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Sarah Flèche,

Conal Smith

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Carrie Exton, Statistics Directorate, +(33-1) 45 24 88 28; carrie.EXTON@oecd.org

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TIME USE SURVEYS AND EXPERIENCED WELL-BEING IN FRANCE AND THE UNITED STATES

Sarah Flèche CEP, London School of Economics

Conal Smith[1]

[1] Conal Smith was a member of the OECD staff in the Statistics Directorate during most of the time when undertaking the work featuring in this paper.

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ABSTRACT / RÉSUMÉ

The last decade has seen a sustained surge of interest in measures of subjective well-being on the part of economists and other social scientists. The vast majority of the academic literature on subjective well-being focuses on measures of life evaluation, as does most discussion of how measures of subjective well-being can be applied to policy. However, measures of life evaluation have well-known limitations, and other measures of subjective well-being, including experienced well-being (i.e. people's time use and emotional state over time), can be an important complement to measures of life evaluation. As of 2016, however, few countries have included experienced well-being in their official time use surveys, and there is relatively little understanding of how different methodological approaches to measuring experienced well-being affect the results obtained. This paper presents results using data from the US and the French time use surveys, showing that the different approaches adopted by these two countries have quite different implications for the data collected. Results highlight the sensitivity of experienced well-being measures – particularly the U-index – to the choice of affective states included, and shed light on the differing results found in the literature on how unemployment impacts upon experienced well-being.

Keywords: experienced well-being, U-index, time use survey, measurement

JEL Classification Codes: C8, I31, J22

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Ces dix dernières années, l'évaluation du bien-être subjectif a connu un regain d'intérêt soutenu de la part des économistes et d'autres spécialistes des sciences sociales. La grande majorité des travaux universitaires publiés sur cette question portent sur les indicateurs de l'évaluation de la vie, de même que la plupart des discussions sur la façon dont les indicateurs du bien-être subjectif peuvent être utilisés pour l'action des pouvoirs publics. Toutefois, les indicateurs de l'évaluation de la vie ont des limites bien connues, et d'autres indicateurs du bien-être subjectif, y compris du bien-être ressenti (qui recueillent des données sur l'emploi du temps et l'état émotionnel des individus au fil du temps), peuvent venir les compléter utilement. En 2016, pourtant, rares étaient les pays à avoir inclus des indicateurs du bien-être ressenti dans leurs enquêtes officielles sur l'emploi du temps, et la façon dont l'utilisation de différentes approches méthodologiques pour évaluer le bien-être ressenti influençait les résultats obtenus était relativement mal comprise. Dans ce document, nous présentons des résultats à l'aide de données tirées des enquêtes américaine et française sur l'emploi du temps et nous montrons que les différentes approches adoptées par les deux pays ont des incidences assez différentes sur les données recueillies. Nos résultats mettent en évidence la sensibilité des indicateurs du bien-être ressenti – en particulier le « U-index » – au choix des états émotionnels inclus, et mettent en lumière les résultats divergents observés dans les travaux publiés en ce qui concerne l'impact du chômage sur le bien-être ressenti.

Mots-clés : bien-être ressenti, U-index, enquête sur l'emploi du temps, évaluation

Classification JEL : C8, I31, J22

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1. Introduction

1. The last decade has seen a sustained surge of interest in the use of measures of subjective well-being on the part of economists and other social scientists. This is reflected in the number of academic articles on life satisfaction or happiness[2], and in publications with a stronger policy focus such as the 2014 report on *Well-being and Public Policy* released by the Legatum Institute (O'Donnell et al., 2014). Underlying this phenomenon is an extensive body of evidence supporting the view that measures of subjective well-being contain meaningful information and are sufficiently valid and reliable to support useful analysis (OECD, 2013).

2. Interest in the value of subjective well-being measures to inform policy has translated into a strong call for its systematic measurement through official statistics (Stiglitz, Sen, Fitoussi, 2009). As a result, there has been a large increase in the number of national statistical agencies producing measures of subjective well-being, with the number of OECD countries for which data are available rising from only a handful in 2010 to 32 out of 35 OECD countries in 2016.

3. Almost all of the subjective well-being measures produced by national statistical agencies are measures of life evaluation, which capture a judgement by the respondent about the state of their life as a whole.[3] Such measures are easy to collect and are also well-understood. The vast majority of the academic literature on subjective well-being focuses on measures of life evaluation, as does most discussions of how measures of subjective well-being can be applied to policy. However, measures of life evaluation also have well-known limitations, and there is broad consensus that measures of other aspects of subjective well-being are an important complement to measures of life evaluation (e.g. Stiglitz, Sen, Fitoussi, 2009; OECD, 2013; Mackie and Stone, 2013).

4. In contrast to evaluative measures of subjective well-being, measures of experienced well-being collect people's emotional states at particular periods of time. Such measures capture how people experience their life rather than how they remember or evaluate it (Kahneman and Krueger, 2006). Experienced well-being is usually considered to be multi-dimensional, with people experiencing a diverse range of different affective states such as joy, contentment, sadness, anger, worry and stress (Kahneman et al., 1999; Diener et al., 1999). Traditionally experienced well-being has been measured through the Experience Sampling Method (ESM), which uses real time data collection via an electronic pager or similar device. Since 2004, however, an alternative to ESM – the Day Reconstruction Method (DRM) – has been shown to provide comparable information through a time use diary (Kahneman et al., 2004). These measures, which can link individuals' reported moods and emotions to specific events, places and people, collect fundamentally different information to measures of life evaluation.

5. The Report by the *Commission on the Measurement of Economic Performance and Social Progress* (Stiglitz, Sen, Fitoussi, 2009) placed significant weight on collecting measures of experienced well-being in its recommendations, and this argument was made at greater length by Kahneman et al. (2004), Krueger (2007) and Krueger et al. (2009), who argued strongly for the policy relevance of such measures. Both the OECD (2013) and the US National Academy of Sciences (Mackie and Stone, 2013) were broadly supportive of this view, but this has not been widely reflected in measurement initiatives. One key factor limiting the wider use of experienced well-being measures is a lack of information about the relative merits of different approaches to measurement (UNECE, 2014).

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2 Citations in the AEA Econlit database for articles containing "happiness" or "life satisfaction" in the title rose from 1 418 in 2000, to 3 133 in 2010 and to 3 528 in 2014.

3 The most commonly used measures of life evaluation are questions on "how satisfied you are with your life as a whole" and the Cantril ladder question that asks the respondent to rate their life on a ladder, where the top of the ladder is the "best possible life for you" and the bottom is "the worst possible life for you".

6. The lack of initiatives to measure experienced well-being is regrettable. Measures of people's affective state on the previous day have very different drivers than measures of life evaluation (Kahneman and Deaton, 2010; Boarini et al., 2012), and are therefore useful in addressing different questions. Issues as diverse as commuting (Kahneman and Krueger, 2006), health policy (Dolan and Kahneman, 2008), and the impact of environmental quality on well-being (MacKerron and Mourato, 2013) have all been identified as areas where measures of experienced well-being have the potential to add significant value. One recent issue where experienced well-being measures have been prominent is examining the non-pecuniary costs of unemployment. Knabe et al. (2010) present DRM evidence that the experienced well-being of unemployed people is similar to that of the employed. Krueger and Mueller (2012), however, using a different dataset find lower levels of experienced well-being among the unemployed population. This is in contrast to the life evaluation literature that consistently finds unemployment associated with lower levels of subjective well-being (Boarini et al., 2012).

7. This paper draws on data from the American Time Use Survey (ATUS) and the French *Enquête Emploi du Temps* (EDT) to explore the impact of different approaches to measuring experienced well-being in time use surveys. The paper contrasts the results from the ATUS wave of 2010 with data from the EDT 2009-10, first comparing each set of results with data from an earlier study of the experienced well-being of French and US women (Krueger et al., 2009), and then looking at how the two 2010 studies compare with each other. By using the Krueger et al. (2009) study as a control for differences in the experienced well-being of French and US women, the paper is able to examine the impact of the different measurement approaches adopted in each country in 2010.

8. Section 1 of the paper describes the two survey datasets and the differing methodologies used by INSEE (the French national statistical agency) and the US Bureau of Labour Statistics (BLS) respectively. It then provides a summary of the main differences in the data provided by the two methodologies. Sections 2 to 4 use the 2010 data from the ATUS and EDT, essentially replicating the key tables from the Krueger's paper to examine the impacts of the different measurement approaches adopted by the ATUS and EDT, compared to Krueger et al. (2009)'s results. Section 5 takes advantage of the fact that both the EDT and the ATUS contain data on a representative sample of the French and US populations to briefly look at gender differences in experienced well-being. Finally, Section 6 provides a discussion of the main results. This focuses primarily on the implications of the different measurement approaches and, in particular, on the relative strengths of the approaches adopted by INSEE and the BLS. However, the paper also discusses the impact of different measurement approaches on the relationship between experienced well-being and unemployment status.

2. Brief overview of the different approaches to measuring experienced well-being

9. The DRM (Kahneman et al., 2004) was developed as a survey-based alternative to ESM for assessing how people experience the various activities and settings of their lives. Combining features of time use studies and experience sampling, the DRM involves participants systematically reconstructing their activities and experiences in the proceeding day with procedures designed to reduce recall bias. In particular, respondents construct a short diary of the previous day based around a continuous series of discrete episodes. Each episode is given a name (for example, 'commuting to work'); then respondents answer structured questions about each episode including when it occurred (start and end times), where they were, who they were with, and how they felt using 12 different affect descriptors.

10. Although developed as a more practical and less resource intensive alternative to ESM, the full DRM procedure is still substantially more complex and time consuming to administer than is typically the case for items included in large scale time use surveys. For this reason, national statistical agencies that have moved to include measures of experienced well-being in their time use surveys such as the United States and France have made significant changes to the original DRM.

11. In the US, a well-being module was attached to the ATUS waves of 2010, 2012, and 2013. The ATUS is a survey collecting information from about 12 000 respondents aged 15 or older annually using computer assisted telephone interviewing. For the 2010 wave the achieved sample size was 12 829 individuals. During the interview, each respondent assists the interviewer in constructing a detailed diary of the previous day.[4] This contains information on the start and end time of different activities, what each activity undertaken was, and who the respondent was with for that activity.

12. The ATUS well-being module collects information on three randomly selected activities from the time diary. For each of these three activities the respondent is asked about how they felt with respect to six different dimensions relating to their affective state: *happy*, *tired*, *stressed*, *sad*, *pain* and *meaningful*. The respondent then records the strength of each of these feelings on a scale from 0 to 6, where 0 means that the respondent did not experience this feeling at all and 6 means the feeling was very strong. The order in which the different feelings were presented to respondents is randomised to ensure that aggregate responses are not biased due to priming effects from previous questions.

13. In the case of France, INSEE's EDT took a different approach to measuring experienced well-being. The EDT is a time use survey conducted every 10 years by the French statistical office. Data are collected via computer assisted personal interviewing, with the respondent completing a time use diary for two days (one week day and one week-end day). In contrast to ATUS, the INSEE time use diary takes the form of a paper questionnaire filled in by the respondent, rather than being recorded by the interviewer during a telephone interview. The diary records each activity's start and end time in ten-minute intervals as well as the nature of the activity. The sample size is approximately 12 000 households.

14. Following the release of the report by the *Commission on the Measurement of Economic Performance and Social Progress,* INSEE included a "Stiglitz sub-sample" of 1 735 respondents randomly selected from the larger EDT sample for which information was captured on experienced well-being. This was achieved by adding an additional column to the time use diary, where the respondent records their affective state on a seven-point scale ranging from -3 to +3, where -3 is very unpleasant (*très désagréable*) and +3 is very pleasant (*très agréable*).[5] This provides a single uni-dimensional measure of affective state for each of the activities undertaken by the respondent during the day.

15. The ATUS well-being module and the EDT well-being module vary significantly in how they approach measuring well-being. The ATUS collects detailed information on a range of different types of feeling, but minimises respondent burden by only collecting information on three episodes. In contrast, the EDT collects information on all activities recorded by the respondent, but only for a single measure of affective state. Table 1 summarises the impact of these different measurement approaches in descriptive terms. It can be seen immediately that the average number of episodes described per respondent is over seven times higher in the EDT (21.5) than in the ATUS (2.98). Because of this, the total number of well-being observations for each of the two surveys is similar, despite the fact that the "Stiglitz sub-sample" of the EDT is much smaller. In fact, with a sample size of only 1 735, the EDT collects 33 555 well-being/episode observations compared to only 38 110 for the entire ATUS sample of 12 829 respondents. Only when we look at the number of individual well-being measures (i.e. counting each affective state measured in the ATUS as a distinct measure) do we see evidence of the ATUS collecting significantly more information than the EDT (228 000 compared to 33 000).

[4] The sample is split evenly between weekdays and weekend days.

[5] See Annex 1 for a copy of the EDT diary.

Table 1. Characteristics of the ATUS and EDT experienced well-being measures

	ATUS	EDT
Sample size (number of respondents)	12 829	1 735
Average number of episodes described per respondent	2.98	21.5
Average number of well-being measurements per respondent	17.84	20.87
Total number of well-being/episode measurements	38 110	33 555
Total number of well-being measurements	227 987	32 469
Average observed awake time for respondents (minutes)	202	1 042

Notes: Data shown in this table are from the 2010 ATUS well-being module and the 2009-10 EDT well-being module.

16. It is evident from Table 1 that the two approaches collect very similar total quantities of information. While the ATUS collects roughly six times as much data per episode, the EDT collects information on just over seven times as many episodes per respondent. For a given sample size, therefore, the EDT will provide better measures of activities that are relatively infrequent or of short total duration, and which therefore will be present only in relatively low numbers in surveys following the ATUS approach. However, where the precise dimension of affect is important (e.g. the distinction between whether an activity involves pain or is meaningful to the respondent), then the ATUS is unambiguously more informative. One point not captured in Table 1 is that the EDT approach also allows the respondent to record intra-episode variation in experienced well-being. Although complete and accurate recording of intra-episode variation is not emphasised in the instructions for respondents, the diary is designed to capture information in ten-minute intervals, and some respondents do record changes in levels of experienced well-being within individual episodes. There are 483 respondents (out of 1 735) who report intra-episode variation. For those that do, it corresponds to 1.49 episodes on average. Overall, the total number of episodes containing intra-episode variance in the EDT is 692 (roughly 2%) and the intra-episode variance of experienced well-being in the EDT ranges from 0 to 4.24 on the seven-point scale. This suggests that large shifts in experienced well-being are recorded for at least some respondents, and that the INSEE methodology has some potential for examining intra-episode variance in experienced well-being.

3. Data and method

17. While descriptive information from the ATUS and EDT identifies some key strengths and weaknesses associated with the two measurement approaches, it leaves one core issue un-answered i.e. whether the uni-dimensional measure of affect captured by the EDT has sufficient validity to provide useful information. Because of the multi-dimensional nature of experienced well-being, it would appear that a uni-dimensional measure such as the one used in the EDT is unlikely to fully describe the respondent's experience. On one level, this is tautologically true: the EDT cannot distinguish between different emotions. However, much analysis of experienced well-being data does not use the full dimensionality of the affective states being examined. In particular, Kahneman et al. (2004) use multi-

dimensional experienced well-being data to develop a uni-dimensional construct – the U-index – to provide an overall assessment of the respondent's experience of different activities.

18. The U-index is defined as the fraction of time for which the strongest emotion is negative on the basis of DRM measurements. Each episode in the time use diary is characterized as unpleasant if the strongest measured feeling is negative and pleasant otherwise. Information from the time use diary on the length of episodes is then used to calculate the proportion of time spent in an unpleasant emotional state.

19. As the ATUS uses a variant of the DRM, it is straightforward to calculate a U-index from it. The EDT is already a uni-dimensional measure, so the key question is whether the EDT data reproduces the results of the U-index. In this regard, it is useful to note that the terminology used by Kahneman and Krueger (2006) to describe the dichotomous categorisation of episodes used to calculate the U-index is 'unpleasant or pleasant'. This is essentially the same terminology as the scale anchors used by the EDT after allowing for translation, and makes a comparison between the two measurement approaches intuitively plausible.

20. To examine the impact of the different approaches to measuring experienced well-being, this paper takes advantage of the existence of a study comparing the experienced well-being of women in France and the United States using the DRM that was carried out in 2005 (Krueger et al., 2009). This study provides a baseline against which the results of the 2010 well-being module of the ATUS and the 2010 Stiglitz sub-sample of the EDT can be compared. Although there are some differences in the nature of the sample used in 2005, which referred to two specific cities in the US and France, compared to the nationally representative samples used in the ATUS and EDT, the existence of a French-US study conducted using a consistent DRM methodology makes it possible to reach tentative conclusions about the impact of the EDT methodology on results. In the remainder of this paper, the analysis is primarily based on comparison of the U-index levels between the studies carried out in 2005 and 2010, and between the two 2010 studies. All results are statistically significant at the 5% level unless otherwise indicated. Annex 4 presents the relevant t- tests for the main comparisons in Tables 2 to 8.

21. Krueger et al. use data from two cities (Rennes in France and Columbus, Ohio, in the United States) for the basis of their 2009 article. This is supplemented by nationally representative information on time use patterns drawn from the 2003-04 wave of the ATUS and from the 1998-99 wave of the EDT, which is used to extrapolate a picture of the U-index across the whole of France and of the United States.

22. In this paper, data are taken from the ATUS 2010 well-being module and the EDT 2009-10 Stiglitz sub-sample. The same methodology is applied to both of these datasets that was used by Krueger et al. in their 2009 analysis of the Rennes/Columbus data. Detailed data from the time use diaries are collapsed into five broad categories of activities: work/commute; compulsory activities; active leisure; passive leisure; and eating.[6] This is necessary as there are slight differences between the ATUS, EDT, and the Columbus/Rennes dataset in how activities are categorised at the most detailed level. The data are then re-weighted by day of week to be representative of a random day.[7]

23. Table 2 compares the socio-demographic characteristics of the ATUS and EDT datasets with the Columbus/Rennes dataset. The analysis is restricted to women as the Columbus/Rennes sample was only

6 Annex 2 presents the scheme by which the more detailed activities were grouped up into the five broader categories.

7 Applying the correct weights to the ATUS and EDT is important, both because of the intrinsic complexity of time use weights (which need to be representative across individuals in the sample and across types of activity), as well as because of an error in the weights originally released for the 2010 ATUS. Annex 5 explains the weighting procedure used in this paper.

of women; the age range of the ATUS and EDT data has also been restricted to match that of the Columbus/Rennes data.

Table 2. Differences in socio-demographic characteristics, women

	Krueger et al. Rennes 2005 (France)	EDT 2009-2010 (France)	Krueger et al. Columbus 2005 (Ohio, US)	ATUS 2010 (US)
Age	18-60	18-60	19-68	19-68
Median age	39	42	44	43
Employed	67	69	75	65
Unemployed	17	09	10	5.5
Married or cohabiting	62	51	73	51
Median income	$28 000	$35 600	$50 000	$55 000
Enrolled at school	16	05	10	12
Highly educated	14.5	09	18	12.5

Note: Data shown in this table are from Krueger et al. (2009), the 2010 ATUS well-being module and the 2009-2010 EDT well-being module. Income data have been converted into US dollars (2010), and refer to annual total household income.

24. Even after restricting the 2010 data, there are differences between this and the earlier Columbus/Rennes data. In particular, unemployment rates are significantly lower in both the ATUS and EDT than in the Columbus/Rennes data; the ATUS/EDT sample has a lower level of educational attainment; and ATUS/EDT respondents are less likely to be married or cohabiting (although the difference is not statistically different between the ATUS and the EDT sample). Focusing on France, EDT respondents have a higher median age than in the Rennes dataset (42 compared to 39) and a higher median income ($35 000 compared to $28 000). In contrast, ATUS respondents are very slightly younger (median age 43 compared to 44), less likely to be employed, but richer than the Columbus respondents (median income of $55 000 compared to $50 000). To address these differences, in the following analysis the data are re-weighted to take into account differences in socio-demographic characteristics.

25. Table 3 compares the allocation of time use across different activities in the different datasets after re-weighting. While there are differences in time allocation between the 2005 and 2010 samples for almost all activities[8], these are generally not large given the 5 year gap between the Columbus/Rennes dataset and the ATUS/EDT. People in the EDT sample spend a little more time on work/commute than those in the Rennes sample, and a little less time on compulsory activities; passive leisure is a marginally lower as a proportion of total time, but active leisure is a little higher. In the US, time use is more closely matched between the Columbus and ATUS samples, with people in the ATUS sample spending a bit more

[8] Statistically significant differences are found for all activity classifications between the 2005 Rennes sample and the EDT 2009/10, and for all activities except compulsory time between the 2005 Columbus sample and the ATUS 2010.

time on work/commute than those in the Columbus sample, and a little less time on passive leisure. Overall, however, the datasets present generally comparable pictures of time allocation.

Table 3. Allocation of time use, women

	Percentage of awake time spent in each activity			
	Krueger et al. Rennes 2005 (France)	EDT 2009-2010 (France)	Krueger et al. Columbus 2005 (Ohio, US)	ATUS 2010 (US)
Work/commute	21.8%	28.7%	24.6%	27.6%
Compulsory	34.8%	30.4%	35.2%	35.4%
Passive leisure	18.1%	15.1%	24.8%	20.9%
Active leisure	10.6%	12.1%	7.5%	8.9%
Eating	14.8%	13.7%	7.9%	7.1%
Total	100%	100%	100%	100%

26. To evaluate whether the EDT pleasant/unpleasant scale performs well as a uni-dimensional measure of experienced well-being, it is necessary to produce a U-index for the ATUS data and a U-index analogue for the EDT. In the case of the ATUS 2010 well-being module, the same procedure is followed as outlined by Krueger et al. (2009). The U-index for an episode is defined as 1 if the maximum rating for any of the negative emotions strictly exceeds the rating of *happy*, and 0 otherwise. This is then weighted by the proportion of each person's waking day spent in an episode to derive an overall estimate. The U-index can be presented either as an average for individuals or as an average for an activity type.

27. One difference between the approach adopted here and that used by Krueger et al. (2009) is in the list of emotions used to construct the U-index. In their 2009 paper, Krueger et al. used four emotions: *happy*, *stressed*, *depressed* and *angry*. It was not possible to repeat this using the 2010 ATUS well-being module, as this does not include measures of whether the respondent was angry or depressed. To address this issue, three versions of the U-index were constructed using different combinations of the feelings available in the ATUS 2010. These results were then compared with the 2009 paper, and the index producing the results closest to those from the 2009 study was used as the basis for the rest of the analysis in this paper. This U-index is based on responses to questions on *happy*, *stressed*, *sad*, and *pain*. Annex 3 compares the different variations of the U-index considered alongside data for Columbus.

28. For the EDT the process of developing a quasi U-index required significantly fewer decisions. As the EDT metric is already uni-dimensional, no choice of which feelings to include occurs. An episode was deemed to be unpleasant in the EDT if it received a response of -1 or less on the scale, and pleasant otherwise. Episodes were then aggregated to produce a U-index in the same manner as for the ATUS.

29. In addition to the U-index, a measure of affect balance is calculated as well. Where the U-index is ordinal (in the sense that it requires only that individuals are consistent in their use of the measurement scale) affect balance treats responses as cardinal by averaging the reported scores across individuals. For

the EDT, affect balance is simply the mean response of an individual on the pleasant/unpleasant scale averaged across all the individuals in the sample. For the ATUS, affect balance is calculated as the score for "happy" minus the average of the scores for *stressed*, *pain*, and *sad*.[9] This is then normalised to go from +3 to -3 as is the case for the EDT. Although the U-index is in many respects preferable as a measure of affect balance in that it does not require any strong assumptions about the cardinality of responses, affect balance is included here as a supplementary measure because it provides additional information about the degree to which the EDT and ATUS measures provide comparable data.

4. Comparing the EDT with the ATUS

30. Table 4 reports the average U-index for the EDT 2010, the ATUS 2010 well-being module and for the Columbus and Rennes samples from 2005. In their 2009 paper, Krueger et al. found that the U-index was a statistically significant 2.8 percentage points lower in the French sample (16%) than in the American sample (18.8% – here rounded to 19%). This is shown in the top row of columns 1 (Rennes) and 4 (Columbus) of Table 4. A similar, but stronger pattern is found when comparing the EDT and ATUS samples, with a U-index for French women 5 percentage points lower than for the United States (15% compared to 20%). This gap is statistically significant, and is driven by a significantly higher U-index in ATUS than in the Columbus sample (20% compared to 18.8%), and by a lower U-index in EDT than in the Rennes sample (15% compared to 16%, not significant).

Table 4. Comparing different measures of experienced well-being, women

	Krueger et al. Rennes 2005 (France)	EDT 2009-2010 (France)		Krueger et al. Columbus 2005 (Ohio, US)	ATUS 2010 (US)	
	U-index	U-index	Affect balance	U-index	U-index	Affect balance
All (women)	0.16	0.15	1.65	0.19	0.20	1.90
Employed	0.14	0.14	1.60	0.19	0.20	1.93
Unemployed	0.19	0.14	1.74	0.22	0.27	1.80
Enrolled at school	0.23	0.12	1.70	0.24	0.22	1.96

Note: U-index was weighted by the proportion of each person's waking day spent in an episode. In the ATUS, the U-index and the net affect balance are based on 4 dimensions: happy, stressed, pain and sad.

31. Although the U-index for women as a whole in the EDT and ATUS seem broadly comparable with the earlier results, it is important to know whether the pattern of U-index results across sub-populations is also plausible. Information on sub-populations is shown in rows 2 to 4 of Table 4 and shows a somewhat mixed picture. While the Rennes sub-sample shows a higher U-index for the unemployed and those enrolled at school when compared to the employed population, the same is not true for the EDT sample. In fact, in the EDT sample there is no difference between the U-index for the employed and unemployed (14% each), while students have a lower U-index than either (12%). The differences between the Rennes sample and the EDT are significant for the unemployed and the enrolled at school populations, but not for the employed.

32. In contrast, the ATUS sample appears to replicate the broad findings of the Columbus sample fairly well. The unemployed have a higher U-index than the employed (27% compared to 20%). The only significant difference between these results and the Columbus sample is that they show a larger gap

[9] Three different variants of affect balance were tried. The results of this comparison are shown in Annex 3.

between the employed and the unemployed. There are two potential reasons for this. First, it is possible that people experience pain more frequently than they do anger, or sadness more than feeling depressed (which has connotations of a more intense emotional state); thus, there may be a methodological reason for people reporting more negative emotions and thus a higher U-index. However, 2010 was also a period of high unemployment in the United States, with the unemployment rate reaching 9.9% during April and May of that year. In 2005, when the Columbus study was undertaken, monthly unemployment rates varied between 4.9% and 5.2%. It is therefore possible that being unemployed was a more unpleasant experience in 2010 than in 2005 as job search would be less rewarding and life, in general, more stressful.

33. Table 5 presents the U-index during episodes involving five different types of activity recorded in the ATUS and the EDT. These broad groupings are taken from more detailed breakdowns of activity types shown in Annex 2. Both the ATUS and EDT samples show considerable variation in the U-index across the different types of activity, ranging from 0.13 to 0.20 for the ATUS, and from 0.09 to 0.22 in the EDT. A fairly consistent pattern emerges across both ATUS and EDT when looking at the U-index for different activities. Work/commute is the least pleasant activity followed by compulsory time (which includes unpaid work and child care). In contrast, active leisure is consistently the most pleasurable of the 5 broad categories. Passive leisure is less pleasurable than active leisure, but more preferable than compulsory time for the EDT.

Table 5. The U-index and allocation of time across activities

	Krueger et al. Rennes 2005 (France)	EDT 2009-2010 (France)		Krueger et al. Columbus 2005 (Ohio, US)	ATUS 2010 (US)	
	U-index	U-index	Affect balance	U-index	U-index	Affect balance
Work/Commute	0.26	0.22	1.08	0.29	0.20	2.30
Compulsory	0.17	0.16	1.29	0.19	0.17	1.65
Passive leisure	0.14	0.12	2.13	0.15	0.17	1.62
Active leisure	0.09	0.10	2.36	0.10	0.13	2.91
Eating	0.09	0.09	2.27	0.10	0.14	2.55

Note: the U index in the ATUS is based on 4 dimensions: happy, stressed, pain and sad.

34. Comparing the EDT and the ATUS to the earlier Columbus/Rennes studies, it is evident that, while there are small differences in the absolute magnitude of the U-indices for most activities between 2005 and 2010[10], both the EDT and ATUS approaches yield results broadly in line with the full DRM in terms of the ranking of different activities. As was the case in 2005, France has a lower U-index than the United States for most activities. The EDT yields the same ranking across different activities as did the Rennes study in 2005, although there are small but statistically significant differences in the levels of the U-indices for both passive and active leisure. Work/commute is rated as significantly less unpleasant in 2010 than in the 2005 sample. The ATUS presents a similar picture, but with several of exceptions. First, in the 2010 ATUS compulsory time and passive leisure have the same U-index (17%), where in the Columbus study passive leisure was more pleasant than compulsory time (15% compared to 19%). Second, active leisure and eating have a significantly higher U-index in the ATUS than in the Columbus sample, although the general ranking is the same with both these activities rated as more pleasant than for any other type of activity. Work/commute has a much lower U-index in the ATUS than was the case for the Columbus sample, with a U-index only 3 percentage points higher than for compulsory time or passive

[10] For the EDT, the U-index scores for work/commute, active leisure, and passive leisure are significantly different from those based on the 2005 Rennes sample. All U-index scores are significantly different between the ATUS and the 2005 Columbus study.

leisure. In fact, U-index scores for all activity categories in the ATUS are significantly different from those in the Columbus sample. Finally, it is worth observing that the range of U-index scores is much more compressed for the ATUS (maximum 0.20, minimum 0.13) than for any of the other studies.

35. While the results for both the ATUS and the EDT are mostly plausible, the EDT results for the unemployed population are a cause of potential concern. It is strongly counter-intuitive that people who are involuntarily unemployed should have a lower U-index than those in employment. Table 6 looks at the unemployed population in both the EDT and the ATUS to examine why unemployment is so much less unpleasant in the French sample than in the US sample. From this table, several patterns are visible. First, there are large differences in how time is used by the unemployed in France and the US. The ATUS sample spent more time on work/commute, compulsory time and passive leisure (relatively unpleasant activities), but less on active leisure and eating (more pleasant activities). Second, there are quite large differences in the U-index associated with different activities for the unemployed in the US and France (all are statistically significant). In particular, the ratings for work/commute, compulsory and passive leisure in the ATUS are exceptionally high, compared to the employed population (Table 7), marking them as strongly unpleasant. In the EDT, ratings for work/commute, compulsory and passive leisure, are similar regardless of employment situation, producing a U-index that is quite similar between the employed and the unemployed. Only work/commute in the EDT is perceived as more unpleasant by the unemployed than by the employed.[11]

Table 6. The experienced well-being of the unemployed: ATUS and EDT, 2010

Unemployed	EDT 2009-2010		ATUS 2010	
	Percent of awake time	U -index	Percent of awake time	U-index
Work/commute	12.6 %	0.29	17.3 %	0.26
Compulsory	37.6 %	0.16	41.9 %	0.25
Passive leisure	19.8 %	0.11	24.7 %	0.25
Active leisure	15.7 %	0.08	9.5 %	0.15
Eating	14.2 %	0.07	6.5 %	0.11

Note: U-index was weighted by the proportion of each person's waking day spent in an episode. In the ATUS, the U-index is based on 4 dimensions: happy, stressed, pain and sad.

[11] The work/commute category of time use also includes job search activities.

Table 7. The experienced well-being of the employed: ATUS and EDT, 2010

Employed	EDT 2009-2010		ATUS 2010	
	Percentage of awake time	U -index	Percentage of awake time	U-index
Work/commute	35.1 %	0.19	35.6 %	0.20
Compulsory	28.3 %	0.16	31.1 %	0.16
Passive leisure	13.2 %	0.11	17.9 %	0.14
Active leisure	9.9 %	0.08	8.3 %	0.11
Eating	13.4 %	0.07	6.9 %	0.13

Note: U-index was weighted by the proportion of each person's waking day spent in an episode. In the ATUS, the U-index is based on 4 dimensions: happy, stressed, pain and sad.

36. Table 8 shows the U-index for the unemployed population in the Rennes/Columbus study. Here it is clear that there are significant differences in the experienced well-being for different activities between the 2005 and 2010 studies for both France and the US. In France, the EDT (Table 6) unambiguously shows all activities except work/commute and compulsory time as less unpleasant for the unemployed than was the case in the Rennes study (Table 8). In the case of the US, however, the picture is mixed. Work/commute and eating were more unpleasant in the Columbus study than in the ATUS, and passive leisure was less unpleasant. There was no significant difference for active leisure or compulsory time.

Table 8. The experienced well-being of the unemployed: Rennes and Columbus, 2005

Unemployed	Krueger et al. Rennes 2005 (France)		Krueger et al. Columbus 2005 (Ohio, US)	
	Percentage of awake time	U -index	Percentage of awake time	U-index
Work/commute	19 %	0.29	18 %	0.34
Compulsory	25 %	0.19	32 %	0.22
Passive leisure	27 %	0.17	27 %	0.20
Active leisure	18 %	0.11	16 %	0.16
Eating	11 %	0.16	7 %	0.17

Note: U-index was weighted by the proportion of each person's waking day spent in an episode. In Krueger et al. (2009), the U-index is based on 4 dimensions: happy, stressed, depressed and angry.

37. Empirically the extremely high U-index for compulsory and passive leisure in the ATUS appears to drive about half of the difference between the EDT and the ATUS. For example, a counter-factual where the EDT sample has the same U-index for compulsory and passive leisure as the ATUS sample would change the U-index for the unemployed in the EDT from 0.14 to 0.20. Alternatively, a counter-factual where the ATUS sample has the same U-index for compulsory and passive leisure as in the EDT would lower the US U-index for the unemployed from 0.27 to 0.20. By comparison, allocation of time use to the various types of activity explains relatively little of the difference in the U-index for unemployed people between the ATUS and EDT.

5. Counterfactual cross-country comparisons

38. It is possible to use data on the U-index for different activities to create a counter-factual U-index for a country so as to illustrate the relative impact of the affective character of different activities as opposed to the proportion of time spent on different activities on a country's overall U-index. Table 9 below illustrates this with a number of counterfactuals based on applying the U-indices for one set of

studies to the time allocations for different studies. The diagonal line of data in bold indicates the actual U-indices obtained from the Columbus/Rennes study, the EDT, and the ATUS.

39. Looking first at results for France, it is clear that the choice of U-indices for activities from the EDT or the Rennes study makes little difference to the main qualitative results, although there is a significant difference in the absolute value of the overall U-index in each situation. Under either set of U-indices, the overall U-index for France is significantly higher for the time allocation of the 2009/10 EDT than is the case for the Rennes study. Similarly, the U-indices for activities from the Rennes sample produce a significantly higher overall U-index than do the values from the EDT, regardless of which set of time allocations is used.

40. Bringing the US studies into the frame produces a slightly different picture. The overall U-indices derived using activity specific U-indices from the Columbus sample and the ATUS are higher than those derived from the French data, regardless of the source of time allocation data. Similarly, the ATUS produces a significantly higher overall U-index than the Columbus data regardless of which time allocation is used. None of the U-index weights produce significantly different results between the ATUS and Columbus time allocation data (i.e. between columns 3 and 4 on Table 9), although the ATUS U-index weights are the only ones that produce no difference at all.

Table 9. Counterfactual experienced well-being, women

	Country's time			
Country's U-index	Krueger et al. Rennes 2005 (France)	EDT 2009-2010 (France)	Krueger et al. Columbus 2005 (Ohio, US)	ATUS 2010 (US)
Krueger et al. Rennes 2005 (France)	**0.164**	0.171	0.172	0.176
EDT 2009-2010 (France)	0.149	**0.154**	0.155	0.158
Krueger et al. Columbus 2005 (Ohio, US)	0.182	0.189	**0.191**	0.195
ATUS 2010 (US)	0.168	0.170	0.172	**0.172**

41. Two important conclusions emerge from an examination of the counterfactuals in Table 9. The first of these is methodological. In particular, the U-index based on the EDT and the ATUS perform equally well in replicating the main findings of the Rennes/Columbus study, despite the fact that the ATUS more closely follows the DRM methodology used in the earlier study.[12] This is an issue that will be discussed further later. The second important point is that, for all of the measures used except ATUS, the U-index for women in France increased between 2005 and 2010 (between 0.5 and 0.9 percentage points). The counter-factual U-index for US women is also higher in 2010 than 2005 (between 0 and 0.4 percentage points), but for none of the estimates is this increase significant. Although the precise reasons for this shift are beyond the scope of this paper, the general trend is plausible. The Columbus/Rennes study took place around 3 years before the financial crisis, while the EDT and ATUS

[12] In fact, the ATUS may even perform marginally worse in that it is the only set of activity-specific U-indices that produce no difference at all between the 2005 Columbus time use data and the 2010 ATUS data. However, none of the differences found with the other three sets of U-indices (rows 1 to 3 of Table 9) are significant, even though all are roughly the same size.

studies took place in the aftermath of the crisis, in an environment characterised by much higher unemployment and greater economic insecurity.

6. Gender differences in experienced well-being

42. In their 2009 article, Krueger et al. construct gender-specific U-indices for the United States. These were based on the activity based U-indices for women from the Columbus study weighted by time use patterns for men and women from the ATUS 2003-05. For 2005, women had a U-index of just over 20%, compared to men at just under 19%, indicating that women spent more of their time in an unpleasant state. However, a key limitation of these synthetic indices was that differences in how men and women experience life might be due not only to differences in time allocation, but also to differences in how men and women experience different activities. With information on how activities are experienced only for women, the data available to Krueger et al. (2009) did not allow decomposing gender difference into time use and activity based components.

43. In contrast to the Columbus/Rennes study, both EDT and ATUS have a representative sample of men and women. It is therefore possible to compare the U-index for the different groups directly and to decompose the results into those due to differences in time use and those due to how people experience different activities. Table 10 shows the U-index for women in the Rennes/Columbus study and U-indices for men and women from EDT and ATUS, broken down by occupational status and by activity type.

Table 10. Gender differences in experienced well-being

	Krueger et al. Rennes 2005 (France)	EDT 2009-2010 (France)		Krueger et al. Columbus 2005 (Ohio, US)	ATUS 2010 (US)	
	Women	Women	Men	Women	Women	Men
All	0.16	0.15	0.15	0.19	0.20	0.16
Employed	0.14	0.14	0.16	0.19	0.20	0.16
Unemployed	0.19	0.14	0.11	0.22	0.27	0.19
Enrolled at school	0.23	0.12	0.21	0.24	0.22	0.15
Work/Commute	0.26	0.22	0.24	0.29	0.20	0.19
Compulsory	0.17	0.16	0.18	0.19	0.17	0.14
Passive leisure	0.14	0.12	0.09	0.15	0.17	0.16
Active leisure	0.09	0.10	0.09	0.10	0.13	0.10
Eating	0.09	0.09	0.08	0.10	0.14	0.11

44. Table 10 reproduces the main finding from Krueger et al. (2009b), i.e. that women in the United States have a higher overall U-index than men. In fact, the ATUS suggests an even larger gender gap than that found earlier (4 percentage points in the ATUS compared to 1 percentage point in Krueger et al.). Activity-specific U-indices for US men are significantly lower than is the case for women across all activities except passive leisure, which reinforces the effect of different time use patterns across genders. In France, by way of contrast, there is no evident overall gender gap in experienced well-being. The overall U-index for French men and women is the same at 15%. Underneath this, however, the picture is more complex, with French men and women having significantly different U-indices for all activity classifications.

45. There are several interesting differences between France and the United States evident in Table 10. In France, unemployed men have a lower U-index than employed men, implying that their experienced well-being is actually better than is the case for employed men. In the United States, however, unemployed men have a higher U-index than employed men. Similar to US men, unemployed US women have a higher U-index than their employed counterparts, but among French women employment status does not impact the U-index. Being enrolled in school is associated with a high U-index for US women (0.22), and is also the highest U-index for French men. For French women and US men, however, being enrolled in education was associated with a lower U-index than other population groups.

7. Discussion

46. Analysis of the experienced well-being modules attached to the 2010 ATUS and EDT suggest that both modules provide useful information on how people experience their lives. Although the comparative strategy adopted here, of comparing the ATUS and EDT to the Columbus/Rennes sample used by Krueger et al. (2009) cannot provide a definitive answer as to whether the ATUS or EDT approach provides a better measure of experienced well-being, a number of points do emerge from the analysis.

47. First, both approaches appear to 'work' in the sense that they produce a generally credible U-index. The overall U-index for both the ATUS and the EDT is within 1 percentage point of that obtained in the Columbus/Rennes sample and this difference is not significant, indicating that both the ATUS and EDT produce plausible estimates of the amount of time respondents spend in unpleasant states. The pattern of U-indices for specific activities is also consistent with earlier research although there are some exceptions – such as in the failure of the ATUS to identify a difference in compulsory time and passive leisure, or the failure of the EDT to identify unemployed women as having lower experienced well-being than employed women. The overall patterns, however, are remarkably consistent with both Krueger et al. (2009) and with what one might reasonably expect.

48. The fact that both EDT and ATUS approaches produce a reasonable estimate of the U-index is interesting not just in practical terms, but also because it provides information on the characteristics of good measures of experienced well-being. In particular, both the ATUS and the EDT require the respondent to fill in a detailed time use diary, but only the ATUS collects detailed information on a range of different affective states. The fact that both approaches appear to produce U-indices of similar accuracy suggests that the instantiation process associated with filling in the time use diary is more important to producing a valid estimate of the affective valence of an activity than is collecting detailed information on the full range of affective states that the respondent experienced. This is consistent with the view that most moments can be validly characterized along a single good/bad dimension (Kahneman et al., 1999).

49. If it is indeed possible to directly characterize a moment on a good/bad axis, then this suggests that the EDT approach to measuring experienced well-being in household surveys has several advantages over the ATUS approach. In particular, it is much more efficient at obtaining information at the level of the U-index, providing around seven times as many observations for a given sample. While there will clearly be research topics where the greater detail on different affective states provided by the full DRM is of value (e.g. medical research into pain), the fact that it is possible to directly obtain information on the affective valence of an activity from respondents suggests that it may be less costly to collect experienced well-being measures in large scale time use surveys than might have been anticipated.

50. In addition to the methodological implications discussed above, the comparison of the EDT and ATUS can shed some light on the apparently contradictory findings of Knabe et al. (2010) and Krueger and Mueller (2012) with respect to the impact of unemployment on experienced well-being. Knabe et al. reaffirm the common finding that unemployment has a strong negative effect on life satisfaction, but find no difference in the levels of experienced well-being between the employed and unemployed. The

measures of experienced well-being used include both a U-index[13] as well as a measure of 'episode satisfaction' where the respondent is asked to rate their general satisfaction during each episode on a 0 to 10 scale. In contrast to Knabe et al., Krueger and Mueller find that the unemployed have significantly lower levels of experienced well-being, particularly with respect to their experience of sadness and pain. In accounting for the differences between the two studies, Krueger and Mueller argue that Knabe et al.'s omission of both pain and sadness from the affective states collected in their survey is responsible for the lack of difference in experienced well-being between the employed and unemployed.

51. The analysis of the ATUS and EDT in this paper effectively replicates both results. The U-index calculated from ATUS – which includes measures of both sadness and pain – shows lower levels of experienced well-being for the unemployed. However, the alternative U-indices considered in this paper (see Annex 3) show that this correlation is highly sensitive to the precise choice of affective states to be included. In the EDT, employed and unemployed men have similar levels of experienced well-being, and among women the unemployed have only slightly lower well-being than the employed. This is consistent with the results from Knabe et al. using their measure of episode satisfaction. In fact, the wording and implementation of the EDT scale is very close to the episode satisfaction measure developed by White and Dolan (2009), which formed the model for Knabe et al. This highlights the sensitivity of experienced well-being measures to methodological issues, particularly where the intent is to produce a uni-dimensional summary measure such as the U-index.

52. The analytical approach taken in this paper has a number of limitations. First, it is important to acknowledge that the Rennes/Columbus sample does not provide an ideal baseline against which to evaluate the validity of the ATUS and EDT approaches. The Rennes/Columbus sample is not representative of the population as a whole, and has a relatively small sample size. The former fact introduces the risk of bias, while the latter raises the possibility that estimates do not accurately reflect the true underlying characteristics of the sampled population. Thus, where the EDT or ATUS results differ from the Rennes/Columbus results, this may reflect measurement error or bias in the original sample rather than a problem with the newer data. Obviously, the reverse is also true where the EDT and ATUS results are consistent with the earlier study.

53. The comparisons used in this paper use the Rennes/Columbus data as a baseline in order to investigate the impact of the different methodologies adopted by the ATUS and EDT. However, a comparison of this sort is clearly limited in the range of potential confounding factors that can be controlled for. Ideally it would be desirable to use random assignment across a split sample to test the two different methods experimentally. A full experimental study would control fully for potential confounding factors and would enable the results obtained by the two methodologies to be directly compared. Split sample trials of this sort have been used by national statistical offices to inform the development of evaluative measures of subjective well-being (e.g. ONS, 2011), and experienced well-being would seem to be a promising area for a similar experimental approach.

54. Despite the limitations inherent in the available data, the ATUS and EDT experienced well-being modules provide valuable evidence on the viability of measuring experienced well-being in household surveys. On the basis of this evidence, both approaches produce valid data, and the simpler EDT format may allow for collecting information more efficiently in large scale household surveys where respondent burden is of high concern and where the primary interest is analysis of a uni-dimensional measure of experienced well-being such as the U-index.

[13] The U-index used by Knabe et al. was calculated using the emotions "relaxed", "happy", "comfortable/at ease", "enjoying myself", "lethargic/dull", "insecure/anxious", "stressed", and "frustrated/annoyed".

REFERENCES

Boarini, R. et al. (2012), "What makes for a better life: the determinants of subjective well-being in OECD countries, evidence from the Gallup World Poll", *OECD Working Paper 45-2012/2*, OECD Publishing, Paris, http://dx.doi.org/10.1787/5k9b9ltjm937-en.

Diener, E. et al. (1999), *Subjective Well-being: Three Decades of Progress*, Psychological Bulletin, Vol. 125, No. 2, pp. 276-302, https://scholars.opb.msu.edu/en/publications/subjective-well-being-three-decades-of-progress-4.

Dolan, P. and D. Kahneman (2008), "Interpretations of utility and their implications for the valuation of health", *The Economic Journal*, Vol. 118, No. 525, pp. 215-234, http://profron.net/happiness/files/readings/Dolan-Kahneman_InterpretationsUtilityValueHealth.pdf.

Kahneman, D. and A. Deaton (2010), "High income improves evaluation of life but not emotional well-being", *Proceedings of the National Academy of Sciences*, Vol. 107, No. 38, www.pnas.org/content/107/38/16489.full.pdf.

Kahneman, D. and A.B. Krueger (2006), "Developments in the measurement or subjective well-being", *Journal of Economic Perspectives*, Vol. 20, No. 1, pp. 3-24, http://pubs.aeaweb.org/doi/pdfplus/10.1257/089533006776526030.

Kahneman, D. et al. (2004a), "A survey method for characterizing daily life experience: The day reconstruction method", *Science*, Vol. 306, pp. 1776-1780, http://science.sciencemag.org/content/sci/306/5702/1776.full.pdf.

Kahneman, D. et al. (2004b), "Toward national well-being accounts", *American Economic Review*, Vol. 94, No. 2, pp. 429-434, http://pubs.aeaweb.org/doi/pdfplus/10.1257/0002828041301713.

Kahneman, D., E. Diener and N. Schwarz (eds.) (1999), *Well-being. The Foundations of Hedonic Psychology*, Russel Sage Foundation, New York.

Knabe, A. et al. (2010), "Dissatisfied with life but having a good day: Time-use and well-being of the unemployed", *The Economic Journal,* Vol. 120, pp. 867-889, http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0297.2009.02347.x/full.

Krueger, A.B. and A. Mueller (2012), "Time away from work. Time use, emotional well-Being, and unemployment: Evidence from longitudinal data", *American Economic Review: Papers and Proceedings,* Vol. 102, No. 3, pp. 594-599, www0.gsb.columbia.edu/mygsb/faculty/research/pubfiles/5607/time_use_mueller.pdf.

Krueger, A.B. et al. (2009a), "Time use and subjective well-being in France and the US", *Social Indicators Research*, Vol. 93, No. 1, pp. 7-18, http://link.springer.com/article/10.1007%2Fs11205-008-9415-4.

Krueger, A.B. et al. (2009b), *National Time Accounting: The Currency of Life*; in A.B. Krueger (ed.), *Measuring the Subjective Well-Being of Nations: National Accounts of Time Use and Well-Being*, University of Chicago Press, Chicago, www.nber.org/chapters/c5053.pdf.

Krueger, A.B. (2007), "Are we having more fun yet? Categorizing and evaluating changes in time allocation", *Brookings Papers on Economic Activity*, Vol. 38, No. 2, pp. 193-218, www.brookings.edu/wp-content/uploads/2007/09/2007b_bpea_krueger.pdf.

MacKerron, G. and S. Mourato (2013), "Happiness is greater in natural environments", *Global Environmental Change*, Vol. 23, pp. 992-1000, http://ac.els-cdn.com/S0959378013000575/1-s2.0-S0959378013000575-main.pdf?_tid=e5bf6c06-3583-11e7-8428-00000aab0f6c&acdnat=1494422807_f03a235f6b5f27557ee04339d13ec91a.

Mackie, C. and A.A. Stone (2013), *Subjective Well-being: Measuring Happiness, Suffering, and Other Dimensions of Experience*, National Academies Press, Washington D.C.

O'Donnell, G. et al. (2014), *Well-being and Public Policy*, Legatum Institute, London, http://li.com/docs/default-source/commission-on-wellbeing-and-policy/commission-on-wellbeing-and-policy-report---march-2014-pdf.pdf.

OECD (2013), *OECD Guidelines on Measuring Subjective Well-being*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264191655-en.

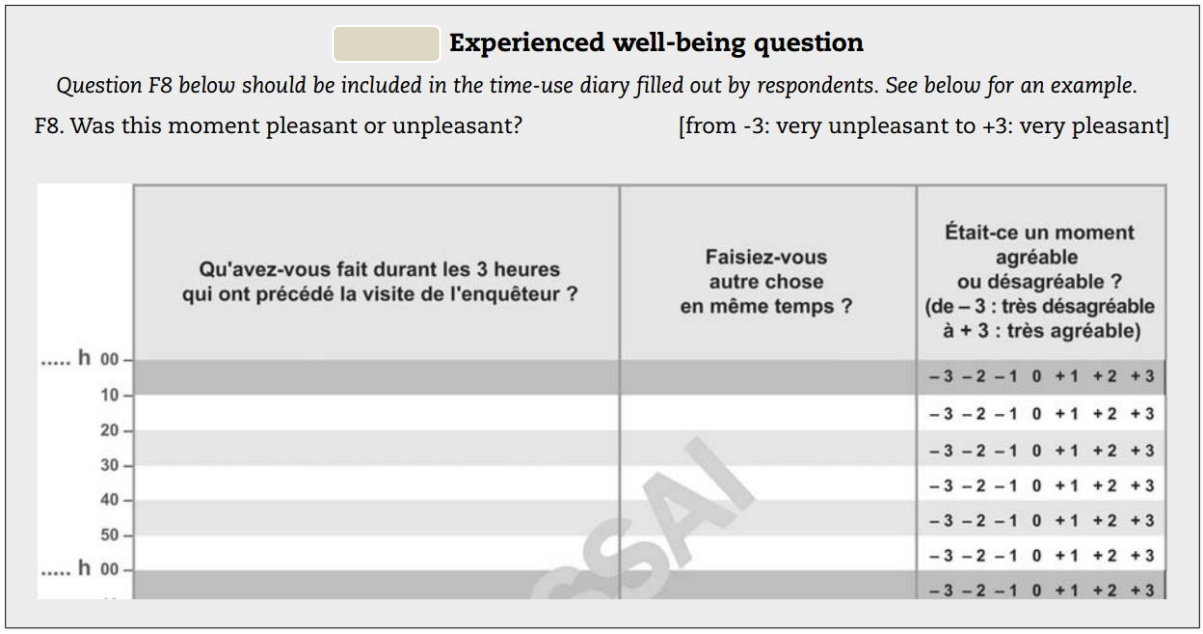
Office for National Statistics (2011), *Initial Investigation into Subjective Wellbeing from the Opinions Survey*, United Kingdom, www.ons.gov.uk/ons/dcp171776_244488.pdf.

Stiglitz, J.E., Sen A. and J-P. Fitoussi (2009), *Report by the Commission on the Measurement of Economic Performance and Social Progress*, INSEE, Paris, http://library.bsl.org.au/jspui/bitstream/1/1267/1/Measurement_of_economic_performance_and_social_progress.pdf.

UNECE (2014), *Guidelines for Harmonizing Time Use Surveys*, United Nations, Geneva.

White, M. and P. Dolan (2009), "Accounting for the richness of daily activities", *Psychological Science*, Vol. 20, No. 8, pp. 1000-1008, http://journals.sagepub.com/doi/pdf/10.1111/j.1467-9280.2009.02392.x.

ANNEX 1. TIME DIARY USED IN THE FRENCH *ENQUÊTE EMPLOI DU TEMPS*



Experienced well-being question

Question F8 below should be included in the time-use diary filled out by respondents. See below for an example.

F8. Was this moment pleasant or unpleasant? [from -3: very unpleasant to +3: very pleasant]

	Qu'avez-vous fait durant les 3 heures qui ont précédé la visite de l'enquêteur ?	Faisiez-vous autre chose en même temps ?	Était-ce un moment agréable ou désagréable ? (de – 3 : très désagréable à + 3 : très agréable)
..... h 00			– 3 – 2 – 1 0 + 1 + 2 + 3
10			– 3 – 2 – 1 0 + 1 + 2 + 3
20			– 3 – 2 – 1 0 + 1 + 2 + 3
30			– 3 – 2 – 1 0 + 1 + 2 + 3
40			– 3 – 2 – 1 0 + 1 + 2 + 3
50			– 3 – 2 – 1 0 + 1 + 2 + 3
..... h 00			– 3 – 2 – 1 0 + 1 + 2 + 3

ANNEX 2. GROUPING OF THE DETAILED ACTIVITIES IN ATUS AND EDT INTO THE FIVE BROAD CATEGORIES USED IN THIS PAPER

Activities

Work /Commute

- Act 1: paid work (paid work (all jobs), commuting, activities related to employment
- Act 5: learning (general education, homework and study, independent study, travel related to learning, other activities related to learning)
- Act 2.7: travel related to unpaid work
- Act 3.3: travel and other activities related to caregiving for household members
- Act 4.3: travel and other activities related to community service and volunteering
- Act 6.3: travel and other activities related to socialising and participatory activities
- Act 7.6: travel related to leisure
- Act 8.5: travel related to personal care

Compulsory activities

- Act 2.1: food management
- Act 2.2 cleaning, upkeep of dwelling and surroundings
- Act 2.3 decoration, maintenance and repair
- Act 2.4 care of textiles and footwear
- Act 2.5 pet care
- Act 2.6 shopping
- Act 2.8 other activities related to unpaid work
- Act 3.1 childcare
- Act 3.2 adultcare
- Act 4.1 unpaid help to other households
- Act 4.2 formal volunteering
- Act 8.4 Professional and Personal Care services
- Act 8.6 Grooming and Personal care emergencies; Health related self-care
- Act 8.3 personal activities; personal care

Passive leisure

- Act 7.4 mass media use
- Act 7.5 resting, relaxing, reflecting
- Act 7.7 other activities related to leisure

Active leisure

- Act 7.1 Attending/visiting cultural, entertaining sport events
- Act 7.2 hobbies, games and other pastime activities
- Act 7.3 sport participations and exercise and related activities
- Act 6.2 participatory activities
- Act 6.1 Socialising and communication

Eating

- Act 8.2 eating and drinking

ANNEX 3. COMPARISON OF DIFFERENT ESTIMATES OF THE U-INDEX FOR THE UNITED STATES

Table A1. Comparison of options for U-index constructed from 2010 ATUS with 2005 Columbus dataset

	Krueger et al. Columbus 2005 (Ohio, US)	ATUS 2010 (US)		
	U-index: happy, stressed, depressed, angry	U-index: happy, stressed, tired, sad	U-index: happy, stressed, pain, sad	U-index: happy, stressed, tired, sad, pain, meaningful
All (women)	0.19	0.28	0.20	0.15
Employed	0.19	0.29	0.20	0.15
Unemployed	0.22	0.30	0.27	0.12
Enrolled at school	0.24	0.30	0.22	0.16
Work/Commute	0.29	0.26	0.20	0.14
Compulsory	0.19	0.26	0.17	0.14
Passive leisure	0.15	0.27	0.17	0.18
Active leisure	0.10	0.17	0.13	0.07
Eating	0.10	0.19	0.14	0.12

Table A2. Comparison of options for affect balance constructed from 2010 ATUS with 2005 Columbus U-index

	Krueger et al. Columbus 2005 (Ohio, US)	ATUS 2010 (US)		
	U-index: happy, stressed, depressed, angry	Affect balance: happy, stressed, tired, sad	Affect balance: happy, stressed, pain, sad	Affect balance: happy, stressed, tired, sad, pain, meaningful
All (women)	0.19	1.75	1.90	1.82
Employed	0.19	1.80	1.93	1.88
Unemployed	0.22	1.65	1.80	1.72
Enrolled at school	0.24	1.29	1.96	1.47
Work/Commute	0.29	2.07	2.30	2.15
Compulsory	0.19	1.45	1.65	1.50
Passive leisure	0.15	1.35	1.62	1.41
Active leisure	0.10	2.68	2.91	2.71
Eating	0.10	2.32	2.55	2.37

Note: The net affect balance in each column goes from -3 to 3.

Table A3. Detailed comparison of the U-index across activity types in the ATUS and EDT

	EDT 2009-2010 (France)	ATUS 2010 (US)
1. Paid work	**0.22**	**0.26**
Paid work (all jobs)	0.25	0.30
Commuting	0.46	0.19
Activities related to employment	0.49	0.24
2. Unpaid household work	**0.27**	**0.18**
Food management	0.37	0.16
Cleaning, upkeep of dwelling and surroundings	0.57	0.19
Decoration, maintenance and repair	0.19	0.26
Care of textiles and footwear	0.67	0.19
Pet care	0.37	0.13
Shopping	0.55	0.17
Travel related to unpaid work		0.17
Other activities related to unpaid work	0.77	0.28
3. Unpaid caregiving services to household members	**0.17**	**0.14**
Childcare	0.21	0.12
Adultcare		0.23
Travel and other activities related to caregiving for household members	0.27	0.17
4. Community services and help to other households	**0.42**	**0.14**
Unpaid help to other households	0.34	0.16
Formal volunteering		0.10
Travel and other activities related to community service and volunteering	0.48	0.15
5. Learning	**0.46**	**0.29**
General education	0.58	0.17
Homework and study	0.76	0.33
Travel related to learning		0.38
Other activities related to learning	0.48	0.41
6. Socialising, community participation and religious practice	**0.19**	**0.14**
Socialising and communication	0.19	0.15
Participatory activities	0.22	0.09
Travel and other activities related to socialising and participatory activities		0.15
7. Leisure and sports	**0.08**	**0.16**
Attending/visiting cultural, entertaining, sports events	0.18	0.02
Hobbies, games and other pastime activities	0.11	0.26
Sports participations and exercise and related activities	0.04	0.09
Mass media use	0.08	0.16
Resting, relaxing, reflecting	0.22	0.22
Travel related to leisure	0.44	0.10
Other activities related to leisure		0.24
8. Personal care	**0.03**	**0.16**
Sleep and related activities	0.05	
Eating and drinking	0.08	0.14
Other personal care	0.29	

ANNEX 4. BASIC STATISTICS OF THE KRUGER ET AL. SAMPLE AND IN THE DATASET USED IN THIS PAPER

Table A4. Descriptive statistics across different datasets

Basic Descriptive Statistics					Standard deviations		Sample size		t-statistics		
	Krueger et al.	EDT 2009-2010	Krueger et al.	ATUS 2010							
	Rennes 2005 (France)	(France)	Columbus 2005 (Ohio, US)	(US)	S.D.	S.D.	N	N	t-statistics (1) - (2)	t-statistics (3) - (4)	t-statistics (2) - (4)
Age	18-60	18-60	19-68	19-68	(France)	(US)	(France)	(US)	(France)	(US)	France vs US
Median age	39	42	44	43	12	13	9966	5948	**25.0**	**-5.9**	**4.8**
Employed	67	69	75	65	46	48	9966	5948	**4.3**	**-16.1**	**-5.2**
Unemployed	17	9	10	5.5	3	2	9966	5948	**-295.8**	**-150.9**	**-86.9**
Married or cohabiting	62	51	73	51	50	50	9966	5948	**-22.0**	**-33.9**	0.0
Median income	$28,000	$35,600	$50,000	$55,000	11592	53638	9966	5948	**65.4**	**7.2**	**27.5**
Enrolled at school	16	5	10	12	2	26	9966	5948	**-522.9**	**5.9**	**20.7**
Highly educated	14.5	9	18	12.5	28	33	9966	5948	**-19.6**	**-12.9**	**6.8**

Table A5. Percentage of awake time spent in each activity across different datasets

Percentage of awake time spent in each activities					Standard deviations		Sample size		t-statistics		
	1	2	3	4							
	Krueger et al.	EDT 2009-2010	Krueger et al.	ATUS 2010	S.D.	S.D.	N	N	t-statistics (1) - (2)	t-statistics (3) - (4)	t-statistics (2) - (4)
	Rennes 2005 (France)	(France)	Columbus 2005 (Ohio, US)	(US)	(France)	(US)	(France)	(US)	(France)	(US)	France vs US
Work/commute	0.218	0.287	0.246	0.276	0.237	0.255	9966	5948	**29.1**	**9.1**	**-2.7**
Compulsory	0.348	0.304	0.352	0.354	0.176	0.335	9966	5948	**-25.0**	0.5	**10.7**
Passive leisure	0.181	0.151	0.248	0.209	0.130	0.248	9966	5948	**-23.0**	**-12.1**	**16.7**
Active leisure	0.106	0.121	0.075	0.089	0.140	0.102	9966	5948	**10.7**	**10.6**	**-16.6**
Eating	0.148	0.137	0.079	0.071	0.083	0.072	9966	5948	**-13.2**	**-8.6**	**-52.8**
Total	**100%**	**100%**	**100%**	**100%**							

Table A6. Different measures of experienced well-being across various datasets

Comparing different mesures of experienced wellbeing							Standard deviations		Sample size		t-statistics		
	1	2	3	4	5	6							
	Krueger et al.	EDT 2009-2010		Krueger et al.	ATUS 2010								
	Rennes 2005 (France)	(France)		Columbus 2005 (Ohio, US)	(US)		S.D.	S.D.	N	N	t-statistics (1) - (2)	t-statistics (4) - (5)	t-statistics (2) - (5)
	U-index	U-index	Affect BA	U-index	U-index	Affect BA	(France)	(US)	(France)	(US)	(France)	(US)	France vs US
All (women)	0.160	0.150	1.65	0.190	0.200	1.90	0.201	0.386	880	5948	-1.48	**2.00**	**5.94**
Employed	0.140	0.140	1.60	0.190	0.200	1.93	0.205	0.436	615	3885	0.00	1.43	**5.54**
Unemployed	0.190	0.140	1.74	0.220	0.270	1.80	0.184	0.399	77	329	**-2.37**	**2.27**	**4.28**
Enrolled at school	0.230	0.120	1.70	0.240	0.220	1.96	0.217	0.378	46	442	**-3.40**	-1.11	**2.72**

Table A7. U-index and time allocations across different datasets

The U index and allocation of time across activities							Standard deviations		Sample size		t-statistics		
	1	2	3	4	5	6							
	Krueger et al.	EDT 2009-2010		Krueger et al.	ATUS 2010								
	Rennes 2005 (France)	(France)		Columbus 2005 (Ohio, US)	(US)		S.D.	S.D.	N	N	t-statistics (1) - (2)	t-statistics (4) - (5)	t-statistics (2) - (5)
	U-index	U-index	Affect BA	U-index	U-index	Affect BA	(France)	(US)	(France)	(US)	(France)	(US)	France vs US
Work/Commute	0.26	0.22	1.08	0.29	0.20	2.3	0.231	0.329	880	5948	**-5.13**	**-21.09**	**-6.2**
Compulsory	0.17	0.16	1.29	0.19	0.17	1.65	0.169	0.286	880	5948	-1.75	**-5.38**	**4.9**
Passive leisure	0.14	0.12	2.13	0.15	0.17	1.62	0.097	0.440	880	5948	**-6.11**	**3.51**	**17.7**
Active leisure	0.09	0.10	2.36	0.10	0.13	2.91	0.097	0.447	880	5948	**3.06**	**5.17**	**10.3**
Eating	0.09	0.09	2.27	0.10	0.14	2.55	0.087	0.385	880	5948	0.00	**8.01**	**22.9**

Table A8. Time allocations by labour force status across different datasets

					Standard deviations		Sample size		
Unemployed	**EDT 2009-2010**		**ATUS 2010**		S.D.	S.D.	N	N	t-statistics (2) - (4)
	Perc of awake time	U -index	Perc of awake time	U-index	(France)	(US)	(France)	(US)	France vs US
Work/commute	12.60%	0.29	17.30%	0.26	0.208	0.423	77	329	**-2.0**
Compulsory	37.60%	0.16	41.90%	0.25	0.154	0.39	77	329	**8.1**
Passive leisure	19.80%	0.11	24.70%	0.25	0.122	0.433	77	329	**11.6**
Active leisure	15.70%	0.08	9.50%	0.15	0.058	0.342	77	329	**10.2**
Eating	14.20%	0.07	6.50%	0.11	0.058	0.33	77	329	**6.3**
Employed	**EDT 2009-2010**		**ATUS 2010**		S.D.	S.D.	N	N	t-statistics (2) - (4)
	Perc of awake time	U -index	Perc of awake time	U-index	(France)	(US)	(France)	(US)	France vs US
Work/commute	35.10%	0.19	35.60%	0.2	0.208	0.377	615	3885	**2.5**
Compulsory	28.30%	0.16	31.10%	0.16	0.157	0.344	615	3885	0.0
Passive leisure	13.20%	0.11	17.90%	0.14	0.112	0.33	615	3885	**13.3**
Active leisure	9.90%	0.08	8.30%	0.11	0.1	0.28	615	3885	**18.1**
Eating	13.40%	0.07	6.90%	0.13	0.077	0.322	615	3885	**31.5**

Table A9. U-index across different datasets

	Country's time				Standard deviations		Sample size		t-statistics		
Country's U-index	Krueger et al.	EDT 2009-2010	Krueger et al.	ATUS 2010	S.D.	S.D.	N	N	t-statistics (1) - (2)	t-statistics (3) - (4)	t-statistics (2) - (4)
	Rennes 2005 (France)	(France)	Columbus 2005 (Ohio, US)	(US)	(France)	(US)	(France)	(US)	(France)	(US)	France vs US
Rennes 2005 (France)	**0.164**	0.171	0.172	0.176	0.201	0.386	9966	5948	**3.48**	0.80	**2.1**
EDT 2009-2010	0.149	**0.154**	0.155	0.158	0.201	0.386	9966	5948	**2.48**	0.60	1.7
Columbus 2005 (Ohio)	0.182	0.189	**0.191**	0.195	0.201	0.386	9966	5948	**3.48**	0.80	**2.6**
ATUS 2010	0.168	0.17	0.172	**0.172**	0.201	0.386	9966	5948	0.99	0.00	0.9

	Rennes 2005 (France)	(France)	Columbus 2005 (Ohio, US)	(US)
t-statistics (row 1) - (row 2)	**-7.4**	**-8.4**	**-3.4**	**-3.6**
t-statistics (row 3) - (row 4)	**-7.0**	**-9.4**	**-3.8**	**-4.6**
t-statistics (row 1) - (row 3)	**8.9**	**8.9**	**3.8**	**3.8**
t-statistics (row 2) - (row 4)	**9.4**	**7.9**	**3.4**	**2.8**

Table A7. U-index by socio-economic groups and activities across different datasets

	Krueger et al.	EDT 2009-2010		Krueger et al.	ATUS 2010				Standard deviations		Sample size			
	Rennes 2005 (France)	(France)		Columbus 2005 (Ohio, US)	(US)				S.D.	S.D.	N	N	t-statistics (2) - (3)	t-statistics (5) - (6)
	Women	Women	Men	Women	Women	Men			(France)	(US)	(France)	(US)	(France)	(US)
All	0.16	0.15	0.15	0.19	0.2	0.16			0.201	0.386	880	5948	0.00	**-8.00**
Employed	0.14	0.14	0.16	0.19	0.2	0.16			0.205	0.436	615	3885	**2.42**	**-5.71**
Unemployed	0.19	0.14	0.11	0.22	0.27	0.19			0.184	0.399	77	329	-1.42	**-3.63**
Enrolled at school	0.23	0.12	0.21	0.24	0.22	0.15			0.217	0.378	46	442	**2.78**	**-3.88**
Work/Commute	0.26	0.22	0.24	0.29	0.2	0.19			0.231	0.329	880	5948	**2.57**	**-2.34**
Compulsory	0.17	0.16	0.18	0.19	0.17	0.14			0.169	0.286	880	5948	**3.51**	**-8.08**
Passive leisure	0.14	0.12	0.09	0.15	0.17	0.16			0.097	0.440	880	5948	**-9.17**	-1.75
Active leisure	0.09	0.1	0.09	0.1	0.13	0.1			0.097	0.447	880	5948	**-3.06**	**-5.17**
Eating	0.09	0.09	0.08	0.1	0.14	0.11			0.087	0.385	880	5948	**-3.41**	**-6.01**

ANNEX 5. A DESCRIPTION OF THE WEIGHTING PROCEDURE USED IN THIS PAPER

Applying the correct weights is an important issue with time use data. This annex explains the weighting procedure used in this paper.

ATUS Weights and estimation

The ATUS final weights (TUFINLWGT) need to be applied when computing estimates with the ATUS data. The ATUS weights are designed to produce estimates for an average person-day. That is, estimates represent the time use for an average person, on an average day. The ATUS weights compensate for important aspects of the sampling and data collection process. They ensure that each demographic group is represented in the weighted in proportion to its share in the population. They also ensure that each day of the week is correctly represented.

Columbus Weights

In order to be able to compare the Columbus data with the ATUS data, the ATUS data were re-weighted to take into account differences in socio-demographic characteristics, as shown in Table 2.

ATUS Well-Being Module Weights and estimation

The well-being respondent-level final weight should be used when using the well-being module data. Because some ATUS respondents did not complete the well-being Module, the well-being respondent-level final weights account for this non-response. Like the ATUS final weights, the well-being Module respondent weights are person-day weights.

When estimating U-indexes, we use weights from the whole ATUS sample to account for the time respondents spent doing each activity. This enables us to estimate the percentage of time the average person spent in an unpleasant state on an average day.

Alternatively, the well-being activity weights can be used. They are designed to account for the time respondents spent doing each sampled activity, and the total time they spent in activities eligible for selection in the module. They also account for the differences between respondents in the probability that a specific activity was sampled.

Please see www.bls.gov/tus/wbmintcodebk.pdf for further discussion.

EDT Weights and estimation

When computing estimates with the EDT data, the EDT respondent-level weights (POND_QI) should be applied. The EDT weights are designed to produce estimates for an average person-day. For instance, young adults who are less likely to be interviewed are given higher weights. To use variables like the life satisfaction question, it is also important to use the EDT satisfaction weights (POND_STIG) as only a sub-sample of individuals answered this questionnaire.

Like with the ATUS data, we re-weight the EDT data to take into account differences in socio-demographic characteristics between the Rennes sample and the EDT sample.