

Work Rhythms and Workers' Well-being in the United Kingdom and the United States: Evidence from Time Diary Data^{*}

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Abstract

This paper studies how workers organize their time during and outside work hours to shed light on the evolution of workers' well-being in the United Kingdom and in the United States over the last decades. First, we exploit the complex sequential structure of diary data and instant enjoyment information from the 2010 American Time Use Survey to show that work and leisure rhythms are directly related to workers' well-being. We then document that increases in the amount of leisure time over this period have been accompanied by declines in the quality of leisure in both countries. In particular, we see a decline in the percentage of leisure time in the company of other adults, and an increase in the amount of leisure time done at the same time that a non-leisure activity is being carried out. Workers in both countries are also engaging in more activities during longer periods of time before taking a break, reflecting a more stressful pattern of activities. Changes in work and leisure rhythms are concentrated during working days, suggesting that increased labor market constraints are behind these changes. Our findings can explain why despite increases in income and leisure time over this period workers report being more stressed now than five decades ago, and can inform policies and firm practices aimed at increasing workers' well-being and ultimately productivity.

Keywords: Time use, Enjoyment, Workers, Employment, Well-being.

JEL Codes: I31, J22, J28

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1. Introduction

This paper uses detailed time diary data for the last decades in the United Kingdom (UK) and the United States (US) to analyze work and leisure rhythms for workers as an objective way to understand trends in employee's well-being. Aspects like the timing and sequencing of daily activities seem increasingly important in circumstances where the erosion of traditional institutional methods of social coordination (such as standard working hours and universally observed public holidays), make it more difficult to time leisure and coordinate with others (e.g., Hamermesh, 1998;1999). For more than 70 years, social scientists have been documenting that employee well-being is positively associated to productivity (e.g., Hersey, 1932; Freeman, 1978; Oswald, 1997; Compte and Postlewaite, 2004; Oswald et al., 2009).¹ Estimates using well-being data of the income-equivalents non-financial aspects of the workplace suggest that there may be unexploited opportunities to improve both employee satisfaction and enterprise efficiency (Helliwell, 2006). To the extent that a worker's well-being is directly related to work and leisure rhythms, our work forms the basis for policies aimed at facilitating workers' control over their schedule as a means to increase job satisfaction and ultimately productivity.

Using four decades of detailed time use surveys at the episode level starting in the 70s for the UK, and five decades starting in the 60s for the US, we exploit the wealth of information embedded in the *diary* to document how a series of objective indicators of workers well-being have evolved over this period. We look not just at the quantity of leisure, but also its quality, and analyze the percentage of *pure leisure* (e.g., leisure that is not done simultaneously with other non-leisure activity), and the percentage of *co-present leisure* (e.g., leisure done in the presence of the spouse and other adults). We also look at leisure and work rhythms by analyzing *break cycles*, i.e., cycles that start and end with a break activity (such as sleeping or relaxing), and *work cycles* (e.g., cycles that start with a work-related activity and end with a break activity). We look at the time which elapses, the activities done, and the number of *break cycles*, the number of *work cycles*, and the duration and the number of activities done within *work cycles* to properly characterize working and leisure patterns.

The first part of the analysis establishes a direct link between our objective indicators and workers' subjective well-being using instant enjoyment information from the ATUS 2010 Well-being Module. We find that spending more leisure with the spouse and/or other adults is related to higher levels of happiness (i.e., 4.15 and 4.90 percentage-point increases per additional hour),

¹ Happier employees in a positive mood are more sensitive to opportunities, more helpful to co-workers, and more confident (e.g., Isen and Baron, 1991; Cropanzano and Wright, 2001). Positive emotions may also lead to better performance in more complex jobs by enhancing creative problem solving (e.g., Estrada et al., 1997; Madjar et al., 2002), and are likely foster new skill acquisition and the building of social capital that may be utilized at a later time (Fredrickson, 2001). See Zelensky et al. (2008) for a review of the happy-productive worker hypothesis.

and lower levels of negative feelings (i.e., 19.95 and 17.68 percentage-point decreases per additional hour). Similarly, we find that more activities done between *break cycles* contribute to higher levels of stress (i.e., a 1.18 percentage-point increase in workers' stress per additional activity), and more time spent between *break cycles* contribute to higher levels of stress (e.g., a 1.89 percentage-point increase per additional hour), tiredness (e.g., a 1.17 percentage-point increase per additional hour) and negative feelings (e.g., a 1.35 percentage-point increase per additional hour). Additionally, longer *work cycles* contribute to higher levels of stress (e.g., a 1.38 percentage-point increase per additional hour) and lower levels of happiness (e.g., a 0.2 percentage-point decrease per additional hour), and more activities per *work cycle* contribute to higher levels of stress (e.g., a 1.89 percentage-point increase per additional activity), tiredness (e.g., a 1.17 percentage-point increase per additional activity) and negative feelings (e.g., a 1.37 percentage-point increase per additional activity).

The second part of the paper documents that despite increases in the *quantity* of leisure for workers during the reference period, the *quality* of leisure decreased. In the UK leisure increased by 4 and 7 hours per week for men and women respectively, but the percentage of *pure leisure* decreased by one and a half percentage points for women which represent a decrease of 0.16 hours per day in pure leisure. We also document a decrease in the number of *break cycles* (e.g., 3.43 and 3.58 percentage-point decreases, respectively), and an increase of almost one hour in the time elapsed between each *break cycle* (e.g., 17.77 and 23.23 percentage-point increases in the hours between *break cycles*, respectively). The number of activities workers engage in between break cycles has also increased by 1.22 and 1.19 for men and women, respectively (e.g., 38.14 and 38.10 percentage-point increases).

Similar patterns are observed in the US. Time spent in leisure activities increased by 9 and a half hour per week for working men and 12 hours per week for working women respectively. However, the percentage of *pure leisure* decreased by 5 and 4 percentage points, which represents a decrease of 0.32 and 0.20 fewer hours per day of pure leisure. Similarly, the percentage of *co-present leisure* decreased by 18 and 16 percentage points for working men and women respectively, which represents a decrease of 1 and 0.79 fewer hours per day of leisure with adults. We also find that American workers try to push themselves for longer and do more things before they take a break. In particular, we document a decrease of 0.98 and 1.80 in the number of *break cycles* for men and women respectively (e.g., a 25.65 and 21.94 percentage-point decrease, respectively), and an increase in almost one hour in the time spent between each *break cycle*.

We further document that during working days, workers try to do more things and for a longer time once they start to work until they stop to have a break. In particular, in the UK the

number of breaks working men and women take declined by 0.19 and 0.36 cycles during working days (e.g., a 5.68 and 9.01 percentage-point decrease), the number of activities done between each *break cycle* increased by around one and a half (e.g., a 29.34 and 43.95 percentage-point increase), and the time elapsed between each *break cycle* increased by slightly over an hour. Additionally working men and women have fewer *work cycles* during working days now than before (e.g., 0.34 and 0.31 fewer *work cycles*), and do almost 2 additional activities more and spend almost an hour more hours in each *work cycle* compared to four decades ago. As in the UK, in the US the number of breaks working men and women take declined by 1.10 and 1.98 cycles during working days (e.g., a 30.82 and 24.90 percentage-point decrease), the number of activities done between each *break cycle* increased by around one half (e.g., a 5.54 and 11.02 percentage-point increase), and the time elapsed between each *break cycle* increased by slightly over an hour. Additionally working men and women have fewer *work cycles* during working days now than before (e.g., 1.10 and 0.98 fewer *work cycles*), and do almost 2 additional activities more and spend almost an hour more hours in each *work cycle* compared to four decades ago.

We also find that leisure time did not increase during non-working days, and most of the decrease in the percentage of pure leisure was concentrated during non-working days (and in the percentage of leisure time spent with an adult for the US). This evidence seems to suggest that workers tried to compensate for more stressful rhythms during working days by giving up some of the quantity and quality leisure time during non-working days.

This paper extends the economics literature in three important ways. First, it looks at worker's well-being beyond job satisfaction measures. Most of the economics literature concentrates on job satisfaction (e.g., Clark, 1997,2001; Lévy-Garboua, Montmarquette, and Simonett, 2007; Booth and Van Ours, 2008), focusing on aspect such as job security (e.g., Böckerman, Ilmakunnas, and Johansson, 2011), flexicurity (e.g., Origo and Pagani, 2009), employment protection legislation (e.g., Salvatori, 2010), and labour mobility (e.g., Green, 2010). By showing that objective measures of behavior inside and outside the working place are correlated with instant enjoyment, we provide an alternative lens through which to assess and compare workers well-being over a long period of time. In that sense, we follow Kahneman et al. (2004), Kahneman and Krueger (2006) and Krueger (2007) in that we propose the use of diaries, on the one hand, and instant enjoyment data, on the other hand, as a way to value how people experience the settings and activities of their lives, as opposed to subjective wellbeing measure. Our objective indicators of leisure quality may provide an additional basis for interpreting well-being inequality in the United States behind the happiness and well-being indicators.

Second, we contribute to explain why despite increases in leisure time, workers report to be more hurried now compared to decades ago (e.g., Robinson and Godbey, 1997; Bittman and Wajcman, 2000; Mattingly and Sayer, 2006; Chartered Institute of Personnel and Development, 2011). Following Linder (1970), several authors have suggested that the perception of time famine is an illusion based on the growth of choices about what to do with their free-time (e.g., Robinson and Godbey, 1997). For example, increases in discretionary wealth that enables people to purchase the goods and services to sample a wider range of activities can also lead to a qualitative reduction in the experience of each activity (Hamermesh and Lee, 2007). By looking at how the rhythms of work and leisure have changed over this period, we offer an alternative explanation to the underlying mechanisms behind time poverty.

Third, our work adds to the existing literature on measuring changes in the allocation of time in developed countries by moving beyond the study of aggregate times (e.g., Ghez and Becker, 1975; Juster and Stafford, 1985; Robinson and Godbey, 1997; Aguiar and Hurst, 2007;2009; Gimenez-Nadal and Sevilla-Sanz, 2012). Whereas material resources increase with economic growth relaxing the goods constraint over time, the time constraint remains fixed at 24 hours a day (e.g., Hamermesh and Lee, 2007). By introducing a new time dimension that focuses not just on total times spent in leisure and work activities, but also at *how* this time is spent, we provide a way in which the time constraint can be relaxed over time.

The paper is organized as follows. Section 2 presents the time diary datasets and the variables used in the analysis. Section 3 presents the analysis of the relationship between our objective time use indicators and workers' well-being. Section 4 presents main trends for work and leisure rhythms for the UK and the US, and Section 5 sets out the main conclusions.

2. Data

We use the UK time use data included in the Multinational Time Use Survey (MTUS) for the analysis in the UK. This data are available at the Center for Time Use Research (University of Oxford). The Multinational Time Use Study (MTUS) is an ex-post harmonized cross-time, cross-national comparative time-use database, constructed from national random-sampled time-diary studies with detailed measures of time use. The MTUS aggregates daily 'primary activity' in 68 time use categories (and an additional category for missing time), with approximately 30 standardized demographic variables. We use the version W6 of the dataset, which harmonizes at the episode level and allows us to analyze intervals of time rather than aggregated files. The surveys included in the MTUS are for the year 1974, 1983, 1995, 2000 and 2005. Table A2 in

Appendix A provides a thorough description of the 5 surveys in the MTUS. Table A1 in Appendix A provides a thorough description of the five UK surveys in the MTUS.

We also use the American Heritage Time Use Study (AHTUS) to analyze how leisure and work rhythms have changed during the last five decades in the US. The AHTUS is a harmonized dataset that covers five decades, from 1965 to 2010, over six time-use surveys. Table A2 in Appendix A provides a thorough description of the six surveys in the AHTUS. The main instrument of all the surveys is an activity diary in which respondents record what they do for a consecutive period of 24 hours. For each respondent there is a diary file made up of a sequence of episodes over the 24 hour span, which allows the inclusion of harmonized information on secondary activity, and who else is present at the time of the activity. Because the AHTUS has been harmonized at the episode level, it allows us to analyze intervals of time rather than aggregated files.

A diary is completed by respondents on selected days, and is divided into intervals where the respondent records a main activity (and other features depending on the survey such as the secondary activity carried out simultaneously with the primary activity, whether the activity was performed in the company of a child, another member of the household, or another adult, and where the activity took place). Appendix B presents an example of a diary for the ATUS 2010. An extensive literature confirms the reliability and validity of diary data and their superiority over other time-use surveys based on stylized questions, asking respondents to estimate time in activities on a ‘typical day’ (e.g., Robinson and Godbey 1985; Juster and Stafford 1985). In the labor supply literature for example, Klevmarken (2005) argues that information on actual hours of work from time-use surveys are more relevant than normal hours or contracted hours generally reported in stylized questions. He shows that time-use data yields much smaller estimates of wage rate effects compared to measures of normal hours of work, which may have important implications for tax policy design among others. Thus, the same way money expenditure diaries have become the gold standard in the consumption literature, so have time-use diaries become the preferred method to gather information on time spent on market work, non-market work and leisure. Most studies documenting long term trends in how individuals use their time are now based on these data sets, including recent studies for the analysis of trends in time use (e.g. Guryan et al. 2008, Aguiar and Hurst 2007, Krueger and Mueller, 2008).

We acknowledge that the time use surveys were conducted in a variety of different manners across the different countries and that comparing the exact amount of time spent in different activities across countries becomes more problematic when finer classifications of time use categories are considered, as the exact classification of activities may have changed across countries and over time. However, although the classification of time-use activities changes

over time and across countries, and some activities disappear and new activities emerge (just as in the case of expenditure diary categories in expenditure surveys), our broad classification of leisure provides a good basis to run meaningful comparisons over time. Furthermore, the harmonization exercise also addressed differences in survey methodologies such as different response rates (especially the lower response rate of some of the surveys), whether they covered or not the twelve months of the year, and the sampling frame. All the surveys provide weights designed to ensure that the surveys are nationally representative.

In 2010, the American Time Use Survey (ATUS) collected a *Well-being Module* together with the time use.² This module was added to the ATUS diary to capture how people felt during selected activities and fielded from January through December 2010. Respondents were first asked to fill out a diary summarizing episodes that occurred in the preceding day, and three episodes from the diary which lasted at least five minutes were randomly selected and diarist were asked about their feelings and emotions during these episodes. In fact, respondents were asked to rank on a 7-point scale the extent to which they were happy/stressed/sad/tired/ or felt pain during the episode, with “0” indicating “did not experienced the feeling at all” and a 6 indicating “feeling was extremely strong”. These questions were not asked for sleeping and personal activities (e.g., grooming, wash, dress).

Sample

For the sake of comparison with previous studies (e.g., Aguiar and Hurst, 2007; Gimenez-Nadal and Sevilla-Sanz, 2012), and to minimize the role of time allocation decisions, such as education and retirement, that have a strong inter-temporal component over the life cycle, we restrict the sample used throughout the analysis to non-retired/non-student individuals between the ages of 21 and 65 (inclusive) who devote at least 10 hours per week to the labor market.³ We also restrict the sample to include only workers who have time diaries that add up to a complete day (1440 minutes) and whose diary is not “low quality”, i.e., the diary has 90 minutes or less missing main activity time, it has seven or more episodes, and it records some time in at least three of four basic activities (sleep or rest, eat or drink, personal care, and travel), either as a

² This module has a similar structure than the survey used in Krueger and Mueller (2011) that collects data for New Jersey, although the ATUS Well-Being Module has not a panel data structure.

³ For the United Kingdom there is no information on the total hours individuals work per week for the year 1995. For this reason, for this year we include all working individuals, independently on whether they work full- or part-time.

primary or secondary activity.⁴ The excluded diaries represent 10% of the age 21-65 sample, and results are robust to their inclusion.

We further limit the sample to married workers or those individuals living with a partner wherever the dependent variable is the percentage of leisure time with the spouse. This sample restriction is necessary because trends in marriage rates and the timing of marriage have changed over time, especially for highly educated workers, and if marriage patterns alter behavior in daily routines, such as time together, they could in principle explain some patterns in the data.

Definition of Variables

Leisure

The conceptualization of leisure time, and of time use categories in general, is usually driven by a systematic, principle-driven approach of distinguishing *means vs. ends*. The so-called *third person criterion* excludes activities that might be carried out by some third party without losing the intended utility for the final consumer. Unfortunately, the third person criterion involves questionable assumptions such that the enjoyment derived from work can legitimately be ignored, and that all leisure is enjoyable. One quarter of time that would be considered leisure according to the conventional implementation of the third person criterion, and one third of what would conventionally be considered work, is unexpectedly placed by the diarists (Gershuny, 2009). Certain activities, such as sleeping, eating, personal and medical care, or resting, do not fall comfortably into the *means vs. ends* classification. These activities cannot be purchased in the market, but they may not be considered leisure in the sense that they are necessary for life. Nonetheless, some variation in the time spent in these activities may result from conscious choice. Biddle and Hamermesh (1990) show that sleep time responds to economic incentives such as the wage. Decreasing marginal utility of sleep (and of other consumption activities) is indeed shown by Gershuny (2009) using (subsequent) diary reports of enjoyment.

Rather than trying to resolve this debate on theoretical grounds, we adopt an empirical approach, and follow the literature by conceptualizing leisure as hours per week devoted to all activities that we cannot pay somebody else to do for us and that are not biological needs (e.g., Walker and Gauger, 1973; Hawrylyshyn, 1976,1977; Burda, Hamermesh and Weil, 2008). Among the activities included in our leisure definition are watching television, sport activities,

⁴ Some respondents providing child-care to multiple children, or to an infant, as well as some diarists performing adult care did not record travel and also missed a second or third basic activity. If these diaries from carers nonetheless included at least 10 episodes, then we counted these diaries as good diaries (as it may be possible the diarists ate while feeding the care recipient, for example, but did not record her or his own eating).

general out-of-home leisure, and socializing. We exclude voluntary activities from our main definition of leisure, since it classes as work under the third person criterion (see Hawrylyshyn, 1976).

Work and leisure rhythms

There are different ways of assessing workers' well-being using time use diaries. One methodology is to use self-reported measures of how enjoyable activities are. For instance, "how much an individual likes or dislikes the activity 'painting one's house,' in conjunction with the amount of time one spends in painting the house, is as important determinant of well-being independent of how satisfied one feels about having a freshly painted house" (e.g., Juster and Stafford, 1985:pp.113-131). The *process benefits* approach uses *Activity Enjoyment Ratings*, where respondents rate on a scale from 0 to 10 how much they generally enjoyed a type of activity (e.g., Juster and Stafford, 1985). The information gathered this way offers a global and retrospective interpretation of feelings about activities, although they may not serve as a good predictor of the instantaneous satisfaction experienced in any given instance of the activity (e.g., Gershuny and Halpin, 1996). The *experienced utility* literature has proposed the *Experience Sampling* method as a superior way for collecting objective instantaneous enjoyment data (Kahneman et al., 2004). As opposed to the *Activity Enjoyment Ratings*, the *Experience Sampling* method collects information on *hedonic experiences* (or instant enjoyment) in real time. It has however never been applied to a representative population sample because it is extremely burdensome for the respondent.⁵ Alternative methods of collecting data on hedonic experiences, such as the conventional *yesterday diary* used in time budget surveys (Szalai, 1972) or the *Day Reconstruction Method* (Kahneman et al., 2004; Knabe et al., 2010; Dolan and Metcalfe, 2011) are less costly to implement. Both methods collect information on how the respondent experienced all or some of the activities he or she engaged in during the previous day, as described by a time-use diary.⁶

⁵ *Experience sampling* was developed to collect information on people's reported feelings in real time in natural settings during selected moments of the day (Csikszentmihalyi, 1990; Stone and Schiffman, 1994). Participants in ESM carry a handheld computer that prompts them several times during the course of the day (or days) to answer a set of questions immediately, such as their physical location, the activities in which they were engaged just before they were prompted or the people with whom they were interacting. They also report their current subjective experience by indicating the extent to which they feel the presence or absence of various feelings, such as feeling angry, happy, tired and impatient (Steptoe, Wardle and Marmot, 2005; Kahneman and Krueger, 2006).

⁶ The *Day Reconstruction Method* has been used for example in the collection of the Princeton Affect and Time Survey (PATS). Here respondents were asked to reconstruct the previous day by completing a short diary. Then three 15-minute intervals were randomly selected from the non-sleeping portion of the diary, and respondents were then asked the extent to which they experienced six different feelings (pain, happy, tired, stressed, sad, and interested) during each interval (Krueger, 2007). Previously, the otherwise similar "*yesterday diary*" approach was used to collect information on the levels of instant enjoyment for *all* the episodes (not just three) in the diary for the UK 1985 (see Sullivan, 1996) and the AHTUS 1985 (see Robinson, 1993). Unlike the PATS, these surveys collect one

Whereas there is historical information on time-use diary records from 1965 for the US, only one survey contains information about instant enjoyment for a nationally representative sample. We thus adopt a complementary approach to the above literature and exploit the rich information in the diary to construct three classes of well-being indicators that emerge independently from different strands in the socio-economic and psychological literature.⁷ Even though we lack additional direct information about how much respondents enjoy engaging in a given activity for the decades being analyzed, the relationship between well-being and some of these indicators, in particular those related to the presence of other individuals while the respondent engages in leisure activities, has already been directly established using instant-enjoyment data of the sort proposed by the *process-benefits* and *experienced-utility* literature (see Sevilla-Sanz, Gimenez-Nadal and Gershuny (2012) for a review of the literature, and for a direct validation of some of the indicators we use in this paper).

Pure leisure

The first class of indicator is related to activity density. Respondents frequently engage in more than one single activity at the same time. The secondary activity is an activity simultaneous with another identified by the diary respondent as the “main activity”, which may in some way complement or qualify it. The underlying rationale behind this indicator is that leisure activities with no “distracting” accompanying activities will be associated with a higher utility than leisure activities accompanied by a secondary activity (see Bittman and Wajcman, 2000).⁸ We define *pure leisure* as leisure that is reported as primary activity whose secondary activity is not market work, home production or personal care, and analyze the proportion of *pure leisure* out of total leisure. *Pure leisure* cannot be analyzed for 1993 and 2003 in the US, and for 1995 in the UK, since these surveys collected no separately identified secondary activities.

Co-present leisure

The second class of indicators relates to with whom the leisure activity is performed. We first consider first leisure with the spouse (or partner). The concept of *leisure with spouse* draws from the empirical evidence found in the socio-economic literature on spouses’ synchronization

dimension of instant enjoyment, which is scaled from 5 to 0 and 0 to 10 respectively. Knabe et al. (2010) uses both types of measures and reach the same conclusions with the two types of measures.

⁷ An alternative method would require imputations of enjoyment-levels for the other survey years (either at the activity level as in Krueger (2007) or at the individual level). A potential limitation to this method (see Krueger 2007) is that it maintains the nature of activities relatively constant over time. This assumption is particularly restrictive in the current context, as different groups of individuals may rank the same activity differently, and the mix of these responses may change over time.

⁸ For example, Gimenez-Nadal and Ortega-Lapiedra (2011) shows that the leisure of self employed men is more often intertwined with market work activities, leading self-employed men to report higher levels of time stress.

of work and leisure activities. Sullivan (1996) uses a 1985 UK time-use survey, a diary survey including instantaneous enjoyment diary information, to show that partners report higher levels of satisfaction when they synchronize their working schedules (and thus maximize the potential time they can spend in leisure activities together). Hamermesh (1999), Hallberg (2003), and Jenkins and Osberg (2005) follow Sullivan (1996) in finding that synchronization of leisure activities between partners is indeed greater than random male-female pairing would predict. We thus use information on whether leisure as primary activity is carried out while the spouse/partner is present, to calculate the percentage of total leisure time of *leisure with spouse* (or partner) as an indicator of well-being. Because of demographic changes regarding the propensity to marry, which has fallen in the US during this time period due to the delay in the age of marriage and increase in divorce rates, we restrict the sample to those individuals with a partner when computing this indicator. The indicator of *leisure with spouse* can be constructed for all the surveys in the US except for those in 1985 and 1993, where information on spouse or partner co-presence was not gathered.

The second indicator in this class uses information on whether another adult was present during a leisure activity to construct the percentage of total leisure that constitutes *leisure with adults*, i.e. leisure time spent neither alone nor in the presence of children. The category “other adult” is considered to be the spouse or partner, other adult from the household, a shop or professional worker, a co-worker, a person well-known, and other (adult) person present. Unfortunately, the AHTUS lacks comparable information across years on whether a child is present, and thus comparisons along these lines are not possible. Evidence from instant enjoyment data suggests that individuals report higher levels of instant satisfaction from activities done in the company of others than by themselves (e.g., Kahneman et al., 2004; Helliwell and Putnam, 2005). In fact the adverse effects of isolation on mental health are well-known in the epidemiological and psychological literature (e.g., House, Landis and Umberson, 1988; Berkman and Glass, 2000; Putnam, 2000; Eng et al., 2002; Berkman et al., 2004; Singh-Manoux and Marmot, 2005). Similarly, the positive externalities of synchronicity not just in leisure, but also in market work and household labor, have been also pointed out in the economics literature (e.g., Weiss, 1996).⁹ We can calculate this measure for the 1965, 1975, and 2003 US surveys.

These indicators cannot be computed for the UK. The presence of other adults during main activities is only reported in the 1983 and 2000 surveys, however the original coding differs

⁹ Few studies have tried to identify exogenous determinants of coordination. For example, public holidays have been found to be welfare enhancing, not only by increasing the amount of leisure to each individual, but also by increasing the coordination of leisure activities among individuals (e.g., Mers and Osberg, 2006). Similarly, Hamermesh, Myers and Pocock (2008) find that an exogenous shock to time in one area, due to daylight-saving time, leads its residents to change their work schedule so as to coordinate their other (leisure) activities with those in adjacent areas.

greatly between the two surveys making comparisons between the two years impossible. In particular, whereas in the 1983 survey there are several codes to identify adult individuals (e.g., elderly relatives, spouse, siblings, sales workers...), in the 2000 survey only two codes are used to identify the presence of others (“other household adult present” and “other person that you know present”). The main problem with the 2000 survey is that the category “other person that you know present” also includes children. Thus, comparing the percentage of leisure with adults in the two surveys, it is 47 and 39 percentage points for men and women in 1983, while those percentages are 73 and 71 percentage points, respectively. Similarly, while the percentage of leisure with the spouse/partner is 52 and 47 percentage points for men and women in 1983, those percentages are 64 and 63 percentage points, respectively. However, we cannot rule out that increases are just artifact of the data due to the inclusion of children in the latter survey.

Break cycles

The human body has physical limits. Individuals regularly need both to refuel (eat or drink) and rest to enable their minds and bodies to relax before they can continue to engage in other activities. More fatigued workers are more likely to be less efficient and also at greater risk of feeling stressed (e.g., Schwartz and McCarthy, 2007). Next, we look at patterns of breaks workers in the US take during the diary days.

We first look at completed *break cycles* in the 24-hour diary. These are cycles where the diarist reports engaging in a break activity, then undertakes one or more non-break activities, followed by a new break activity. The end of a *break cycle* marks the beginning of the following *break cycle*. A break activity is defined as a diary episode where time is spent in “general or other personal care”, “imputed personal or household care”, “sleep”, “imputed sleep”, “naps or rest”, “wash, dress or personal care”, “personal medical care”, “meals at work”, “other meals or snacks”, “work breaks”, “at restaurant, café or bar”, “relax, do nothing”, “read books”, “read periodicals”, “read newspapers”, “listen to music, cds etc.”, “listen to radio” and “watch TV”..

We look at the number of cycles that begin and finish with a break activity (*Number of break cycles*). We also construct a measure of how many different things workers engage in before taking a break (*Activities between breaks*), and the hours which elapse between break activities (*Hours between breaks*). A decrease in the number of *break cycles*, and/or an increase in the time and the number of activities between breaks would all suggest that, compared to 40 years ago, workers in the US are trying to accomplish more things for longer before they take a break to recharge.

Work cycles

We also look at work cycles in the 24-hour diary which begin with paid work activities and finish with a break activity. Necessarily these cycles only occur on days where the diarist undertook any form of paid work, so this analysis is limited to working days. Although break activities are the same than those for *break cycles*, what differentiates such *work cycles* from *break cycles* is that the former start with a work/study activity, while the latter start with a break activity. Also, while *work cycles* may be discontinuous throughout the day, *break cycles* follow continuously throughout the day. Thus, *work cycles* are developed to measure how many breaks workers take once they start to work, and how many activities and for how long they do things before they break once they start to work.

We look at the number of *work cycles* throughout the day (*Number of work cycles*), how many activities workers do since they start working until taking a break (*Activities during work cycles*) and how long they undertake activities for once they start to work before they take a break (*Hours during work cycles*). An increase in the number of number of *work cycles*, and increases in the time spent within each *work cycle* and the number of activities within each *work cycle* would all suggest that, compared to 40 years ago, workers in the US are trying to accomplish more things for longer once they start working and before having a break.

Figure 1 shows the sequence of *break* and *work cycles* for a diary in our data. The example is taken for a male worker during a working day from AHTUS 2003. Column (1) shows the time when activity starts, Column (2) shows the time when activity finishes, Column (3) shows the duration of the activity, Column (4) shows the description of the activity, Column (5) shows if the activity is a break activity, and Column (6) shows if the activity is a work activity. The first *break cycle* starts at 6:00, when the diarist is sleeping, wakes up to take care of infants, and it ends at 7:11 when the diarist does some personal care. This *break cycle* lasts 1 hour and 11 minutes and the individual does 1 activity. The second *break cycle* starts at 7:11, when the diarist does some personal care, prepares food, and it ends at 7:48 when the diarist takes other meals/snacks. This *break cycle* lasts 37 minutes and the individual does 1 activity. The third *break cycle* starts at 7:48, when the diarist takes other meals/snacks, the diarist does 3 non-break activities, and it ends at 8:20 when the diarist takes other meals/snacks. The last (7th) *break cycle* starts at 17:40, when the diarist watches television, the diarist does 10 non-break activities, and it ends at 23:20 when the diarist takes other meals/snacks. This *break cycle* lasts 5 hours and 40 minutes. In total, this diarist has 7 *break cycles* that last an average of 2 hours and 26 minutes, and does 3.14 activities in each *break cycle*.

In the case of work cycle, the first *work cycle* starts 8:05 when the diarist goes to work, and it ends at 8:20 when the diarist takes other meals/snacks. This *work cycle* lasts 15 minutes, and the diarist does 1 activity (commuting). The *second work cycle* starts 8:20 when the diarist starts

to work, and it ends at 14:55 when the diarist takes personal care. This *work cycle* lasts 6 hours and 35 minutes, and the diarist does 2 activities (main paid work plus commuting). In total, this diarist has 2 *work cycles*, they last 3 hours and 12 minutes, and the diarist does 1.5 activities on average in each *work cycle*.

3. Work and leisure rhythms, and subjective well-being

The first part of our analysis aims at producing a direct link between our work and leisure rhythm indicators and subjective well-being, using the feelings reported by diarists in the 2010 ATUS Well-Being module.¹⁰ In the analysis we take into account previous literature showing that assuming ordinality or cardinality of happiness scores makes little difference, whilst allowing for fixed-effects does change results substantially (e.g., Ferrer-i-Carbonell and Frijters 2004). Unfortunately, the data does not have a panel structure, and hence we rely on OLS estimates for our analysis. We estimate the following equation:

$$E_i = \alpha + \beta I_i + \gamma X_i + \varepsilon_i \quad (1)$$

where “*i*” refers to respondent “*i*”, the dependent variable E_i is the average rating for the reference feeling for respondent “*i*” and represents the worker’s well-being, as measured by the average over the rating for the 3 randomly selected episodes. In particular, for the feelings of happiness, tiredness, sadness, stress and pain we average for each respondent the responses in the 0-to-6 scale to the three episodes. For instance, if the diarist responded the values 2, 3 and 5 of happiness for the 33 episodes, we obtain the average value of 3.33 for the diarist. We also use of the U-Index defined in Kahneman and Krueger (2006), and used in Krueger (2007), as a negative feeling of the individual. This index, also known as misery index, measures the proportion of time that people spend in an unpleasant state, and has the virtue of not requiring a cardinal conception of individuals’ feelings. In this case, the U-index for an episode is defined as equal to 1 if the maximum rating of any of the negative emotions (stressed, tired, sad, pain) strictly exceeds the rating of happy, and 0 if not. Once the U-index has been defined at the episode level, we compute the mean value at the individual level (as done with the other feelings).

I_i is the indicator of reference at the diary level for respondent “*i*”. In that sense, given that we only have one observation per diarist, the information for each indicator is obtained from the whole diary, and not from the 3 episodes that are chosen to report feelings. For instance, for the

¹⁰ The ATUS 2010 does not report the secondary activity done by the diarist, and thus we cannot test whether our indicator of *Pure Leisure* is related to higher happiness and well-being. However, we rely on previous studies showing such positive relationship (e.g., Sevilla-Sanz, Gimenez-Nadal and Gershuny 2012).

indicator of *Leisure with Adults*, we use the percentage of leisure done with the presence of adults at the diary level. Also, for the mean number of activities in each break cycle, we compute the average value at the diary level.

The rest of controls X_i capture household and personal characteristics of respondent “i” (age and its squared, male dummy, dummies for university and secondary education, a dummy for working part-time, a dummy if there are children under 18 in the household, and a dummy to indicate whether the worker is married/cohabiting). We also include day-of-week dummies in all of the regressions (reference day is Friday). The sample is composed by 6,383 (full-/part-time) workers, and by 3,968 married workers for the analysis of leisure with the spouse/partner.

Table 1 shows the results of estimating Equation (1) for U-Index (Columns 1 and 2), and the feelings of happiness (Columns 3 and 4), stress (Columns 5 and 6), sadness (Columns 7 and 8), tiredness (Columns 9 and 10) and pain (Columns 11 and 12), considering whether leisure activities were done in the presence of the spouse/adults. Columns 1 and 2 show that the presence of the spouse/partner, and adults is negatively related with the U-Index, while positively related with happiness, with these associations being statistically significant at the 99% level. In this sense, considering a mean value of the U-Index of 0.20 for married workers, the presence of the spouse/partner decreases the U-Index by 0.01, which represents a decrease of 4 percentage points. For the presence of adults in leisure activities, considering a mean value of the U-Index of 0.22, the presence of other adults in leisure activities decreases the U-Index by 0.01, which represents a decrease of 4 percentage points. For the case of happiness, for mean values of 4.39 for married workers, and 4.32 for all workers, the presence of the spouse/partner and adults in leisure activities is associated with an increase of 0.79 and 0.92, which represents an increase of 18 and 21 percentage points.

Table 2 shows the results of estimating Equation (1) for U-Index (Columns 1 and 2), and the feelings of happiness (Columns 3 and 4), stress (Columns 5 and 6), sadness (Columns 7 and 8), tiredness (Columns 9 and 10) and pain (Columns 11 and 12), considering the mean number of activities done and the average time spent between each break cycle. We find that a higher number of activities done between each break cycle is positively associated with stress, and negatively associated with happiness. In this sense, for mean values of 4.32 and 1.37 for the feelings of happiness and stress, an extra activity done between each break cycle is associated with a decrease and an increase of 0.03, which represents a decrease in happiness and an increase in stress of 1 and 2 percentage points, respectively. Also, we find that more time spent doing things between each break cycle is positively associated with the U-Index, stress and tiredness. In this sense, for mean values of 1.37 and 2.28 for the feelings of stress and tiredness,

an extra hour doing things between each break cycle is associated with an increase of 0.04 and 0.062, which represents increases in stress and tiredness of 3 percentage points for each feeling.

Table 3 shows the results of estimating Equation (1) for U-Index (Columns 1 and 2), and the feelings of happiness (Columns 3 and 4), stress (Columns 5 and 6), sadness (Columns 7 and 8), tiredness (Columns 9 and 10) and pain (Columns 11 and 12), considering the mean number of activities done and the average time spent within each break cycle. We find that a higher number of activities done within each break cycle is positively associated with the U-Index, stress, and tiredness. In this sense, for mean values of 1.37 and 2.28 for the feelings of stress and tiredness, an extra activity done within each break cycle is associated with an increase of 0.04 and 0.07, respectively, which represents an increase in stress and tiredness of 3 percentage points. Also, we find that more time spent doing things within each break cycle is positively associated with the U-Index, stress and tiredness. In this sense, for mean values of 1.37 and 2.28 for the feelings of stress and tiredness, an extra hour doing things within each break cycle is associated with an increase of 0.04 and 0.11, which represents increases in stress and tiredness of 3 and 5 percentage points, respectively.

Overall, our findings provide supporting evidence that the indicators constructed in this paper are good enough to draw conclusions about the evolution of the quality of leisure time and the stress levels of American workers. While all indicators are strongly related to enjoyment feelings however, work and leisure rhythms indicators are particularly related to levels of stress and tiredness. In particular, we find that the presence of the spouse and/or adults during leisure activities increases happiness of workers, while the more activities workers do and the more workers extend their work cycles the more stress they feel. This is not surprising and supports previous findings in the literature showing that leisure time contributes to an individual's utility (e.g., Gershuny 2009) by being more enjoyable than other activities (e.g., Kahneman et al., 2004; Kahneman and Krueger 2006; Krueger 2007). We provide here further evidence that patterns of work and leisure throughout the day has an effect on whether workers are more fatigued, and thus more likely to be at greater risk of feeling stressed.

4. Trends in work and leisure rhythms

For the second part of the analysis we follow Aguiar and Hurst (2007) and Gimenez-Nadal and Sevilla-Sanz (2012) by documenting trends over the last decades holding constant the demographic composition of the sample in the two countries. Specifically, we divide the sample into demographic cells defined by five age groups (21–29, 30–39, 40–49, 50–59, 60–65), three education categories (uncompleted secondary or less, completed secondary, above secondary

education), and whether or not there is a child under 18 in the household. We do not create separate cells distinguishing child status for respondents aged sixty to sixty-five due to the small number that have children present in the home. To calculate the constant weights used for our demographic adjustments, we pool together all of our time use data sets, and compute the percentage of the population that resides in each demographic cell. We do this procedure for men and women separately. As in previous research, we follow Katz and Murphy (1992) and use these fixed weights to calculate weighted means for each year. When pooling the surveys together to compute the percent of the population in each of our cells, we used the weights provided by the surveys to ensure the data is representative of the total population. We adjusted these weights so that each day of the week and each survey are equally represented in the overall sample. The final samples for the UK are 13,422 male workers and 10,990 female workers. For the US, the samples include 14,035 male workers and 13,943 female workers, and 7,798 and 6,387 married male and female workers.

Table 4 and 5 show weighted means for the indicators of work and leisure rhythms, for men and women separately in the UK and the US. In the case of the UK, we find that *leisure* time increased over this period for both working men and women, consistent with previous results shown in Gimenez-Nadal and Sevilla-Sanz (2012). Men's *leisure* time follows an increasing trend, increasing (on average) by 4 hours and 45 minutes per week over the relevant period from 41 hours in 1974. Women's average hours of *leisure* per week exhibit a statistically significant increase of 8 hours per week over the reference period, from 38 hours and 30 minutes of *leisure* per week in 1974 to 46 hours and 30 minutes of *leisure* per week in 2010. Consistent with other studies (Aguiar and Hurst, 2007; Sevilla-Sanz, Gimenez-Nadal and Gershuny, 2012), we find that *leisure* time increased over this period for both working men and women in the US. Men's average hours of *leisure* per week exhibit a statistically significant increase of 9 and a half hours per week over the reference period, from 28 hours of *leisure* per week in 1965 to 37 and a half hours of *leisure* per week in 2010. Women's *leisure* time follows a similar pattern, increasing (on average) by 12 hours per week over the relevant period from 22 hours in 1965.¹¹

In contrast to trends in leisure time in the UK, the percentage of *pure leisure* held relative constant over the period, with no statistically significant changes for nor men neither women. In the US, between 1965 and 1985 the percentage of *pure leisure* went down from 88.36 to 83.08 percentage points for working men, and from 84.52 to 80.69 percentage points for working women. Married working women reported to spend more leisure time in the presence of the spouse over this period, increasing from an average of 43.19 percentage points of the time in

¹¹ As in previous time use studies (e.g., Aguiar and Hurst 2007, 2009; Ramey and Francis, 2009; Ramey and Ramey, 2010; Gimenez-Nadal and Sevilla-Sanz, 2012; Sevilla-Sanz, Gimenez-Nadal and Gershuny, 2012), we multiply the amount of daily leisure by 7/60 to get hours per week.

1965 to 54.14 percentage points in 2010. In contrast, we find no statistically significant changes in the percentage of *leisure with spouse* for men. The discrepancy between the reported *leisure with spouse* between married working men and women is probably due to the fact that married women are more likely to do housework while their spouses are enjoying leisure (Fisher et al., 2007). Thus, the different trends in this indicator between men and women are the result of women's decrease in the time devoted to household chores over these decades. There was also a statistically significant decrease in the percentage of *leisure with adults* for working men during this period, from an average of 74.96 percentage points of the time in 1965, to 56.36 percentage points in 2010, and for working women from an average of 68.34 percentage points of the time in 1965, to 52.51 percentage points in 2010.

In the UK, the *Number of break cycles* decreased over the period for both working men and women, from an average of 3.00 *break cycles* in 1974 to 2.91 *break cycles* in 2005 in the case of working men. In the case of working women, the *Number of break cycles* decreased from an average of 3.68 *break cycles* in 1974 to 3.50 *break cycles* in 2005. Both changes are statistically significant at the 99% level. Men and women also increased the number of *Hours between breaks* and the number of *Activities between breaks*, since men and women spend 0.74 and 0.79 more hours, and do 1.18 and 1 more activities in each *break cycle* in 2005 compared to 1974, respectively. As for the US, the *Number of break cycles* decreased over the period for both working men and women, from an average of 4.55 *break cycles* in 1965 to 3.57 *break cycles* in 2010 in the case of working men. In the case of working women, the *Number of break cycles* decreased from an average of 5.70 *break cycles* in 1965 to 3.90 *break cycles* in 2010. Both changes are statistically significant at the 99% level. Men and women also increased the number of *Hours between breaks*. Men and women spend 0.90 and 0.88 more hours in each *break cycle* in 2010 compared to 1965, respectively. All these changes are statistically significant at standard levels.

4.2.1 Working vs. non-working days

This Section further analyzes differences in trends between working and non-working days. Given that the 24-hour time constraint becomes more binding during working days, and the impact of a decrease in the quality of leisure on the well-being of workers may be higher if such changes occur in working days, having a good quality of leisure is more important during working days. We define working days as those days where workers devoted at least 60 minutes to market work activities, excluding commuting. We choose 60 minutes because there may be cases that workers are having a day off, but they go their work place just to check their e-mail or

meet some colleagues for lunch. In our case, around 1% of the sample of workers reporting positive market work devotes less than 60 minutes to such activities, excluding commuting.

Table 6 and 7 show trends in our indicators for the UK and the US, by working/non-working day, respectively. In the case of the UK, the first rows in Panels A1 and A2 of Table 6 shows that whereas working men have more *leisure* now than 4 decades ago during working days (2 hours and 30 more minutes per week), they did not experience any statistically significant change in *leisure* time during non-working days. About the quality of this leisure, Panel A1 in Table 6 shows that working men increased the percentage of *pure leisure* (1.28 percentage points) during working days, pointing toward a small increase in the quality of leisure. However, working men decreased the number of *break cycles* during working days (overall decrease of 0.17 break cycles), and they experienced an increase in the hours before a break (1.02 hours) and the activities done before a break (1.42 activities). For the case of non-working days, panel A2 shows that working men did not experienced any change in the percentage of *pure leisure*, while they experienced an increase in the hours before a break (0.47 hours) and the activities done before a break (0.66 activities).

Working women in the UK increased their *leisure* time particularly during non-working days (3.49 hours during working days vs 4.33 hours during non working days). Panel B1 in Table 6 shows however that whereas working women experienced a non-statistically significant increase in the percentage of *pure leisure* during working days, the number of *break cycles* decreased (0.36 fewer break cycles), leading to an increase in the hours and the activities done before a break of 1.234 hours and 1.65 activities. During non-working days, the percentage of *pure leisure* decreased by 1.34 percentage points, with this change being statistically significant at the 90% level. Working women also decreased the number of *break cycles* in a non-working day (0.14 break cycles), and experienced an increase of 0.67 hours per day and 0.56 activities before a break.

For the US, Table 7 also shows that whereas working men have more *leisure* now than 5 decades ago during working days (7 more hours per week), they did not experience any statistically significant change in *leisure* time during non-working days. The quality of this leisure time is lower now than it was 45 years ago during both working and non-working days. Panel A1 in Table 7 shows that working men decreased the percentage of *pure leisure* (5.15 percentage points), the percentage of *leisure with spouse* (4.22 percentage points) and the percentage of *leisure with adults* (19.21 percentage points) during working days. Working men also decreased the number of *break cycles* during working days (overall decrease of 1.10 break cycles), and they experienced an increase in the hours before a break (1.25 hours) and the activities done before a break (0.24 activities). For the case of non-working days, panel A2

shows that working men experienced a decrease in the percentage of *pure leisure* (6.15 percentage points) and the percentage of *leisure with adults* (22.20 percentage points), and experienced a decrease in the number of *break cycles* during non-working days (0.47 *break cycles*) and an increase in the hours before a break (0.45 hours).

Working women in the US increased their *leisure* time particularly during working days (9.90 hours during working days vs 6.60 during non working days). Panel B1 in Table 7 shows however that whereas working women experienced an increase in the percentage of *leisure with spouse* (7.97 percentage points) during working days, the number of *break cycles* decreased (1.98 fewer break cycles), leading to an increase in the hours and the activities done before a break of 1.27 hours and 0.43 activities. During non-working days, the percentage of *pure leisure* and the percentage of *leisure with adults* decreased by 8.23 and 21.92 percentage points, respectively. Working women also decreased the number of *break cycles* in a non-working day (1.36 break cycles), and experienced an increase of 0.44 hours per day before a break. All these changes are statically significant at the 95% level.

Table 8 shows trends in the *Number of work cycles*, *Hours during work cycles* and *Activities during work cycles*, for both working men (Panel A) and working women (Panel B) in the UK during working-days. Both working men and women experienced a decrease in the number of *work cycles* between 1974 and 2005, while the duration and the number of activities done during each *work cycles* went up. In particular, the number of *work cycles* decreased by 0.34 between 1974 and 2005 for working men, which resulted in an increase in the duration of each *work cycle* (0.56 more hours), and the number of activities done during each *work cycle* (1.79 more activities). For working women we observe similar trends during this period. Women experienced a decrease of 0.31 *work cycles* between 1974 and 2005, which resulted in an increase in the duration of each *work cycle* (0.75 more hours), and the number of activities done during each *work cycles* (2.01 more activities), between 1974 and 2005, with all these changes being statistically significant at the 99% level. We thus observe that, compared to 1974, in 2005 workers in the UK have fewer breaks once they start to work, evidence that they push themselves for longer before taking a break from work

Table 9 shows trends in the *Number of work cycles*, *Hours during work cycles* and *Activities during work cycles*, for both working men (Panel A) and working women (Panel B) in the United Kingdom during working-days. Both working men and women experienced a decrease in the number of *work cycles* between 1965 and 2010, while the duration and the number of activities done during each *work cycles* went up. In particular, the number of *work cycles* decreased by 1.10 between 1965 and 2010 for working men, which resulted in an increase in the duration of each *work cycle* (0.61 more hours), and the number of activities done during each

work cycle (1.96 more activities). For working women we observe similar trends during this period. Women experienced a decrease of 0.98 *work cycles* between 1965 and 2010, which resulted in an increase in the duration of each *work cycle* (0.87 more hours), and the number of activities done during each *work cycles* (1.66 more activities), between 1965 and 2010, with all these changes being statistically significant at the 99% level. Hence we observe that, compared to 1965, in 2010 American workers have fewer breaks once they start to work, evidence that they push themselves for longer before taking a break from work.

These findings suggest that labor market constraints have imposed tighter work and leisure rhythms, especially during working days. For example, increasing problems to balance work and family responsibilities may have had an influence on daily rhythms especially in working days, due to the fact that families where adults work for pay have become much more common (e.g., e.g., Hochschild and Machung, 1989; Schor, 1991; Hochschild, 1997; Jacobs and Gerson, 2001).¹² Additionally, there has been a long term rise in the skill profile of the workforce in most capitalist societies, reflected in part in a growth in the number of employees in managerial and professional occupations (Tahlin, 2007), and those at higher occupational levels have had more complex tasks with higher levels of responsibility, which could have probably lead to work preoccupations spilling over into family life. In this sense, greater international competition was intensifying work and thereby reducing the time and energy available for family and leisure life – there is some empirical support for the view that work intensity increased in many Western countries in the 1990s (Askenazy et al., 2006; Green, 1999; Green and McIntosh, 2001). To the extent that the UK and the US are liberal market economies (e.g.,), these countries have combined an expansion of higher level skills with a low skilled workforce that has been subject to an intensification of work through tighter managerial control over the work process, leading to an increased work pressure (e.g., Gallie, 2007a,b).

This more frantic pace may have led workers to give up some of their quality and quantity of leisure time during non-working days. Thus, in stark contrast with the changing amount of leisure, most of our indicators show increases in the amount of busyness over this period for working individuals. Although there are no clear trends in the amount of leisure time spent with the spouse or with another adult, we find that leisure is more intertwined with other non-leisure activities, pointing toward a decrease in the quality of leisure. Similarly, our findings indicate that workers in the United States and the United Kingdom now push themselves longer and do more things before they take a break, compared to 40 years ago, given the decrease in the

¹² For instance, Winslow (2005) find that work-family conflict has increased between 1977 and 1997 in the US, particularly for men, and that marital, parental, and spouses employment status prove to be consistently important predictors of work-family conflict

number of *break cycles*, and the increase in the number of activities and the time spent between breaks.

5. Conclusion

We link six decades of detailed time-use surveys at the episode level starting in the 60s in the United States, and four decades starting in the 70s in the United Kingdom, and use the valuable information embedded in the *diary* to create a well-crafted empirical decomposition of trends in work and leisure rhythms for US and UK workers. In particular, we document not just the quantity of leisure, but also its quality, and look at how much workers in the United States and the United Kingdom push themselves during the day by documenting the number of breaks, and the duration and the number of activities between breaks.

The evidence presented here indicates that working individuals are more stressed and less happy now than several decades ago. We find that although the amount of leisure increased for workers in both the United States and the United Kingdom during the reference period, leisure quality decreased. The percentage of time spent in leisure activities only decreased, as did leisure with the partner and other adults. Additionally, workers in the United States and the United Kingdom now take fewer breaks, they do more activities before a break, and spend more time before a break. Complementary data on enjoyment reveals that all these behavioural changes are associated with lower levels of happiness, and higher levels of negative feelings such as stress and tiredness. Further evidence from comparisons between working and non-working days seems to suggest that workers tried to compensate for more stressful rhythms during working days by giving up some of the quantity and quality leisure time during non-working days.

Our findings suggest that labour market constraints may have led workers to push themselves for longer during working days, and to decrease the quality of leisure time during non-working days to compensate for the more frantic leisure and work rhythms during working days. The evidence provides some support for policies aimed at facilitating workers' control over their schedule. Such policies may include flexible work practices, as a mean to increase job satisfaction and ultimately productivity. There is an emerging consensus that these types of family friendly working practices - such as the provision of on-site nurseries, flexible working hours, working from home, and job sharing - are mainly productivity enhancing in line with efficiency wage theories (e.g., Lehrer et al., 1991; Johnson and Provan, 1995; Brown and Sessions, 1996; Gariety and Shaffer, 2001; Hill et al., 2001; Heywood and Jirjahn, 2004; McCrate, 2005; Eldridge and Pabilonia, 2007; Winder, 2009) by means of increasing on-the-job

effort (e.g., Allen, 1980; Dalton and Mesch, 1990; Shepard, Clifton and Kruse, 1996; Owen, 1997), reducing worker turnover (e.g., Ronen, 1981; Kim and Compagna; 1981; Ralston, 1985;1989), and increasing loyalty to the employer (e.g., Roehlin et al., 2001; Eaton, 2003). Therefore these amenities might be offered at no extra cost to employees. In line with an efficiency wage argument, these practices may not only increase worker's wellbeing, but they may also lead to increases in wages.

By documenting trends in daily rhythms our paper opens up a new and interesting line of research that should aim to investigate the forces behind these trends. Stiglitz et al. (2009) recently proposed a broad range of measures of household economic activity to evaluate quality of life, such as time spent in leisure and the instant enjoyment of leisure activities. Understanding the channels under which recent economic progress has led to increases in the relative price of the quality of leisure, and the greater competition that has intensified work demands, leading to substitutions away from high-quality leisure in favor of low-quality leisure, remains a fact in need of an empirically based theory. It is hoped that the facts presented in this paper will guide that search.

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Figure 1 – An example of *break* and *work cycles* sequence ^a

Start	Finish	Duration	Description of Activities	Break Activities	Work Activities	Break Cycles	Work Cycles
6:00	7:10	1:10	sleep	X		1	
7:10	7:11	0:01	care of infants			↓	
7:11	7:46	0:35	wash, dress, personal care	X		2	
7:46	7:48	0:02	food preparation, cooking			↓	
7:48	7:58	0:10	other meals and snacks	X		3	
7:58	8:03	0:05	general care of older children			↓	
8:03	8:05	0:02	other domestic work			↓	
8:05	8:20	0:15	travel to/from work + other work travel		X		1
8:20	8:45	0:25	other meals and snacks	X		↓	↓
8:45	14:45	6:00	main paid work (not at home)		X	4	2
14:45	14:55	0:10	travel to/from work + other work travel		X	↓	↓
14:55	14:57	0:02	wash, dress, personal care	X		5	2
14:57	15:02	0:05	travel related to child care			↓	
15:02	15:17	0:15	other child care			↓	
15:17	15:32	0:15	travel related to child care			↓	
15:32	15:34	0:02	other child care			↓	
15:34	15:49	0:15	travel related to consumption			↓	
15:49	16:19	0:30	other meals and snacks	X		6	
16:19	17:00	0:41	watch television, video	X		↓	
17:00	17:10	0:10	other domestic work			↓	
17:10	17:20	0:10	conversation, phone, texting			↓	
17:20	17:40	0:20	wash, dress, personal care	X		7	
17:40	18:25	0:45	watch television, video	X		↓	
18:15	18:30	0:15	personal or adult care travel			↓	
18:30	18:40	0:10	adult care			↓	
18:40	18:45	0:05	travel related to consumption			↓	
18:45	19:30	0:45	purchase other services			↓	
19:30	19:35	0:05	personal or adult care travel			↓	
19:35	19:37	0:02	personal or adult care travel			↓	
19:37	19:50	0:13	other travel			↓	
19:50	22:30	2:40	receive or visit friends			↓	
22:30	22:50	0:20	other travel			↓	
22:50	23:20	0:30	receive or visit friends			↓	
23:20	23:30	0:10	wash, dress, personal care	X		7	
23:30	23:45	0:15	read books	X			
23:45	6:00	6:15	sleep	X			
Number of Cycles						7	2
Average Duration of Cycles						2:26	3:12
Number of Activities between Breaks						3.14	1.5

Source: American Heritage Time Use Study 2003

Table 1 – Regressions on levels of feelings, leisure indicators^{a,b}

<i>Leisure Quality</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	U Index		Happiness		Stress		Sadness		Tiredness		Pain	
<i>Leisure with spouse</i>	-0.044*** (0.014)	-	0.180*** (0.060)	-	-0.015 (0.069)	-	0.008 (0.049)	-	-0.096 (0.078)	-	-0.035 (0.062)	-
<i>Leisure with adults</i>	-	-0.039*** (0.011)	-	0.212*** (0.046)	-	-0.077 (0.053)	-	-0.045 (0.038)	-	-0.044 (0.060)	-	0.012 (0.049)
<i>Male</i>	-0.064*** (0.010)	-0.046*** (0.008)	(0.023) (0.041)	(0.045) (0.033)	-0.256*** (0.047)	-0.218*** (0.037)	-0.090*** (0.035)	-0.079*** (0.028)	-0.403*** (0.053)	-0.374*** (0.041)	(0.065) (0.043)	-0.068** (0.034)
<i>Age</i>	-0.001 (0.004)	0.006* (0.003)	-0.024 (0.017)	-0.021* (0.012)	-0.005 (0.018)	0.032** (0.013)	0.008 (0.014)	0.026*** (0.010)	-0.019 (0.020)	-0.005 (0.015)	0.025 (0.017)	0.031*** (0.012)
<i>Age Squared</i>	0.000 (0.005)	-0.007** (0.003)	0.028 (0.019)	0.026* (0.014)	0.003 (0.021)	-0.038** (0.015)	-0.002 (0.016)	-0.022* (0.012)	0.005 (0.023)	-0.008 (0.017)	-0.017 (0.020)	-0.022 (0.014)
<i>University Education</i>	0.017 (0.019)	0.009 (0.016)	-0.339*** (0.089)	-0.296*** (0.075)	0.002 (0.102)	-0.005 (0.084)	-0.518*** (0.090)	-0.492*** (0.076)	0.030 (0.112)	0.023 (0.090)	-0.602*** (0.106)	-0.562*** (0.086)
<i>Secondary Education</i>	0.022 (0.021)	0.014 (0.017)	-0.244** (0.096)	-0.232*** (0.080)	-0.119 (0.108)	-0.145 (0.089)	-0.398*** (0.095)	-0.389*** (0.080)	0.046 (0.120)	0.015 (0.096)	-0.382*** (0.112)	-0.354*** (0.091)
<i>Working part-time</i>	-0.043*** (0.012)	-0.021** (0.010)	0.103** (0.049)	0.032 (0.041)	-0.085 (0.058)	-0.025 (0.046)	0.031 (0.044)	0.042 (0.035)	-0.093 (0.064)	-0.105** (0.050)	0.030 (0.054)	0.023 (0.042)
<i>Presence of children <18</i>	-0.001 (0.013)	0.003 (0.010)	0.053 (0.050)	0.061 (0.039)	0.149*** (0.058)	0.141*** (0.045)	-0.024 (0.045)	-0.011 (0.035)	0.108* (0.065)	0.092* (0.050)	-0.086 (0.054)	-0.026 (0.041)
<i>Married</i>	-	-0.041*** (0.009)	-	0.159*** (0.038)	-	-0.120*** (0.042)	-	-0.175*** (0.033)	-	0.006 (0.047)	-	-0.117*** (0.039)
<i>Constant</i>	0.290*** (0.085)	0.167*** (0.062)	4.983*** (0.356)	4.727*** (0.257)	1.778*** (0.383)	1.050*** (0.280)	0.778*** (0.279)	0.480** (0.215)	3.339*** (0.426)	2.912*** (0.309)	0.562 (0.349)	0.428* (0.250)
<i>Observations</i>	3,968	6,383	3,968	6,383	3,968	6,383	3,968	6,383	3,968	6,383	3,968	6,383
<i>R-squared</i>	0.026	0.024	0.025	0.026	0.034	0.035	0.025	0.028	0.041	0.032	0.028	0.028

Note: Sample consists of respondents in the ATUS 2010 Well-being Module, between 21-65 and working at least 10 hours per week in the labor market. Standard errors in parentheses.

^a *Leisure with spouse* indicates the percentage of leisure done with a co-present partner during the reference day; *Leisure with adults* the percentage of leisure done with a co-present adult during the reference day. Only married individuals are selected in regressions with the indicator of *Leisure with spouse*.

^b We estimate the following equation: $E_i = \alpha + \beta I_i + \gamma X_i + \varepsilon_i$ where “*i*” refers to respondent, E_i is the average rating of the reference feeling for respondent “*i*”, I_i is the indicator at the diary level for respondent “*i*”, and X_i measures household and personal characteristics of respondent “*i*” (age and its squared, male dummy, dummies for university and secondary education, a dummy for working part-time, a dummy if there are children under 18 in the household, and a dummy to indicate whether the worker is married/cohabiting). We also include day-of-week dummies in all of the regressions.

Table 2 – Regressions on levels of emotions feelings, break cycles ^{a,b}

<i>Break Cycles</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	U Index		Happiness		Stress		Sadness		Tiredness		Pain	
<i>Activities between breaks</i>	0.001 (0.001)	-	-0.008** (0.004)	-	0.019*** (0.004)	-	0.002 (0.003)	-	0.000 (0.005)	-	0.000 (0.004)	-
<i>Hours between breaks</i>	-	0.003*** (0.001)	-	-0.002 (0.004)	-	0.026*** (0.005)	-	0.005 (0.004)	-	0.027*** (0.005)	-	0.001 (0.004)
<i>Male</i>	-0.045*** (0.008)	-0.046*** (0.008)	(0.051) (0.034)	(0.042) (0.033)	-0.197*** (0.037)	-0.215*** (0.037)	-0.077*** (0.029)	-0.079*** (0.028)	-0.375*** (0.042)	-0.370*** (0.041)	-0.068** (0.034)	-0.067** (0.034)
<i>Age</i>	0.006* (0.003)	0.006* (0.003)	-0.021* (0.012)	-0.022* (0.012)	0.030** (0.013)	0.031** (0.013)	0.026*** (0.010)	0.026*** (0.010)	-0.005 (0.015)	-0.005 (0.015)	0.031*** (0.012)	0.031*** (0.012)
<i>Age Squared</i>	-0.007** (0.003)	-0.007** (0.003)	0.026* (0.014)	0.027* (0.014)	-0.036** (0.015)	-0.038** (0.015)	-0.022* (0.012)	-0.022* (0.012)	-0.009 (0.017)	-0.008 (0.017)	-0.022 (0.014)	-0.022 (0.014)
<i>University Education</i>	0.008 (0.016)	0.007 (0.016)	-0.291*** (0.076)	-0.298*** (0.076)	-0.023 (0.084)	-0.022 (0.084)	-0.494*** (0.076)	-0.495*** (0.076)	0.024 (0.090)	0.005 (0.090)	-0.562*** (0.086)	-0.562*** (0.086)
<i>Secondary Education</i>	0.015 (0.017)	0.015 (0.017)	-0.234*** (0.081)	-0.237*** (0.081)	-0.151* (0.089)	-0.149* (0.089)	-0.389*** (0.080)	-0.389*** (0.080)	0.016 (0.096)	0.011 (0.095)	-0.355*** (0.091)	-0.355*** (0.091)
<i>Working part-time</i>	-0.022** (0.010)	-0.021** (0.010)	0.035 (0.041)	0.032 (0.041)	-0.031 (0.046)	-0.020 (0.046)	0.041 (0.035)	0.043 (0.035)	-0.105** (0.050)	-0.100** (0.050)	0.023 (0.042)	0.023 (0.042)
<i>Presence of children <18</i>	0.003 (0.010)	0.003 (0.010)	0.063 (0.040)	0.055 (0.039)	0.123*** (0.045)	0.135*** (0.044)	-0.013 (0.035)	-0.012 (0.035)	0.094* (0.050)	0.085* (0.050)	-0.026 (0.041)	-0.026 (0.041)
<i>Married</i>	-0.044*** (0.009)	-0.045*** (0.009)	0.177*** (0.038)	0.176*** (0.038)	-0.129*** (0.042)	-0.131*** (0.042)	-0.179*** (0.033)	-0.180*** (0.033)	0.002 (0.047)	-0.002 (0.047)	-0.116*** (0.039)	-0.116*** (0.039)
<i>Constant</i>	0.159** (0.062)	0.151** (0.062)	4.774*** (0.258)	4.775*** (0.258)	1.020*** (0.279)	0.957*** (0.279)	0.469** (0.215)	0.456** (0.215)	2.904*** (0.309)	2.825*** (0.309)	0.430* (0.250)	0.428* (0.250)
<i>Observations</i>	6,383	6,383	6,383	6,383	6,383	6,383	6,383	6,383	6,383	6,383	6,383	6,383
<i>R-squared</i>	0.023	0.024	0.023	0.023	0.038	0.04	0.027	0.028	0.032	0.036	0.028	0.028

Note: Sample consists of respondents in the ATUS 2010 Well-being Module, between 21-65 and working at least 10 hours per week in the labor market. Standard errors in parentheses.

^a *Activities in break cycles* measures the mean number of activities done between break cycle for the reference day. *Time in break cycle* measures the mean number of hours which elapse between break cycles for the reference day.

^b We estimate the following equation: $E_i = \alpha + \beta I_i + \gamma X_i + \varepsilon_i$ where “*i*” refers to respondent, E_i is the average rating of the reference feeling for respondent “*i*”, I_i is the indicator at the diary level for respondent “*i*”, and X_i measures household and personal characteristics of respondent “*i*” (age and its squared, male dummy, dummies for university and secondary education, a dummy for working part-time, a dummy if there are children under 18 in the household, and a dummy to indicate whether the worker is married/cohabiting). We also include day-of-week dummies in all of the regressions.

Table 3 – Regressions on levels of feelings, work cycles^{a,b}

<i>Work Cycles</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	U Index		Happiness		Stress		Sadness		Tiredness		Pain	
<i>Activities in work cycle</i>	0.004**	-	-0.002	-	0.026***	-	0.004	-	0.029***	-	0.005	-
	(0.002)	-	(0.006)	-	(0.008)	-	(0.005)	-	(0.008)	-	(0.007)	-
<i>Time in work cycle</i>	-	0.004*	-	0.008	-	0.028***	-	0.003	-	0.046***	-	0.001
	-	(0.002)	-	(0.007)	-	(0.008)	-	(0.006)	-	(0.009)	-	(0.007)
<i>Male</i>	-0.046***	-0.047***	(0.042)	(0.042)	-0.215***	-0.219***	-0.079***	-0.080***	-0.370***	-0.375***	-0.067*	-0.068**
	(0.008)	(0.008)	(0.034)	(0.033)	(0.037)	(0.037)	(0.028)	(0.028)	(0.041)	(0.041)	(0.034)	(0.034)
<i>Age</i>	0.006*	0.006**	-0.022*	-0.022*	0.032**	0.032**	0.027***	0.027***	-0.005	-0.004	0.031***	0.031***
	(0.003)	(0.003)	(0.012)	(0.012)	(0.013)	(0.013)	(0.010)	(0.010)	(0.015)	(0.014)	(0.012)	(0.012)
<i>Age Squared</i>	-0.007**	-0.007**	0.027*	0.027*	-0.038**	-0.039**	-0.022*	-0.022*	-0.008	-0.009	-0.022	-0.022
	(0.003)	(0.003)	(0.014)	(0.014)	(0.015)	(0.015)	(0.012)	(0.012)	(0.017)	(0.017)	(0.014)	(0.014)
<i>University Education</i>	0.008	0.008	-0.299***	-0.302***	-0.014	-0.013	-0.493***	-0.492***	0.012	0.010	-0.564***	-0.562***
	(0.016)	(0.016)	(0.076)	(0.075)	(0.084)	(0.084)	(0.076)	(0.076)	(0.090)	(0.090)	(0.086)	(0.086)
<i>Secondary Education</i>	0.015	0.015	-0.237***	-0.238***	-0.148*	-0.145	-0.389***	-0.388***	0.011	0.014	-0.356***	-0.355***
	(0.017)	(0.017)	(0.081)	(0.080)	(0.089)	(0.089)	(0.080)	(0.080)	(0.095)	(0.095)	(0.091)	(0.091)
<i>Working part-time</i>	-0.021**	-0.020**	0.032	0.034	-0.022	-0.019	0.043	0.043	-0.102**	-0.095*	0.024	0.024
	(0.010)	(0.010)	(0.041)	(0.041)	(0.046)	(0.046)	(0.035)	(0.035)	(0.050)	(0.050)	(0.042)	(0.042)
<i>Presence of children <18</i>	0.003	0.004	0.055	0.055	0.138***	0.143***	-0.011	-0.010	0.087*	0.094*	-0.027	-0.026
	(0.010)	(0.010)	(0.039)	(0.039)	(0.044)	(0.044)	(0.035)	(0.035)	(0.050)	(0.050)	(0.041)	(0.041)
<i>Married</i>	-0.044***	-0.044***	0.176***	0.176***	-0.127***	-0.126***	-0.179***	-0.179***	0.002	0.003	-0.116***	-0.116***
	(0.009)	(0.009)	(0.038)	(0.038)	(0.042)	(0.042)	(0.033)	(0.033)	(0.047)	(0.047)	(0.039)	(0.039)
<i>Constant</i>	0.158**	0.154**	4.769***	4.755***	1.023***	0.994***	0.470**	0.467**	2.889***	2.835***	0.428*	0.428*
	(0.062)	(0.062)	(0.258)	(0.258)	(0.279)	(0.279)	(0.215)	(0.215)	(0.308)	(0.308)	(0.249)	(0.249)
<i>Observations</i>	6,383	6,383	6,383	6,383	6,383	6,383	6,383	6,383	6,383	6,383	6,383	6,383
<i>R-squared</i>	0.023	0.023	0.023	0.023	0.037	0.037	0.027	0.027	0.034	0.036	0.028	0.028

Note: Sample consists of respondents in the ATUS 2010 Well-being Module, between 21-65 and working at least 10 hours per week in the labor market. Standard errors in parentheses.

^a *Activities in work cycle* measures the mean number of activities workers undertake once they start to work before they take a break for the reference day; *Time in work cycle* measures the mean time workers spent doing things once they start to work before they take a break for the reference day.

^b We estimate the following equation: $E_i = \alpha + \beta I_i + \gamma X_i + \varepsilon_i$ where “*i*” refers to respondent, E_i is the average rating of the reference feeling for respondent “*i*”, I_i is the indicator at the diary level for respondent “*i*”, and X_i measures household and personal characteristics of respondent “*i*” (age and its squared, male dummy, dummies for university and secondary education, a dummy for working part-time, a dummy if there are children under 18 in the household, and a dummy to indicate whether the worker is married/cohabiting). We also include day-of-week dummies in all of the regressions.

Table 4 – Trends in work and leisure rhythms, UK ^a

The United Kingdom	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Men	1974	1983	1995	2000	2005	Diff. 1974-Ti(b)	p-value diff
<i>Leisure time</i>	40.86	40.61	49.10	41.25	44.90	4.05	(<0.01)
<i>Percentage pure leisure</i>	94.79	93.90	-	90.93	95.03	0.24	(0.64)
<i>Number of break cycles</i>	3.00	4.12	3.03	4.28	2.88	-0.12	(0.01)
<i>Hours between breaks</i>	4.90	3.74	5.21	3.68	5.70	0.80	(<0.01)
<i>Activities between breaks</i>	2.99	2.70	2.59	3.42	4.21	1.22	(<0.01)
Panel B: Women	1974	1983	1995	2000	2005	Diff. 1974-Ti(c)	p-value diff
<i>Leisure time</i>	36.48	36.72	42.57	37.15	43.67	7.19	(<0.01)
<i>Percentage pure leisure</i>	93.46	92.11	-	90.32	91.90	-1.55	(0.01)
<i>Number of break cycles</i>	3.53	4.74	3.33	5.19	3.38	-0.15	(<0.01)
<i>Hours between breaks</i>	3.75	2.97	4.30	2.75	4.56	0.81	(<0.01)
<i>Activities between breaks</i>	2.92	2.73	2.70	3.35	4.12	1.19	(<0.01)

Note: p-value of the difference between the average value between 2005 and 1974 in parentheses.

Source: Sample consists of respondents in the MTUS, who are aged 21-65 and working at least 10 hours per week.

^a *Leisure time* measures the hours per week devoted to leisure activities; *Pure leisure* measures the amount of leisure that is reported as primary activity whose secondary activity is also leisure or with no secondary activity; *Number of break cycles* measures the amount of break cycles during the reference day; *Hours between breaks* measures the number of hours which elapse between break activities; *Activities between breaks* measures the mean number of activities between break activities.

^b T_i is 2005 for all the dependent variables.

Table 5 – Trends in work and leisure rhythms, US ^a

The United States	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Men	1965	1975	1985	1993	2003	2010	Diff. 1965-Ti(b)	p-value diff
<i>Leisure time</i>	27.95	26.06	30.35	32.98	33.98	37.49	9.54	(<0.01)
<i>Percentage pure leisure</i>	88.36	83.04	83.08	-	-	-	-5.28	(<0.01)
<i>Percentage leisure with spouse(c)</i>	56.29	59.20	-	-	55.01	55.74	-0.55	(0.76)
<i>Percentage leisure with adults</i>	74.96	75.20	-	-	64.39	56.36	-18.59	(<0.01)
<i>Number of break cycles</i>	4.55	3.87	4.11	2.71	3.38	3.57	-0.98	(<0.01)
<i>Hours between breaks</i>	2.92	3.43	3.35	5.11	4.07	3.83	0.90	(<0.01)
<i>Activities between breaks</i>	3.30	3.63	3.08	3.14	3.62	3.46	0.15	(0.14)
Panel B: Women	1965	1975	1985	1993	2003	2010	Diff. 1965- Ti(b)	p-value diff
<i>Leisure time</i>	22.29	28.82	27.96	29.85	29.68	34.24	11.95	(<0.01)
<i>Percentage pure leisure</i>	84.52	83.02	80.69				-3.84	(0.06)
<i>Percentage leisure with spouse(c)</i>	43.19	46.11			52.72	54.14	10.95	(<0.01)
<i>Percentage leisure with adults</i>	68.34	74.98			65.58	52.51	-15.83	(<0.01)
<i>Number of break cycles</i>	5.70	5.19	5.06	3.27	3.81	3.90	-1.80	(<0.01)
<i>Hours between breaks</i>	2.61	2.47	2.66	4.43	3.59	3.49	0.88	(<0.01)
<i>Activities between breaks</i>	3.88	3.70	3.28	3.58	4.20	4.11	0.24	(0.19)

Note: p-value of the difference between the average value between 2010 and 1965 in parentheses.

Source: Sample consists of respondents in the AHTUS (1965-2010), who are aged 21-65 and working at least 10 hours per week.

^a *Leisure time* measures the hours per week devoted to leisure activities; *Pure leisure* measures the amount of leisure that is reported as primary activity whose secondary activity is also leisure or with no secondary activity; *Leisure with spouse* measures the amount of leisure that is done with a co-present partner; *Leisure with adults* measures the amount of leisure that is done with a co-present adult; *Number of break cycles* measures the amount of break cycles during the reference day; *Hours between breaks* measures the number of hours which elapse between break activities; *Activities between breaks* measures the mean number of activities between break activities.

^b T_i is 2010 for all the dependent variables, with the exception of the *Percentage of Pure Leisure* where T_i is 1985.

^c We restrict the sample to those individuals with a partner.

Table 6 – Trends in work and leisure rhythms by working/non-working day, UK^{a,b}

The United Kingdom	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Men	1974	1983	1995	2000	2005	Diff. 1974-Ti(c)	p-value diff
Panel A1: Working day							
<i>Leisure time</i>	32.15	31.92	31.84	28.28	34.53	2.38	(<0.01)
<i>Percentage pure leisure</i>	94.60	93.41	-	89.56	95.78	1.18	(0.04)
<i>Number of break cycles</i>	2.96	4.16	3.04	3.99	2.77	-0.19	(<0.01)
<i>Hours between breaks</i>	5.17	3.90	5.62	4.20	6.22	1.05	(<0.01)
<i>Activities between breaks</i>	2.94	2.64	2.68	3.22	4.38	1.44	(<0.01)
Panel A2: Non-Working day							
<i>Leisure time</i>	67.88	64.29	70.24	59.63	67.36	-0.52	(0.71)
<i>Percentage pure leisure</i>	95.39	95.23	-	92.87	93.42	-1.96	(0.07)
<i>Number of break cycles</i>	3.11	3.99	3.01	4.69	3.13	0.02	(0.82)
<i>Hours between breaks</i>	4.06	3.33	4.72	2.93	4.57	0.52	(<0.01)
<i>Activities between breaks</i>	3.14	2.83	2.48	3.71	3.84	0.71	(<0.01)
Panel B: Women	1974	1983	1995	2000	2005	Diff. 1974-Ti(c)	p-value diff
Panel B1: Working day							
<i>Leisure time</i>	28.52	29.74	28.77	25.97	32.55	4.03	(<0.01)
<i>Percentage pure leisure</i>	93.41	91.74	-	89.13	93.54	0.13	(0.87)
<i>Number of break cycles</i>	3.47	4.71	3.31	4.90	3.11	-0.36	(<0.01)
<i>Hours between breaks</i>	4.03	3.17	4.80	3.18	5.37	1.34	(<0.01)
<i>Activities between breaks</i>	2.96	2.77	2.95	3.27	4.67	1.71	(<0.01)
Panel B2: Non-Working day							
<i>Leisure time</i>	53.47	49.44	51.93	48.72	55.13	1.66	(0.12)
<i>Percentage pure leisure</i>	93.57	92.77	-	91.55	90.22	-3.35	(<0.01)
<i>Number of break cycles</i>	3.67	4.81	3.34	5.50	3.66	-0.01	(0.92)
<i>Hours between breaks</i>	3.15	2.60	3.97	2.30	3.72	0.57	(<0.01)
<i>Activities between breaks</i>	2.84	2.64	2.53	3.42	3.54	0.70	(<0.01)

Note: p-value of the difference between the average value between 2005 and 1974 in parentheses.

Source: Sample consists of respondents in the MTUS, who are aged 21-65 and working at least 10 hours per week.

^a *Leisure time* measures the hours per week devoted to leisure activities; *Pure leisure* measures the amount of leisure that is reported as primary activity whose secondary activity is also leisure or with no secondary activity; *Number of break cycles* measures the amount of break cycles during the reference day; *Hours between breaks* measures the number of hours which elapse between break activities; *Activities between breaks* measures the mean number of activities between break activities.

^b Working days are those where the individual devotes at least 60 minutes to market work activities, excluding commuting.

^c T_i is 2005 for all the dependent variables.

Table 7 – Trends in work and leisure rhythms by working/non-working day, US^{a,b}

The United States	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Men	1965	1975	1985	1993	2003	2010	Diff. 1965-T_i(c)	p-value diff
Panel A1: Working day								
<i>Leisure time</i>	22.41	20.44	23.61	24.54	24.77	29.45	7.04	(<0.01)
<i>Percentage pure leisure</i>	87.98	83.12	82.83	-	-	-	-5.15	(0.01)
<i>Percentage leisure with spouse(d)</i>	55.45	60.43	-	-	50.81	51.23	-4.22	(0.05)
<i>Percentage leisure with adults</i>	72.96	75.49	-	-	60.02	53.75	-19.21	(<0.01)
<i>Number of break cycles</i>	4.67	3.92	3.99	2.61	3.49	3.57	-1.10	(<0.01)
<i>Hours between breaks</i>	3.00	3.73	3.60	5.78	4.48	4.25	1.25	(<0.01)
<i>Activities between breaks</i>	3.21	3.73	3.07	3.23	3.59	3.45	0.24	(0.01)
Panel A2: Non-Working day								
<i>Leisure time</i>	51.67	46.21	50.54	52.27	48.79	52.70	1.03	(0.63)
<i>Percentage pure leisure</i>	89.98	82.76	83.83	-	-	-	-6.15	(0.01)
<i>Percentage leisure with spouse(d)</i>	59.88	54.32	-	-	61.57	64.04	4.17	(0.20)
<i>Percentage leisure with adults</i>	83.50	74.19	-	-	71.43	61.30	-22.20	(<0.01)
<i>Number of break cycles</i>	4.05	3.71	4.47	2.93	3.21	3.58	-0.47	(0.01)
<i>Hours between breaks</i>	2.58	2.36	2.58	3.60	3.42	3.02	0.45	(0.07)
<i>Activities between breaks</i>	3.70	3.25	3.13	2.95	3.67	3.46	-0.23	(0.53)
Panel B: Women								
Panel B1: Working day								
<i>Leisure time</i>	16.14	21.68	21.35	21.59	21.62	26.04	9.90	(<0.01)
<i>Percentage pure leisure</i>	82.77	82.52	80.53	-	-	-	-2.23	(0.39)
<i>Percentage leisure with spouse(d)</i>	40.01	44.96	-	-	47.90	47.98	7.97	(0.02)
<i>Percentage leisure with adults</i>	63.62	72.01	-	-	59.47	47.69	-15.92	(<0.01)
<i>Number of break cycles</i>	5.84	5.36	4.89	3.06	3.80	3.86	-1.98	(<0.01)
<i>Hours between breaks</i>	2.67	2.64	2.97	5.23	4.03	3.93	1.27	(<0.01)
<i>Activities between breaks</i>	3.78	3.66	3.28	3.74	4.25	4.20	0.43	(0.06)
Panel B2: Non-Working day								
<i>Leisure time</i>	38.66	41.10	40.32	41.96	38.97	45.26	6.60	(<0.01)
<i>Percentage pure leisure</i>	89.20	83.88	80.98	-	-	-	-8.23	(<0.01)
<i>Percentage leisure with spouse(d)</i>	51.57	48.06	-	-	57.69	62.00	10.43	(0.03)
<i>Percentage leisure with adults</i>	80.91	80.08	-	-	72.62	58.98	-21.92	(<0.01)
<i>Number of break cycles</i>	5.32	4.90	5.37	3.58	3.82	3.96	-1.36	(<0.01)
<i>Hours between breaks</i>	2.45	2.18	2.09	3.26	3.08	2.89	0.44	(0.01)
<i>Activities between breaks</i>	4.15	3.77	3.28	3.34	4.15	3.99	-0.16	(0.57)

Note: p-value of the difference between the average value between 2010 and 1965 in parentheses.

Source: Sample consists of respondents in the AHTUS (1965-2010), who are aged 21-65 and working at least 10 hours per week.

^a *Leisure time* measures the hours per week devoted to leisure activities; *Pure leisure* measures the amount of leisure that is reported as primary activity whose secondary activity is also leisure or with no secondary activity; *Leisure with spouse* measures the amount of leisure that is done with a co-present partner; *Leisure with adults* measures the amount of leisure that is done with a co-present adult; *Number of break cycles* measures the amount of break cycles during the reference day; *Hours between breaks* measures the number of hours which elapse between break activities; *Activities between breaks* measures the mean number of activities between break activities.

^b Working days are those where the individual devotes at least 60 minutes to market work activities, excluding commuting.

^c T_i is 2010 for all the dependent variables, with the exception of the *Percentage of Pure Leisure* where T_i is 1985.

^d We restrict the sample to those individuals with a partner.

Table 8 – Number of work cycles, hours and activities during work cycles during working days, US ^{a,b}

The United Kingdom	(1)	(2)	(3)	(4)	(5)	(7)	(8)
Panel A: Men	1974	1983	1995	2000	2005	Diff. 1974-Ti(c)	p-value diff
<i>Number of work cycles</i>	1.71	2.43	1.85	1.95	1.36	-0.34	(<0.01)
<i>Hours during break cycles</i>	4.08	2.52	3.97	3.60	4.64	0.56	(<0.01)
<i>Activities during break cycles</i>	1.50	1.31	1.40	1.85	3.29	1.79	(<0.01)
Panel B: Women	1974	1983	1995	2000	2005	Diff. 1974-Ti(c)	p-value diff
<i>Number of work cycles</i>	1.58	2.23	1.58	1.84	1.27	-0.31	(<0.01)
<i>Hours during break cycles</i>	3.82	2.11	3.41	3.29	4.56	0.75	(<0.01)
<i>Activities during break cycles</i>	1.76	1.55	1.61	2.21	3.77	2.01	(<0.01)

Note: p-value of the difference between the average value between 2005 and 1974 in parentheses.

Source: Sample consists of respondents in the MTUS, who are aged 21-65 and working at least 10 hours per week.

^a *Number of work cycles* measures the number of cycles which begin with paid work or paid work training activities, and finish with a break activity; *Hours during work cycles* measures how many things people do once they start to work before they take a break; *Activities during work cycles* measures how many activities they undertake once they start to work before they take a break.

^b Working day are those where the individual devotes at least 60 minutes to market work activities, excluding commuting.

^c T_i is 2005 for all the dependent variables.

Table 9 – Number of work cycles, hours and activities during work cycles during working days, US ^{a,b}

The United States	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Men	1965	1975	1985	1993	2003	2010	Diff. 1965-Ti(c)	p-value diff
<i>Number of work cycles</i>	3.16	2.54	2.16	1.54	2.12	2.06	-1.10	(<0.01)
<i>Hours during break cycles</i>	1.44	2.04	2.95	5.33	3.31	3.40	1.96	(<0.01)
<i>Activities during break cycles</i>	1.60	2.00	1.96	1.79	2.13	2.21	0.61	(<0.01)
Panel B: Women	1965	1975	1985	1993	2003	2010	Diff. 1965- Ti(c)	p-value diff
<i>Number of work cycles</i>	2.94	2.50	2.05	1.57	2.02	1.96	-0.98	(<0.01)
<i>Hours during break cycles</i>	1.83	2.06	2.95	5.38	3.45	3.49	1.66	(<0.01)
<i>Activities during break cycles</i>	2.26	2.65	2.54	2.65	3.06	3.13	0.87	(<0.01)

Note: p-value of the difference between the average value between 2010 and 1965 in parentheses.

Source: Sample consists of respondents in the AHTUS (1965-2010), who are aged 21-65 and working at least 10 hours per week.

^a *Number of work cycles* measures the number of cycles which begin with paid work or paid work training activities, and finish with a break activity; *Hours during work cycles* measures how many things people do once they start to work before they take a break; *Activities during work cycles* measures how many activities they undertake once they start to work before they take a break.

^b Working day are those where the individual devotes at least 60 minutes to market work activities, excluding commuting.

^c T_i is 2010 for all the dependent variables.

APPENDIX A: TECHNICAL INFORMATION

Table A1- Survey description for the UK surveys

Study aims, target populations, and sample restrictions			
Survey years	Organizing Aims and Considerations	Target Population	Sampling Restrictions
1974	Aimed to monitor time use by people aged 5+ living in randomly sampled households in the UK (excluding Northern Ireland)	People aged 5+ living in randomly sampled households in the UK (excluding Northern Ireland).	None
1983	Aimed to monitor time use by people aged 14+ living in randomly sampled households in the UK	People aged 14+ living in randomly sampled households in the UK.	None
1995	Aimed to facilitate future studies using time budgets which would not unduly burden respondents	Multi- purpose survey for the people in age 16 or over	None
2000	This study collects the UK contribution to the Harmonised European Time Use Studies (HETUS) data. The results of the main survey will be used by government departments, academics and other policy makers to monitor how people use their time and help shape policies	Multi- purpose survey for the people in age 8+	The survey aimed to collect 24,000 diaries (2 diaries for each of the 12,000 individuals taking part). Each participant was asked to complete two diaries. children aged 8 to 13 completed child diaries. Child diaries also covered one day
2005	This study builds on lessons for collecting national time use data from the UK HETUS study in 2000-2001	One person aged 16 or older was selected for the interview and the diary	None
Relevant points in time from the sample designs			
Survey years	Fieldwork Period	Sampling of Days of the Week	When Activities Were Recorded
1974	14-20 August, 1974; 4-10 September, 1974, 12-18 February 1975; 26 February - 4 March, 1975	7 day / one week in three of the four waves, only 2 days (Monday & Tuesday) in the 4-10 September wave remain, other data from this wave no longer exists	Same day as activities
1983	November-December 1983, January-February 1984	All household members aged 14+ asked to complete a 7 day diary, specifying main activity and secondary activities	On the day of observed activities
1995	May-95	All household members aged 16+ asked to complete 1 diary, specifying main activity and secondary activities	Respondents completed the diaries themselves with the assistance of interviewer. Recall
2000	June 2000 - August 2001	2 days, 1 weekend and 1 weekday	Self-completed in own-words with pen and paper. Same day as activities
2005	21 March - 13 April 2005; 20 June - 16 July 2005; 19 September - 15 October 2005; 21 November - 17 December 2005	1 day	Previous day (with some diaries covering up to three days previously)
Sample designs and response rates			
Survey years	Sample Frame	How Sample Drawn	Response Rate
1974	Private households	The BBC Audience Research sampled electoral register to locate households	60%
1983	Private households	Stratified national random sample of addresses; prior to diaries commencing, one household member interviewed with extensive household questionnaire	40%
1995	Private households	OPCS Omnibus sample frame: interview 2,000 households per month randomly selected from 100 post code sectors, stratified by region, proportion of households renting from local authorities and proportion of heads of households in SEGs 1-5 (professionals, employers and managers)	93%
2000	Private households	The sample of addresses is selected from the Postcode Address File (PAF). One household per address is randomly selected	45%
2005	Private households	An independent cross-sectional multi-stage stratified random sample of private households in Great Britain (England, Wales and Scotland) is drawn for each month of the Omnibus survey, and the diary served as the module accompanying the core of basic survey details collected with every Omnibus survey.	59% across the four waves

Source: Authors' compilation. See <http://www-2009.timeuse.org/information/studies/>

Table A2- AHTUS Description

Study aims, target populations, and sample restrictions			
Survey years	Organizing Aims and Considerations	Target Population	Sampling Restrictions
1965-1966	Aimed to be comparable with the Multinational Comparative Time-Budget project collected in 12 countries	The national working age population (19-64) of the USA (excluding families where all members worked as farmers)	Only people aged 19 to 64 (with a few older diarists), and one person per household (Alaska, Hawaii, and some smaller, rural states excluded)
1975-1976	Aimed to measure national accounts and changes in time use over the year	The national adult population	People aged 18 or older and one person plus spouse if present per household
1985	Aimed to determine how people used their time and to compare diaries collected by post-out/post-back, phone, and face-to-face interview	The national population beyond secondary school age not living in institutions	People aged 12 or older living in private households with phones (Alaska, Hawaii, and some smaller, rural states excluded)
1992-1994	Aimed to measure time use and exposure	The national population living in private residences	1 person of any age living in sampled private households with phones (Alaska and Hawaii excluded)
2003	Aimed to follow a sub-sample of the CPS for a 9 th wave to facilitate the study of national accounts	The national population not living in military bases or institutions	1 person aged 15 or older in the household
2010	Aimed to follow a sub-sample of the CPS for a 9 th wave to facilitate the study of national accounts	The national population not living in military bases or institutions	1 person aged 15 or older in the household
Relevant points in time from the sample designs			
Survey years	Fieldwork Period	Sampling of Days of the Week	When Activities Were Recorded
1965-1966	15 November -15 December 1965; 1 January - 18 February 1966; 7 March - 20 May, 1966	2/7ths of diaries were stamped for collection on a weekend day; 5/7ths were stamped for collection on a weekday	A two-stage tomorrow approach, diaries left behind for completion on diary day
1975-1976	Wave 1: 9 October 1975 – 22 November 1975; Wave 2: 6 February 1976 - 28 March 1976; Wave 3: 2 May 1976 - 19 July 1976; Wave 4: 4 September 1976 - 26 October 1976	The study aimed to collect one diary on a Sunday, one on a Saturday, and two on different weekdays from each sample member.	Diaries covered the previous 24 hour day
1985	Whole year of 1985	Mail-out after phone calls.	Diaries to be completed on a specified day in the subsequent week
1992-1994	September 1992 – October 1994	Phone calls were attempted on all days of the week.	Diaries covered the previous 24 hour day
2003	Whole year of 2003	Half of diaries were collected on weekday, half on weekend days.	Diaries covered the previous 24 hour day
2010	Whole year of 2010	Half of diaries were collected on weekday, half on weekend days.	Diaries covered the previous 24 hour day
Sample designs and response rates			
Survey years	Sample Frame	How Sample Drawn	Response Rate
1965-1966	Jackson, Michigan and surrounding townships, and a national sample	Jackson – random selection; National multi-stage clustered area sampling of clusters containing around 4 addresses; one individual per household	82 % in Jackson; 74 % in the national sample
1975-1976	Private households	Stratified, clustered and probability selection within strata. One individual was sampled per household. Data was also collected from spouses where present.	72 % in the first wave; 44.9 % responded to all four waves
1985	Adults 18 years or over, living in houses with telephones in the contiguous United States.	Stratified and clustered, random-digit dialing, with only private residences pursued for an interview. Information on the household collected by telephone.	55.2 % overall, 51 % for mail back sample
1992-1994	Potential phone numbers within lists of area codes	Random-digit dialing, only private residences pursued for interview. The person who would next have a birthday completed the diary.	63%
2003	The CPS sample	A random sub-sample of the CPS, with the over-sampling of small states dropped but families with children over-sampled. Half of the diaries are collected on week days, the other half on weekend days	57.80%
2010	The CPS sample	A random sub-sample of the CPS, with the over-sampling of small states dropped but families with children over-sampled. Half of the diaries are collected on week days, the other half on weekend days	56.40%

Source: Fisher et al. (2011).

APPENDIX B: COMMON DIARY

Figure B1-Example of a diary from the AHTUS 2010

Day Person id	Starting Time	Ending Time	Main Activity	With whom										Where or mode of transport		
				Children <5	Children <18	Spouse/ Partner	Close Family	Hhld adult	Domestic animal	Shop/ prof	Co- worker	Well- known person	Other person		Unknown person	
A	6:00	6:10	Sleep													At home
A	6:10	6:20	Sleep													At home
A	6:20	6:30	Sleep													At home
A	6:30	6:40	Sleep													At home
A	6:40	6:50	Sleep													At home
A	6:50	7:00	Sleep													At home
A	7:00	7:10	Showe													At home
A	7:10	7:20	Had breakfast	Ch5												At home
A	7:20	7:30	Dressing													At home
A	7:30	7:40	Walked to bus													By foot
A	7:40	7:50	Bus to job													By bus
A	7:50	8:00	Bus to job													By bus
A	8:00	8:10	Paid work									CO				At work
A	8:10	8:20	Paid work									CO				At work
A	8:20	8:30	Paid work									CO				At work
A	8:30	8:40	Paid work									CO				At work
A	8:40	8:50	Paid work									CO				At work
A	8:50	9:00	Paid work									CO				At work
A	9:00	9:10	Paid work									CO				At work
A	9:10	9:20	Paid work									CO				At work
A	9:20	9:30	Paid work									CO				At work
A	9:30	9:40	Paid work									CO				At work
A	9:40	9:50	Paid work									CO				At work
A	9:50	10:00	Lunch break									CO				At work
A	10:00	10:10	Lunch break									CO				At work
A	10:10	10:20	Paid work									CO				At work

Source: American Heritage Time Use Study 2010