Extreme temperatures: Gender differences in well-being

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Abstract

The aim of this study is to analyze the relationship between subjective well-being and extreme temperatures. To do this, data were collected from a special supplement of the American Time Use Survey for the years 2010, 2012, 2013 and 2021, the Well-Being Module. This special supplement allows us to focus on the well-being experienced by respondent during three randomly episodes, and collects information about instant feelings such as happiness, sadness, stress, among others, together with some cognitive measures of well-being. Within this framework, we estimate the effects of weather conditions on subjective well-being, by examining daily variations in weather conditions within counties in the US. We report different results according to the gender of the respondent, with males being more affected by extreme temperatures, manifested through greater levels of fatigue and stress, and lower levels of happiness and interest when daily temperatures are above 80ºF, in comparison to days with maximum temperatures around 70ºF. For potential mechanisms behind these gender differences, we obtain that days with higher maximum temperatures are negatively related to males' slept quality and that in warmer states there are lesser males in the last four decades, in average terms. One of the aspects that climate change may affect is well-being of individuals and this study is, to the best of our knowledge, the first to report these results, which could be important to understand the affective well-being consequences of climate change, given that these extreme events would be more frequent in a warmer future.

Keywords: gender, weather conditions, extreme temperatures, subjective well-being, time use, United States

JEL Codes: I31, J16, Q54

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1. Introduction

In this paper we analyze the relationship between subjective well-being and weather conditions, characterized by precipitation, snowfall and temperature variables, by exploring instant utility feelings data collected in the American Time Use Survey Well-Being Module (henceforth ATUS WB-Module), in conjunction with daily weather records for the entire US region from four survey years, 2010, 2012, 2013, and 2021. In particular, we analyze how the level of happiness, meaningfulness, sad, stress, fatigue, and pain experienced for three randomly chosen episodes of the diary day, together with two uni-dimensional emotional variables, are related to extreme temperatures.

Personal well-being can be measured using objective measures (e.g., income, health status, inequality) and subjective measures (e.g., happiness, sadness, stress, tired). In recent years, particular attention has been devoted to subjective well-being and dimensions beyond income-based measures (such as the GDP, wealth or consumption) into the policy-making process and assessment, as objective measures provide an incomplete view of quality of life (Diener and Seligman, 2004; Diener, 2006; Dolan et al., 2008; Diener and Ryan, 2009; Stiglitz et al., 2009; Senik, 2014; Graham and Ruiz Pozuelo, 2017). In contrast, subjective measures of well-being refer to individual perceptions and judgments made by an individual of satisfaction with life, ratings of happiness, sadness, and stress, among others (Kahneman et al., 1999) and have become increasingly popular among academics and policymakers.

Improving subjective well-being, quality of life and life satisfaction of the population are emerging as key policy objectives for social progress and life standards (Fitoussi and Stiglitz, 2012; Steptoe et al., 2015) and, given the increasing importance of well-being for policy, over the last decades an increasing number of empirical articles has studied the determinants and consequences of subjective well-being. This explosion in research has been made together from social sciences in general, and by psychologists, sociologists, and economists in particular, all of whom has suggested significant interventions for policy makers to enhance subjective well-being and ultimately the nation's health. However, little attention has been devoted to addressing how daily weather conditions affect daily feelings in general, and affective emotions in particular. Besides, given the current context of climate change, where the frequency and magnitude of extreme weather events are expected to increase, it is interesting to analyze the impact

of weather conditions to understanding the well-being consequences of all these changes for a better design of our climate change mitigation and adaptation strategies.

Using data from four recent nationally representative time use surveys, conducted between 2010 and 2021, we test the effect of weather as an environmental predictor of subjective well-being. In contrast to previous articles, the ATUS provides well-being data for four entire years, and not restricted to a particular season which is likely to bias the results. This fact, combined with being a large nationally representative sample of how the US adult population spend their time, makes our results of general interest and provides a robust examination of the association between weather and personal well-being.

Our results suggest that weather on survey day influences subjective well-being, with a clear relationship between maximum temperatures and subjective well-being. Nevertheless, we find important gender-specific differences and males are more affected maximum temperatures. We obtain that high temperatures reduce the net affect of males, possible due to these days are associated with lower feelings of happiness, and meaningfulness, and greater feelings of stress and tiredness. In the case of female respondents, we do not obtain any relationship with extreme temperatures. We next test whether there exists heterogeneity in the effect of weather across different population subgroups, by age and area of residence. Finally, we provide evidence of potential mechanisms behind our main results. Specifically, we find that greater maximum temperatures are associated with poorer males' slept quality and in those states with greater maximum temperatures males appear to come out.

Our contribution to the literature is threefold. First, we contribute to the well-being literature by studying the relationship between weather conditions and subjective well-being, by shedding new light on how the day-to-day weather conditions impacts into respondents' self-reported well-being. Recent studies have examined whether weather conditions affect how people evaluates their life or instant feelings recorded during activities (Connolly, 2013; Frijters et al., 2020). Nevertheless, the literature has not produced conclusive evidence yet. Within this framework, our study is the first that uses time use diary data from nationally representative US samples. Second, while the existing literature examines an array of cognitive well-being measures, such as life satisfaction, self-rated health, physical health, general health, most do not focus on affective measures of well-being. Against this background, in this study we examine six different affective

measures of instant feelings. Third, we try to understand potential mechanisms behind our main results and conduct several additional analyses, paying attention to the extreme temperatures' effects on life satisfaction, general health status, two distinct sleeping measures and the distribution of population across the US.

The rest of the paper is organized as follows. Section two provides a literature review on the relationship between weather conditions and subjective well-being in the US. Section three presents data and the construction of the variables used in the paper, together with some descriptive statistics. Section four introduces the econometric strategy. Section five shows the empirical findings of the paper. Finally, Section six concludes.

2. Related literature: Some background in the US

Several researchers have examined potential health-related effects of weather conditions in recent years and have improved the understanding of how daily weather conditions affect the well-being of the society. Nevertheless, despite the growing interest of the literature on health-related outcomes of weather, there are still some gaps in the literature in general, and in the US, where the evidence so far remains mixed, in particular. Regarding the studies about cognitive and affective measures of well-being, on the one hand, and weather conditions, on the other, we can cite the studies of Connolly (2013), Lucas and Lawless (2013), Noelke et al. (2016), and Frijters et al. (2020).[1]

Connolly (2013) uses data from a confidential version of the Princeton Affect and Time Survey (PATS), the predecessor of the ATUS WB-Module with detailed geographical identifiers to match the weather data, and report different estimates by gender.[2] More concretely, Connolly (2013) reports that women are more responsive than men to temperature and precipitation, showing that rainier days and greater temperatures significantly decrease life satisfaction for females. Furthermore, she also studies two uni-dimensional emotional variables, the net affect and the U-index, and six different affective measures, happiness, interested, tired, stressed, sad and pain, and show that low

[1] We focus on this literature review in studies located in the US. For studies in other geographical contexts, we can cite that of Kämpfer and Mutz (2013) and Schmiedeberg and Schröder (2014) in Germany, Feddersen et al. (2016) in Australia or Barrington-Leigh or Behzadnejad (2017) in Canada.

[2] As the ATUS WB-Module, the PATS collected contemporaneous subjective-wellbeing using the DRM for only three of the many activities in which respondents had engaged the previous day, with the exception of sleep, grooming, and private activities. In both PATS and ATUS respondents reported values of 0 to 6 to each instant-feeling for each three randomly selected activities.

temperatures increase happiness and high temperatures decrease it, whereas low temperatures decrease tired, stressed, sadness and the U-index, only for women. All this lead to a rise in net affect for low temperatures and a decrease for very high temperatures, only for women, consistent with the life satisfaction results. For males, no statistically significant effects are found, which leads her to conclude, maybe tentatively, that "[o]verall, women appear more responsive to environmental variables […]". The main limitation of this study is that the author focuses on only one season of a year – Summer 2006 – due to the availability of data. This fact prevents any analysis of snowfall days in her regressions, for example, and the author argues that the survey period makes it difficult to extend her results to other seasons in the Discussion Section. Against this, we have information from four distinct survey years, which results in more information for empirical analyses. Our findings dramatically contrast with that of Connolly (2013), as we report that males appear more responsive to environmental variables, particularly daily maximum temperatures.

Other study about cognitive measures of subjective well-being in the US is that of Lucas and Lawless (2013), where the authors examine the association between daily weather conditions and life satisfaction, and test whether life seems better when the weather is good. Using a representative cross-sectional sample of over one million of Americans over a 5-year period from the Behavioral Risk Factor Surveillance System (BRFSS), they show that weather does not affect life satisfaction. For those estimates that are statistically significant, the effects appear to be very small. The explanation behind is that the effect of weather conditions may be more pronounced in the short than in the long run, and a type of adaptation may take place.

Other studies in the US include Noelke et al. (2016) and Frijters et al. (2020). For instance, Noelke et al. (2016) use the Gallup G1K dataset for the years 2008-2013 and find that temperatures above 70ºF, compared to temperatures in the 50-60ºF range, reduce happiness and increase feelings of stress, anger and fatigue, whereas Frijters et al. (2020), using the Gallup Daily tracking survey, show that both temperature and precipitation have no clear effects on both cognitive (life satisfaction, self-reported health) and affective (an index of positive emotions, where higher values indicate a better feeling) well-being measures. From our point of view, an aggregation of different emotions, as Frijters et al. (2020) do, could omit important differences across instant feelings and our research results, taking advantage of the multitude affective information for instant emotions,

supports this hypothesis. Besides, the affective information in Frijters et al. (2020) refers to feelings of enjoyment, sadness, stress or happiness of the full-day yesterday, and the potential responses are either yes or no (e.g., 2-scale well-being variables), omitting important differences in the intensity of feelings across episodes.[3] The ATUS WB-Module takes all this into account.

Then, the findings in the US appear to differ, as some associations have been found whereas other studies have found no effects of weather conditions. Against this background, in this study we will use data from the ATUS WB-Module, conducted in the years 2010, 2012, 2013, and 2021, four recent survey years. We link these individual and episode level characteristics collected in the ATUS, with weather data gathered from the National Climatic Data Center (NCDC) at the county level. The county is the most precise regional level of information gathered in this survey, and we use this variable together with the date of interview (the diary day in the ATUS data) to match our individual and well-being data with weather variables.

3. Data and variables

Our data are drawn from the ATUS and the National Oceanic and Atmospheric Administration (NOAA) of the National Climatic Data Center (NCDC).[4] The ATUS, a joint project of the Bureau of Labor Statistics and the US Census Bureau conducted every year since January 2003, is a time-diary study, publicly available, that provides nationally representative data on how, where, when, and with whom Americans that are at least 15 years of age perform their activities during a 24 hours period on a preassigned day of the week (the "diary day"), from 4 AM on the pre-selected day to 4 AM of the interview day in sequential order, including over 470 activities.[5] ATUS respondents are randomly picked from the Current Population Survey (CPS) and data are collected through Computer-assisted telephone interview (CATI) interviewing every day of the week (including holidays except Christmas Day in 2003 and Thanksgiving Day since 2004

[3] Gallup interviews around 1,000 adults, aged 18+, across the US each day. Large-scale surveys, such as the Gallup, are typically not able to implement the DRM procedure and rely on a singly-item or brief questionnaire about subjective well-being.

[4] Other works using these two datasets include Connolly (2008), Graff Zivin and Neidell (2014), Neidell et al. (2021) or Belloc et al. (2022).

[5] Information on where and with whom is available for all activities except for personal care and sleeping.

onward), with weekend days oversampled due to the fact that approximately one half of the diaries coming from Saturdays and Sundays whereas one half of the sample is allocated to weekdays. Besides, the ATUS diary days are distributed evenly across the weeks of the year, to have a good coverage of times and representative picture of daily life through the week.[6] The unit of analysis in the ATUS is an individual, and only one individual per household is surveyed, although there is some information about the whole household.[7] The survey is available in both English and Spanish, the two most frequent languages in the US, and consists on a conversational interviewing to allow the respondent to report on his/her activities comfortably and accurately on their own words.

The ATUS was designed so that organizations can sponsor a special module, a series of questions on a topic in the public interest usually related to time use at the end of the survey, to supplement data from the core ATUS. In 2010, 2012, 2013 and 2021 the ATUS conducted a WB-Module that collects affective data for three randomly selected day's activities reported for each respondent that lasted at least 5 minutes.[8] Specifically, the WB-Module sampled three randomly selected daily activities and asked participants about the extent to which they felt happiness, sadness, fatigue, pain, and stress during each episode, using a 7-point Likert scale of 0 to 6, in which 0 indicates a low intensity ("did not experience the feeling at all") and 6 a high intensity of the feeling ("feeling was extremely strong").[9] The module also captured one question about how meaningful the activity was and we use all available waves of the ATUS WB-Module to examine the effects of weather on subjective well-being.

The WB-Module questions were asked at the end of the ATUS interview and this method of measuring feelings during activities is similar to a partial Day Reconstruction Method (DRM), since the module does not collect well-being ratings for all episodes of

[6] The response rate is much lower in the ATUS survey, around 50 percent, against the CPS, which is about 90 percent. Nevertheless, the sample is highly representative of the non-institutionalized US population age 15 or older.

[7] During the ATUS WB-Module, the sample size ranges from 13,260 randomly-selected respondents in 2010 to 9,087 in 2021.

[8] Note that the limitation of observing only three activities per respondent limits our sample size. The response rate is these years fluctuated between 39.4% in 2021 and 56.9% in 2010.

[9] The 2010-2012-2013 WB-Modules were funded by the National Institute on Aging (NIA) and in 2021 the University of Maryland and the University of Minnesota with grants from the National Institute for Child Health and Human Development and the National Science Foundation sponsored collection of the well-being module in the ATUS. The 2010-2012-2013 WB-Modules were fielded for the three full years, whereas in 2021 the WB-Module was fielded between March 1, 2021 and December 31, 2021.

the day due to time and resource limitations. By contrast, the DRM collects well-being information for all episodes of the day.[10]

From these six feelings, we construct two latent variables: net affect and the U-index. Net affect represents mood in general, and we create this variable by subtracting the mean of negative emotions (pain, sadness, fatigue, and stress) from the mean of positive emotions (happiness, meaningful) that an individual experienced during a given episode. This yields an overall mood net affect on a range from 6 to -6, with 6 (-6) reflecting the best (worst) possible mood, and has been substantially used in similar studies as a reliable predictor of overall self-ratings of happiness (Bradburn, 1969; Kahneman et al., 2006; Kahneman and Krueger, 2006). Besides, we construct the U-index, that takes value 1 and classifies an activity as "unpleasant" if the maximum for any of the negative feelings (i.e., sad, stress, tired, pain) is strictly greater (indicating a stronger emotion) than the maximum rating on any of the positive feelings (i.e., happiness, meaningfulness) in a given activity, 0 otherwise. This index indicates the predominance of negative emotions over positive ones during a given activity and measures the proportion of time an individual spends in an unpleasant state (Kahneman and Krueger, 2006).

Information about the diary day and county of the interview were used to add the information on weather conditions to the ATUS data set. Thus, respondents in one county are subject to the same weather on the same survey diary day, the previous day of the ATUS interview day and the date about which the respondents were interviewed and reported their well-being. Hence, we use the county as the unit of analysis, which is the best geographic delineation for understanding how weather affects well-being.

[10] Respondents are only interviewed once in the ATUS questionnaire. In the well-being module, respondents first 'reconstruct' the previous day and list all the activities in sequential order, with whom and where they did these activities. Next, they rate their feelings during three activities lasting at least 5 minutes randomly chosen, excluding times respondents reported sleeping (code 0101xx), grooming (code 0102xx), and engaging in personal activities (code 0104xx), as well as activities in which the respondents did not know (code 500106) or refused to report what they were doing (code 500105). Thus, DRM is a combination of time use and affective experience reported in activities. Consequently, it should be acknowledged that errors remembering feelings could introduce a potential memory bias (Robinson and Clore, 2002; Xu and Schwarz, 2009; Schwarz and Xu, 2011), although extensive validation studies have indicated that the DRM is an acceptable approximation of the Experience Sampling Method (ESM) or the Ecological Momentary Assessment (EMA), the gold standards in experience measures, which record feelings directly during activities – in real-time - and reduce recall bias (Grube et al., 2008; Krueger et al., 2009b; Dockray et al., 2010; Christodoulou et al., 2014; Diener and Tay, 2014; Tweten et al., 2016), supporting the validity of the process of recalling. We refer the reader to Kahneman et al. (2004), Krueger et al. (2009a) and Stone et al. (2018) for much more details.

However, the county of residence can only be identified for a part of the ATUS sample, since due to confidentiality issues only counties over 100,000 inhabitants are identified in the survey. Data for precipitation, snowfall, and temperature were obtained from the NCDC of the NOAA, which provides historical weather data from thousands of weather stations across the United States, and all variables were collected on a daily basis at the county level from 19,729 meteorological stations located over the US.[11] Originally, the precipitation and snowfall variables are measured in inches, while the maximum temperature is measured in degrees Fahrenheit.[12]

In addition to the 24-hour time diary and the well-being questions, the ATUS also includes and provides rich information on respondents' demographic and household characteristics, which we employ as covariates in our models considering the literature on the determinants of subjective well-being. The variables included are gender, age, native status, education level, labor force status, marital status, number of people in household, number of children in household, family income, and health status. Gender is categorized as a binary variable that takes value 1 if the respondent is male and 0 otherwise (female and other). Age is defined as a continuous variable, measured in years old. Native status is controlled by a dummy variable that takes value 1 for those citizens born in the US and 0 indicating the foreign-born (not born in the US). Education attainments is transformed into three binary variables, coded for less than high school, some high school or some college. Employment status is coded through a dummy variable that take value 1 if the respondent is employed, 0 otherwise. Marital status is measured through a dummy variable coded as 1 if the respondent report having a partner, either married or cohabiting, with no cohabiting and unmarried individuals as the reference group. We also include other household characteristics such as household total (gross) income, household size and total number of children under 18. We reclassified household income into three categories (low, middle, and high) from its original sixteen categories. As the household income information in the ATUS was categorical, the thresholds to classify the low-, middle-, and high-income variables were set as $25,000 and $75,000, respectively. Finally, we control for the general health status of respondent through a

[11] The weather data were retrieved from https://www.ncdc.noaa.gov/cdo-web/datatools.

[12] Although a variety of weather-related variables are available, most stations only report total amount of precipitation, snowfall, minimum temperature, and maximum temperature for the day.

dummy variable that take value 1 for those respondents who report an excellent, very good or good health, 0 otherwise (fair or poor health).

For the episode characteristics, we control for episode duration in minutes (in logarithmic terms, as time use is typically right skewed), activity categories, presence of other while performing the episode, location of activity (whether the activity took place at home, outdoors, indoors, and travelling, in response to a question asked about activities, "Where were you?"), and, because the diary day could occur on any date, we also control for whether the diary day was at weekend and/or a holiday, as people may generally feel better during weekends and holidays and may also have fewer time constraints to devote more time to more enjoyable activities. For a detailed description of all variable definition, see Appendix Table A1.

In ATUS there are more than 470 activity codes and we reclassify each activity into fifteen activity categories: cooking, shopping, other housework, childcare, market work, outdoor leisure, indoor leisure, entertainment, socializing, religious, hobbies, reading, sports, and personal care. The leisure classification follows closely that of Aguiar and Hurst (2007) and we provide detail of each activity that is contained within our fourteen time use categories listed in Appendix Table A2.

Table 1 depicts the descriptive statistics of all key variables, both subjective measures, episode characteristics, weather variables and socio-demographic controls, for all the respondents in our sample, and gives an overview of the summary statistics for the dependent, control and weather variables. The first eight rows of Table 1 report the average level of feelings experienced in different activities (i.e., the three randomly activities with subjective well-being information). On a scale from 0 to 6, the average level of happiness, meaningfulness, sad, stress, tired, and pain are 4.395, 4.369, 0.602, 1.464, 2.273, and 0.879, respectively. For the net affect, the difference between the average of positive and negative feelings, the sample average is 3.077, whereas the average U-index is 0.131. In terms of episode characteristics, the episode duration is in average 167 minutes per activity, about 69.1% of the activities are performed in presence of another person, whereas 58.1% of activities are performed at home, 6.5% outdoors, 27.8% indoors and 7.5% while travelling. Besides, in our sampled diary days, 32.7% are weekend days and 2.4% holidays.

For weather conditions, the average daily maximum temperature figure is about 70.895 degrees Fahrenheit. The average number of days under 50ºF is 14.5%, the average number

of days between 50 and 60ºF is 11.3%, between 60 and 70ºF is 16.1%, between 70 and 80ºF 20.7%, between 80 and 90ºF 25% and greater than 90ºF 12.4%. Finally, the average intraday change in maximum temperature is 0.075 degrees Fahrenheit.

For socio-demographics, men account for slightly less than half of the sample, around 48 per cent. The average age of respondents in our sample is about 42 years old. Furthermore, 78.3% of individuals are native citizens born in the US. In terms of education, 17.1 per cent of individuals have less than a high school education, 25.7 per cent have attained a high school diploma, and 57.2 per cent have at least some college. Additionally, 61.9 per cent of respondents declared being at the labor force. Regarding household characteristics, about half of the sample live with a (married or unmarried) partner, the number of household members is 3.36 and the average number of children in the household is 1. For household socio-economic status, 19.1 per cent of households in the sample fall within our broad low range (household earnings lower than $25,000), 43 per cent fall within our middle range and have an income between $25,000 and $75,000, and 37.9 per cent exceeds $75,000. Finally, 83.8 per cent of individuals declare to have an excellent, very good or good general health status.

In Table 2 the correlation matrix of the instant feeling variables considered in each model (i.e., the eight dependent variables) is presented, together with the relationship's statistical significance. These correlations range between -0.592 and 0.761, and are statistically significant at the 1% level.

4. Econometric strategy

To model the relationship between weather conditions and well-being, we used ordinary least squares (OLS) regression models with sampling weights provided by the ATUS and adjusting for cluster standard errors by individual, which is necessary to account for correlation within individuals since the data contains multiple observations from each respondent. Then, we estimate linear probability models for binary dependent variables (e.g., U-index) and OLS models for continuous dependent variables (e.g., happiness, meaningfulness, sadness, stress, tired, pain, net affect). We apply activity-level weights to account for differences in the fraction of time in eligible activities and the probability of having an eligible activity selected in the module, that is, aspects of the ATUS sample design and data collection process (e.g., only activities over 5 minutes are eligibles, certain demographic groups and weekends are oversampled, nonresponse rates,… and the

activity weights allow to account and compensate for those important aspects). Furthermore, we use activity weights because the subjective well-being questions vary by activity.[13]

The OLS estimator was chosen for its simplicity and the ease of result interpretation (i.e., coefficients in the linear model can be interpreted as marginal effects, in contrast to ordered models that cannot be interpreted quantitatively), as prior research shows that the cardinal models (OLS regressions) and ordinal models (ordered latent response models, such as ordered logit or probit model) produces very similar results, at least qualitatively (Ferrer-i-Carbonell and Frijters, 2004; Rasciute et al., 2023). Consequently, although the survey provides ordinal measures of affective well-being, we adopt a cardinal interpretation of individuals' responses.

Specifically, we estimate the following linear regression:

$$SWB_{ijk,t} = \alpha_0 + W_{j,t}\delta + X_{ij,t}\beta + E_{ijk,t}\Upsilon + \Phi_s + \theta_m + \tau_t + \varepsilon_{ijk,t} \quad (1)$$

In all models, subscript i denotes individuals, j denotes county of residence, k denotes episode and t denotes survey years. The dependent variable, $SWB_{ijk,t}$, is the feeling or measure of subjective well-being (happiness, meaningfulness, sadness, fatigue, stress, pain, net affect or U-index) reported by respondent i in county j at time t during episode k, where time is expressed in terms of the year, month and day of interview. We standardize each continuous instant feeling measure (happiness, meaningfulness, sadness, fatigue, stress, pain, net affect) to have a mean of 0 and a standard deviation of 1 for ease of interpretation (i.e., estimated coefficients can be interpreted as the change in terms of one standard deviation of each well-being measure). $X_{ij,t}$ represents a vector of socio-demographic characteristics of individual i. $W_{j,t}$ is a vector of county-level weather variables, the main independent variables in our models, whereas $E_{ijk,t}$ is a vector of episode characteristics. The individual control variables include sex (ref.: females), age and its square term (divided by 100), being a native individual (ref.: immigrants), highest education completed (ref.: primary education), employment status (ref.: not in labor force), married or cohabiting (ref.: no cohabiting), the family size, the number of children

[13] Note that our unit of analysis is activity, rather than individual. Thus, we cluster the standard errors on the person because the data contains multiple observations from each respondent (i.e., 3 episodes are from the same respondent). Additionally, we tested the results with regard to clustering on the state level, to allow the correlation of error terms for individuals who live in the same state across time, and the results were robust to the cluster level. Those results are available from the authors upon request.

in the household, total household income (ref.: low household income, less than $25,000), and health status (ref.: fair, poor). Most of these variables have been demonstrated to have an impact on well-being by prior research (Dolan et al., 2008; Kahneman and Deaton, 2010).

Besides, we also control for episode characteristics, as prior research has obtained differential affective results according to the activity characteristics (Kahneman et al., 2004). Specifically, we control for the type of activity (with personal care as reference activity category), its duration (in minutes), its location (at home, indoors, outdoors, with travelling as reference category), whether the respondent interacted with someone else during the activity (e.g., spouse, parent, children, other family member, friends), and whether the diary was a weekend and holiday.

For weather characteristics we focus on daily maximum temperature. Specifically, maximum temperature on the diary day t in county j was included into the model as dummy variables in 10ºF ranges, with 70-80ºF taken as the reference category, and we also include the change in maximum temperature with respect to the previous day for each county. We use maximum temperature rather than daily average as most of the people are sleeping when minimum temperatures occur (Graff Zivin and Neidell, 2014; Krüger and Neugart, 2017) and these other measures may not capture extreme temperature exposure. Besides, maximum temperatures are highly correlated with average and minimum temperatures in our sample (correlation coefficients equal to 0.981 and 0.918, statistically significant at the 99% confidence level). Hence, δ measures the impact of an additional day in a given bin on each instant feeling outcome variable, relative to the impact of a day within the 70-80ºF bin.

Time-specific fixed effects are captured by the year dummies indicating the year in which the survey was fielded τ_t, which are included to account for unobserved factors pertaining to a specific year such as survey issues and macroeconomic conditions (2010 is the reference survey year) that can influence individual well-being, and to allow for differences in instant utility over time that are common to all individuals, whereas the variable θ_m describes month dummies and controls for any seasonal pattern in $SWB_{ijk,t}$ (with December as the reference month category). Φ_s denotes US state of residence fixed effects, to capture for any unobserved heterogeneity at the regional level and account for permanent (time-invariant) state characteristics that may simultaneously influence daily

maximum temperature and subjective well-being. Standard errors are described by $\varepsilon_{ijk,t}$, the error term.

5. Results

In Table 3 we report OLS estimates on the effects of daily maximum temperature in individual well-being – happiness, meaningfulness, sad, stress, tired, pain, net affect, and the U-index – conditional on demographic, household, episode, time and state characteristics. Hence, Table 3 displays the main results of the regression analyses conducted with the full sample.[14]

Coming up with the coefficients of interest of the results of Equation 1, that is, those related to daily maximum temperatures, we obtain that maximum temperatures under 50s are positively related to instant emotions of sadness and stress, whereas maximum temperatures above 80s are positively related to fatigue, in comparison to days with maximum temperatures around 70s. Specifically, those days with maximum temperatures under 50ºF are related to an increase of 0.125 of a standard deviation in sadness, and an increase of 0.105 of a standard deviation in stress. On the other, days with maximum temperature around 80ºF are related to an increase of 8.5 per cent of a standard deviation in fatigue and to an increase of 3.5 per cent in the U-index, whereas those days with maximum temperatures above 90ºF are associated with an increase of 10.6 per cent of a standard deviation in fatigue.

Alternatively, we repeat the analysis of the same empirical model and run Eq. (1) separately by gender, in order to document any gender-specific difference and exposure to maximum temperatures. In Tables 4 and 5 we report the estimation results of two different sub-samples divided by gender. The estimates report important gender differences, as males appear to be more sensitive to extreme maximum temperatures. Specifically, we obtain that maximum temperatures around 80s degrees Fahrenheit, in comparison to maximum temperatures around 70s, are negatively related to positive instant feelings, such as happiness and meaning, and positively related to negative emotions, such as stress and fatigue. When we compute the standard deviation of each

[14] Since the dependent variables are ordinal, ranging from -6 to 6, we also run ordered models such as ordered logit/probit models. Results were robust and very similar regarding the sign and statistical significance (coefficients are not directly comparable across models), confirming the findings of Ferrer-i-Carbonell and Frijters (2004). The logit/probit results are available on request.

instant-feeling emotion, we obtain that those days with maximum temperature around 80s, relative to a 70s maximum temperature day, are associated with an increase in stress and fatigue emotions by 0.120 and 0.169 of a standard deviation for males, respectively. On the other, those same days are related to a decrease of 0.136 and 0.140 of a standard deviation in happiness and meaning, respectively. Hence, days with maximum temperatures around 80s are related to a decrease of 18.9 per cent of a standard deviation in the net affect and to an increase of 6 per cent in the U-index. For days with maximum temperatures above 90ºF, we also document a positive relationship of 0.194 of a standard deviation in fatigue and a negative relationship of 0.147 of a standard deviation with the net-affect.

For females, by contrast, we obtain only one statistically significant coefficient, associated with instant feelings of interest in days with maximum temperature above 90ºF. Specifically, those days are positively related to interest feelings, of around 0.112 of a standard deviation in meaningfulness. Finally, for deviations from recent conditions, change in maximum temperature from the previous day, we do not obtain any statistically significant coefficient for males at standard levels of significance, whereas the estimates for females suggest a reduction in happiness and pain, and an increase in tiredness for greater intraday maximum temperature differences. Consequently, for females it is not the absolute temperature that matter, it is the deviation from recent temperature, whereas males' self-reported well-being is more responsive to extreme temperatures.[15]

Heterogeneity analyses: age groups and adaptation

Alternatively, we conduct two heterogeneity analyses by age and area of residence. This would allow us to identify potential subgroups more vulnerable to extreme temperatures.

First, we split the males' sample by age into five different groups: 15-29, 30-39, 40-49, 50-59, and over 60, and estimate Equation 1 for each sub-sample.[16] Results in Tables 6-10 suggest that the positive relationship between days with maximum temperature

[15] In Tables B1 and B2 we report the estimates by gender after controlling for other meteorological variables. Specifically, we control for precipitation and snowfall intensity in the diary day, and precipitation and snowfall difference from the previous day. We report these estimates in Appendix B because we cannot identify important differences across gender, and the main results, those related to maximum temperature, are robust to this alternative specification.

[16] We concentrate on the males' results. The females' results by age groups are available upon request.

above 80ºF and tired is concentrated in those individuals aged 15-29 and 40-59, whereas the positive relationship with stress is reported only by those individuals between 50 and 59 years old. For those males aged above 60 years old, both low and high maximum temperatures are negatively related to instant emotions of pain.

Finally, we also conduct a heterogeneity analysis by area of residence, classify states into colder and warmer places, and estimate Eq (1) for males separately by sub-sample. This sub-analysis allows us to test for any potential adaptation of respondents, according to their area of residence. We consider colder places those located in the Northeast and Midwest, whereas warmer places are states in the Southeast and West (Graff Zivin and Neidell, 2014). The results are displayed in Tables 11 and 12. For warmer areas, we obtain that low temperatures are positively related to happiness, whereas high temperatures, above 80ºF, are negatively related to meaningfulness and positively related to instant feelings of fatigue. Hence, the previous estimates of Table 4 that suggest that males report higher feelings of fatigue during days with maximum temperatures above 80ºF are associated to respondents in warmer places. For respondents in colder areas, the results in Table 12 suggest that maximum temperatures above 90ºF are positively related to stress and negatively related to pain, whereas lower maximum temperatures are negatively related to happiness and meaningfulness. Finally, in colder places low daily temperatures are negatively related to net affect, whereas high maximum temperatures in warmer areas are negatively related to net affect.

Potential mechanisms: Cognitive well-being measures, sleep time/quality and sex ratio

Alternatively, we discuss potential mechanisms behind our main well-being estimates, previously reported in Tables 4 and 5. Specifically, we have obtained that males are more sensitive to extreme temperatures, manifested through greater levels of fatigue and stress, and lower levels of happiness and meaningfulness. We restrict our analyses of mechanisms to three potential factors: cognitive measures of emotional well-being, sleeping time and quality, and population's location.

First, for cognitive well-being measures we use data from the ATUS WB-Module too, as in the ATUS WB-Module there is some information about cognitive measures of well-being, such as life satisfaction and general health status. Specifically, in 2012, 2013 and 2021 the ATUS asked respondents to complete the Cantril Ladder life satisfaction question, which asks respondents to rate their overall quality of life on a 10-point scale,

with 0 being the worst possible life they could be leading, and 10 the best possible life. We report the estimates for the life satisfaction in the first three columns of Table 13, where we use sample weights at the individual level and we cluster the error term at the state level.[17]

In the first column of Table 13 we display the results for the pooled sample, which suggest that days with maximum temperatures lesser than 70ºF are negatively related to life satisfaction, in comparison to survey days with maximum temperature around 70-80ºF. For males, results are reported in Column 2, the estimates suggest that they report a lower life satisfaction on survey days with maximum temperatures lower than 50ºF, whereas females in Column 3 report lower life satisfaction in those days where maximum temperatures are lower than 70ºF, in comparison to days with maximum temperatures around 70 and 80ºF.

Additionally, during the 2010, 2012, 2013, and 2021 WB-Modules of the ATUS the survey also asks for general self-rated health status. Specifically, the question was "Would you say your health in general is excellent (1), very good, good, fair, or poor (5)?". We use this question to study the relationship between health status and maximum temperatures and display the results in the last three columns of Table 13. For the general health status, results in Columns (4-6) do not suggest any relationship with maximum temperature, neither for the pooled sample nor gender sub-sample.

Next, we pay attention to both sleep time and quality. For sleep time, we use data from the ATUS 2003-2019 and 2021, and obtain daily sleeping time (in minutes per day) and regress it on the same vector of individual and weather characteristics as in Eq. (1). For sleep quality, we exploit information from a question asked in the ATUS WB-Module about how well-rested individuals felt yesterday, with potential answers range from 'Very' (1), 'Somewhat' (2), 'A little' (3), and 'Not at all' (4), so higher values of this variable are related to poorer sleep quality. We estimate the effects of maximum temperatures on both sleep time and slept quality variable. The results are reported in Table 14 and suggest that maximum temperature days above 80ºF, in comparison to those days with maximum temperature days around 70ºF, are not statistically related to total sleeping time. Hence, warmer temperatures are not related to a decrease in minutes slept. Nevertheless, for sleep quality we obtain that in those days where maximum temperatures

[17] Contrary to the affective well-being information gathered in the ATUS, we have only one record/row of information for each respondent who completed the WB-Module.

are around 80-90ºF, males report lower sleep quality. This could explain why males report greater levels of fatigue in days with maximum temperature above 80ºF, as our results indicate that warmer temperatures are related to a worse in sleep quality.

Finally, by using data from the CPS for the years 1980-2021, we compute the state average of sex ratio (i.e., ratio of males to females). In Figure 1 we plot both the state average of sex ratio and maximum temperature during all those years. The scatter plot shows that states with higher maximum temperatures tend to have a lower number of males, in comparison to females, so males appear to avoid and come out of warmer states.[18]

6. Conclusions

This paper provides evidence of the relationship between weather and subjective well-being. We use nationally representative data from the ATUS, together with weather information from the NCDC, gathered at the daily and county level. We use a special supplement to the ATUS, conducted in 2010, 2012, 2013, and 2021. More specifically, we use the corresponding Well-Being Modules of the ATUS to test how weather conditions are related to affective well-being in the US. We consider the US as a study case, due to both data availability and the wide coverage of the country. The fact that we use data from four entire years allows us to estimate more credible relationships, as prior research has focused on specific seasons which is likely to bias the estimates. The empirical evidence includes a total of 17,460 individuals, with more than 68,000 pooled observations. Then, this paper contributes to the current literature by exploring the health impacts of climate change, from both a subjective well-being and gender point of view.

We focus on daily maximum temperatures due to its relevance in the current climate context, where global temperatures are warming, and analyze its impact on instant feelings reported by respondents during specific days. Understanding how individuals respond to those events, from an affective perspective, is essential to mitigate global warming consequences and identify potential affected groups by the climate emergency. The finding that males appear to be more sensitive to temperature is, to the best of our knowledge, a novel result to the literature, and suggest that global climate change could have negative affective well-being consequences for males. This finding contrasts with

[18] Future studies must investigate the possible implications of climate change from population's location perspective. This is beyond the scope of this paper and requires additional investigation.

Connolly (2013) who shows that women appear to be more affected by daily temperature. We additionally try to identify potential mechanisms, and report that higher temperatures are negatively related to slept quality in males and that in warmer states there are lower males, in average terms during the last four decades (1980-2021). Our findings also contrast with Frijters et al. (2020), since we identify a robust and clear relationship between daily temperatures and subjective well-being, after accounting for different well-being determinants, episode characteristics and weather variables.

When we compare our estimates with other determinants of affective well-being, we obtain large estimates for extreme temperature and a day with maximum temperature over 80 degrees Fahrenheit has a greater impact on instant emotions than other standard socio-demographic determinants of subjective well-being, such as age, native status, education level, marital status or family size. Thus, for practitioners using subjective well-being data, we recommend to control for daily weather conditions in their estimates of affective well-being, as well-being judgements may be influenced by the weather and this could bias the estimates otherwise. However, we should reckon that our estimates are likely to be geographical context-specific, so further research in other areas is extremely recommended.

A major limitation of the current study is that we cannot control for unobserved individual heterogeneity, as we are using data from a cross-sectional survey and each individual participates in the ATUS only once. Future research using panel datasets is needed to explore, more precisely, the impacts of extreme temperatures on well-being among the same individuals. Although the ATUS WB-Module reports subjective well-being for three episodes, the fact that temperature is a daily-level variable does not allow us to use individual fixed-effects models and we need information for the same respondent for different survey days. For instance, the UK Time Use Survey (UKTUS) provides data for two different survey days for the same respondent, one being a weekday and the other one being a weekend day, and is technically a panel dataset. This would allow to control for unobserved heterogeneity at individual level and use panel data estimators (e.g., fixed effects or random effects models), in contrast to our pooled cross-sectional dataset models.

Nevertheless, this dataset also presents some disadvantages to our econometric strategy, as the information at the geographical level is not as detailed as in the ATUS data. Furthermore, the UKTUS only gathers information about only one rather general emotion, instant enjoyment, through a broad question for each activity performed during

the diary day, and our results suggest that including different instant emotions in the models, positive and negative affective measures, is important to more fully capture these relationships with all components of subjective well-being. This also highlights the value of the ATUS WB-Module, which is unambiguously more informative than alternative datasets.

Future research could also examine whether our findings could be extended to other general health measures, such as depression or mental health scores using standard measures such as the Centre for Epidemiological Studies Depression Scale (CES-D), or to other regional contexts, such as developing countries where the effects of weather on well-being have received no attention and could be even more important due to the significance of the agriculture sector, a more exposed occupation.

REFERENCES

Barrington-Leigh, C., & Behzadnejad, F. (2017). The impact of daily weather conditions on life satisfaction: Evidence from cross-sectional and panel data. *Journal of Economic Psychology*, 59, 145-163. https://doi.org/10.1016/j.joep.2017.01.003

Belloc, I., Gimenez-Nadal, J. I., & Molina, J. A. (2022). Weather conditions and daily commuting. *IZA DP No. 15661*.

Bradburn, N. M. (1969). The structure of psychological well-being.

Christodoulou, C., Schneider, S., & Stone, A. A. (2014). Validation of a brief yesterday measure of hedonic well-being and daily activities: Comparison with the day reconstruction method. *Social Indicators Research*, 115, 907-917. https://doi.org/10.1007/s11205-013-0240-z

Connolly, M. (2008). Here comes the rain again: Weather and the intertemporal substitution of leisure. *Journal of Labor Economics*, 26(1), 73-100. https://doi.org/10.1086/522067

Connolly, M. (2013). Some like it mild and not too wet: The influence of weather on subjective well-being. *Journal of Happiness Studies*, 14, 457-473. https://doi.org/10.1007/s10902-012-9338-2

Diener, E. (2006). Guidelines for national indicators of subjective well-being and ill-being. *Journal of Happiness Studies*, 7, 397-404. https://psycnet.apa.org/doi/10.1007/s10902-006-9000-y

Diener, E., & Ryan, K. (2009). Subjective well-being: A general overview. *South African Journal of Psychology*, 39(4), 391-406.

Diener, E., & Seligman, M. E. (2004). Beyond money: Toward an economy of well-being. *Psychological Science in the Public Interest*, 5(1), 1-31.

Diener, E., & Tay, L. (2014). Review of the day reconstruction method (DRM). *Social Indicators Research*, 116, 255-267. https://doi.org/10.1007/s11205-013-0279-x

Dockray, S., Grant, N., Stone, A. A., Kahneman, D., Wardle, J., & Steptoe, A. (2010). A comparison of affect ratings obtained with ecological momentary assessment and the day reconstruction method. *Social Indicators Research*, 99, 269-283. https://doi.org/10.1007/s11205-010-9578-7

Dolan, P., Peasgood, T., & White, M. (2008). Do we really know what makes us happy? A review of the economic literature on the factors associated with subjective well-being. *Journal of Economic Psychology*, 29(1), 94-122. https://doi.org/10.1016/j.joep.2007.09.001

Feddersen, J., Metcalfe, R., & Wooden, M. (2016). Subjective wellbeing: Why weather matters. *Journal of the Royal Statistical Society. Series A (Statistics in Society)*, 179 (1), 203-228.

Ferrer-i-Carbonell, A., & Frijters, P. (2004). How important is methodology for the estimates of the determinants of happiness?. *The Economic Journal*, 114(497), 641-659. https://doi.org/10.1111/j.1468-0297.2004.00235.x

Fitoussi, J. P., & Stiglitz, J. E. (2012). On the measurement of social progress and wellbeing: some further thoughts. *The Global Macro Economy and Finance*, 13-24. https://doi.org/10.1057/9781137034250_2

Frijters, P., Lalji, C., & Pakrashi, D. (2020). Daily weather only has small effects on wellbeing in the US. *Journal of Economic Behavior & Organization*, 176, 747-762. https://doi.org/10.1016/j.jebo.2020.03.009

Graff Zivin, J., & Neidell, M. (2014). Temperature and the allocation of time: Implications for climate change. *Journal of Labor Economics*, 32(1), 1-26. https://doi.org/10.1086/671766

Graham, C., & Ruiz Pozuelo, J. (2017). Happiness, stress, and age: How the U curve varies across people and places. *Journal of Population Economics*, 30, 225-264. https://doi.org/10.1007/s00148-016-0611-2

Grube, A., Schroer, J., Hentzschel, C., & Hertel, G. (2008). The event reconstruction method: An efficient measure of experience-based job satisfaction. *Journal of Occupational and Organizational Psychology*, 81(4), 669-689. https://doi.org/10.1348/096317907X251578

Kahneman, D., & Deaton, A. (2010). High income improves evaluation of life but not emotional well-being. *Proceedings of the national academy of science*s, 107(38), 16489-16493. https://doi.org/10.1073/pnas.1011492107

Kahneman, D., & Krueger, A. B. (2006). Developments in the measurement of subjective well-being. *Journal of Economic Perspectives*, 20(1), 3-24. https://doi.org/10.1257/089533006776526030

Kahneman, D., Diener, E., & Schwarz, N. (Eds.). (1999). Well-being: Foundations of hedonic psychology. Russell Sage Foundation.

Kahneman, D., Krueger, A. B., Schkade, D. A., Schwarz, N., & Stone, A. A. (2004). A survey method for characterizing daily life experience: The day reconstruction method. *Science*, 306(5702), 1776-1780. https://doi.org/10.1126/science.1103572

Kahneman, D., Krueger, A. B., Schkade, D., Schwarz, N., & Stone, A. A. (2006). Would you be happier if you were richer? A focusing illusion. S*cience*, 312(5782), 1908-1910. https://doi.org/10.1126/science.1129688

Kämpfer, S., & Mutz, M. (2013). On the sunny side of life: Sunshine effects on life satisfaction. *Social Indicators Research*, 110, 579-595. https://doi.org/10.1007/s11205-011-9945-z

Krueger, A. B., Kahneman, D., Fischler, C., Schkade, D., Schwarz, N., & Stone, A. A. (2009a). Time use and subjective well-being in France and the US. *Social Indicators Research*, 93, 7-18. https://doi.org/10.1007/s11205-008-9415-4

Krueger, A. B., Kahneman, D., Schkade, D., Schwarz, N., & Stone, A. A. (2009b). National time accounting: The currency of life. In Measuring the subjective well-being of nations: National accounts of time use and well-being (pp. 9-86). University of Chicago Press.

Krüger, J. J., & Neugart, M. (2018). Weather and Intertemporal Labor Supply: Results from German Time-Use Data. *Labour*, 32(1), 112-140. https://doi.org/10.1111/labr.12105

Lucas, R. E., & Lawless, N. M. (2013). Does life seem better on a sunny day? Examining the association between daily weather conditions and life satisfaction judgments. *Journal of Personality and Social Psychology*, 104(5), 872. https://psycnet.apa.org/doi/10.1037/a0032124

Neidell, M., Graff Zivin, J., Sheahan, M., Willwerth, J., Fant, C., Sarofim, M., & Martinich, J. (2021). Temperature and work: Time allocated to work under varying climate and labor market conditions. *PloS one*, 16(8), e0254224. https://doi.org/10.1371/journal.pone.0254224

Noelke, C., McGovern, M., Corsi, D. J., Jimenez, M. P., Stern, A., Wing, I. S., & Berkman, L. (2016). Increasing ambient temperature reduces emotional well-being. *Environmental Research*, 151, 124-129. https://doi.org/10.1016/j.envres.2016.06.045

Rasciute, S., Downward, P., & Simmons, N. (2023). Valuation of subjective wellbeing and the role of marital status: Linear versus ordinal estimators. *Economic Modelling*, 123, 106260. https://doi.org/10.1016/j.econmod.2023.106260

Robinson, M. D., & Clore, G. L. (2002). Belief and feeling: evidence for an accessibility model of emotional self-report. *Psychological Bulletin*, 128(6), 934. https://psycnet.apa.org/doi/10.1037/0033-2909.128.6.934

Schmiedeberg, C., & Schröder, J. (2014). Does weather really influence the measurement of life satisfaction?. *Social Indicators Research*, 117, 387-399. https://doi.org/10.1007/s11205-013-0350-7

Schwarz, N., & Xu, J. (2011). Why don't we learn from poor choices? The consistency of expectation, choice, and memory clouds the lessons of experience. *Journal of Consumer Psychology*, 21(2), 142-145. https://doi.org/10.1016/j.jcps.2011.02.006

Senik, C. (2014). The French unhappiness puzzle: The cultural dimension of happiness. *Journal of Economic Behavior & Organization*, 106, 379-401. https://doi.org/10.1016/j.jebo.2014.05.010

Steptoe, A., Deaton, A., & Stone, A. A. (2015). Subjective wellbeing, health, and ageing. *The Lancet*, 385(9968), 640-648. https://doi.org/10.1016/S0140-6736(13)61489-0

Stiglitz, R., Sen, A., & Fitoussi, J. (2009). Report by the Commission on the Measurement of Economic Performance and Social Progress. CMEPSP Report.

Stone, A. A., Schneider, S., Krueger, A., Schwartz, J. E., & Deaton, A. (2018). Experiential wellbeing data from the American Time Use Survey: Comparisons with other methods and analytic illustrations with age and income. *Social Indicators Research*, 136, 359-378. https://doi.org/10.1007/s11205-016-1532-x

Tweten, C., Anusic, I., Lucas, R. E., & Donnellan, M. B. (2016). A direct comparison of the Experience Sampling Method (ESM) and the Day Reconstruction Method (DRM). Retrieved from https://osf.io/5mjys/

Xu, J., & Schwarz, N. (2009). Do we really need a reason to indulge?. *Journal of Marketing Research*, 46(1), 25-36. https://doi.org/10.1509/jmkr.46.1.25

Table 1. Summary statistics

	Mean	Std. Dev.	Minimum	Maximum
Instant feelings:				
Happy	4.395	1.583	0	6
Meaningful	4.369	1.844	0	6
Sad	0.602	1.319	0	6
Stress	1.464	1.805	0	6
Tired	2.273	1.924	0	6
Pain	0.879	1.583	0	6
Net affect	3.077	2.088	-6	6
U-index	0.131	0.338	0	1
Episode characteristics:				
Episode duration (minutes)	167.019	152.554	5	1,210
Episode with other	0.691	0.462	0	1
Episode at home	0.581	0.493	0	1
Episode outdoors	0.065	0.247	0	1
Episode indoors	0.278	0.448	0	1
Episode travelling	0.075	0.264	0	1
Weekend day	0.327	0.469	0	1
Holiday	0.024	0.153	0	1
Weather conditions:				
Maximum temperature	70.895	17.793	-6	115.278
Under 50s	0.145	0.352	0	1
50s	0.113	0.317	0	1
60s	0.161	0.367	0	1
70s	0.207	0.405	0	1
80s	0.250	0.433	0	1
90s	0.124	0.330	0	1
Change maximum temperature	0.075	5.703	-35	26
Socio-demographics:				
Male	0.480	0.500	0	1
Age	42.633	17.935	15	85
Native citizen	0.783	0.413	0	1
Primary education	0.171	0.376	0	1
Secondary education	0.257	0.437	0	1
University education	0.572	0.495	0	1
Employed	0.619	0.486	0	1
Married or cohabiting	0.526	0.499	0	1
Number of household members	3.358	1.790	1	15
Number of children	1.005	1.337	0	10
Low family income	0.191	0.393	0	1
Medium family income	0.430	0.495	0	1
High family income	0.379	0.485	0	1
Health status	0.838	0.368	0	1
Number of episodes	**68,995**			
Number of individuals	**17,460**			

Notes: Data come from the 2010, 2012, 2013 and 2021 ATUS WB-Module. All observations are weighted using the activity weights provided by the ATUS.

Table 2. Correlation coefficients for subjective well-being variables in the sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Happy	1							
Meaningful	0.428	1						
Sad	-0.305	-0.069	1					
Stress	-0.324	-0.072	0.488	1				
Tired	-0.182	-0.049	0.264	0.388	1			
Pain	-0.153	-0.003	0.367	0.325	0.325	1		
Net affect	0.761	0.656	-0.536	-0.592	-0.510	-0.451	1	
U-index	-0.439	-0.398	0.289	0.334	0.341	0.231	-0.586	1

Note: All correlation coefficients are statistically significant at the 1% level.

Table 3. Regression results, effect of weather on instant feelings, pooled

	Happy	Meaningful	Sad	Stress	Tired	Pain	Net affect	U-index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Log) Episode duration	0.018	0.059***	0.042***	0.058***	-0.017	0.037***	0.012	0.002
	(0.013)	(0.012)	(0.013)	(0.013)	(0.013)	(0.012)	(0.013)	(0.004)
Episode with other	0.223***	0.228***	-0.098***	-0.042	0.013	-0.023	0.214***	-0.032***
	(0.026)	(0.024)	(0.027)	(0.025)	(0.023)	(0.022)	(0.023)	(0.008)
Episode at home	-0.009	0.204***	-0.106**	-0.053	-0.044	-0.004	0.128***	-0.027***
	(0.032)	(0.033)	(0.042)	(0.037)	(0.034)	(0.034)	(0.033)	(0.010)
Episode outdoors	0.047	0.228***	-0.046	0.030	-0.122**	0.041	0.144***	-0.056***
	(0.050)	(0.044)	(0.053)	(0.055)	(0.048)	(0.054)	(0.049)	(0.013)
Episode indoors	-0.009	0.119***	-0.109***	-0.046	-0.132***	-0.001	0.109***	-0.018
	(0.035)	(0.035)	(0.040)	(0.037)	(0.037)	(0.035)	(0.035)	(0.011)
Under 50s	-0.030	-0.067	0.125**	0.105**	0.006	0.044	-0.093*	0.028*
	(0.051)	(0.049)	(0.053)	(0.053)	(0.053)	(0.052)	(0.053)	(0.017)
50s	0.045	-0.060	0.073	0.036	0.026	0.040	-0.043	0.015
	(0.046)	(0.046)	(0.046)	(0.048)	(0.046)	(0.042)	(0.046)	(0.014)
60s	-0.049	-0.000	0.022	0.040	0.034	0.010	-0.040	0.009
	(0.040)	(0.034)	(0.041)	(0.041)	(0.038)	(0.037)	(0.040)	(0.012)
80s	-0.056	-0.044	0.003	0.042	0.085**	0.008	-0.072*	0.035***
	(0.038)	(0.036)	(0.039)	(0.040)	(0.038)	(0.037)	(0.039)	(0.012)
90s and above	-0.004	0.000	-0.018	0.025	0.106**	-0.019	-0.025	0.012
	(0.051)	(0.047)	(0.054)	(0.055)	(0.047)	(0.050)	(0.051)	(0.015)
Change maximum temperature	-0.004**	-0.003*	0.001	0.002	0.005**	-0.003	-0.004**	0.002**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Male	-0.047**	-0.051**	-0.048**	-0.128***	-0.163***	-0.080***	0.047*	-0.032***
	(0.023)	(0.023)	(0.024)	(0.024)	(0.023)	(0.023)	(0.024)	(0.008)
Age	0.001	0.029***	0.021***	0.019***	-0.002	0.033***	0.001	-0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.001)
Age squared/100	0.004	-0.021***	-0.020***	-0.023***	-0.005	-0.027***	0.006	-0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.001)
Native citizen	-0.103***	-0.099***	-0.119***	0.026	0.034	0.049	-0.088***	0.039***
	(0.031)	(0.028)	(0.033)	(0.032)	(0.033)	(0.030)	(0.032)	(0.009)
Secondary education	-0.052	-0.001	-0.089*	-0.056	-0.049	-0.079*	0.032	-0.005
	(0.041)	(0.041)	(0.046)	(0.045)	(0.045)	(0.042)	(0.045)	(0.012)
University education	-0.111***	-0.020	-0.090**	0.062	0.026	-0.113***	-0.034	0.015
	(0.038)	(0.037)	(0.044)	(0.042)	(0.042)	(0.039)	(0.041)	(0.012)
Employed	0.066**	0.007	-0.048*	-0.075***	0.110***	-0.134***	0.051*	0.003
	(0.028)	(0.026)	(0.028)	(0.028)	(0.028)	(0.027)	(0.028)	(0.008)
Married or cohabiting	0.079***	-0.006	-0.055*	-0.032	-0.004	-0.023	0.048*	-0.004
	(0.026)	(0.024)	(0.029)	(0.029)	(0.026)	(0.029)	(0.026)	(0.009)
Number of household members	0.036***	0.027**	0.003	-0.017	-0.005	0.009	0.028**	-0.004
	(0.013)	(0.013)	(0.014)	(0.014)	(0.013)	(0.013)	(0.013)	(0.004)
Number of children	0.002	0.020	-0.048***	0.014	0.008	-0.030*	0.018	-0.005
	(0.017)	(0.016)	(0.017)	(0.017)	(0.018)	(0.017)	(0.016)	(0.005)
Medium family income	-0.053	-0.096***	-0.086**	-0.045	-0.002	-0.153***	-0.011	-0.002
	(0.034)	(0.031)	(0.036)	(0.038)	(0.035)	(0.036)	(0.036)	(0.011)
High family income	-0.110***	-0.186***	-0.130***	-0.011	0.017	-0.222***	-0.066*	0.006
	(0.036)	(0.035)	(0.037)	(0.040)	(0.038)	(0.039)	(0.039)	(0.012)
Health status	0.280***	0.092***	-0.422***	-0.393***	-0.452***	-0.762***	0.547***	-0.132***
	(0.032)	(0.030)	(0.039)	(0.035)	(0.033)	(0.039)	(0.036)	(0.012)

Weekend day	0.059**	-0.030	-0.045*	-0.116***	-0.100***	-0.069***	0.076***	-0.015**
	(0.023)	(0.021)	(0.025)	(0.024)	(0.024)	(0.023)	(0.024)	(0.007)
Holiday	0.085	0.002	0.151	-0.099	0.064	-0.009	0.016	-0.013
	(0.064)	(0.070)	(0.097)	(0.072)	(0.081)	(0.072)	(0.067)	(0.020)
Constant	-1.547***	-1.729***	1.985***	1.011**	1.439***	2.472***	-2.705***	0.710***
	(0.568)	(0.310)	(0.682)	(0.445)	(0.348)	(0.792)	(0.761)	(0.163)
Activity categories	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of episodes	68,995	68,995	68,995	68,995	68,995	68,995	68,995	68,995
Number of individuals	17,460	17,460	17,460	17,460	17,460	17,460	17,460	17,460
R-squared	0.106	0.132	0.071	0.158	0.069	0.157	0.148	0.069

Notes: Clustered standard errors at the individual level are given in parentheses. Data come from the 2010, 2012, 2013 and 2021 ATUS WB-Module. Estimation method for specifications is OLS. Dependent variables in columns (1-7) are standardized. Omitted category is maximum temperature in the 70s. Estimates are weighted using sampling demographic weights at the activity level. All models control for activity categories, month, year and state fixed effects, but not shown for brevity. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4. Regression results, effect of maximum temperature on instant feelings, males

	Happy	Meaningful	Sad	Stress	Tired	Pain	Net affect	U-index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Log) Episode duration	0.008	0.047***	0.052***	0.072***	-0.015	0.031**	-0.001	0.002
	(0.018)	(0.016)	(0.020)	(0.018)	(0.015)	(0.015)	(0.016)	(0.005)
Episode with other	0.222***	0.237***	-0.109***	-0.043	-0.006	-0.063**	0.232***	-0.029***
	(0.038)	(0.034)	(0.039)	(0.036)	(0.031)	(0.028)	(0.032)	(0.011)
Episode at home	-0.000	0.153***	-0.161**	-0.067	-0.065	-0.006	0.125***	-0.012
	(0.043)	(0.049)	(0.068)	(0.054)	(0.047)	(0.038)	(0.046)	(0.013)
Episode outdoors	0.144***	0.156***	-0.129*	0.001	-0.170***	0.007	0.184***	-0.047***
	(0.054)	(0.060)	(0.078)	(0.071)	(0.063)	(0.058)	(0.058)	(0.016)
Episode indoors	-0.036	0.077	-0.132**	-0.072	-0.118**	0.024	0.080*	-0.011
	(0.048)	(0.051)	(0.061)	(0.051)	(0.049)	(0.042)	(0.048)	(0.015)
Under 50s	-0.042	-0.025	0.126*	0.095	-0.004	0.062	-0.078	0.015
	(0.066)	(0.066)	(0.068)	(0.068)	(0.068)	(0.061)	(0.066)	(0.021)
50s	0.058	-0.115*	0.099	0.044	0.032	0.027	-0.068	0.014
	(0.066)	(0.067)	(0.064)	(0.066)	(0.063)	(0.054)	(0.062)	(0.018)
60s	-0.095	-0.050	0.033	0.031	0.067	0.026	-0.091*	0.008
	(0.058)	(0.049)	(0.053)	(0.052)	(0.051)	(0.046)	(0.052)	(0.015)
80s	-0.136**	-0.140***	0.021	0.120**	0.169***	0.031	-0.189***	0.060***
	(0.054)	(0.050)	(0.053)	(0.056)	(0.048)	(0.044)	(0.050)	(0.016)
90s and above	-0.081	-0.127*	-0.001	0.109	0.194***	-0.050	-0.147**	0.029
	(0.073)	(0.071)	(0.084)	(0.074)	(0.065)	(0.057)	(0.068)	(0.020)
Change maximum temperature	-0.003	-0.003	0.002	0.003	0.003	0.003	-0.004*	0.001
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)
Age	-0.002	0.024***	0.025***	0.020***	-0.007	0.032***	-0.003	0.001
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.002)
Age squared/100	0.007	-0.017***	-0.026***	-0.023***	0.001	-0.028***	0.009	-0.002
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.002)
Native citizen	-0.078*	-0.106***	-0.103**	0.005	0.009	0.061	-0.077*	0.036***
	(0.042)	(0.041)	(0.044)	(0.044)	(0.042)	(0.038)	(0.042)	(0.012)
Secondary education	-0.126**	-0.008	-0.123*	-0.042	-0.009	-0.048	-0.012	0.024
	(0.056)	(0.057)	(0.066)	(0.061)	(0.058)	(0.054)	(0.060)	(0.015)
University education	-0.181***	-0.020	-0.042	0.100*	0.097*	-0.072	-0.101*	0.036**
	(0.052)	(0.052)	(0.067)	(0.058)	(0.055)	(0.051)	(0.054)	(0.015)
Employed	0.120***	0.048	-0.135***	-0.067	0.110***	-0.201***	0.115***	-0.005
	(0.046)	(0.042)	(0.047)	(0.041)	(0.039)	(0.038)	(0.042)	(0.012)
Married or cohabiting	0.095**	0.045	-0.012	0.004	0.018	0.034	0.047	-0.011
	(0.038)	(0.039)	(0.038)	(0.041)	(0.037)	(0.038)	(0.039)	(0.012)
Number of household members	0.026	0.022	0.025	-0.004	0.011	0.014	0.011	0.002
	(0.018)	(0.019)	(0.019)	(0.018)	(0.018)	(0.017)	(0.017)	(0.006)
Number of children	0.001	0.008	-0.056**	0.006	-0.027	-0.021	0.022	-0.008
	(0.023)	(0.024)	(0.024)	(0.023)	(0.023)	(0.021)	(0.022)	(0.007)
Medium family income	-0.029	-0.089*	-0.105**	-0.120**	-0.054	-0.172***	0.035	-0.016
	(0.050)	(0.049)	(0.051)	(0.051)	(0.045)	(0.044)	(0.049)	(0.014)
High family income	-0.065	-0.154***	-0.157***	-0.035	0.013	-0.218***	-0.024	-0.011
	(0.050)	(0.051)	(0.050)	(0.054)	(0.047)	(0.046)	(0.051)	(0.015)
Health status	0.278***	0.143***	-0.340***	-0.310***	-0.336***	-0.617***	0.485***	-0.131***
	(0.050)	(0.049)	(0.052)	(0.049)	(0.044)	(0.052)	(0.052)	(0.018)
Weekend day	0.107***	-0.015	-0.082**	-0.144***	-0.135***	-0.052*	0.118***	-0.019*
	(0.034)	(0.031)	(0.035)	(0.032)	(0.031)	(0.028)	(0.030)	(0.010)

Holiday	-0.004	-0.168	0.165	-0.042	0.202*	-0.018	-0.140	0.012
	(0.090)	(0.104)	(0.143)	(0.108)	(0.119)	(0.097)	(0.088)	(0.029)
Constant	-0.257	-1.058***	-0.102	-0.602***	0.636**	0.273	-0.642***	0.226**
	(0.204)	(0.249)	(0.179)	(0.220)	(0.303)	(0.287)	(0.205)	(0.095)
Activity categories	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of episodes	30,790	30,790	30,790	30,790	30,790	30,790	30,790	30,790
Number of individuals	7,862	7,862	7,862	7,862	7,862	7,862	7,862	7,862
R-squared	0.120	0.140	0.074	0.170	0.062	0.141	0.156	0.072

Notes: Clustered standard errors at the individual level are given in parentheses. Data come from the 2010, 2012, 2013 and 2021 ATUS WB-Module. Estimation method for specifications is OLS. Dependent variables in columns (1-7) are standardized. Omitted category is maximum temperature in the 70s. Estimates are weighted using sampling demographic weights at the activity level. All models control for activity categories, month, year and state fixed effects, but not shown for brevity. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5. Regression results, effect of maximum temperature on instant feelings, females

	Happy	Meaningful	Sad	Stress	Tired	Pain	Net affect	U-index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Log) Episode duration	0.022	0.071***	0.028*	0.046***	-0.016	0.039**	0.023	0.002
	(0.017)	(0.016)	(0.016)	(0.018)	(0.019)	(0.018)	(0.019)	(0.006)
Episode with other	0.208***	0.216***	-0.077**	-0.040	0.025	0.014	0.189***	-0.033***
	(0.032)	(0.030)	(0.035)	(0.033)	(0.033)	(0.032)	(0.032)	(0.011)
Episode at home	-0.028	0.245***	-0.045	-0.036	-0.010	0.004	0.117***	-0.038**
	(0.046)	(0.043)	(0.042)	(0.047)	(0.045)	(0.053)	(0.045)	(0.015)
Episode outdoors	-0.059	0.286***	0.049	0.066	-0.064	0.090	0.085	-0.057***
	(0.082)	(0.061)	(0.067)	(0.081)	(0.070)	(0.089)	(0.076)	(0.020)
Episode indoors	0.026	0.162***	-0.078*	-0.020	-0.141***	-0.007	0.135***	-0.025
	(0.048)	(0.045)	(0.045)	(0.051)	(0.052)	(0.053)	(0.048)	(0.016)
Under 50s	-0.016	-0.092	0.126	0.112	0.018	0.039	-0.103	0.041
	(0.074)	(0.069)	(0.078)	(0.076)	(0.076)	(0.081)	(0.077)	(0.025)
50s	0.031	-0.005	0.058	0.020	0.019	0.063	-0.020	0.016
	(0.060)	(0.059)	(0.062)	(0.068)	(0.066)	(0.062)	(0.067)	(0.022)
60s	-0.009	0.054	0.022	0.055	0.008	0.005	0.004	0.010
	(0.053)	(0.046)	(0.058)	(0.059)	(0.055)	(0.058)	(0.059)	(0.019)
80s	0.028	0.047	-0.018	-0.027	0.017	-0.003	0.037	0.008
	(0.048)	(0.047)	(0.052)	(0.053)	(0.054)	(0.057)	(0.055)	(0.019)
90s and above	0.087	0.112**	-0.039	-0.053	0.019	0.012	0.094	-0.009
	(0.065)	(0.056)	(0.064)	(0.077)	(0.067)	(0.079)	(0.067)	(0.022)
Change maximum temperature	-0.006**	-0.004	-0.000	0.002	0.007**	-0.007**	-0.004	0.002*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.001)
Age	0.004	0.033***	0.018***	0.017***	0.002	0.033***	0.003	-0.003
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)	(0.002)
Age squared/100	0.002	-0.025***	-0.017***	-0.023***	-0.009	-0.028***	0.004	0.001
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)	(0.002)
Native citizen	-0.111***	-0.087**	-0.130***	0.041	0.057	0.037	-0.091**	0.037***
	(0.042)	(0.035)	(0.047)	(0.045)	(0.047)	(0.044)	(0.044)	(0.013)
Secondary education	0.036	0.020	-0.069	-0.069	-0.089	-0.119*	0.091	-0.035**
	(0.057)	(0.052)	(0.060)	(0.064)	(0.065)	(0.064)	(0.061)	(0.017)
University education	-0.041	-0.012	-0.135**	0.027	-0.044	-0.164***	0.036	-0.005
	(0.053)	(0.047)	(0.053)	(0.058)	(0.060)	(0.058)	(0.056)	(0.018)
Employed	0.019	-0.023	0.010	-0.086**	0.134***	-0.087**	-0.002	0.010
	(0.034)	(0.032)	(0.034)	(0.037)	(0.038)	(0.038)	(0.036)	(0.011)
Married or cohabiting	0.065*	-0.036	-0.075*	-0.058	-0.021	-0.057	0.047	-0.004
	(0.033)	(0.031)	(0.040)	(0.039)	(0.035)	(0.041)	(0.035)	(0.013)
Number of household members	0.049***	0.035**	-0.019	-0.028	-0.021	0.006	0.047***	-0.010**
	(0.018)	(0.016)	(0.018)	(0.020)	(0.019)	(0.018)	(0.018)	(0.005)
Number of children	-0.000	0.029	-0.041*	0.011	0.034	-0.043	0.017	-0.004
	(0.023)	(0.021)	(0.023)	(0.025)	(0.027)	(0.027)	(0.024)	(0.007)
Medium family income	-0.064	-0.097**	-0.067	0.022	0.040	-0.125**	-0.048	0.009
	(0.043)	(0.038)	(0.046)	(0.050)	(0.049)	(0.052)	(0.048)	(0.015)
High family income	-0.152***	-0.220***	-0.103**	0.014	0.018	-0.215***	-0.108**	0.023
	(0.049)	(0.045)	(0.051)	(0.054)	(0.053)	(0.058)	(0.054)	(0.018)
Health status	0.282***	0.058	-0.500***	-0.467***	-0.541***	-0.877***	0.603***	-0.131***
	(0.040)	(0.036)	(0.055)	(0.048)	(0.046)	(0.055)	(0.046)	(0.016)
Weekend day	0.021	-0.036	-0.023	-0.099***	-0.075**	-0.082**	0.049	-0.013
	(0.031)	(0.028)	(0.032)	(0.034)	(0.035)	(0.034)	(0.034)	(0.010)

Holiday	0.203***	0.215***	0.112	-0.156*	-0.108	-0.011	0.217***	-0.052***
	(0.077)	(0.069)	(0.109)	(0.083)	(0.093)	(0.098)	(0.082)	(0.019)
Constant	-1.195***	-1.351***	0.374	0.166	0.842**	0.360	-1.429***	0.624***
	(0.329)	(0.191)	(0.260)	(0.462)	(0.414)	(0.330)	(0.356)	(0.134)
Activity categories	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of episodes	38,205	38,205	38,205	38,205	38,205	38,205	38,205	38,205
Number of individuals	9,598	9,598	9,598	9,598	9,598	9,598	9,598	9,598
R-squared	0.115	0.145	0.089	0.165	0.085	0.181	0.163	0.086

Notes: Clustered standard errors at the individual level are given in parentheses. Data come from the 2010, 2012, 2013 and 2021 ATUS WB-Module. Estimation method for specifications is OLS. Dependent variables in columns (1-7) are standardized. Omitted category is maximum temperature in the 70s. Estimates are weighted using sampling demographic weights at the activity level. All models control for activity categories, month, year and state fixed effects, but not shown for brevity. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6. Heterogeneous effects across different age groups, 16-29 males

	Happy	Meaningful	Sad	Stress	Tired	Pain	Net affect	U-index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Under 50s	0.295**	0.178	0.027	0.160	-0.154	0.155	0.163	-0.076**
	(0.127)	(0.133)	(0.111)	(0.137)	(0.129)	(0.102)	(0.121)	(0.037)
50s	0.282**	-0.055	-0.147*	0.063	-0.148	0.033	0.121	-0.050
	(0.130)	(0.134)	(0.087)	(0.128)	(0.115)	(0.082)	(0.112)	(0.033)
60s	-0.011	0.063	0.073	0.061	0.123	0.155*	-0.058	0.017
	(0.118)	(0.104)	(0.117)	(0.109)	(0.099)	(0.084)	(0.107)	(0.034)
80s	-0.142	-0.157	-0.182**	0.057	0.150*	-0.046	-0.135	0.080***
	(0.090)	(0.100)	(0.083)	(0.102)	(0.086)	(0.062)	(0.083)	(0.028)
90s and above	-0.006	-0.208	-0.153	0.000	0.224**	-0.054	-0.115	0.078*
	(0.140)	(0.153)	(0.132)	(0.123)	(0.113)	(0.080)	(0.132)	(0.044)
Change maximum temperature	0.004	-0.004	0.002	-0.004	0.000	0.008*	-0.002	0.001
	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)	(0.002)
Socio-demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Episode characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Activity categories	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of episodes	5,890	5,890	5,890	5,890	5,890	5,890	5,890	5,890
Number of individuals	1,420	1,420	1,420	1,420	1,420	1,420	1,420	1,420
R-squared	0.226	0.236	0.171	0.246	0.131	0.127	0.241	0.145

Notes: Clustered standard errors at the individual level are given in parentheses. Data come from the 2010, 2012, 2013 and 2021 ATUS WB-Module. Estimation method for specifications is OLS. Dependent variables in columns (1-7) are standardized. Omitted category is maximum temperature in the 70s. Estimates are weighted using sampling demographic weights at the activity level. All models control for socio-demographics, episode characteristics, activity categories, month, year and state fixed effects, but not shown for brevity. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7. Heterogeneous effects across different age groups, 30-39 males

	Happy	Meaningful	Sad	Stress	Tired	Pain	Net affect	U-index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Under 50s	-0.163	-0.261**	0.257*	0.100	0.139	0.022	-0.279**	0.079
	(0.129)	(0.129)	(0.135)	(0.128)	(0.127)	(0.128)	(0.126)	(0.049)
50s	-0.003	-0.171	0.202	-0.018	0.106	-0.246**	-0.085	0.057
	(0.116)	(0.120)	(0.134)	(0.127)	(0.129)	(0.119)	(0.128)	(0.042)
60s	-0.086	-0.205**	0.076	-0.015	-0.022	-0.041	-0.122	0.010
	(0.096)	(0.098)	(0.095)	(0.099)	(0.103)	(0.095)	(0.102)	(0.033)
80s	-0.048	-0.112	0.272***	0.138	0.100	0.002	-0.164*	0.008
	(0.092)	(0.096)	(0.104)	(0.099)	(0.098)	(0.088)	(0.099)	(0.030)
90s and above	-0.224	-0.133	0.224**	0.170	0.121	-0.051	-0.235*	-0.032
	(0.141)	(0.125)	(0.105)	(0.115)	(0.127)	(0.100)	(0.120)	(0.039)
Change maximum temperature	-0.002	0.003	0.002	0.009**	0.009*	-0.000	-0.004	0.002
	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.002)
Socio-demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Episode characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Activity categories	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of episodes	6,786	6,786	6,786	6,786	6,786	6,786	6,786	6,786
Number of individuals	1,461	1,461	1,461	1,461	1,461	1,461	1,461	1,461
R-squared	0.218	0.172	0.134	0.249	0.101	0.172	0.219	0.112

Notes: Clustered standard errors at the individual level are given in parentheses. Data come from the 2010, 2012, 2013 and 2021 ATUS WB-Module. Estimation method for specifications is OLS. Dependent variables in columns (1-7) are standardized. Omitted category is maximum temperature in the 70s. Estimates are weighted using sampling demographic weights at the activity level. All models control for socio-demographics, episode characteristics, activity categories, month, year and state fixed effects, but not shown for brevity. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8. Heterogeneous effects across different age groups, 40-49 males

	Happy	Meaningful	Sad	Stress	Tired	Pain	Net affect	U-index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Under 50s	-0.223*	-0.050	0.548***	0.291**	0.290**	-0.021	-0.318**	-0.007
	(0.129)	(0.130)	(0.143)	(0.136)	(0.140)	(0.131)	(0.128)	(0.037)
50s	-0.121	-0.131	0.468***	0.228*	0.317**	0.194	-0.338***	0.048
	(0.120)	(0.132)	(0.134)	(0.130)	(0.133)	(0.121)	(0.122)	(0.042)
60s	-0.134	-0.010	0.246**	0.225**	0.110	0.041	-0.174*	-0.001
	(0.102)	(0.090)	(0.101)	(0.096)	(0.110)	(0.088)	(0.104)	(0.028)
80s	-0.121	-0.186**	0.109	0.184*	0.283***	0.163	-0.283***	0.067**
	(0.098)	(0.089)	(0.093)	(0.106)	(0.103)	(0.104)	(0.098)	(0.033)
90s and above	0.020	-0.032	0.026	-0.067	0.031	-0.087	0.012	-0.017
	(0.121)	(0.117)	(0.118)	(0.130)	(0.126)	(0.120)	(0.119)	(0.038)
Change maximum temperature	-0.001	-0.000	0.006	0.008	0.002	0.001	-0.003	0.001
	(0.005)	(0.004)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.001)
Socio-demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Episode characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Activity categories	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of episodes	6,833	6,833	6,833	6,833	6,833	6,833	6,833	6,833
Number of individuals	1,585	1,585	1,585	1,585	1,585	1,585	1,585	1,585
R-squared	0.189	0.206	0.165	0.236	0.146	0.187	0.263	0.149

Notes: Clustered standard errors at the individual level are given in parentheses. Data come from the 2010, 2012, 2013 and 2021 ATUS WB-Module. Estimation method for specifications is OLS. Dependent variables in columns (1-7) are standardized. Omitted category is maximum temperature in the 70s. Estimates are weighted using sampling demographic weights at the activity level. All models control for socio-demographics, episode characteristics, activity categories, month, year and state fixed effects, but not shown for brevity. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 9. Heterogeneous effects across different age groups, 50-59 males

	Happy	Meaningful	Sad	Stress	Tired	Pain	Net affect	U-index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Under 50s	-0.181	-0.192	-0.109	0.016	-0.038	0.307**	-0.192	0.101**
	(0.130)	(0.129)	(0.186)	(0.136)	(0.143)	(0.149)	(0.139)	(0.047)
50s	-0.064	-0.231*	0.156	0.212*	0.027	0.223	-0.247*	0.078
	(0.136)	(0.134)	(0.150)	(0.127)	(0.119)	(0.140)	(0.139)	(0.047)
60s	-0.130	-0.124	0.032	0.101	0.092	0.148	-0.182*	0.012
	(0.105)	(0.092)	(0.128)	(0.098)	(0.107)	(0.120)	(0.102)	(0.037)
80s	-0.199*	-0.104	-0.015	0.212**	0.101	-0.039	-0.181*	0.047
	(0.116)	(0.091)	(0.114)	(0.108)	(0.101)	(0.116)	(0.107)	(0.042)
90s and above	-0.045	-0.112	-0.067	0.131	0.304**	-0.088	-0.140	0.006
	(0.138)	(0.124)	(0.192)	(0.156)	(0.151)	(0.161)	(0.136)	(0.052)
Change maximum temperature	-0.008	-0.006	0.002	-0.003	-0.003	0.002	-0.005	0.002
	(0.006)	(0.006)	(0.007)	(0.006)	(0.007)	(0.008)	(0.007)	(0.002)
Socio-demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Episode characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Activity categories	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of episodes	4,867	4,867	4,867	4,867	4,867	4,867	4,867	4,867
Number of individuals	1,371	1,371	1,371	1,371	1,371	1,371	1,371	1,371
R-squared	0.186	0.172	0.224	0.255	0.136	0.271	0.241	0.174

Notes: Clustered standard errors at the individual level are given in parentheses. Data come from the 2010, 2012, 2013 and 2021 ATUS WB-Module. Estimation method for specifications is OLS. Dependent variables in columns (1-7) are standardized. Omitted category is maximum temperature in the 70s. Estimates are weighted using sampling demographic weights at the activity level. All models control for socio-demographics, episode characteristics, activity categories, month, year and state fixed effects, but not shown for brevity. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 10. Heterogeneous effects across different age groups, 60+ males

	Happy	Meaningful	Sad	Stress	Tired	Pain	Net affect	U-index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Under 50s	-0.047	0.084	-0.023	-0.152	-0.214*	-0.212	0.146	0.019
	(0.135)	(0.122)	(0.128)	(0.111)	(0.120)	(0.131)	(0.131)	(0.037)
50s	0.100	0.064	-0.067	-0.168*	-0.156	-0.260**	0.199*	-0.044
	(0.125)	(0.112)	(0.105)	(0.102)	(0.119)	(0.105)	(0.119)	(0.027)
60s	-0.105	-0.016	-0.132	-0.271***	-0.177**	-0.328***	0.134	-0.027
	(0.103)	(0.091)	(0.088)	(0.090)	(0.090)	(0.095)	(0.095)	(0.025)
80s	-0.184*	-0.082	0.077	0.030	-0.081	-0.219**	-0.065	0.027
	(0.096)	(0.075)	(0.099)	(0.091)	(0.093)	(0.098)	(0.088)	(0.028)
90s and above	-0.042	-0.093	-0.043	0.107	-0.126	-0.276**	0.008	0.009
	(0.117)	(0.100)	(0.142)	(0.117)	(0.114)	(0.129)	(0.118)	(0.038)
Change maximum temperature	-0.002	0.002	0.004	0.002	0.006	-0.004	-0.002	-0.001
	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.001)
Socio-demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Episode characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Activity categories	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of episodes	6,414	6,414	6,414	6,414	6,414	6,414	6,414	6,414
Number of individuals	2,025	2,025	2,025	2,025	2,025	2,025	2,025	2,025
R-squared	0.117	0.141	0.083	0.179	0.140	0.221	0.172	0.109

Notes: Clustered standard errors at the individual level are given in parentheses. Data come from the 2010, 2012, 2013 and 2021 ATUS WB-Module. Estimation method for specifications is OLS. Dependent variables in columns (1-7) are standardized. Omitted category is maximum temperature in the 70s. Estimates are weighted using sampling demographic weights at the activity level. All models control for socio-demographics, episode characteristics, activity categories, month, year and state fixed effects, but not shown for brevity. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 11. Heterogeneous effects across different places, warmer places

	Happy	Meaningful	Sad	Stress	Tired	Pain	Net affect	U-index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Under 50s	0.010	-0.030	0.089	0.120	0.029	0.072	-0.069	0.028
	(0.095)	(0.082)	(0.090)	(0.085)	(0.093)	(0.086)	(0.089)	(0.030)
50s	0.194**	-0.023	0.102	0.068	0.030	-0.077	0.041	-0.006
	(0.078)	(0.077)	(0.082)	(0.082)	(0.076)	(0.063)	(0.075)	(0.021)
60s	-0.037	-0.042	-0.004	0.004	0.099	-0.010	-0.055	0.003
	(0.068)	(0.057)	(0.061)	(0.061)	(0.062)	(0.057)	(0.064)	(0.018)
80s	-0.099	-0.185***	-0.014	0.080	0.217***	0.039	-0.195***	0.074***
	(0.070)	(0.058)	(0.067)	(0.065)	(0.059)	(0.052)	(0.062)	(0.020)
90s and above	-0.051	-0.197**	-0.119	0.016	0.197***	-0.000	-0.140*	0.036
	(0.092)	(0.083)	(0.086)	(0.081)	(0.073)	(0.068)	(0.082)	(0.025)
Change maximum temperature	-0.002	-0.004	-0.000	0.004	0.003	0.005	-0.005	0.002
	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.001)
Socio-demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Episode characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Activity categories	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of episodes	19,566	19,566	19,566	19,566	19,566	19,566	19,566	19,566
Number of individuals	5,029	5,029	5,029	5,029	5,029	5,029	5,029	5,029
R-squared	0.128	0.157	0.075	0.170	0.065	0.159	0.162	0.084

Notes: Clustered standard errors at the individual level are given in parentheses. Data come from the 2010, 2012, 2013 and 2021 ATUS WB-Module. Estimation method for specifications is OLS. Dependent variables in columns (1-7) are standardized. Omitted category is maximum temperature in the 70s. Estimates are weighted using sampling demographic weights at the activity level. All models control for socio-demographics, episode characteristics, activity categories, month, year and state fixed effects, but not shown for brevity. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 12. Heterogeneous effects across different places, colder places

	Happy	Meaningful	Sad	Stress	Tired	Pain	Net affect	U-index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Under 50s	-0.172	-0.082	0.180	0.099	-0.004	0.011	-0.153	0.019
	(0.112)	(0.117)	(0.117)	(0.122)	(0.112)	(0.107)	(0.112)	(0.039)
50s	-0.228**	-0.270**	0.100	0.029	0.003	0.147	-0.260**	0.046
	(0.110)	(0.114)	(0.110)	(0.113)	(0.106)	(0.099)	(0.108)	(0.037)
60s	-0.254***	-0.054	0.108	0.103	-0.034	0.107	-0.172*	0.022
	(0.091)	(0.081)	(0.104)	(0.094)	(0.081)	(0.083)	(0.088)	(0.028)
80s	-0.192**	-0.055	0.033	0.138	0.121	-0.031	-0.154*	0.032
	(0.078)	(0.096)	(0.075)	(0.102)	(0.084)	(0.076)	(0.080)	(0.025)
90s and above	-0.053	0.118	0.306	0.355**	0.274*	-0.293***	-0.096	0.008
	(0.107)	(0.122)	(0.197)	(0.160)	(0.143)	(0.091)	(0.119)	(0.037)
Change maximum temperature	-0.003	-0.002	0.005	0.002	0.004	0.001	-0.004	0.001
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.001)
Socio-demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Episode characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Activity categories	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of episodes	11,224	11,224	11,224	11,224	11,224	11,224	11,224	11,224
Number of individuals	2,833	2,833	2,833	2,833	2,833	2,833	2,833	2,833
R-squared	0.140	0.140	0.110	0.191	0.086	0.136	0.176	0.080

Notes: Clustered standard errors at the individual level are given in parentheses. Data come from the 2010, 2012, 2013 and 2021 ATUS WB-Module. Estimation method for specifications is OLS. Dependent variables in columns (1-7) are standardized. Omitted category is maximum temperature in the 70s. Estimates are weighted using sampling demographic weights at the activity level. All models control for socio-demographics, episode characteristics, activity categories, month, year and state fixed effects, but not shown for brevity. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 13. Cognitive well-being measures

	Life satisfaction			General health status		
	Pooled	Males	Females	Pooled	Males	Females
Under 50s	-0.300***	-0.288***	-0.314**	0.014	0.059	-0.024
	(0.071)	(0.084)	(0.129)	(0.039)	(0.077)	(0.051)
50s	-0.212***	-0.167	-0.254**	-0.017	-0.019	-0.016
	(0.074)	(0.146)	(0.106)	(0.039)	(0.054)	(0.051)
60s	-0.122**	-0.009	-0.217**	-0.018	0.025	-0.054
	(0.058)	(0.087)	(0.105)	(0.030)	(0.048)	(0.040)
80s	-0.029	0.016	-0.064	-0.015	-0.007	-0.019
	(0.078)	(0.111)	(0.123)	(0.031)	(0.036)	(0.041)
90s and above	0.006	0.064	-0.021	0.045	0.069	0.025
	(0.105)	(0.127)	(0.158)	(0.036)	(0.052)	(0.047)
Change maximum temperature	-0.011***	-0.011*	-0.011***	0.000	0.001	-0.001
	(0.004)	(0.005)	(0.004)	(0.002)	(0.003)	(0.002)
Male	-0.215***	-	-	-0.023	-	-
	(0.040)			(0.021)		
Age	-0.035***	-0.050***	-0.022*	0.051***	0.051***	0.051***
	(0.009)	(0.012)	(0.012)	(0.005)	(0.008)	(0.004)
Age squared/100	0.049***	0.065***	0.036***	-0.043***	-0.043***	-0.045***
	(0.008)	(0.012)	(0.011)	(0.005)	(0.008)	(0.004)
Native citizen	-0.024	-0.110	0.085	-0.054**	-0.044	-0.056
	(0.070)	(0.109)	(0.063)	(0.026)	(0.040)	(0.047)
Secondary education	-0.270**	-0.295**	-0.256*	-0.188***	-0.155*	-0.225***
	(0.119)	(0.130)	(0.138)	(0.057)	(0.090)	(0.038)
University education	-0.411***	-0.415***	-0.428***	-0.351***	-0.330***	-0.386***
	(0.106)	(0.108)	(0.127)	(0.061)	(0.094)	(0.046)
Employed	0.148**	0.239**	0.074	-0.227***	-0.238***	-0.237***
	(0.063)	(0.089)	(0.080)	(0.023)	(0.031)	(0.034)
Married or cohabiting	0.526***	0.462***	0.574***	-0.125***	-0.046	-0.199***
	(0.045)	(0.056)	(0.076)	(0.024)	(0.032)	(0.028)
Number of household members	-0.006	-0.022	0.014	0.075***	0.062***	0.093***
	(0.026)	(0.043)	(0.040)	(0.012)	(0.011)	(0.019)
Number of children	0.062	0.099*	0.017	-0.085***	-0.072***	-0.113***
	(0.038)	(0.057)	(0.049)	(0.014)	(0.017)	(0.024)
Medium family income	0.049	-0.001	0.092	-0.247***	-0.177***	-0.292***
	(0.053)	(0.122)	(0.084)	(0.028)	(0.037)	(0.035)
High family income	0.264***	0.265**	0.254**	-0.444***	-0.313***	-0.545***
	(0.060)	(0.119)	(0.114)	(0.028)	(0.041)	(0.034)
Health status	1.283***	1.319***	1.268***	-	-	-
	(0.066)	(0.127)	(0.078)			
Weekend day	-0.046	-0.032	-0.067	-0.009	0.019	-0.036
	(0.028)	(0.054)	(0.045)	(0.022)	(0.028)	(0.028)
Holiday	0.105	0.224	0.013	0.026	0.160	-0.090
	(0.248)	(0.466)	(0.201)	(0.116)	(0.177)	(0.103)
Constant	7.704***	7.800***	5.995***	1.512***	1.415***	2.374***
	(0.213)	(0.370)	(0.296)	(0.092)	(0.140)	(0.127)
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes	Yes	Yes

Number of individuals/observations	12,132	5,455	6,677	17,460	7,862	9,598
R-squared	0.110	0.116	0.117	0.110	0.100	0.137

Notes: Clustered standard errors at the state level are given in parentheses. Data come from the 2010, 2012, 2013 and 2021 ATUS WB-Module. Estimation method for specifications is OLS. Omitted category is maximum temperature in the 70s. Estimates are weighted using sampling demographic weights at the individual level. All models control for month, year and state fixed effects, but not shown for brevity. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

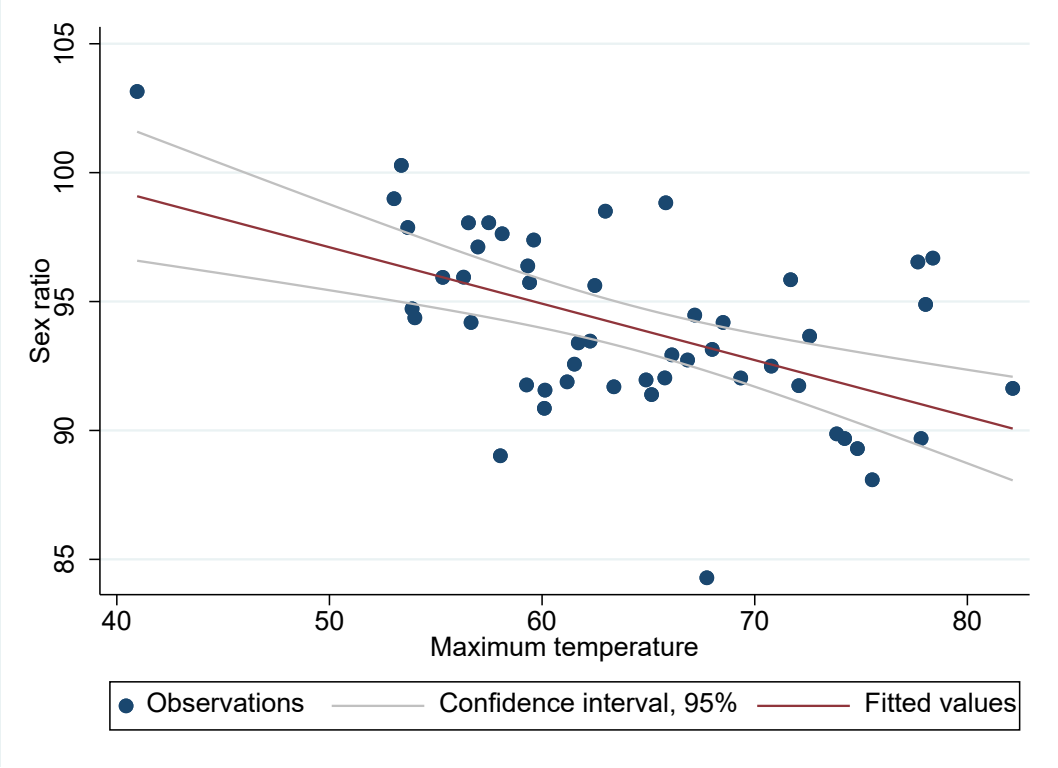
Table 14. Sleep time and quality

	(Log) Sleeping time			Well-rested		
	Pooled	Males	Females	Pooled	Males	Females
Under 50s	0.009*	-0.000	0.016**	0.045	0.084	0.014
	(0.005)	(0.007)	(0.007)	(0.029)	(0.053)	(0.041)
50s	0.006	0.006	0.006	0.005	0.002	0.013
	(0.004)	(0.007)	(0.006)	(0.027)	(0.040)	(0.044)
60s	0.007**	0.019***	-0.004	0.048*	0.042	0.055
	(0.003)	(0.005)	(0.004)	(0.029)	(0.037)	(0.035)
80s	0.000	0.010*	-0.008*	0.066**	0.075**	0.056
	(0.004)	(0.005)	(0.005)	(0.028)	(0.034)	(0.040)
90s and above	-0.005	0.002	-0.012	0.070*	0.047	0.081
	(0.004)	(0.007)	(0.008)	(0.035)	(0.059)	(0.055)
Change maximum temperature	-0.000	-0.000	0.000	0.001	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.002)	(0.002)	(0.002)
Male	-0.010***	-	-	-0.079***	-	-
	(0.004)			(0.017)		
Age	-0.006***	-0.006***	-0.005***	0.007**	0.011***	0.003
	(0.000)	(0.001)	(0.001)	(0.003)	(0.003)	(0.004)
Age squared/100	0.005***	0.006***	0.004***	-0.013***	-0.016***	-0.010**
	(0.000)	(0.001)	(0.001)	(0.003)	(0.004)	(0.004)
Native citizen	-0.030***	-0.037***	-0.026***	0.099***	0.091***	0.106***
	(0.003)	(0.006)	(0.004)	(0.018)	(0.023)	(0.029)
Secondary education	-0.018***	-0.013**	-0.021***	-0.025	-0.014	-0.038
	(0.004)	(0.006)	(0.005)	(0.034)	(0.037)	(0.048)
University education	-0.040***	-0.036***	-0.045***	0.062**	0.076**	0.051
	(0.005)	(0.007)	(0.006)	(0.028)	(0.033)	(0.038)
Employed	-0.069***	-0.081***	-0.058***	0.050**	0.057	0.046*
	(0.003)	(0.006)	(0.004)	(0.021)	(0.038)	(0.023)
Married or cohabiting	-0.009***	-0.022***	-0.001	0.030	0.013	0.042
	(0.003)	(0.004)	(0.002)	(0.024)	(0.031)	(0.029)
Number of household members	0.008***	0.007***	0.008***	-0.035***	-0.018*	-0.054***
	(0.002)	(0.002)	(0.002)	(0.009)	(0.010)	(0.016)
Number of children	-0.017***	-0.011***	-0.020***	0.051***	0.028**	0.073**
	(0.002)	(0.003)	(0.003)	(0.016)	(0.011)	(0.028)
Medium family income	-0.020***	-0.017**	-0.024***	-0.026	-0.076***	0.023
	(0.005)	(0.008)	(0.004)	(0.024)	(0.026)	(0.041)
High family income	-0.034***	-0.030***	-0.038***	-0.000	-0.009	0.008
	(0.007)	(0.011)	(0.006)	(0.030)	(0.037)	(0.042)
Health status	-	-	-	-0.518***	-0.481***	-0.557***
				(0.021)	(0.036)	(0.035)
Weekend day	0.102***	0.107***	0.097***	-0.116***	-0.123***	-0.107***
	(0.002)	(0.003)	(0.003)	(0.011)	(0.018)	(0.021)
Holiday	0.107***	0.115***	0.100***	0.021	0.065	-0.013
	(0.010)	(0.011)	(0.013)	(0.057)	(0.087)	(0.079)
Constant	3.882	-9.883	16.161	2.223***	2.073***	3.056***
	(12.935)	(26.520)	(20.127)	(0.057)	(0.110)	(0.088)
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes	Yes	Yes

Number of individuals/observations	85,980	37,968	48,012	17,460	7,862	9,598
R-squared	0.084	0.096	0.077	0.074	0.074	0.083

Notes: Clustered standard errors at the state level are given in parentheses. Data come from the 2003-2019 and 2021 ATUS in Columns (1-3) and from the 2010, 2012, 2013 and 2021 ATUS WB-Module in Columns (4-6). Estimation method for specifications is OLS. Omitted category is maximum temperature in the 70s. Estimates are weighted using sampling demographic weights at the individual level. All models control for month, year and state fixed effects, but not shown for brevity. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure 1. Scatter plot of sex ratio vs. maximum temperature, state averages during 1980-2021



Notes: Author's own elaboration. Each circle represents the average sex ratio and maximum temperature in a state during 1980-2021. The red line trend describes the relation between sex ratio and maximum temperature in these states, whereas the grey lines represent the associated 95% confidence intervals.

APPENDIX A

Table A1. Description of socio-demographics set from ATUS WB-M

Variable name	Definition and measurements
1) Male	Coded from sex, 1 if male. Value 0 otherwise
2) Age	Coded from age, measured in years
3) Native citizen	Coded from citizen, 1 if citizen equal to "Native, born in United States". Value 0 otherwise
4) Primary education	Coded from educ, 1 if educ equal to "Less than 1st grade", "1st, 2nd, 3rd, or 4th grade", "5th or 6th grade", "7th or 8th grade", "9th grade", "10th grade", "11th grade", "12th grade, no diploma". Value 0 otherwise
5) Secondary education	Coded from educ, 1 if educ equal to "High school graduate – GED", "High school graduate – diploma". Value 0 otherwise
6) University education	Coded from educ, 1 if educ equal to "Some college but no degree", "Associate degree – occupational vocational", "Associate degree – academic program", "Bachelor's degree (BA, AB, BS, etc.)", "Master's degree (MA, MS, Meng, Med, MSW, etc.)", "Professional school degree (MD, DDS, DVM, etc.)", "Doctoral degree (PhD, EdD, etc.)". Value 0 otherwise
7) Employed	Coded from empstat, 1 if empstat equal to "Employed – at work", "Employed – absent". Value 0 otherwise
8) Married or cohabiting	Coded from marst, 1 if marst equal to "Married – spouse present", "Married – spouse absent". Value 0 otherwise
9) Number of household members	Coded from hhsize: Number of people living in the family
10) Number of children	Coded from hh_numkids: Number of children under 18 in household
11) Low family income	Coded from famincome, 1 if famincome equal to "Less than $24,999". Value 0 otherwise
12) Medium family income	Coded from famincome, 1 if famincome equal to "From $25,000 to $74,999". Value 0 otherwise
13) High family income	Coded from famincome, 1 if famincome equal to "$75,000 and over". Value 0 otherwise
14) Health status	Coded from genhealth, 1 if genhealth equal to "Excellent", "Very good", "Good". Value 0 otherwise
15) Episode with other	Coded from relatew, 1 if relatew equal to "Spouse", "Unmarried partner", "Own household child", "Grandchild", "Parent", "Brother sister", "Other related person", "Foster child", "Housemate, roommate", "Roomer, boarder", "Other nonrelative", "Own non-household child under 18", "Parents (not living in household)", "Other non-household family members under 18", "Other non-household family members 18 and older (including parents-in-law)", "Friends", "Co-workers, colleagues, clients (non-work activities only)", "Neighbors, acquaintances", "Other non-household children under 18", "Other non-household adults 18 and older", "Boss or manager (work activities only, 2010+)", "People whom I supervise (work activities only, 2010+)", "Co-workers (work activities only, 2010+", "Customers (work activities only, 2010+)". Value 0 otherwise
16) Episode at home	Coded from where, 1 if where equal to "Respondent's home or yard", "Someone else's home". Value 0 otherwise
17) Episode outdoors	Coded from where, 1 if where equal to "Outdoors away from home", "Other place", "Unspecified place". Value 0 otherwise
18) Episode indoors	Coded from where, 1 if where equal to "Respondent's workplace", "Restaurant or bar", "Place of worship", "Grocery store", "Other store, mall", "School", "Library", "Bank (2004+)", "Gym/health club (2004+)", "Post office (2004+)". Value 0 otherwise
19) Episode travelling	Coded from where, 1 if where equal to "Car, truck or motorcycle (driver)", "Car, truck or motorcycle (passenger)", "Walking", "Bus", "Subway, train", "Bicycle", "Boat, ferry", "Taxi, limousine service, "Airplane", "Other mode of transportation", "Unspecified mode of transportation". Value 0 otherwise
20) Weekend day	Coded from day, 1 if day equal to "Saturday", "Sunday". Value 0 otherwise

21) Holiday	Coded from holiday, 1 if holiday equal to yes. Value 0 otherwise

Source: Author's own elaboration

Table A2. Classification of time use categories, American Time Use Survey Well-Being Module 2010, 2012, 2013, 2021

Time use categories	Time use activity codes
Personal care	Health-related self care; Self care, n.e.c.; Using health and care services outside the home; Using in-home health and care services; Waiting associated with medical services; Using medical services, n.e.c.; Using personal care services; Waiting associated with personal care services; Eating and drinking; Waiting associated with eating and drinking; Providing care; Telephone calls to or from professional or personal care services providers; Travel related to personal care; Travel related to using personal care services; Travel related to using professional and personal care services, n.e.c.; Travel related to eating and drinking
Cooking	Food and drink preparation
Shopping	Grocery shopping; Purchasing gas; Purchasing food (not groceries); Shopping, except groceries, food, and gas; Waiting associated with shopping; Comparison shopping; Travel related to grocery shopping; Travel related to purchasing food (not groceries) (2005+); Travel related to shopping, ex groceries, food, and gas (2005+); Travel related to purchasing gas (2004+)
Other housework	Interior cleaning; Laundry; Sewing, repairing, and maintaining textiles; Storing interior household items, including food; Housework, n.e.c.; Food presentation; Kitchen and food clean-up; Interior arrangement, decoration, and repairs; Building and repairing furniture; Heating and cooling; Interior maintenance, repair, and decoration, n.e.c.; Exterior cleaning; Exterior repair, improvements, and decoration; Lawn, garden, and houseplant care; Ponds, pools, and hot tubs; Care for animals and pets (not veterinary care); Pet and animal care, n.e.c.; Vehicle repair and maintenance (by self); Appliance, tool, and toy set-up, repair, and maintenance (by self); Appliances and tools, n.e.c.; Financial management; Household and personal organization and planning; Household and personal mail and messages; Home security; Household management, n.e.c.; Household activities, n.e.c.; Physical care for household adults; Looking after household adult; Providing medical care to household adult; Obtaining medical and care services for household adult; Waiting associated with caring for household adults; Caring for household adults, n.e.c.; Helping household adults; Picking up/dropping off household adult; Waiting associated with helping household adults; Helping household adults, n.e.c.; Caring for and helping household members, n.e.c.; Helping household adults, n.e.c.; Caring for and helping household members, n.e.c.; Homework (nonhh children); Physical care for non-household adults; Looking after non household adult; Providing medical care to non-household adult; Obtaining medical and care services for non-household adult; Waiting associated with caring for non-household adults; Caring for non-household adults, n.e.c.; Housework, cooking, and shopping assistance, n.e.c.; House and lawn maintenance and repair assistance for non-household adults; Animal and pet care assistance for non-household adults; Vehicle and appliance maintenance or repair assistance for non-household adults; Financial management assistance for non-household adults; Household management and paperwork assistance for non-household adults; Picking up or dropping off non-household adult; Waiting associated with helping non-household adults; Helping non-household adults, n.e.c.; Banking; Using other financial services; Waiting associated with banking or financial services; Using legal services; Activities related to purchasing or selling real estate; Using veterinary services; Waiting associated with veterinary

	services; Professional and personal services, n.e.c.; Using interior cleaning services; Using clothing repair and cleaning services; Using home maintenance, repair, decoration, or construction services; Waiting associated with home maintenance, repair, decoration, or construction; Using pet services; Waiting associated with pet services; Using lawn and garden services; Using vehicle maintenance or repair services; Using vehicle maintenance and repair services, n.e.c.; Using police and fire services; Using social services; Obtaining licenses and paying fines, fees, or taxes; Using government services, n.e.c.; Security procedures related to government services or civic obligations; Telephone calls to or from salespeople; Telephone calls to or from household services providers; Telephone calls to or from government officials; Travel related to housework; Travel related to food and drink preparation, clean-up, and presentation; Travel related to interior maintenance, repair, and decoration; Travel related to exterior maintenance, repair, and decoration; Travel related to lawn, garden, and houseplant care; Travel related to care for animals and pets; Travel related to vehicle care and maintenance; Travel related to appliance, tool, and toy set-up, repair, and maintenance; Travel related to household management; Travel related to caring for household adults; Travel related to helping household adults; Travel related to caring for and helping non-household children; Travel related to caring for non-household adults; Travel related to helping non-household adults; Travel related to using financial services and banking; Travel related to using legal services; Travel related to using medical services; Travel related to using personal care services; Travel related to using real estate services; Travel related to using veterinary services; Travel related to using household services; Travel related to using home maintenance, repair, decoration, or construction services; Travel related to using pet services (not veterinary care); Travel related to using lawn and garden services; Travel related to using vehicle maintenance and repair services; Travel related to using government services; Travel related to civic obligations and participation
Childcare	Physical care for household children; Reading to/with household children; Playing with household children, not sports; Arts and crafts with household children; Playing sports with household children; Talking with/listening to household children; Organization and planning for household children; Looking after household children; Attending household children's events; Waiting for/with household children; Picking up/dropping off household children; Caring for and helping household children, n.e.c.; Homework (household children); Meetings and school conferences (household children); Home schooling of household children; Activities related to household child's education; Providing medical care to household children; Obtaining medical care for household children; Waiting associated with household children's education; Physical care for non-household children; Reading to/with non-household children; Playing with non-household children, not sports; Arts and crafts with non-household children; Playing sports with non-household children; Talking with/listening to non-household children; Organization and planning for non-household children; Looking after non-household children; Attending non-household children's events; Waiting for/with non-household children; Dropping off/picking up non-household children; Caring for and helping non-household children; Home schooling of non-household children; Waiting associated with non-household children's education; Using paid childcare services; Travel related to caring for and helping household children; Travel related to household children's education; Travel related to household children's health; Travel related to

	non-household children's education; Travel related to non-household children's health; Travel related to using childcare services
Market work	Work, main job; Work, other job(s); Waiting associated with working; Working, n.e.c.; Socializing, relaxing, and leisure as part of job; Eating and drinking as part of job; Work-related activities, n.e.c.; Income-generating hobbies, crafts, and food; Income-generating services; Income-generating rental property activities; Other income-generating activities, n.e.c.; Jobs earch activities; Job interviewing;Job search and interviewing, n.e.c.; Taking class for degree, certification or licensure; Taking class for personal interest; Waiting associated with taking classes; Extracurricular club activities; Extracurricular music and performance activities; Education-related extracurricular activities; Research/homework for class for degree, certification, or licensure; Research/homework for class for personal interest; Research/homework, n.e.c.; Administrative activities: class for degree, certification or licensure; Waiting associated with administrative activities; Administrative for education, n.e.c.; Education, n.e.c.; Teaching, leading, counselling, mentoring; Telephone calls to/from education services; Travel related to working; Travel related to work-related activities; Travel related to income-generating activities; Travell related to job search and interviewing; Travel related to taking class; Travel related to extracurricular activities; Travel related to research/homework; Travel related to registration/administrative activities; Education travel, n.e.c.
Outdoor leisure	Walking, exercising, playing with animals; Attending performing arts; Attending museums; Attending movies/film; Attending gambling establishments; Watching boating; Watching softball; Watching vehicle touring/racing; Fundraising; Building houses, wildlife sites, and other structures; Attending meetings, conferences, and training; Travel related to relaxing and leisure; Security procedures related to traveling; Traveling, n.e.c.
Indoor leisure	Relaxing, thinking; Tobacco and drug use; Playing games; Computer use for leisure; Relaxing and leisure, n.e.c.; Watching baseball; Computer use; Organizing and preparing; Administrative and support activities, n.e.c.; Food preparation, presentation, clean-up; Collecting and delivering clothing and other goods; Performing
Entertainment	Television and movies; Television; Listening to the radio; Listening To/playing music
Religious	Attending religious services; Participation in religious practices; Waiting associated with religious and spiritual practices; Religious education activities; Religious and spiritual activities, n.e.c.; Social services and care activities, n.e.c.; Serving at volunteer events and cultural activities; Security procedures related to volunteer activities; Volunteer activities, n.e.c.; Travel related to religious/spiritual practices: Travel related to volunteering; Travel related to volunteer activities, n.e.c.
Hobbies	Arts and crafts as a hobby; Collecting as a hobby; Hobbies, except arts and crafts and collecting; Arts and entertainment, n.e.c.; Waiting associated with arts and entertainment; Travel related to arts and entertainment; Travel as a form of entertainment
Reading	Reading for personal interest; Writing for personal interest; Reading; Writing
Socializing	Civic obligations and participation; Waiting associated with using government services; Socializing and communicating with others; Attending

	or hosting parties/receptions/ceremonies; Attending meetings for personal interest; Attending/hosting social events, n.e.c.; Relaxing, thinking; Relaxing and leisure, n.e.c.; Waiting associated with socializing and communicating; Waiting associated with relaxing/leisure; Socializing, relaxing and leisure, n.e.c.; Watching baseball; Watching basketball; Watching dancing; Watching equestrian sports; Watching football; Watching hockey; Watching racquet sports; Watching soccer; Watching water sports; Telephone calls (except hotline counselling); Administrative and support activities, n.e.c.; Food preparation, presentation, clean-up; Collecting and delivering clothing and other goods; Indoor and outdoor maintenance, repair, and clean-up; Indoor and outdoor maintenance, building, and clean-up activities, n.e.c.; Performing; Public health services; Telephone calls to/from family members; Phone calls to/from friends, neigbors, or acquaintances; Telephone calls (to or from), n.e.c.; Waiting associated with telephone calls; Travel related to socializing and communicating; Travel related to attending or hosting social events; Travel related to socializing, relaxing, leisure, n.e.c.; Travel related to phone calls
Sports	Doing aerobics; Playing baseball; Playing basketball; Biking; Playing billiards; Boating; Bowling; Climbing, spelunking, caving; Dancing; Participating in equestrian sports; Fishing; Playing football; Golfing; Hiking; Playing hockey; Hunting; Participating in martial arts; Playing racquet sports; Rollerblading; Running; Skiing, ice skating, snowboarding; Playing soccer; Playing softball; Using cardiovascular equipment; Vehicle touring/racing; Playing volleyball; Walking; Participating in water sports; Weightlifting/strength training; Working out, unspecified; Doing yoga; Playing sports, n.e.c.; Attending sporting events, n.e.c.; Waiting related to playing sports or exercising; Waiting related to attending sporting events; Travel related to participating in sports/exercise/recreation; Travel related to attending sporting or recreational events

Source: Author's own elaboration

APPENDIX B

Table B1. Regression results, effect of weather on instant feelings, males

	Happy	Meaningful	Sad	Stress	Tired	Pain	Net affect	U-index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Log) Episode duration	0.009	0.048***	0.049**	0.073***	-0.018	0.026*	0.002	0.002
	(0.018)	(0.017)	(0.019)	(0.018)	(0.016)	(0.014)	(0.016)	(0.005)
Episode with other	0.214***	0.227***	-0.106***	-0.038	-0.003	-0.064**	0.222***	-0.027**
	(0.038)	(0.034)	(0.039)	(0.036)	(0.031)	(0.029)	(0.032)	(0.011)
Episode at home	-0.004	0.164***	-0.151**	-0.061	-0.058	0.006	0.122***	-0.012
	(0.044)	(0.049)	(0.068)	(0.054)	(0.048)	(0.037)	(0.046)	(0.013)
Episode outdoors	0.134**	0.157***	-0.120	0.005	-0.167***	0.018	0.176***	-0.047***
	(0.054)	(0.061)	(0.077)	(0.070)	(0.064)	(0.058)	(0.058)	(0.016)
Episode indoors	-0.048	0.081	-0.120**	-0.067	-0.102**	0.041	0.068	-0.010
	(0.048)	(0.052)	(0.061)	(0.052)	(0.049)	(0.041)	(0.048)	(0.015)
0 < prec. < 0.1	-0.061	-0.108	0.076	0.197**	0.085	0.033	-0.151**	-0.022
	(0.074)	(0.077)	(0.074)	(0.083)	(0.082)	(0.071)	(0.067)	(0.022)
0.1 < prec. < 0.5	-0.010	-0.052	0.093	0.117*	0.062	-0.077	-0.066	0.008
	(0.058)	(0.066)	(0.062)	(0.062)	(0.057)	(0.054)	(0.060)	(0.022)
0.5 < prec. <1	-0.046	-0.020	-0.087	-0.103	-0.054	-0.063	0.033	-0.053***
	(0.092)	(0.094)	(0.058)	(0.084)	(0.073)	(0.072)	(0.068)	(0.020)
1 ≤ prec.	-0.035	-0.001	0.060	0.014	0.004	0.007	-0.028	-0.003
	(0.043)	(0.039)	(0.043)	(0.042)	(0.036)	(0.036)	(0.038)	(0.012)
Change precipitation	0.000	0.000	0.001	0.000	0.001**	0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)
0 < snow. < 0.1	-0.053	0.329*	0.048	0.255	-0.029	0.042	0.069	-0.054*
	(0.149)	(0.178)	(0.196)	(0.271)	(0.291)	(0.246)	(0.204)	(0.032)
0.1 < snow. < 0.5	-0.157	0.146	0.257	0.007	0.212	0.258	-0.134	0.014
	(0.146)	(0.161)	(0.231)	(0.141)	(0.144)	(0.199)	(0.159)	(0.043)
0.5 < snow. <1	0.201	-0.044	-0.252*	-0.075	-0.088	-0.213	0.173	-0.006
	(0.195)	(0.128)	(0.149)	(0.190)	(0.129)	(0.150)	(0.162)	(0.094)
1 ≤ snow.	0.001	-0.010	0.029	-0.055	-0.052	-0.092	0.033	0.036
	(0.107)	(0.105)	(0.099)	(0.108)	(0.100)	(0.084)	(0.107)	(0.035)
Change snowfall	0.004	0.002	-0.004	-0.003	0.002	-0.001	0.003	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.001)
Under 50s	-0.045	-0.043	0.110	0.105	0.005	0.076	-0.091	0.009
	(0.068)	(0.069)	(0.072)	(0.072)	(0.072)	(0.066)	(0.068)	(0.022)
50s	0.068	-0.122*	0.077	0.036	0.023	0.031	-0.061	0.012
	(0.068)	(0.068)	(0.067)	(0.068)	(0.065)	(0.056)	(0.063)	(0.018)
60s	-0.086	-0.040	0.004	0.017	0.059	0.022	-0.073	0.011
	(0.060)	(0.050)	(0.053)	(0.053)	(0.051)	(0.045)	(0.052)	(0.015)
80s	-0.129**	-0.134***	0.020	0.123**	0.174***	0.039	-0.187***	0.062***
	(0.055)	(0.051)	(0.053)	(0.056)	(0.049)	(0.045)	(0.050)	(0.016)
90s and above	-0.087	-0.125*	0.005	0.112	0.201***	-0.037	-0.154**	0.030
	(0.074)	(0.071)	(0.085)	(0.075)	(0.067)	(0.058)	(0.069)	(0.021)
Change maximum temperature	-0.003	-0.003	0.003	0.003	0.003	0.003	-0.005*	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)
Age	-0.002	0.023***	0.025***	0.020***	-0.008	0.032***	-0.002	0.001
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.002)
Age squared/100	0.006	-0.017***	-0.025***	-0.024***	0.003	-0.028***	0.008	-0.002
	(0.006)	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)	(0.005)	(0.002)
Native citizen	-0.081*	-0.107***	-0.096**	0.010	0.013	0.069*	-0.083*	0.037***

	(0.042)	(0.041)	(0.044)	(0.044)	(0.042)	(0.038)	(0.043)	(0.012)
Secondary education	-0.141**	-0.017	-0.116*	-0.034	-0.002	-0.054	-0.025	0.025
	(0.057)	(0.058)	(0.066)	(0.061)	(0.058)	(0.054)	(0.061)	(0.016)
University education	-0.195***	-0.024	-0.039	0.101*	0.103*	-0.070	-0.111**	0.037**
	(0.053)	(0.052)	(0.068)	(0.059)	(0.056)	(0.051)	(0.055)	(0.015)
Employed	0.115**	0.052	-0.123***	-0.057	0.120***	-0.192***	0.106**	-0.003
	(0.047)	(0.042)	(0.047)	(0.042)	(0.040)	(0.039)	(0.042)	(0.012)
Married or cohabiting	0.102***	0.051	-0.022	-0.002	0.018	0.031	0.056	-0.012
	(0.039)	(0.039)	(0.038)	(0.042)	(0.038)	(0.038)	(0.039)	(0.013)
Number of household members	0.022	0.019	0.025	-0.005	0.012	0.014	0.009	0.003
	(0.018)	(0.019)	(0.019)	(0.019)	(0.018)	(0.017)	(0.017)	(0.006)
Number of children	0.004	0.012	-0.057**	0.008	-0.028	-0.021	0.025	-0.009
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.021)	(0.022)	(0.007)
Medium family income	-0.025	-0.091*	-0.109**	-0.128**	-0.062	-0.175***	0.040	-0.014
	(0.051)	(0.050)	(0.052)	(0.052)	(0.046)	(0.045)	(0.050)	(0.014)
High family income	-0.060	-0.156***	-0.155***	-0.045	0.001	-0.215***	-0.020	-0.011
	(0.050)	(0.051)	(0.051)	(0.054)	(0.048)	(0.047)	(0.051)	(0.015)
Health status	0.279***	0.137***	-0.344***	-0.320***	-0.329***	-0.618***	0.483***	-0.132***
	(0.050)	(0.049)	(0.053)	(0.049)	(0.044)	(0.053)	(0.052)	(0.018)
Weekend day	0.107***	-0.014	-0.081**	-0.148***	-0.138***	-0.050*	0.120***	-0.020**
	(0.034)	(0.031)	(0.034)	(0.032)	(0.031)	(0.028)	(0.030)	(0.010)
Holiday	-0.005	-0.178*	0.159	-0.040	0.196*	-0.012	-0.144	0.012
	(0.091)	(0.105)	(0.142)	(0.108)	(0.118)	(0.098)	(0.088)	(0.029)
Constant	-0.224	-1.024***	-0.127	-0.623***	0.635**	0.273	-0.605***	0.220**
	(0.208)	(0.248)	(0.180)	(0.223)	(0.301)	(0.287)	(0.204)	(0.094)
Activity categories	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of episodes	29,993	29,993	29,993	29,993	29,993	29,993	29,993	29,993
Number of individuals	7,642	7,642	7,642	7,642	7,642	7,642	7,642	7,642
R-squared	0.121	0.142	0.078	0.174	0.065	0.140	0.159	0.074

Notes: Clustered standard errors at the individual level appear in parentheses. Data come from the 2010, 2012, 2013 and 2021 ATUS WB-Module. Omitted categories are no rain, no snowfall, and maximum temperature in the 70s. Estimates are weighted using sampling demographic weights at the activity level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B2. Regression results, effect of weather on instant feelings, females

	Happy	Meaningful	Sad	Stress	Tired	Pain	Net affect	U-index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Log) Episode duration	0.020	0.070***	0.029*	0.049***	-0.012	0.040**	0.020	0.002
	(0.017)	(0.016)	(0.016)	(0.018)	(0.019)	(0.018)	(0.019)	(0.006)
Episode with other	0.206***	0.219***	-0.080**	-0.034	0.025	0.007	0.190***	-0.035***
	(0.032)	(0.030)	(0.035)	(0.033)	(0.033)	(0.033)	(0.032)	(0.012)
Episode at home	-0.024	0.249***	-0.048	-0.038	-0.006	0.006	0.120***	-0.037**
	(0.047)	(0.044)	(0.042)	(0.048)	(0.046)	(0.053)	(0.045)	(0.015)
Episode outdoors	-0.044	0.287***	0.045	0.056	-0.071	0.088	0.096	-0.057***
	(0.082)	(0.062)	(0.068)	(0.082)	(0.071)	(0.089)	(0.077)	(0.020)
Episode indoors	0.032	0.170***	-0.078*	-0.023	-0.145***	-0.001	0.141***	-0.025
	(0.049)	(0.046)	(0.046)	(0.051)	(0.053)	(0.053)	(0.049)	(0.017)
0 < prec. < 0.1	-0.063	-0.041	-0.124*	0.024	-0.096	-0.121*	0.017	0.027
	(0.066)	(0.068)	(0.068)	(0.086)	(0.087)	(0.071)	(0.078)	(0.033)
0.1 < prec. < 0.5	0.112**	0.080	-0.052	0.005	-0.037	-0.040	0.102*	-0.034**
	(0.054)	(0.051)	(0.056)	(0.059)	(0.065)	(0.060)	(0.058)	(0.017)
0.5 < prec. <1	-0.108	0.033	0.140	0.136	0.168**	0.068	-0.129	0.016
	(0.093)	(0.067)	(0.088)	(0.090)	(0.079)	(0.096)	(0.084)	(0.027)
1 ≤ prec.	0.003	0.032	-0.005	0.061	0.038	-0.011	-0.002	-0.005
	(0.039)	(0.040)	(0.038)	(0.042)	(0.042)	(0.045)	(0.046)	(0.015)
Change precipitation	0.000	-0.000	0.000	0.000	-0.001	-0.001	0.000	-0.000
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
0 < snow. < 0.1	-0.351*	-0.043	0.381	-0.109	-0.226	-0.160	-0.106	0.003
	(0.192)	(0.191)	(0.245)	(0.224)	(0.293)	(0.136)	(0.167)	(0.076)
0.1 < snow. < 0.5	0.301**	0.256*	0.154	0.145	0.195	-0.059	0.142	-0.060
	(0.148)	(0.133)	(0.137)	(0.166)	(0.188)	(0.143)	(0.127)	(0.039)
0.5 < snow. <1	0.242**	0.023	-0.138	-0.173	-0.328	-0.139	0.264*	-0.057
	(0.110)	(0.208)	(0.109)	(0.169)	(0.206)	(0.122)	(0.154)	(0.035)
1 ≤ snow.	-0.009	-0.035	-0.004	-0.157	-0.101	0.069	0.024	0.005
	(0.089)	(0.083)	(0.102)	(0.099)	(0.100)	(0.122)	(0.095)	(0.034)
Change snowfall	0.002	0.002	-0.002	-0.003	-0.000	0.003	0.002	-0.000
	(0.003)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.001)
Under 50s	-0.029	-0.104	0.105	0.127	0.022	0.025	-0.111	0.046*
	(0.081)	(0.075)	(0.085)	(0.082)	(0.080)	(0.083)	(0.083)	(0.028)
50s	0.033	-0.006	0.052	0.009	-0.007	0.060	-0.010	0.020
	(0.064)	(0.063)	(0.063)	(0.071)	(0.069)	(0.064)	(0.071)	(0.023)
60s	-0.007	0.048	0.015	0.043	0.000	0.011	0.006	0.014
	(0.055)	(0.048)	(0.059)	(0.061)	(0.056)	(0.060)	(0.061)	(0.020)
80s	0.032	0.050	0.002	-0.017	0.032	0.006	0.029	0.014
	(0.049)	(0.047)	(0.051)	(0.053)	(0.055)	(0.057)	(0.055)	(0.019)
90s and above	0.085	0.112*	-0.035	-0.039	0.032	0.014	0.087	-0.007
	(0.066)	(0.058)	(0.064)	(0.077)	(0.068)	(0.080)	(0.068)	(0.022)
Change maximum temperature	-0.005*	-0.003	-0.000	0.002	0.007**	-0.007*	-0.004	0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.001)
Age	0.004	0.034***	0.017***	0.018***	0.001	0.033***	0.004	-0.003
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)	(0.002)
Age squared/100	0.001	-0.026***	-0.015**	-0.024***	-0.008	-0.028***	0.003	0.001
	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)	(0.002)
Native citizen	-0.106**	-0.085**	-0.143***	0.037	0.066	0.045	-0.088**	0.036***
	(0.042)	(0.036)	(0.047)	(0.045)	(0.047)	(0.044)	(0.045)	(0.013)
Secondary education	0.036	0.020	-0.078	-0.083	-0.086	-0.113*	0.094	-0.035**

	(0.058)	(0.053)	(0.061)	(0.065)	(0.066)	(0.064)	(0.062)	(0.018)
University education	-0.047	-0.022	-0.138**	0.019	-0.037	-0.164***	0.030	-0.002
	(0.054)	(0.048)	(0.054)	(0.059)	(0.061)	(0.059)	(0.057)	(0.018)
Employed	0.010	-0.024	0.015	-0.075**	0.137***	-0.087**	-0.010	0.012
	(0.035)	(0.033)	(0.034)	(0.037)	(0.039)	(0.038)	(0.036)	(0.011)
Married or cohabiting	0.069**	-0.034	-0.081**	-0.069*	-0.007	-0.055	0.049	-0.005
	(0.034)	(0.031)	(0.040)	(0.039)	(0.036)	(0.041)	(0.036)	(0.013)
Number of household members	0.049***	0.033**	-0.018	-0.028	-0.027	-0.005	0.050***	-0.010*
	(0.018)	(0.016)	(0.018)	(0.020)	(0.019)	(0.018)	(0.018)	(0.005)
Number of children	-0.001	0.029	-0.039*	0.013	0.043	-0.033	0.012	-0.003
	(0.024)	(0.022)	(0.022)	(0.025)	(0.027)	(0.027)	(0.024)	(0.007)
Medium family income	-0.061	-0.093**	-0.065	0.022	0.046	-0.124**	-0.047	0.009
	(0.044)	(0.039)	(0.046)	(0.050)	(0.050)	(0.053)	(0.049)	(0.015)
High family income	-0.140***	-0.217***	-0.096*	-0.002	0.016	-0.220***	-0.099*	0.022
	(0.049)	(0.046)	(0.051)	(0.055)	(0.053)	(0.059)	(0.055)	(0.018)
Health status	0.266***	0.055	-0.496***	-0.456***	-0.544***	-0.882***	0.594***	-0.131***
	(0.040)	(0.037)	(0.055)	(0.048)	(0.046)	(0.055)	(0.047)	(0.016)
Weekend day	0.026	-0.033	-0.021	-0.103***	-0.074**	-0.079**	0.052	-0.012
	(0.031)	(0.029)	(0.032)	(0.034)	(0.036)	(0.034)	(0.034)	(0.011)
Holiday	0.204***	0.219***	0.130	-0.157*	-0.099	-0.004	0.214***	-0.052***
	(0.078)	(0.070)	(0.111)	(0.084)	(0.093)	(0.099)	(0.083)	(0.020)
Constant	-0.175	-1.919***	0.632	-0.301	0.249	0.173	-1.070***	0.157**
	(0.330)	(0.630)	(0.446)	(0.251)	(0.380)	(0.424)	(0.368)	(0.068)
Activity categories	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of episodes	37,158	37,158	37,158	37,158	37,158	37,158	37,158	37,158
Number of individuals	9,330	9,330	9,330	9,330	9,330	9,330	9,330	9,330
R-squared	0.115	0.145	0.093	0.166	0.089	0.185	0.164	0.089

Notes: Clustered standard errors at the individual level appear in parentheses. Data come from the 2010, 2012, 2013 and 2021 ATUS WB-Module. Omitted categories are no rain, no snowfall, and maximum temperature in the 70s. Estimates are weighted using sampling demographic weights at the activity level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.