TIME USE IN ECONOMICS

Edited by Daniel S. Hamermesh and Solomon W. Polachek

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RESEARCH IN LABOR ECONOMICS

VOLUME 51

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TIME USE IN ECONOMICS

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Emerald Publishing, Floor 5, Northspring, 21-23 Wellington Street, Leeds LS1 4DL

First edition 2024

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN: 978-1-83753-605-4 (Print)
ISBN: 978-1-83753-604-7 (Online)
ISBN: 978-1-83753-606-1 (Epub)

ISSN: 0147-9121 (Series)

Awarded in recognition of Emerald's production department's adherence to quality systems and processes when preparing scholarly journals for print

INVESTOR IN PEOPLE

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PREFACE

Economics is about scarcity – how to allocate resources in the presence of limits. Time is the scarcest factor at a human's disposal. As Will Rogers said, "Buy land – they ain't making any more of it." He might have said the same thing about time. The statement is not quite correct – the Dutch have proved Rogers wrong over the past millennium; and we have obtained some more time due to increases in life expectancy. Those increases, however, are small compared to the increases in incomes in both rich and middle-income countries. Our time has become increasingly scarce relative the purchasing power that we now have. There remain 24 hours in a day (except when we switch to or from Summer Time).

While economic research has concentrated on our spending on goods and services, it has paid relatively much less attention to how we spend our time. That began to change with the fundamental theoretical ideas of Gary Becker in 1965. Small samples of individuals who agreed to keep diaries of how their spent time at every point in a day, or even a week, had been collected as early as the 1910s; but it is only in the 1960s that large samples of time diaries began to be available. Most wealthy and many less-developed countries now have large random samples of their populations for whom time diaries are available, and these underlie most of the articles included in this volume. Indeed, many base their analyses on the American Time Use Survey (ATUS), the only ongoing such study in the world, which includes around 1,000 diaries each month starting in January 2003. The articles included here cover a variety of aspects of time use, including its effects on our feelings about life; how time is used by children and their parents, and how it is important in familial interactions, and in considering how we measure economic inequality.

In the last 20 years the consideration of happiness has become a major focus of economic research. This makes sense; after all, much of economic theory deals with consumers maximizing their utility; and measures of happiness are a reasonable proxy for the theoretical concept of utility. How happiness relates to income has been a central question of this economic analysis. What has been mostly absent is the relationship between happiness, often measured by answers to questions like, "Rate your satisfaction with your life," and the way people spend their time. In their study *Naomi Friedman-Sokuler* and *Claudia Senik* examine not what people do with their time, but how they allocate it across the day – the variety of things that they engage in during their 24 hours. It is noteworthy and admirable that they study this on two similar sets of data, one from France, and the other the ATUS, thus enabling them to infer whether their findings, about how the variety of uses of time alters feelings of life satisfaction

and feelings about well-being during the moments when one is engaging in a particular activity, are more than single country-specific.

In their study of the relation of time use to happiness, also based on the ATUS, *Jose Ignacio Giménez-Nadal*, *José Alberto Molina*, and *Almudena Sevilla* examine people's work time while on the job. This examination is novel, in that a huge literature investigates how much people work, while almost no research has studied what people do while at work and how they feel about it. Does having more breaks in the workplace make workers feel better? Does the timing of breaks – not only their length, but when they occur during the workday – affect workers' well-being? Is the pattern of time use at work related to how stressed workers feel? These are important questions, and the answers are important, not just in terms of our assessment of the role of time use in the economy, but also for enabling employers to structure workdays so as to make workers better off and, in the end, increase efficiency in the workplace.

How children utilize their time throughout the day plays an essential role in shaping their outcomes later in life, including health, human capital accumulation, and earnings. Whereas a number of studies focus on the United States and OECD countries, very few have analyzed children's time allocation in less-developed countries, let alone how time allocation has changed over the last couple of decades. India, with a population of 361 million children aged 14 or under as of 2020, provides an important setting to study children's time use. *Matthew Gibson, Maulik Jagnani*, and *Hemant K. Pullabhotla* utilize two waves of the India Time Use Survey (ITUS) to investigate changes in children's allocation of time between 1998 and 2019. They find that mean learning time increased by 30%, from 310 minutes in 1998 to 420 minutes in 2019, then they decompose the change and explore why and from which activities this increase arose. Did the increase vary across Indian states? Is it related to specific programs like the bicycle program in Bihar? Is it larger for younger children, different for boys than girls? And finally, how did such leisure activities like watching TV, playing games, and simply chatting with friends change? Answers to each of these have to do with social interactions and are important for understanding human development.

A large literature has concentrated on the intergenerational transmission of income/earnings inequality. A less thoroughly researched question is how the community where a child grows up affects her/his economic success later in life. *Sulagna Mookerjee*, *John Pedersen*, and *David Slichter* go one step beyond this literature to consider how parents' time use when there is a young child in the home affects the impact of their community on their children's subsequent incomes. What makes some communities more successful than others in producing young citizens who achieve more later in life? Does the amount of time parents spend with kids in more successful communities contribute to those communities' ability to produce economically successful young adults?

Parents will have more time available to spend with their children if they are compelled to spend less time on other activities. The second-most important activity in the average person's day is time spent working for pay. If a parent loses his/her job, that will give the parent much more time that might potentially be

spent with the child. But do they? And if so, how much more time? By utilizing the 2005–2019 American Time Use Survey, *Anja Gruber* not only explores these questions, but in addition analyzes whether the answers depend upon which parent, father or mother, loses their job, as well as on family income. The results shed light on why the negative impact of parental job loss is experienced more severely by children in low-income families.

While Gruber focused on an involuntary reduction in work time through job loss, *Taehyun Ethan Kim* and *Dean R. Lillard* consider another, more felicitous involuntary reduction, namely one created by a legislated mandate and incentives to reduce hours of paid work. Over a period of years, the South Korea government created these mandates, which applied at different times to enterprises of different size. Along with data from the South Korean Labor and Income Panel Study (KLIPS), these phase-ins enabled Kim and Lillard to examine, like Gruber, how time is spent with children. In addition, with this extra time available, an interesting question that they also answer is how expenditures on children – purchasing child care – are altered.

Understanding poverty and assessing individual welfare is crucially important for public policy. However, conventional studies on poverty and inequality tend to focus solely on material consumption, ignoring variations in individuals' time use. Nonetheless, it is worth questioning whether two individuals who have the same level of material consumption can be considered equally well-off if one of them has twice as much leisure time as the other. *Ruben Bostyn, Laurens Cherchye, Bram De Rock*, and *Frederic Vermeulen* utilize the MEqIn survey to evaluate whether incorporating disparities in how individuals allocate their time can affect the outcomes of empirical welfare analyses. They consider how expenditure shares affect the likelihood of women being classified as poor, and whether lesser material consumption can be compensated for by more leisure time? If so, how does this affect poverty and inequality rates? Similarly, in what way does accounting for economies of scale affect the poverty rate of multi-person households differently from singles?

Bostyn et al. show that examining each partner's time allocation in the household is important for welfare analysis. But how is that sharing affected by the nature of the relationships between the people in the household? Using data from the 2001–2019 waves of the Australian HILDA survey, *Leslie S. Stratton* examines how time use changes as men and women transition into and out of relationships and how reported specialization differs by relationship type. She answers such questions as whether cohabitating couples specialize less than married couples. Is specialization different in marriage for previously cohabitating men and women? And in which activities do men rather than women bear the brunt of specialization? Getting the answers to these questions is clearly important to understanding intrahousehold behavior given the roles couples have in family formation and the labor market.

In the past, as is mirrored in most theoretical and empirical studies, a clear boundary existed between time spent at home and time spent at work. However, with advancements in technology, such as email, cellphones, and the internet, this distinction has become increasingly blurred. The COVID-19 pandemic further

intensified this delineation, but by how much is not known. *Sarah M. Flood* and *Katie R. Genadek* utilize the 2019–2021 American Time Use Survey to determine where workers performed their jobs during the pandemic, and how this changed from 2019 to 2020. Further, were there any changes in the length of workdays and when workers worked during the pandemic? Did the changes in where workers performed their jobs persist into 2021? Which group of workers experienced the most significant increase in working from home during the pandemic, and which group lost ground?

Independent of COVID-19 and new technology, one job where work–life balance has been particularly blurred is teaching. However, how much so has not been studied. *Victoria Hunter Gibney, Kristine L. West*, and *Seth Gershenson* analyze daily American Time Use Survey time-diary data on 3,168 teachers and 1,886 professionals in comparable prosocial occupations, from 2003 to 2019, to investigate variations in time use between occupations. They determine how much time teachers spend working for pay, volunteering, and working on main job duties outside of the workplace. Further, they analyze the nature of differences in time use between weekdays and weekends.

The contributions to this volume resulted from an open Call for Abstracts that elicited 28 responses, out of which we solicited complete articles from authors of 12 submissions. All were then refereed, each by two scholars whose identity was held anonymous from the contributors. Sadly, two contributions could not be accepted, with the 10 articles included here passing muster by the referees and us. The process was aided by the diligent refereeing provided by: Tina Asgeirsdottir, Cynthia Bansak, Marie Connolly, Dhaval Dave, Osea Giuntella, Nabanita Datta Gupta, Tor Eriksson, Shoshana Grossbard, Tim Halliday, Nathan Jones, Loukas Karabarbounis, Daiji Kawaguchi, Costas Meghir, Richard Murphy, Michał Myck, Monika Oczkowska, Nuria Rodriguez Planas, Jennifer Roff, Anna Sanz de Galdeano, Frank Schilbach, Elena Stancanelli, Jay Stewart, Chao Wei, and Riley Wilson. This volume would not have been possible without their thorough and expeditious help.

Daniel S. Hamermesh
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Volume Editors

TIME-USE AND SUBJECTIVE WELL-BEING: IS DIVERSITY REALLY THE SPICE OF LIFE?

Naomi Friedman-Sokuler and Claudia Senik

ABSTRACT

Using the American and the French time-use surveys, we examine whether people have a preference for a more diversified mix of activities, in the sense that they experience greater well-being when their time schedule contains many different activities rather than is concentrated on a very small number. This could be due to decreasing marginal utility, as is assumed for goods consumption, if each episode of time is conceived as yielding a certain level of utility per se. With returns to specialization, people would then face a trade-off between efficiency and diversity in choosing how to allocate time. We examine these issues and investigate potential gender differences, considering both instantaneous feelings and life satisfaction.

Keywords: Time allocation; time-use diversity; subjective well-being; life satisfaction; momentary utility; gender

1. INTRODUCTION

Although how to use one's time is certainly the most important decision a person has to make all along their life time, applied economic research has mostly reflected on a limited number of related issues, namely the global quantity of time people devote to labor supply versus leisure, education as an investment in human capital, and the division of tasks within the household. Beyond these specific topics, where time is considered as a pure input, the concrete mix of activities and their temporal arrangement has attracted less attention. In this paper, we are interested in the direct utility derived from the way people use their time, as opposed to the indirect utility allowed by this choice in terms of

Time Use in Economics
Research in Labor Economics, Volume 51, 1–33

ISSN: 0147-9121/doi:10.1108/S0147-912120230000051001

consumption. Hence, we are not considering the value of time as an input into the production of a commodity, as in Becker (1965), but rather as a consumption good that produces "experienced utility" (Kahneman et al., 1997) in itself. In consumer theory, convexity of preferences is generally assumed, implying that consumers have a taste for diversity. Is this assumption also relevant when it comes to the choice of how to allocate one's time over competing activities? If each episode of time is conceived as yielding a certain level of utility per se, people may have a preference for diversity in their mix of activities. They would thus reach a higher level of well-being or "experienced utility" by following a more diversified daily schedule rather than by concentrating their time on a very small number of activities.[1]

Under this hypothesis, we would expect people's schedule to be fragmented into many different activities over the day, week or month span, in the way Karl Marx advocated for a (communist) society where it would be possible "to hunt in the morning, fish in the afternoon, rear cattle in the evening, criticise after dinner [...] without ever becoming hunter, fisherman, herdsman or critic."[2] However, in practice this type of time arrangement remains rare due to the countervailing force of increasing returns to specialized human capital, whereby a person becomes more efficient as she accumulates experience in a given task or type of activity over time. Increasing returns constitute a powerful driver of concentration of one's time and effort on a few activities (not to mention the potential short-run costs of adjusting between one activity and another). Does this create a trade-off between the efficiency of specialization and the taste for diversity, as concerns time allocation?

To enquire, we explore the empirical relationship between the structure of time-use and subjective well-being, using two time-use surveys that contain measures of self-declared life satisfaction and episode-based affect. We test two main hypotheses:

- *H1.* The association between measures of time-use diversity and life satisfaction is positive, potentially concave.
- *H2.* The returns to scale, in terms of subjective well-being, on the time spent on an activity are increasing. Hence, the relationship is convex. This would indicate positive returns to specialization.

An additional motivation for this study comes from the well-known gender differences, both in time-use and life satisfaction. On the one hand, it is common knowledge that women's and men's time-use differ, notably in the greater share of paid-work in men's time (Blau & Kahn, 2017) and the greater variety of women's activities (Gronau & Hamermesh, 2008). On the other hand, a large number of studies, mobilizing many different sources, show that women generally report a higher level of life satisfaction than men, especially in developed countries (Becchetti & Conzo, 2022; Blanchflower & Oswald, 2004; Graham & Chattopadhyay, 2013; Helliwell et al., 2015) although a recent paper qualifies this observation (Blanchflower & Bryson, 2022).

Admittedly, women's higher satisfaction may be due to lower expectations (Plagnol & Easterlin, 2008; Stevenson & Wolfers, 2009). However, it could also be due to the specific pattern of their schedule – an hypothesis that we explore in this paper.

If it turns out that a substantial part of women's life satisfaction can be attributed to the diversity of their time-use, then why do men's schedule tend to focus on paid-work at the expense of diversity? Does this gender gap in time-use reflect different preferences, whereby men do not value diversity of activities as much as women do, or is it the expression of a traditional social norm, along the lines of the so-called "male breadwinner" norm, in which men are judged solely on the basis of professional and financial success, as opposed to women who enjoy a wider range of socially accepted combinations of family care and work commitment?[3]

We thus test three additional hypotheses:

- *H3.* Women's mix of activities is more diversified than that of men.
- *H4.* Women's greater variety of activities accounts for the observed gender gap in life satisfaction.
- *H5.* A greater variety of activities is equally associated with higher subjective well-being for men and women. (This would mean that gender difference in activity-diversity reflects different constraints weighing on women and men, rather than different preferences.)

We test the aforementioned hypotheses using the American (ATUS) and the French (FTUS) time-use surveys, where people report the duration and succession of activities they have undertaken in a given day, together with a general evaluation of their life satisfaction on a Cantril scale. Each of these surveys presents distinct advantages. The ATUS offers a large sample size, where each individual is interviewed once, while that the FTUS sample is much smaller but documents two day-diaries for each individual, one during the week and one on the weekend. Both surveys also collect measures of momentary utility – the emotions felt by respondents during the time episodes of the day.

In both countries we find evidence that higher diversity in a person's activity portfolio is associated with higher life satisfaction (validating hypothesis *H1*). Furthermore, we find no evidence for increasing returns to the duration of activities in terms of "momentary utility" (hypothesis *H2*); rather we more often observe a concave relationship. We also document a significant gender gap in both countries, where women's life satisfaction is higher than men's (*ceteris paribus*) and the activity-mix of women is much more diversified than that of men (*H3*). In both the ATUS and the FTUS samples, women's greater index of activity-variety accounts for a non-negligible share of their higher satisfaction (*H4*), but the association between activity-diversity and life satisfaction is not specific to women, although, in the French sample, the association is stronger for

women than for men (*H5*). In sum, the general picture is that activity-diversity contributes to life satisfaction; there are no increasing returns to specialization in terms of subjective well-being; women's daily schedule is more diversified than men's; and this is associated with additional life satisfaction. However, men also enjoy time-use diversity, so that their lower degree of time-use diversity cannot be entirely attributed to different preferences.

To our knowledge, the only existing study that touches upon the question of variety in time-use is Gronau and Hamermesh (2008), who used Australian, Israeli and German time-use data, and observed that more educated people engage into a greater number of activities, which they attribute to the higher efficiency of their time both in the labor market and in household production. They also note the greater variety of women's daily schedules, as compared to men's. We complete this study by looking at how these patterns are associated with subjective well-being. We also extend the exploration of time-use structure by using an indicator of diversity, rather than a simple measure of variety, i.e. by taking into account not only the number of different activities in a person's daily schedule, but also the degree of concentration of their distribution over time.

A large literature based on time-use data has explored the division of tasks within the household, especially the gendered specialization of spouses into paid-work versus housework (Bianchi & Milkie, 2010; Gimenez-Nadal & Molina, 2020; Hamermesh & Lee, 2007). Several studies have documented the upward trend in time spent on parenting, in particular by educated parents (Dotti Sani & Treas, 2016; Ramey & Ramey, 2009). A few papers have devoted attention to the impact of shocks, such as changes in the legal work time, economic fluctuations (Aguiar et al., 2013), child birth (Buddelmeyer et al., 2018), or widowhood (Adena et al., 2023). Others have explored people's preferences over different activities. Biddle and Hamermesh (1990) show that sleep and television-watching are uniformly inferior (and time-consuming) goods, especially TV-watching. Hamermesh (2019) showed that spending time with others increases life satisfaction (especially friends and spouse), and Adena et al. (2023) that, conversely, spending time alone is the reason for the greater unhappiness of widows. Finally, Hamermesh and Biddle (2018) extend the Beckerian commodity production model to study the allocation of time of different segments of the French and American population.

On the other hand, among the abundant literature on subjective well-being, that has been blooming for the last 20 years, not many papers have focused on time-use related issues. A famous paper by Stutzer and Frey (2008) has illustrated the negative impact of long commuting on life satisfaction. The aforementioned papers by Hamermesh (2019) and Adena et al. (2023) stress the importance of social time. Another stream of research has investigated the subjective quality of the experience associated with the different episodes composing people's diary, a.k.a. "momentary utility" (Kahneman et al., 2004; Krueger et al., 2009b, 2009a; Knabe et al., 2010; Robinson & Godbey, 1997; Stone et al., 1999; Stratton, 2012).

This paper thus hopes to contribute a new stylized fact both to the literature dedicated to time-use and to the happiness literature. To do so, it proposes a

characterization of activity-diversity, applying the Shannon-Wiener indicator to time-use data for the first time.

The paper continues as follows: Section 2 discusses the measurement of activity-diversity and of subjective well-being. Section 3 presents the estimation strategy; Section 4 the data; Section 5 the results; and Section 6 concludes.

2. MAIN METRICS: ACTIVITY-DIVERSITY AND SUBJECTIVE WELL-BEING

2.1 How to Measure Time-Use Diversity?

Measuring the diversity of time-use raises several challenges. Gronau and Hamermesh (2008) measure time-use variety as the number of *non-work* activities a person engages with throughout a day. However, variety is only one element of diversity, whose full concept also includes balance, i.e. the share of each activity, and disparity, i.e. the nature and degree to which the activity categories themselves are different from each other (Stirling, 1998). Measurement of time-use diversity may also differ according to the time span over which it is measured. In what follows we discuss these characteristics.

Balance. In order to take into account both variety and balance across activities, our measure of diversity must increase in the number of activities as well as in their even distribution of time.

While the simple count of activities puts all the weight on variety, the Gini index, for example, puts all the weight on balance (i.e. it is not sensitive to the number of activities over which it is measured). The most commonly applied diversity measure that encompasses both variety and balance is the Shannon-Wiener (S-W) index of ecological diversity. A similar measure in the economics literature is the Herfindahl-Hirschman Index (HHI), also known as the Simpson Index of market concentration. In the context of time-use, we choose to use the S-W index, given in Eq. (1), rather than the HHI for two main reasons: (1) the S-W index weighs activities precisely by their frequency, without disproportionately weighing common activities, as opposed to the HHI (Jost, 2006); (2) with the S-W, the rank ordering of time use portfolios is not sensitive to changes in the index parameters (either the logarithm base or the exponential power) (Stirling, 1998).[4]

$$D^{\mathrm{SW}} = -\sum_{i=1}^{S} p_i ln(p_i) \tag{1}$$

The S-W index weights activities by the time allocated to them relative to the total amount of available time in the following manner: total time during a day is divided into S categories, and p_i denotes the share of time spent on category i. We define total time during a day as the number of minutes a day (1,440) minus the number of minutes dedicated to sleep. To compute the S-W index for each diary day, we sum over activities with positive time shares $p_i > 0$, meaning that the diversity index is constructed over a potentially different subset of activities for

each individual. The SW-index increases in the number of activity categories S with a positive share, as well as when these single shares are distributed relatively equally among the performed categories. It thus, takes into account two dimensions of diversity: it penalizes the presence of very dominant activities (with high shares) and increases with the number of activities performed.

Disparity. When determining the set of activities over which people diversify, one faces a trade-off between using a fine classification, separating tasks that may be part of the same category in terms of the individual experience (e.g. laundering and ironing clothes), and coarse classifications that lump together inherently different activities (i.e. sport and watching TV under the category of leisure). Clearly, any classification of activities is limited to the activity definition used in the survey. In this paper we use the two-digit classification of activities defined by the French statistical office (INSEE) for the FTUS, and align the ATUS data accordingly, in order to make the country level analyses comparable.[5] Gronau and Hamermesh (2008) focus on variety in what they define as "non-work" activities. However, in terms of diversity, we expect the work-life balance to play an important role. Therefore, in our measure of diversity, we include all activities except for the share of time dedicated to sleep, as it accounts on average for 35% of a day time, so that variation in sleeping time might dominate the index. We include sleeping time as a control in our regressions. The results of our analysis do not change in a meaningful way when replacing diversity without sleep to diversity with sleep.

Finally, any measure of diversity clearly depends on the time over which individuals diversify. Admittedly, diversity within a single day is likely to be a very noisy indicator for overall diversification, as people may specialize within days and still diversify over weeks or months. However, we are limited by available time-use data, which refer to a single day in the ATUS and two days (a weekday and a weekend) in the FTUS. Therefore, we consider our measure as a lower bound of the degree of diversity for individuals who diversify over larger units of time. However, we also take advantage of the feature of the FTUS that interviews each individual twice. This allows us to construct measures of diversity based on each diary, as well as on the two diaries pooled together. For robustness, we also use a simple measure of variety, i.e. the number of different activities undertaken by respondents.

2.2 Measures of Subjective Well-Being

In the abundant literature dedicated to subjective well-being, self-declared life satisfaction has emerged as the standard metric, one that includes both a cognitive judgmental dimension and a hedonic dimension (Van Praag et al., 2003; Layard, 2011). Self-reported evaluations of time episodes, on the other hand, are now classically seen as measures of momentary utility (Gershuny & Halpin, 1996; Robinson & Godbey, 1999), process benefits (Stratton, 2012), or ecological momentary assessments (Stone et al., 1999). They have been conceptualized as "experienced utility" (Kahneman et al., 2004), i.e. ex-post utility, as opposed to ex-ante decision-utility. Krueger et al. (2009a) have used them to produce

so-called National Time Accounts (NTA) that allow comparisons of "evaluated time episodes" across countries, over time, or between groups of people.

The relationship between momentary utility and life satisfaction has also received some attention. Most studies see a disconnect between the two types of measures. Krueger et al. (2009b) for instance, find that American women report higher levels of life satisfaction than French women but that the French spend their days in a more positive mood, on average, and spend more of their time in activities that are more enjoyable. In their eponymous article, Knabe et al. (2010) also note that the unemployed are "dissatisfied with life but having a good time" during weekdays. We use self-declared life satisfaction, as measured by the Cantril scale as our main outcome of interest, and we exploit measures of momentary utility to test the relationship between activity duration and affect.

3. ESTIMATION STRATEGY

3.1 The Relationship Between Life Satisfaction and Time-Use Diversity

Hypothesis [*H1*] addresses the relationship between life satisfaction LS_{iw} of individual i in survey time w, measured on the Cantril scale, and time-use diversity, as measured by the S-W index SW_{iw}. The Cantril scale is an ordinal measure of life satisfaction with no clear interval properties. Therefore, for the estimation of the relationship, we convert responses into a binary variable indicating whether respondents ranked their life satisfaction above the sample mean. Our main estimation equation is presented in Eq. (2):[6]

$$\Pr\left[LS_{iw} \geq \overline{LS_{iw}}\right] = \beta_0 + \beta_1 SW_{iw} + \beta_2 SW_{iw}^2 + X_i^{'}\gamma + \omega + \epsilon_i \tag{2}$$

Our coefficients of interest are β_1 and β_2, allowing for a non-linear relationship between diversity and life satisfaction. We expect β_1 to be positive, and β_2 to be negative. This would correspond to a concave relationship between activity diversity and subjective well-being, following the idea that diversifying one's daily schedule is conducive to a higher level of satisfaction, up to a certain optimal point. Given that our measure of diversity increases in the number of activities, one could imagine that after a given threshold, adding activities yields more stress or other negative emotions than hedonic benefits. We estimate Eq. (2) on various sub-samples (by country, weekday, etc.) in order to examine potential heterogeneity in the nature of the relationship.

While our analysis of this relationship is descriptive in nature, we include in our estimation all relevant observable individual characteristics X_i that are likely related to both life satisfaction and time-use diversity. One obvious example is income level, which exhibits a positive relationship with life satisfaction as demonstrated by Easterlin (2001) and enables a diversification of one's leisure portfolio (Gronau & Hamermesh, 2008). On the negative side, people suffering from chronic health conditions that lower their life satisfaction (Steptoe et al., 2015) are also likely to be limited in their ability to engage in a number of

activities. Finally, some characteristics may affect life satisfaction and diversity in different directions. For instance, full time employment may boost life satisfaction, as it reflects social worth, but may limit time-use diversity due time crunch. To address such interconnections, our full specification includes controls for observable individual characteristics that are available in the two surveys. Additionally, we include fixed effects w for the timing of the survey, and a quadratic function of time slept, as the latter is not included in our diversity measure.

3.2 Hedonic Returns to Time in Activity

Hypothesis [*H2*] asks whether the returns to the duration of an activity are convex (increasing) or concave (decreasing). If the former is true, concentration on a few activities is conducive to higher subjective well-being; if it is the latter, then time-use diversity is preferable. In order to test hypothesis [*H2*], we estimate the relationship between the duration of an activity episode and the momentary utility (MU) reported for that episode, and we do so both across and within individuals.

We begin with a cross-sectional, minimally parametric estimation strategy, Restricted Cubic Spline (RCS) regression, relating reported momentary utility MU_{ijw} of respondent i during activity j occurring on survey day w as a function of time t spent in activity j on the same day.[7] This allows us to examine the relationship without assuming its shape. The relationship will thus be estimated across individuals.

Ideally, we would like to estimate this relationship "within-individual." However, the short duration of observation in time-use survey limits this ability. We can however exploit the two day structure of the FTUS and estimate the relationship between momentary utility and episode duration with individual fixed effects, as shown in Eq. (3):

$$\Pr[\mathrm{MU}_{iwa} = \max(\mathrm{MU})] = \alpha_0 + \alpha_1 \mathrm{time}_{iwa} + \alpha_2 \mathrm{time}_{iwa}^2 + \eta_i + \theta_w + \epsilon_i \quad (3)$$

For each activity type a we estimate α_1 and α_2 to test for increasing returns, conditional on individual fixed effects η_i and a weekend constant θ_w. While this is a more direct way to test for hedonic returns to time, it severely limits the sample as it includes only individuals who took up an activity on both days (for instance, because one day is always a weekend, there will be few observations for time in work), and whose reported momentary utility varies across both days.

Therefore, we use both within and across individual approaches to examine hypothesis [2].

3.3 Diversity, Well-Being, and Gender

In order to test hypothesis *H3*, we simply measure the difference between men and women in terms of the S-W index of activity-diversity. To test hypothesis *H4*, we introduce the S-W diversity index together with the female indicator in the estimates of life satisfaction, as in Eq. (2). If this reduces the magnitude of the