Unveiling the Monetary Value of Non-Market Activities Using Experienced Well-Being and Time-Use Surveys

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Abstract

Traditional approaches to value household production of non-market services typically rest on stringent assumptions and demanding data requirements. This paper develops an alternative method for attributing a monetary value to non-market activities, taking advantage of questions on experienced well-being available in a number of national time-use surveys. Our valuation model allows computing the shadow price of time by activity, even for those activities for which no market price equivalents of the goods and services produced exist. Our results show that the value of unpaid work ranges from the 25% of GDP in the United States to 49% in Italy; while the share of the value of leisure to GDP ranges from 13% in France to 33% in the United Kingdom.

1. Introduction

Estimates of production, income and consumption in the System of National Accounts (SNA) are generally based on the idea that households are final consumers, rather than producers, of goods and services. Goods and services produced by households for the market are included in economic aggregates, as are goods produced for own-consumption, such as agricultural products and own-account construction, but non-market services produced by households for own-consumption, with the notable exception of dwelling services, are not included in economic aggregates in the SNA.

Many of the services produced by households for their own-use, such as cleaning services, preparation of meals, child-care, etc. contribute however to people's material well-being and often share the characteristics of the same activities conducted by the market, which are included in the production boundary of the SNA. Yet, they have always been excluded from the SNA production boundary on the general grounds that the transactions could not "be brought directly or indirectly into relation with the measuring-rod of money" (Pigou, 1932) and, in particular, because of the perception that the imputations needed to estimate the size of these activities were relatively arbitrary; therefore reducing the accuracy, credibility, and usefulness of the accounts for analysing, projecting, and informing policies.

Despite recent improvements in the statistical infrastructure of many countries (e.g. more detailed data on wages, improved data on non-market activities, and time-use surveys) and the efforts to produce household production satellite accounts that complement the traditional estimates of economic activity and provide a more comprehensive assessment of the material well-being of households, the broad consensus remains that the core accounts should continue to exclude non-market activities from the GDP production boundary.

Further momentum to the efforts towards broadening the income concept was given by the work of the Commission on the of Economic Performance and Social Progress (Stiglitz et al., 2009), which recommended to extend traditional income measures, so as to recognise not only the own-account production of household services but also leisure. There are indeed good reasons for accounting for leisure in broader measures of income. First, individuals spend a large amount of time on leisure activities: on average, 21% of people's daily time is allocated to leisure, compared to 14% to unpaid work and about 13% to paid work.[1] Time available for leisure contributes to well-being in several ways — through its positive effects on mental and physical health, interpersonal relationships and life satisfaction, just to mention a few. Second, an important objective in valuing leisure is to make cross-country comparisons: a given real income in a society with more

[1] See https://stats.oecd.org/Index.aspx?datasetcode=TIME_USE

leisure will typically imply a higher living standard than in a society with the same income but less leisure. Placing a value on time spent on leisure, such that it can be compared with the benefits gained from conventional consumption of market goods and services or the consumption of goods and services produced by households for their own-use, is however more challenging, both empirically and conceptually, than finding values for time spent on household production of goods and services, where market price equivalents of the goods and services produced are increasingly available.

Against this backdrop, in this paper we develop a new method for attributing a monetary value to non-market activities, where information on how people spend their time is combined with information on the emotions they experience during these activities. The major contribution of our approach is to derive the shadow price of time for a given activity by taking into account the marginal (dis)utility derived from performing that activity, as proxied by the emotional experience during that activity.

The remainder of the paper is organised as follows. Section 2 reviews the main traditional approaches to valuing non-market activities and describes the novelty of our approach. Section 3 presents our framework; while Section 4 describes the data. Section 5 illustrates and discusses the results and Section 6 concludes.

2. Traditional Methods for Valuing Non-Market Activities

Previous attempts at broadening the income concept to non-market activities have mainly focused on the production of household non-market services. In principle, their economic value can be estimated in two different ways (UNECE, 2017). The *output method* takes market price equivalents of the non-market services and applies these, adjusted for differences in quality, to the quantity of non-market services produced by households. While being conceptually closer to the conventions used for compiling economic accounts, there are major obstacles to putting this approach into practice (Prouteau, 2002). First, it requires clear and full identification of the outputs generated by unpaid work, which is not always possible. Second, there is often no close substitute on the market for the output produced during unpaid work activities.

The *input method* attributes a monetary value to the sum of costs involved in producing the non-market services. These costs include the intermediate consumption involved in producing the services, the costs of labour and the value of capital services used in production. In practice, however, non-labour costs are often ignored. The cost of the time (labour) involved in the production of non-market services is given by the shadow price of time, which — according to the household production theory (Becker, 1965; Gronau, 1986) — is defined as the ratio of the marginal utility of time to the marginal utility of consumption. However, the estimation of the shadow price of time rests on several unobservable parameters and is particularly data demanding.[2] The valuation of household non-market production of services is typically putting into practice in two ways:

- The *opportunity cost method* quantifies the wage that the household members forego to engage in the production of household non-market services. While the equality between the wage rate and the shadow price of time is plausible according to the household production theory, it occurs only if a variety of assumptions that are empirically questionable concur: as stated in Gronau (1986), the marginal wage must be equal to the average wage; working on the labour market must not be associated with market goods; and time allocated to paid work must not generate direct (dis)utility. If any of these assumptions is not met, then the shadow price of time will differ from the wage rate.[3] From a computational

[2] Recently, Gardes (2018) derived a method to structurally estimate the shadow price of time through statistically matched datasets, which leads to shadow prices defined at the individual level. According to his estimations, the shadow price of time is roughly 50% of the wage rate and it increases with the latter but only at a decreasing rate.

[3] The shadow price of time plays a key role in a number of economic application, such as the computation of inequality measures based on full income, as well as individuals' decisions about human capital accumulation, labour supply and fertility, just to mention a few examples (see Heckman, 2015).

point of view, this approach has also some weaknesses. First, a complication arises for unemployed people who have no equivalent market wage. Second, it implies that the value of household non-market production of services might be vastly different depending on who is performing the task. Finally, the aim should be to measure what households actually produce, instead of what they might have produced on the market.

- The *replacement cost method* values the time spent on unpaid activities at the hourly earnings of individuals who are engaged in similar activities in the market sector, thus assuming that household members and their "replacements" are equally productive. The assumption behind this approach is that households save money by deciding to perform the activity themselves. The amount they save, and hence the value to the household of doing the work, is the cost of purchasing the same services in the market or hiring someone else to perform the activity. The best-practice application of this approach (specialist wage approach) would classify the tasks carried out by household members into detailed activities (e.g. adult care) and then calculate their cost if these tasks were performed by paid specialists (e.g. professional carers); this application is however data demanding, as it requires detailed information on the nature of the task performed, as well as an adjustment for any productivity differential between paid specialists and household members. The simplest way to apply the replacement cost method is the generalist wage approach, where the replacement costs of unpaid activities are imputed based on hourly earnings of people employed in matched occupations. While this method is widely used, it is worth noting that when the shadow price of time differs from the wage rate, the assumption that the shadow price can be proxied by the replacement cost does not necessarily hold.

Putting a monetary value on leisure is even more contentious. Economists have worked around this issue by treating leisure time like a consumer good whose price is the value of income from foregone work. Nordhaus and Tobin (1972) conducted one of the original works on this topic. Their work was a part of a study to measure a nation's economic welfare, of which they deemed leisure to be an important part. To value leisure, they multiplied an estimated average amount of leisure time by an estimated average wage rate of persons in several employment categories — e.g. employed in manufacturing, female, under 20 years old — and then aggregated according to the population in each category. A survey of people's average daily time use in 1954 provided the basis of their leisure time estimates. On this basis, they calculated leisure's value in the U.S. to be 102 percent of measured GNP in 1965. This method of valuing leisure is conceptually identical to the input method that has commonly been used to value household output — as such it suffers from the same drawbacks as discussed earlier.

In this paper, we provide an alternative method for attributing a monetary value to non-market activities, where information on how people spend their time is combined with information on the emotions they experience during these activities. As our approach takes advantage of the well-being questions available in a number of time-use surveys, we will refer to it as the "*well-being valuation method*".

The well-being valuation method can be shortly described as follows. First, we derive the emotional experience during a given activity, which proxies the marginal (dis)utility derived from performing that activity. In a second step, we compute the shadow price of time for that activity, by multiplying the wage rate by the ratio of the experienced well-being in that activity to the experienced well-being in paid work. Then, we multiply the

resulting shadow prices by the time individuals allocate to daily non-market activities in order to compute the daily values of those activities. Finally, by using the average wage rates, we compute an extended GDP measure, which shows by how much GDP would increase if non-market activities were valued and accounted for in national accounts.

Without despising the importance of the replacement and opportunity cost methods reviewed above, the well-being valuation method developed in this paper presents a number of advantages. First, it is based on the economic standard practice of valuing non-market commodities with shadow prices: in particular, it allows deriving shadow prices of time by activity that reflect the different emotional states experienced by individuals — while the opportunity cost approach assumes that the value of time is identical across activities and the replacement cost assumes that the value of time is equal for all the individuals. Second, it allows valuing even those activities for which no market price equivalents of the goods and services produced exist; without assuming that the shadow price of time is the foregone wage rate, as done in the opportunity cost method.

3. Theoretical Framework: The Value of Time Allocated to Different Activities

According to the well-being valuation method developed in this paper, the utility associated to the time allocated to a given activity has two components: the utility derived from the *output* produced during the activity (e.g. the utility of having cooked a meal) and the *well-being* experienced during that activity (e.g. the enjoyment derived by cooking). As in Kahneman et al. (2004) and Krueger et al. (2009), we assume that the experienced well-being of the *i-th* activity does not depend directly on the experienced well-being of the *j-th* activity, although it depends on the utility derived from the outputs produced by the *j*-th activity (e.g., watching television in a clean house is likely to be more pleasant than watching it in a dusty house).

Under these assumptions, let U_l denote the daily utility of the representative agent *l*:

$$U_l = u_l\big(Z_{1l}(t_{1l}), Z_{2l}(t_{2l}), \dots, Z_{nl}(t_{nl})\big)\left(\sum_{i=1}^{n} \bar{v}_{il} t_{il}\right) \qquad (1)$$

where t_{il} is the amount of time allocated to activity *i;* Z_{il} is the quantity of output produced during activity *i* (where the input is the amount of time allocated to the production of output under the assumptions that $\partial Z_{il}/\,\partial t_{il} > 0$ and $\partial^2 Z_{il}\,/\partial {t_{il}}^2 < 0$; $u_l(.)$ is the utility derived from the outputs produced ($\partial u_l/\,\partial Z_{il} > 0$, $\partial^2 u_l/\partial {Z_{il}}^2 < 0$, and $\partial^2 u_l/[\partial Z_{jl}\,\partial Z_{il}] > 0$); $\bar{v}_{il}$ is the well-being experienced during a unit of time (episode) allocated to *i-th* activity; $\bar{v}_{il} t_{il}$ is the experienced well-being over the duration of the *i-th* activity; and $\sum \bar{v}_{il} t_{il}$ is the total experienced well-being over a day.

We totally differentiate U_l and equalise it to zero (dU_l*=0)* to find the marginal rate of substitution between the time allocated to activities *j* and *k* (i.e., the rate at which the individual substitutes t_{jl} for t_{kl} while keeping their utility constant):

$$dU_l = \sum_{i=1}^{n} \left(\frac{\partial u}{\partial Z_{il}} \frac{\partial Z_{il}}{\partial t_{il}} \bar{v}_{il} t_{il} \; + u_l(.)\bar{v}_{il}\right) dt_{il} = 0 \qquad (2)$$

The terms in parenthesis show the effect of a marginal increase in t_{il} on the utility. Dividing both sides by U_l, we get the percentage change in U_l due to the changes in the allocation of time:

$$\frac{dU_l}{U_l} = \frac{1}{\sum_{i=1}^{n}(\bar{v}_{il} t_{il})} \sum_{i=1}^{n} \bar{v}_{il} \left(\frac{\partial \ln(u_l)}{\partial \ln(Z_{il})} \frac{\partial \ln(Z_{il})}{\partial \ln(t_{il})} + 1\right) dt_{il} = 0 \qquad (3)$$

Using equation (3) the marginal rate of substitution between t_j and t_k writes:

$$-\frac{dt_{kl}}{dt_{jl}} = \frac{\bar{v}_{jl}\left(\frac{\partial \ln(u_l)}{\partial \ln(Z_{jl})}\frac{\partial \ln(Z_{jl})}{\partial \ln(t_{jl})}+1\right)}{\bar{v}_{kl}\left(\frac{\partial \ln(u_l)}{\partial \ln(Z_{kl})}\frac{\partial \ln(Z_{kl})}{\partial \ln(t_{kl})}+1\right)} \tag{4}$$

where the right hand side of equation (4) is the ratio of the marginal utility of t_{jl} to the marginal utility of t_{kl}.

At the optimum, which is found by maximising the utility function in equation (1) subject to the time constraint $\sum_i t_{il} = T$(where *T* is the total available time), the marginal utility of time is equal across activities, which implies that the marginal rate of substitution between t_{jl} and t_{kl} is equal to one:

$$\frac{\bar{v}_{jl}\left(\frac{\partial \ln(u_l)}{\partial \ln(Z_{jl})}\frac{\partial \ln(Z_{jl})}{\partial \ln(t_{jl})}+1\right)}{\bar{v}_{kl}\left(\frac{\partial \ln(u_l)}{\partial \ln(Z_{kl})}\frac{\partial \ln(Z_{kl})}{\partial \ln(t_{kl})}+1\right)} = 1 \quad \Leftrightarrow \quad \frac{\frac{\partial \ln(u_l)}{\partial \ln(Z_{jl})}\frac{\partial \ln(Z_{jl})}{\partial \ln(t_{jl})}+1}{\frac{\partial \ln(u_l)}{\partial \ln(Z_{kl})}\frac{\partial \ln(Z_{kl})}{\partial \ln(t_{kl})}+1} = \frac{\bar{v}_{kl}}{\bar{v}_{jl}} \tag{5}$$

Equation (5) shows that the marginal utility of the output produced in activity *j* equals $\bar{v}_{kl}/\bar{v}_{jl}$ times the marginal utility of the output produced in activity *k.* This is an intuitive but key result: for instance, if an individual enjoys leisure twice as much as housework, then the marginal utility of the housework output must be twice the marginal utility of the leisure output; otherwise, the individual would either not engage in housework (if the ratio of the marginal utility of housework to the marginal utility of leisure were to remain always below 2) or in leisure (if the ratio of the marginal utility of housework to the marginal utility of leisure were to remain always above 2).

In equation (5) $\bar{v}_{kl}$ can be viewed as the cost — in terms of experienced well-being — of using a unit of time in the production of output *j* and $\bar{v}_{jl}$ is the cost of using a unit of time in the production of output *k.* Therefore, we can also interpret the optimality condition as the equality of the marginal utilities of outputs *k* and *j*, per unit of the forgone experienced well-being:

$$\frac{\left(\frac{\partial \ln(u_l)}{\partial \ln(Z_{jl})}\frac{\partial \ln(Z_{jl})}{\partial \ln(t_{jl})}+1\right)}{\bar{v}_{kl}} = \frac{\left(\frac{\partial \ln(u_l)}{\partial \ln(Z_{kl})}\frac{\partial \ln(Z_{kl})}{\partial \ln(t_{kl})}+1\right)}{\bar{v}_{jl}} \tag{6}$$

Under the assumption that the value of a unit of time spent on paid work, *W*, can be proxied by the wage rate, it is possible to numerically compute the monetary value of a unit of time allocated to any given activity, as shown in equation (7):

$$\frac{\frac{\partial \ln(u_l)}{\partial \ln(Z_{wl})}\frac{\partial \ln(Z_{wl})}{\partial \ln(t_{wl})}+1}{\frac{\partial \ln(u_l)}{\partial \ln(Z_{kl})}\frac{\partial \ln(Z_{kl})}{\partial \ln(t_{kl})}+1} \approx \frac{W_l}{\frac{\partial \ln(u_l)}{\partial \ln(Z_{kl})}\frac{\partial \ln(Z_{kl})}{\partial \ln(t_{kl})}+1} = \frac{\bar{v}_{kl}}{\bar{v}_{wl}} \tag{7}$$

where Z_{wl} is the output of paid work and t_{wl} is the time spent on paid work. The value of an activity usually refers to the value of the output produced while performing that activity. For instance, the wage rate values the output of paid work and does not account for the experienced well-being. In the remainder of the paper, when we make reference to the value of an activity, we implicitly consider the value of the output produced during that activity.

4. The Datasets

The time-use surveys (TUS) for Canada (Time-Use module of the Canada General Social Survey - GSS); Italy (Inchiesta sull'Uso Del Tempo); France (Enquête Emploi du temps - EDT); the United Kingdom (UK Time-Use Survey - UKTUS); and the United States (American Time Use Survey - ATUS) are used to test the well-being valuation method derived in the previous section. Data have been harmonised, so as to ensure cross-country comparability, although differences in sampling design and survey characteristics remain (Table 4.1). In order to improve cross-country comparability, we focus only on primary activities, as the ATUS does not allow for the recording of multiple activities performed simultaneously. Furthermore, we drop the individuals below 15 years old so that the minimum age is identical across surveys. Differences in the number of household members interviewed are not deemed to affect our estimates, given that the selected surveys are nationally representative.

Furthermore, Table 4.1 shows that the Canadian TUS provides 64 categories to classify daily activities; whereas the ATUS has more than 300. For comparability purposes, we regroup activities according to the OECD activity classification, which is made of 23 activities (e.g., routine housework, shopping, eating, and sleeping) regrouped under 5 major divisions (e.g., unpaid work, personal care, and paid work/study). Lastly, note that, while in our analysis the most recent wave of each survey is considered, the French TUS was conducted during the Great Recession, which may have an impact on the respondents' allocation of time between market and non-market activities.

Table 4.1. Survey characteristics

	Data collection period	Recording of simultaneous activities	Age and number of household members interviewed	Numbers of activity categories
Canada	April 2015 – April 2016	Yes	15 and more; 1 household member	64
France	September 2009 – September 2010	Yes	11 and more; 1 member and spouse if applicable	140
Italy	November 2013 – October 2014	Yes	3 and plus, all household members	147
United Kingdom	April 2014 – December 2015	Yes	8 and plus; all household members	277
United States	January 2013 – December 2013	No	15 and more, 1 household member	More than 300

In addition to providing detailed information on their use of time, respondents are also asked to report their experienced well-being during a given episode.[4] Countries take various approaches to measuring experienced well-being, both in terms of the type of information collected and the number of surveyed episodes. Table 4.2 presents an overview of these different approaches. Compared to other surveys, where respondents are asked to rate either "how much they enjoyed" or "how pleasant was" an episode, the ATUS collects information on individuals' positive (i.e. happiness) and negative (i.e. sadness, tiredness, stress, and pain) affect during a given activity. Experienced well-being is reported on a 7-point scale, although with varying bottom and top values as shown in Table 4.2.

In the EDT the experienced well-being module is administered only to a sub-sample of respondents. The UKTUS initially adopted a similar approach but, after the first 3 months, the well-being module was extended to the whole sample. To avoid a high non-response rate, the American and Canadian time-use surveys ask respondents to report their experienced well-being only on 3 and 2 randomly selected activities, respectively. Since the American, Canadian, and Italian surveys exclude the emotional experience of sleeping, we drop this activity from our analysis (we focus therefore on the wake time allocated across the 22 remaining activities).

Table 4.2. Experienced well-being questions in time use surveys

	Question	Scale	Sample	Episodes/activity per person
Canada	at # o'clock, how would you rate the activity you were doing	-3 (very unpleasant) to 3 (very pleasant)	All sample	2 activities (excludes sleeping)
France	Was it a pleasant or unpleasant moment?	-3 (very unpleasant) to 3 (very pleasant)	Sub-sample	All activities
Italy	Is this moment pleasant?	-3 (not at all pleasant) to 3 (very pleasant)	All sample	All activities except "in bed" or "sleeping"
United Kingdom	How much did you enjoy this time?	1 (not at all) to 7 (very much)	35% of sample for the first 3 months, all sample for the remaining 9 months	All activities
United States	- How [stressed, sad, tired] were you during this time? - How much [pain] did you feel during this time if any? - How [happy] did you feel during this time?	0 to 6	All sample	3 activities (excludes sleeping, grooming, and personal/private activities)

[4] In the EDT, an episode consists always of 10 minutes. In the other surveys, respondents can adjust the length of episodes according to their will (usually the length of an episode in these surveys corresponds to the length of an activity carried-out with no change in location, in the persons with whom the respondent is, and in the number of activities performed simultaneously).

Table 4.3 provides a number of demographic statistics for the national samples considered in our analysis (i.e. those individuals who have reported both their experienced well-being in addition to information on their use of time). For France and the United Kingdom, where the well-being module was administered only to a representative sub-sample, the values reported in Table 4.3 differ only slightly (on average by less than 1.5%) from the corresponding values computed on the full sample.

Table 4.3. Descriptive statistics of the survey datasets

	USA 2013	Canada 2015/2016	France 2009/2010	Italy 2013/2014	UK 2014/2015
Age (average)	39.24	40.32	41.46	41.44	39.26
Share of women (%)	50.4	50.00	51.73	50.34	50.54
Marital Status (%)					
- Married or living with partner	55.94	58.87	67.79	50.77	59.35
- Single, divorced, widowed, or does not apply	44.07	41.13	32.21	49.23	40.65
Occupational status (%)					
- employed	68.8	63.31	62.57	56.1	68.63
- unemployed or looking for a job	9.91	3.04	9.16	8.05	4.44
- student	5.35	10.64	9.32	11.73	10.38
- other	9.01	23.01	18.95	24.12	16.55
Presence of children in the household (%)					
- none	53.79	59.46	61.31	47.31	62.44
- one	19.80	15.06	19.04	28.91	18.07
- two	16.50	18.2	13.55	20.02	14.48
- three	6.65	5.52	4.05	3.26	3.39
- four and plus	3.26	1.76	2.05	0.49	1.62
Number of observations (diaries with experienced well-being)	8,236	12,485	1,896	26,098	9,593

Note: The average age in the Canadian and Italian surveys are computed based on age ranges.

Table 4.4 shows large cross-country variation in the time allocated to personal care (the estimate for France is almost twice as large as that for Canada) and paid work/study (ranging from 133 minutes a day in Italy to 252 minutes in Canada).[5] On the other hand, the average daily time allocated to unpaid work and leisure show limited cross-country variation (the highest country values being roughly 16% and 11% larger than the lowest ones for these two activities, respectively). On average, individuals allocate 35.0%, 22.4%, 21.5%, and 18.2% of their wake time to leisure, unpaid work, paid work, and personal care, respectively.

[5] To compute the time allocated to different daily activities, we consider all the individuals who have successfully completed their time-use diary rather than the sample of those who have reported, in addition, their experienced well-being. As mentioned above, this does not affect significantly the average estimates and allows us obtain more precise time use estimates. The small differences in the number of observations for Canada, Italy and the United States reported in Table 4.3 and Table 4.4 are due to random item and unit non-response.

Table 4.4. Time spent on daily activities (in minutes)

	USA 2013	Canada 2015/2016	France 2009/2010	Italy 2013/2014	UK 2014/2015
Paid work or study	**233**	**252**	**162**	**133**	**211**
- paid work (all jobs)	186	201	115	93	156
- travel to and from work/study	18	20	18	16	32
- time in school or classes	17	17	19	10	11
- research/homework	9	13	8	11	11
- job search	3	1	2	2	1
Unpaid work	**206**	**196**	**191**	**228**	**209**
- routine housework	111	125	143	148	118
- shopping	24	26	22	28	31
- child care	24	23	18	19	21
- adult care	2	1	1	2	7
- care for non-household members	5	5	2	8	7
- volunteering	9	3		3	2
- travel related to household activities	26	12	5	20	21
- other unpaid	4	1	1	0	1
Personal care	**129**	**124**	**244**	**196**	**146**
- eating & drinking	68	70	136	128	86
- personal, household, and medical services + travel related to personal care	61	53	107	69	60
Leisure	**318**	**307**	**316**	**341**	**328**
- sports	18	21	11	37	19
- participating / attending events	7	5	15	5	6
- visiting or entertaining friends	48	54	53	64	48
- TV or radio at home	166	129	130	121	148
- Other leisure activities	79	98	108	114	107
Other	**32**	**36**	**9**	**16**	**36**
- religious / spiritual activities and civic obligations	11	4	3	9	5
- other (no categories)	21	31	6	6	31
Total (excluding sleeping time)	**919**	**914**	**923**	**913**	**930**
Number of observations (diaries)	8,992	12,557	20,981	27,035	11,600

Note: Information on time spent on formal volunteer work is not available in the French dataset.

As in Krueger et al. (2009) and Kanheman et al. (2004), the available information on experienced well-being is used to derive the U-index, which is designed to measure the proportion of time an individual spends in an unpleasant state. The first step in computing the U- index is to determine whether an episode is unpleasant or pleasant. An episode is classified as unpleasant if the most intense feeling reported for that episode is a negative one — that is, if the maximum rating on any of the negative affect dimensions is strictly greater than the maximum rating of the positive affect dimensions. Once the episode has been categorised as unpleasant or pleasant, the U-index is defined as the fraction of an individual's wake time that is spent in an unpleasant state. The U-index can be computed for each individual and averaged over the sampled population as follows:

$$\text{U index} = \sum_{l=1}^{N} \left(\frac{\sum_j I_{lj} h_{lj}}{\sum_j h_{lj}} \right) / N \qquad (8)$$

where I_{lj} is a dummy variable that takes value 1 if and only if the level of any of the negative emotions exceeds the level of any of the positive emotions (i.e., the activity is perceived as unpleasant) during episode j of duration h_{lj}. $\sum_j I_{lj} h_{lj} / \sum_j h_{lj}$ gives the proportion of time the representative individual l spends in an unpleasant state of mind. Summing $\sum_j I_{lj} h_{lj} / \sum_j h_{lj}$ over a population of N individuals as in equation (8) measures the average proportion of time that individuals spend in an unpleasant state of

mind. The U-index can be computed for each of the activities recorded in time-use diaries, in this vein it can be considered as a proxy for the average well-being experienced by the representative individual l during a given activity (i.e., $\bar{v}_{il}t_{il}$). While the dichotomous categorisation of activities as pleasant or not overlooks the intensity of emotional states, Krueger et al. (2009) point out that the U-index has many advantages, among which its ordinal nature, since it provides on ordinal measure *at the level of feelings* (Kanheman and Krueger, 2006).

As summarised in Table 4.2, among the 5 surveys considered in this analysis, only the 2013 ATUS allows computing the U-index following the exact definition proposed by Krueger et al. (2009). Yet, using the ordinal experienced well-being variable available in the 2009/2010 French EDT, Flèche and Smith (2017) derive a binary summary measure which yields a good proxy for the U-index. Ordinal measures of experienced well-being are more prone than binary variables to suffer from interpretation biases: it is likely that some respondents who find an episode slightly unpleasant will report a zero level of enjoyment, while others will record it as -1;[6] the question then arises whether an episode should be recorded as unpleasant if its experienced enjoyment is equal to zero.[7]

Table 4.5 provides, for the 22 daily activities defined in Table 4.4, the U-indices computed under different assumptions. First, by considering an episode as unpleasant only if its associated *enjoyment* is strictly negative (as in columns labelled with (1)); and then, by relaxing this assumption and allowing for an unpleasant status even in the presence of nil *enjoyment* (as in columns labelled with (2)). Finally, the average values of these two methods are provided in columns (3).

We use the U-indices as computed on the ATUS survey as benchmark, since they have been derived according to the exact definition proposed by Krueger et al. (2009). Given the similar level of economic development shared by the five selected countries, one might expect the U-indices to be rather comparable across countries, in which case the assumption of negative experienced well-being in the presence of strictly negative enjoyment (as reported in columns (1)) seems too stringent compared to the US benchmark. Under this assumption, for instance, individuals in Canada, France, Italy, and the United Kingdom would report on average being in a negative state of mind during only about 12.2% of their paid work time, compared to 27.4% of their Americans counterparts. While this finding may be partly due to different working conditions and cultural biases, the U-indices in columns (1) are consistently lower than the corresponding US benchmark: in the United States, individuals report on average spending 17.9% of all their daily time in a negative state of mind compared with only 9.2% on average in the other four countries.

[6] The terms "experienced well-being" and "enjoyment" are used interchangeably in the case of the Canadian, French, Italian and UK datasets, where respondents rate either "how much they enjoyed" or "how pleasant was" an activity.

[7] For comparability purpose, the enjoyment variable in the UK dataset has been re-coded on a -3 to 3 scale, by subtracting 4 from each of its initial values.

Table 4.5. U-indices of daily activities

	USA 2013	Canada 2015/2016			France 2009/2010			Italy 2013/2014			United Kingdom 2014/2015		
		(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Paid work or study	**30.4%**	**14.2%**	**33.5%**	**23.8%**	**21.1%**	**48.8%**	**34.9%**	**13.9%**	**34.2%**	**24.1%**	**26.0%**	**47.4%**	**36.7%**
- paid work (all jobs)	27.4%	9.6%	26.8%	18.2%	10.9%	30.2%	20.5%	9.7%	29.7%	19.7%	18.8%	39.5%	29.2%
- travel to and from work/study	18.0%	12.9%	32.0%	22.5%	11.3%	38.9%	25.1%	9.5%	32.2%	20.8%	21.9%	42.6%	32.2%
- time in school or classes	17.0%	12.5%	25.2%	18.8%	17.5%	62.0%	39.8%	15.3%	30.5%	22.9%	22.2%	42.0%	32.1%
- research/homework	38.3%	24.0%	44.3%	34.1%	31.3%	68.2%	49.8%	21.2%	42.1%	31.6%	29.1%	56.0%	42.5%
- job search	51.3%	11.9%	39.1%	25.5%	34.3%	44.9%	39.6%	14.0%	36.5%	25.3%	38.2%	56.9%	47.5%
Unpaid work	**14.0%**	**5.8%**	**21.5%**	**13.7%**	**8.7%**	**24.4%**	**16.5%**	**7.3%**	**22.2%**	**14.8%**	**13.6%**	**29.9%**	**21.8%**
- routine housework	17.5%	6.9%	22.1%	14.5%	9.8%	25.9%	17.9%	11.4%	32.7%	22.1%	17.0%	35.8%	26.4%
- shopping	16.8%	6.1%	17.6%	11.9%	7.0%	20.1%	13.6%	7.4%	22.9%	15.2%	16.8%	33.8%	25.3%
- child care	7.7%	7.9%	17.1%	12.5%	3.0%	11.0%	7.0%	3.5%	12.0%	7.8%	8.4%	19.1%	13.8%
- adult care	13.2%	5.6%	34.4%	20.0%	0.0%	14.5%	7.3%	12.8%	32.3%	22.6%	26.6%	50.1%	38.4%
- care for non-household members	6.1%	11.3%	26.8%	19.0%	6.3%	12.5%	9.4%	8.7%	24.1%	16.4%	9.2%	21.4%	15.3%
- volunteering	10.0%	0.0%	9.3%	4.6%				5.4%	20.1%	12.7%	6.3%	20.4%	13.4%
- travel related to household activities	15.7%	5.3%	22.6%	13.9%	6.2%	19.8%	13.0%	5.2%	23.6%	14.4%	14.7%	34.2%	24.5%
- other unpaid	25.2%	3.7%	22.4%	13.0%	28.2%	67.2%	47.7%	3.9%	9.9%	6.9%	10.1%	24.5%	17.3%
Personal care	**20.3%**	**4.3%**	**17.3%**	**10.8%**	**3.9%**	**15.7%**	**9.8%**	**3.3%**	**18.3%**	**10.8%**	**9.8%**	**22.0%**	**15.9%**
- eating & drinking	10.8%	1.9%	8.7%	5.3%	1.2%	6.3%	3.8%	1.6%	8.8%	5.2%	4.5%	12.6%	8.5%
- personal, household, and medical services + travel related to personal care	29.7%	6.7%	25.9%	16.3%	6.6%	25.1%	15.8%	5.1%	27.7%	16.4%	15.2%	31.4%	23.3%
Leisure	**12.1%**	**2.8%**	**8.3%**	**5.5%**	**1.6%**	**5.3%**	**3.4%**	**1.8%**	**8.2%**	**5.0%**	**4.8%**	**13.0%**	**8.9%**
- sports	10.6%	1.1%	3.3%	2.2%	1.4%	3.9%	2.7%	1.5%	6.2%	3.9%	4.5%	12.1%	8.3%
- participating / attending events	9.6%	2.4%	6.4%	4.4%	2.6%	7.0%	4.8%	1.1%	3.6%	2.3%	2.7%	7.5%	5.1%
- visiting or entertaining friends	10.6%	3.3%	9.2%	6.3%	1.6%	4.7%	3.1%	2.1%	8.4%	5.2%	4.7%	11.9%	8.3%
- TV or radio at home	16.9%	3.2%	11.5%	7.3%	1.0%	5.5%	3.3%	2.1%	10.9%	6.5%	4.7%	14.3%	9.5%
- Other leisure activities	13.1%	3.7%	11.3%	7.5%	1.2%	5.5%	3.4%	2.0%	11.9%	7.0%	7.4%	19.3%	13.3%
Other	**14.4%**	**10.0%**	**22.0%**	**16.0%**	**4.8%**	**15.1%**	**9.9%**	**4.2%**	**16.4%**	**10.3%**	**9.0%**	**17.7%**	**13.4%**
- religious / spiritual activities and civic obligations	8.1%	5.0%	11.4%	8.2%	3.0%	13.7%	8.4%	3.1%	10.4%	6.7%	4.3%	10.2%	7.3%
- other (no categories)	20.8%	14.9%	32.6%	23.8%	6.6%	16.5%	11.5%	5.2%	22.4%	13.8%	13.6%	25.2%	19.4%
Correlation with the USA U-index		**0.547**	**0.689**	**0.665**	**0.819**	**0.657**	**0.726**	**0.581**	**0.626**	**0.623**	**0.768**	**0.713**	**0.738**
Average U-index	**17.9%**	**7.3%**	**20.9%**	**14.1%**	**9.1%**	**24.0%**	**16.5%**	**6.9%**	**20.9%**	**13.9%**	**13.7%**	**28.2%**	**20.9%**

Note: Information on time spent on formal volunteer work is not available in the French dataset.

Allowing for a negative experienced well-being in the presence of nil enjoyment (as in columns (2)), instead, yields U-index values closer to the US benchmark, although slightly over-estimated for France and the United Kingdom. Since we expect the level of experienced well-being to be similar across the selected countries, we follow a country-specific approach and choose the method that yields the highest correlation coefficient and the closest values to the US benchmark.[8] This corresponds to retaining the values in columns (2) for Canada and Italy and those in columns (3) for France and the United Kingdom.[9]

[8] The average U-indices reported at the bottom of Table 4.5 are highly correlated with the US benchmark: the lowest correlation coefficient is found for Canada (0.547, column (1)) and the highest is found for France (0.819, column (1)).

[9] To assess the robustness of the preferred method over alternative assumptions, a sensitivity analysis of our results will however be performed and presented in Section 5. The findings show that value of non-market activities is only moderately affected by the method used to compute the U-indices.

5. Results: The Estimated Value of Non-Market Activities

5.1. Value of a unit of time spent on non-market activities

Based on equations (7) and (8), for the representative agent *l*, the shadow price of time allocated to a given activity *k* relative to the shadow price of time allocated to paid work (V_{kl}) writes as follows

$$V_{kl} = \frac{\bar{v}_{wl}}{\bar{v}_{kl}} = \frac{\text{U index}_{kl}}{\text{U index}_{wl}} \quad (9)$$

Note that the ratio of experienced well-being is equal to the inverse ratio of the U-indices, since $\bar{v}_{kl}$ measures how pleasant activity *k* is, whereas the U-index$_{kl}$ measures how unpleasant it is. Using the U-indices in Table 4.5, Table 5.1 shows the value of a unit of time spent on the 22 activities of the OECD activity classification relative to the value of a unit of time spent on paid work.[10] For instance, the value of a unit of time allocated to the personal care division is 74.2% of the value of a unit of time allocated to paid work in the United States.

The value of a unit of time in the major division *paid work/study* is greater than the unit value of time in any of the remaining four major divisions: if this was not the case, no time would have been allocated to *paid work/study*, being paid work/study the most unpleasant major division (see Table 4.5).

Unpaid work (e.g., routine housework) is also highly unpleasant, as shown in Table 4.5, even though this major division also includes a number of activities that are reported as relatively pleasant, such as childcare, shopping, and volunteering. Therefore, the value of a unit of time allocated to unpaid work is relatively high: Table 5.1 shows that, on average, the value of a unit of time spent on unpaid work is 51% of the value of a unit of time spent on paid work/study in the USA, 80% in Canada and France, and 75% in Italy and the United Kingdom.

[10] In each national dataset, the value of a unit of time spent on paid work has been normalised to one.

Table 5.1. Value of a unit of time in daily activities

Ratio of the value of a unit of time spent on a given activity to the value of a unit of time spent on paid work.

	USA 2013	Canada 2015/2016	France 2009/2010	Italy 2013/2014	UK 2014/2015
Paid work or study	**1.110**	**1.255**	**1.701**	**1.420**	**1.259**
- paid work (all jobs)	1.000	1.000	1.000	1.000	1.000
- travel to and from work/study	0.657	1.195	1.222	1.083	1.104
- time in school or classes	0.620	0.941	1.936	1.026	1.100
- research/homework	1.399	1.652	2.422	1.417	1.459
- job search	1.876	1.458	1.927	1.229	1.630
Unpaid work	**0.513**	**0.804**	**0.805**	**0.748**	**0.747**
- routine housework	0.640	0.824	0.870	1.102	0.904
- shopping	0.615	0.658	0.660	0.771	0.868
- child care	0.282	0.638	0.341	0.405	0.473
- adult care	0.484	1.286	0.354	1.087	1.315
- care for non-household members	0.224	0.999	0.458	0.811	0.524
- volunteering	0.365	0.347	0.000	0.676	0.458
- travel related to household activities	0.573	0.842	0.633	0.795	0.839
- other unpaid	0.920	0.835	2.322	0.334	0.593
Personal care	**0.742**	**0.646**	**0.477**	**0.614**	**0.546**
- eating & drinking	0.396	0.325	0.184	0.298	0.293
- personal, household, and medical services + travel related to personal care	1.088	0.967	0.770	0.931	0.799
Leisure	**0.444**	**0.311**	**0.168**	**0.277**	**0.306**
- sports	0.388	0.121	0.129	0.210	0.285
- participating / attending events	0.349	0.239	0.234	0.121	0.175
- visiting or entertaining friends	0.386	0.344	0.153	0.284	0.285
- TV or radio at home	0.616	0.429	0.158	0.367	0.326
- Other leisure activities	0.480	0.421	0.164	0.402	0.458
Other	**0.528**	**0.822**	**0.484**	**0.552**	**0.458**
- religious / spiritual activities and civic obligations	0.295	0.425	0.407	0.350	0.249
- other (no categories)	0.760	1.218	0.561	0.755	0.666

Note: Information on time spent on formal volunteer work is not available in the French dataset.

On the other hand, the most pleasant major division is *leisure*, with the unit value of time spent on this major division being 44%, 31%, 17%, 28%, and 31% of the unit value of time spent on paid work/study in the USA, Canada, France, Italy, and the United Kingdom, respectively. Unsurprisingly, this means that individuals value more the outputs produced through unpaid work (e.g. as a clean house, ironed clothes and a good meal) than the outputs produced through leisure activities (e.g. watching TV). We can also interpret our results in terms of opportunity costs: individuals do not spend more of their time in leisure because the increase in their experienced well-being would not compensate the forgone earnings of paid work and the output of unpaid work.

Table 5.2 shows that the relative values of daily activities in Table 5.1 are highly correlated across the five selected countries (the correlation coefficient is 0.77 on average). The greatest cross-country variation is found for residual activities (e.g., other unpaid work or activities not elsewhere classified), care for adults and for non-household members, and time in school. Regarding this last activity, there is a clear difference in values between European and North American countries, with time spent on school being much less enjoyed in the former than in the latter countries, and particularly so in France.

Table 5.2. Pair-wise correlation coefficients between the values of time spent on daily activities

	United States	Canada	France	Italy
Canada	0.962	..	..	..
France	0.781	0.738	..	.
Italy	0.801	0.799	0.955	..
United Kingdom	0.920	0.929	0.894	0.935

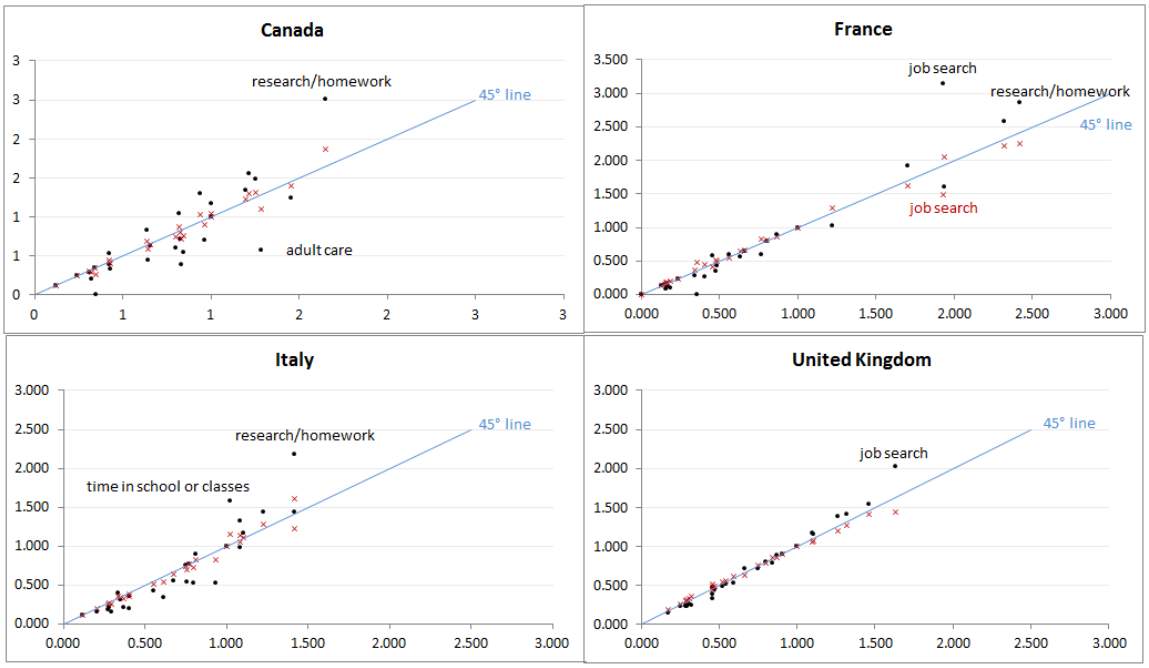
Note: The table shows Pearson product-moment correlation coefficients.

We test the sensitivity of the values shown in Table 5.1 to the different approaches to developing the U-index discussed earlier (see Table 4.5). In Figure 5.1, the horizontal axis records the value of a unit of time spent on daily activities computed with our preferred approach, while the same metric is displayed on the vertical axis but as measured under the two alternative approaches discussed earlier: i.e. *i)* an episode is considered as unpleasant if its associated enjoyment is strictly negative, and *ii)* an episode is considered unpleasant even in the presence of nil enjoyment in the French and UK datasets; while the enjoyment experienced during an episode is computed as the average of the values resulting from the other two approaches in the Canadian and Italian datasets. Values computed under approach *(i)* are displayed as black dots; while values computed under approach *(ii)* are represented as red crosses. The closer black dots or red crosses are to the 45° line the less sensitive is the value of a unit of time spent on daily activities to the chosen approach.

Figure 5.1 shows that the value of a unit of time spent on daily activities is hardly affected by the method chosen to compute the U-indices in the case of the UK dataset (except for job-search, which however accounts for no more than 2 minutes a day, on average). This is overall true also for the French and Italian datasets, although a few remarkable exceptions are worth noting: the value of a unit of time spent on research/homework is quite sensitive to the method chosen to compute the U-indices, and this is true also for job search in the French data, and for time in school/classes in the Italian ones. In the case of Canada, Figure 5.1 shows that the value of a unit of time in daily activities is slightly more sensitive to the method used in the computation of the U-index. However, most of the unit values of time fall on or near the 45° line, which suggests that in general our results are only slightly affected by the method chosen to compute the U-index.

Figure 5.1 Sensitivity checks

Unit values of time computed under different approaches to computing the U-index



Note: The horizontal axis records the value of a unit of time spent on daily activities computed with our preferred approach to compute the U-index, while the same metric is displayed on the vertical axis but as measured under two alternative approaches: i.e. i) an episode is considered as unpleasant if its associated enjoyment is strictly negative, and ii) an episode is considered unpleasant even in the presence of nil enjoyment in the French and UK datasets; while the enjoyment experienced during an episode is computed as the average of the values resulting from the other two approaches in the Canadian and Italian datasets. Values computed under approach (i) are displayed as black dots; while values computed under approach (ii) are represented as red crosses. The closer black dots or red crosses are to the 45° line the less sensitive is the value of a unit of time spent on daily activities to the chosen approach.

Based on the results derived in Table 5.1, according to the well-being valuation method, the average shadow price of time spent on non-market activities for the representative agent l, denoted as $\overline{\omega_l}$, can be computed as follows:

$$\overline{\omega_l} = \sum_k \left(\frac{t_k}{(\sum_k t_k)} \frac{\text{U index}_{kl}}{\text{U index}_{wl}} \right) \qquad (10)$$

where t_k is the amount of time allocated to such activity. Applying this formula yields average shadow prices of time that are 61%, 48%, 59%, 56%, and 60% of the average wage rates in Canada, France, Italy, the United Kingdom, and the United States, respectively. These results show that, when the well-being experienced during a given activity is accounted for, the opportunity cost of non-market time is not the wage rate but, on average, 57% of it (similar to the structural estimation in Gardes (2018)), which is however still higher than the shadow price computed under the replacement cost method.

5.2. Daily value of activities

We now derive the daily value of non-market activities relative to the value of paid work by multiplying the value of a unit of time spent on a given activity relative to the value of a unit of time spent on paid work (Table 5.1) by the amount of time allocated to that activity in a day (Table 4.4), as shown in Table 5.3.[11] The daily value of a number of activities is small, despite the shadow price of time spent on those activities being relatively high: this is the case, for instance, for job search, adult care, and other unpaid work. In Canada, the United Kingdom, and the United States, the daily value of paid work is by far the greatest. However, the daily value of routine housework in France and Italy exceeds that of paid work by 8% and 22%, respectively, which suggests that if routine housework was considered in national accounts, its contribution to the GDP would exceed that of labour.[12]

The daily value of the major division *unpaid work* ranges from 63% to 169% of the daily value of paid work. While the unit value of time spent on unpaid work is not particularly high in France and Italy (see Table 5.1), compared to individuals in other countries, the French and Italians spend on average longer hours in routine housework (which is the activity with the highest unit value within the unpaid work division), and fewer hours on paid work (see Table 4.4). In other words, rather than working on the labour market and substituting the outputs of unpaid work with market goods, the French and Italians spend fewer hours on paid jobs and produce a larger amount of output through domestic work. For instance, each day Americans spend on average 34 minutes cooking, compared to an average of 67 minutes for Italians. Assuming that the cooking productivity in both countries is similar, Americans either buy more pre-prepared food on the market or they cook simpler dishes than Italians. Therefore, the average income in France and Italy would not be sufficient to fully externalise the production of unpaid work, not necessarily because the monetary value of paid work is low in absolute terms, but rather because it is low compared to the value of their unpaid work production.

The daily value of *leisure* is also quite high in Italy and the USA (90% of the daily value of paid work), followed the United Kingdom (75%), Canada (59%) and France (44%). In all of the 5 countries, the daily value of watching TV or listening to the radio is at least 17% of the daily value of paid work (around 55% in the United States). Other activities with a relative daily value of at least 10% are those related to personal care, travel to/from work (16%), time in school or classes (13%), research/homework (12%), and shopping (13%). Although the value of a unit of time allocated to leisure activities is relatively low (see Table 5.1), the daily value of individuals' leisure 'production' is remarkably high because of the amount of time allocated to these activities (Table 4.4); hence, the importance of valuing and accounting for leisure.

[11] In each national dataset, the daily value of paid work has been normalised to one.

[12] The contribution of non-market activities to GDP will be further explored later in this section.

Table 5.3. Daily value of non-market activities relative to paid work

	USA 2013	Canada 2015/2016	France 2009/2010	Italy 2013/2014	UK 2014/2015
Paid work or study	**1.217**	**1.313**	**1.709**	**1.497**	**1.412**
- paid work (all jobs)	1.000	1.000	1.000	1.000	1.000
- travel to and from work/study	0.063	0.120	0.193	0.190	0.224
- time in school or classes	0.055	0.080	0.317	0.110	0.076
- research/homework	0.071	0.103	0.172	0.172	0.098
- job search	0.027	0.010	0.027	0.025	0.015
Unpaid work	**0.630**	**0.764**	**1.310**	**1.687**	**1.127**
- routine housework	0.383	0.515	1.077	1.219	0.681
- shopping	0.081	0.084	0.127	0.176	0.175
- child care	0.036	0.073	0.052	0.082	0.063
- adult care	0.004	0.009	0.004	0.018	0.061
- care for non-household members	0.006	0.023	0.008	0.044	0.025
- volunteering	0.018	0.005	..	0.014	0.005
- travel related to household activities	0.081	0.051	0.027	0.134	0.114
- other unpaid	0.021	0.004	0.016	0.001	0.005
Personal care	**0.501**	**0.371**	**0.935**	**0.826**	**0.467**
- eating & drinking	0.144	0.114	0.217	0.310	0.161
- personal, household, and medical services + travel related to personal care	0.357	0.257	0.718	0.516	0.306
Leisure	**0.903**	**0.592**	**0.443**	**0.900**	**0.751**
- sports	0.038	0.012	0.012	0.066	0.034
- participating / attending events	0.013	0.007	0.030	0.006	0.007
- visiting or entertaining friends	0.099	0.092	0.070	0.152	0.088
- TV or radio at home	0.550	0.275	0.178	0.312	0.309
- Other leisure activities	0.203	0.206	0.154	0.363	0.312
Other	**0.103**	**0.200**	**0.042**	**0.059**	**0.142**
- religious / spiritual activities and civic obligations	0.018	0.009	0.011	0.020	0.008
- other (no categories)	0.086	0.191	0.031	0.039	0.134

Note: Information on time spent on formal volunteer work is not available in the French dataset.

Table 5.4 provides, for a given day, the value of each daily activity, as a share of the total value produced by the representative agent in that day. In Canada, France, the United Kingdom, and the United States, paid work/study represents between 36.2% and 40.5% of the total value produced in a day; while this value is lower, at 30.1%, in Italy. The contribution of unpaid work ranges from 18.8% of the total value produced in a day in the United States to 34% of that value in Italy (in the 3 other countries, this share is around 27%). The contribution of the value of leisure stands at around 18.6% in Canada, Italy and the United Kingdom while it reaches 26.9% in the United States. In France, the contribution of the value of leisure is as low as 10%, although the value of personal care (excluding sleep) accounts for almost 21% of the total value produced in a day, the highest share among the 5 selected countries. Overall, when only paid work is valued and accounted for, 69.1%, 70.2%, 74.4%, 77.5%, and 79.9% of the value of the daily activities is omitted in Canada, the United States, the United Kingdom, France, and Italy, respectively.

Table 5.4. Share of the value of daily activities to the total value of daily production

	USA 2013	Canada 2015/2016	France 2009/2010	Italy 2013/2014	UK 2014/2015
Paid work or study	**36.3%**	**40.5%**	**38.5%**	**30.1%**	**36.2%**
- paid work (all jobs)	29.8%	30.9%	22.5%	20.1%	25.6%
- travel to and from work/study	1.9%	3.7%	4.3%	3.8%	5.7%
- time in school or classes	1.6%	2.5%	7.1%	2.2%	1.9%
- research/homework	2.1%	3.2%	3.9%	3.5%	2.5%
- job search	0.8%	0.3%	0.6%	0.5%	0.4%
Unpaid work	**18.8%**	**23.6%**	**29.5%**	**34.0%**	**28.9%**
- routine housework	11.4%	15.9%	24.3%	24.5%	17.5%
- shopping	2.4%	2.6%	2.9%	3.5%	4.5%
- child care	1.1%	2.3%	1.2%	1.6%	1.6%
- adult care	0.1%	0.3%	0.1%	0.4%	1.6%
- care for non-household members	0.2%	0.7%	0.2%	0.9%	0.6%
- volunteering	0.5%	0.2%	..	0.3%	0.1%
- travel related to household activities	2.4%	1.6%	0.6%	2.7%	2.9%
- other unpaid	0.6%	0.1%	0.4%	0.0%	0.1%
Personal care	**14.9%**	**11.4%**	**21.1%**	**16.6%**	**12.0%**
- eating & drinking	4.3%	3.5%	4.9%	6.2%	4.1%
- personal, household, and medical services + travel related to personal care	10.6%	7.9%	16.2%	10.4%	7.8%
Leisure	**26.9%**	**18.3%**	**10.0%**	**18.1%**	**19.3%**
- sports	1.0%	0.4%	0.3%	1.3%	0.9%
- participating / attending events	0.3%	0.2%	0.7%	0.1%	0.2%
- visiting or entertaining friends	2.6%	2.8%	1.6%	3.1%	2.3%
- TV or radio at home	14.5%	8.5%	4.0%	6.3%	7.9%
- Other leisure activities	5.4%	6.3%	3.5%	7.3%	8.0%
Other	**3.1%**	**6.2%**	**0.9%**	**1.2%**	**3.6%**
- religious / spiritual activities and civic obligations	0.5%	0.3%	0.2%	0.4%	0.2%
- other (no categories)	2.6%	5.9%	0.7%	0.8%	3.4%

Note: Information on time spent on formal volunteer work is not available in the French dataset.

5.3. Extended GDP

We now consider how much GDP would vary if we were to include the monetary value of non-market activities. The monetary value of a given activity is derived by multiplying the relative value of a unit of time spent on that activity (Table 5.3) by the average post-tax hourly wage rate, which measures the monetary value of a unit of time spent on paid work. We then multiply the resulting number by the amount of daily time allocated to that activity (expressed in hours for consistency with the hourly wage rate), by 365 (to obtain the annual value of that activity), and by the size of the population (to obtain the annual value of the activity produced within the country). Therefore, the contribution of the *k-th activity* to the GDP of country *l*, s_{kl}, writes:

$$s_{kl} = \frac{\left(\frac{\text{U index}_{kl}}{\text{U index}_{wl}}\right) * W_l * \left(\frac{t_{kl}}{60}\right) * 365 * \text{population}_l}{\text{GDP}_l} \qquad (11)$$

Table 5.5 shows that, if all non-market activities were valued with the well-being valuation method developed in this paper, their monetary value would account for a large share of GDP – ranging from 95% of GDP in Canada to 135% in the United Kingdom.

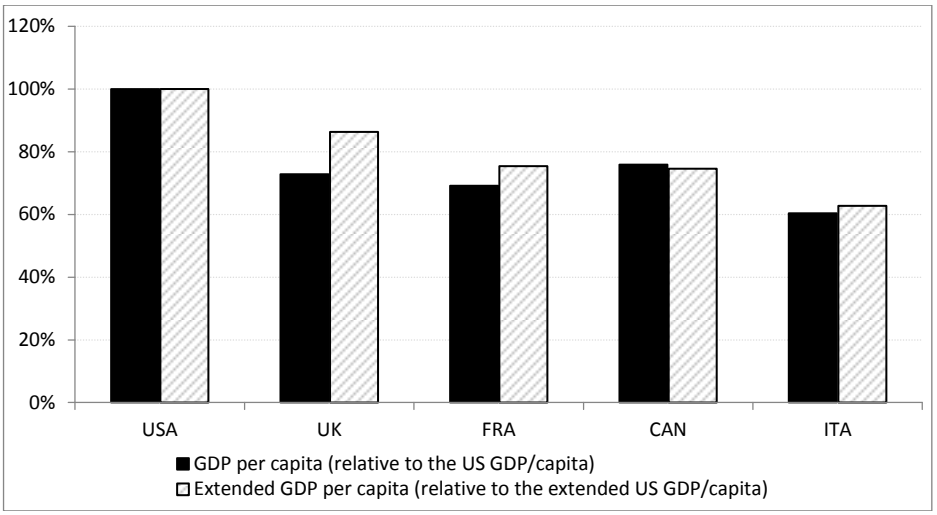
Table 5.5. Monetary value of non-market activities, as a share of GDP

	USA 2010	Canada 2015/2016	France 2009/2010	Italy 2013/2014	UK 2014/2015
Unpaid work	**26.3%**	**32.4%**	**44.3%**	**41.0%**	**52.6%**
- routine housework	16.0%	21.8%	36.4%	39.1%	31.8%
- shopping	3.4%	3.6%	4.3%	5.2%	8.1%
- child care	1.5%	3.1%	1.8%	1.8%	2.9%
- adult care	0.2%	0.4%	0.1%	0.7%	2.8%
- care for non-household members	0.2%	1.0%	0.3%	1.5%	1.2%
- volunteering	0.7%	0.2%	..	0.4%	0.2%
- travel related to household activities	3.4%	2.2%	0.9%	3.9%	5.3%
- other unpaid	0.9%	0.2%	0.5%	0.0%	0.2%
Personal care	**20.9%**	**15.7%**	**31.6%**	**29.1%**	**21.8%**
- eating & drinking	6.0%	4.8%	7.3%	9.2%	7.5%
- personal, household, and medical services + travel related to personal care	14.9%	10.9%	24.2%	15.4%	14.3%
Leisure	**37.7%**	**25.1%**	**15.0%**	**22.7%**	**35.0%**
- sports	1.6%	0.5%	0.4%	1.9%	1.6%
- participating / attending events	0.5%	0.3%	1.0%	0.1%	0.3%
- visiting or entertaining friends	4.1%	3.9%	2.4%	4.4%	4.1%
- TV or radio at home	23.0%	11.7%	6.0%	10.7%	14.4%
- Other leisure activities	8.5%	8.7%	5.2%	11.0%	14.6%
Other	**4.3%**	**8.5%**	**1.4%**	**2.1%**	**6.6%**
- religious/spiritual activities and civic obligations	0.7%	0.4%	0.4%	0.8%	0.4%
- other (no categories)	3.6%	8.1%	1.0%	1.2%	6.3%
Total monetary value of non-market activities, as a share of GDP	**98.3%**	**94.9%**	**116.2%**	**105.9%**	**135.2%**

Note: Information on time spent on formal volunteer work is not available in the French dataset. The total monetary value of non-market activities includes also the monetary value of: travel to work/study, time in school or classes, research or homework, and job search (not shown in Table 5.5).

How would the GDP ranking by country vary if non-market activities were attributed a monetary value and included in GDP measures? To answer this question we compare the effect of valuing non-market activities on GDP per capita (to account for differences in the size of national economies). Figure 5.2 shows that the gap in GDP per capita between the United States and the other surveyed countries decreases when non-market activities are accounted, thus suggesting that the lower GDP per-capita levels for France, Italy, and the United Kingdom relative to that of the United States are partly due to the exclusion from official economic measures of the non-market sector, which is relatively smaller in the United States than elsewhere.

Figure 5.2. Extended GDP per capita, relative to the extended GDP per capita of the US



Note: For each country, both GDP per capita and extended GDP per capita values are expressed as a share of the corresponding US value. Countries are ranked in descending order of the extended GDP per capita.

Getting back to the monetary value of the various non-market activities, that of *leisure* represents 38% of GDP in the United States, 35% in the United Kingdom, 25% in Canada, 23% in Italy, and 15% in France. The share of leisure is low in France because of both the low unit value of time and the small amount of time allocated to this activity. However, the value of *personal care* as a share of GDP is higher in France (32%) than elsewhere, where it ranges between 16% and 29% of GDP.

If *unpaid work* was attributed a monetary value according to the well-being valuation method and included in national accounts, GDP would increase by 26% in the United States and by more than 50% in the United Kingdom. This increase would mainly be driven by the value of routine housework, which is at its highest in Italy (39.1% of GDP). As shown in Table 5.6, our findings fall in between the results obtained by van deVen et al. (2018), who use both the opportunity and replacement cost methods. Since both our and van de Ven et al.'s studies make use of the same time-use data and wage rates, we can expect differences in the monetary value of unpaid work to be driven exclusively by the different valuing approaches used.

Table 5.6. The monetary value of unpaid work as a share of GDP based on different methods

	Canada	France	Italy	United Kingdom	United States
Well-being approach	32%	44%	42%	53%	26%
Opportunity cost (van de Ven et al., 2018)	41%	52%	53%	60%	42%
Replacement cost (van de Ven et al., 2018)	12%	20%	24%	19%	18%

The magnitude of the differences between estimates based on the opportunity and replacement cost methods –which ranges between 41 percentage points for the United Kingdom and 24 percentage points for the United States – may be partly explained by the fact that valuing a unit of time by the forego wage rate is likely to lead to an overestimation of the shadow price of time (one would have to assume, *inter alia*, that paid work does not generate any disutility (e.g. fatigue), although our results indicate that paid work is one of the most unpleasant activity). On the other hand, valuing a unit of time by the average wage rate of the worker hired to perform unpaid work (which is close to the minimum wage rate) is likely to underestimate the shadow price of time.

6. Conclusion

In this paper we developed a new method to value non-market activities by taking advantage of questions on experienced well-being available in a number of time-use surveys, and applied it to selected OECD countries.

We began by computing a summary measure of the well-being experienced while performing a given activity. Unsurprisingly, on average, paid work and commuting are among the top 5 most unpleasant activities for which individuals spend on average at least 10 minutes per day; while sports, visiting friends, and eating and drinking are among the top 5 most pleasant.

We then estimated the shadow price of time for a given activity, by making use of information on wage rates as well as the ratio of the well-being experience in that activity to that of paid work. Our results highlight a large variation in the shadow price of time for different activities. For instance, in the United States, the average value of an hour allocated to care for non-household members is 22% of the wage rate; while the average value of an hour spent on job search is almost twice as high as the wage rate. According to our estimates, the average shadow price of time is between 47% and 61% of the wage rate, which is consistent with recent structural estimates of the average shadow price of time (e.g., Gardes, 2018).

In a third step we combined the results on the shadow price of time with information on time allocated to daily activities, in order to estimate the monetary value of non-market activities. We obtain, for instance, that the value of unpaid work (e.g., routine housework, shopping, and care for others) is 76%, and 63% of the value of paid work in Canada and the United States, respectively.[13] For France, Italy, and the United Kingdom, our results suggest that the value of unpaid work is larger than value of paid work.

Finally, using the average wage rates, we show by how much GDP would increase if non-market activities were valued and accounted for in national accounts. According to our estimates, the value of unpaid work ranges from the 25% of GDP in the United States to 49% in Italy; while the share of the value of leisure to GDP ranges from 13% in France to 33% in the UK. These results fall in between the results obtained by van de Ven et al. (2018), who use both the opportunity and replacement cost methods.

The well-being valuation approach presented in this paper makes a valuable contribution to the valuation of non-market activities, in that it allows computing the shadow price of time by activity, even for those activities for which no market alternatives exist. However, the proposed approach also suffers from a number of

[13] Using data from 1973, Gronau (1980) estimated that home production exceeded 60% of the household monetary income in the United States.

limitations, in particular regarding the information on experienced well-being available in time-use surveys. The lack of harmonised questions on emotional experience during a given activity hampers the cross-country comparability of our results: although they are only moderately affected by the hypothesis underlying the construction of an index of experienced well-being, this issue requires further investigation. Moreover, the analysis could be improved by considering the contribution of different population groups (e.g. women vs men) to the value of non-market activities.

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