conditions. People rarely decide to make a trip to the beach or play tennis outdoors on a rainy day. On the other hand, a majority of Americans work indoors, where the weather does not matter. Casual observation suggests that workers might want to modify their work schedule in order to take advantage of good weather conditions. Suppose an individual knows that today will be a great day, while tomorrow it will rain. If at all possible, she might decide to leave work early in order to enjoy an outdoors activity, postponing work to a future date. In this paper I will try to measure the extent to which workers respond to daily fluctuations in weather conditions by substituting future leisure for current leisure. Following Lucas and Rapping's (1969) seminal paper, I will first develop a model of intertemporal labor supply, in which weather conditions affect the enjoyment of leisure. I will then use the American Time Use Survey (ATUS) 2003 and 2004 data—which have the distinctive feature of reporting daily time diaries for Americans all over the United States, for every day of the year—coupled with weather records from over 8,000 individual weather stations, to test the weather-influenced behavior described in the model. Weather here is considered as an exogenous shock, about which individuals may have an idea ahead of time, but whose actual realization is only known the same day.

Lucas and Rapping (1969) proposed a model that aimed to reconcile two divergent assumptions: the long-run labor supply that seems to be inelastic to the wage rate, and the short-run, infinitely elastic, labor supply. Within a two-period intertemporal labor supply framework, they modeled unemployment (hours of work variations) as being voluntary leisure, a response to temporarily low wages. This model has become the basis for much of the subsequent work on labor supply and the intertemporal substitution effect, particularly the effect of wage variations (see Blundell and MaCurdy's *Handbook* survey, 1999). Empirically, however, Lucas and Rapping's model has not fared too well. In an appraisal of the research on intertemporal labor supply, David Card (1994) concludes: "My assessment is hardly positive: the only real success for the model has come as a description of aggregate patterns in wage and hours during the post-1970 period. Even here, my suspicion is that a careful consideration of wealth effects undermines the success of the model (p. 72)." Ham and Reilly (2002) also reject the intertemporal substitution model, using data from the Panel Study of Income Dynamics (PSID) and the Consumer Expenditure Survey (CES).

Farber (2005) points out that "[o]ne criticism of this literature is that the standard neoclassical model assumes that workers are free to set their hours in response to changes in the wage or, alternatively, can select a job with the optimal wage-hours combination from a dense joint distribution of jobs. Evidence that neither of these are credible assumptions is that the distribution of hours is quite lumpy, with a substantial fraction of workers reporting usual weekly hours of precisely forty (pp. 46–47)." Challenging this conventional view of labor supply, a few recent papers have looked at jobs held by individuals such as taxi drivers (Camerer et al., 1997; Farber, 2004 and 2005) and bike messengers (Fehr and Goette, 2002), in which workers can effectively choose their daily hours of work. Oettinger (1999) studies stadium vendors who, while unable to choose how many hours they want to work on a particular shift, have total freedom in their daily participation decision.

The American Time Use Survey data provide a unique opportunity to take a fresh look at labor supply. With daily work time calculated in minutes, the lumping at eight hours a day or forty hours a week should be greatly reduced. I propose to abstract from wage considerations and look at how the labor supply is affected by a truly exogenous variable: the weather. The time horizon I consider is the very-short-run, where wages do not vary and workers do not change employer or renegotiate their wage-hour contract. I do not examine how much an individual wants to work weekly or yearly at a given wage rate, but rather by how much he would adjust, on the margin, his daily working hours in reaction to the weather. I assume that the traditional labor supply decision has been made previously, upon the signing of the job contract. In this case, I am interested only in the marginal adjustments on a given day in response to exogenous weather shocks. I define a rainy day as a day with at least 0.10 inches of rain in 24 hours. My findings show that men work more and have an average of 14 minutes less leisure on rainy days. The findings for women are mixed. The magnitude of the response varies by region, with men in the South and the Sunbelt working 38 and 45 minutes more, respectively. The impact of a rainy day on the previous day is also examined, in order to discover if an intertemporal substitution can be observed. Indeed, a rainy day yesterday reduces the time spent at work by an average of 25 minutes for men. For women, rain yesterday as well as today induces a shift of 33 minutes from work to leisure.

The paper will be organized as follows. Weather-related literature in economics is surveyed in section 2. Section 3 describes the theoretical model of intertemporal labor supply. Section 4 presents the data and the empirical strategies. Section 5 discusses the findings of this study and section 6 presents its conclusion, followed by references and a data appendix.

2 Weather-related Literature in Economics

The effect of weather and climatic conditions on agriculture is probably the topic that has received the most study in the weather-related economic literature. Moschini and Hennessy (2001) devote their entire chapter of the *Handbook of Agricultural Economics* to risk and uncertainty, stating that "uncontrollable elements, such as the weather, play a fundamental role in agricultural production (p. 89)." Paxson (1992) cleverly uses regional rainfall in Thailand to construct estimates of shocks to transitory income of Thai farm households, which are then used to estimate their savings behavior. Apart from agriculture, very few other areas in economics have looked at the weather. In contrast, its effect on mood, and thus on judgement and behavior, has been widely studied in psychology.[1] Sunshine encourages a positive mood, while rain is associated with negative moods. Saunders (1993) applies the psychological literature to finance in his examination of the effect of the weather on New York Stock Exchange (NYSE) daily stock prices from 1927 to 1989. He finds a small but significantly positive relation between sunshine and stock prices. He attributes it to investors' good mood on sunny days and its effect on their cognitive processes and trading decisions. Hirshleifer and Shumway (2003) look at the same question, but expand their analysis to 26 countries from 1982 to 1997. They also find that sunshine has a positive effect on stock returns. After controlling for sunshine however, other weather variables are not significant. Dowling and Lucey's (2005) study of the Irish stock market corroborates Saunders' and Hirshleifer and Shumway's findings. For their part, Goetzman and Zhu (2003) challenge the claim that investors' moods are affected. They look at individual investor accounts in five major U.S. cities over a six-year period, and find that weather has no effect on the propensity to buy or sell equities. They do admit that NYSE spreads are greater on cloudy days, but they cannot really explain why.

More anecdotically, Levitt and Dubner (2005) report the story of a man who sells bagels in offices on the honor system. He drops off the bagels, together with a money box, in the morning in office kitchen rooms and comes back at the end of the day to collect the leftover bagels and his payment. He charges one dollar per bagel. Over the years he has been tracking the cheating rate, that is, the percentage of bagels that disappear without being paid for. He noticed that the weather has an effect, with unseasonably nice weather increasing the payment rate, and bitter cold, heavy rain and wind being associated with more cheating.[2]

Other research in the same vein has looked at how the weather may affect an individual's evaluation of a certain situation. Psychologists Schwarz and Clore (1983) found that people report greater life dissatisfaction on cloudy days, thus apparently commingling the effect of a single day's rain-induced bad mood with overall life evaluation. However, when first primed about the weather, subjects were better able to attribute the source of their mood, and reported the same average life satisfaction as they would on sunny days. Simonsohn (2005) argues that cloudier weather makes people place more weight on academic factors, and less on social factors and enjoyment, while making decisions about which college to enroll in. He finds that prospective college students who visit a school on a cloudy day are more likely to enroll in that school. Also, university admission officers place greater relative importance on academics when reviewing applications on cloudier days.

Weather can also be used as an instrument. Noting that hotter weather is generally associated with more crime, and inclement weather with less crime,

[1] Hirshleifer and Shumway (2003) present a good review of the psychological literature on weather and mood.

[2] Levitt and Dubner (2005, p. 49) report that the overall payment rate oscillates around 85–90%.

Jacob, Lefgren and Moretti (2004) use weather shocks as instruments for identifying the impact of lagged crime on current criminal activity. Some studies have also looked at the impact of the weather on quality of life. Blomquist, Berger and Hoehn (1988) construct a quality of life index using the 1980 Census. They look at the effect of climatic conditions, as well as other amenities, on housing expenditures and wages in hedonic regressions. They find that precipitation, humidity, windspeed, sunshine, and temperature have a significant impact, and are thus able to rank 253 urban counties. Rappaport (2004) observes that local population growth in the United States is highly correlated with warmer winter weather and cooler, less humid summer weather. He argues that people are moving to areas with better weather, due to an increasing valuation of this factor's contribution to their quality of life, which is, in turn, due to rising real incomes.

Direct and indirect effects of the weather on retail sales are examined by Starr-McCluer (2000). Using monthly data on retail sales from the Census Bureau's representative survey of retailers from 1967 to 1998, she finds a modest but significant role for unusual weather in explaining monthly fluctuations in sales. However, such effect disappears when she considers quarterly sales.

The only other study about the effect of the weather on time use of which I am aware is the one by Huysmans (2002), which uses the Netherlands' Time Budget Survey. This survey is conducted every five years during the first two weeks of October. Huysmans noticed that, while in 1975, 1980, 1985, 1990 and 1995 the weather was quite pleasant, it was rather dreary in 2000. He controls for temperature, precipitation, sunshine and wind, and finds that the weather has a significant effect on the time spent sleeping, watching television, reading, participating in sports, walking and cycling outside, using transportation of various forms, and on the leisure time spent outside the home. The weather did not seem to have any influence on the amount of free time or the time spent going out to restaurants or cultural or sporting events. While Huysmans' results are interesting, they do not shed much light on the question I want to explore in this paper. First, Huysmans' time-use data cover only two weeks of the year, and second, data on weather conditions come from only one weather station in the Netherlands. The data used in this study cover a much longer time span, two years, and its weather information is much more precise, since it comes from over 8,000 individual weather stations located across the United States.

3 A Model of Intertemporal Labor Supply

The model of intertemporal labor supply is based on Lucas and Rapping's (1969) classic model, which they apply to unemployment. In this model, an individual's utility is a function of current and future leisure, L_t and L_{t+1}, where the index t

indicates the time period.[3] The individual's problem is to maximize utility with respect to his intertemporal budget constraint, which depends on wages W_t and W_{t+1}, and on the discount rate r. The time horizon is reduced to two periods, t and $t+1$. While in the original model a time period is a long interval, here I will consider a period to be one day. Today is t, tomorrow is $t+1$. The budget constraint here differs from that of Lucas and Rapping, referring to a situation where a worker has a fixed commitment to his employer, and is supposed to work a certain number of hours today (N_t) and tomorrow (N_{t+1}).[4] The worker has the ability to allocate more of his time to one day or the other, as long as his total income reaches a set lower bound, C, that was previously established when the job contract was entered into. There is an additional time constraint, which says that total daily time, T, is equal to time devoted to leisure, L_t, and time in market work, N_t.

Now suppose that in each period there is a randomly drawn state of the nature s_t that represents the quality of the weather. A value of s above one, its expectation, would mean a better day than usual. This state of the nature enters directly into the utility function, and affects the utility obtained from leisure. I assume that the weather does not affect wages, nor puts an additional constraint on time at work. This is clearly restrictive, since certain types of occupation are directly affected by the weather. For example, in his study of stadium vendors, Oettinger (1999) finds that, through their effect on baseball game attendance, temperature and rainfall have an impact on the wage, and thus on the participation decision, of the vendors. Other workers might simply see their workday cancelled or shortened because of inclement weather. I will keep this in mind when the time comes to look at the data, but, in the case of the theoretical model, I will continue to assume that only leisure enjoyment is affected by the weather. Casting the problem in terms of leisure, I get the following:

$$\max_{L_t, L_{t+1}} U\left(s_t L_t, s_{t+1} L_{t+1}\right) \tag{1}$$

subject to the budget constraint:

$$W_t N_t + \frac{W_{t+1}}{1+r} N_{t+1} \geq C \tag{2}$$

and the time constraints:

$$T = N_t + L_t \text{ and } T = N_{t+1} + L_{t+1} \tag{3}$$

(where T is total available time in a day).

[3] For simplicity of argument, consumption is left out of the picture, as the analysis of leisure remains unchanged.

[4] In Lucas and Rapping (1969), the budget constraint states that current and future discounted consumption expenses need to be covered by current and future discounted labor income plus initial wealth.

Normalization:

$$E(s_t) = E(s_{t+1}) = 1 \tag{4}$$

Assume $U(.)$ is concave and has negative double derivatives, the utility function being twice continuously derivable and behaving nicely. Only internal solutions are considered, since I am solely interested in workers, and their marginal adjustments of time at work.

Under certainty, the problem can be expressed with the following Lagrangian (substituting the time constraint in the budget constraint):[5]

$$\max_{L_t, L_{t+1}} \mathcal{L} = U(s_t L_t, s_{t+1} L_{t+1}) +$$
$$\lambda \left(-W_t T + W_t L_t - \frac{W_{t+1}}{1+r} T + \frac{W_{t+1}}{1+r} L_{t+1} + C \right) \tag{5}$$

Solving for first-order conditions:

$$\frac{\partial \mathcal{L}}{\partial L_t} = s_t \frac{\partial U}{\partial L_t} + \lambda W_t = 0 \tag{6}$$

$$\frac{\partial \mathcal{L}}{\partial L_{t+1}} = s_{t+1} \frac{\partial U}{\partial L_{t+1}} + \lambda \frac{W_{t+1}}{1+r} = 0 \tag{7}$$

Solving for λ and rearranging:

$$\lambda = -s_t \frac{\partial U}{\partial L_t} \frac{1}{W_t} = -s_{t+1} \frac{\partial U}{\partial L_{t+1}} \frac{1+r}{W_{t+1}} \tag{8}$$

The following relationship is obtained:

$$\frac{\partial U / \partial L_t}{\partial U / \partial L_{t+1}} = \frac{W_t / s_t}{W_{t+1} / s_{t+1}} (1+r) \tag{9}$$

This equation shows the relationship between current and future leisure. If the weather today and tomorrow is average, i.e. $s_t = s_{t+1} = 1$, then we are back to the original Lucas and Rapping model, where the ratio of the marginal utilities of current and future leisure is equal to the ratio of the current and future (discounted) wages. What I am interested in here is the effect of today's weather, s_t, on the leisure decision. If a worker wakes up one day and observes that s_t is greater than s_{t+1}, meaning that the weather is nicer today than it will be tomorrow, in order to preserve the equality in equation no. 9 he will need to lower $\partial U / \partial L_t$ and increase $\partial U / \partial L_{t+1}$ (compared to a case of $s_t = s_{t+1} = 1$), This will amount to increasing current leisure and decreasing future leisure, or, in other words, to substituting present for future leisure. I will assume here that

[5] I formulate the problem under certainty, since no real insight is gained by looking at it under uncertainty.

wages do not change between t and $t+1$, and that r is, for all practical purposes, zero.

The model presented above assumes that workers have flexible working hours. How realistic is this? Many, if not most, workers in the U.S. do not have the luxury of allocating their work hours as they please. Factory workers have shifts, salespersons need to open and close stores at a fixed time, and business people have meetings and appointments to attend. While the ATUS data set does not contain direct information on flexibility, it does provide workers' occupations. Evidence from the May 2004 Current Population Survey (CPS) Supplement shows that flexibility varies a great deal between occupations, and somewhat between other covariates, such as race or sex (Bureau of Labor Statistics, 2005a). CPS respondents were asked directly, "Do you have flexible work hours that allow you to vary or make changes in the time you begin and end work?" If the answer was yes, they were then asked, "Is your flexible work schedule part of a flexitime or other program offered by your employer?". Table 1 presents the findings. Overall, 27.5% of full-time and salaried workers (note that the data exclude self-employed workers) report having a flexible schedule, with women reporting slightly less flexibility, contrary to popular wisdom, at 26.7%. When broken down by occupation, the portion of employees with flexible schedules ranges from as low as 12.4% for production occupations, to 52.4% for computer and mathematical occupations.

In a comparison of work schedules in the United States and Germany, Hamermesh (1996, p. 24) notes that self-employed workers, possibly the most flexible type of worker, demonstrate a much greater variance and skewness in both work hours per day and days worked per week. Devine (2001, p. 246) finds, in a study of self-employed women using SIPP (Survey of Income and Program Participation) data, that their distribution of work hours is quite different from that of wage-and-salary women, attributing this fact to the hypothesis that self-employed women have much greater control over their work schedule. In light of the above evidence, I will control for occupation and self-employment status in the analysis, to take into account the fact that not all workers may be able to marginally adjust their work hours.

4 Data and Empirical Strategy

4.1 ATUS Data

The American Time Use Survey is a time diary study that collects information about how people spend their time during a day. The first wave of data, covering the calendar year 2003, was made publicly available in January 2005, while the 2004 data was released in September 2005. The ATUS sample is drawn from households that have completed their final (eighth) month in sample for the CPS. One individual (age 15 or over) from each selected household is randomly chosen to answer the ATUS questionnaire, and he or she is interviewed only once about his or her time use during the previous day. Some variables from the eighth month in sample in the CPS are included in the ATUS data; a few are also updated during the ATUS interview. To get geographical information, however, it was necessary to go back to the last CPS interview to have the county or MSA/PMSA code.[6] Activities are coded using a 3-tiered system, with 17 major (first-tier) categories. For the present analysis, the total number of minutes spent at work, in home production, and in leisure were compiled. Table A4 in the appendix lists which activities fall into each of the time variables. The appendix also contains some additional information about the data.

4.2 Weather Data

The data on weather come from the National Climatic Data Center (NCDC) of the National Oceanic and Atmospheric Administration (NOAA).[7] For data on the actual weather conditions, daily summaries from over 8,000 weather stations located across the United States were used. These correspond to the data sets 3200 and 3210, which contain information on four types of meteorological element: maximum and minimum daily temperatures, in Fahrenheit degrees, daily precipitation, in inches (to hundreths), and daily snowfall, in inches (to tenths). From this, mean temperatures were calculated by taking the average of the maximum and the minimum temperatures. A rainy day is defined as a day with 0.10 inches of rain or more, to avoid classifying as rainy a day featuring a little morning dew or a very short drizzle. It would be interesting to obtain cloud cover data, especially since cloudiness has been documented in the psychological literature as having a significant effect on mood . Unfortunately, this information is only collected at a few stations, making the sample size too small for the purposes of this analysis. Data on normal temperatures and precipitation levels are also available from the data set CLIM84, which is based on the weather from 1971 to 2000. A list of the variables, as well as their summary characteristics, can be found in Table 2.

4.3 Empirical Strategy: What is a Nice Day?

If $s_{i,t}$ and $s_{i,t+1}$ were known for everyone, it would suffice to regress the time spent in leisure or time spent working on $s_{i,t}$, $s_{i,t+1}$, and on a set of controls to directly estimate the effect of a good day on labor supply and the intertemporal

[6] The data appendix contains a discussion on supplementing the ATUS data with geographical identifiers.

[7] The data can be downloaded from http://www.ncdc.noaa.gov/oa/ncdc.html.

substitution of leisure. The problem here is that $s_{i,t}$ and $s_{i,t+1}$ are not directly reported, and it is unclear how the observed weather, that is, the mean temperature ($TMEAN$), precipitation ($PRCP$), snowfall ($SNOW$), and normals ($normTMEAN$, $normPRCP$), maps into s. What is a nice day? How relative to one's location, or to the season, is it? The form of the function f below would be needed to answer those questions:

$$s = f\left(TMEAN, normTMEAN, PRCP, normPRCP, SNOW, month, region\right) \tag{10}$$

One way to proceed would be to have survey data in which people are asked how they perceive the weather on a particular day, and whether they perceive it as being average, above, or below average. Unfortunately, such data are not currently available. The estimation of the parameters of the $f\left(.\right)$ function thus remains for future investigation.

4.4 The Twain Hypothesis

Mark Twain is famous for saying "Everybody talks about the weather, but nobody does anything about it."[8] The model of intertemporal labor supply presented in section 3 suggests that workers actually *do* do something about the weather. To estimate the impact of the weather on time allocation, the time spent on each of the three major time-use categories—work, home production, and leisure—is regressed on the weather variables. Home production, while not explicitly part of the model, represents a major possible use of time and an alternative to work or leisure, and thus it makes sense to include it in the analysis. In order to account for the censoring that happens because time cannot be negative, all regressions are specified as tobit models, estimated by maximum likelihood, using the ATUS sampling weights.[9] Flood and Gråsjö (1998) compare and evaluate different estimators and specifications for time-use data, and conclude that a simple tobit produces the best results. I will dub the null hypothesis that the coefficients on the weather variables are zero as the Twain hypothesis. The following section presents the findings testing this hypothesis.

[8] The exact origin of this quote could not be found, except in Robert Underwood Johnson's book, *Remembered Yesterdays* (1932): "Nor have I ever seen in print Mark's saying about the weather. "We all grumble about the weather, but" (dramatic pause) "–but–but nothing is done about it." He was a master in the piquant use of the pause at the right moment." Some also say that it is actually Twain's collaborator on *The Gilded Age*, Charles Dudley Warner, who wrote the statement.

[9] Following the BLS' guidelines (Bureau of Labor Statistics, 2005b, p. 10), the weights used were TU04FWGT for 2003, and TUFINLWGT for 2004.

5 Findings

This analysis will focus on the impact of rain. Data on temperature, temperature normals and snowfall were available, but no clear pattern emerged from the inclusion of these variables in the regressions. Different specifications were tried, using the mean temperature, the normal mean temperature, dummies for whether the day's temperature was above or below the normal, dummies for 10-degree temperature bands, and for extreme weather. None of these attempts produced a conclusive result. However, precipitation, rather than temperature, has a much more unambiguous effect on the enjoyment of leisure. Tables 3 and 4 present the coefficients of regressions of time use on precipitation variables only (no controls) for men and women, respectively. Specifications (1), (2), and (3) include an indicator of whether or not the day surveyed was on a weekend, the daily normal precipitation (to partially control for different climates across the country and across the seasons), and an indicator for a rainy day. In columns (4), (5), and (6), I add dummies for whether yesterday and tomorrow are also rainy days and, finally, in the last three columns, interactions between rainy yesterday and today, and between rainy today and tomorrow are added. Estimates do change when the extra dummies are added. This is presumably due to the rainy day variable picking up the effect of yesterday and tomorrow's rain because of correlation.[10] An F-test of the joint significance of the interacted rain dummies (columns (7), (8), and (9)) shows that for men, those interactions are not significant, but that they are for women, at least for leisure. In the following regressions, those interactions will not be used when looking at males, but will be included when looking at females.

Table 3 shows that for men, a rainy day removes between 11 to 22 minutes from leisure. The effect on time at work is positive but insignificant. The coefficient on daily normal precipitation seems to be fairly stable across specifications, at around 1.3 to 1.5, meaning that for each additional 0.10 inches of daily normal rain we would observe on average 13 minutes of extra time at work. The picture for women in table 4 appears to be different than that for men. In the most complete specification, columns (7), (8), and (9), the only significant coefficients are those on rainy yesterday and today. It appears that women would work 37 minutes less and enjoy roughly the equivalent extra time in leisure. The fact that these coefficients are observed on the interaction of rainy yesterday and today, and not just on the rainy today dummy, suggests that an intertemporal substitution is present. It seems counterintuitive that one would substitute leisure for work on a rainy day. However, if yesterday was rainy as well, a similar decision would have been made then, leading the worker to work more that day and plan for more leisure the following day. When the following day comes and it is still raining, she would want to engage in leisure activities irregardless, in order to stay closer to the long-term equilibrium (when $s_t = s_{t+1} = 1$).

[10] The correlation between rain today and yesterday or tomorrow is around 0.35, and the correlation between rain yesterday and rain tomorrow is 0.12.

Tables 5 and 6 present the results for tobit regressions including dummies for rainy days, as well as controls and occupation dummies.[11] The occupation dummies are also interacted with the presence of rain today to investigate if workers in different occupational groups react differently to the weather, perhaps because of flexibility constraints. An F-test of the joint significance of the occupation groups' interaction with the rainy day dummy indicates that the interactions are significant for men, but not for women. For men, two occupational categories exhibit a large and negative effect on time at work: sales and office, and farming, fishing and forestry. It seems logical to think that these occupations, especially farming, are directly affected by the rain. Farmers report about nine hours less work on a rainy day, which would be due to a direct constraint on the work, not to the lower value of leisure. It also appears that home production is substituted for the farmers' work, suggesting that they do not simply take the day off, but rather spend their rainy day working at home or running errands. Since the occupational dummies' interactions are not significant for women, the same regressions were run, but without the interactions. The full results are shown in the Appendix Table B2; the coefficients on the weather variables are roughly similar to those in Table 4. Appendix Table B3 contains the same estimates, but for men.

It would seem logical to think that the weather affects people differently in different areas of the country. Some places have a much more unpredictable climate than others. Southern California and Florida, for example, can be thought to be usually sunny, just as Seattle in the winter is likely to be wet. Other places, such as the Northeast, have more variable, less predictable weather patterns. Would that influence the reaction of workers to weather shocks? Tables 7 and 8 contain the results of separate regressions by region for males and females, respectively.[12] For males, the weather variables are jointly significant only in the South. There, a rainy day is associated with 38 more minutes at work, and 31 less at leisure. Rain yesterday reduces work today by 48 minutes, suggesting that more work had been done the previous day which allows the worker to get some rest the following day. Similar effects can be found for the West, but most coefficients there are not significant. In the Northeast, some coefficients are significant, but the magnitude of the response to the weather shocks is lower. A rainy day causes an adjustment of time at work of only 11 more minutes. Examination of Table 8 indicates mixed results for females. Weather variables are not jointly significant for women in the West, but they are elsewhere. As for men, larger effects can be seen in the South, especially for the coefficient of the interaction of rain today and yesterday in the leisure regression, which rises to 57 from 33 when the same regression is run with observations from throughout the country.

[11] For the complete results of the regressions of Table 5, including the coefficients on the control variables, please refer to Table B1 of the appendix.

[12] The regions are coded using the Census classification. Please refer to the data appendix for a list of states and the regions they fall into.

Finally, Table 9 shows the results when the regressions were run separately for Sunbelt and non-Sunbelt states.[13] Do workers react differently to the weather if they live in a generally nice climate? The top panel, containing results for male workers, indicates that the effect of the weather is much stronger in the Sunbelt than in the rest of the country. A rainy day there implies, on average, 45 more minutes at work, 27 less in home production and 20 less in leisure. Rain yesterday is associated with 74 minutes less at work today, 33 more in home production and 22 more in leisure, perhaps showing the intertemporal substitution in action. The F-tests demonstrate that weather does have an effect in the Sunbelt, but not elsewhere. The bottom panel presents the results for females. Echoing Table 8, the results are mixed. Note that in the Sunbelt, a rainy day brings 27 fewer minutes of leisure, which was not previously observed. This pattern is not observed outside of the Sunbelt, but less work and more leisure are observed everywhere when both yesterday and today are rainy.

6 Conclusion

This study proposed a model of intertemporal substitution of labor in which the enjoyment of leisure is a function of the weather. Bad weather shocks would induce workers to forego some leisure today and work longer. Using American Time Use Survey data for 2003 and 2004 matched with weather reports, the impact of a rainy day on the time spent in work, home production and leisure is examined. For men, a rainy day shifts about 14 more minutes from work to leisure. This effect varies greatly by region, in particular when looking at the South or the Sunbelt states. There, the impact on work reaches 38 to 45 minutes, while that on leisure is 20 to 31 minutes. The Twain hypothesis, expressed as the F-test of the joint significance of the weather variables, in most cases is rejected.

Some evidence of an intertemporal effect is found. On average, men work more when yesterday was rainy, which I attribute to the fact that, since they got more work done yesterday, they can enjoy more leisure on that day. Women appear to be working on average 33 minutes less when it rained yesterday and today. This perhaps suggests that they did change their schedule to have less leisure the day before, but that today, being the second rainy day in a row, they do not want to do the same and again postpone leisure.

While the model presented in this paper is about weather conditions in general, only rain seems to have a clear impact. It would be interesting to have a better idea of what makes a good day in terms of temperature and other meteorological elements. This would enabler a better testing of the model.

[13] States in the Sunbelt are California, Nevada, Arizona, New Mexico, Texas, Louisiana, Mississippi, Alabama, Georgia, South Carolina and Florida.

Furthermore, the model made a complete abstraction of the effect of the weather on mood, which is well documented in psychology. It would also be of interest to investigate how weather, through mood, affects time allocation. My findings also suggest that weather has a direct effect on work time, as bad weather can close down workplaces or prevent people from doing their work. A more complete model would include that effect, as well as the possibility of weather impacting wages. It would also be interesting to investigate if workers who lose a workday because of inclement weather receive any form of compensation for it.

In the end, I reject the Twain hypothesis, that "everybody talks about the weather, but nobody does anything about it." I might not know how much they talk about it, but I do find that the weather does have an impact on workers' time allocation.

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A Data appendix

The American Time Use Survey (ATUS) data do not contain geographical identifiers, which are crucial for supplementing the ATUS data with weather information. The FIPS (Federal Information Processing Standards) county codes, Metropolitan Statistical Area (MSA) and Primary Metropolitan Statistical Area (PMSA) codes had to be retrieved from the last Current Population Survey (CPS) interviews of ATUS respondents. Since, for confidentiality purposes, the CPS does not assign a county code to individuals living in a county with a population under 100,000 inhabitants, I was not able to obtain such a code for all ATUS respondents. In the case of these individuals, I used the MSA or PMSA code, when available. When no geographical identifier other than the state was available, the observations were dropped. Table A1 shows the number of observations lost in the process.

It may be of concern that I am dropping individuals who systematically differ from those I keep. Table A2 presents means-comparison tests of a number of key variables, providing comparison between the group of observations that are dropped, and those that are kept. It is not surprising that a major difference between the two groups is the proportion living in a metropolitan area, since counties with less than 100,000 inhabitants are much more likely to be in a rural area. The definition metropolitan status variable reported in the CPS changed in May 2004; formerly based on the 1990 Decennial Census, it is now based on the 2000 Decennial Census. For respondents that had their final CPS interview before May 2004, the proportion living in a metropolitan area ranges from 17% for the observations that are dropped to 99% for those that are kept. The numbers range from 70% to 98%, respectively, for May 2004 and after. The differences in the mean characteristics of the two groups follow the direction expected from an urban vs. rural population. Urban people are, overall, more educated, and tend to work more in management, professional, sales and office-related occupations. Rural people are more likely to be in farming, fishing and forestry occupations, as well as in construction, maintenance, production, transportation, and material moving jobs. More business and farm owners are in the group that I have dropped. I have also retained relatively more people from the Northeast and the West.

How many of these differences can be explained by metropolitan status alone? Table A2 also shows the adjusted difference, that is, the difference in the means conditional on metropolitan status. Most of the differences become insignificant, especially those pertaining to the time-use categories of work, home production and leisure. Thus, when looking at the analysis, please bear in mind those characteristics of the subgroup with which I am working. I believe it was preferable to look at mostly urban people, rather than imperfectly imputing state-level weather to the observations for which no geographical identifier other than the state of residence was available.

Once I had the geographical information, I matched the observations with county-, MSA-, or PMSA-level weather data, depending on which identifier I had. When multiple weather stations were within the same area, an average of the weather measurements was used. From my sample size of 24,526, I then dropped observations according to a few criteria. First, observations that correspond to a holiday (New Year's Day, Easter, Memorial Day, the Fourth of July, Labor Day, Thanksgiving Day and Christmas Day) were dropped because they probably do not reflect the usual behavior of workers. For a similar reason, the days between Christmas and New Year's were also dropped, because even though they are not holidays per se, many people take that week off, which could have distorted the results. Then, because I am only interested in the reaction of workers to the weather, I dropped non-workers, as well as retirees and full-time students. I kept the part-time students. Table A3 shows how I arrived at the final sample size of 14,440 individuals.

The ATUS uses a 3-tiered coding system for the activities it lists. Transportation is listed as a separate activity in the first tier, with the second tier showing the purpose of the transportation. Time in transportation is lumped with the activity it is related to. Table A4 shows which activities comprise each of the three main time-use categories of work, home production and leisure, as well as the ATUS codes for those activities.

The classification of the data into regions follows the Census Region Codes (ATUS variable GEREG). The regions and the states they represent are as follows:

- Northeast: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania;
- Midwest: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas;
- South: Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, Texas;
- West: Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Washington, Oregon, California, Alaska, Hawaii.

Please note that there are no observations from Wisconsin, Wyoming and Montana, due to the aforementioned problem of the lack of county identifier.

Table 1
Flexible schedules: Full-time wage and salary workers by sex and occupation, CPS supplement of May 2004

	Both sexes			Men			Women		
		With flexible schedules			With flexible schedules			With flexible schedules	
Occupation	Total[a]	Number	Percent of total	Total[a]	Number	Percent of total	Total[a]	Number	Percent of total
Total, 16 years and over	99,778	27,411	27.5	56,412	15,853	28.1	43,366	11,558	26.7
Management, professional, and related occupations	36,200	13,325	36.8	17,911	7,832	43.7	18,289	5,492	30
Management, business, and financial operations occupations	14,496	6,483	44.7	7,969	3,741	46.9	6,527	2,742	42
Management occupations	10,036	4,598	45.8	6,000	2,862	47.7	4,035	1,736	43
Business and financial operations occupations	4,461	1,885	42.3	1,969	879	44.7	2,492	1,006	40.4
Professional and related occupations	21,704	6,842	31.5	9,942	4,091	41.1	11,762	2,751	23.4
Computer and mathematical occupations	2,683	1,405	52.4	2,023	1,085	53.6	660	320	48.5
Architecture and engineering occupations	2,478	1,080	43.6	2,147	917	42.7	330	163	49.3
Life, physical, and social science occupations	1,016	483	47.5	640	285	44.6	376	198	52.6
Community and social services occupations	1,866	860	46.1	786	430	54.7	1,080	430	39.8
Legal occupations	1,118	497	44.5	536	312	58.2	582	185	31.8
Education, training, and library occupations	6,414	843	13.1	1,779	374	21	4,635	469	10.1
Arts, design, entertainment, sports, and media occupations	1,502	613	40.8	915	396	43.3	587	217	37
Healthcare practitioner and technical occupations	4,626	1,060	22.9	1,115	291	26.1	3,511	769	21.9
Service occupations	13,423	2,849	21.2	6,858	1,339	19.5	6,566	1,510	23
Healthcare support occupations	1,908	315	16.5	199	37	18.7	1,708	278	16.3
Protective service occupations	2,224	419	18.8	1,807	312	17.2	417	107	25.7
Food preparation and serving related occupations	3,881	972	25	2,086	524	25.1	1,795	448	25
Building and grounds cleaning and maintenance occupations	3,481	531	15.2	2,260	318	14.1	1,221	213	17.4
Personal care and service occupations	1,929	612	31.7	505	148	29.2	1,424	465	32.6
Sales and office occupations	24,359	7,196	29.5	9,561	3,069	32.1	14,798	4,127	27.9
Sales and related occupations	9,634	3,669	38.1	5,683	2,305	40.6	3,952	1,364	34.5
Office and administrative support occupations	14,724	3,527	24	3,878	764	19.7	10,847	2,763	25.5
Natural resources, construction, and maintenance occupations	10,848	1,908	17.6	10,403	1,820	17.5	445	88	19.8
Farming, fishing, and forestry occupations	744	172	23.1	591	132	22.4	152	39	25.7
Construction and extraction occupations	5,825	942	16.2	5,750	925	16.1	74	17	[b]
Installation, maintenance, and repair occupations	4,280	795	18.6	4,061	762	18.8	218	32	14.7
Production, transportation, and material moving occupations	14,948	2,133	14.3	11,679	1,793	15.3	3,268	340	10.4
Production occupations	8,281	1,030	12.4	5,928	806	13.6	2,353	224	9.5
Transportation and material moving occupations	6,666	1,102	16.5	5,751	986	17.1	915	116	12.7

Source: Bureau of Labor Statistics (2005a), Table 2

Notes: [a] Includes persons who did not provide information on flexible schedules.

[b] Percent not shown where base is less than 75,000.

Data relate to the sole or principal job of full-time wage and salary workers and exclude all self-employed persons, regardless of whether or not their businesses were incorporated.

Table 2
List of variables and their summary characteristics

Variable	Mean[a]	Standard deviation[a]	Minimum	Maximum
Female	0.4598	0.4984	0	1
Partner present	0.6652	0.4719	0	1
No child	0.5541	0.4971	0	1
Age	41.4346	12.6927	15	80
Self-employed	0.1073	0.3095	0	1
Union covered or member	0.1351	0.3419	0	1
Student	0.0495	0.2170	0	1
Education				
Less than high school	0.1010	0.3014	0	1
High school	0.2861	0.4519	0	1
Some college	0.1753	0.3802	0	1
College	0.3136	0.4640	0	1
More than college	0.1240	0.3296	0	1
Occupation				
Management, professional, and related	0.3996	0.4898	0	1
Service	0.1460	0.3531	0	1
Sales and office	0.2394	0.4267	0	1
Farming, fishing, and forestry	0.0045	0.0667	0	1
Construction and maintenance	0.0946	0.2927	0	1
Production, transportation, and material moving	0.1159	0.3202	0	1
Weekend day	0.2890	0.4533	0	1
Time use (in minutes)				
Work	353.8842	278.4238	0	1430
Leisure	270.0159	189.2909	0	1350
Home production	184.9638	179.1099	0	1349
Time use, not including the zeros				
Work (N = 8,514)	500.206	190.7299	1	1430
Leisure (N = 13,917)	280.4781	185.1616	1	1350
Home production (N = 12.974)	211.4077	176.2845	1	1349
Daily normal precipitation[b]	10.5101	5.4560	0	35.67
Rainy today dummy[c] (t)	0.2412	0.4278	0	1
Rainy yesterday dummy[c] (t-1)	0.2473	0.4315	0	1
Rainy tomorrow dummy[c] (t+1)	0.2299	0.4208	0	1

Notes: [a] The means and standard deviations are weighted using the ATUS sampling weights.
[b] Precipitation is measured in hundredths of an inch.
[c] A day is considered rainy if it rained 0.10 inches or more in a 24-hour period.
N = 14,440

Table 3
Tobit of time use on precipitation variables, Males only

Dependent variable (in minutes)	Work (1)	Home production (2)	Leisure (3)	Work (4)	Home production (5)	Leisure (6)	Work (7)	Home production (8)	Leisure (9)
Daily normal precipitation[a]	1.350*	-1.178***	0.526	1.530*	-1.236***	0.395	1.519*	-1.242***	0.415
	(0.769)	(0.403)	(0.411)	(0.796)	(0.417)	(0.426)	(0.796)	(0.417)	(0.426)
Rainy today dummy[b] (t)	11.411	4.493	-11.406**	13.908	3.786	-14.360**	16.881	6.600	-21.953**
	(9.867)	(5.167)	(5.302)	(10.896)	(5.716)	(5.859)	(15.964)	(8.382)	(8.595)
Rainy yesterday dummy[b] (t-1)	-	-	-	-21.339**	9.393*	4.586	-14.874	7.616	-0.217
				(10.321)	(5.403)	(5.543)	(12.938)	(6.765)	(6.940)
Rainy tomorrow dummy[b] (t+1)	-	-	-	12.241	-7.728	3.983	7.643	-2.731	2.004
				(10.705)	(5.623)	(5.758)	(13.781)	(7.243)	(7.412)
Rainy yesterday and today	-	-	-	-	-	-	-16.591	3.813	13.509
							(21.021)	(11.027)	(11.307)
Rainy today and tomorrow	-	-	-	-	-	-	10.091	-12.086	6.055
							(21.569)	(11.338)	(11.614)
Weekend day	-563.770***	91.140***	173.286***	-563.671***	91.122***	173.007***	-563.663***	91.123***	173.016***
	(10.127)	(4.717)	(4.847)	(10.119)	(4.718)	(4.845)	(10.117)	(4.717)	(4.845)
Constant	462.563***	115.666***	228.963***	463.013***	115.822***	228.886***	462.699***	115.485***	229.757***
	(9.184)	(4.862)	(4.969)	(9.178)	(4.864)	(4.968)	(9.281)	(4.914)	(5.020)
F-test of rainy dummies	1.34	0.76	4.63	2.37	1.93	2.01	1.60	1.41	1.54
Prob. > F	0.25	0.38	0.03	0.07	0.12	0.11	0.16	0.22	0.18
Only interacted dummies	-	-	-	-	-	-	0.44	0.64	0.83
Prob. > F	-	-	-	-	-	-	0.65	0.53	0.44
Observations	7021	7021	7021	7016	7016	7016	7016	7016	7016

Notes: Standard errors in parentheses, all regressions weighted using the ATUS sampling weights
* significant at 10%; ** significant at 5%; *** significant at 1%

[a] Precipitation is measured in hundredths of an inch.

[b] A day is considered rainy if it rained 0.10 inches or more in a 24-hour period.

Table 4
Tobit of time use on precipitation variables, Females only

Dependent variable (in minutes)	Work (1)	Home production (2)	Leisure (3)	Work (4)	Home production (5)	Leisure (6)	Work (7)	Home production (8)	Leisure (9)
Daily normal precipitation[a]	0.609	-0.214	0.115	0.765	-0.177	0.052	0.699	-0.186	0.084
	(0.837)	(0.433)	(0.392)	(0.870)	(0.449)	(0.407)	(0.870)	(0.450)	(0.407)
Rainy today dummy[b] (t)	-12.946	-13.700**	21.035***	-9.338	-11.868**	18.751***	12.882	-7.789	3.862
	(10.560)	(5.454)	(4.939)	(11.662)	(6.040)	(5.469)	(17.306)	(8.966)	(8.115)
Rainy yesterday dummy[b] (t-1)	-	-	-	-12.340	-7.648	13.013**	1.016	-4.148	-1.164
				(11.180)	(5.756)	(5.214)	(14.119)	(7.264)	(6.577)
Rainy tomorrow dummy[b] (t+1)	-	-	-	1.719	3.032	-7.223	7.946	3.073	-5.908
				(11.137)	(5.779)	(5.234)	(14.012)	(7.306)	(6.611)
Rainy yesterday and today	-	-	-	-	-	-	-36.826	-9.341	37.470***
							(22.742)	(11.736)	(10.621)
Rainy today and tomorrow	-	-	-	-	-	-	-19.796	-0.903	-0.259
							(22.640)	(11.748)	(10.629)
Weekend day	-604.990***	77.371***	132.090***	-604.724***	77.534***	131.962***	-604.576***	77.446***	132.421***
	(11.612)	(5.019)	(4.544)	(11.608)	(5.018)	(4.543)	(11.615)	(5.026)	(4.547)
Constant	371.964***	209.822***	205.710***	372.083***	210.022***	205.504***	369.701***	209.591***	207.052***
	(9.912)	(5.191)	(4.700)	(9.912)	(5.192)	(4.700)	(10.007)	(5.244)	(4.743)
F-test of rainy dummies	1.50	6.31	18.14	0.93	2.76	8.85	1.21	1.78	7.82
Prob. > F	0.22	0.01	0.00	0.43	0.04	0.00	0.30	0.11	0.00
Only interacted dummies	-	-	-	-	-	-	1.62	0.32	6.24
Prob. > F	-	-	-	-	-	-	0.20	0.73	0.00
Observations	7309	7309	7309	7306	7306	7306	7306	7306	7306

Notes: Standard errors in parentheses, all regressions weighted using the ATUS sampling weights
* significant at 10%; ** significant at 5%; *** significant at 1%
[a] Precipitation is measured in hundredths of an inch.
[b] A day is considered rainy if it rained 0.10 inches or more in a 24-hour period.

Table 5
Tobit of time use on precipitation variables and controls, Males only

Dependent variable (in minutes)	Work (1)	Home production (2)	Leisure (3)
Daily normal precipitation[a]	1.831**	-1.016**	0.087
	(0.793)	(0.412)	(0.421)
Rainy today dummy[b] (t)	32.258**	1.673	-19.819**
	(16.411)	(8.558)	(8.829)
Rainy yesterday dummy[b] (t-1)	-25.465**	8.765*	6.399
	(10.258)	(5.324)	(5.474)
Rainy tomorrow dummy[b] (t+1)	12.486	-9.367*	3.945
	(10.666)	(5.551)	(5.697)
Occupation [c]			
Service	6.257	-7.469	-4.156
	(17.058)	(8.930)	(9.158)
Sales and office	19.487	-14.240*	7.140
	(14.372)	(7.479)	(7.678)
Farming, fishing, and forestry	85.942	-17.469	-24.575
	(54.155)	(28.067)	(28.965)
Construction and maintenance	0.209	4.425	-7.406
	(15.313)	(7.915)	(8.139)
Production, transportation, and material moving	5.066	-1.776	-3.318
	(15.528)	(8.038)	(8.261)
Occupation interactions			
Service*Rainy today	0.722	23.826	-4.790
	(30.621)	(16.147)	(16.552)
Sales and office*Rainy today	-72.478**	16.724	11.280
	(28.244)	(14.652)	(15.088)
Farming, fishing, and forestry*Rainy today	-576.572*	289.795***	-29.957
	(322.167)	(97.731)	(102.087)
Construction and maintenance*Rainy today	-43.022	-19.264	27.182*
	(28.140)	(14.486)	(14.866)
Production, transportation, and material moving*Rainy today	-1.404	-10.661	8.203
	(28.181)	(14.667)	(15.054)
Weekend day	-562.853***	92.188***	172.750***
	(10.058)	(4.645)	(4.782)
Constant	228.366***	57.119**	372.155***
	(43.142)	(22.476)	(22.948)
F-test of occupation groups interaction	2.35	3.37	0.87
Prob. > F	0.04	0.00	0.50

Notes: Standard errors in parentheses, all regressions weighted using the ATUS sampling weights
N = 7,016 * significant at 10%; ** significant at 5%; *** significant at 1%
The regressions also include controls for education, age and age squared, and dummies for presence of partner, children, union status, self-employment, and student status.

[a] Precipitation is measured in hundredths of an inch.

[b] A day is considered rainy if it rained 0.10 inches or more in a 24-hour period.

[c] Omitted category: management, professional, and related occupations

Table 6
Tobit of time use on precipitation variables and controls, Females only

Dependent variable (in minutes)	Work (1)	Home production (2)	Leisure (3)
Daily normal precipitation[a]	0.696	-0.236	0.075
	(0.857)	(0.423)	(0.401)
Rainy today dummy[b] (t)	15.514	-5.082	-3.479
	(20.476)	(10.167)	(9.634)
Rainy yesterday dummy[b] (t-1)	4.313	-5.391	-1.983
	(13.875)	(6.830)	(6.472)
Rainy tomorrow dummy[b] (t+1)	16.858	-1.270	-8.115
	(13.778)	(6.873)	(6.508)
Rainy yesterday and today	-32.813	-5.664	32.628***
	(22.380)	(11.041)	(10.457)
Rainy today and tomorrow	-23.996	3.360	-0.231
	(22.255)	(11.048)	(10.462)
Occupation [c]			
Service	-19.668	17.021**	5.095
	(15.592)	(7.684)	(7.277)
Sales and office	-4.627	-2.944	-6.589
	(12.534)	(6.196)	(5.871)
Farming, fishing, and forestry	-31.582	77.463	-60.953
	(128.590)	(58.184)	(55.245)
Construction and maintenance	38.781	-47.710	-1.069
	(59.789)	(30.242)	(28.555)
Production, transportation, and material moving	30.659	-1.122	-21.408**
	(22.828)	(11.362)	(10.737)
Occupation interactions			
Service*Rainy today	-29.560	-8.732	27.056**
	(28.228)	(14.013)	(13.266)
Sales and office*Rainy today	-6.405	9.351	5.141
	(23.488)	(11.557)	(10.948)
Farming, fishing, and forestry*Rainy today	-74.714	-14.953	55.654
	(202.110)	(96.127)	(91.269)
Construction and maintenance*Rainy today	-182.770	64.215	53.691
	(130.859)	(65.150)	(61.783)
Production, transportation, and material moving*Rainy today	-15.225	-12.813	17.763
	(44.624)	(22.314)	(21.045)
Weekend day	-601.339***	81.833***	131.670***
	(11.411)	(4.734)	(4.482)
Constant	81.298*	154.165***	391.119***
	(46.193)	(22.665)	(21.390)
F-test of occupation groups interaction	0.61	0.60	1.07
Prob. > F	0.70	0.70	0.38

Notes: Standard errors in parentheses, all regressions weighted using the ATUS sampling weights
N = 7,306 * significant at 10%; ** significant at 5%; *** significant at 1%

The regressions also include controls for education, age and age squared, and dummies for presence of partner, children, union status, self-employment, and student status.

[a] Precipitation is measured in hundredths of an inch.

[b] A day is considered rainy if it rained 0.10 inches or more in a 24-hour period.

[c] Omitted category: management, professional, and related occupations

Table 7
Tobit of time use on precipitation variables and controls, by region, Males only

Dependent variable (in minutes)	Northeast			Midwest		
	Work	Home production	Leisure	Work	Home production	Leisure
	(1)	(2)	(3)	(4)	(5)	(6)
Daily normal precipitation[a]	11.361***	-6.973***	-2.906	2.772	3.255**	-2.255
	(4.352)	(2.316)	(2.382)	(2.713)	(1.412)	(1.446)
Rainy today dummy[b] (t)	-13.403	7.688	7.945	0.290	1.033	-8.267
	(19.772)	(10.509)	(10.848)	(20.056)	(10.571)	(10.805)
Rainy yesterday dummy[b] (t-1)	-32.837*	-4.601	6.849	23.411	-11.212	-0.299
	(18.488)	(9.860)	(10.147)	(19.619)	(10.313)	(10.552)
Rainy tomorrow dummy[b] (t+1)	-8.674	-6.317	-6.167	31.542	-22.754**	13.577
	(19.652)	(10.568)	(10.859)	(20.589)	(10.899)	(11.107)
Weekend day	-575.574***	92.768***	187.997***	-573.853***	91.189***	178.800***
	(20.242)	(9.571)	(9.853)	(21.060)	(9.710)	(9.950)
Constant	187.287*	67.660	347.963***	397.414***	-30.807	391.799***
	(105.195)	(55.965)	(57.389)	(91.500)	(48.319)	(49.124)
F-test of rainy dummies	1.55	0.28	0.48	1.36	1.96	0.58
Prob. > F	0.20	0.84	0.70	0.25	0.12	0.63
Observations	1517	1517	1517	1549	1549	1549
Dependent variable (in minutes)	**South**			**West**		
	Work	**Home production**	**Leisure**	**Work**	**Home production**	**Leisure**
	(7)	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Daily normal precipitation[a]	1.191	-2.267**	1.059	-0.086	-1.364**	1.337*
	(1.678)	(0.892)	(0.869)	(1.381)	(0.676)	(0.730)
Rainy today dummy[b] (t)	37.915**	0.094	-31.188***	32.049	-9.821	-18.510
	(19.241)	(10.281)	(10.002)	(30.711)	(14.926)	(16.242)
Rainy yesterday dummy[b] (t-1)	-48.536***	24.803***	20.294**	-47.712	26.399*	-9.872
	(17.832)	(9.496)	(9.257)	(29.003)	(14.015)	(15.315)
Rainy tomorrow dummy[b] (t+1)	1.172	-3.942	5.842	37.672	-8.243	3.535
	(18.440)	(9.790)	(9.566)	(29.183)	(14.233)	(15.444)
Weekend day	-542.349***	87.828***	164.986***	-579.029***	101.831***	165.548***
	(18.003)	(8.710)	(8.530)	(21.406)	(9.138)	(9.952)
Constant	156.402**	119.753***	372.209***	187.636**	63.215	397.214***
	(79.159)	(42.468)	(41.205)	(89.923)	(43.728)	(47.225)
F-test of rainy dummies	2.97	2.59	3.76	2.00	1.36	0.99
Prob. > F	0.03	0.05	0.01	0.11	0.25	0.40
Observations	2213	2213	2213	1737	1737	1737

Notes: Standard errors in parentheses, all regressions weighted using the ATUS sampling weights
* significant at 10%; ** significant at 5%; *** significant at 1%
The regressions also include controls for education, age and age squared, and dummies for presence of partner, children, union status, self-employment, occupation groups and student status.
[a] Precipitation is measured in hundredths of an inch.
[b] A day is considered rainy if it rained 0.10 inches or more in a 24-hour period.

Table 8
Tobit of time use on precipitation variables and controls, by region, Females only

Dependent variable (in minutes)	Northeast Work (7)	Northeast Home production (8)	Northeast Leisure (9)	Midwest Work (10)	Midwest Home production (11)	Midwest Leisure (12)
Daily normal precipitation[a]	-8.504*	1.280	-0.165	1.665	1.171	0.882
	(4.701)	(2.286)	(2.178)	(2.929)	(1.420)	(1.336)
Rainy today dummy[b] (t)	-44.770	-15.516	29.188*	52.394	-27.421*	0.556
	(32.334)	(15.665)	(14.936)	(33.534)	(16.443)	(15.462)
Rainy yesterday dummy[b] (t-1)	-20.151	7.286	5.634	45.954*	-26.614**	-11.335
	(25.763)	(12.423)	(11.850)	(27.348)	(13.315)	(12.522)
Rainy tomorrow dummy[b] (t+1)	33.916	-14.406	-4.486	-7.579	32.701**	-27.720**
	(24.725)	(12.256)	(11.680)	(28.676)	(13.944)	(13.107)
Rainy yesterday and today	-19.114	9.069	11.734	-79.556*	28.775	44.217**
	(42.051)	(20.399)	(19.452)	(47.559)	(23.073)	(21.700)
Rainy today and tomorrow	-17.428	34.453*	-21.942	-51.232	-4.000	18.723
	(41.556)	(20.333)	(19.388)	(48.961)	(23.658)	(22.253)
Weekend day	-655.209***	82.107***	143.760***	-615.715***	81.149***	132.130***
	(25.182)	(9.832)	(9.365)	(24.351)	(9.895)	(9.303)
Constant	284.991**	108.763*	416.996***	60.767	128.306***	453.154***
	(116.790)	(56.437)	(53.671)	(99.103)	(47.725)	(44.731)
F-test of rainy dummies	2.79	0.81	2.61	1.13	2.81	2.48
Prob. > F	0.02	0.54	0.02	0.34	0.02	0.03
Observations	1626	1626	1626	1790	1790	1790

Dependent variable (in minutes)	South Work (7)	South Home production (8)	South Leisure (9)	West Work (10)	West Home production (11)	West Leisure (12)
Daily normal precipitation[a]	4.813***	-0.230	-2.019**	0.704	-0.994	0.120
	(1.680)	(0.836)	(0.815)	(1.471)	(0.742)	(0.679)
Rainy today dummy[b] (t)	7.600	12.698	-15.998	73.431	-2.849	-17.522
	(30.064)	(15.077)	(14.709)	(46.142)	(23.154)	(21.198)
Rainy yesterday dummy[b] (t-1)	11.366	4.275	-8.625	-21.587	-9.867	-11.826
	(24.102)	(11.985)	(11.692)	(39.622)	(19.654)	(17.976)
Rainy tomorrow dummy[b] (t+1)	36.779	-34.206***	3.064	22.822	33.535	-23.645
	(23.040)	(11.659)	(11.351)	(41.464)	(20.633)	(18.898)
Rainy yesterday and today	-32.210	-40.093**	57.145***	-43.320	17.767	35.788
	(37.561)	(18.700)	(18.239)	(62.871)	(31.550)	(28.857)
Rainy today and tomorrow	-41.562	13.207	14.068	-32.771	-36.287	9.724
	(36.096)	(18.205)	(17.731)	(63.103)	(31.741)	(29.053)
Weekend day	-574.475***	81.160***	137.269***	-579.439***	80.747***	117.361***
	(19.828)	(8.415)	(8.207)	(22.950)	(9.882)	(9.026)
Constant	-19.086	176.348***	369.244***	84.854	166.194***	323.776***
	(82.248)	(40.615)	(39.507)	(96.576)	(47.806)	(43.473)
F-test of rainy dummies	0.89	3.78	4.30	0.76	0.59	0.82
Prob. > F	0.48	0.00	0.00	0.58	0.71	0.54
Observations	2256	2256	2256	1634	1634	1634

Notes: Standard errors in parentheses, all regressions weighted using the ATUS sampling weights
* significant at 10%; ** significant at 5%; *** significant at 1%
The regressions also include controls for education, age and age squared, and dummies for presence of partner, children, union status, self-employment, occupation groups and student status.
[a] Precipitation is measured in hundredths of an inch.
[b] A day is considered rainy if it rained 0.10 inches or more in a 24-hour period.

Table 9
Tobit of time use on precipitation variables and controls, by Sunbelt location

Dependent variable (in minutes)	Males, not in Sunbelt			Males, in Sunbelt		
	Work	Home production	Leisure	Work	Home production	Leisure
	(1)	(2)	(3)	(4)	(5)	(6)
Daily normal precipitation[a]	4.335***	-1.508**	-1.154*	1.037	-1.095**	0.295
	(1.277)	(0.695)	(0.688)	(1.106)	(0.537)	(0.579)
Rainy today dummy[b] (t)	1.581	14.020**	-11.038*	45.059**	-27.422**	-19.585*
	(12.210)	(6.608)	(6.589)	(21.996)	(10.732)	(11.519)
Rainy yesterday dummy[b] (t-1)	-5.387	-2.410	0.382	-74.926***	33.777***	22.106**
	(11.642)	(6.297)	(6.274)	(20.633)	(9.987)	(10.783)
Rainy tomorrow dummy[b] (t+1)	11.769	-8.897	1.169	13.637	-7.473	9.301
	(12.201)	(6.632)	(6.594)	(20.922)	(10.148)	(10.941)
Weekend day	-563.401***	89.305***	175.552***	-568.931***	98.561***	170.627***
	(12.453)	(5.972)	(5.961)	(16.968)	(7.363)	(7.965)
Constant	234.298***	51.665*	376.481***	220.689***	61.686*	366.437***
	(53.727)	(29.106)	(28.850)	(73.600)	(36.040)	(38.536)
F-test of rainy dummies	0.43	1.71	1.03	5.10	5.35	1.82
Prob. > F	0.73	0.16	0.38	0.00	0.00	0.14
Observations	4416	4416	4416	2600	2600	2600

Dependent variable (in minutes)	Females, not in Sunbelt			Females, in Sunbelt		
	Work	Home production	Leisure	Work	Home production	Leisure
	(7)	(8)	(9)	(10)	(11)	(12)
Daily normal precipitation[a]	0.518	-0.755	0.007	0.622	0.086	-0.123
	(1.407)	(0.694)	(0.665)	(1.156)	(0.578)	(0.537)
Rainy today dummy[b] (t)	-3.334	-5.655	12.453	51.381	-11.154	-27.377*
	(19.888)	(9.757)	(9.347)	(33.287)	(16.801)	(15.630)
Rainy yesterday dummy[b] (t-1)	11.030	-11.576	-5.299	-8.211	9.711	1.259
	(16.132)	(7.879)	(7.540)	(27.307)	(13.582)	(12.677)
Rainy tomorrow dummy[b] (t+1)	10.203	2.691	-10.735	41.430	-12.612	-8.534
	(16.009)	(7.926)	(7.585)	(27.021)	(13.635)	(12.689)
Rainy yesterday and today	-48.187*	14.114	30.672**	-21.135	-37.941*	48.198**
	(26.408)	(12.917)	(12.369)	(42.945)	(21.497)	(20.014)
Rainy today and tomorrow	-17.570	6.980	-7.896	-61.195	6.867	29.068
	(26.305)	(12.936)	(12.388)	(41.717)	(21.086)	(19.602)
Weekend day	-623.132***	88.458***	131.427***	-566.530***	71.692***	132.703***
	(14.571)	(5.915)	(5.662)	(18.349)	(7.874)	(7.324)
Constant	123.072**	140.063***	418.203***	31.435	174.453***	340.678***
	(59.165)	(28.896)	(27.574)	(74.746)	(36.998)	(34.289)
F-test of rainy dummies	1.93	0.66	5.07	0.89	2.86	2.86
Prob. > F	0.09	0.65	0.00	0.49	0.01	0.01
Observations	4720	4720	4720	2586	2586	2586

Notes: Standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%
States in the Sunbelt are AL, AZ, CA, FL, GA, LA, MS, NM, NV, SC and TX.
The regressions also include controls for education, age and age squared, and dummies for presence of partner, children, union status, self-employment, occupation groups and student status.
[a] Precipitation is measured in hundredths of an inch.
[b] A day is considered rainy if it rained 0.10 inches or more in a 24-hour period.

Table A1
Source of geographical information

Survey year	ATUS sample size	Source of geographical information			Our sample size	Observations dropped
		FIPS county code	MSA code	PMSA code		
2003	20,720	8,200	5,139	2,562	15,901	4,819
2004	13,973	5,616	1,993	1,016	8,625	5,348
Total	34,693	13,816	7,132	3,578	24,526	10,167

Table A2
Mean comparison tests between observations dropped due to lack of geographical identifier and observations kept

Variable	Mean[a] dropped obs.	Mean[a] kept obs.	Difference dropped-kept	t-stat	Adjusted difference[b]	t-stat
Metropolitan[c]	0.1694	0.9909	-0.8214	-136.790		
(before May 2004)	(0.0060)	(0.0008)	(0.0060)			
Metropolitan[c]	0.6938	0.9802	-0.2864	-26.484		
(May 2004 and after)	(0.0100)	(0.0042)	(0.0108)			
Female	0.5219	0.5159	0.0060	0.785	0.0132	1.167
	(0.0064)	(0.0042)	(0.0077)		(0.0113)	
Partner present	0.6232	0.5767	0.0464	6.096	0.0104	0.921
	(0.0063)	(0.0042)	(0.0076)		(0.0113)	
No child	0.5967	0.5657	0.0311	4.146	0.0108	0.972
	(0.0062)	(0.0042)	(0.0075)		(0.0112)	
Age	45.2716	42.8927	2.3789	8.275	0.7890	1.890
	(0.2431)	(0.1535)	(0.2875)		(0.4175)	
Self-employed	0.1150	0.1024	0.0126	2.134	-0.0138	-1.771
	(0.0050)	(0.0031)	(0.0059)		(0.0078)	
Union covered or member	0.0716	0.0871	-0.0156	-3.969	-0.0095	-1.623
	(0.0032)	(0.0023)	(0.0039)		(0.0059)	
Student	0.1230	0.1578	-0.0349	-5.937	-0.0130	-1.465
	(0.0047)	(0.0035)	(0.0059)		(0.0089)	
Education						
Less than high school	0.2079	0.1963	0.0116	1.774	-0.0079	-0.848
	(0.0055)	(0.0035)	(0.0065)		(0.0093)	
High school	0.3618	0.2818	0.0799	10.888	0.0295	2.765
	(0.0062)	(0.0039)	(0.0073)		(0.0107)	
Some college	0.1654	0.1755	-0.0101	-1.777	-0.0077	-0.913
	(0.0047)	(0.0032)	(0.0057)		(0.0084)	
College	0.2022	0.2505	-0.0483	-8.019	-0.0041	-0.441
	(0.0049)	(0.0035)	(0.0060)		(0.0093)	
More than college	0.0628	0.0959	-0.0332	-9.217	-0.0098	-1.690
	(0.0028)	(0.0022)	(0.0036)		(0.0058)	
Occupation						
Management, professional, and	0.2032	0.2492	-0.0460	-7.522	-0.0047	-0.490
related	(0.0050)	(0.0035)	(0.0061)		(0.0096)	
Service	0.1019	0.1067	-0.0048	-0.980	0.0013	0.170
	(0.0040)	(0.0028)	(0.0049)		(0.0074)	
Sales and office	0.1474	0.1582	-0.0108	-1.973	0.0024	0.282
	(0.0046)	(0.0030)	(0.0055)		(0.0083)	
Farming, fishing, and forestry	0.0112	0.0029	0.0083	5.370	0.0024	1.738
	(0.0015)	(0.0004)	(0.0015)		(0.0014)	
Construction and maintenance	0.0663	0.0582	0.0081	2.015	-0.0017	-0.327
	(0.0034)	(0.0022)	(0.0040)		(0.0053)	
Production, transportation, and	0.1005	0.0726	0.0279	6.021	0.0066	1.064
material moving	(0.0040)	(0.0023)	(0.0046)		(0.0062)	
Worker	0.6305	0.6478	-0.0173	-2.352	0.0062	0.579
	(0.0061)	(0.0040)	(0.0073)		(0.0107)	

Business or farm owner	0.1708	0.1406	0.0302	5.426	0.0025	0.314
	(0.0047)	(0.0029)	(0.0056)		(0.0078)	
Region						
Northeast	0.1338	0.2119	-0.0781	-14.222	-0.0435	-5.184
	(0.0043)	(0.0034)	(0.0055)		(0.0084)	
South	0.4116	0.3121	0.0995	13.328	0.0910	8.237
	(0.0064)	(0.0039)	(0.0075)		(0.0111)	
Midwest	0.3197	0.2147	0.1050	15.349	0.0911	8.837
	(0.0059)	(0.0034)	(0.0068)		(0.0103)	
West	0.1348	0.2612	-0.1264	-21.831	-0.1386	-17.808
	(0.0044)	(0.0038)	(0.0058)		(0.0078)	
Season						
Winter	0.2447	0.2484	-0.0037	-0.578	-0.0124	-1.315
	(0.0054)	(0.0035)	(0.0065)		(0.0095)	
Spring	0.1796	0.2830	-0.1035	-16.543	-0.1908	-26.902
	(0.0049)	(0.0039)	(0.0063)		(0.0071)	
Summer	0.2432	0.2557	-0.0125	-1.866	-0.0341	-3.590
	(0.0055)	(0.0037)	(0.0067)		(0.0095)	
Fall	0.3325	0.2129	0.1196	17.079	0.2373	21.621
	(0.0061)	(0.0034)	(0.0070)		(0.0110)	
Weekend day	0.2780	0.2874	-0.0094	-1.627	-0.0126	-1.503
	(0.0048)	(0.0032)	(0.0058)		(0.0084)	
Time use (in minutes)						
Work	217.2771	219.1803	-1.9032	-0.432	3.9577	0.617
	(3.6955)	(2.3980)	(4.4054)		(6.4194)	
Home production	209.9765	204.6102	5.3663	1.826	1.0994	0.254
	(2.4622)	(1.6055)	(2.9394)		(4.3303)	
Leisure	343.0456	333.4742	9.5714	2.866	3.2176	0.653
	(2.8212)	(1.7881)	(3.3401)		(4.9280)	
Number of observations	10,167	24,526	34,693		34,610	

Notes: Standard errors are in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

[a] The means and standard errors are weighted using the ATUS sampling weights.

[b] Coefficients for the difference, controlling for metropolitan status

[c] For CPS interviews prior to May 2004, the MSA definitions were based on the 1990 Decennial Census (28,939 observations).
Starting in May 2004, the definitions are based on the 2000 Decennial Census (5,671 observations).

Table A3
Categories dropped from the sample

Survey year	Excluded categories					Total reduced sample size
	Day was a holiday	Between Christmas and New Year's	Non-workers	Retired	Full-time students	
2003	179	246	5,577	2,439	1,321	9,480
2004	209	66	3,117	1,338	769	4,960
Total	388	312	8,694	3,777	2,090	14,440

Note: Due to the overlap of certain categories, the sum of observations in excluded categories does not equal the total number of observations that were dropped from the sample.

Table A4
Time variables and the activities they encompass

Time variable	Activities	Codes[a]	Exclusions
Work	Working, work-related activities, other income-generating activities, and travel related to work	05xxxx, 1705xx	0504xx (Job search)
Leisure variables			
Active recreation	Participating in sports, exercise, or recreation, and waiting, security procedures, and travel related to it	1301xx, 130301, 130401, 1399xx, 171301	
Passive recreation	Socializing, relaxing, and leisure, attending sporting/recreational events (and waiting and security related to it), personal communications, and travel related to passive recreation	12xxxx, 1302xx, 130302, 130399, 130402, 020903, 020904, 130101, 130201, 1712xx, 1713xx	171301
Religious and civic activities	Government services and civic obligations, religious and spiritual activities, volunteer activities, phone calls to/from government officials, and travel related to those activities	10xxxx, 14xxxx, 15xxxx, 160108, 1710xx, 1714xx, 1715xx	
Leisure	Recreation and religious and civic activities		
Home production variables			
Indoor housework	Housework, food and drink preparation, interior maintenance, repair, and decoration, pet and animal care, appliances and tools, household management (except personal communications)	0201xx, 0202xx, 0203xx, 0206xx, 0208xx, 020901, 020902, 020905, 020999	
Outdoor housework	Exterior maintenance, repair, and decoration; lawn, garden, and houseplants	0204xx, 0205xx	
Other non-market work	Vehicle repair and maintenance, other household activities, travel related to household activities	0207xx, 0299xx, 1702xx	
Shopping	Consumer purchases, professional services, household services, phone calls to/from service providers, and travel related to shopping	07xxxx,08xxxx, 09xxxx, 1707xx, 1708xx, 1709xx, 160103, 160104, 160105, 160106, 160107	0805xx, 170805
Caring	Caring for and helping household and non-household members, and travel related to care	03xxxx, 04xxxx, 1703xx, 1704xx	
Home production	Indoor and outdoor housework, other non-market work, shopping, and caring		

Note: [a] The codes correspond to the variables TUTIER1CODE, TUTIER2CODE, and TUTIER3CODE from the ATUS

Table B1
Tobit of time use on precipitation variables and controls, Males only

Dependent variable (in minutes)	**Work (1)**	**Home production (2)**	**Leisure (3)**
Daily normal precipitation[a]	1.831**	-1.016**	0.087
	(0.793)	(0.412)	(0.421)
Rainy today[b] (t)	32.258**	1.673	-19.819**
	(16.411)	(8.558)	(8.829)
Rainy yesterday[b] (t-1)	-25.465**	8.765*	6.399
	(10.258)	(5.324)	(5.474)
Rainy tomorrow[b] (t+1)	12.486	-9.367*	3.945
	(10.666)	(5.551)	(5.697)
Occupation [c]			
Service	6.257	-7.469	-4.156
	(17.058)	(8.930)	(9.158)
Sales and office	19.487	-14.240*	7.140
	(14.372)	(7.479)	(7.678)
Farming, fishing, and forestry	85.942	-17.469	-24.575
	(54.155)	(28.067)	(28.965)
Construction and maintenance	0.209	4.425	-7.406
	(15.313)	(7.915)	(8.139)
Production, transportation, and material moving	5.066	-1.776	-3.318
	(15.528)	(8.038)	(8.261)
Occupation interactions			
Service*Rainy day	0.722	23.826	-4.790
	(30.621)	(16.147)	(16.552)
Sales and office*Rainy day	-72.478**	16.724	11.280
	(28.244)	(14.652)	(15.088)
Farming, fishing, and forestry*Rainy day	-576.572*	289.795***	-29.957
	(322.167)	(97.731)	(102.087)
Construction and maintenance*Rainy day	-43.022	-19.264	27.182*
	(28.140)	(14.486)	(14.866)
Production, transportation, and material moving*Rainy day	-1.404	-10.661	8.203
	(28.181)	(14.667)	(15.054)
Partner present	42.375***	23.005***	-25.535***
	(10.529)	(5.458)	(5.598)
No child	34.747***	-44.895***	22.960***
	(9.482)	(4.919)	(5.052)
Self-employed	24.186*	-6.714	1.614
	(12.576)	(6.578)	(6.763)
Union covered or member	-5.368	12.201*	15.287**
	(12.062)	(6.235)	(6.417)
Age	9.620***	3.020***	-6.475***
	(1.962)	(1.020)	(1.042)
Age squared	-0.125***	-0.030**	0.077***
	(0.022)	(0.012)	(0.012)
Student	-28.884	3.746	-30.283***
	(21.162)	(11.054)	(11.321)

Education [d]			
Less than high school	6.624	-28.389***	0.256
	(14.659)	(7.600)	(7.740)
Some college	15.046	-1.099	-4.801
	(12.667)	(6.571)	(6.743)
College	20.129*	7.589	-27.304***
	(11.689)	(6.080)	(6.253)
More than college	42.892***	-2.040	-31.743***
	(15.859)	(8.285)	(8.527)
Weekend day	-562.853***	92.188***	172.750***
	(10.058)	(4.645)	(4.782)
Constant	228.366***	57.119**	372.155***
	(43.142)	(22.476)	(22.948)
F-test of occupation groups interaction	2.35	3.37	0.87
Prob. > F	0.04	0.00	0.50
F-test of rainy dummies	2.57	2.92	1.17
Prob. > F	0.01	0.00	0.32

Notes: Standard errors in parentheses, all regressions weighted using the ATUS sampling weights
* significant at 10%; ** significant at 5%; *** significant at 1%
N = 7,016

[a] Precipitation is measured in hundredths of an inch.

[b] A day is considered rainy if it rained 0.10 inches or more in a 24-hour period.

[c] Omitted category: management, professional, and related occupations

[d] Omitted category: high school

Table B2
Tobit of time use on precipitation variables and controls, Females only

Dependent variable (in minutes)	**Work (1)**	**Home production (2)**	**Leisure (3)**
Daily normal precipitation[a]	0.674	-0.229	0.077
	(0.857)	(0.423)	(0.401)
Rainy today[b] (t)	5.949	-3.659	4.267
	(17.014)	(8.429)	(7.987)
Rainy yesterday[b] (t-1)	4.166	-5.575	-1.780
	(13.877)	(6.831)	(6.473)
Rainy tomorrow[b] (t+1)	17.316	-1.406	-8.266
	(13.778)	(6.873)	(6.508)
Rainy yesterday and today	-32.516	-5.822	32.777***
	(22.360)	(11.034)	(10.453)
Rainy today and tomorrow	-24.000	3.041	-0.196
	(22.238)	(11.043)	(10.459)
Occupation [c]			
Service	-27.128*	14.846**	11.822*
	(13.879)	(6.858)	(6.495)
Sales and office	-6.275	-0.739	-5.258
	(11.200)	(5.541)	(5.251)
Farming, fishing, and forestry	-60.947	71.696	-41.171
	(99.654)	(46.437)	(44.097)
Construction and maintenance	0.032	-33.945	10.649
	(53.216)	(26.815)	(25.361)
Production, transportation, and material moving	26.795	-4.068	-17.019*
	(20.326)	(10.128)	(9.568)
Partner present	-26.129***	48.710***	-16.331***
	(9.314)	(4.617)	(4.368)
No child	99.570***	-114.604***	27.418***
	(9.535)	(4.703)	(4.453)
Self-employed	-17.250	40.576***	-0.062
	(15.557)	(7.774)	(7.385)
Union covered or member	-14.951	6.021	8.387
	(13.502)	(6.665)	(6.312)
Age	14.616***	2.687***	-9.313***
	(2.078)	(1.022)	(0.965)
Age squared	-0.184***	-0.015	0.110***
	(0.024)	(0.012)	(0.011)
Student	-4.478	-24.716***	-15.548*
	(18.704)	(9.290)	(8.764)
Education [d]			
Less than high school	12.370	-26.977***	-14.283*
	(17.958)	(8.817)	(8.348)
Some college	-13.259	-0.270	-1.637
	(13.115)	(6.463)	(6.126)
College	-14.508	4.628	-6.639
	(12.118)	(5.978)	(5.665)

More than college	25.074	-13.503*	-10.832
	(16.203)	(8.094)	(7.661)
Weekend day	-600.866***	82.053***	131.265***
	(11.403)	(4.728)	(4.478)
Constant	83.236*	153.672***	389.622***
	(46.131)	(22.633)	(21.363)
F-test of rainy dummies	1.35	0.92	6.36
Prob. > F	0.24	0.47	0.00

Notes: Standard errors in parentheses, all regressions weighted using the ATUS sampling weights

* significant at 10%; ** significant at 5%; *** significant at 1%

N = 7,306

[a] Precipitation is measured in hundredths of an inch.

[b] A day is considered rainy if it rained 0.10 inches or more in a 24-hour period.

[c] Omitted category: management, professional, and related occupations

[d] Omitted category: high school

Table B3
Tobit of time use on precipitation variables and controls, Males only

Dependent variable (in minutes)	Work (1)	Home production (2)	Leisure (3)
Daily normal precipitation[a]	1.710**	-0.976**	0.091
	(0.793)	(0.412)	(0.421)
Rainy today[b] (t)	12.184	3.224	-12.572**
	(10.833)	(5.634)	(5.783)
Rainy yesterday[b] (t-1)	-24.967**	8.788*	6.247
	(10.266)	(5.329)	(5.474)
Rainy tomorrow[b] (t+1)	14.188	-9.988*	3.625
	(10.653)	(5.547)	(5.687)
Occupation [c]			
Service	7.446	-1.168	-5.707
	(14.978)	(7.861)	(8.057)
Sales and office	2.380	-10.185	9.762
	(12.698)	(6.603)	(6.781)
Farming, fishing, and forestry	57.853	5.520	-25.789
	(52.731)	(26.939)	(27.849)
Construction and maintenance	-9.577	-0.218	-0.957
	(13.780)	(7.129)	(7.321)
Production, transportation, and material moving	5.272	-4.282	-1.475
	(13.827)	(7.180)	(7.367)
Partner present	42.059***	23.069***	-25.376***
	(10.536)	(5.463)	(5.597)
No child	34.269***	-44.756***	23.066***
	(9.487)	(4.924)	(5.052)
Self-employed	23.649*	-6.343	1.585
	(12.587)	(6.586)	(6.764)
Union covered or member	-4.501	11.901*	15.052**
	(12.056)	(6.233)	(6.407)
Age	9.559***	3.084***	-6.496***
	(1.963)	(1.021)	(1.042)
Age squared	-0.125***	-0.030***	0.078***
	(0.022)	(0.012)	(0.012)
Student	-30.044	2.976	-29.658***
	(21.154)	(11.055)	(11.310)
Education [d]			
Less than high school	6.056	-28.200***	0.168
	(14.669)	(7.607)	(7.739)
Some college	14.930	-1.357	-4.734
	(12.676)	(6.577)	(6.742)
College	21.514*	7.486	-27.621***
	(11.690)	(6.082)	(6.248)
More than college	43.757***	-2.119	-31.945***
	(15.871)	(8.292)	(8.526)

Weekend day	-563.745***	92.356***	172.852***
	(10.065)	(4.649)	(4.782)
Constant	235.397***	54.948**	370.945***
	(43.036)	(22.432)	(22.879)
F-test of rainy dummies	2.94	2.17	1.66
Prob. > F	0.03	0.09	0.17

Notes: Standard errors in parentheses, all regressions weighted using the ATUS sampling weights
* significant at 10%; ** significant at 5%; *** significant at 1%
N = 7,016

[a] Precipitation is measured in hundredths of an inch.

[b] A day is considered rainy if it rained 0.10 inches or more in a 24-hour period.

[c] Omitted category: management, professional, and related occupations

[d] Omitted category: high school