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MULTI-DIMENSIONAL LIVING STANDARDS: A WELFARE MEASURE BASED ON PREFERENCES

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Romina Boarini, Statistics Directorate, +(33-1) 45 24 92 91; Romina.BOARINI@oecd.org - Fabrice Murtin, Statistics Directorate, +(33-1) 45 24 76 08; Fabrice.MURTIN@oecd.org

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A WELFARE MEASURE BASED ON PREFERENCES

Romina Boarini, Fabrice Murtin and Paul Schreyer, OECD Statistics Directorate

Marc Fleurbaey, Princeton University

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ABSTRACT / RÉSUMÉ

We compute a distribution-adjusted welfare measure that aggregates outcomes in three dimensions of well-being, namely income, employment and longevity. Aggregation weights reflect preferences of people on these dimensions. The welfare measure is calculated for 26 OECD countries and selected emerging economies, and covers about three decades. Relying on a single theoretical model of a hypothetical representative agent, we combine life satisfaction regressions to capture the full welfare losses of unemployment with a calibration approach to capture the value of longevity. We test for robustness of results over a series of datasets and specifications and find that the resulting estimated shadow prices of (one percentage point of) unemployment and one year of longevity average 2% and 6% of income respectively. While we assume an identical utility function for all individuals, shadow prices of unemployment and longevity vary both across countries and within countries across income groups. We find that economic growth differs significantly from the growth of our welfare measure. The latter grew faster than GDP thanks to the gains that countries experienced on longevity, but was also more volatile due to changes in unemployment. Rising income inequality exerts a negative effect on our welfare measure. Gains in longevity have almost the same impact on welfare as income growth, while the long-term impact of employment was smaller.

Keywords: welfare, well-being, living standards, shadow prices, value of statistical life, measurement, indicator

JEL Classification: I31, I32, J17, J18, I38, I18

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Nous calculons une mesure de niveau de vie ajustée pour le degré d'inégalité et agrégeant le revenu, l'emploi et l'espérance de vie. Les poids associés à ces dimensions reflètent les préférences des populations. Cette mesure de niveau de vie qui couvre trois décennies est calculée pour 26 pays de l'OCDE et une sélection de pays émergeants. En nous basant sur un modèle théorique unique d'un agent représentatif hypothétique, nous combinons des régressions de satisfaction envers la vie pour capter le coût social du chômage avec une approche de calibration pour rendre compte de la valeur monétaire de la longévité. Nous testons la robustesse des résultats à l'aide d'un ensemble de bases de données et de spécifications différentes, et nous trouvons que les prix fictifs estimés d'un point de pourcentage de chômage et d'une année d'espérance de vie sont en moyenne respectivement égaux à 2% et 6% du revenu des ménages. Alors qu'une fonction d'utilité unique est utilisée pour tous les individus, les prix fictifs du chômage et de l'espérance de vie varient à la fois entre pays et entre groupes de revenu à l'intérieur des pays. Nous montrons que la croissance économique diffère significativement de la croissance de notre mesure de niveau de vie. Celle-ci a crû plus vite que le PIB en vertu des gains d'espérance de vie, mais a été également plus volatile à cause des variations du taux de chômage. L'augmentation des inégalités de revenu a exercé un effet négatif sur notre mesure de niveau de vie. Les gains d'espérance de vie ont eu pratiquement le même impact sur le niveau de vie que la croissance économique, alors que l'impact de long-terme de l'emploi a été plus faible.

Mots-clés : bien-être, niveau de vie, prix fictif, valeur d'une vie statistique, mesure, indicateur

Classification JEL : I31, I32, J17, J18, I38, I18

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1.   Introduction

1.   Stiglitz, Sen and Fitoussi (2009) make a strong case to complement well-established measures of economic well-being such as income or consumption with dimensions that capture the quality of life, for example health, education or social relations. This can be achieved by elaborating dashboards of indicators as in OECD (2011, 2013, 2015): this approach has the obvious advantage of covering a broad number of dimensions but also the drawback that no overall comparison can be undertaken across countries or in time absent a single welfare metric. Nordhaus and Tobin (1973) were first to devise a monetary summary measure of well-being that incorporated some aspects of quality of life. Today, there is a myriad of composite indexes, most prominently represented by the Human Development Index. While these indexes provide a single overall metric, they typically suffer from aggregation weights that are chosen ad hoc and do not allow quantifying trade-offs between dimensions in a credible way. Similar, most of these indexes fail to take into account distributional elements, looking at average achievements only.

2.   While there is a long-standing literature on social welfare that addresses the aggregation of income or consumption across individuals (Atkinson, 1970, Jorgenson and Slesnick, 1983), recent theoretical and empirical advances in welfare economics have also provided foundations for aggregating across various dimensions of outcomes and so create a single-valued welfare metric. Leading examples include Fleurbaey and Gaulier (2009), Jones and Klenow (2015), Fleurbaey and Blanchet (2013), Schokkaert and Decancq (2016) and Boarini et al. (2015). The contributions to the literature differ somewhat in their theoretical foundations and in their empirical strategy.

3.   This paper relies on an equivalent income approach to address the issue of aggregation across several well-being outcomes, an approach that has the virtue of providing consistent welfare evaluations even when individuals do not hold the same preferences over the bundle of items being evaluated.

4.   We estimate people's preferences as follows. We first derive a monetary measure of the marginal welfare loss of unemployment by estimating the relative elasticity of unemployment to income in a life satisfaction regression. This econometric approach permits capturing the effects of unemployment above and beyond the loss of income. These effects relate to both the impact of unemployment on the unemployed and the impact of the unemployment rate on everyone, as an 'environmental' variable. We then calibrate a life-time utility model where utility is defined over two quality of life dimensions (longevity and jobs) as well as consumption to derive the value of a statistical life.

5.   The paper contributes to the literature on welfare measurement in several ways:

- First, it provides a unified theoretical framework for evaluating welfare losses due to unemployment and reduced longevity that is consistent with standard decision theory (i.e. the maximization of an instantaneous utility function over the overall life time) and derives from this framework a distribution-adjusted welfare measure that we label multi-dimensional living standards (MDLS). As other theoretical approaches in the field (e.g. Becker et al., 2005), the framework assumes an identical utility function for all individuals in the society and all countries considered, although the valuation of non-monetary goods such as longevity and (un)employment will differ both between and within countries (across income groups). The adjustment for changes in income distribution introduces a normative element into the computation and our MDLS depends on the degree of aversion to inequality chosen for a social welfare function in the tradition of Atkinson (1970).

- Second, it carries out a metadata analysis of life satisfaction regressions with the objective of deriving a distribution of shadow prices for unemployment and longevity that is sufficiently robust and coherent with other evaluation methods in the literature. This analysis comprises various international surveys with life satisfaction questions, spans over several decades and covers many OECD countries. We use reliability-weighted distributions of shadow prices that allow us to determine whether there are robust central moments that hold across data sets with different variables, different levels of aggregation, time periods and country coverage.

- Third, it calculates MDLS for 21 countries over several decades showing how this welfare measure has evolved over time, and how it compares across countries. Results distinguish between different degrees of aversion to inequality and measure the contributions of income, jobs and longevity.

6.   The main findings are as follows.

- Life satisfaction regressions prove to be reliable only for estimating the shadow prices of unemployment. Expressed in absolute terms (constant 2005 international dollars), the shadow price of unemployment is country-specific as it is also a function of countries unemployment rates. The shadow price of unemployment expressed as a percentage of household income varies between 1.8% and 1.5%, and is on average equal to 1.7% across countries in 2013.

- Life satisfaction regressions do not produce stable and theoretically correct results for the shadow price of longevity. This is in line with earlier findings in the literature (Deaton, 2008) and supports our mixed empirical approach: unlike the shadow price for unemployment, we derive the shadow price for longevity by calibrating a CRRA utility function that turns out to be about 6% of income per extra year of life expectancy on average. The shadow price in percentage terms increases with income and decreases with longevity.

- There is a significant degree of uncertainty on the 'true' value of longevity (as in Viscusi and Aldy, 2003) and unemployment shadow prices as reflected by the width of confidence intervals. Regarding longevity, the range of shadow prices varies between 3.6% and 8.5% of income, versus 1.0% and 3.4% for unemployment and 1.4% and 4.6% for employment.

- After using the average shadow prices for unemployment and longevity to compute MDLS, and comparing their levels across countries, we find a high correlation with GDP per capita. However, there is also sizable variance in this correlation, implying for instance a different country ranking than the one based on GDP per capita.

- Over time, (1995 to 2013), MDLS of median households have grown much faster than GDP, mainly because of an increase in life expectancy. Different subpopulation groups also experienced uneven welfare growth, with living standards of the population at the bottom 10% of the income scale growing at a slower pace than those of the population around median income, because of slower income growth of the worst-off.

- When employment-related effects are measured with the employment rate, these contributed positively to a long-term rise of MDLS. When employment-related effects are captured through the unemployment rate, average effects are small over the whole period but short-run effects can be significant, reflecting the cyclical nature of this variable.

7.   The paper is organized as follows. The first section describes the theoretical framework, including the identification strategy and the derivation of shadow prices of unemployment and longevity.

The second section presents the methodology used to estimate the shadow prices of unemployment, providing details on the life satisfaction regressions and their metadata analysis. The third section focuses on the shadow prices of longevity, discussing how this has been calculated building on well-established approaches in the literature that are then adapted to our theoretical framework. The following section discusses the MDLS for median and bottom 10% households, looking at the levels and the evolution of our welfare metric. The final section concludes.

2. *Theoretical framework*

2.1. *Defining equivalent income and multi-dimensional living standards*

8.   The approach adopted here borrows the concept of equivalent income (or money-metric utility) that was introduced by Samuelson (1974) and later extended to non-market dimensions by Willig (1981) and Hammond (1994). Deaton and Muellbauer (1980) used the approach as a convenient measure of people's access to resources. More recently, the equivalent income approach has been given a new foundation through the theory of fair social orderings (Fleurbaey and Maniquet 2011, Fleurbaey and Blanchet 2013).

9.   Consider an individual i with disposable lifetime income Y_i who faces prices p_i for market consumption goods c_i and enjoys non-market quality of life q_i, all represented by an indirect utility function $V(Y_i, p_i, q_i)$. The equivalent income is computed as the level of income Y_i^* that would give this person the same indirect utility if she faced reference prices p^* and enjoyed a reference quality of life q^*:

$$V(Y_i, p_i, q_i) = V(Y_i^*, p^*, q^*).$$

10.   It is useful to recall that the dual to the indirect utility function $V(Y_i, p_i, q_i)$ is an expenditure function $m(u, p_i, q_i) = min\{p_i c_i | u(c_i, q_i) \geq u\}$, and equivalent income Y_i^* equals $m(u(c_i, q_i), p^*, q^*)$. Consider the Konüs (1924) cost-of-living index for market consumption, conditional on a particular level of quality of life q_i: $\mathcal{P}_i \equiv \frac{m(u, p_i, q_i)}{m(u, p^*, q_i)}$. By deflating individual i's nominal income by $\mathcal{P}_i$, we obtain $\frac{Y_i}{\mathcal{P}_i} = m(u(c_i, q_i), p^*, q_i)$, a measure of real income conditioned on the environmental variables q_i. In what follows, all income variables will be expressed in real terms, deflated by $\mathcal{P}_i$. We approximate $\mathcal{P}_i$ by national accounts private consumption deflators and purchasing power parities so that all monetary variables are expressed in 2005 international dollars, our reference price vector p^{*}[1].

11.   We can now rewrite the definition of the equivalent income as[2]

$$V\left(\frac{Y_i}{\mathcal{P}_i}, q_i\right) = V(Y_i^*, q^*) = V\left(\frac{Y_i}{\mathcal{P}_i} - \delta_i^{\,q}, q^*\right),$$

where $\delta_i^{\,q}$ is the real income compensating individual i for the change in quality of life from q_i to q^*: $\delta_i^{\,q} = m(u(c_i, q_i), p^*, q_i) - m(u(c_i, q_i), p^*, q^*)$. Equivalent income $Y_i^* = \frac{Y_i}{\mathcal{P}_i} - \delta_i^{\,q}$ thus corresponds to real disposable lifetime income with a quality of life adjustment. When all individuals' incomes are made

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[1]   In a market context, and for welfare comparisons in time, Jorgenson and Slesnick (1983, 2014) define a welfare quantity index as $\frac{m(u^1, p^0)}{m(u^0, p^0)}$ where u^1 and u^0 are utility levels in the comparison and in base period, respectively. The corresponding quantity index implied by the current approach is $\frac{m(u^1, p^*)}{m(u^0, p^*)}$, similar in spirit.

[2]   With an abuse of notation, we keep V as the label of the indirect utility function with deflated income.

comparable, in that they reflect the same reference quality of life q* and the same set of prices p*, these equivalent incomes lend themselves to welfare comparisons between individuals.

12.	One advantage of the equivalent income approach is its capacity to preserve consistency in welfare evaluations even if preferences among individuals are heterogeneous. Consistency is ensured if there is a single vector of reference outcomes q^* against which the outcomes for individual i, q_i, are compared. Similarly, real income is valued in terms of a single vector of reference prices[3]. Consistency in preference orderings is an advantage over measures based on compensating variations such as Becker et al. (2005), for which the references are moving or Jones and Klenow (2015), where the main measure (equivalent variation) takes the US values as the fixed reference, whereas the second measure (compensating variation) takes each country's values as reference. Jorgenson and Slesnick (2014), in their market-based welfare comparisons for the United States, use a chain welfare index where the reference price p^0 evolves (although every binary comparison is for a given set of prices, in line with standard practice in national accounts and price indices). Moving references create the risk of cycles and inconsistent chains, even though they have the advantage to underpin outcomes (of quality of life) or quantities (of market consumption) that are closer to the geographical location or time period of the shadow prices or market prices that the individual faces. For the purpose at hand – valuation of quality-of-life components - we have a preference for single reference vectors p^* and q^*.

13.	In practice, two dimensions of quality of life will be selected, namely longevity and job prospects. The proxies used for job prospects are alternatively the unemployment rate or the employment-population ratio. For the sake of simplicity and without loss of generality, the theoretical framework is derived with the unemployment rate only, but the empirical section considers both unemployment and employment rates.

14.	Regarding the choice of reference values for the components of q^*, a "natural" reference value is the best possible outcome for longevity as well as for unemployment. The status of "not being unemployed" is thus our reference for the latter. For the former, we consider the maximum value of longevity in the countries of our sample[4].

15.	Once equivalent incomes are calculated at the individual level, society's multi-dimensional living standards (MDLS) can be defined by inserting equivalent incomes into a social welfare function. Our choice falls on Atkinson's (1970) formulation, a generalised mean over individual welfare[5] with a coefficient of inequality aversion τ:

$$MDLS = \left(\sum_i (Y_i^*)^{1-\tau}\right)^{\frac{1}{1-\tau}} = \left(\frac{1}{n}\sum_i Y_i^*\right)(1 - I), \quad (1)$$

where $I \equiv \left(\sum_i (Y_i^*)^{1-\tau}\right)^{\frac{1}{1-\tau}} / \left(\sum_i Y_i^*/n\right)$ is the Atkinson-Kolm-Sen index of inequalities in equivalent incomes. We do not yet have enough individual-level data to compute inequalities in equivalent incomes

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[3]	For a more extensive discussion of this point see Fleurbaey and Blanchet (2013) and Fleurbaey (2015).

[4]	A detailed discussion of the choice of references q^*, p^* can be found in Fleurbaey and Blanchet (2013, appendix).

[5]	For a discussion of Atkinson's measure see Diewert (1985), Deaton and Muellbauer (1980) and Blackorby and Donaldson (1978). Another well-established social welfare specification is Jorgenson and Slesnick (1983, 2014). Jorgenson and Schreyer (2015) compare the Atkinson formula with the Jorgenson-Slesnick formula in a national accounts context. They also discuss a number of practical issues such as the transition from survey-based to national accounts data or the use of equivalence scales, issues that are not further addressed in the paper at hand.

and instead take the index of inequalities in disposable incomes to compute *I*. This remains a proxy, however. A first evaluation of the impact of non-income dimensions on the inequality in equivalent incomes (Diaz and Murtin 2016a, 2016b) shows that effects can be sizable, at least for individual countries and work is underway to extend this approach to our full set of countries.

2.2. Specification of instantaneous utility

16. The next task is selecting a specific form for the utility function at hand. One of the innovations in the present paper is that we treat the prevalent, economy-wide risk of unemployment as an "environmental" variable that generates disutility for everybody. Social adverse effects of unemployment such as the loss of social connections and purpose in life have been found to be detrimental to well-being in empirical studies (Blanchflower and Oswald 2004). In addition to direct status effects for the unemployed, there are negative externalities such as increased insecurity and lower social cohesion for others. Evidently, unemployment also has a direct negative effect on income that can be taken into account (as this paper does) when considering an average disposable income that incorporates the income shock arising from higher unemployment. Typically, economic studies have investigated the welfare impact of unemployment only via monetary effects (Krusell and Smith 1999), and often failed to find any significant impact of unemployment on discounted utility due to the capacity of people to save and cushion income shocks. We also note that our treatment of employment and unemployment is different from the standard approach where time that is allocated to work affects utility negatively.

17. In terms of the functional form, we use a Constant Relative Risk aversion (CRRA) utility function that depends positively on current consumption and negatively on the unemployment rate. The CRRA is common in the literature. Murphy and Topel (2005), Hall and Jones (2007), Jones and Klenow (2015), Cordoba and Ripoll (2013) and Murtin et al. (2015) calibrate the rate of risk aversion[6] to 1.25, while Becker et al. (2005) and Gaulier and Fleurbaey (2009) retain a value of 0.8. Following De Serres and Murtin (2016) and empirical evidence provided by Layard et al. (2008)[7], we select a logarithmic utility function, defined over the current consumption bundle and the aggregate unemployment rate U, without intercept and an inter-temporal elasticity of substitution equal to unity:

$$u(c_i, U) = \alpha \log\left(\frac{c_i}{\omega}\right) + \beta U; \ \alpha > 0, \beta < 0 \qquad (2)$$

where ω parameterizes the consumption level just above survival for which instantaneous utility is equal to zero.[8]

2.3. Specification of indirect utility

18. To assess discounted lifetime income and utility, we place instantaneous utility (2) into an inter-temporal context, using the same valuation framework as in Becker et al. (2005) or Jones and Klenow (2015). As stressed by Rosen (1988), the willingness-to-pay for longer life is determined by the expected

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[6] Assuming that utility is separable between periods, the rate of risk aversion equals the intertemporal elasticity of substitution.

[7] Deriving conclusions on cardinal utility from subjective well-being surveys is obviously controversial, since respondents may not pick satisfaction levels that reflect their risk aversion or their elasticity of intertemporal substitution. But the fact that the logarithmic form appears salient in these data provides a useful anchor.

[8] This zero-utility level of consumption is given by $c_0 = w.\exp(-\beta.U/\alpha)$.

discounted present value of lifetime utility. Let Y_i and S_π be respectively lifetime income and the survival function that depends on the crude death rate π. The indirect lifetime utility $V(Y_i, \pi, U)$ derived from consumption $c_i(t)$ and affected by the unemployment rate $U(t)$ is

$$V(Y_i, \pi, U) = max \int e^{-\rho t} S_\pi(t) u\big(c_i(t), U(t)\big) dt$$

subject to $Y_i = \int e^{-rt} S_\pi(t) y_i(t) dt = \int e^{-rt} S_\pi(t) c_i(t) dt$

where ρ is the rate of time preference, r the interest rate and $y_i(t)$ income in period t. The budget constraint stipulates that the lifetime expected discounted value of future consumption equals expected lifetime income, assuming a perfect annuity markets. In line with in Becker et al. (2005), we consider a hypothetical life-cycle individual who receives the same income per capita and faces the same unemployment rate throughout her lifetime, and who is subject throughout life to the survival function of the country at a given date. Under the assumption that the interest rate r equals the actualisation rate ρ, the solution of the maximisation programme specifies that consumption remains constant throughout the life cycle, and that for all t, $c_i(t) = y_i(t) = y_i$, so that indirect utility is simply given by

$$V(y_i, \pi, U) = u(y_i, U)A(\pi)$$

where $A(\pi) = \int e^{-rt} S_\pi(t) dt$ is the value of an annuity discounted by the survival function $S_\pi(t)$. A standard assumption in this context is a constant mortality rate π over the life cycle, that is, $-\frac{S'_\pi(t)}{S_\pi(t)} = \pi$ and $S_\pi(t) = e^{-\pi t}$. This yields a simple expression for life expectancy T – calculated as the integral of the survival function – as $T = 1/\pi$ and for the value of one annuity: $A(\pi) = 1/(r + \pi)$. Indirect utility now reads:

$$V(y_i, T, U) = \frac{u(y_i, U)}{r + \pi(T)} = \frac{u(y_i, U)}{r + 1/T} \qquad (3)$$

19.   A constant mortality rate throughout the life cycle is not realistic from an empirical perspective, but importantly, the latter assumption is innocuous for the valuation of longevity. To see this, consider the 'true' observed distribution of mortality rates by age $-\frac{S'_\pi(t)}{S_\pi(t)} = \pi(t)$. To relate it to the Value of a Statistical Life (see below), it is convenient to consider an average Crude Death Rate equal to the average mortality rate calculated over the stationary distribution of the population where each age group t has a population share $S_\pi(t)/\int_0^\infty S_\pi(t) dt = S_\pi(t)/T$. This yields an average mortality rate equal to $\bar{\pi} = \int_0^\infty \frac{-S'_\pi(t)}{S_\pi(t)} \frac{S_\pi(t)}{T} dt = \frac{1}{T}$, which is the same relationship between mortality and longevity as the one derived above under the simplifying assumption of a constant mortality rate. In other words, the most natural Crude Death Rate to be considered in this simple valuation framework is always equal to the inverse of longevity, irrespective of the distribution of mortality rates by age.

20.   We shall now add a spatial dimension to our set-up when combining equations (2) and (3) so that the indirect utility function of an individual i who lives in a country j with life expectancy T_j and aggregate unemployment rate U_j and who enjoys an annual disposable income $y_{i,j}$ is given by:

$$V\big(y_{i,j}, T_j, U_j\big) = \frac{\alpha log\big(\frac{y_{i,j}}{\omega}\big) + \beta U_j}{r + 1/T} \qquad (4).$$

21.   Indirect utility thus depends on four fundamental parameters $(\alpha, \beta, \omega, r)$, identical across and within countries. Parameters (α, β) determine the value of work or the willingness-to-pay to reduce unemployment, while parameters (ω, r) determine the value of life or the willingness-to-pay for extended life expectancy. Indirect utility (and therefore the willingness to pay) is however country-specific as it depends on the levels of unemployment, income and longevity.

2.4.   Identification strategy

22.   To identify the required parameters we rely on life satisfaction regressions for the unemployment parameters (α, β) and on a calibration approach for the longevity parameter ω that is based on the Value of a Statistical Life (VSL). The value of the discount rate *r* is fixed at 3% as in Becker et al. (2005).

23.   Turning to the unemployment parameters (α, β), we start by taking life satisfaction observations to capture instantaneous utility that is shaped by contemporary effects of income and unemployment, but not by progress in longevity. This assumption is supported by the empirical finding that most respondents to life satisfaction surveys are not forward looking and have a relatively short time horizon in mind as shown by Benjamin et al. (2016). Hence, life satisfaction is deemed to reflect contemporary and large changes in socio-economic conditions rather than long-term transformations with small contemporary changes such as progress in longevity. Building on previous work in this area (Murtin et al., 2015) we nonetheless test whether longevity has a significant and robust effect on life satisfaction and our evidence is mixed at best (see below). Although some specifications yield plausible results, they seem insufficiently robust. This is corroborated by other research, in particular Deaton (2008) who also finds no robust evidence that changes in longevity and in life satisfaction are correlated.

24.   In practice, life satisfaction is assumed to be a noisy linear transformation of individual instantaneous utility. Consider an individual *i* from country *j* at time *t*, her level of life satisfaction $LS_{i,j,t}$ is derived from (2) as:

$$LS_{i,j,t} = \mu.u_{i,j,t} + \tau + \theta_{i,j,t} = \mu.\alpha.log\left(\frac{y_{i,j,t}}{\omega}\right) + \mu.\beta.U_{j,t} + \tau + \theta_{i,j,t}$$

$$= \mu.\alpha.log(y_{i,j,t}) + \mu.\beta.U_{j,t} + \tau - \mu.\alpha.log(\omega) + \theta_{i,j,t} \quad (5)$$

where (μ, τ) are two constant parameters and $\theta_{i,j,t}$ is a combination of individual factors and error-terms influencing life satisfaction with a statistical structure that is laid out in the empirical section below. Importantly, the estimation of equation (5) yields an estimate of the ratio β/α that determines the value of unemployment from the ratio of coefficients $\hat{\mu}\hat{\beta}/\hat{\mu}\hat{\alpha}$. However, equation (5) is not informative on the value of longevity that is captured by coefficient ω.

25.   The vast majority of studies devoted to the subject derive the value of longevity from a measure of the VSL. As explained in De Serres and Murtin (2015) there is a tight connection between the VSL and the notion of compensating income presented in Section 2.1. Consider a population of *N* workers who pay each year the compensating income δ to observe a marginal decrease $d\pi$ in the crude death rate π. Each year, the statistical number of saved life is *-N dπ* and the amount invested for the mortality risk reduction is *N δ*, which corresponds to a VSL

$$\text{VSL} = -\frac{\delta}{d\pi}$$

26.   For marginal changes in the crude death rate π, the compensating income δ also satisfies $V(Y - \delta, \pi + d\pi) = V(Y, \pi)$ with $d\pi < 0$, $\delta > 0$, which yields after a first-order expansion and the use of (2):

$$VSL = -\frac{\delta}{d\pi} = -\frac{\partial V/\partial \pi}{\partial V/\partial y} = -\frac{A'(\pi)}{A(\pi)} \frac{u(y,U)}{u'(y,U)} \qquad (6)$$

27.   After a few algebraic calculations and the use of (2), the closed-form expression for parameter ω is found to be equal to:

$$\omega = y . exp\left(-\frac{VSL}{y}.\left(r + \frac{1}{T}\right) + \frac{\beta}{\alpha}.U\right) \qquad (7)$$

28.   It will soon become clear that the unemployment component $\frac{\beta}{\alpha}.U$ in (7) is negligible from an empirical perspective.

2.5.   Willingness-to-pay to eliminate unemployment and increase longevity

29.   Consider the two benchmarks, $U^*=0$ and T^* the maximum level of longevity observed in the sample. The willingness-to-pay to eliminate unemployment U and simultaneously raise longevity from T to T^* satisfies $V(y_{i,j}, T_j, U_j) = V(y_{i,j} - \delta^{T,U}, T^*, 0)$. With the help of equation (4), the adjustment to income for quality of life components are:

$$\delta^{T,U}(y_{i,j}, T_j, U_j) = y_{i,j} - \omega exp\left[\frac{r + 1/T^*}{r + 1/T_j}.\left(log\left(\frac{y_{i,j}}{\omega}\right) + \frac{\beta}{\alpha}.U_j\right)\right] \qquad (8)$$

30.   The above term is a non-linear function of current income, longevity and unemployment and involves some interactions between those three variables. It can conveniently be decomposed into the contributions of longevity and unemployment as follows. The increase in longevity from T to T^* at the current level of unemployment involves a correction for longevity δ^T implicitly defined by $V(y_{i,j}, T_j, U_j) = V(y_{i,j} - \delta^T, T^*, U_j)$; similarly the elimination of unemployment at the current level of longevity involves the correction δ^U that solves the equation $V(y_{i,j}, T_j, U_j) = V(y_{i,j} - \delta^U, T, 0)$. Then, it is convenient to decompose $\delta^{T,U}$ into the respective contributions of longevity and unemployment as follows:

$$\delta^{T,U} = \frac{\delta^T}{\delta^T + \delta^U}.\delta^{T,U} + \frac{\delta^U}{\delta^T + \delta^U}.\delta^{T,U} \qquad \text{with}$$

$$\delta^T(y_{i,j}, T_j) = y_{i,j} - \omega exp\left[\frac{r + 1/T^*}{r + 1/T_j}.log\left(\frac{y_{i,j}}{\omega}\right)\right] \quad \text{and} \quad \delta^U(y_{i,j}, U_j) = y_{i,j}\left(1 - exp\left(\frac{\beta}{\alpha}.U_j\right)\right) \quad (9)$$

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3.   *The value of work*

31.   This section describes the data used to construct the MDLS index as well as the econometric model used to derive the value of work from subjective well-being regressions. It presents the basic results obtained from analysing a large dataset on life satisfaction, and then examines the robustness of regressions when applying the framework to sub-samples or by including additional control variables. A summary of unemployment and employment shadow prices obtained from around 600 regressions is presented at the end of the section. The objective is to derive a robust and theoretically sound set of shadow prices for longevity and unemployment or employment.

3.1.   *The Data*

32.   An original database gathering various measures of income, longevity, unemployment or employment as well as income distribution (i.e. average income across 10 deciles) has been constructed for 30 OECD countries plus China, Russia and Colombia. Time coverage varies but the final index of MDLS is available from 1974 for the United States and from 1995 for 26 countries. The latest year of the panel with full country coverage is 2013.

33.   Our preferred measure for income is national accounts-based household net disposable income. This is the sum of primary household incomes from various sources (compensation of employees, self-employed income, and property income), minus taxes paid on income and wealth, minus social security contributions paid, plus government transfers received and minus depreciation of household assets (essentially real estate). In some regressions we also use GDP per capita and household consumption per capita as a robustness test over income proxies. All variables are expressed at constant prices and constant PPPs with 2005 as the reference year. Along with the general unemployment rate (number of unemployed as a percentage of the labour force), the long-term unemployment rate (the number of persons who have been unemployed for one year or more as a percentage of the labour force), the employment rate and life expectancy at birth, all variables were extracted from the various sections of the online OECD database (OECD, 2015a). This includes also information from the OECD Income Distribution database (OECD, 2015b) from which we draw information on the distribution of disposable household income. It is of note that the income definition underlying the distributional data differs somewhat from the income definition of the aggregate national accounts data as the distributional information is directly based on household surveys and administrative registers. Survey measures of household income refers to cash income – excluding imputed components such as home production and imputed rents – that is disposable after transfers and taxes. It includes earnings (broken down into those of the household head, of the spouse and of other household members), self-employment income, capital income (rents, dividends and interest), public transfers and household taxes. Incomes are equivalised within the household using the square root of household size as an equivalence scale[9].

34.   Several other measures are used in the regressions: the inflation rate (OECD, 2015a), mean years of higher education (OECD, 2013 based on Morrisson and Murtin, 2013), air pollution as measured by the SOx concentration per m3 (OECD, 2015a) and morbidity measures captured by either healthy life expectancy (Eurostat, 2015) or Disability Adjusted Life Years lost (i.e. DALYS drawn from WHO, 2015).

35.   Data on life satisfaction come from a variety of micro-economic databases including: the Gallup World Poll (2004-2013), the European Social Survey (2002-2013), the European Value Survey (1981-

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[9]   As part of an ongoing work programme at the OECD, distributional data is being developed that is fully consistent with the national accounts. First results have been provided by Fesseau et al. (2013a, 2013b) but information for longer time periods and broader country coverage are needed before this work can be incorporated into the present calculations.

2009), the European Quality of Life Survey (2003-2007), Eurobarometer (1973-2012) and the World Value Survey (1981-2008). Whenever these surveys do not measure life satisfaction with the same scale, life satisfaction observations are rescaled on the 0-10 range (the most common in the data at hand). Table 1 shows values of the main indicators of interest for 2013 while using Gallup for life satisfaction in 2013.

Table 1.   Descriptive statistics - 2013

	Household disposable income	Life expectancy at birth	Unemployment rate *in per cent*	Income ratio of top and bottom quintiles	Life satisfaction (0-10 scale)
	2005 USD PPP				
AUS	24920	82.2	5.8	5.4	7.4
AUT	22178	80.9	5.0	4.4	7.6
BEL	19201	80.3	8.5	4.0	7.3
CAN	23534	82.1	7.2	5.2	7.6
CHE	26075	82.8	4.5	4.4	7.7
CHL	10157	78.9	6.2	13.0	6.7
CHN	4791	75.2	2.8	12.9	5.2
COL	6650	75.2	10.4	21.8	6.3
CZE	11919	78.4	7.1	3.7	6.5
DEU	22363	81.2	5.4	4.4	7.0
DNK	15302	80.3	7.2	3.6	7.6
ESP	15590	82.4	26.2	6.7	6.2
EST	9713	76.6	8.8	5.4	5.2
FIN	17330	80.8	8.4	3.7	7.5
FRA	19939	82.0	10.0	4.7	6.7
GBR	21632	81.0	7.8	5.6	7.0
GRC	12250	80.6	27.5	6.3	4.7
HUN	9153	75.4	10.3	4.5	4.9
IRL	17568	81.2	14.1	4.7	6.8
ITA	17064	82.3	12.4	5.6	6.1
JPN	18590	83.7	4.3	6.2	6.0
KOR	15019	81.6	3.3	5.5	5.9
MEX	9774	74.6	5.2	13.7	7.5
NLD	18395	81.1	6.7	4.1	7.5
NZL	16141	81.8	6.4	5.2	7.4
POL	9952	76.9	10.5	4.8	5.7
PRT	13648	80.4	17.0	5.8	5.2
RUS	10793	70.6	5.5	7.6	5.7
SVK	10935	76.3	14.3	3.9	5.9
SVN	14044	80.3	10.3	3.6	6.1
SWE	18965	81.7	8.2	4.1	7.5
USA	34808	78.9	7.5	8.2	7.2

Note: Data for household income, life expectancy, (un)employment and income distribution are extracted from OECD (2015a, 2015b). Data on life satisfaction is from Gallup World Poll (2013).

3.2.   Econometric framework

36.   A simple econometric framework can be used to obtain the shadow price of the job variable Z (i.e. alternatively the unemployment or the employment-adult population ratio) under the assumption that life satisfaction constitutes a linear but noisy transformation of utility. Equation (5) shows that the life satisfaction $LS_{i,j,t,k}$ for individual i in country j at time t as drawn from survey k can be written as:

$$LS_{i,j,t,k} = \mu\alpha.log(y_{i,j,t}) + \mu.\beta.U_{j,t} + \tau - \mu.\alpha.log(\omega) + \theta_{i,j,t,k}$$

37.　　The above equation is estimated under the following set of assumptions. The vector $\theta_{i,j,t,k}$ comprises country fixed-effects that reflect systemic cross-country cultural (or other time-invariant) differences in the relationship between life satisfaction and individual utility, a period-specific component allowing momentary shifts in the latter relationship, individual characteristics such as age and gender reflecting systemic differences in life satisfaction across population groups enjoying the same level of instantaneous utility, a survey dummy capturing survey-specific measurement errors as well as an error term. Moreover, as individual income is either not observed in some surveys or is affected by large measurement errors in others (e.g. in the Gallup World Poll), we measure it with a national level proxy for average income $y_{j,t}$ (i.e. GDP per capita, household consumption or equivalised household income). In particular, Murtin et al. (2015) show that the use of individual income drawn from the Gallup survey yields a large attenuation bias on the income variable and hence a crude overestimation of shadow prices. Without loss of generality one can assume $\mu = 1$ and the econometric model writes:

$$LS_{i,j,t,k} = a_j + b_t + c_k + \alpha \log y_{j,t} + \beta Z_{j,t} + \gamma X_{i,j,t,k} + \varepsilon_{i,j,t}, \quad (10)$$

where $y_{j,t}$ consists of a measure of national income, $Z_{j,t}$ denotes the job-related variable (i.e. unemployment or the employed share of adult population), $X_{i,j,t,k}$ is a vector of individual characteristics namely gender and age dummies (as for instance in Deaton 2008), a_j denotes country dummies, b_t time dummies and c_k survey dummies.

38.　　In this framework, the estimated share of income that households would be willing to pay to increase the job outcome Z to reference level Z* is given by:

$$\hat{p} \equiv \delta_{j,t} / y_{j,t} = \left[1 - \exp\left(-\frac{\hat{\beta}.\Delta Z}{\hat{\alpha}}\right)\right] \text{ with } \Delta Z = Z^* - Z, \quad (11)$$

39.　　While the coefficients $\hat{\beta}$ and $\hat{\alpha}$ are country-invariant, the unitary shadow price $\hat{p} / \Delta Z$ depends on the level of unemployment and is therefore country-specific.

40.　　A fixed-effects framework also reduces the risk of biased estimates due to unobserved heterogeneity (i.e., omitted time-invariant effects that are correlated to the regressors). Introducing fixed-effects is indeed equivalent to regressing the change in average life satisfaction on the change in explanatory variables. In the sample of countries under study, there appears to be very low correlation (i.e., below 0.25) between changes in log income, longevity and unemployment, and hence little risk of encountering multicollinearity problems.

41.　　The choice of running regressions with the average rather than individual income variable helps correcting for large measurement errors affecting the income variable as measured from surveys, and therefore attenuates the implicit bias in coefficient $\hat{\alpha}$ estimates (which leads to overestimating shadow prices in individual-level regressions as shown in Murtin et al., 2015). Moreover, the available data are repeated cross-section and not longitudinal panels, which rules out the possibility of controlling for individual fixed effects. As national average income and longevity are used, the average unemployment rate is similarly used for the sake of consistency. The latter variable captures the individual disutility effect on the unemployed as well as the unemployment risk affecting the whole population.

42.　　In addition, we aim to correct for the measurement errors arising from transitory shocks on income or the job variable Z, and we test some specifications where life satisfaction and the latter variables

are smoothed with Hoddrick-Prescott filters to extract their structural components, which may be better proxies of economic conditions in the medium term than the actual variables.

43.   The following sections present the results in two steps. First, the results from the baseline specification of life satisfaction regressions for both unemployment and longevity are discussed, with the baseline being designed in line with Murtin et al. (2015). Second, a robustness analysis is carried out by running a very large number of regressions based on several other specifications, involving a different set of control variables, various estimators and the inclusion of country and time fixed effects. The robustness analysis is used to obtain a plausible range of shadow prices of unemployment.

3.3.   Main results

44.   Table 2 reports the estimation of Equation (10) based on all available datasets. The unemployment rate appears to be negatively signed and strongly significant in all regressions. Excluding the three regressions in which income is wrongly-signed and/or weakly significant, one percentage point of unemployment is on average worth as much as 9% of GDP per capita, 5.5% of consumption and 7.7% of household income. In addition, the estimates of shadow prices vary in a large range (between 1.7% and 26.5%), which is mainly due to the variability of the income coefficient.

Table 2.   The shadow price of unemployment – baseline estimates

	OECD				OECD and Partner Countries			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dependent variable is life satisfaction								
Log GDP per capita	1.715***	0.215***	1.701***	0.130***	1.544***	0.318***	1.538***	0.270***
	(0.006)	(0.024)	(0.006)	(0.024)	(0.005)	(0.022)	(0.005)	(0.023)
Unemployment rate	-0.029***	-0.035***	-0.032***	-0.040***	-0.029***	-0.034***	-0.032***	-0.039***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Unemployment's shadow price (% income)	**1.68**	**15.02**	**1.86**	**26.49**	**1.86**	**10.14**	**2.06**	**13.45**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.5e+06	2.5e+06	2.5e+06	2.5e+06	2.6e+06	2.6e+06	2.6e+06	2.6e+06
R^2	0.060	0.115	0.060	0.115	0.070	0.126	0.071	0.126
Dependent variable is life satisfaction								
Log household consumption	1.216***	0.580***	1.180***	0.530***	1.211***	0.620***	1.183***	0.571***
	(0.007)	(0.033)	(0.007)	(0.035)	(0.006)	(0.032)	(0.006)	(0.033)
Unemployment rate	-0.080***	-0.026***	-0.092***	-0.032***	-0.063***	-0.025***	-0.071***	-0.030***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Unemployment's shadow price (% income)	**6.37**	**4.38**	**7.50**	**5.86**	**5.07**	**3.95**	**5.83**	**5.12**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.1e+06	2.1e+06	2.1e+06	2.1e+06	2.1e+06	2.1e+06	2.1e+06	2.1e+06
R^2	0.052	0.122	0.054	0.121	0.054	0.125	0.055	0.125
Dependent variable is life satisfaction								
Log household disposable income	1.010***	0.746***	0.976***	0.797***	1.043***	0.409***	1.034***	0.380***
	(0.007)	(0.042)	(0.007)	(0.046)	(0.005)	(0.036)	(0.005)	(0.038)
Unemployment rate	-0.086***	-0.036***	-0.097***	-0.046***	-0.065***	-0.038***	-0.071***	-0.048***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Unemployment's shadow price (% income)	**8.16**	**4.71**	**9.46**	**5.61**	**6.04**	**8.87**	**6.64**	**11.87**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	1.7e+06	1.7e+06	1.7e+06	1.7e+06	1.8e+06	1.8e+06	1.8e+06	1.8e+06
R^2	0.050	0.119	0.052	0.119	0.057	0.128	0.059	0.128

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the Gallup World Poll (2004-2013), the European Social Survey (2002-2013), the European Value Survey (1981-2009), the European Quality of Life Survey (2003-2007), Eurobarometer (1973-2012) and the World Value Survey (1981-2008).

45.   Similarly, we examine life satisfaction regressions with the employment-population ratio as an alternative to the unemployment rate. Table 3 reports the results. We always find positive and strongly significant coefficients on the employment ratio. On average, one percentage point of employment is worth as much as 5.1% of income, with the range of estimates going from 1.2% to 15.3%. As for unemployment, the meta-data analysis below will aim to derive a narrower distribution of shadow prices for the rate of employment.

Table 3.   The shadow price of the employment ratio baseline estimates

	OECD				OECD and Partner Countries			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dependent variable is life satisfaction								
Log GDP per capita	1.299***	0.549***	1.288***	0.493***	1.322***	0.639***	1.319***	0.605***
	(0.007)	(0.023)	(0.007)	(0.023)	(0.005)	(0.021)	(0.005)	(0.022)
Employment-population ratio	0.041***	0.014***	0.042***	0.015***	0.036***	0.013***	0.037***	0.015***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Employment ratio's shadow price (% income)	**3.11**	**2.52**	**3.21**	**3.00**	**2.69**	**2.01**	**2.77**	**2.45**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.5e+06	2.5e+06	2.5e+06	2.5e+06	2.6e+06	2.6e+06	2.6e+06	2.6e+06
R^2	0.067	0.114	0.067	0.114	0.076	0.126	0.077	0.126
Dependent variable is life satisfaction								
Log household consumption	0.666***	0.910***	0.650***	0.901***	0.739***	0.932***	0.726***	0.913***
	(0.007)	(0.031)	(0.007)	(0.033)	(0.007)	(0.029)	(0.007)	(0.031)
Employment-population ratio	0.067***	0.011***	0.070***	0.013***	0.061***	0.011***	0.063***	0.012***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Employment ratio's shadow price (% income)	**9.57**	**1.20**	**10.21**	**1.43**	**7.92**	**1.17**	**8.31**	**1.31**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.1e+06	2.1e+06	2.1e+06	2.1e+06	2.1e+06	2.1e+06	2.1e+06	2.1e+06
R^2	0.067	0.121	0.068	0.121	0.067	0.124	0.068	0.124
Dependent variable is life satisfaction								
Log household disposable income	0.549***	1.218***	0.535***	1.443***	0.847***	0.851***	0.847***	0.961***
	(0.007)	(0.039)	(0.008)	(0.042)	(0.005)	(0.033)	(0.005)	(0.036)
Employment-population ratio	0.086***	0.034***	0.089***	0.042***	0.065***	0.036***	0.066***	0.043***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Employment ratio's shadow price (% income)	**14.50**	**2.75**	**15.33**	**2.87**	**7.39**	**4.14**	**7.50**	**4.38**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	1.7e+06	1.7e+06	1.7e+06	1.7e+06	1.8e+06	1.8e+06	1.8e+06	1.8e+06
R^2	0.070	0.119	0.071	0.119	0.072	0.127	0.072	0.128

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the Gallup World Poll (2004-2013), the European Social Survey (2002-2013), the European Value Survey (1981-2009), the European Quality of Life Survey (2003-2007), Eurobarometer (1973-2012) and the World Value Survey (1981-2008).

3.4.   Robustness and Meta-data analysis

46.   In a first step, the life satisfaction regressions are run again on the five main sub-samples, namely the Gallup World Poll, the European Value Survey, the European Quality of Life Survey, Eurobarometer and the World Value Survey. For European surveys, the sample is limited to OECD countries. All Tables are reported in Annex (see Tables A1 to A8). To evaluate the quality of the results, one considers as a quality criterion the share of regressions in which both the income and job variables are statistically significant with the expected sign, which are characterized as "admissible regressions". When run over sub-samples, these regressions yield an important insight: the Gallup World Poll appears to constitute the highest-quality source of information as it is the only one where 100% of employment and unemployment regressions are admissible. After Gallup come Eurobarometer (87.7% of admissible regressions overall), the European Social and Value Surveys (83.3%), the European Quality of Life Survey (58.3%) and the World value Survey (33.4%).

47.   To further evaluate the robustness of the job regressions, the number of covariates is extended and additional variables based on previous literature are tested in turn. The Gallup World Poll is used for that purpose. Furthermore, one considers the OECD sample, both because of data availability and because this sample yields more stable estimates than the sample with OECD and Partner Countries in Table A2. Following several studies that have investigated the determinants of life satisfaction (e.g. Blanchflower and Oswald, 2004; DiTella et al., 2003; Deaton, 2008), one introduces the log income variable lagged 3 years[10], the inflation rate[11], mean years of higher education, SOx emission per capita[12] as well as morbidity measures[13].

48.   The results are reported in the Annex, Tables A9 to A13. Importantly, we find that the job variable (i.e. either unemployment or employment) is significant in 115 out of 120 regressions ran with an additional covariate. It can therefore be concluded that the job variable is a strongly robust determinant of life satisfaction. Moreover, a couple of interesting results emerge regarding the additional variables included inside the regressions: i) lagged log income is generally significant but its sign is ambiguous; ii) the rate of inflation is negative and significant in 16 out of 24 regressions, which is consistent with DiTella et al. (2003); iii) mean years of higher education are significant in 16 out of 24 cases, which is consistent with microeconomic evidence found in other studies (e.g. Dolan, Peasgood and White, 2008; iv) air pollution is negative and significant in only 2 cases and positive and significant in 19 out of 24 cases, which may point at omitted variable bias; v) the decomposition of longevity into healthy longevity and longevity with chronic illness yield a majority of positive and significant estimates on the latter variables (in respectively 17 and 18 cases).

49.   Finally, it is possible to collect all the estimates from the various job regressions presented in the Annex and run a meta-data analysis of the shadow prices of employment-related variables. Each regression yields an estimate of a shadow price, but some estimates are deemed to be more accurate than others. In practice, we assume that the stability of shadow prices across the various specifications of a given regression indicates a more accurate estimation. In practice, each regression is run under 4 specifications, using either OLS or Fixed-effects (FE), and actual or smoothed variables. Hence, for each data sample and set of regressors, we calculate the variance of shadow prices across these 4 specifications, and derive the corresponding weight of shadow prices as the inverse of their variance. This methodology has been used in former economic studies such as Stanley et al. (2010).

50.   Table 4 reports the results. Among the 156 available job regressions, 81.3% yield admissible estimates of jobs' value (80.1% for unemployment and 82.7% for employment). As noted above, this share is much larger among estimates using the Gallup database than among other samples. When all estimates (i.e. both admissible and non-admissible ones) are re-weighted, the shadow price of unemployment is equal to 1.51% and that of employment to 2.48%. When considering only admissible estimates, the shadow prices rise slightly to 1.87% and 2.54%, respectively.

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[10]   Controlling for lagged income boils down to testing for an adaptation effect (Clark et al., 2008), i.e. that as time goes by individuals get used to better economic conditions up to the point that they do not draw any benefit in terms of higher happiness .

[11]   According to Frey and Stutzer (2002) inflation harms people's subjective well-being as signalling a deterioration of future living standard, but also a worsening of the income distribution that may lead to political and economic unrest.

[12]   Sulphur oxide (SOx) is one of the air pollutants that is organised in PM (Particulate Matters), which have been shown to be particularly harmful to human health. Silva et al. (2012) found that air pollution has an impact of satisfaction with air quality, which in turns affects life satisfaction.

[13]   Many studies have shown that health is a major driver of life satisfaction (see OECD 2013 and Frey and Stutzer 2002 for a review).

Table 4. The shadow prices of the unemployment and employment - various estimates

	Number of estimates	Share of admissible estimates		Average shadow price (weighted)		Average shadow price among admissible estimates (weighted)	
		Unemployment	Employment	Unemployment	Employment	Unemployment	Employment
All	**156**	**80.1**	**82.7**	**1.51**	**2.48**	**1.87**	**2.54**
Gallup	84	96.4	97.6	1.54	2.29	1.54	2.29
World Value Survey	24	25	41.7	-0.29	0.35	0.67	3.09
European Social Survey	12	66.7	100	2.22	2.65	2.21	2.65
European Value Survey	12	100	66.7	3.21	1.53	3.2	2.69
European Quality of Life Survey	12	66.7	50	0.14	1.04	2.25	3.09
Eurobarometer	12	83.3	91.7	6.81	3.03	6.84	3.04

Note: Admissible estimates correspond to regressions where income and (un)employment display significant and rightly-signed coefficients. Weights correspond to the inverse variability of estimates across subsets of regressions. Data on life satisfaction is drawn from the Gallup World Poll (2004-2013), the European Social Survey (2002-2013), the European Value Survey (1981-2009), the European Quality of Life Survey (2003-2007), Eurobarometer (1973-2012) and the World Value Survey (1981-2008).

51.   Note that the re-weighing process eliminates many negative or very large shadow prices. As shown on Figure 1, the thick left and right tails of the distribution of shadow prices drawn from all available estimates disappear after the re-weighing process. This is because outlier shadow prices are often generated from unstable regressions, and more particularly from an unstable coefficient on log income. Then, focusing on the re-weighted distribution of shadow prices using only admissible regressions, negative shadow prices disappear by construction, with noticeable implications on the value of (un)employment.

Figure 1. Distributions of estimated and selected shadow prices
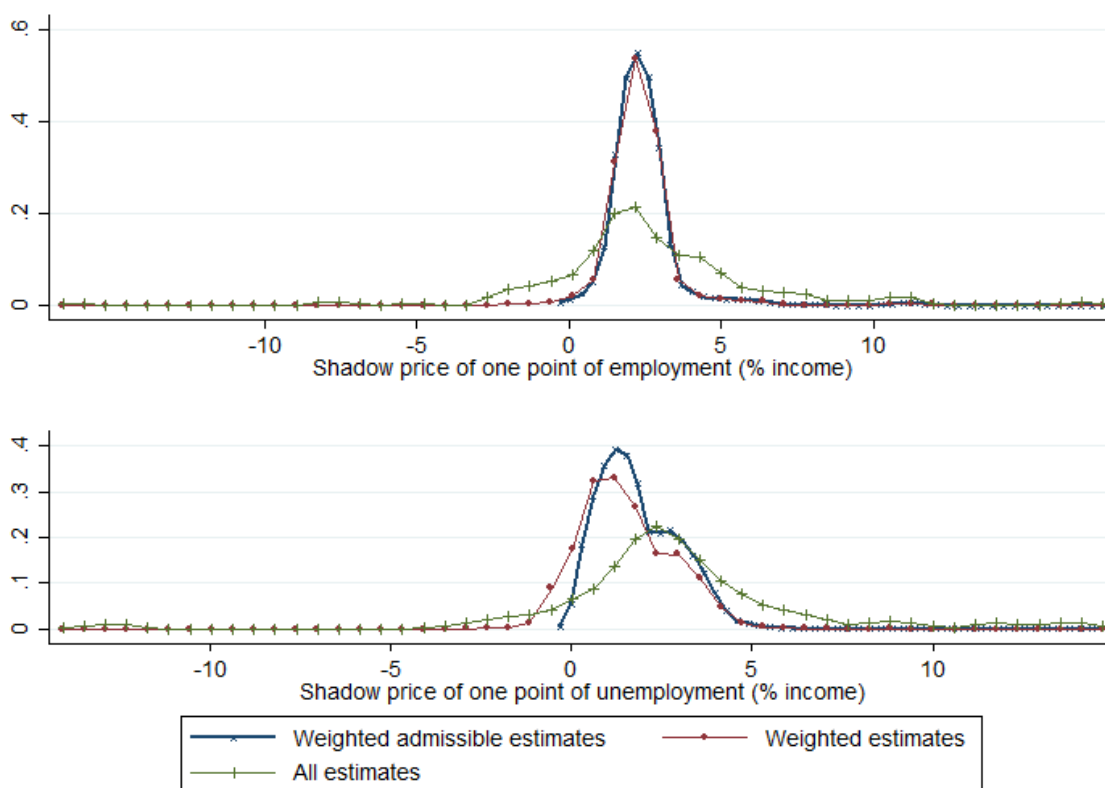
Note: Admissible estimates correspond to regressions where income and (un)employment display significant and rightly-signed coefficients. Weights correspond to the inverse variability of estimates across subsets of regressions.

52.   As a result, Table 5 presents the statistical characteristics of the distributions of employment and unemployment's shadow prices as inferred from admissible and weighted estimates only. Their median is slightly lower than their average, which indicates some right-tail skewness. The 90% confidence interval for shadow prices includes the percentiles 5 and 95 of their respective distribution. It appears that the shadow price of one point of unemployment (respectively employment) lies between 0.95% and 3.44% of income (resp. 1.4% and 4.6%) at the 90% confidence level.

53.   The average shadow price of 1.9% found for unemployment is fully in line with Murtin et al. (2015), who found an average shadow price of 1.8% when using life satisfaction regressions, and a slightly lower one when using a model-based approach. Hence, this meta-data analysis fully confirms their previous results [14].

54.   Finally, the sample average shadow price of unemployment is equal to 1.87% for each unemployment percentage point (corresponding to a ratio $\frac{\beta}{\alpha}$ equal to -1.89e-2 in equation (11)) and 2.5%

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[14] Moreover, when focusing on a preferred subset of estimates derived from the OECD sample, using the FE estimator and the consumption and household income proxy, the average shadow price of unemployment is almost unchanged, and equals 2.05%.

for each employment percentage point (corresponding to a ratio $\frac{\beta}{\alpha}$ equal to 2.57e-2). When defined as the value of each unemployment percentage point in terms of income's share when unemployment is fully eliminated (i.e. $U^* = 0$), unemployment shadow prices calculated as $\delta^U(U, y)/(y.U)$ become country-specific as illustrated by Figure 2. Due to the concavity of the $\delta^U(U)$ function, their average is slightly lower and equals 1.74% of income. The range varies between 1.5% in high-unemployment countries (e.g. Greece or Spain) and 1.8% in low-unemployment countries (e.g. Korea or China).

Figure 2. Value of one percentage point of unemployment when the latter is eliminated - 2013
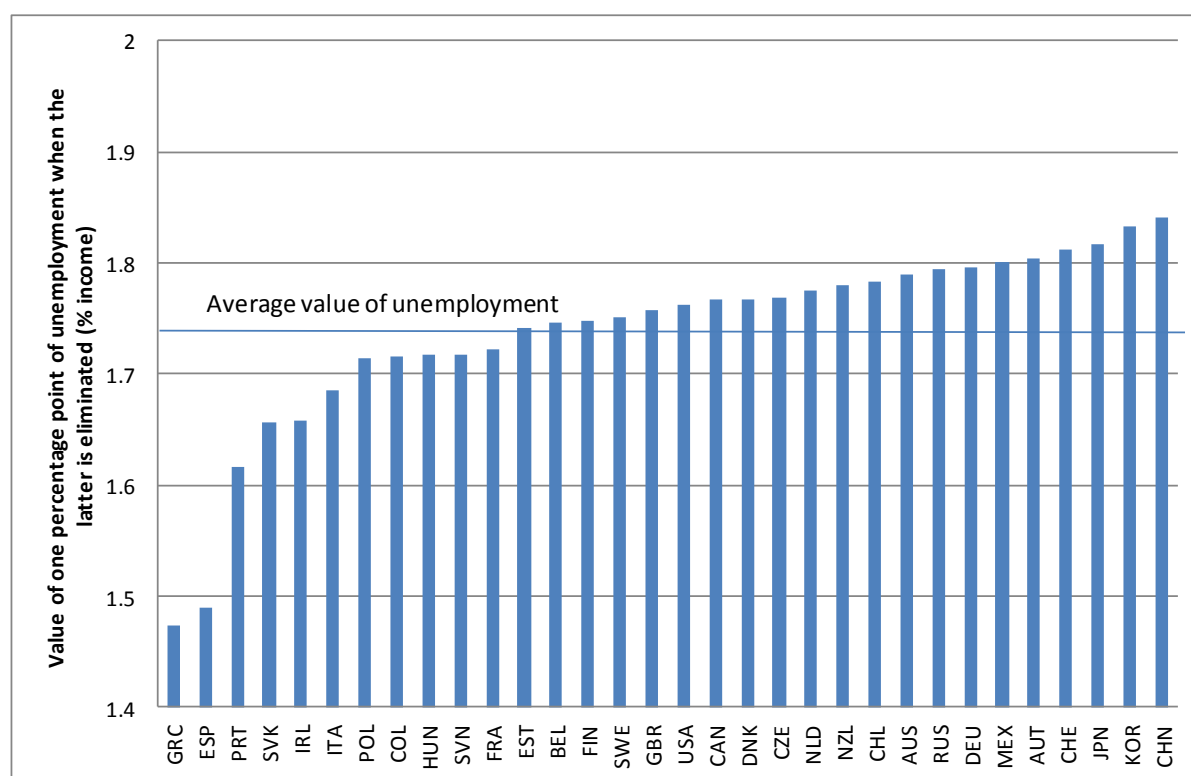
Note: The shadow price of unemployment is calculated as the monetary value of eliminating unemployment divided by the unemployment rate and expressed as a share of household average income.

Table 5. The distributions of shadow prices for unemployment and the employment-population ratio using only weighted admissible estimates

	Unemployment	Employment
Average	1.87	2.54
Median	1.26	2.3
Standard deviation	1.04	1.34
P5-P95	0.95-3.44	1.4-4.6

Note: The distribution of shadow prices for (un)employment are calculated over the set of regressions with admissible estimates.

4. *The value of life*

55.   This section explains the calculation of the willingness-to-pay for longer life and it highlights the cross-country differences in this valuation. It also provides further evidence on the shadow price of longevity based on life satisfaction regressions.

4.1. *Choice of the VSL*

56.   A large number of studies have been devoted to the valuation of life using the approach of the VSL. While Murphy and Topel (2006) have provided the theoretical foundations of the valuation framework, Viscusi (1993) and Viscusi and Aldy (2003) have surveyed the empirical studies that have sought to assess the VSL. Typically, these studies assess the willingness-to-pay of workers for reductions in risks of accidental death by using wage differences across jobs with different occupational mortality risks. The marginal willingness-to-pay of workers is then aggregated on a statistical population and expressed in the form of the VSL, which is defined as the aggregate monetary value that a given population would be collectively willing to pay to save one (statistical) life by reducing mortality risks. In practice, estimates of the VSL range between 4 and 9 million in 2004 USD, and the US Environmental Protection Agency uses a default value of 6.3 million in 2004 USD. As shown by Murphy and Topel (2005), the latter amount corresponds to the value of a life-year of about USD 200,000 at the beginning of active life, which peaks at USD 350,000 around age 50 and flattens around USD 100,000 after age 90.

57.   For the purpose at hand, the parameter ω is calibrated on the average VSL value of 6.3 million 2004 USD, the US Environmental Protection Agency benchmark.[15] This is a conservative choice as Viscusi-Aldy (2003), in their meta-analysis, report an average VSL of 6.7 million USD. After reviewing over 100 empirical studies, the authors conclude that "the mean predicted VSL vary from 5.5 to 7.6 million

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[15] See Dockins et al. (p.4): "EPA's Guidelines advise analysts to use a central VSL estimate of $4.8 million in 1990 dollars. Based on the gross domestic product (GDP) deflator this converts to approximately $6.2 million in 2002 dollars. This value is derived from 26 estimates assembled for EPA=s first retrospective analysis of the Clean Air Act (USEPA, 1997). Each estimate is from a different study, with 21 of the estimates from hedonic wage studies and the remaining five derived from contingent valuation (CV) studies. Until 2003, the estimate from EPA's Guidelines was uniformly applied to mortality risk reductions across program offices. EPA recently used an estimate of $5.5 million (1999 dollars) in its analysis of reduced mortality from air regulations."

USD for the U.S. sample" (Viscusi and Aldy, 2003, p.42). Finally, we follow Becker et al. (2005) and Murtin et al. (2005) and select an annual interest rate of r = 0.03.

58.   As argued by Murtin et al. (2015), VSL studies pertain to adult workers and ignore the unrevealed value of life-years during childhood, but the surveys by Hammitt and Haninger (2010) suggest a significantly larger VSL for a child. To ensure consistency between the empirical VSL and the theoretical framework, one considers an adult aged 25 years and we correct life expectancy at birth by subtracting 25 years. As life expectancy at age 25 is not available for all countries and years, this adjustment is convenient from an empirical point of view. Moreover, child mortality is not large in our sample of OECD countries and this adjustment is very close to reality. For instance, Murtin et al. (2016) find an average life expectancy at age 25 years equal to 54.5 years among a sample of 15 OECD countries over the period 2009-2013, while the corresponding life expectancy at birth equals 78.9 years, entailing a gap of 24.4 years.

59.   As a result, the parameter ω yielding a VSL of 6.3 million in the United States in 2004 is equal to 1.996. Considering the infra-marginal increase of one year in longevity in the United States in 2004, equation (7) yields a value of 2198 USD, or 6.8% of household disposable income. This figure is almost fully consistent with the VSL and equation (3) that pertains to marginal changes. Indeed, after adjustment for life expectancy at age 25, the latter increase implies a decrease in average mortality equal to $1/52.4 - 1/53.4 = 3.57 \times 10^{-4}$ or 3.57 deaths per 10,000 people, implying a VSL of $2,198/(3.57 \times 10^{-4}) = 6.16$ million USD. The slight difference with the benchmark VSL of 6.3 million USD only arises from the difference in formulas for marginal and infra-marginal changes.

60.   Note that the formula for compensating income entails a variation in the unitary price of one year of longevity along longevity and income levels. Figure 3 plots the income profile of the shadow price of one year of longevity for different levels of life expectancy at birth (i.e. adding 25 years to longevity at 25 years)[16]. The calibration for the US in 2004 is indicated by a cross. As a property of the CRRA utility function, the value of longevity (as a share of income) increases with income and decreases with longevity. Comparatively speaking, the shadow price of longevity is more sensitive to the level of longevity than to the level of income.

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[16]   One abstracts from unemployment and simply reports the value of δ^T / y for $T^* = T + 1$.

Figure 3. The shadow price of longevity by income and longevity
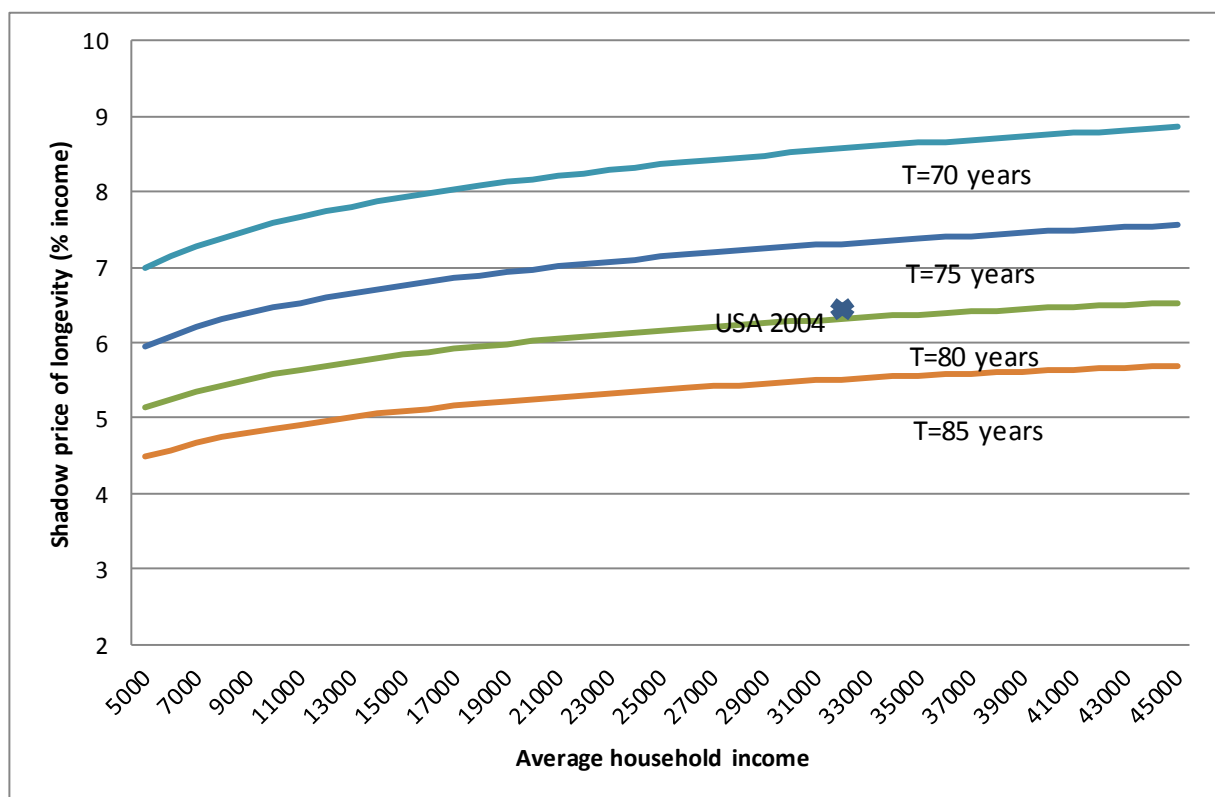
Note: The shadow price of longevity is expressed as a share of household income.

61.   The relationship between compensating income δ^T, longevity T and household income y described by equation (9) implies that the shadow price δ^T/y of one year of longevity differs across countries. Figure 4 depicts the value of one year of longevity as a share of household income in 2013. The average shadow price equals 5.9% and ranges between 5.4% in Japan and 7.5% in the Russian Federation. The value of longevity is the largest in the Russian Federation as this is the country with the lowest level of life expectancy in the sample (70.6 years versus 79.6 years on average in 2013). Conversely, high longevity countries display a lower shadow price (e.g. Japan, Spain and Italy)[17].

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[17]   Another way of valuing longevity follows from the use of subjective wellbeing data, in particular life satisfaction. Under some conditions the use of life satisfaction data can yield almost the same valuation of longevity as a model-based approach identical to the one proposed above (Murtin et al., 2015). However, the use of life satisfaction data for the valuation of longevity is not straightforward as longevity is not always a significant determinant of life satisfaction in econometric studies. For instance, Deaton (2008) does not find a single regression with a significant coefficient on life expectancy. In unreported work, we applied the same valuation framework described in Section 3 and regressed life satisfaction from all available datasets on country-level income proxies, life expectancy at birth, individual-level characteristics (gender and age) and a set of time, survey and country dummies. The results are found to be mixed. With GDP per capita as an income proxy, longevity is always wrongly signed and significant across all estimators, specifications and samples, while it is always positive and strongly significant when using household consumption. With household disposable income as an income proxy, the sign of longevity is

Figure 4. The shadow price of longevity across countries in 2013
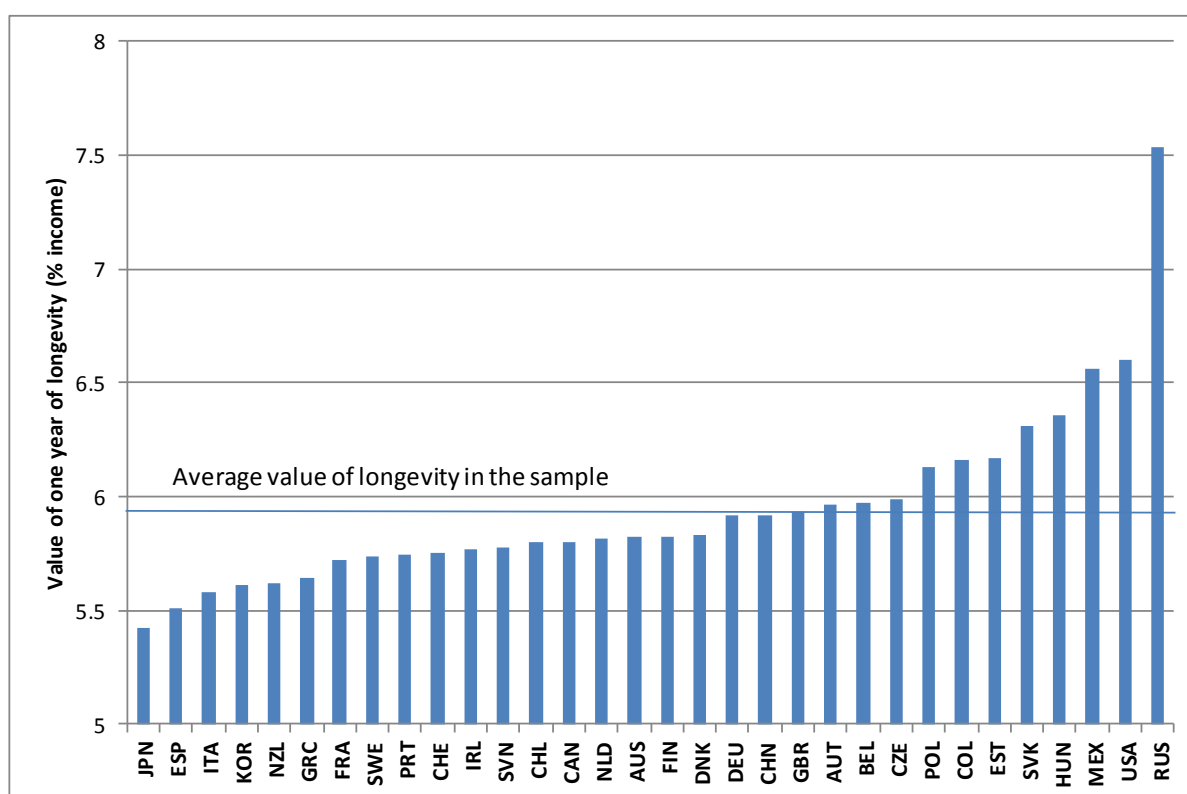
Note: The shadow price of longevity is calculated as the monetary value of raising longevity by one year expressed as a share of household average income.

5.   *Measuring multi-dimensional living standards*

5.1.   *Levels and evolution of living standards over time*

62.   Once the willingness to pay to reduce unemployment and increase longevity are calculated, multi-dimensional living standards can be calculated as specified in equation 1:

$$MDLS = \left(\frac{1}{n}\sum_i Y_i^*\right)(1-I) = \left(\frac{1}{n}\sum_i y_i \ - \ \delta^U - \ \delta^T\right)(1-I)$$

63.   Lacking individual-level data to calculate willingness to pay for unemployment and unemployment by individual income, the following calculations of MDLS assume that the correction for unemployment and longevity is the same across the income distribution. The Atkinson-Kolm-Sen Index of inequalities I is calculated for two levels of aversion to inequality (τ=1.5 and τ=50), implying that the resulting MDLS refer to households at the median and at the bottom 10% levels of income. This is because

always positive in OLS regressions and negative or insignificant in FE regressions. These results indicate that the use of subjective well-being data is not the most appropriate to derive the shadow price of longevity as it is highly sensitive to the nature of the econometric model.

the equally-distributed equivalent[18] value of income for τ=1.5 is close to the median, while for τ=50 it is close to the first decile. This section presents the results for the median households while the following one concentrates on the bottom 10%.

64.   Figure 5 shows the MDLS of median households for the latest available year and when taking unemployment rate as a proxy for the job dimension. MDLS vary in a large interval, from 17,930 USD for Switzerland to 1,330 USD to Colombia. Across the sample, average living standards (8,340 USD) represent about half of average disposable income (16,200 USD). The average correction for longevity is the largest (-2,900 USD) followed by unemployment (-2,300 USD) and the inequality penalty related to the median household (-2,240 USD). Although income is the main component of MDLS for all countries under study, moving to MDLS as a broader welfare measure changes countries' positions in the large majority of cases (Figure 6). The largest decreases in rank are observed for the Russian Federation and Ireland, due to low longevity and high unemployment, followed by Spain, Greece, Belgium and the United States, where both factors play a role. Conversely, Estonia, Poland, Japan and Korea perform better based on MDLS than on income, as penalties from unemployment and/or mortality are relatively small as compared to other countries.

Figure 5. Living standards of the median household in 2013
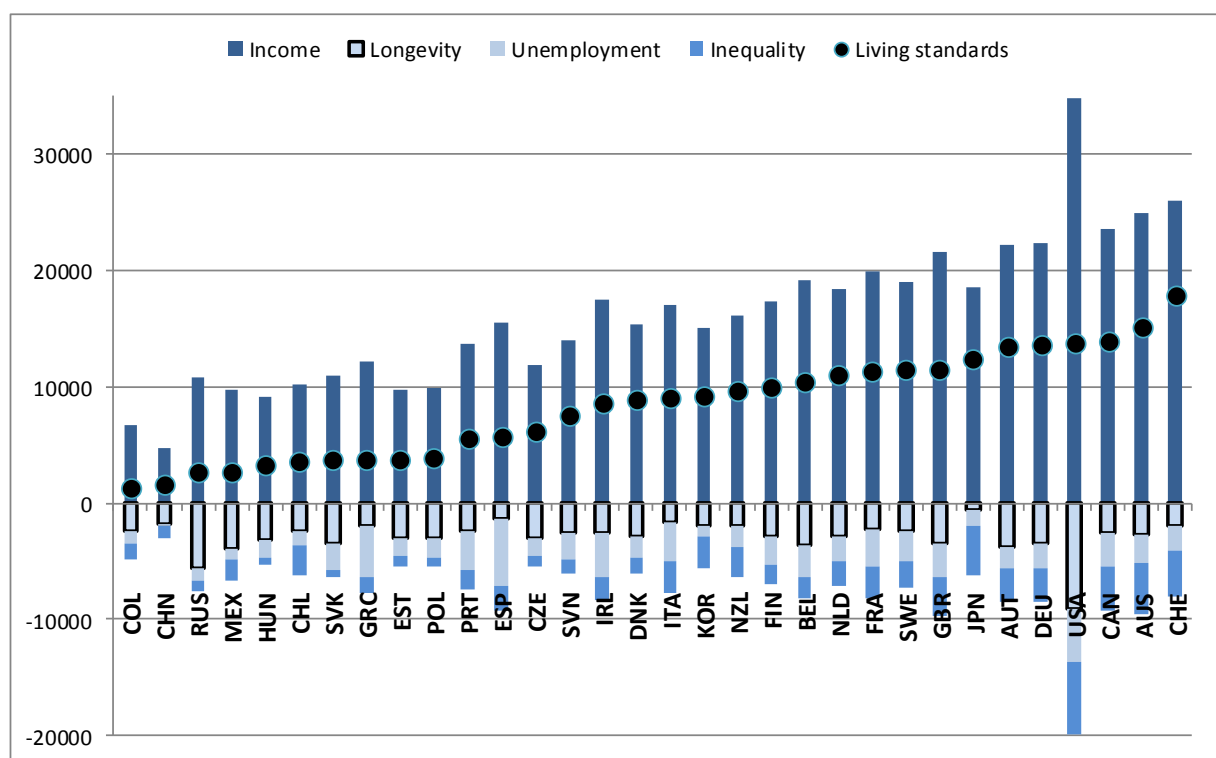
Note: Living standards are expressed in 2005 USD.

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[18]   The equally-distributed equivalent level of income (Atkinson 1970) is the value that, equally distributed among individuals, would yield the same social welfare as the contemplated distribution.

Figure 6. Changes in country rankings when moving from income to MDLS
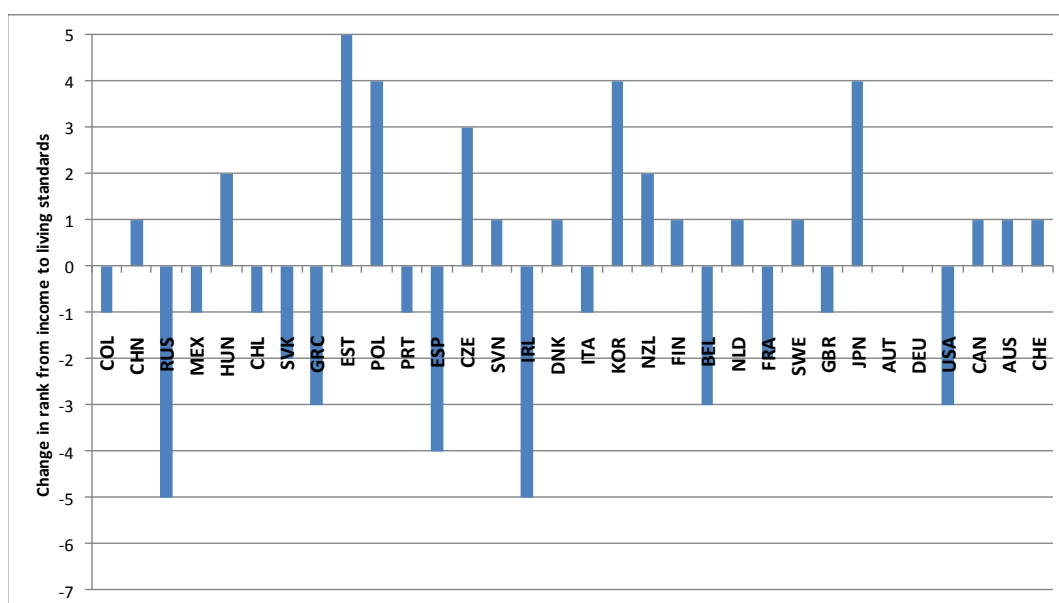
Note: The change in country ranking is calculated as the rank in income minus the rank in living standards.

65.   Figure 7 compares our welfare measure to the results by Jones and Klenow (2016) for the year 2007, the year with the largest number of common country points. The two welfare measures are highly correlated (0.976), though results differ from some countries such as Switzerland. These differences may stem from differences in the theoretical frameworks (e.g. Jones and Klenow use leisure on top of income, mortality and inequality) and the different sources of data. Overall, however, the two welfare measures are rather consistent.

Figure 7. Comparison with Jones and Klenow's measure of welfare 2007
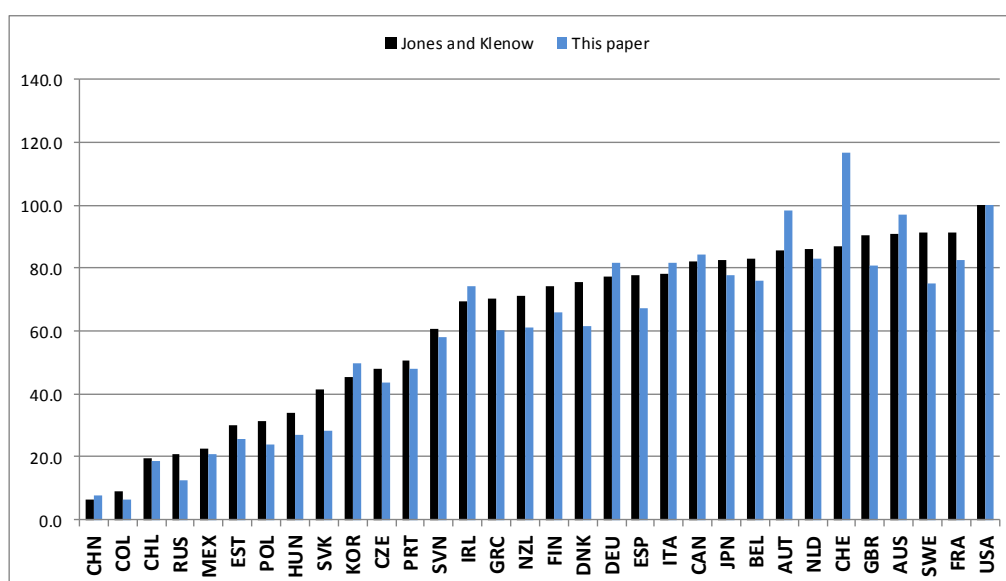
Note: Living standards and Jones and Klenow's measure of welfare are expressed in relative terms with respect to the US in 2007.

66.   Figure 8 shows how MDLS of the median households (Panel A with unemployment rate, panel B with employment rate) have evolved over a relatively long period of time. With the unemployment-based metric, MDLS have grown significantly in most countries under study until around 2008, when the Great Recession started. In a few countries including Switzerland, France and UK, the impact of the crisis on MDLS has been relatively mild, while in others (Spain, Greece and Portugal) the impact has been very large (in Greece for instance MDLS returned to the levels observed in early 80s). Panel B of Figure 8 shows that most of the same patterns hold when using employment rate as a proxy of jobs in the calculation of MDLS, though the time profiles are generally less steep as the employment rate is typically less volatile than the unemployment rate.

Figure 8. Living standards of the median household over time - selected countries
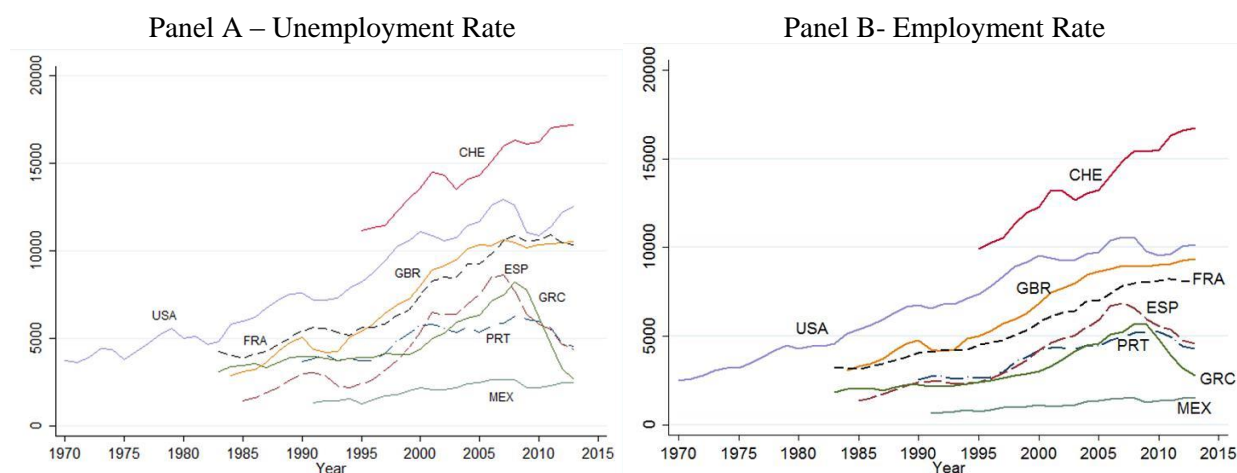
Note: Living standards are expressed in 2005 USD.

67.   The next table provides a comparison of GDP growth with MDLS growth as well as a decomposition of the latter into its main determinants between 1995 and 2013 with both unemployment and employment variables. Focusing first on the median household ($\tau = 1.5$), in all OECD countries but Greece MDLS have grown faster than GDP (the OECD average being respectively 2.7% and 1.6% per year with unemployment). In China, GDP growth has been just slightly above that of MDLS and both measures grew at above 8% per year. In the OECD countries (average), income and longevity have been the two largest drivers of MDLS (respectively growing at 1.5% and 1.4%) while unemployment and inequality have had a much smaller impact. Looking at the employment-based MDLS does not alter the qualitative picture on MDLS-GDP growth differentials. However, because employment has also provided a significant contribution to MDLS (growing by 0.4% on average), the corresponding welfare growth has been twice that of GDP (3.2% versus 1.6%). Overall, however, MDLS and GDP growth are highly correlated (0.88 when MDLS are based on unemployment).

Table 6. Annual growth of living standards of households at various points of the income distribution 1995-2013

Country	Per capita GDP growth, in percentage	Growth of living standards (percentage points)			Average household income	Longevity	Unemployment	Inequality*			Growth of living standards (percentage points)			Average household income	Longevity	Employment	Inequality*		
		Average (τ=0)	Median (τ=1.5)	Bottom decile (τ=50)				Average (τ=0)	Median (τ=1.5)	Bottom decile (tau=50)	Average (τ=0)	Median (τ=1.5)	Bottom decile (τ=50)				Average (τ=0)	Median (τ=1.5)	Bottom decile (tau=50)
Australia	1.77	4.05	3.87	3.65	2.32	1.39	0.34	0.00	-0.18	-0.40	4.39	4.19	3.96	2.32	1.43	0.64	0.00	-0.19	-0.42
Austria	1.53	1.99	1.70	0.87	0.69	1.47	-0.17	0.00	-0.29	-1.12	2.63	2.34	1.50	0.69	1.36	0.59	0.00	-0.30	-1.14
Belgium	1.23	1.72	1.89	2.84	0.47	1.13	0.12	0.00	0.17	1.12	2.42	2.57	3.47	0.47	1.26	0.69	0.00	0.15	1.05
Canada	1.51	3.48	3.21	2.78	1.85	1.34	0.28	0.00	-0.27	-0.70	3.94	3.66	3.23	1.85	1.35	0.74	0.00	-0.28	-0.71
Chile	3.09	5.84	6.04	6.28	4.68	1.11	0.05	0.00	0.20	0.45	6.91	7.01	7.17	4.68	1.13	1.10	0.00	0.10	0.26
China	8.60	9.22	8.31	8.04	8.44	1.10	-0.31	0.00	-0.91	-1.18	-	-	-	-	-	-	-	-	-
Czech Republic	2.16	3.27	3.15	2.45	1.89	1.85	-0.47	0.00	-0.12	-0.82	3.34	3.21	2.50	1.89	1.75	-0.30	0.00	-0.13	-0.84
Denmark	0.82	2.37	2.12	1.45	0.67	1.71	0.00	0.00	-0.26	-0.92	2.19	1.93	1.27	0.67	1.76	-0.24	0.00	-0.26	-0.92
Finland	1.95	4.14	3.86	3.19	2.03	1.26	0.84	0.00	-0.28	-0.95	4.34	4.06	3.38	2.03	1.35	0.96	0.00	-0.28	-0.96
France	1.05	2.72	2.46	2.11	1.14	1.37	0.22	0.00	-0.26	-0.61	3.17	2.89	2.52	1.14	1.56	0.47	0.00	-0.27	-0.65
Germany	1.22	2.69	2.46	2.16	0.79	1.53	0.37	0.00	-0.23	-0.53	3.64	3.39	3.07	0.79	1.48	1.37	0.00	-0.24	-0.56
Greece	0.68	-0.45	-0.55	-1.62	0.40	1.33	-2.18	0.00	-0.10	-1.17	0.71	0.58	-0.54	0.40	1.43	-1.12	0.00	-0.13	-1.25
Hungary	2.27	3.55	3.40	2.41	1.75	1.80	0.00	0.00	-0.15	-1.14	4.39	4.17	3.05	1.75	1.70	0.94	0.00	-0.22	-1.35
Ireland	2.69	4.85	4.84	3.92	3.22	1.86	-0.22	0.00	-0.01	-0.93	5.91	5.86	4.89	3.22	2.08	0.61	0.00	-0.05	-1.02
Italy	0.16	0.90	0.92	1.06	-0.40	1.42	-0.11	0.00	0.02	0.16	1.72	1.71	1.79	-0.40	1.89	0.23	0.00	-0.01	0.07
Japan	0.73	1.54	1.33	1.08	0.28	1.38	-0.12	0.00	-0.21	-0.46	1.99	1.78	1.52	0.28	1.46	0.25	0.00	-0.22	-0.48
Mexico	1.75	2.89	3.08	2.61	1.93	0.60	0.36	0.00	0.20	-0.28	3.25	3.35	2.81	1.93	0.61	0.70	0.00	0.11	-0.44
Netherlands	1.36	1.88	1.90	1.45	0.65	1.18	0.05	0.00	0.02	-0.43	3.15	3.16	2.69	0.65	1.08	1.42	0.00	0.01	-0.46
New-Zealand	1.59	3.42	3.42	3.50	1.76	1.64	0.02	0.00	0.00	0.09	3.90	3.89	3.96	1.76	1.59	0.55	0.00	-0.01	0.06
Portugal	0.92	1.42	1.47	1.29	0.70	1.98	-1.26	0.00	0.05	-0.13	2.25	2.27	2.04	0.70	1.90	-0.35	0.00	0.02	-0.21
Slovak Republic	3.85	4.40	4.36	4.11	3.40	1.16	-0.15	0.00	-0.04	-0.29	4.49	4.43	4.15	3.40	1.17	-0.08	0.00	-0.05	-0.34
Spain	1.18	2.03	1.66	0.14	0.96	1.71	-0.65	0.00	-0.37	-1.88	3.40	3.01	1.44	0.96	2.03	0.41	0.00	-0.39	-1.96
Sweden	1.87	3.18	2.74	1.51	2.23	0.84	0.11	0.00	-0.44	-1.67	3.39	2.95	1.72	2.23	0.82	0.35	0.00	-0.44	-1.67
Switzerland	1.18	2.41	2.29	2.32	1.12	1.42	-0.13	0.00	-0.11	-0.09	2.93	2.81	2.83	1.12	1.33	0.48	0.00	-0.11	-0.09
United Kingdom	1.47	3.17	3.05	2.85	1.60	1.44	0.12	0.00	-0.11	-0.32	3.38	3.27	3.05	1.60	1.43	0.35	0.00	-0.12	-0.33
United States	1.46	2.69	2.26	1.35	1.73	1.23	-0.27	0.00	-0.43	-1.35	2.15	1.72	0.81	1.73	1.36	-0.94	0.00	-0.43	-1.34
Average of the 25 OECD countries included above	**1.8**	**3.0**	**2.9**	**2.5**	**1.8**	**1.4**	**-0.1**	**0.0**	**-0.2**	**-0.6**	**3.4**	**3.2**	**2.7**	**1.5**	**1.4**	**0.4**	**0.0**	**-0.2**	**-0.6**

Column group headers: ECONOMIC GROWTH 1995-2013 | GROWTH OF LIVING STANDARDS 1995-2013 - UNEMPLOYMENT VARIABLE | GROWTH OF LIVING STANDARDS 1995-2013 - EMPLOYMENT VARIABLE. The "Living standards contributions of annualised growth in: (percentage points)" headers span the contribution columns.

* Based on disposable income only. Further, income distribution measures rely on surveys and comparability with national accounts income data is incomplete.

68.   Turning to the MDLS of the bottom 10%, Table 6 shows that the MDLS of this income group have grown slower than those of the median households (at an annual 2.2% versus 2.7%) which can be seen from the higher growth of the inequality penalty. This penalty amounts to 0.6% for the bottom 10% and corresponds to the difference between the income growth of households with an average income and the income growth of households at the bottom 10% of the income distribution. Once again using employment rather than unemployment has the effect of magnifying the MDLS growth as employment rate has been a positive driver of MDLS (and in this framework employment gains are considered equal across the income spectrum).

6.   *Conclusion*

69.   This paper has proposed a methodology to measure MDLS incorporating the effect of income, unemployment and longevity. It confirms the result of other studies showing that this new measure is correlated with GDP, but nevertheless quite different. MDLS incorporate population preferences over unemployment estimated from SWB surveys as well as a value of longevity calibrated from a model with intertemporal utility. The combination of survey-based and model-based valuations appears useful in order to take account of the fact that SWB surveys provide information about flow utility rather than lifetime utility.

70.   While advancing the research agenda on welfare metrics, this study suffers from a number of limitations due to the available data. While the theory accommodates individual-specific preferences, we had to adopt uniform preference coefficients and compute average equivalent incomes, using income inequalities as a proxy for inequalities in MDLS. It is also arguable that standard VSL estimates, that guide our model-based valuation of longevity, imperfectly reflect the value of longevity since they rely on a rather indirect estimation strategy.

71.   It seems to us that the most interesting question for future research is the analysis of inequalities in MDLS relying on inequalities at the individual level in income, unemployment, and longevity. The accumulation of disadvantages on the bottom of the distribution suggests that our inequality coefficient underestimates the inequality in MDLS.

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ANNEX - SUPPORTING EVIDENCE

Table A0. Longevity and Unemployment in Subjective Well-being Regressions

	OECD				OECD and Partner Countries			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dependent variable is life satisfaction								
Log GDP per capita	2.071***	0.296***	2.027***	-0.023	1.848***	0.541***	1.666***	0.152***
	(0.009)	(0.027)	(0.009)	(0.026)	(0.007)	(0.026)	(0.006)	(0.024)
Longevity	-0.057***	0.066***	-0.058***	0.071***	-0.034***	0.046***	-0.025***	0.049***
	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)	(0.004)
Unemployment	-0.021***	-0.037***	-0.023***	-0.046***	-0.024***	-0.035***	-0.031***	-0.044***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Longevity's shadow price (% income)	**-2.79**	**19.99**	**-2.90**	**-2091.03**	**-1.86**	**8.15**	**-1.51**	**27.56**
Unemployment's shadow price (% income)	**1.01**	**11.75**	**1.13**	**-638.91**	**1.29**	**6.26**	**1.84**	**25.13**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.5e+06	2.5e+06	2.5e+06	2.5e+06	2.5e+06	2.5e+06	2.6e+06	2.6e+06
R^2	0.063	0.116	0.061	0.115	0.067	0.122	0.068	0.123
Dependent variable is life satisfaction								
Log household consumption	0.656***	0.449***	0.614***	0.354***	1.137***	0.472***	1.126***	0.379***
	(0.011)	(0.033)	(0.012)	(0.035)	(0.009)	(0.032)	(0.009)	(0.034)
Longevity	0.087***	0.151***	0.088***	0.177***	0.010***	0.116***	0.007***	0.133***
	(0.001)	(0.005)	(0.001)	(0.005)	(0.001)	(0.004)	(0.001)	(0.005)
Unemployment	-0.089***	-0.037***	-0.101***	-0.045***	-0.063***	-0.035***	-0.070***	-0.041***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Longevity's shadow price (% income)	**12.42**	**28.56**	**13.35**	**39.35**	**0.88**	**21.79**	**0.62**	**29.60**
Unemployment's shadow price (% income)	**12.69**	**7.91**	**15.17**	**11.94**	**5.39**	**7.15**	**6.03**	**10.25**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.1e+06	2.1e+06	2.1e+06	2.1e+06	2.1e+06	2.1e+06	2.1e+06	2.1e+06
R^2	0.054	0.122	0.056	0.122	0.054	0.125	0.055	0.125
Dependent variable is life satisfaction								
Log household disposable income	0.213***	0.715***	0.171***	0.759***	0.859***	0.677***	0.953***	0.375***
	(0.012)	(0.042)	(0.012)	(0.046)	(0.009)	(0.039)	(0.007)	(0.039)
Longevity	0.130***	0.038***	0.131***	0.042***	0.020***	0.001	0.013***	0.004
	(0.002)	(0.007)	(0.002)	(0.007)	(0.001)	(0.005)	(0.001)	(0.006)
Unemployment	-0.099***	-0.038***	-0.110***	-0.047***	-0.065***	-0.037***	-0.069***	-0.049***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Longevity's shadow price (% income)	**45.68**	**5.18**	**53.52**	**5.38**	**2.30**	**0.15**	**1.35**	**1.06**
Unemployment's shadow price (% income)	**37.17**	**5.18**	**47.44**	**6.00**	**7.29**	**5.32**	**6.98**	**12.25**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	1.7e+06	1.7e+06	1.7e+06	1.7e+06	1.8e+06	1.8e+06	1.8e+06	1.8e+06
R^2	0.054	0.119	0.056	0.119	0.053	0.124	0.059	0.128

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the Gallup World Poll (2004-2013), the European Social Survey (2002-2013), the European Value Survey (1981-2009), the European Quality of Life Survey (2003-2007), Eurobarometer (1973-2012) and the World Value Survey (1981-2008).

Table A1. The Shadow Price of Unemployment – Gallup World Poll

	OECD				OECD and Partner Countries			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dependent variable is life satisfaction								
Log GDP per capita	1.373***	1.990***	1.362***	2.254***	1.324***	0.281***	1.323***	0.421***
	(0.011)	(0.155)	(0.011)	(0.166)	(0.007)	(0.092)	(0.007)	(0.097)
Unemployment rate	-0.049***	-0.034***	-0.054***	-0.040***	-0.033***	-0.050***	-0.036***	-0.061***
	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)	(0.002)
Unemployment's shadow price (% income)	**3.51**	**1.69**	**3.89**	**1.76**	**2.46**	**16.30**	**2.68**	**13.49**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.8e+05	2.8e+05	2.8e+05	2.8e+05	3.4e+05	3.4e+05	3.4e+05	3.4e+05
R^2	0.085	0.150	0.086	0.151	0.132	0.193	0.133	0.194
Dependent variable is life satisfaction								
Log household consumption	1.492***	1.650***	1.479***	2.251***	1.442***	1.352***	1.429***	1.339***
	(0.013)	(0.153)	(0.013)	(0.168)	(0.011)	(0.113)	(0.011)	(0.113)
Unemployment rate	-0.042***	-0.030***	-0.048***	-0.034***	-0.026***	-0.034***	-0.028***	-0.045***
	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)
Unemployment's shadow price (% income)	**2.78**	**1.80**	**3.19**	**1.50**	**1.79**	**2.48**	**1.94**	**3.30**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.8e+05	2.8e+05	2.8e+05	2.8e+05
R^2	0.080	0.144	0.081	0.144	0.097	0.158	0.097	0.158
Dependent variable is life satisfaction								
Log household disposable income	1.246***	1.678***	1.233***	1.929***	1.236***	0.346***	1.235***	0.276***
	(0.012)	(0.133)	(0.012)	(0.158)	(0.007)	(0.086)	(0.007)	(0.088)
Unemployment rate	-0.055***	-0.038***	-0.061***	-0.045***	-0.034***	-0.053***	-0.037***	-0.067***
	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)	(0.003)
Unemployment's shadow price (% income)	**4.32**	**2.24**	**4.83**	**2.31**	**2.71**	**14.20**	**2.95**	**21.55**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.9e+05	2.9e+05	2.9e+05	2.9e+05
R^2	0.075	0.143	0.076	0.143	0.124	0.185	0.124	0.186

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the Gallup World Poll (2004-2013).

Table A2. The Shadow Price of Employment Ratio – Gallup World Poll

	OECD				OECD and Partner Countries			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dependent variable is life satisfaction								
Log GDP per capita	0.956***	2.362***	0.937***	2.707***	1.275***	0.501***	1.273***	0.668***
	(0.015)	(0.155)	(0.015)	(0.173)	(0.007)	(0.085)	(0.007)	(0.091)
Employment-population ratio	0.041***	0.029***	0.042***	0.032***	0.019***	0.056***	0.020***	0.068***
	(0.001)	(0.003)	(0.001)	(0.004)	(0.000)	(0.002)	(0.000)	(0.003)
Employment ratio's shadow price (% income)	**4.20**	**1.22**	**4.38**	**1.18**	**1.48**	**10.58**	**1.56**	**9.68**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.8e+05	2.8e+05	2.8e+05	2.8e+05	3.4e+05	3.4e+05	3.4e+05	3.4e+05
R^2	0.088	0.150	0.088	0.150	0.132	0.193	0.133	0.194
Dependent variable is life satisfaction								
Log household consumption	1.045***	1.763***	1.018***	2.395***	1.222***	1.432***	1.205***	1.461***
	(0.017)	(0.149)	(0.017)	(0.166)	(0.013)	(0.107)	(0.013)	(0.108)
Employment-population ratio	0.038***	0.031***	0.040***	0.034***	0.025***	0.038***	0.027***	0.048***
	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)	(0.003)	(0.001)	(0.003)
Employment ratio's shadow price (% income)	**3.57**	**1.74**	**3.85**	**1.41**	**2.03**	**2.62**	**2.22**	**3.23**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.8e+05	2.8e+05	2.8e+05	2.8e+05
R^2	0.085	0.144	0.086	0.144	0.100	0.158	0.100	0.158
Dependent variable is life satisfaction								
Log household disposable income	0.852***	1.837***	0.829***	2.174***	1.192***	0.633***	1.190***	0.655***
	(0.015)	(0.122)	(0.015)	(0.143)	(0.007)	(0.077)	(0.007)	(0.079)
Employment-population ratio	0.052***	0.046***	0.054***	0.054***	0.025***	0.063***	0.026***	0.078***
	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)	(0.003)
Employment ratio's shadow price (% income)	**5.92**	**2.47**	**6.31**	**2.45**	**2.08**	**9.47**	**2.16**	**11.23**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.9e+05	2.9e+05	2.9e+05	2.9e+05
R^2	0.081	0.143	0.081	0.143	0.125	0.186	0.126	0.186

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the Gallup World Poll (2004-2013).

Table A3. The Shadow Price of Unemployment – World Value Survey

	OECD				OECD and Partner Countries			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dependent variable is life satisfaction								
Log GDP per capita	0.578***	0.385**	0.573***	0.165	0.532***	0.838***	0.535***	0.797***
	(0.022)	(0.165)	(0.022)	(0.177)	(0.015)	(0.132)	(0.015)	(0.132)
Unemployment rate	-0.026***	0.010*	-0.027***	0.021***	-0.003*	0.011*	-0.001	0.017***
	(0.002)	(0.006)	(0.002)	(0.006)	(0.002)	(0.006)	(0.002)	(0.006)
Unemployment's shadow price (% income)	**4.40**	**-2.63**	**4.60**	**-13.57**	**0.56**	**-1.32**	**0.19**	**-2.16**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	7.1e+04	7.1e+04	7.1e+04	7.1e+04	9.0e+04	9.0e+04	9.0e+04	9.0e+04
R^2	0.053	0.104	0.053	0.104	0.054	0.119	0.054	0.119
Dependent variable is life satisfaction								
Log household consumption	0.554***	3.046***	0.546***	2.474***	0.472***	3.145***	0.485***	2.542***
	(0.025)	(0.266)	(0.026)	(0.303)	(0.022)	(0.271)	(0.022)	(0.311)
Unemployment rate	-0.040***	0.002	-0.043***	0.014*	-0.002	0.008	0.001	0.024***
	(0.003)	(0.006)	(0.003)	(0.008)	(0.002)	(0.006)	(0.002)	(0.007)
Unemployment's shadow price (% income)	**6.97**	**-0.07**	**7.57**	**-0.57**	**0.42**	**-0.25**	**-0.21**	**-0.95**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	6.6e+04	6.6e+04	6.6e+04	6.6e+04	7.7e+04	7.7e+04	7.7e+04	7.7e+04
R^2	0.056	0.107	0.057	0.106	0.050	0.109	0.050	0.108
Dependent variable is life satisfaction								
Log household disposable income	-0.519***	-2.439***	-0.475***	-3.718***	0.161***	-2.003***	0.167***	-1.970***
	(0.051)	(0.510)	(0.051)	(0.741)	(0.022)	(0.241)	(0.022)	(0.236)
Unemployment rate	-0.062***	-0.042**	-0.056***	-0.093***	-0.006***	-0.029**	-0.002	-0.030**
	(0.004)	(0.018)	(0.004)	(0.029)	(0.002)	(0.013)	(0.002)	(0.014)
Unemployment's shadow price (% income)	**-12.69**	**-1.74**	**-12.51**	**-2.53**	**3.66**	**-1.46**	**1.19**	**-1.53**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	4.1e+04	4.1e+04	4.1e+04	4.1e+04	5.5e+04	5.5e+04	5.5e+04	5.5e+04
R^2	0.044	0.075	0.043	0.075	0.047	0.090	0.047	0.090

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the World Value Survey (1981-2008).

Table A4. The Shadow Price of Employment Ratio – The World Value Survey

	OECD				OECD and Partner Countries			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dependent variable is life satisfaction								
Log GDP per capita	0.404***	0.392**	0.377***	0.161	0.488***	0.792***	0.491***	0.748***
	(0.034)	(0.165)	(0.033)	(0.177)	(0.017)	(0.132)	(0.016)	(0.133)
Employment-population ratio	0.016***	-0.019***	0.018***	-0.024***	0.008***	-0.016***	0.007***	-0.017***
	(0.002)	(0.004)	(0.002)	(0.004)	(0.001)	(0.004)	(0.001)	(0.004)
Employment ratio's shadow price (% income)	**3.88**	**-4.97**	**4.66**	**-16.08**	**1.63**	**-2.04**	**1.42**	**-2.30**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	7.1e+04	7.1e+04	7.1e+04	7.1e+04	9.0e+04	9.0e+04	9.0e+04	9.0e+04
R^2	0.052	0.104	0.053	0.104	0.054	0.119	0.054	0.119
Dependent variable is life satisfaction								
Log household consumption	0.464***	3.036***	0.437***	2.349***	0.311***	3.112***	0.318***	2.325***
	(0.037)	(0.264)	(0.037)	(0.296)	(0.030)	(0.270)	(0.030)	(0.305)
Employment-population ratio	0.014***	0.001	0.016***	-0.009	0.014***	0.001	0.013***	-0.012**
	(0.002)	(0.005)	(0.002)	(0.006)	(0.002)	(0.006)	(0.002)	(0.006)
Employment ratio's shadow price (% income)	**2.97**	**0.03**	**3.60**	**-0.38**	**4.40**	**0.03**	**4.01**	**-0.52**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	6.6e+04	6.6e+04	6.6e+04	6.6e+04	7.7e+04	7.7e+04	7.7e+04	7.7e+04
R^2	0.054	0.107	0.054	0.106	0.051	0.109	0.051	0.108
Dependent variable is life satisfaction								
Log household disposable income	-0.747***	-2.292***	-0.729***	-2.560***	0.144***	-1.953***	0.148***	-1.919***
	(0.054)	(0.428)	(0.054)	(0.478)	(0.022)	(0.240)	(0.022)	(0.233)
Employment-population ratio	0.057***	0.042***	0.054***	0.045***	0.008***	0.034***	0.007***	0.029***
	(0.003)	(0.013)	(0.003)	(0.015)	(0.001)	(0.012)	(0.001)	(0.011)
Employment ratio's shadow price (% income)	**-7.93**	**-1.85**	**-7.69**	**-1.77**	**5.40**	**-1.76**	**4.62**	**-1.52**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	4.1e+04	4.1e+04	4.1e+04	4.1e+04	5.5e+04	5.5e+04	5.5e+04	5.5e+04
R^2	0.047	0.075	0.047	0.075	0.047	0.090	0.047	0.090

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the World Value Survey (1981-2008).

Table A5. The Shadow Prices of Unemployment and Employment European Social Survey OECD Sample

Job variable:	Unemployment rate				Employment-population ratio			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dependent variable is life satisfaction								
Log GDP per capita	1.620***	1.462***	1.612***	1.675***	1.380***	1.612***	1.366***	1.809***
	(0.017)	(0.145)	(0.017)	(0.159)	(0.020)	(0.138)	(0.020)	(0.152)
Job variable	-0.032***	-0.038***	-0.034***	-0.038***	0.029***	0.041***	0.030***	0.043***
	(0.001)	(0.003)	(0.002)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)
Job variable's shadow price (% income)	**1.96**	**2.57**	**2.09**	**2.24**	**2.08**	**2.51**	**2.17**	**2.35**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05
R^2	0.091	0.135	0.091	0.135	0.093	0.135	0.093	0.135
Dependent variable is life satisfaction								
Log household consumption	1.234***	0.070	1.198***	-0.012	0.873***	0.867***	0.842***	1.037***
	(0.019)	(0.150)	(0.019)	(0.164)	(0.022)	(0.128)	(0.022)	(0.137)
Job variable	-0.074***	-0.062***	-0.080***	-0.068***	0.050***	0.067***	0.052***	0.071***
	(0.002)	(0.003)	(0.002)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)
Job variable's shadow price (% income)	**5.82**	**58.76**	**6.46**	**-28806.94**	**5.57**	**7.44**	**5.99**	**6.62**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.2e+05	2.2e+05	2.2e+05	2.2e+05	2.2e+05	2.2e+05	2.2e+05	2.2e+05
R^2	0.077	0.136	0.077	0.135	0.081	0.136	0.081	0.136
Dependent variable is life satisfaction								
Log household disposable income	1.089***	0.167	1.078***	0.124	0.583***	0.492***	0.574***	0.676***
	(0.017)	(0.128)	(0.017)	(0.151)	(0.020)	(0.120)	(0.020)	(0.137)
Job variable	-0.067***	-0.050***	-0.070***	-0.054***	0.068***	0.061***	0.069***	0.065***
	(0.001)	(0.002)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)
Job variable's shadow price (% income)	**5.97**	**25.87**	**6.29**	**35.30**	**11.01**	**11.66**	**11.33**	**9.17**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.1e+05	2.1e+05	2.1e+05	2.1e+05	2.1e+05	2.1e+05	2.1e+05	2.1e+05
R^2	0.067	0.138	0.067	0.138	0.080	0.139	0.080	0.138

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the European Social Survey (2002-2013).

Table A6. The Shadow Prices of Unemployment and Employment European Value Survey OECD Sample

Job variable:	Unemployment rate				Employment-population ratio			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dependent variable is life satisfaction								
Log GDP per capita	1.113***	1.072***	1.131***	1.112***	1.071***	1.459***	1.073***	1.428***
	(0.026)	(0.120)	(0.027)	(0.119)	(0.025)	(0.108)	(0.025)	(0.111)
Job variable	-0.039***	-0.036***	-0.033***	-0.035***	0.023***	0.004	0.022***	-0.000
	(0.002)	(0.005)	(0.003)	(0.005)	(0.001)	(0.003)	(0.001)	(0.003)
Job variable's shadow price (% income)	**3.44**	**3.30**	**2.88**	**3.10**	**2.12**	**0.27**	**2.03**	**0.00**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	1.0e+05	1.0e+05	1.0e+05	1.0e+05	1.0e+05	1.0e+05	1.0e+05	1.0e+05
R^2	0.059	0.081	0.058	0.081	0.061	0.080	0.060	0.080
Dependent variable is life satisfaction								
Log household consumption	0.954***	1.949***	0.929***	2.189***	0.975***	2.256***	0.974***	2.400***
	(0.028)	(0.130)	(0.029)	(0.136)	(0.028)	(0.126)	(0.028)	(0.142)
Job variable	-0.091***	-0.043***	-0.089***	-0.069***	0.036***	0.006	0.035***	0.007
	(0.003)	(0.006)	(0.003)	(0.007)	(0.001)	(0.004)	(0.001)	(0.005)
Job variable's shadow price (% income)	**9.10**	**2.18**	**9.14**	**3.10**	**3.62**	**0.27**	**3.53**	**0.29**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	8.1e+04	8.1e+04	8.1e+04	8.1e+04	8.1e+04	8.1e+04	8.1e+04	8.1e+04
R^2	0.069	0.091	0.068	0.092	0.068	0.091	0.068	0.091
Dependent variable is life satisfaction								
Log household disposable income	0.786***	1.966***	0.751***	2.558***	0.675***	2.864***	0.676***	3.147***
	(0.034)	(0.207)	(0.034)	(0.224)	(0.034)	(0.222)	(0.034)	(0.263)
Job variable	-0.106***	-0.083***	-0.096***	-0.109***	0.053***	0.045***	0.051***	0.037***
	(0.004)	(0.008)	(0.004)	(0.010)	(0.002)	(0.009)	(0.002)	(0.010)
Job variable's shadow price (% income)	**12.62**	**4.13**	**12.00**	**4.17**	**7.55**	**1.56**	**7.27**	**1.17**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	6.0e+04	6.0e+04	6.0e+04	6.0e+04	6.0e+04	6.0e+04	6.0e+04	6.0e+04
R^2	0.041	0.072	0.039	0.072	0.044	0.070	0.042	0.070

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the European Value Survey (1981-2009).

Table A7. The Shadow Prices of Unemployment and Employment European Quality of Life Survey OECD Sample

Job variable:	Unemployment rate				Employment-population ratio			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dependent variable is life satisfaction								
Log GDP per capita	1.707***	4.260***	1.727***	5.202***	1.371***	4.725***	1.322***	5.517***
	(0.034)	(0.320)	(0.035)	(0.387)	(0.036)	(0.271)	(0.036)	(0.324)
Job variable	-0.005	-0.007	0.001	0.008	0.026***	-0.047***	0.029***	-0.077***
	(0.004)	(0.009)	(0.004)	(0.011)	(0.002)	(0.010)	(0.002)	(0.013)
Job variable's shadow price (% income)	**0.29**	**0.16**	**-0.06**	**-0.15**	**1.88**	**-1.00**	**2.17**	**-1.41**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	4.8e+04	4.8e+04	4.8e+04	4.8e+04	4.8e+04	4.8e+04	4.8e+04	4.8e+04
R^2	0.092	0.137	0.091	0.136	0.095	0.137	0.095	0.137
Dependent variable is life satisfaction								
Log household consumption	1.600***	3.651***	1.563***	4.682***	1.216***	4.246***	1.135***	5.144***
	(0.038)	(0.296)	(0.039)	(0.364)	(0.041)	(0.261)	(0.041)	(0.323)
Job variable	-0.045***	-0.022***	-0.043***	-0.020**	0.042***	-0.036***	0.045***	-0.037***
	(0.004)	(0.008)	(0.004)	(0.010)	(0.002)	(0.010)	(0.002)	(0.013)
Job variable's shadow price (% income)	**2.77**	**0.60**	**2.71**	**0.43**	**3.39**	**-0.85**	**3.89**	**-0.72**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	4.7e+04	4.7e+04	4.7e+04	4.7e+04	4.7e+04	4.7e+04	4.7e+04	4.7e+04
R^2	0.078	0.139	0.077	0.139	0.086	0.139	0.087	0.139
Dependent variable is life satisfaction								
Log household disposable income	1.167***	2.523***	1.111***	3.459***	0.865***	3.544***	0.799***	4.487***
	(0.038)	(0.292)	(0.040)	(0.357)	(0.038)	(0.280)	(0.038)	(0.337)
Job variable	-0.064***	-0.055***	-0.062***	-0.062***	0.068***	-0.017	0.071***	-0.015
	(0.004)	(0.008)	(0.004)	(0.010)	(0.002)	(0.011)	(0.002)	(0.015)
Job variable's shadow price (% income)	**5.34**	**2.16**	**5.43**	**1.78**	**7.56**	**-0.48**	**8.50**	**-0.33**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	4.2e+04	4.2e+04	4.2e+04	4.2e+04	4.2e+04	4.2e+04	4.2e+04	4.2e+04
R^2	0.053	0.131	0.051	0.131	0.073	0.130	0.073	0.130

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the European Quality of Life Survey (2003-2007).

Table A8. The Shadow Prices of Unemployment and Employment Eurobarometer OECD Sample

Job variable:	Unemployment rate				Employment-population ratio			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
				Dependent variable is life satisfaction				
Log GDP per capita	2.298***	0.037	2.274***	-0.072**	1.733***	0.496***	1.728***	0.455***
	(0.010)	(0.033)	(0.010)	(0.034)	(0.010)	(0.033)	(0.010)	(0.033)
Job variable	-0.011***	-0.050***	-0.016***	-0.063***	0.048***	0.014***	0.049***	0.017***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Job variable's shadow price (% income)	**0.48**	**74.11**	**0.70**	**-139.89**	**2.73**	**2.78**	**2.80**	**3.67**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	1.1e+06	1.1e+06	1.1e+06	1.1e+06	1.1e+06	1.1e+06	1.1e+06	1.1e+06
R^2	0.072	0.157	0.073	0.157	0.085	0.155	0.086	0.155
				Dependent variable is life satisfaction				
Log household consumption	1.180***	1.140***	1.127***	1.195***	0.759***	1.756***	0.762***	1.938***
	(0.012)	(0.072)	(0.012)	(0.079)	(0.012)	(0.066)	(0.012)	(0.073)
Job variable	-0.115***	-0.026***	-0.136***	-0.036***	0.086***	0.001	0.088***	0.003***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)	(0.001)	(0.000)	(0.001)
Job variable's shadow price (% income)	**9.29**	**2.25**	**11.37**	**2.97**	**10.71**	**0.06**	**10.91**	**0.15**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	8.3e+05	8.3e+05	8.3e+05	8.3e+05	8.3e+05	8.3e+05	8.3e+05	8.3e+05
R^2	0.064	0.180	0.069	0.180	0.093	0.180	0.095	0.180
				Dependent variable is life satisfaction				
Log household disposable income	0.987***	1.756***	0.941***	1.959***	0.627***	2.148***	0.629***	2.526***
	(0.012)	(0.069)	(0.012)	(0.075)	(0.012)	(0.066)	(0.012)	(0.071)
Job variable	-0.121***	-0.037***	-0.141***	-0.051***	0.114***	0.031***	0.117***	0.045***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
Job variable's shadow price (% income)	**11.54**	**2.09**	**13.92**	**2.57**	**16.62**	**1.43**	**16.97**	**1.77**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	6.4e+05	6.4e+05	6.4e+05	6.4e+05	6.4e+05	6.4e+05	6.4e+05	6.4e+05
R^2	0.062	0.179	0.067	0.180	0.103	0.179	0.105	0.179

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from Eurobarometer (1973-2012).

Table A9. Life satisfaction regressions – Robustness analysis: Lagged Log Income - Gallup data set, OECD

Job variable:	Unemployment rate				Employment-population ratio			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dependent variable is life satisfaction								
Log GDP per capita	-0.627***	1.762***	-0.667***	3.203***	0.248***	2.407***	0.541***	4.014***
	(0.094)	(0.188)	(0.115)	(0.262)	(0.085)	(0.175)	(0.105)	(0.243)
Lagged log GDP per capita	1.862***	0.299**	1.898***	-0.988***	0.652***	-0.074	0.368***	-1.518***
	(0.087)	(0.140)	(0.107)	(0.211)	(0.077)	(0.135)	(0.096)	(0.198)
Job variable	-0.062***	-0.036***	-0.065***	-0.033***	0.042***	0.029***	0.043***	0.025***
	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.004)
Job variable's shadow price (% income)	**4.90**	**1.73**	**5.14**	**1.48**	**4.56**	**1.24**	**4.62**	**1.00**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.8e+05	2.8e+05	2.8e+05	2.8e+05	2.8e+05	2.8e+05	2.8e+05	2.8e+05
R^2	0.087	0.150	0.087	0.151	0.088	0.150	0.088	0.151
Dependent variable is life satisfaction								
Log household consumption	1.657***	0.869***	2.752***	1.750***	1.453***	1.168***	2.495***	2.084***
	(0.089)	(0.173)	(0.109)	(0.239)	(0.086)	(0.163)	(0.106)	(0.224)
Lagged log household consumption	-0.149*	1.377***	-1.189***	0.673***	-0.368***	1.173***	-1.360***	0.421**
	(0.083)	(0.135)	(0.102)	(0.201)	(0.078)	(0.131)	(0.097)	(0.194)
Job variable	-0.040***	-0.036***	-0.041***	-0.033***	0.036***	0.035***	0.037***	0.031***
	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)	(0.003)	(0.001)	(0.004)
Job variable's shadow price (% income)	**2.62**	**1.59**	**2.59**	**1.35**	**3.26**	**1.48**	**3.21**	**1.23**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05
R^2	0.081	0.146	0.083	0.145	0.085	0.145	0.087	0.145
Dependent variable is life satisfaction								
Log household disposable income	1.960***	1.200***	3.360***	2.099***	1.358***	1.510***	2.488***	2.722***
	(0.081)	(0.156)	(0.103)	(0.278)	(0.081)	(0.140)	(0.105)	(0.236)
Lagged log household disposable income	-0.659***	0.328***	-2.020***	-0.512**	-0.409***	0.341***	-1.488***	-0.751***
	(0.077)	(0.123)	(0.097)	(0.210)	(0.074)	(0.123)	(0.097)	(0.200)
Job variable	-0.053***	-0.041***	-0.051***	-0.043***	0.050***	0.047***	0.047***	0.048***
	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.004)
Job variable's shadow price (% income)	**3.99**	**2.65**	**3.73**	**2.67**	**5.13**	**2.51**	**4.59**	**2.41**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.3e+05	2.3e+05	2.3e+05	2.3e+05	2.3e+05	2.3e+05	2.3e+05	2.3e+05
R^2	0.078	0.147	0.081	0.147	0.084	0.147	0.085	0.147

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the Gallup World Poll (2004-2013).

Table A10. Life satisfaction regressions Robustness analysis: Inflation Rate - Gallup data set, OECD

Job variable:	Unemployment rate				Employment-population ratio			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dependent variable is life satisfaction								
Log GDP per capita	1.395***	1.699***	1.372***	1.631***	1.061***	2.287***	1.052***	2.455***
	(0.014)	(0.158)	(0.014)	(0.177)	(0.016)	(0.155)	(0.017)	(0.176)
Inflation rate	-0.009***	-0.018***	-0.014***	-0.068***	0.024***	-0.010**	0.030***	-0.042***
	(0.003)	(0.004)	(0.003)	(0.008)	(0.003)	(0.004)	(0.003)	(0.008)
Job variable	-0.049***	-0.039***	-0.054***	-0.054***	0.042***	0.030***	0.043***	0.039***
	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.004)
Job variable's shadow price (% income)	**3.45**	**2.27**	**3.86**	**3.26**	**3.88**	**1.30**	**4.01**	**1.58**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.7e+05	2.7e+05	2.7e+05	2.7e+05	2.7e+05	2.7e+05	2.7e+05	2.7e+05
R^2	0.086	0.152	0.087	0.152	0.089	0.151	0.090	0.152
Dependent variable is life satisfaction								
Log household consumption	1.440***	1.185***	1.408***	1.246***	1.089***	1.673***	1.059***	2.046***
	(0.015)	(0.178)	(0.015)	(0.216)	(0.018)	(0.158)	(0.018)	(0.189)
Inflation rate	-0.041***	-0.027***	-0.052***	-0.093***	-0.011***	-0.023***	-0.014***	-0.073***
	(0.003)	(0.005)	(0.003)	(0.009)	(0.003)	(0.005)	(0.003)	(0.008)
Job variable	-0.040***	-0.038***	-0.046***	-0.054***	0.037***	0.035***	0.038***	0.046***
	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)	(0.003)	(0.001)	(0.004)
Job variable's shadow price (% income)	**2.74**	**3.16**	**3.21**	**4.24**	**3.34**	**2.07**	**3.52**	**2.22**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05
R^2	0.082	0.145	0.084	0.146	0.086	0.145	0.087	0.146
Dependent variable is life satisfaction								
Log household disposable income	1.277***	1.473***	1.275***	1.705***	0.930***	1.787***	0.929***	2.129***
	(0.014)	(0.141)	(0.014)	(0.172)	(0.016)	(0.125)	(0.016)	(0.149)
Inflation rate	-0.001	-0.004	0.009**	0.024*	0.028***	-0.000	0.049***	0.041***
	(0.003)	(0.005)	(0.004)	(0.013)	(0.003)	(0.005)	(0.004)	(0.012)
Job variable	-0.055***	-0.040***	-0.060***	-0.046***	0.053***	0.047***	0.055***	0.050***
	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.004)
Job variable's shadow price (% income)	**4.22**	**2.68**	**4.60**	**2.66**	**5.54**	**2.60**	**5.75**	**2.32**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05
R^2	0.075	0.144	0.077	0.144	0.082	0.144	0.083	0.144

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the Gallup World Poll (2004-2013).

Table A11. Life satisfaction regressions Robustness analysis: Mean Years of Higher Education - Gallup data set, OECD

Job variable:	Unemployment rate				Employment-population ratio			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dependent variable is life satisfaction								
Log GDP per capita	1.045***	1.993***	1.036***	2.249***	0.800***	2.330***	0.788***	2.619***
	(0.013)	(0.155)	(0.013)	(0.166)	(0.016)	(0.155)	(0.016)	(0.174)
Mean years of higher education	0.552***	0.418***	0.550***	0.552***	0.410***	0.456***	0.402***	0.604***
	(0.012)	(0.117)	(0.012)	(0.117)	(0.012)	(0.118)	(0.012)	(0.120)
Job variable	-0.051***	-0.035***	-0.056***	-0.043***	0.035***	0.032***	0.036***	0.038***
	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.004)
Job variable's shadow price (% income)	**4.76**	**1.74**	**5.26**	**1.89**	**4.28**	**1.36**	**4.47**	**1.44**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.8e+05	2.8e+05	2.8e+05	2.8e+05	2.8e+05	2.8e+05	2.8e+05	2.8e+05
R^2	0.092	0.150	0.093	0.151	0.092	0.150	0.092	0.150
Dependent variable is life satisfaction								
Log household consumption	1.178***	1.677***	1.173***	2.285***	0.874***	1.808***	0.859***	2.438***
	(0.016)	(0.160)	(0.016)	(0.177)	(0.018)	(0.155)	(0.018)	(0.176)
Mean years of higher education	0.463***	-0.079	0.455***	-0.087	0.341***	-0.147	0.325***	-0.104
	(0.014)	(0.136)	(0.014)	(0.138)	(0.014)	(0.134)	(0.014)	(0.140)
Job variable	-0.042***	-0.029***	-0.048***	-0.033***	0.034***	0.030***	0.036***	0.032***
	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)	(0.004)
Job variable's shadow price (% income)	**3.50**	**1.71**	**4.01**	**1.43**	**3.82**	**1.65**	**4.10**	**1.30**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05
R^2	0.085	0.144	0.086	0.144	0.087	0.144	0.088	0.144
Dependent variable is life satisfaction								
Log household disposable income	0.980***	1.711***	0.969***	1.937***	0.733***	1.856***	0.715***	2.166***
	(0.015)	(0.134)	(0.015)	(0.160)	(0.016)	(0.123)	(0.016)	(0.144)
Mean years of higher education	0.423***	-0.263*	0.421***	-0.053	0.249***	-0.180	0.239***	0.064
	(0.013)	(0.143)	(0.013)	(0.145)	(0.013)	(0.144)	(0.013)	(0.146)
Job variable	-0.055***	-0.036***	-0.061***	-0.045***	0.048***	0.045***	0.051***	0.054***
	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.004)
Job variable's shadow price (% income)	**5.46**	**2.08**	**6.10**	**2.30**	**6.34**	**2.40**	**6.88**	**2.46**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05
R^2	0.079	0.143	0.080	0.143	0.082	0.143	0.083	0.143

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the Gallup World Poll (2004-2013).

Table A12. Life satisfaction regressions Robustness analysis: Air Pollution - Gallup data set, OECD

Job variable:	Unemployment rate				Employment-population ratio			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dependent variable is life satisfaction								
Log GDP per capita	1.837***	2.168***	1.820***	2.724***	1.557***	2.500***	1.533***	3.223***
	(0.014)	(0.180)	(0.014)	(0.201)	(0.018)	(0.175)	(0.018)	(0.203)
Sox emission per capita	0.003***	0.008***	0.003***	0.007***	0.002***	0.008***	0.002***	0.008***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Job variable	-0.019***	-0.022***	-0.023***	-0.026***	0.023***	0.017***	0.025***	0.016***
	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)	(0.004)
Job variable's shadow price (% income)	**1.03**	**1.01**	**1.26**	**0.95**	**1.47**	**0.68**	**1.62**	**0.50**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05	2.4e+05
R^2	0.099	0.149	0.100	0.150	0.101	0.149	0.102	0.149
Dependent variable is life satisfaction								
Log household consumption	1.684***	1.600***	1.659***	2.314***	1.296***	1.851***	1.262***	2.582***
	(0.014)	(0.182)	(0.014)	(0.213)	(0.018)	(0.163)	(0.018)	(0.193)
Sox emission per capita	-0.000	0.009***	-0.000	0.008***	-0.001***	0.009***	-0.000***	0.008***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Job variable	-0.033***	-0.025***	-0.040***	-0.029***	0.033***	0.026***	0.035***	0.030***
	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)	(0.003)	(0.001)	(0.004)
Job variable's shadow price (% income)	**1.94**	**1.55**	**2.38**	**1.25**	**2.51**	**1.39**	**2.74**	**1.16**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.3e+05	2.3e+05	2.3e+05	2.3e+05	2.3e+05	2.3e+05	2.3e+05	2.3e+05
R^2	0.088	0.148	0.088	0.148	0.092	0.148	0.093	0.148
Dependent variable is life satisfaction								
Log household disposable income	1.481***	1.726***	1.458***	2.080***	1.121***	2.016***	1.096***	2.475***
	(0.015)	(0.163)	(0.015)	(0.202)	(0.016)	(0.144)	(0.016)	(0.175)
Sox emission per capita	0.001***	0.003**	0.001***	0.004***	0.000	0.003**	0.000*	0.004***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Job variable	-0.040***	-0.031***	-0.046***	-0.038***	0.050***	0.036***	0.052***	0.042***
	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)	(0.003)	(0.001)	(0.004)
Job variable's shadow price (% income)	**2.66**	**1.78**	**3.11**	**1.81**	**4.36**	**1.77**	**4.63**	**1.68**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	2.1e+05	2.1e+05	2.1e+05	2.1e+05	2.1e+05	2.1e+05	2.1e+05	2.1e+05
R^2	0.078	0.141	0.079	0.142	0.088	0.141	0.089	0.142

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the Gallup World Poll (2004-2013).

Table A13. Life satisfaction regressions Robustness analysis: Morbidity variables - Gallup data set, OECD

Job variable:	Unemployment rate				Employment-population ratio			
	Actual		Smoothed		Actual		Smoothed	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dependent variable is life satisfaction								
Log GDP per capita	1.666***	1.011***	1.616***	1.412***	1.440***	1.743***	1.433***	2.235***
	(0.031)	(0.215)	(0.032)	(0.265)	(0.029)	(0.209)	(0.029)	(0.252)
Healthy longevity	0.068***	0.080***	0.070***	0.013	0.060***	0.032	0.057***	-0.041*
	(0.004)	(0.023)	(0.004)	(0.024)	(0.003)	(0.022)	(0.003)	(0.023)
Longevity with chronic conditions	0.044***	0.075***	0.047***	0.011	0.034***	0.030	0.032***	-0.039*
	(0.004)	(0.023)	(0.004)	(0.023)	(0.004)	(0.022)	(0.004)	(0.023)
Job variable	-0.030***	-0.044***	-0.036***	-0.048***	0.034***	0.036***	0.036***	0.040***
	(0.002)	(0.003)	(0.002)	(0.004)	(0.001)	(0.004)	(0.001)	(0.005)
Job variable's shadow price (% income)	**1.78**	**4.26**	**2.20**	**3.34**	**2.33**	**2.04**	**2.48**	**1.77**
Healthy longevity's shadow price	**4.00**	**7.61**	**4.24**	**0.92**	**4.08**	**1.82**	**3.90**	**-1.85**
Longevity with chronic condition's shadow price	**2.61**	**7.15**	**2.87**	**0.78**	**2.33**	**1.71**	**2.21**	**-1.76**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	1.8e+05	1.8e+05	1.8e+05	1.8e+05	1.8e+05	1.8e+05	1.8e+05	1.8e+05
R^2	0.115	0.149	0.115	0.149	0.120	0.148	0.120	0.148
Dependent variable is life satisfaction								
Log household consumption	0.876***	1.209***	0.806***	1.354***	0.643***	1.802***	0.647***	2.030***
	(0.039)	(0.201)	(0.039)	(0.243)	(0.038)	(0.184)	(0.038)	(0.217)
Healthy longevity	0.129***	0.126***	0.133***	0.069***	0.114***	0.111***	0.110***	0.051**
	(0.005)	(0.023)	(0.005)	(0.022)	(0.004)	(0.023)	(0.004)	(0.022)
Longevity with chronic conditions	0.097***	0.122***	0.102***	0.066***	0.081***	0.109***	0.077***	0.052**
	(0.005)	(0.023)	(0.005)	(0.022)	(0.004)	(0.023)	(0.004)	(0.022)
Job variable	-0.060***	-0.040***	-0.070***	-0.047***	0.050***	0.035***	0.052***	0.046***
	(0.002)	(0.003)	(0.002)	(0.004)	(0.001)	(0.004)	(0.001)	(0.004)
Job variable's shadow price (% income)	**6.62**	**3.25**	**8.32**	**3.41**	**7.48**	**1.92**	**7.72**	**2.24**
Healthy longevity's shadow price	**13.69**	**9.90**	**15.21**	**4.97**	**16.25**	**5.97**	**15.63**	**2.48**
Longevity with chronic condition's shadow price	**10.48**	**9.60**	**11.89**	**4.76**	**11.84**	**5.87**	**11.22**	**2.53**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	1.7e+05	1.7e+05	1.7e+05	1.7e+05	1.7e+05	1.7e+05	1.7e+05	1.7e+05
R^2	0.100	0.146	0.102	0.146	0.106	0.146	0.107	0.146
Dependent variable is life satisfaction								
Log household disposable income	0.553***	1.398***	0.471***	2.039***	0.416***	1.889***	0.414***	2.580***
	(0.041)	(0.187)	(0.042)	(0.249)	(0.038)	(0.167)	(0.039)	(0.210)
Healthy longevity	-0.073***	-0.040***	-0.083***	-0.042***	0.059***	0.041***	0.061***	0.044***
	(0.002)	(0.003)	(0.002)	(0.004)	(0.001)	(0.004)	(0.001)	(0.004)
Longevity with chronic conditions	0.159***	0.054**	0.165***	-0.024	0.128***	0.020	0.124***	-0.065***
	(0.005)	(0.023)	(0.005)	(0.023)	(0.005)	(0.023)	(0.005)	(0.023)
Job variable	0.116***	0.050**	0.124***	-0.024	0.087***	0.018	0.084***	-0.061***
	(0.006)	(0.023)	(0.006)	(0.024)	(0.005)	(0.023)	(0.005)	(0.023)
Job variable's shadow price (% income)	**-23.34**	**-3.64**	**-30.12**	**1.17**	**18.87**	**0.95**	**18.36**	**-2.39**
Healthy longevity's shadow price	**-14.11**	**-2.90**	**-19.27**	**-2.08**	**13.22**	**2.15**	**13.70**	**1.69**
Longevity with chronic condition's shadow price	**24.99**	**3.79**	**29.55**	**-1.18**	**26.49**	**1.05**	**25.88**	**-2.55**
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes	No	Yes	No	Yes
N	1.7e+05	1.7e+05	1.7e+05	1.7e+05	1.7e+05	1.7e+05	1.7e+05	1.7e+05
R^2	0.102	0.150	0.103	0.150	0.110	0.149	0.111	0.150

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the Gallup World Poll (2004-2013).

Table A14. Life satisfaction regressions Robustness analysis: Long-term unemployment - Gallup data set, OECD

	Actual		Smoothed	
	OLS	FE	OLS	FE
	Dependent variable is life satisfaction			
Log GDP per capita	1.526***	1.911***	1.509***	2.336***
	(0.013)	(0.174)	(0.013)	(0.193)
Long-term unemployment	-0.151***	-0.045***	-0.155***	-0.044***
	(0.002)	(0.005)	(0.002)	(0.006)
Short-term unemployment	0.102***	-0.005	0.098***	-0.017**
	(0.002)	(0.007)	(0.002)	(0.008)
Long-term unemployment's shadow price	**9.42**	**2.33**	**9.76**	**1.87**
Short-term unemployment's shadow price	**-6.91**	**0.26**	**-6.71**	**0.73**
Time dummies	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes
N	2.5e+05	2.5e+05	2.5e+05	2.5e+05
R^2	0.099	0.146	0.100	0.147
	Dependent variable is life satisfaction			
Log household consumption	1.570***	1.414***	1.552***	2.276***
	(0.014)	(0.183)	(0.014)	(0.217)
Long-term unemployment	-0.136***	-0.045***	-0.140***	-0.033***
	(0.002)	(0.006)	(0.002)	(0.006)
Short-term unemployment	0.069***	-0.015**	0.064***	-0.038***
	(0.002)	(0.007)	(0.002)	(0.008)
Long-term unemployment's shadow price	**8.30**	**3.13**	**8.63**	**1.44**
Short-term unemployment's shadow price	**-4.49**	**1.06**	**-4.21**	**1.66**
Time dummies	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes
N	2.3e+05	2.3e+05	2.3e+05	2.3e+05
R^2	0.094	0.146	0.094	0.146
	Dependent variable is life satisfaction			
Log household disposable income	1.169***	1.495***	1.159***	1.745***
	(0.014)	(0.160)	(0.014)	(0.199)
Long-term unemployment	-0.168***	-0.041***	-0.174***	-0.053***
	(0.002)	(0.006)	(0.002)	(0.005)
Short-term unemployment	0.097***	-0.027***	0.093***	-0.024***
	(0.002)	(0.007)	(0.003)	(0.009)
Long-term unemployment's shadow price	**13.39**	**2.71**	**13.94**	**2.99**
Short-term unemployment's shadow price	**-8.65**	**1.79**	**-8.35**	**1.37**
Time dummies	Yes	Yes	Yes	Yes
Country dummies	No	Yes	No	Yes
N	2.2e+05	2.2e+05	2.2e+05	2.2e+05
R^2	0.088	0.138	0.090	0.138

Note: OLS stands for Ordinary Least Squares and FE for the Fixed-effects estimator. Partner countries include China, Colombia and Russia. Data on life satisfaction is drawn from the Gallup World Poll (2004-2013).