Working Papers 155

Bridging the gap between GDP and subjective wellbeing: the role of multidimensional objective wellbeing measures

Leonardo Becchetti,
University of Tor Vergata

Fabio Pisani,
University of Tor Vergata

Lorenzo Semplici,
University LUMSA

Dicembre 2016

AICCON | T. 0543.62327 | www.aiccon.it

aiccon
cooperazione | non profit

Alma Mater Studiorum - Università di Bologna
Scuola di Economia Management e Statistica
sede di Forlì

Bridging the gap between GDP and subjective wellbeing: the role of multidimensional objective wellbeing measures

Leonardo Becchetti, *University of Tor Vergata*

Fabio Pisani, *University of Tor Vergata*

Lorenzo Semplici, *University LUMSA*

Abstract

We contribute to the debate on the relative pros and cons of using composite wellbeing indicators as a relevant source of information beyond (in addition to) GDP. We use the set of the official Italian Sustainable and Equitable Wellbeing indicators and an ad hoc survey on expenditure preference weights on the same measures to create regional composite indicators combining positive (statistical) and normative (survey based) weighting approaches. We show that the created multidimensional wellbeing indicators have significant additional explanatory power beyond GDP when regressed on a standard cognitive measure of regional subjective wellbeing (life satisfaction). Paper findings support the hypothesis that multidimensional wellbeing indicators are useful to policymakers for capturing voter preferences and that various forms of aggregations (such as those proposed here) can solve the aggregation problem and obtain informationally rich synthetic wellbeing measures.

Keywords: GDP, subjective wellbeing, composite wellbeing indicators.

JEL Numbers: I31 (General Welfare, Well-Being) , I39 (Welfare, Well-Being, and Poverty – Other).

1. Introduction

The debate over the validity of GDP as wellbeing measure has a longstanding tradition. For many years economists have implicitly considered GDP growth as a synthetic indicator capturing not only the economic value created in a given geographical area but also subjective wellbeing so that GDP targeting and growth were considered sufficient to predict and satisfy citizens and voters' preferences. The simple descriptive evidence of the Easterlin (1974) paradox forced them to focus on the possibility of a decoupling between per capita GDP and life satisfaction. The paradox opened a debate to which many other researchers contributed, either providing evidence in its favour or criticizing it.[1]

[1] Evidence consistent with the Easterlin (1974) paradox has been documented by Veenhoven (1993) for Japan in the 1958-1987 period, by Blanchflower and Oswald (2004) for the United States, United Kingdom, Belgium and Japan, in the period going from the early 1970s to the late 1990s and by Frey and Stutzer (2002) for a large sample of countries on the World Database of Happiness and the U.S. Bureau of Census data. Strong criticism to the paradox and to the idea that GDP growth does not affect positively subjective wellbeing has been advanced with supporting empirical evidence by

Whatever the opinion on this debate, many recent political events seem to confirm at anecdotal level that policymakers cannot solely rely on the synthetic information provided by GDP growth to predict their future political success. Three relevant examples of it are: i) the Bulgarian elections after the fall of the Berlin wall where the incumbent leader king Simeon failed to be reconfirmed after his 2001-2005 mandate despite a 3 percent GDP growth; ii) data on Egyptian GDP and life satisfaction that closely resembled those of the Easterlin paradox just before the outburst of the Arab spring and, iii) political elections of 2016 in Ireland where the ruling party lost power in spite of an astonishing 6.6 percent rate of growth achieved just before them.

These three examples clearly show that GDP dynamics may be at times misleading when it comes to predict subjective wellbeing and voters' decisions driven by it. Our hypothesis is that this poor result is highly likely to be related to the suboptimal predictive power of GDP (as unique synthetic wellbeing indicator) vis-à-vis the potential predictive power of more articulated composite wellbeing indicators on voters' subjective wellbeing.

This last hypothesis has however never be rigorously tested.

An empirical test is important because an observationally equivalent explanation for the above described "anomalies" is simply that the promises of political competitors in elections are so attractive to create a differential between the expected life satisfaction under the opponent than under the incumbent win in spite of the good economic performance of the latter. Alternatively, we may assume that the gap between GDP and subjective wellbeing may be driven by a rise in expectations. Even in this case the use of multidimentional objective wellbeing measures, in alternative or in addition to GDP, would not contribute to predict better subjective wellbeing and voters' decisions.

To sum up what considered above, the main point of interest in this literature for economists and policymakers is not just the controversy on the direction and/or existence of the causal nexus between GDP and life satisfaction (as in the Easterlin paradox debate), but, as well, what else is important to consider beyond GDP in order to capture properly subjective wellbeing and explain the above mentioned anomalies.

Based on these considerations our paper aims to test directly whether multidimensional wellbeing indicators can integrate and enrich the explanatory power of GDP growth on subjective wellbeing. The well-known rationales in the literature behind our hypothesis (to mention any) are that GDP growth: i) may have much less positive impact on subjective wellbeing than more direct household measures of economic wellbeing (such as disposable household income net of expenditure for health and education), ii) does not account for distributional problems (which give more accurate indication than simple averages about the share of losers and winners among the population); iii) does not consider many other wellbeing dimensions (e.g. related to health, education, safety, etc.) captured by multidimensional wellbeing indicators and iv) does not consider that quality of jobs is as important as its quantity and that precarious jobs of the working poor do not help to bridge the gap between growth and life satisfaction even when growth is accompanied by a reduction in unemployment.

Stevenson and Wolfers (2008) to whom Bartolini et al. (2008) and Easterlin and Angelescu (2009) replicate.

The empirical analysis of the paper is carried out by using an official set of wellbeing indicators, the Equitable and Sustainable Wellbeing indicators of the Italian National Statistical Institute (known in Italy as *Benessere Equo e Sostenibile*, acronym BES) and an ad hoc survey of preference weights built on them (the FQTS survey). Based on these two sources of information we build composite wellbeing indicators combining different types of positive and normative weights where the former are meant to address problems of statistical relevance and redundancy, while the latter are intended to capture people preferences based on their survey responses.

The main findings of the paper document that several composite indicators have additional explanatory power on life satisfaction at regional and individual level beyond GDP and even beyond a more severe measure of economic wellbeing represented by per capita household income. Our evidence therefore documents that such measures are important if policymakers want to capture voters' satisfaction and should be considered among indicators measuring performance of their political action.

2. The BES process and the FQTS survey

The process for the creation of the equitable and sustainable wellbeing indicators in Italy was inspired by the conclusion of the Sen-Stiglitz-Fitoussi (2009) commission report[2] recommending the creation of a more articulated set of wellbeing indicators beyond GDP. The Italian National Statistical Institute (ISTAT) followed this suggestion in 2011 and decided to implement it with the creation of a set of equitable and sustainable wellbeing indicators (indicators of *Benessere Equo e Sostenibile*, or BES indicators)[3] through a participatory process involving the different components of the Italian society

[2] Downloadable at http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf.

[3] BES indicators come last in a long history of broader wellbeing indexes that, following Costanza et al. (2009), can be divided into four groups: i) indicators correcting GDP; ii) indicators that do not use GDP; iii) composites that include GDP and iv) other set of indicators. In the first group we find, among others, the Index of Sustainable Economic Welfare (ISEW) developed by Daly and Cobb (1989), the Genuine Progress Indicator, the Green GDP promoted by the UN, the Genuine Savings of the World Bank. In the second group, among others, the Ecological Footprint (Wackernagel and Rees, 1996), the Gross National Happiness in Bhutan, the Happy Life Years (Veenhoven, 1993 and 2004), the Quality of Life Index Physics (Morris, 1979), the Human Suffering Index (Population Crisis Committee). In the third group, among others, the Canadian Index of Well-being, the Human Development Index (UNDP), the Living Planet Report (WWF), the Happy Planet Index (New Economics Foundation in London), The Atlas of Happiness (University of Leicester), the Quality of Life Index (the Economist Intelligence Unit). The fourth group includes the World Happiness Report, the National Income Accounts Satellite, the Calvert-Henderson Quality of Life Indicators (Henderson and Lickerman, 2000), the MDG Indicators (UN) and the Better Life Index (OECD). The BES experience, but also, at the provincial level, the Index of Quality of Life and Sole24ore and, at regional level, the QUARS (index of quality of regional life realized by Sbilanciamoci!), they can be placed in this fourth chapter. For a more complete overview see also Bandura (2008) and Fleurbaey and Blanchet (2013).

represented in the CNEL board.[4] In the first step of this process the delegates of the different interest groups members of CNEL (industry associations, unions, ngos) were asked to identify a limited number of most relevant wellbeing domains. In the second step commissions of experts were created in each domain in order to identify relevant indicators. In the third step the indicators selected by the commissions were proposed, discussed with the interest groups, eventually revised and finally validated by the latter.

This three-step process led to the final identification of the following twelve domains; i) Health; ii) Education and Training; iii) Work and Life Balance; iv) Economic Well-being; v) Social Relationships; vi) Politics and Institutions; vii) Safety; viii) Subjective Wellbeing; ix) Natural and Cultural Heritage; x) Environment; xi) Research and Innovation; xii) Quality of Services.

Wellbeing in each of 12 domains was declined with its own set of indicators (a full description of the indicators for each domain is provided in Table A1 in the Appendix A). The first BES report providing a statistical description of Italian wellbeing on the different domains at regional level was released the 12th March 2013 and, since then, every year. In June 2016 the Italian parliament approved a law requiring that the Financial Law presented by the Italian government each year containing the main financial decisions (*Documento di Economia e Finanza*) should include an evaluation of their impact not just in terms of GDP growth or government debt sustainability but also in terms of BES indicators (ie. health expenditure cuts in terms of life expectancy, job reforms in terms of quality of work and work and life balance) .

Two nice properties of the BES wellbeing indicators are the mix of subjective and objective measures and the participatory process that originated them. These two properties help to overcome the two main opposite critiques advanced in the literature to objective and subjective indicators. On the one side, objective indicators, even in their more "englightened" versions, are accused to be paternalistic, that is, inevitably designed by a board of experts that decide what is good for the rest of the population (Sugden, 2008). On the other side, subjective wellbeing indicators (and, more specifically, cognitive measures such as life satisfaction, affective measures such as positive/negative affect and eudaimonic measures such as sense of life) overcome the paternalism' critique but fall into the Sen's "happy slave" critique.[5] That is, they may misreport and underestimate wellbeing if respondents are so pessimistic about their future to lower their expectations even when they are deprived of basic human rights.

The ISTAT-BES approach is designed to overcome both problems. On the one side, BES indicators are built with a participated process that avoids the paternalism' critique (ie. they are not univocally imposed by a group of experts but defined through a three-step consultation process with representatives of the interest groups who define the domains and finally validate the indicators proposed by the commissions of experts). On the other side, only a very small subset of BES

[4] The CNEL (National Council of Economics and Labour) has 64 members representing different interest groups in the country according to the following taxonomy: 10 as representative of institutions in economic, social and legal fields, 48 members from the private sector, 6 from social service and voluntary organisations.

[5] "*The defeated and the downtrodden come to lack the courage to desire things that others more favourably treated by society desire with easy confidence"* (Sen, 1985: 15).

indicators is represented by subjective indicators (ie. income and life satisfaction, fear of walking alone at night) thereby overcoming the "happy slave" critique.

It is worth noting that the ISTAT/BES survey does not address the weighting and aggregation problem of multidimensional wellbeing since it does not propose an overall aggregate BES indicator. In this sense our work aims to contribute in this direction by building aggregate BES indicators and verifying their predictive power vis-à-vis more standard measures of GDP and household income.

In order to tackle the aggregation problem we complement BES data with an ad hoc (Forum Quadri Terzo Settore or FQTS) online survey where respondents are demanded to allocate virtually a sum of 100 million euros among 11 BES domains (the 12th subjective wellbeing domain is excluded). Beyond this value weight exercise the survey collects standard information on socio-demographic variables and is enriched with additional data at the local level of the respondent living place. The FQTS survey questionnaire is attached in the Appendix B.[6]

The survey was launched online through the websites of three main Italian newspapers on March 2013 (Messaggero, Avvenire, Unità). The three newspapers capture a quite heterogeneous readership. Messaggero is owned by one of the top Italian companies in the construction industry and the newspaper has a reputation of center-right political orientation. The newspaper is the fifth most read in Italy (excluding sport newspapers). Avvenire is a popular newspaper owned by the Italian church. As such it reflects the divide of Italian believers that are equally proportionally distributed between left and right wing political orientation. Unità is the official newspaper of the ruling Democrat Party (and the former official newspaper of the Italian Communist party). Its political orientation is today moderate and of center-left. The three newspapers were therefore selected to provide an articulated representation of the Italian public opinion. In addition to Messaggero, Avvenire and Unità that accepted to host the survey in their websites, our questionnaire appeared on other minor newspaper and websites.[7]

Proper filters were used to avoid eventual attempts of respondents of filling more than one questionnaire from the same web address. The survey was online for five months and, at end July, 2,605 complete questionnaires were collected. The final sample of the online survey is obviously biased toward high education and young age. The representativeness problem will be addressed with re-weighting procedures described in section 4.

3. The dataset

[6] After this first question participants to the survey are asked to identify the first five priorities in terms of indicator in each BES domain. This part of the analysis is not used in the present research.

[7] The list of additional websites and minor (local) newspapers includes: Forum Nazionale Terzo Settore, FQTS, ARCI, ConVol, CSV Net, Labsus, Dignità del lavoro, Auser, Avis, Anpas, Bandiera Gialla, La perfetta letizia, Mondo alla Rovescia, Confini online, Il Metapontino.it, ARCI, Campania, Blog vitobiolchini, Domos (domotica sociale).

The data sources of our research are represented by three datasets (2013, 2014 and 2015) of yearly BES indicators collected at regional level by the Italian National Statistical Institute (with the approach described in section 3) and by the FQTS survey on citizens' preferences on such indicators (also described above). BES indicators have been slightly reshaped or changed domains in the BES report 2015 that represents our benchmark for the set of chosen measures (the list of changes is described in Table A2 in the Appendix). We exclude from the analysis the BES subjective wellbeing domain (thereby considering 11 domains) since the survey of expenditure preferences make sense only on objective domains and subjective wellbeing will the dependent variable of our econometric analysis. The total number of BES indicators remaining after this exclusion are 130. We further limit this set of indicators to 97 mainly due to severe lack of representativeness (entire years without data or too many missing data). The detailed reasons for exclusion of each of these 27 indicators are described in Table A3 in the Appendix. The remaining dataset presents very few missing values related to some indicators.[8] Descriptive evidence for the selected BES indicators is provided in Table 1. Our second source of information is represented by the FQTS survey on people preferences on BES indicators and described in detail in section 2.

4. Methodology for the construction of composite indicators

As is well known the construction of composite indicators involves some crucial decisions about normalization, weighting and aggregation. Weighting techniques may be positive or normative. The former use statistical methods such as Principal Component Analysis (PCA) or Factor Analysis (FA) to identify weights based on statistical relevance of the indicators in order to eliminate redundancy. The latter base weights on people preferences using surveys or expert weights and different approaches to extract them.[9]

A first methodological contribution of our paper in this respect consists of the simultaneous combined use of positive and normative weighting approaches. On the first side we use, after Factor Analysis, the squared factor loadings of the varimax-rotated matrix scaled to unity and multiply them for the

[8] More specifically, we have missing data for: i) quality of urban air (in Calabria for the years 2013 and 2014); ii) households connected to the gas distribution infrastructure (in Sardinia for the years 2013, 2014 and 2015); iii) public per capita expenditure for managing cultural heritage at council level (museums, libraries and art galleries) (in Valle d'Aosta for the years 2013, 2014 and 2015); iv) productive specialization in knowledge intensive sectors (in Valle d'Aosta and Molise for the years 2013, 2014 and 2015).

[9] For surveys on aggregation methods see among others Munda and Nardo (2003), Nardo at al. (2005), Giovannini et al. (2008), Massoli et al. (2014), Mazziotta and Pareto (2013, 2014a, 2014b and 2015) and Zhou and Ang, (2009). For guidelines on model selection see, among others, Ebert and Welsch (2004) and Zhou et al. (2006).

share of the total variance explained by the component containing the specific indicator.[10] Results are scaled and normalised in order to obtain scores ranging between 1 and 2.

The use of this approach requires performing a few preliminary tests, aimed at determining the feasibility of factor analysis. First, we look at correlation matrices (with the 5% significance level) for each dimension and perform, in a second step, the Bartlett sphericity test and the Kaiser-Meyer-Olin Measure of Sampling Adequacy (KMO), as conventionally suggested (Giovannini et al., 2008). This first test gives positive results for all domains, while the KMO turns out to be problematic (less than 0.60) in Politics and Institutions (KMO = 0.502), Landscape and Cultural Heritage (KMO = 0.594) and Environment (KMO = 0.453) . In order to obtain an adequate level of KMO, that is, greater than or equal to 0.60 (Giovannini et al., 2008) we eliminated indicators 3 and 4 in the Politics and Institutions domain, indicator 1 in the Landscape and Cultural Heritage domain and indicators 5, 7 and 9 in the Environment domain, by entering into this domain the indicator for recycling (qs_11), before pertaining to the size of the Quality of Services. These decisions were taken in reference to the assessments of the correlation matrix related to each domain and after testing that the elimination from the analysis of the chosen indicators determines an effective increase of the KMO value. [11] Results of this preliminary analysis are reported in Table 2. We also evaluated the reliability of the latent construct of each domain with the Cronbach Alpha Coefficient, that expresses a measure of weight relative to the variability associated with the item with respect to variability associated to their sum. The results, all greater than 0.60 and reported in Table 3, indicate a degree of reliability of the significant constructs.

On the second side (normative approaches) we use wellbeing expenditure preference weights provided by the large sample of online respondents on the FQTS survey (described in section 2) where the latter were asked to allocate a sum of 100 million euros among 11 BES domains. The average sample shares allocated in each domain by respondents are used as domain weights. Since the online survey sample is biased, as expected, toward the younger and more educated respondents, we follow a double-weighting approach where survey weights are corrected in order to make our sample representative of the Italian population. More specifically on this point the approach followed is the standard use of a raking ratio estimation (Deming 1943, Kalton 1983, Izrael at al. 2009). The estimation adjusts sampling weights of each observation in order to obtain a match of the adjusted weights' marginal totals for a given specified characteristics (gender, age, education and geographic location in our case) with the corresponding totals for the national population. The correspondence

[10] More specifically on this point we follow the standard practice (Giovannini et al., 2008) of choosing factors that: (i) have associated eigenvalues higher than one; (ii) contribute individually to the explanation of more than 10 percent of the overall variance; and (iii) contribute cumulatively to the explanation of more than 60 percent of the overall variance. The third step deals with the rotation of factors. The rotation (we use the varimax rotation, following a standard approach in the literature) is used to minimise the number of individual indicators that have a high loading on the same factor. The last step deals with the construction of the weights from the matrix of factor loadings after rotation, given that the square of factor loadings represents the proportion of the total unit variance of the indicator that is explained by the factor. The approach used by Nicoletti et al. (2000) is that of grouping the individual indicators with the highest factors loadings into intermediate composite indicators.

[11] We follow in the elimination procedure the standard methodology implemented by Kaiser and Rice (1974) and recommended in Giovannini et al. (2008).

between survey totals and population totals is achieved with an iterating process that stops when the weights converge. [12]

We build our composite indicators using two different aggregation techniques: the arithmetic mean and the Adjusted Mazziotta-Pareto Index (AMPI - in the continuation of treatment simply MPI -)[13]. We therefore obtain two composite indicators with unitary weight, two composite indicators weighed with the FQTS survey respondents' opinions, two composite indicators weighed with the results of the factor analysis, two composite indicators weighed with the average of the FQTS survey opinions and the results of the factor analysis. We call these eight composite indicators as follows: *UnWeightedBES; SurveyWeightedBES; StatisticallyWeightedBES; Stat&SurveyWeightedBES; UnWeightedBES (MPI); SurveyWeightedBES (MPI); StatisticallyWeightedBES (MPI); Stat&SurveyWeightedBES (MPI*). Differences in single indicator weights under each approach are compared in Table 4. Legend and summary descriptive statistics for the composite indicators are provided in Tables 5.1-5.2. Details of the formulas for each composite indicator are in Appendix 2.

5. Empirical evidence

In what follows we evaluate the performance of the above described synthetic wellbeing indicators in terms of: i) regional rankings and econometric significance in ii) regional level and iii) individual level estimates.

5.1 Rankings

In Tables 6.1-6.3 we present rankings of different regions based on different composite indicators compared to ranking of regions based on regional income per capita. We can divide regions between *relative* (vis-à-vis income) *wellbeing winners* and *relative wellbeing losers*. The former (latter) are those ranking higher (lower) in terms of multidimensional wellbeing indicators than of per capita income. The strongest rank progress among winners is realized by Friuli-Venezia-Giulia that jumps from the 7th to the 2nd place according to the different composite wellbeing indicators. Other winners are Veneto (from tenth to third place in 2013 and from ninth to third and fifth in 2014 and 2015 respectively, according to the different synthetic indicators considered), Marche and Tuscany. Among the losers we find Lazio, Lombardia, Emilia-Romagna, Liguria and Valle d'Aosta.

More in detail we find that, among *relative wellbeing winners*, Friuli Venezia Giulia's performance is explained by high scores in Education and Training, Social Relationships, Natural and Cultural

[12] We use the command *ipfweight* in Stata in order to implement the trimming method during the raking iterative process.

[13] The combined use of simple and Adjusted Mazziotta-Pareto Indexes (AMPI) follows the Istat approach in BES Report 2015. The AMPI is based on a min-max standardization of elementary indicators that makes the indicators independent from variability of their value ranges and suitable for absolute comparisons. The additional peculiarity of this index is given by the choice of penalizing statistical units that, within the single domain, show a high variability among the primary indicators taken into consideration "the penalty is based on the coefficient of variation and is nothing if all the values are equal. The aim is to foster unity, to the mean value equal, have a greater balance between the various indicators "(Istat, 2015: 53) (for further details see the MPI formula in Appendix 2)..

Heritage, Environment and Economic Wellbeing, Basilicata's performance by high scores in Safety, Environment and Natural and Cultural Heritage, while Veneto is outstanding in Work Life Balance, Social Relationships, Natural and Cultural Heritage, Environment, Quality of Services and Economic Well-being. Among relative wellbeing losers Lazio has low rankings in Health, Social Relationships, Safety and Environment; Liguria in Social Relationships, Natural and Cultural Heritage, Environment and Research and Innovations; Sicily, while having good rank in Safety, has low rank in Education and Training and Economic Well-being; Valle d'Aosta in Health, Education, Politics and Institutions, Research and Innovation and Quality of Services.

Following Giovannini et al. (2008) we perform a sensitivity analysis to test the robustness of our composite indicators[14]. More specifically, we remove, for each composite indicator, the Health domain and the Economic Well-being domain (namely the domains considered more important in the expenditure preference survey and having higher weights in factor analysis). We also recalculated all the composite indicators by replacing the arithmetic mean with the geometric mean. Results in Tables A.5 and A.6 show that previously described findings are robust to these changes.

To sum up what considered above, the inclusion of BES dimensions not directly related to economic wellbeing make some regions much better ranked than otherwise would be the case. To make an example quality of social relationships make relative wellbeing winners much better places to live than what should be thought under the picture of regional income.

In order to check whether our methodology for creating composite wellbeing indicators makes sense and the latter help to create rankings reflecting better citizens' satisfaction we need external validation criteria. The external criterion that we select is represented by the explanatory power of composite wellbeing indicators on average regional subjective wellbeing once standard income per capita at regional level has been accounted for.

5.2 Econometric findings: estimates at regional level

We perform our empirical test on pooled estimates with the following specification

$$LS_{i,t} = \alpha_0 + \alpha_1 EconWB_{\ i,t} + \beta_1 CWB_{i,t}^{j} + \sum DYear + \varepsilon_{i.t} \quad (1)$$

where LS is the i-th region life satisfaction level measured in the year t as the average of respondents' answers to the standard question (*Currently, how much satisfied are you about your life overall? Give a score from 0 to 10 (0 means not at all satisfied, 10 very satisfied*) in the ISTAT regionally representative sample of Italian population. The *EconWB* variable is, in turn, regional GDP per capita in estimates reported in Table 7.1 and per capita disposable income at regional level in estimates reported in Table

[14] You can also see Saltelli et al. (2004) and Saisana et al. (2005) for more details on the uncertainty and sensitivity analysis.

7.2, while CWB^j is the j-th composite wellbeing indicator also measured at regional level at time t. Year dummies are included. The regression is estimated with robust standard errors.

Our null hypothesis of irrelevance of multidimensional wellbeing indicators is obviously H_0: $\beta_1=0$

The choice of two different economic wellbeing indicators has the following logic. We first start from the classical GDP variable and then test our hypothesis of the relevance of a broader concept of wellbeing against the more severe benchmark of per capita disposable income that amends some of the GDP limits in representing economic wellbeing of respondents but still does not cover non economic wellbeing dimensions.[15]

In order to test our hypothesis we first estimate the simplest "economic wellbeing -only" model and, in a second step, the augmented model with the composite wellbeing indicator. The null is rejected in the expected direction if the coefficient of the latter is positive and significant in the augmented specification or, equivalently, if the F-test on nested models (the simple and the augmented) rejects the null of insignificance of the added regressor.

In rows of Tables 7.1 and 7.2 we display findings for each of the composite wellbeing indicators separately taken (β_1 coefficient and significance and F-test on nested hypothesis) against the regional GDP (Table 7.1) and the regional disposable income (Table 7.2).

The first row in Table 7.1 presents the regional GDP-only estimate with the regional per capita disposable income plus year effects. The *Regional GDP* variable is significant. From the second row on we introduce our composite wellbeing indicators (one for each separate regression) in order to test whether the j-th indicator is significant and adds goodness of fit in the augmented specification. Results do not change substantially when we replace the regional GDP with regional disposable income in Table 7.2.

The best performing indicator in both estimates presented in Tables 7.1 and 7.2 is the composite BES indicator corrected with principal component weights addressing the problem of statistical redundancy (*StatisticallyWeightedBES* in column 2). The second best indicator is that corrected with both statistical and survey preference weights *(Stat&SurveyWeightedBES)*. The third best indicator is the indicator where the relative importance of BES domains depends on survey respondents average preference weights (*SurveyWeightedBES)*. Note as well that the income indicator in Table 7.2 is no more significant when we introduce the synthetic BES indicator. To give an idea of the economic significance of our findings the estimated composite wellbeing coefficient in Table 7.1, row 5 implies that a ten percent change in the BES indicator from its mean value would produce a 0.15 change in life satisfaction that corresponds to 3/5 of its standard deviation. The effect is twice as much and therefore above one standard deviation if we consider coefficient of Table 7.2, column 5.

[15] Note as well that in the regional GDP estimate 2015 data are missing since the variable is still not available from Italian Statistical Institute at the moment in which we write the paper.

5.2 Econometric findings: estimates at individual level

The limit of this approach lies in the difficulty of controlling for several concurring factors that can affect life satisfaction at individual level (even though such factors can level out in average regional data). An alternative test lies in taking a much larger sample of individual observations for the same years and estimating the following specification. We do so for a specific representative sample of the Italian population of individuals aged above 50[16]

$$(2)\quad LifeSat_{tj} = \alpha_0 + \alpha_1 CWB_{t-1} + \alpha_2 LogPerCapitaIncome_{t-1} + \alpha_3 Male_{t-1} + \alpha_4 Age_{t-1} + \alpha_3 EduYears_{t-1} + \alpha_6 WithPartner_{t-1} + \alpha_9 Divorced_{t-1} + \alpha_5 Widowed_{t-1} + \alpha_7 ChildrenNear_{t-1} + \alpha_8 Retired_{t-1} + \alpha_9 Employed_{t-1} + \sum_m \lambda_m DRegion_{t-1} + \varepsilon_t$$

where the dependent variable is the standard life satisfaction question (the same as in (1) but measured for each individual and not as a regional average), *CWB* is the selected composite wellbeing indicator (in the base specification the statistically and survey weighted measure or *Stat&SurveyWeightedBES*), *Male* is a (0/1) gender dummy for male respondents, *Age* captures respondent's age, *LogPerCapitaIncome* is the log of household per capita income, *EduYears* is the number of the respondent's education years, while *Widowed, Divorced* and *WithPartner* are three dummies picking up the three marital status conditions respectively. *ChildrenNear* measures the number of children that live in proximity of the respondent house, while *Retired* and *Employed* are two (0/1) dummies picking up the respective conditions. Regional dummies are included in the specification and the model is estimated with robust standard errors.

Table 8.1 shows the complete results of the regression carried out using the *Stat&SurveyWeightedBES* indicators, while Table 8.2 provides a robustness check with findings when using alternatively all other synthetic wellbeing indicators.

Results from estimating our model with different specifications, where we progressively introduce regressors up to the final fully augmented specification in (2), show that the composite wellbeing indicator is always positive and significant confirming its role in explaining life satisfaction (Table 8.1). Among other regressors living with partner, education and income are as expected positive, while indicators of health are all significant. In terms of economic significance a 10 percent change of the composite wellbeing indicator from its mean value would produce something more than a half

[16] The sample is taken from the "Survey of Health, Ageing and Retirement in Europe (SHARE)", a cross-national panel dataset collecting information on more than 45,000 Europeans aged 50 and over from representative sample of 12 European countries. The research is harmonized with the U.S. Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA). We choose this dataset for its richness of control and socio-demographic variables.

standard deviation change of the dependent variable if we consider the coefficient of the estimates in column 4. In Table 8.2 we report synthetically coefficients of all the other composite wellbeing indicators when they replace *Stat&SurveyWeightedBES* variable in (2). Composite wellbeing indicators are always positive and significant confirming that all our BES wellbeing aggregates capture life satisfaction components that are not captured by traditional income variables.

6. Conclusions

The acknowledgement of the possibility of decoupling between GDP and subjective wellbeing dynamics de facto implies that GDP cannot be considered as a sufficiently informative synthetic measure of citizens' and voters' satisfaction. This fact increased the interest of academicians and policymakers around the construction of composite wellbeing indicators. In this paper we directly test whether such indicators have additional explanatory power in predicting subjective wellbeing beyond GDP. In doing so we exploit the richness of the institutional BES innovation in Italy and an ad hoc survey on expenditure preference weights. Based on these two sources of information we build a rich set of composite indicators in the methodological part of the paper combining different statistical and survey approaches to weight the different items.

Our empirical findings show that the constructed composite wellbeing indicators have additional and significant predictive power beyond GDP. Their introduction improves goodness of fit in regional and individual level estimates. These findings show that the poor performance of GDP (and even income) in capturing citizen's subjective wellbeing and ultimately voters' preferences is not only due to factors such as shifts in expectations or relatively higher expected wellbeing of opposition parties at elections. Our results illustrate that part of the decoupling may be overcome by using composite BES indicators. This conclusion obviously comes with the challenge of identifying the correct weights for each individual component of the composite indicator. In this paper we propose some methodological choices to the purpose based on statistical or survey value weight approaches and demonstrate that the alternative weighting options produce results which are broadly similar. Overall, our findings can help to build consensus on the definition of aggregate synthetic wellbeing measures to be used by policymakers in evaluating impact of policies on citizens' wellbeing.

Table 1 Descriptive statistics of the standardized BES indicators used in the factor analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
Life expectancy at birth	60	107.485	12.744	70	130
Healthy life expectancy at birth	60	98.476	13.163	70	130
Physical Component Summary (PCS)	60	106.179	15.214	70	130
Mental Component Summary (MCS)	60	96.125	12.994	70	130
Infant mortality rate	60	96.747	12.897	70	130
Traffic accidents	60	103.910	11.061	70	130
Cancer mortality rate	60	103.901	14.799	70	130
Mortality rate for dementia	60	106.000	12.455	70	130
Life expectancy without activity limitations at 65 years of age	60	102.625	16.949	70	130
Overweight or obesity	60	101.666	16.683	70	130
Smoking	60	106.329	11.766	70	130
Alcohol consumption	60	101.592	14.169	70	130
Sedentariness	60	98.066	15.433	70	130
Nutrition	60	101.793	13.094	70	130
Participation in early childhood education	60	108.873	12.598	70	130
Percentage of people aged 25-64 having completed at least upper secondary education	60	100.023	15.234	70	130
Percentage of people aged 30-34 having completed tertiary education	60	97.682	14.429	70	130
Percentage of early leavers (aged 18-24) from education and training	60	104.868	15.016	70	130
Percentage of people aged 15-29 not in education, employment, or training (NEET)	60	104.560	15.993	70	130
Percentage of people aged 25-64 participating in formal or non-formal education	60	90.566	12.768	70	130
Level of literacy	60	102.362	18.496	70	130
Level of numeracy	60	103.006	15.689	70	130
Percentage of people aged 16 and over with high level of ICT competencies	60	99.256	14.651	70	130
Synthetic indicator of the level of cultural participation	60	95.845	15.805	70	130
Employment rate of people 20-64 years old	60	104.836	19.613	70	130
Rate of non-attendance at work	60	106.136	17.915	70	130
Share of employed persons with temporary jobs for at least 5 years	60	109.666	13.989	70	130
Share of employees with below 2/3 of median hourly earning	60	110.812	16.771	70	130
Share of over-qualified employed persons	60	98.821	12.825	70	130
Incidence rate of fatal occupational injuries or injuries leading to permanent disability	60	102.835	14.980	70	130
Share of employed persons not in regular occupation	60	110.993	14.810	70	130
Ratio of employment rate for women with children to women without children	60	102.925	14.336	70	130
Share of population aged 15-64 years that work over 60 hours per week	60	96.359	19.132	70	130
Transition rate (12 month time-distance) from non-standard to standard employment	60	95.272	14.508	70	130

Per capita disposable income	60	101.270	19.975	70	130
Disposable income inequality	60	113.946	12.732	70	130
People at risk of relative poverty	60	110.991	16.781	70	130
Severely materially deprived people	60	112.923	13.309	70	130
People suffering poor housing conditions	60	106.636	13.256	70	130
Index of subjective evaluation of economic distress	60	111.942	13.267	70	130
People living in jobless households	60	110.241	17.017	70	130
Satisfaction with family relationship	60	101.460	14.186	70	130
Satisfaction with friendship relationship	60	97.838	13.328	70	130
Percentage of people of 14 years and over which have people which they can count	60	107.739	13.653	70	130
Synthetic indicator of social participation	60	93.302	12.825	70	130
Volunteer work	60	87.061	13.347	70	130
Association funding	60	92.140	13.363	70	130
Non-profit organizations per 10,000 inhabitants	60	94.181	14.538	70	130
Civic and political participation	60	102.951	16.546	70	130
Voter turnout	60	100.962	15.732	70	130
Trust in the parliament	60	100.792	15.279	70	130
Trust in local institutions	60	92.936	13.231	70	130
Trust in other institutions	60	105.312	14.169	70	130
Women and political representation in Parliament	60	103.320	14.087	70	130
Women and political representation at regional level	60	94.537	13.200	70	130
Length of civil proceedings of ordinary cognisance	60	107.732	16.076	70	130
Homicide rate	60	112.200	11.959	70	130
Burglary rate	60	108.010	12.280	70	130
Pick-pocketing rate	60	112.815	13.782	70	130
Robbery rate	60	112.927	14.667	70	130
Physical violence rate	60	94.380	14.790	70	130
Sexual violence rate	60	94.318	16.249	70	130
Domestic violence rate	60	98.270	12.893	70	130
Worries of sexual crime rate:	60	96.783	16.633	70	130
Social decay (or incivilities) rate	60	108.221	15.596	70	130
Current expenditure of Municipalities for the management of cultural heritage	60	90.683	15.706	70	130
Index of illegal construction	60	112.421	17.167	70	130
Urbanisation rate of areas subject to building restriction	60	120.431	15.241	70	130
Erosion of farmland	60	95.429	12.421	70	130
Presence of historic rural landscapes	60	85.857	14.233	70	130
Quality assessment of Regional programmes for rural development	60	102.160	14.286	70	130
Conservation of historic urban fabric	60	100.693	11.720	70	130
Presence of Historic Parks/Gardens and other Urban Parks	60	86.129	16.458	70	130
Quality of water	60	97.021	14.889	70	130
Quality of urban air	60	114.972	14.480	70	130
Urban parks and gardens	60	77.295	14.316	70	130
Concern for biodiversity loss	60	94.818	14.293	70	130
Energy from renewable sources	60	78.850	12.264	70	130
Waste in landfills	60	109.057	15.581	70	130

separate collection of municipal waste	60	100.318	16.997	70	130
Research intensity	60	94.286	15.008	70	130
Patent propensity	60	87.796	15.847	70	130
Percentage of knowledge workers on total employment	60	92.693	11.534	70	130
Innovation rate of the national productive system	60	102.601	16.137	70	130
Percentage of product innovators	60	95.491	15.655	70	130
Productive specialization in high-tech and knowledge intensive sectors	60	87.540	12.587	70	130
Internet use	60	105.552	16.189	70	130
Beds in residential health care facilities	60	90.469	12.720	70	130
Citizens who benefit from infancy services	60	96.092	15.868	70	130
Elders who benefit from home assistance	60	89.219	12.944	70	130
Irregularity in electric power distribution	60	112.084	15.682	70	130
Percentage of population served by natural gas	60	110.863	16.017	70	130
Irregularity in water supply	60	112.645	14.733	70	130
Prison density per 100 places	60	106.299	13.551	70	130
Time devoted to mobility	60	92.950	12.845	70	130
Density of urban public transport networks	60	89.027	14.867	70	130
Composite index of service accessibility	60	103.227	16.482	70	130

Table 2. Diagnostic checks on principal component analysis

	Before			After		
Domain	Det	BTS	KMO	Det	BTS	KMO
Health	0.000	Chi-square = 606.573 Degrees of freedom = 91 p-value = 0.000	0.754			
Education and Training	0.000	Chi-square = 615.790 Degrees of freedom = 45 p-value = 0.000	0.758			
Work and Life Balance	0.000	Chi-square = 629.320 Degrees of freedom = 45 p-value = 0.000	0.831			
Economic Wellbeing	0.000	Chi-square = 490.846 Degrees of freedom = 21 p-value = 0.000	0.859			
Social Relationships	0.000	Chi-square = 637.130 Degrees of freedom = 28 p-value = 0.000	0.866			
Politics and institutions	0.002	Chi-square = 360.103 Degrees of freedom = 36 p-value = 0.000	**0.502**	0.034	Chi-square = 188.172 Degrees of freedom = 21 p-value = 0.000	0.620
Safety	0.007	Chi-square = 286.172 Degrees of freedom = 36 p-value = 0.000	0.607			
Natural and Cultural Heritage	0.034	Chi-square = 196.788 Degrees of freedom = 36 p-value = 0.000	**0.594**	0.063	Chi-square = 153.263 Degrees of freedom = 28 p-value = 0.000	0.660
Environment	0.164	Chi-square = 105.725 Degrees of freedom = 28 p-value = 0.000	**0.453**	0.102	Chi-square = 127.274 Degrees of freedom = 21 p-value = 0.000	0.612
Research and Innovation	0.008	Chi-square = 284.289 Degrees of freedom = 21 p-value = 0.000	0.679			

Quality of Services	0.001	Chi-square = 407.921 Degrees of freedom = 55 p-value = 0.000	0.649	0.015	Chi-square = 231.158 Degrees of freedom = 36 p-value = 0.000	0.649

Legend: Det: Determinant of the correlation matrix; BTS: Bartlett test of sphericity (H0: variables are not intercorrelated); KMO: Kaiser-Meyer-Olkin Measure of Sampling Adequacy.

Table 3. Cronbach's Alpha of the diferent BES domains

Domain	Average Inter-item Covariance	Cronbach's Alpha
Health	67.629	0.882
Education and Training	114.378	0.909
Work and Life Balance	112.684	0.886
Economic Wellbeing	162.842	0.939
Social Relationships	136.381	0.948
Politics and institutions	54.970	0.709
Safety	58.806	0.781
Natural and Cultural Heritage	48.686	0.697
Environment	39.689	0.610
Research and Innovation	90.326	0.831
Quality of Services	70.165	0.830

Table 4 Comparison of weights attached to the individual BES indicators under the different (statistical and survey weighted) methodologies

Domain	Indicator	Survey Weights	Survey recalibrated weights	Statistical Weights by FA	Survey+statistical Weights	Survey + statistical recalibrated Weights
Health						
	Life expectancy at birth	1.00	1.00	1.13	1.07	1.07
	Healthy life expectancy at birth	1.38	1.36	1.70	1.54	1.53
	Physical Component Summary (PCS)	1.43	1.38	1.94	1.68	1.66
	Mental Component Summary (MCS)	1.78	1.74	2.00	1.89	1.87
	Infant mortality rate	1.42	1.42	1.44	1.43	1.43
	Traffic accidents	1.40	1.42	1.67	1.54	1.55
	Cancer mortality rate	2.00	2.00	1.73	1.86	1.86
	Mortality rate for dementia	1.30	1.28	1.00	1.15	1.14
	Life expectancy without activity limitations at 65 years of age	1.50	1.54	1.83	1.67	1.69
	Overweight or obesity	1.19	1.18	1.48	1.34	1.33
	Smoking	1.31	1.30	1.37	1.34	1.34
	Alcohol consumption	1.38	1.43	1.15	1.26	1.29
	Sedentariness	1.29	1.27	1.52	1.40	1.39
	Nutrition	1.55	1.55	1.05	1.30	1.30
Education and Training						
	Participation in early childhood education	1.02	1.06	1.38	1.20	1.22
	Percentage of people aged 25-64 having completed at least upper secondary education	1.08	1.12	1.60	1.34	1.36

	Percentage of people aged 30-34 having completed tertiary education	1.03	1.05	1.74	1.39	1.40
	Percentage of early leavers (aged 18-24) from education and training	1.44	1.47	1.49	1.47	1.48
	Percentage of people aged 15-29 not in education, employment, or training (NEET)	1.66	1.69	1.80	1.73	1.74
	Percentage of people aged 25-64 participating in formal or non-formal education	1.60	1.60	1.12	1.36	1.36
	Level of literacy	1.51	1.49	2.00	1.76	1.75
	Level of Numeracy	1.00	1.00	1.60	1.30	1.30
	Percentage of people aged 16 and over with high level of ICT competencies	1.13	1.14	1.00	1.06	1.07
	Synthetic indicator of the level of cultural participation	2.00	2.00	1.68	1.84	1.84
Work life balance						
	Employment rate of people 20-64 years old	1.00	1.00	2.00	1.50	1.50
	Rate of non-attendance at work	1.33	1.32	1.98	1.66	1.65
	Share of employed persons with temporary jobs for at least 5 years	1.35	1.30	1.00	1.17	1.15
	Share of employees with below 2/3 of median hourly earning	1.91	1.89	1.96	1.94	1.92
	Share of over-qualified employed persons	1.33	1.13	1.76	1.54	1.45
	Incidence rate of fatal occupational injuries or injuries leading to permanent disability	1.76	1.67	1.43	1.60	1.55
	Share of employed persons not in regular occupation	1.62	1.65	1.90	1.76	1.77
	Ratio of employment rate for women with children to women without children	2.00	2.00	1.35	1.68	1.68
	Share of population aged 15-64 years that work over 60 hours per week	1.29	1.50	1.86	1.58	1.68
	Transition rate (12 month time-distance) from non-standard to standard employment	1.21	1.23	1.24	1.23	1.24
Economic well-being						
	Per capita disposable income	1.00	1.00	1.21	1.11	1.11
	Disposable income inequality	1.11	1.14	1.16	1.14	1.15
	People at risk of relative poverty	1.59	1.59	1.92	1.75	1.76
	Severely materially deprived people	2.00	2.00	1.38	1.69	1.69
	People suffering poor housing conditions	1.08	1.09	2.00	1.54	1.55
	Index of subjective evaluation of economic distress	1.66	1.74	1.00	1.33	1.37
	People living in jobless households	1.29	1.29	1.72	1.51	1.50
Social relationships						

	Satisfaction with family relationship	1.11	1.14	2.00	1.55	1.57
	Satisfaction with friendship relationship	1.00	1.00	2.00	1.50	1.50
	Percentage of people of 14 years and over which have people which they can count	1.25	1.28	1.82	1.54	1.55
	Synthetic indicator of social participation	2.00	2.00	1.21	1.61	1.61
	Volunteer work	1.76	1.81	1.13	1.45	1.47
	Association funding	1.66	1.63	1.26	1.46	1.44
	Non-profit organizations per 10,000 inhabitants	1.71	1.75	1.03	1.37	1.39
	Civic and political participation	1.28	1.31	1.00	1.14	1.15
Politics and institutions						
	Voter turnout	1.00	1.00	1.00	1.00	1.00
	Trust in the parliament	1.31	1.38	1.95	1.63	1.66
	Trust in local institutions	1.42	1.43	1.97	1.69	1.70
	Trust in other institutions	1.17	1.24	1.88	1.52	1.56
	Women and political representation in Parliament	1.13	1.14	2.00	1.56	1.57
	Women and political representation at regional level	1.07	1.02	1.01	1.04	1.01
	Length of civil proceedings of ordinary cognisance	2.00	2.00	1.83	1.92	1.92
Safety						
	Homicide rate	1.17	1.18	1.00	1.09	1.09
	Burglary rate	1.20	1.24	1.60	1.40	1.42
	Pick-pocketing rate	1.00	1.00	1.72	1.36	1.36
	Robbery rate	1.19	1.19	1.64	1.41	1.41
	Physical violence rate	1.50	1.49	1.32	1.41	1.40
	Sexual violence rate	1.51	1.50	1.90	1.71	1.70
	Domestic violence rate	1.58	1.58	2.00	1.79	1.79
	Worries of sexual crime rate:	1.17	1.14	1.48	1.33	1.31
	Social decay (or incivilities) rate	2.00	2.00	1.52	1.76	1.76
Natural and Cultural heritage						
	Current expenditure of Municipalities for the management of cultural heritage	1.20	1.16	1.66	1.43	1.41
	Index of illegal construction	1.47	1.45	1.84	1.65	1.65
	Urbanisation rate of areas subject to building restriction	1.56	1.57	1.00	1.28	1.28
	Erosion of farmland	1.00	1.00	1.60	1.30	1.30
	Presence of historic rural landscapes	1.60	1.52	1.73	1.67	1.63
	Quality assessment of Regional programmes for rural development	1.56	1.46	1.10	1.33	1.28
	Conservation of historic urban fabric	1.72	1.55	1.43	1.58	1.49
	Presence of Historic Parks/Gardens and other Urban Parks	2.00	2.00	2.00	2.00	2.00
Environment						

	Quality water	1.17	1.00	2.00	1.59	1.50
	Quality of urban air	1.43	1.31	1.00	1.21	1.16
	Urban parks and gardens	1.48	1.35	1.97	1.73	1.66
	Concern for biodiversity loss	1.27	1.05	1.23	1.25	1.14
	Energy from renewable sources	2.00	1.10	1.81	1.90	1.45
	waste in landfill	1.00	2.00	1.95	1.48	1.98
	separate collection of municipal waste	1.89	1.84	1.94	1.91	1.89
Research and Innovation						
	Research intensity	1.22	1.22	1.00	1.11	1.11
	Patent propensity	1.00	1.00	1.60	1.30	1.30
	Percentage of knowledge workers on total employment	1.42	1.42	1.92	1.67	1.67
	Innovation rate of the national productive system	1.79	1.74	2.00	1.90	1.87
	Percentage of product innovators	1.82	1.72	1.98	1.90	1.85
	Productive specialization in high-tech and knowledge intensive sectors	2.00	2.00	1.92	1.96	1.96
	Internet use	1.47	1.43	1.56	1.51	1.49
Quality of Services						
	Beds in residential health care facilities	1.17	1.16	1.96	1.56	1.56
	Citizens who benefit from infancy services	1.50	1.57	1.68	1.59	1.62
	Elders who benefit from home assistance	1.82	1.91	2.00	1.91	1.95
	Irregularity in electric power distribution	1.00	1.00	1.76	1.38	1.38
	Percentage of population served by natural gas	1.02	1.00	1.03	1.03	1.02
	Irregularity in water supply	1.17	1.18	1.52	1.34	1.35
	Prison density per 100 places	1.74	1.78	1.54	1.64	1.66
	Time devoted to mobility	1.38	1.39	1.00	1.19	1.19
	Density of urban public transport networks	1.95	2.00	1.42	1.68	1.71
	Composite index of service accessibility	1.51	1.51	1.85	1.68	1.68
Overall						
	Health	2.00	2.00	1.88	1.94	1.94
	Education and Training	1.76	1.63	1.97	1.87	1.80
	Work and Life Balance	1.51	1.46	1.88	1.69	1.67
	Economic Wellbeing	1.46	1.56	2.00	1.73	1.78
	Social Relationships	1.26	1.25	1.73	1.50	1.49
	Politics and institutions	1.00	1.00	1.00	1.00	1.00
	Safety	1.24	1.27	1.99	1.62	1.63
	Natural and Cultural Heritage	1.28	1.26	1.71	1.50	1.48
	Environment	1.36	1.30	1.34	1.35	1.32
	Research and Innovation	1.37	1.32	1.80	1.58	1.56
	Quality of Services	1.31	1.27	1.96	1.64	1.61

Legend. FQTS recalibrated weights: survey respondents' weights adjusted to make the FQTS sample representative of the Italian population. For details on weight construction see Appendix 2. For details on recalibration see section 4.

Table 5.1 Variable legend of composite indicators

Our Composite indicators	Description
UnWeightedBES	Aggregate equitable and sustainable well-being index calculated as unweighted average
SurveyWeightedBES	Aggregate equitable and sustainable well-being index calculated as average weighted with the budget allocation process
StatisticallyWeightedBES	Aggregate equitable and sustainable well-being index calculated as average weighted with factor analysis
Stat&SurveyWeightedBES	Aggregate equitable and sustainable well-being index calculated as average weighted with budget allocation process and factor analysis
UnWeightedBES(MPI)	Aggregate equitable and sustainable well-being index calculated as Mazziotta Pareto Index
SurveyWeightedBES(MPI)	Aggregate equitable and sustainable well-being index calculated as Mazziotta Pareto Index weighted with budget allocation process
StatisticallyWeightedBES(MPI)	Aggregate equitable and sustainable well-being index calculated as Mazziotta Pareto Index weighted with factor analysis
Stat&SurveyWeightedBES (MPI)	Aggregate equitable and sustainable well-being index calculated as Mazziotta Pareto Index weighted with budget allocation process and factor analysis

For details on the construction of the indexes see Appendix 2

Table 5.2 Descriptive findings on composite indicators

Variable	Obs	Mean	Std. Dev.	Min	Max
UnWeightedBES	60	100.843	7.509	86.800	113.223
SurveyWeightedBES	60	101.048	7.651	86.044	113.728
StatisticallyWeightedBES	60	100.928	7.732	86.330	113.660
Stat&SurveyWeightedBES	60	100.959	7.687	86.177	113.648
UnWeightedBES(MPI)	60	98.448	7.499	84.071	110.592
SurveyWeightedBES(MPI)	60	98.673	7.797	83.422	110.945
StatisticallyWeightedBES(MPI)	60	98.548	7.850	83.797	110.975
Stat&SurveyWeightedBES (MPI)	60	98.579	7.816	83.598	110.913

Table 6.1 Regional wellbeing ranks based on different wellbeing indicators (2013)

Region	Year	Per capita income	UWB	SuWB	StWB	SSWB	UW(MPI)	SuWB (MPI)	StWB (MPI)	SSWB (MPI)	Min rank	Max rank	St.Dev	Average rank	Average rank difference (BES-income)
Trentino-Alto Adige/Südtirol	2013	1	1	1	1	1	1	1	1	1	1	1	0.00	1.00	0.00
Lombardia	2013	2	5	4	4	4	4	5	4	4	4	5	0.46	4.25	2.25
Emilia-Romagna	2013	3	4	5	5	5	5	4	5	5	4	5	0.46	4.75	1.75
Liguria	2013	4	8	8	8	8	7	8	8	8	7	8	0.35	7.88	3.88
Valle d'Aosta/Vallée d'Aoste	2013	5	6	6	6	6	8	7	7	7	6	8	0.74	6.63	1.63
Piemonte	2013	6	7	7	7	7	6	6	6	6	6	7	0.53	6.50	0.50
Friuli-Venezia Giulia	2013	7	2	2	2	2	2	2	2	2	2	2	0.00	2.00	-5.00
Lazio	2013	8	13	13	13	13	13	13	13	13	13	13	0.00	13.00	5.00
Toscana	2013	9	10	10	9	9	9	9	9	9	9	10	0.46	9.25	0.25
Veneto	2013	10	3	3	3	3	3	3	3	3	3	3	0.00	3.00	-7.00
Umbria	2013	11	9	9	10	10	10	10	10	10	9	10	0.46	9.75	-1.25
Italia	2013	12	12	12	12	12	12	12	12	12	12	12	0.00	12.00	0.00
Marche	2013	13	11	11	11	11	11	11	11	11	11	11	0.00	11.00	-2.00
Abruzzo	2013	14	14	14	14	14	14	14	14	14	14	14	0.00	14.00	0.00
Molise	2013	15	16	16	16	16	16	16	16	16	16	16	0.00	16.00	1.00
Sardegna	2013	16	15	15	15	15	15	15	15	15	15	15	0.00	15.00	-1.00
Puglia	2013	17	18	18	18	18	18	18	18	18	18	18	0.00	18.00	1.00
Sicilia	2013	18	21	21	21	21	21	21	21	21	21	21	0.00	21.00	3.00
Campania	2013	19	20	19	20	20	19	19	20	20	19	20	0.52	19.63	0.63
Basilicata	2013	20	17	17	17	17	17	17	17	17	17	17	0.00	17.00	-3.00
Calabria	2013	21	19	20	19	19	20	20	19	19	19	20	0.52	19.38	-1.63

Legend: UWB: Unweighted BES; SuWB: Survey Weighted BES; StWB: statistically weighted BES; SSWB: Statistically and survey weighted BES; MPI: Mazziotta-Pareto index.

Table 6.2 Regional wellbeing ranks based on different wellbeing indicators (2014)

Region	Year	income per capita	UWB	SuWB	StWB	SSWB	UW(MPI)	SuWB (MPI)	StWB (MPI)	SSWB (MPI)	Min rank	Max rank	St.Dev	Average rank	Average rank difference (BES-income)
Trentino-Alto Adige/Südtirol	2014	1	1	1	1	1	1	1	1	1	1	1	0.00	1.00	0.00
Lombardia	2014	2	3	4	3	4	3	4	3	3	3	4	0.52	3.38	1.38
Emilia-Romagna	2014	3	5	5	5	5	4	5	5	5	4	5	0.35	4.88	1.88
Liguria	2014	4	11	11	10	10	9	10	9	9	9	11	0.83	9.88	5.88
Valle d'Aosta/Vallée d'Aoste	2014	5	7	7	6	6	7	8	7	7	6	8	0.64	6.88	1.88
Piemonte	2014	6	6	6	7	7	6	6	6	6	6	7	0.46	6.25	0.25
Friuli-Venezia Giulia	2014	7	2	2	2	2	2	2	2	2	2	2	0.00	2.00	-5.00
Toscana	2014	8	8	8	8	8	8	7	8	8	7	8	0.35	7.88	-0.13
Veneto	2014	9	4	3	4	3	5	3	4	4	3	5	0.71	3.75	-5.25
Lazio	2014	10	12	12	13	12	13	13	13	13	12	13	0.52	12.63	2.63
Umbria	2014	11	9	9	9	9	10	9	10	10	9	10	0.52	9.38	-1.63
Marche	2014	12	10	10	11	11	11	11	11	11	10	11	0.46	10.75	-1.25
Italia	2014	13	13	13	12	13	12	12	12	12	12	13	0.52	12.38	-0.63
Abruzzo	2014	14	14	14	14	14	14	14	14	14	14	14	0.00	14.00	0.00
Sardegna	2014	15	15	15	15	15	15	15	15	15	15	15	0.00	15.00	0.00
Molise	2014	16	16	16	16	16	16	16	16	16	16	16	0.00	16.00	0.00

Puglia	2014	17	18	18	18	18	18	18	18	18	18	18	0.00	18.00	1.00
Sicilia	2014	18	21	21	21	21	21	21	21	21	21	21	0.00	21.00	3.00
Basilicata	2014	19	17	17	17	17	17	17	17	17	17	17	0.00	17.00	-2.00
Campania	2014	20	20	20	20	20	19	19	20	19	19	20	0.52	19.63	-0.38
Calabria	2014	21	19	19	19	19	20	20	19	20	19	20	0.52	19.38	-1.63

Legend: UWB: Unweighted BES; SuWB: Survey Weighted BES; StWB: statistically weighted BES; SSWB: Statistically and survey weighted BES; MPI: Mazziotta-Pareto index.

Table 6.3 Regional wellbeing ranks based on different wellbeing indicators (2014)

Region	Year	income per capita	UWB	SuWB	StWB	SSWB	UW(MPI)	SuWB (MPI)	StWB (MPI)	SSWB (MPI)	Min rank	Max rank	St.Dev.	Average rank	Average rank difference (BES-income)
Trentino-Alto Adige/Südtirol	2015	1	1	1	1	1	1	1	1	1	1	1	0.00	1.00	0.00
Lombardia	2015	2	5	4	4	4	3	4	3	4	3	5	0.64	3.88	1.88
Emilia-Romagna	2015	3	4	5	5	5	4	5	5	5	4	5	0.46	4.75	1.75
Liguria	2015	4	9	9	9	9	8	8	8	8	8	9	0.53	8.50	4.50
Valle d'Aosta/Vallée d'Aoste	2015	5	8	8	8	8	9	11	9	9	8	11	1.04	8.75	3.75
Piemonte	2015	6	6	6	6	6	6	6	6	6	6	6	0.00	6.00	0.00
Friuli-Venezia Giulia	2015	7	2	2	2	2	2	2	2	2	2	2	0.00	2.00	-5.00
Toscana	2015	8	7	7	7	7	7	7	7	7	7	7	0.00	7.00	-1.00

Veneto	2015	9	3	3	3	3	5	3	4	3	3	5	0.74	3.38	-5.63
Lazio	2015	10	12	12	12	12	13	13	13	13	12	13	0.53	12.50	2.50
Marche	2015	11	10	10	10	10	10	9	11	10	9	11	0.53	10.00	-1.00
Umbria	2015	12	11	11	11	11	11	10	10	11	10	11	0.46	10.75	-1.25
Italia	2015	13	13	13	13	13	12	12	12	12	12	13	0.53	12.50	-0.50
Abruzzo	2015	14	14	14	14	14	14	14	14	14	14	14	0.00	14.00	0.00
Sardegna	2015	15	15	15	15	15	15	15	15	15	15	15	0.00	15.00	0.00
Molise	2015	16	16	16	16	16	16	16	16	16	16	16	0.00	16.00	0.00
Puglia	2015	17	18	18	18	18	18	18	18	18	18	18	0.00	18.00	1.00
Sicilia	2015	18	21	21	21	21	21	21	21	21	21	21	0.00	21.00	3.00
Basilicata	2015	19	17	17	17	17	17	17	17	17	17	17	0.00	17.00	-2.00
Campania	2015	20	20	20	20	20	19	19	20	20	19	20	0.46	19.75	-0.25
Calabria	2015	21	19	19	19	19	20	20	19	19	19	20	0.46	19.25	-1.75

Legend: UWB: Unweighted BES; SuWB: Survey Weighted BES; StWB: statistically weighted BES; SSWB: Statistically and survey weighted BES; MPI: Mazziotta-Pareto index.

Table 6.4 Regional ranking over specific BES domains (Stat&SurveyWeightedBES indicator)

Region	Year	Income per capita	Health	Ed. and Training	Work and Life Balance	Ec. Well-Being	Social Relationships	Politics and Inst.	Safety	Natural and Cultural Heritage	Envir.	Res. and Innov.	Quality of Services	Min rank	Max rank	St. Dev.	Avg rank	Avg rank diff.
Abruzzo	2013	13	11	10	13	14	15	8	9	17	6	12	14	6	17	3.29	11.73	-1.27
Basilicata	2013	19	15	15	17	18	16	16	5	15	5	19	17	5	19	4.80	14.36	-4.64
Calabria	2013	20	19	18	20	17	17	20	6	20	14	16	19	6	20	4.09	16.91	-3.09
Campania	2013	18	20	19	18	19	20	15	19	16	15	14	18	14	20	2.16	17.55	-0.45
Emilia-Romagna	2013	3	6	2	6	4	6	2	17	6	11	2	1	1	17	4.71	5.73	2.73

Friuli-Venezia Giulia	2013	7	5	3	8	2	3	7	4	2	3	3	3	2	8	1.97	3.91	-3.09
Lazio	2013	8	13	12	10	11	13	13	20	13	19	6	7	6	20	4.25	12.45	4.45
Liguria	2013	4	7	5	4	8	9	4	11	11	10	9	5	4	11	2.70	7.55	3.55
Lombardia	2013	2	3	6	2	6	5	5	15	8	7	1	2	1	15	3.88	5.45	3.45
Marche	2013	12	10	9	11	12	11	10	14	7	13	10	11	7	14	1.90	10.73	-1.27
Molise	2013	14	17	14	16	15	14	14	7	12	20	20	15	7	20	3.62	14.91	0.91
Piemonte	2013	6	8	8	7	10	7	3	16	3	12	4	6	3	16	3.93	7.64	1.64
Puglia	2013	16	16	16	14	16	19	18	18	18	17	18	16	14	19	1.45	16.91	0.91
Sardegna	2013	15	14	17	15	13	8	19	1	14	9	17	13	1	19	5.08	12.73	-2.27
Sicilia	2013	17	18	20	19	20	18	17	13	19	18	15	20	13	20	2.21	17.91	0.91
Toscana	2013	9	4	13	9	9	10	6	10	10	8	8	12	4	13	2.53	9.00	0.00
Trentino-Alto Adige/Südtirol	2013	1	1	1	5	1	1	1	2	4	1	7	10	1	10	3.08	3.09	2.09
Umbria	2013	11	12	7	12	7	12	11	12	1	16	13	9	1	16	4.02	10.18	-0.82
Valle d'Aosta/Vallée d'Aoste	2013	5	2	11	3	3	4	12	3	9	2	11	8	2	12	4.02	6.18	1.18
Veneto	2013	10	9	4	1	5	2	9	8	5	4	5	4	1	9	2.63	5.09	-4.91
Abruzzo	2014	13	14	13	10	12	13	9	8	16	9	11	15	8	16	2.64	11.82	-1.18
Basilicata	2014	18	17	15	16	17	15	20	4	15	6	19	16	4	20	5.01	14.55	-3.45
Calabria	2014	20	18	17	20	16	18	19	6	20	15	18	20	6	20	4.00	17.00	-3.00
Campania	2014	19	20	19	18	19	20	16	19	17	16	14	18	14	20	1.89	17.82	-1.18
Emilia-Romagna	2014	3	11	6	9	3	5	1	17	6	11	2	1	1	17	5.03	6.55	3.55
Friuli-Venezia Giulia	2014	7	10	2	8	4	2	8	5	2	2	3	3	2	10	2.91	4.45	-2.55
Lazio	2014	10	13	7	11	10	14	10	20	12	13	6	9	6	20	3.80	11.36	1.36
Liguria	2014	4	9	8	3	11	12	3	10	11	17	10	5	3	17	4.15	9.00	5.00
Lombardia	2014	2	6	3	1	2	6	7	15	8	8	1	2	1	15	4.20	5.36	3.36
Marche	2014	12	3	10	12	13	10	5	13	7	7	12	10	3	13	3.35	9.27	-2.73
Molise	2014	15	8	14	17	15	16	14	7	13	20	20	13	7	20	4.15	14.27	-0.73
Piemonte	2014	6	5	11	6	7	9	2	16	3	14	4	6	2	16	4.50	7.55	1.55
Puglia	2014	16	15	16	15	18	17	18	18	18	19	17	17	15	19	1.30	17.09	1.09
Sardegna	2014	14	16	18	14	14	11	17	1	14	5	16	14	1	18	5.24	12.73	-1.27

Sicilia	2014	17	19	20	19	20	19	15	14	19	18	15	19	14	20	2.17	17.91	0.91
Toscana	2014	8	2	12	7	8	4	4	11	10	10	7	11	2	12	3.34	7.82	-0.18
Trentino-Alto Adige/Südtirol	2014	1	1	1	5	1	1	6	3	4	1	8	8	1	8	2.84	3.55	2.55
Umbria	2014	11	7	4	13	9	8	11	12	1	12	13	7	1	13	3.89	8.82	-2.18
Valle d'Aosta/Vallée d'Aoste	2014	5	12	9	2	6	7	13	2	9	4	9	12	2	13	3.90	7.73	2.73
Veneto	2014	9	4	5	4	5	3	12	9	5	3	5	4	3	12	2.73	5.36	-3.64
Abruzzo	2015	13	14	13	12	14	14	12	17	16	7	12	14	7	17	2.60	13.18	0.18
Basilicata	2015	18	15	17	16	15	16	20	5	14	8	14	16	5	20	4.19	14.18	-3.82
Calabria	2015	20	19	16	20	18	17	19	2	20	14	20	20	2	20	5.29	16.82	-3.18
Campania	2015	19	20	19	18	19	20	13	19	15	11	13	18	11	20	3.22	16.82	-2.18
Emilia-Romagna	2015	3	3	7	9	4	3	1	16	6	12	4	1	1	16	4.71	6.00	3.00
Friuli-Venezia Giulia	2015	7	7	2	6	2	2	5	3	3	3	1	3	1	7	1.86	3.36	-3.64
Lazio	2015	10	13	9	11	11	13	7	20	12	17	2	7	2	20	4.93	11.09	1.09
Liguria	2015	4	4	8	3	10	11	3	18	10	15	9	5	3	18	4.86	8.73	4.73
Lombardia	2015	2	5	3	1	6	8	8	14	9	5	3	2	1	14	3.76	5.82	3.82
Marche	2015	11	8	11	10	12	12	10	8	7	6	11	9	6	12	2.02	9.45	-1.55
Molise	2015	15	11	14	17	13	15	15	10	17	20	19	12	10	20	3.22	14.82	-0.18
Piemonte	2015	6	10	10	7	5	7	4	12	4	13	5	6	4	13	3.21	7.55	1.55
Puglia	2015	16	17	18	15	17	19	17	13	18	19	15	17	13	19	1.83	16.82	0.82
Sardegna	2015	14	16	15	13	16	9	18	6	13	9	16	15	6	18	3.74	13.27	-0.73
Sicilia	2015	17	18	20	19	20	18	16	7	19	18	17	19	7	20	3.64	17.36	0.36
Toscana	2015	8	2	12	8	8	6	2	11	11	10	7	10	2	12	3.45	7.91	-0.09
Trentino-Alto Adige/Südtirol	2015	1	1	1	5	1	1	6	4	2	1	8	11	1	11	3.44	3.73	2.73
Umbria	2015	12	9	4	14	9	10	9	15	1	16	10	8	1	16	4.46	9.55	-2.45
Valle d'Aosta/Vallée d'Aoste	2015	5	12	6	4	7	4	14	1	8	2	18	13	1	18	5.47	8.09	3.09
Veneto	2015	9	6	5	2	3	5	11	9	5	4	6	4	2	11	2.58	5.45	-3.55

Table 7.1 Contribution of composite wellbeing indicators in explaining regional subjective wellbeing beyond GDP (years 2013 and 2014)

	α_0	α_1	β_1	F test (H_0:β_1=0)	Prob>F	R^2
Base estimate (regional GDP per capita -only)	6.074***	2.92e-05 ***				0.646
	(0.109)	(0.000)				
UnWeightedBES	4.949***	1.44e-05**	0.015**	7.02	0.019	0.689
	(0.459)	(0.000)	(0.006)			
SurveyWeightedBES	4.960***	1.41e-05**	0.015***	7.44	0.009	0.689
	(0.441)	(0.000)	(0.005)			
StatisticallyWeightedBES	4.899***	1.31e-05**	0.016***	9.27	0.004	0.697
	(0.419)	(0.000)	(0.005)			
Stat&SurveyWeightedBES	4.925***	1.35e-05**	0.015***	8.34	0.006	0.693
	(0.431)	(0.000)	(0.005)			
UnWeightedBES (MPI)	5.056***	1.56e-05**	0.014**	5.97	0.019	0.685
	(0.452)	(0.000)	(0.006)			
SurveyWeightedBES (MPI)	5.185***	1.67e-05**	0.012**	5.13	0.029	0.679
	(0.424)	(0.000)	(0.005)			
StatisticallyWeightedBES (MPI)	5.109***	1.55e-05**	0.013**	6.47	0.015	0.686
	(0.411)	(0.000)	(0.005)			
Stat&SurveyWeightedBES (MPI)	5.144***	1.61e-05**	0.013**	5.78	0.021	0.682
	(0.418)	(0.000)	(0.005)			

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7.2 Contribution of composite wellbeing indicators in explaining regional subjective wellbeing beyond Regional Income Disposable Per Capita (years 2013, 2014, 2015)

	α_0	α_1	β_1	F test (H_0: β_1=0)	Prob>F	R^2
Base estimate (regional per capita disposable income -only)	5.824 ***	0.0566 ***				0.378
	(0.143)	(0.000)				
UnWeightedBES	3.961***	-4.76e-03	0.029***	15.95	0.000	0.441
	(0.518)	(0.000)	(0.008)			
SurveyWeightedBES	3.997***	-5.07e-03	0.029***	16.78	0.000	0.444
	(0.496)	(0.000)	(0.008)			
StatisticallyWeightedBES	3.926***	-8.45e-03	0.030***	19.48	0.000	0.453
	(0.476)	(0.000)	(0.007)			
Stat&SurveyWeightedBES	3.951***	-7.10e-03	0.030***	18.27	0.000	0.449
	(0.486)	(0.000)	(0.008)			
UnWeightedBES (MPI)	4.222***	1.89e-03	0.026***	11.10	0.002	0.428
	(0.515)	(0.000)	(0.008)			
SurveyWeightedBES (MPI)	4.415***	5.64e-03	0.024***	11.18	0.001	0.424

	(0.482)	(0.000)	(0.008)			
StatisticallyWeightedBES (MPI)	4.301***	9.40e-04	0.026***	14.03	0.000	0.433
	(0.467)	(0.000)	(0.008)			
Stat&SurveyWeightedBES (MPI)	4.350***	3.07e-03	0.025***	12.66	0.001	0.428
	(0.475)	(0.000)	(0.008)			

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

F-test: nested hypothesis on the higher goodness of fit of the augmented model including the BES indicator indicated in row

Table 8.1 The role of regional BES indicators on subjective wellbeing (individual data)

Variables	(1)	(2)	(3)	(4)
Stat&SurveyWeightedBES	0.064***	0.059***	0.129***	0.112***
	(0.017)	(0.018)	(0.038)	(0.038)
LogPerCapitaIncome	0.091***	0.069***	0.067**	0.043
	(0.022)	(0.021)	(0.029)	(0.029)
Male		0.262***	0.218**	0.043
		(0.057)	(0.090)	(0.097)
Age		-0.015***	-0.012**	-0.009
		(0.003)	(0.005)	(0.007)
EduYears		0.041***	0.057***	0.046***
		(0.007)	(0.010)	(0.011)
WithPartner			0.756***	0.809***
			(0.179)	(0.179)
Divorced			-0.165	-0.192
			(0.258)	(0.262)
Widowed			0.075694	0.104861
			(0.220)	(0.223)
ChildrenNear			0.018*	0.018*
			(0.010)	(0.010)
Retired				0.543***
				(0.150)
Employed				0.680***
				(0.142)
Observations	4.196	4.122	1.812	1.799
ll	-7854	-7652	-3293	-3256

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8.2 The role of regional BES indicators on subjective wellbeing (individual data): performance of the different synthetic BES indicators

	(1)	(2)	(3)	(4)
Composite Indicators				
UnWeightedBES	0.062***	0.057***	0.125***	0.108***
	(0.016)	(0.017)	(0.037)	(0.037)

SurveyWeightedBES	0.063***	0.058***	0.127***	0.110***
	(0.016)	(0.017)	(0.038)	(0.038)
StatisticallyWeightedBES	0.065***	0.060***	0.131***	0.113***
	(0.017)	(0.018)	(0.039)	(0.039)
Stat&SurveyWeightedBES	0.064***	0.059***	0.129***	0.112***
	(0.017)	(0.018)	(0.038)	(0.038)
UnWeightedBES (MPI)	0.061***	0.056***	0.123***	0.107***
	(0.016)	(0.017)	(0.036)	(0.036)
SurveyWeightedBES (MPI)	0.060***	0.055***	0.121***	0.105***
	(0.016)	(0.016)	(0.036)	(0.036)
StatisticallyWeightedBES (MPI)	0.060***	0.055***	0.121***	0.105***
	(0.016)	(0.016)	(0.036)	(0.036)
Stat&SurveyWeightedBES (MPI)	0.059***	0.055***	0.121***	0.105***
	(0.016)	(0.016)	(0.036)	(0.036)

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

References

Bandura, R. (2008), *A Survey of Composite Indices Measuring Country Performance: 2008 Update*, United Nations Development Programme – Office of Development Studies, available at http://web.undp.org/developmentstudies/docs/indices_2008_bandura.pdf

Bartolini, S., Bilancini, E. and Pugno, M. (2008). 'American decline in social capital and happiness. Is there a linkage?' Working Paper no.540, University of Siena

Becchetti, L., Corrado, L. and Fiaschetti, M. (2013). *The heterogeneity of wellbeing "expenditure" preferences: evidence from a simulated allocation choice on the BES indicators*, *CEIS Research Paper*, 297

Becchetti, L; Porciello, R. and Semplici, L. (2014), *Verso una nuova frontiera del benessere* , in Il Benessere Equo e Sostenibile dal punto di vista delle persone, a cura del Laboratorio di Ricerca Intervento del Forum Nazionale del Terzo Settore, Formazione Quadri Terzo Settore.

Blanchflower, D.G. e Oswald, A.J. (2004), Well-Being over Time in Britain and the US, Journal of Public Economics, 88 (7-8), 1359-86.

Costanza, R.; Hart, M.; Posner, S. and Talberth, J. (2009), "Beyond GDP: The need for new measures of progress", Pardee Papers No.4, Boston University.

Daly, H. E. and J. B. Cobb, Jr. 1989. *For the Common Good: Redirecting the Economy Toward Community, the Environment, and a Sustainable Future*. Boston: Beacon Press.

Deming WE. (1943). Statistical Adjustment of Data. New York: Wiley.
Easterlin R.A. and Angelescu L., 2009. Happiness and growth the world over: Time series evidence on the happiness-income paradox. IZA Discussion Paper, (4060).

Easterlin, R.A. (1974), *Does Empirical Growth Improve the Human Lot? Some Empirical Evidence*, in David, P.A. and Reder, M.W. (eds.), *Nations and Households in Economic Growth: essay in honor of Moses Abramovitz*, Academic Press, New York, pp.89-125.

Ebert, U. e Welsch, H. (2004), Meaningful environmental indices: a social choice approach. Hournal of Environmental Economics and Management 47, 270-283

Fleurbaey, M. and Blanchet, D. (2013), *Beyond GDP. Measuring Welfare and Assessing Sustainebility*, New York: Oxford University Press

Frey, B. and Stutzer, A. (2002), *Happiness and Economics: How the Economy and Institutions Affect Human Well-Being*, Princeton: Princeton University Press.

Giovannini, E., Nardo, M., Saisana, M., Saltelli, A., Tarantola, A., & Hoffman, A. (2008). Handbook on constructing composite indicators: methodology and user guide. Paris : Organisation for Economic Cooperation and Development (OECD).

Henderson, H., J. Lickerman, et al. 2000. *Calvert-Henderson Quality of Life Indicators:A New Tool for Assessing National Trends*. Bethesda, Maryland: Calvert Group.

Istat (2015), *BES 2015. Il benessere equo e sostenibile in Italia*.

Istat, CNEL (2013), *BES 2013. Il benessere equo e sostenibile in Italia*.

Istat, CNEL (2014), *BES 2014. Il benessere equo e sostenibile in Italia*.

Izrael D., Battaglia,M., and Frankel, M. (2009). "Extreme Survey Weight Adjustment as a Component of Sample Balancing (a.k.a.Raking)."Proceedings fromthe 2009 SAS Global Forum. Cary, NC: SAS Institute.

Kaiser H.F. and J. Rice,(1974), Little jiffy, mark IV,Educational and Psychological Measurement 34,111-117.

Kalton G. (1983). Compensating for Missing Survey Data. Survey Research Center, Institute for Social Research, University of Michigan.

Massoli P., Mazziotta M., Pareto A., Rinaldelli C. (2014). *Indici Compositi per il BES*. Sessione IV: metodologie di sintesi e analisi del territori, in Giornate della Ricerca in Istat, 10-11 Novembre 2014.

Mazziotta M, Pareto A. 2013. Methods for constructing composite indices: one for all or all for one? Rivista Italiana di Economia Demografia e Statistica, Vol. LXVII, No. 2, pp.67-80.

Mazziotta, M., Pareto, A. (2014a). A composite index for measuring italian regions'development over time. Rivista Italiana di Economia Demografia e Statistica 68 (3/4)

Mazziotta, M., Pareto, A. (2014b). Non-compensatory aggregation of social indicators: An icon representation. In Crescenzi, F., & In Mignani, S. (2014). *Statistical methods and applications from a historical perspective: Selected issues*. Springer International Publishing

Mazziotta, M., Pareto, A. (2015). On a Generalized Non-compensatory Composite Index for Measuring Socio-economic Phenomena. Soc. Indic. Res., DOI 10.1007/s11205-015-0998-2.

Morris, Morris David (1979) Measuring the World's Poor: The Physical Quality of Life Index, Pergamon Press, New York.

Munda, G., Nardo, M., 2003. On the methodological foundations of composite indicators used for ranking countries. Proceeding of the First OECD/JRC Workshop on Composite Indicators of Country performance. JRC, Ispra.

Nardo, M., Saisana, M., Saltelli, A., Tarantola, S., 2005b. Tools for composite indicators building. Joint Research Centre-European Commission, Ispra (Italy).

Nicoletti G., Scarpetta S. and Boylaud O. (2000), Summary indicators of product market regulation with an extension to employment protection legislation, OECD, Economics department working papers No. 226, ECO/WKP(99)18. http://www.oecd.org/eco/eco

Saisana, M., Saltelli, A., Tarantola, S., 2005. Uncertainty and sensitivity analysis techniques as tools for the quality assessment of composite indicators. Journal of the Royal Statistical Society A 168, 307–323.

Saltelli, A.; Tarantola, S.; Campolongo, F. e Ratto, M. (2004), *Sensitivity analysis in practice: A guide to assessing scientific models*. New York: Wiley.

Sen, Amartya K. (1985), 'Commodities and Capabilities', Amsterdam: North-Holland.

Stevenson, B., and Wolfers, J. (2008) 'Economic growth and subjective well-being: reassessing the Easterlin paradox', IZA Discussion Papers No.3654

Stiglitz, J.E.; Sen, A.K.; Fitoussi, J.P. (2009), *Report by the Commission on the Measurement of Economic Performance and Social Progress*, www.stiglitz-sen-fitoussi.com

Sudgen, Robert (2008), 'Capability, Happiness and Opportunity', in Bruni, L., Comim, F., and Pugno, M., 2008, "Capabilities and Happiness", Oxford University Press.

Veenhoven, R. (1993). *Happiness in nations: subjective appreciation of life in 56 nations 1946-1992*, Rotterdam: RISBO -Erasmus University Rotterdam.

Veenhoven, R. (2004). World database of happiness. In *Challenges for Quality of Life in the Contemporary World* (pp. 75-89). Springer Netherlands.

Wackernagel, M. and W. E. Rees. 1996. *Our Ecological Footprint: Reducing Human Impact on the Earth*. Gabriola Island, BC: New Society Publishers.

Zhou, P., & Ang, B. W. (2009). Comparing MCDA aggregation methods in constructing composite indicators using the Shannon-Spearman measure. *Social Indicators Research*, *94*(1), 83-96.

Zhou, P.; Ang, B.W. e Poh, K.L. (2006), Comparing aggregating methods for constructing the composite enviromental index: an objective measure. Ecological economics 59, 305-311

Appendix 1

Table A1 - BES Domains and BES Regional Indicators

BES Domains	Regional Indicators
Health	Life expectancy at birth, Healthy life expectancy at birth, Physical Component Summary (PCS), Mental Component Summary (MCS), Infant mortality rate, Traffic accidents (15-34 years old), Age-standardised cancer mortality rate (19-64 years old), Age-standardised mortality rate for dementia and related illnesses (people aged 65 and over), Life expectancy without activity limitations at 65 years of age, Age-standardized overweight or obesity - percentage of people aged 18 years and over who are overweight or obese,Age standardized smoking - people aged 14 years and over declaring to smoke, Age-standardized alcohol consumption - people aged 14 years and over with at least one risk behaviour in alcohol consumption, Age – standardized sedentariness - people aged 14 years and over who do not practice any physical activity, Age – standardized nutrition - people aged 3 years and over who consume at least 4 portions of fruit and vegetables a day
Economic well-being	Per capita adjusted disposable income, Disposable income inequality, People at risk of relative poverty, Severely materially deprived people, People suffering poor housing conditions, People living in jobless households.
Education and Training	Participation in early childhood education, Percentage of people aged 25-64 having completed at least upper secondary education, Percentage of people aged 30-34 having completed tertiary education (ISCED 5 o 6), Percentage of early leavers (aged 18-24) from education and training, Percentage of people aged 15-29 not in education, employment, or training (NEET), Percentage of people aged 25-64 participating in formal or non-formal education, Level of literacy: Scores obtained in the tests of functional literacy skills of students in the II classes of upper secondary education, Level of numeracy, Percentage of people aged 16 and over with high level of ICT competencies, Synthetic indicator of the level of cultural participation
Work and life balance	Employment rate of people 20-64 years old, Transition rate (12 months time-distance) from non-standard to standard employment, Share of employed persons with temporary jobs for at least 5 years, Share of employees with below 2/3 of median hourly earning, Share of over-qualified employed persons, Incidence rate of fatal occupational injuries or injuries leading to permanent disability, Share of employed persons not in regular occupation, Ratio of employment rate for women 25-49 years with children under compulsory school age to the employment rate of women 25-49 years without children, Share of population aged 15-64 years that work over 60 hours per week (including paid work and household work), Share of employed persons who feel satisfied with their work
Social relationships	Synthetic indicator of social participation, Generalized trust, Non-profit organizations per 10,000 inhabitants, Social co-operatives per 10,000 inhabitants, Volunteer work, Provided aids, Association funding, Satisfaction with family relationship, Satisfaction with friendship relationship, Percentage of people of 14 years and over which have relatives, friends or neighbours on which they can count, Percentage of children aged 3 to 10 years who play with their parents.
Politics and Institutions	Voter turnout, Civic and political participation, Trust in the parliament, Trust in judicial system, Trust in political parties, Trust in local institutions, Trust in other institutions, Women and political representation in Parliament, Women and political representation at regional level, Women in decision-making bodies.
Safety	Homicide rate, Burglary rate, Pick-pocketing rate, Robbery rate, Physical violence rate, Sexual violence rate, Fear of crime rate, Worries of sexual crime rate, Concrete fear rate, Social decay (or incivilities) rate, Intimate partnership violence rate.
Natural and cultural heritage	Endowment of cultural heritage items, Current expenditure of Municipalities for the management of cultural heritage (museums, libraries and art galleries), per capita, Illegal building rate, Urbanisation rate of areas subject to building restrictions by virtue of the Italian laws on landscape protection, Erosion of farmland from urban sprawl, Erosion of farmland from abandonment, Presence of historic rural landscapes, Quality assessment of Regional programmes for rural development (PSRs), with regard to the landscape protection, Presence of Historic Parks/Gardens and other Urban Parks recognised of significant public interest, Conservation of historic urban fabric, People that are not satisfied with the quality of landscape of the place where they live, Concern about landscape deterioration
Environment	Drinkable water, Quality of marine coastal waters, Quality of urban air, Urban parks and gardens, Areas with hydrogeological risks, Contaminated sites, Terrestrial parks, Marine protected areas, Areas of special naturalistic interest, Concern for biodiversity loss, Energy from renewable sources, Emissions of CO2 and other greenhouse gasses.
Research and Innovation	Research intensity, Patent propensity, Percentage of knowledge workers on total employment, Innovation rate of the national productive system, Percentage of product innovators, Productive specialization in high-tech and knowledge intensive sectors, Internet use.
Quality of Services	Index of accessibility to hospitals with emergency room, Beds in residential health care facilities, Waiting lists, Percentage of population served by natural gas, Separate collection of municipal waste, Composite index of service accessibility, Index of accessibility to transport networks, Citizens who benefit from infancy services, Elders who benefit from home assistance, Prison density per 100 places, Irregularity in water supply, Landfill of waste, Irregularity in electric power distribution, Time devoted to mobility.

Source: Becchetti, Corrado and Fiaschetti (2013).

Table A2 – Excluded indicators and reasons for their exclusion

Excluded indicators	Reason for exclusion
University transfer rate	Deleted because this relationship only in 2015 (there are no FQTS weights)
Asymmetry index of family work	Dropped because data not available at regional level
Satisfaction with the work done	Removed as indicator traceable to a subjective evaluation (and therefore not present in FQTS)
Employment insecurity perception	Removed as indicator traceable to a subjective evaluation (and therefore not present in FQTS)
Share of involuntary part-time	Deleted because this relationship only in 2015 (there are no FQTS weights)
Net wealth per capita average	Dropped because data not available at regional level
Financial vulnerability index	Dropped because data not available at regional level
Absolute poverty index	Dropped because data not available at regional level
Fun activities for children from 3 to 10 years conducted with parents	Eliminated in the Report 2015
Free data aid	Eliminated in the Report 2015
Social cooperatives	Eliminated in the Report 2015
Generalized trust	Removed as indicator traceable to a subjective evaluation (and therefore not present in FQTS)
Women in decision-making	Dropped because data not available at regional level
Women on boards of directors of listed companies	Dropped because data not available at regional level
Average age of the italian parliament	Removed because of unclear polarity
Perception of safety walking alone in the dark	Removed as indicator traceable to a subjective evaluation (and therefore not present in FQTS)
Afraid to be about to undergo a criminal offense in the future	Removed as indicator traceable to a subjective evaluation (and therefore not present in FQTS)
Satisfaction with their lives	Removed as indicator traceable to a subjective evaluation (and therefore not present in FQTS)
Satisfaction leisure	Removed as indicator traceable to a subjective evaluation (and therefore not present in FQTS)
Rating's outlook (divided into positive and negative in the 2015 report)	Removed as indicator traceable to a subjective evaluation (and therefore not present in FQTS)
Dissatisfaction with the quality of the place of living landscape	Removed as indicator traceable to a subjective evaluation (and therefore not present in FQTS)
Concern about the deterioration of the landscape values	Removed as indicator traceable to a subjective evaluation (and therefore not present in FQTS)
Contaminated sites	Dropped because data not available for all regions
Quality of marine coastal waters	Eliminated as absent in many regions because of their geographical location
Marine protected areas	Eliminated as absent in many regions because of their geographical location

Flows of matter	Dropped because data not available at regional level
Co2 and other climate-altering gases	Dropped because data not available at regional level
Satisfaction with the environmental situation (for 2015 report only)	Removed as indicator traceable to a subjective evaluation (and therefore not present in FQTS)
Waiting lists (eliminated in the 2015 report)	Dropped because data not available at regional level

Source: own elaboration

Table A3- ISTAT changes in the indicators during the sample period (harmonized in 2015 time series)

ISTAT changes in the indicators during the sample period (harmonized in 2015 time series)
Civic and political participation moved from the domain "Politics and Institutions" to "Social Relations"
Total life expectancy (no longer divided between males and females) in the domain "Health"
Percentage of changes in the course of a year from stable jobs unstable jobs (removal of precarious work of self-employed with unique employer) in the domain "Work Life Balance "
Average annual disposable income per capita (not adjusted average annual disposable income per capita) in the domain "Economic Wellbeing"
The subjective evaluation index of economic difficulty has been simplified to make it available at the regional level (domain "Economic Wellbeing")
People in very low work intensity households (no more incidence of people living in jobless households) in the domain "Economic Wellbeing")
Length of civil proceedings (from ordinary cognition category to ordinary civil) in the domain "Politics and Institutions"
Rate of physical, sexual and domestic violence on Women (changed the reference period of twelve months to five years) in the domain "Safety"
Wastewater treatment (no more availability of drinking water) in the domain "Environment"
Municipal waste landfilled moved from the domain "Quality of Services" to "Environment"

Table A4 - Statistical units and indicators for which we used a direct imputation procedure

Statistics Unit (Region)	Indicator	Procedure for calculating the missing time
Piemonte e Valle d'Aosta	Illegal Building Index	Same value as detected together for the two regions (Istat)
Trentino-Alto Adige	Green density of historical and remarkable City parks public interest	Sum of data of Trento and Bolzano
	Urban air quality	simple average of the data of Trento and Bolzano
	Urban green availability	Weighted average of Trento and Bolzano data with its population
	Evaluation of the quality of rural development programming (regional RDP) in relation to the protection of the landscape	Calculated as described in methodology made available for Istat indicator
	Alphabet skill level of the students	Weighted average of Trento and Bolzano data with its population
	Numerical competency level of students	Weighted average of Trento and Bolzano data with its population

	Places-km offered by TPL	Simple average of the data of Trento and Bolzano
Trentino-Alto Adige e Basilicata	Productive specialization in knowledge-intensive sectors	For the year 2013 contains the figure for 2009, instead of 2011-as in the other regions-, as in the years 2010 and 2011 for these two regions the data are not available
All	Erosion of the countryside from urban sprawl (urban sprawl) Erosion of the countryside from abandonment	Become a single indicator the sum of the two original, since the survey FQTS demand relative to it considers them together
All	Contaminated sites	The measurement refers to hectares of the spread of contamination

Source: own elaboration

Table A.5 Sensitivity analysis on regional rankings (excluding/including health and economic wellbeing domains)

		Unweighted BES			Survey Weighted BES			Statistically Weighted BES			Survey&Statistically Weighed BES			Unweighted BES(MPI)			Survey Weighted BES (MPI)			Statistically Weighted BES (MPI)			Survey&Statistically Weighted BES (MPI)		
Region	Year	ALL	No H	No EW	ALL	No H	No EW	ALL	No H	No EW	ALL	No H	No EW	ALL	No H	No EW	ALL	No H	No EW	ALL	No H	No EW	ALL	No H	No EW
Trentino-Alto Adige/Südtirol	2013	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Friuli-Venezia Giulia	2013	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Veneto	2013	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Emilia-Romagna	2013	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	5
Lombardia	2013	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	4	4	4	4	4	4	4
Valle d'Aosta/Vallée d'Aoste	2013	6	6	7	6	6	6	6	6	6	6	6	6	8	8	8	7	7	7	7	7	7	7	7	7
Piemonte	2013	7	7	6	7	7	7	7	7	7	7	7	7	6	6	6	6	6	6	6	6	6	6	6	6
Liguria	2013	8	8	8	8	8	8	8	8	8	8	8	8	7	7	7	8	8	8	8	8	8	8	8	8
Umbria	2013	9	9	10	9	9	10	10	9	10	10	9	10	10	10	10	10	9	10	10	10	10	10	9	10
Toscana	2013	10	10	9	10	10	9	9	10	9	9	10	9	9	9	9	9	10	9	9	9	9	9	10	9
Marche	2013	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Lazio	2013	12	12	13	12	12	13	12	12	13	12	12	13	12	12	12	12	12	13	12	12	13	12	12	13
Abruzzo	2013	13	13	12	13	13	12	13	13	12	13	13	12	13	13	13	13	13	12	13	13	12	13	13	12
Sardegna	2013	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Molise	2013	15	15	16	15	15	16	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Basilicata	2013	16	16	15	16	16	15	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Puglia	2013	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Calabria	2013	18	19	19	19	19	19	18	18	18	18	18	19	19	19	19	19	19	19	18	18	19	18	18	19
Campania	2013	19	18	18	18	18	18	19	19	19	19	19	18	18	18	18	18	18	18	19	19	18	19	19	18
Sicilia	2013	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Trentino-Alto Adige/Südtirol	2014	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Friuli-Venezia Giulia	2014	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Lombardia	2014	3	4	4	4	4	4	3	3	4	4	4	4	3	3	3	4	4	4	3	3	3	3	3	3

Veneto	2014	4	5	3	3	3	3	4	4	3	3	3	3	5	5	5	3	3	3	4	4	4	4	4	4	
Emilia-Romagna	2014	5	3	5	5	5	5	5	5	5	5	5	5	4	4	4	5	5	5	5	5	5	5	5	5	
Piemonte	2014	6	7	6	6	7	6	7	7	7	7	7	7	6	6	6	6	6	6	6	6	6	6	6	6	
Valle d'Aosta/Vallée d'Aoste	2014	7	6	7	7	6	7	6	6	6	6	6	6	7	7	7	8	7	9	7	7	7	7	7	8	
Toscana	2014	8	8	8	8	9	8	8	8	8	8	9	8	8	8	8	7	8	7	8	8	8	8	8	7	
Umbria	2014	9	9	11	9	8	9	9	9	10	9	8	10	10	10	10	9	9	10	10	10	10	10	10	10	
Marche	2014	10	11	9	10	11	10	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	
Liguria	2014	11	10	10	11	10	11	10	10	9	10	10	9	9	9	9	10	10	8	9	9	9	9	9	9	
Lazio	2014	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	
Abruzzo	2014	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	
Sardegna	2014	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	
Molise	2014	15	16	15	15	16	15	15	16	15	15	16	15	15	15	15	15	16	15	15	15	15	15	16	15	
Basilicata	2014	16	15	16	16	15	16	16	15	16	16	15	16	16	16	16	16	15	16	16	16	16	16	15	16	
Puglia	2014	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	
Calabria	2014	18	19	20	18	19	19	18	18	19	18	18	19	19	19	19	19	19	19	18	19	20	19	19	19	
Campania	2014	19	18	18	19	18	18	19	19	18	19	19	18	18	18	18	18	18	18	19	18	18	18	18	18	
Sicilia	2014	20	20	19	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	19	20	20	20	
Trentino-Alto Adige/Südtirol	2015	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	1	1	2	1	
Friuli-Venezia Giulia	2015	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	1	2	2	1	2	
Veneto	2015	3	3	3	3	3	3	3	3	4	3	3	3	5	5	5	3	3	3	4	3	4	3	3	4	
Emilia-Romagna	2015	4	4	4	5	5	5	5	5	5	5	5	5	4	4	4	5	5	5	5	5	5	5	5	5	
Lombardia	2015	5	5	5	4	4	4	4	4	3	4	4	4	3	3	3	4	4	4	3	4	3	4	4	3	
Piemonte	2015	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
Toscana	2015	7	7	7	7	8	7	7	8	7	7	8	7	7	7	7	7	7	7	7	7	7	7	7	7	
Valle d'Aosta/Vallée d'Aoste	2015	8	8	8	8	7	8	8	7	8	8	7	8	9	9	9	11	9	11	9	8	11	9	9	11	
Liguria	2015	9	9	9	9	9	9	9	9	9	9	9	9	8	8	8	8	8	8	8	9	8	8	8	8	
Marche	2015	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	10	9	11	10	9	10	10	9	
Umbria	2015	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	11	10	10	11	10	11	11	10	
Lazio	2015	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	
Abruzzo	2015	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	

Sardegna	2015	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Molise	2015	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Basilicata	2015	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Puglia	2015	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Calabria	2015	18	19	19	18	18	19	18	18	18	18	18	18	19	19	19	19	19	19	18	19	20	18	19	20
Campania	2015	19	18	18	19	19	18	19	19	19	19	19	19	18	18	18	18	18	18	19	18	18	19	18	18
Sicilia	2015	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	19	20	20	19

Legend:
ALL: all domains of ESW
No H: all domains of ESW without Health
No EW: all domains of ESW without Economic Well-being

Table A.6 Sensitivity analysis (regional rankings with arithmetic and geometric means)

		UnWeightedBES		SurveyWeightedBES		Statistically WeightedBES		Stat&Survey WeightedBES		UnWeightedBES (MPI)		SurveyWeightedBES (MPI)		Statistically WeightedBES(MPI)		Stat&Survey WeightedBES (MPI)	
regione	anno	AM	GM	AM	GM	AM	GM	AM	GM	AM	GM	AM	GM	AM	GM	AM	GM
Veneto	2013	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Umbria	2013	9	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10
Campania	2013	19	19	18	19	19	19	19	19	18	18	18	18	19	19	19	19
Marche	2013	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Sardegna	2013	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Calabria	2013	18	18	19	18	18	18	18	18	19	19	19	19	18	18	18	18
Puglia	2013	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Abruzzo	2013	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Molise	2013	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Liguria	2013	8	8	8	8	8	8	8	8	7	7	8	8	8	7	8	7
Trentino-Alto Adige/Südtirol	2013	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Toscana	2013	10	9	10	9	9	9	9	9	9	9	9	9	9	9	9	9

Basilicata	2013	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Sicilia	2013	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Emilia-Romagna	2013	4	4	5	4	5	5	5	4	5	4	4	4	5	5	5	5
Friuli-Venezia Giulia	2013	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Lazio	2013	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Valle d'Aosta/Vallée d'Aoste	2013	6	7	6	7	6	6	6	7	8	8	7	7	7	8	7	8
Piemonte	2013	7	6	7	6	7	7	7	6	6	6	6	6	6	6	6	6
Lombardia	2013	5	5	4	5	4	4	4	5	4	5	5	5	4	4	4	4
Friuli-Venezia Giulia	2014	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Campania	2014	19	18	19	19	19	19	19	19	18	18	18	18	19	18	18	18
Veneto	2014	4	5	3	4	4	4	3	4	5	5	3	4	4	4	4	4
Calabria	2014	18	19	18	18	18	18	18	18	19	19	19	19	18	19	19	19
Valle d'Aosta/Vallée d'Aoste	2014	7	7	7	7	6	7	6	7	7	11	8	8	7	9	7	9
Puglia	2014	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Toscana	2014	8	8	8	8	8	8	8	8	8	7	7	7	8	7	8	7
Molise	2014	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Piemonte	2014	6	6	6	6	7	6	7	6	6	6	6	6	6	6	6	6
Lazio	2014	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Trentino-Alto Adige/Südtirol	2014	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Emilia-Romagna	2014	5	4	5	5	5	5	5	5	4	4	5	5	5	5	5	5
Marche	2014	10	11	10	11	11	11	11	11	11	10	11	11	11	11	11	11
Basilicata	2014	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Liguria	2014	11	10	11	10	10	10	10	10	9	8	10	10	9	8	9	8
Umbria	2014	9	9	9	9	9	9	9	9	10	9	9	9	10	10	10	10
Sicilia	2014	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Abruzzo	2014	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Lombardia	2014	3	3	4	3	3	3	4	3	3	3	4	3	3	3	3	3
Sardegna	2014	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14

Trentino-Alto Adige/Südtirol	2015	1	1	1	1	1	1	1	1	1	2	1	1	1	2	1	2
Basilicata	2015	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Valle d'Aosta/Vallée d'Aoste	2015	8	9	8	9	8	8	8	9	9	11	11	11	9	11	9	11
Lazio	2015	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Sardegna	2015	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Puglia	2015	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Piemonte	2015	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Lombardia	2015	5	4	4	3	4	4	4	4	3	3	4	4	3	3	4	3
Marche	2015	10	10	10	10	10	10	10	10	10	9	9	9	11	9	10	9
Umbria	2015	11	11	11	11	11	11	11	11	11	10	10	10	10	10	11	10
Toscana	2015	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Molise	2015	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Friuli-Venezia Giulia	2015	2	2	2	2	2	2	2	2	2	1	2	2	2	1	2	1
Campania	2015	19	18	19	19	19	19	19	19	18	18	18	18	19	18	19	18
Sicilia	2015	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Calabria	2015	18	19	18	18	18	18	18	18	19	19	19	19	18	19	18	19
Emilia-Romagna	2015	4	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5
Liguria	2015	9	8	9	8	9	9	9	8	8	8	8	8	8	8	8	8
Abruzzo	2015	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Veneto	2015	3	3	3	4	3	3	3	3	5	4	3	3	4	4	3	4

Appendix 2 Formulas of composite indicators

Legend:

CID: domain composite index

i: i-th domain (by 1 to d)

k: keth region (by 1 to n)

t: t-th year (by 1 to T)

I: simple indicator

j: j-th indicator (by 1 to m)

wp: weight given by respondents in the FQTS survey[17] (budget allocation process)

ws: weight given by statistic analysis (factor analysis/principal component analysis)

For the construction of all composite indicators

$$I_{ijt} = \begin{cases} \frac{\left(x_{jkt} - Min_{x_j}\right)}{\left(Max_{x_j} - Min_{x_j}\right)} 60 + 70 \quad if\ the\ indicator\ has\ positive\ polarity \\ \frac{\left(Max_{x_j} - x_{jkt}\right)}{\left(Max_{x_j} - Min_{x_j}\right)} 60 + 70 \quad if\ the\ indicator\ has\ negative\ polarity \end{cases} \qquad \text{(A2.1)}$$

where $Max_{x_{jt}}$ and $Min_{x_{jt}}$ are, respectively, the maximum and minimum indicator j, between the n statistical units, in T years considered.

Unweighted average

For each domain

$$CID_{ikt} = \frac{\sum_{j=1}^{m} I_{ijkt}}{m} \qquad \text{(A2.2)}$$

For aggregate well-being

$$UnWeightedBES_{kt} = \frac{\sum_{i=1}^{d} CID_{ikt}}{d} \qquad \text{(A2.3)}$$

Weighted average (with FQTS'weights)

For each domain

[17] Weights are constant over time by assumption.

$$CID_{ikt} = \frac{\sum_{j=1}^{m} I_{ijkt} wp_j}{\sum_{j=1}^{m} wp_j} \qquad \text{(A2.4)}$$

For aggregate well-being

$$SurveyWeightedBES_{kt} = \frac{\sum_{i=1}^{d} CID_{ikt} wp_i}{\sum_{i=1}^{d} wp_i} \qquad \text{(A2.5)}$$

Weighted average (with factor loading's weights)

For each domain

$$CID_{ikt} = \frac{\sum_{j=1}^{m} I_{ijkt} ws_j}{\sum_{j=1}^{m} ws_j} \qquad \text{(A2.6)}$$

For aggregate well-being

$$StatisticallyWeightedBES_{kt} = \frac{\sum_{i=1}^{d} CID_{ikt} ws_i}{\sum_{i=1}^{d} ws_i} \qquad \text{(A2.7)}$$

Weighted average (with total weights (FQTS+FL))

For each domain

$$CID_{ikt} = \frac{\sum_{j=1}^{m} I_{ijkt} (wp_j + ws_j)}{\sum_{j=1}^{m} (wp_j + ws_j)} \qquad \text{(A2.8)}$$

For aggregate well-being

$$Stat\&SurveyWeightedBES_{kt} = \frac{\sum_{i=1}^{d} CID_{ikt} (wp_i + ws_i)}{\sum_{i=1}^{d} (wp_i + ws_i)} \qquad \text{(A2.9)}$$

Mazziotta-Pareto Index

For each domain

$$CID_{ikt} = M_{r_{ikt}} - S_{r_{ikt}} cv_{ikt} \qquad \text{(A2.10)}$$

where:

$$M_{r_{ikt}} = \frac{\sum_{j=1}^{m} I_{ijkt}}{m}; \quad S_{r_{ikt}} = \sqrt{\frac{\sum_{j=1}^{m} (I_{ijkt} - M_{r_{ikt}})^2}{m}}; \quad cv_{ikt} = \frac{S_{r_{ikt}}}{M_{r_{ikt}}} \qquad \text{(A2.11)}$$

For aggregate well-being

$$UnWeightedBES(MPI)_{kt} = M_{r_{kt}} - S_{r_{kt}} cv_{kt} \qquad \text{(A2.12)}$$

where:

$$M_{r_{kt}} = \frac{\sum_{i=1}^{d} CID_{ikt}}{d};\ S_{r_{kt}} = \sqrt{\frac{\sum_{i=1}^{d}(CID_{ikt} - M_{r_{kt}})^2}{d}};\quad cv_{kt} = \frac{S_{r_{kt}}}{M_{r_{kt}}} \qquad \text{(A2.13)}$$

Weighted Mazziotta-Pareto Index (with FQTS's weights)

For each domain

$$CID_{ikt} = WM_{r_{ikt}} - WS_{r_{ikt}} wcv_{ikt} \qquad \text{(A2.14)}$$

where:

$$M_{r_{ikt}} = \frac{\sum_{j=1}^{m} I_{ijkt}}{m};\ WM_{r_{ikt}} = \frac{\sum_{j=1}^{m} I_{ijkt} wp_j}{\sum_{j=1}^{m} wp_j};\ WS_{r_{ikt}} = \sqrt{\frac{\sum_{j=1}^{m}(I_{ijkt} - M_{r_{ikt}})^2 wp_j}{\sum_{j=1}^{m} wp_j}};$$

$$wcv_{ikt} = \frac{WS_{r_{ikt}}}{WM_{r_{ikt}}} \qquad \text{(A2.15)}$$

For aggregate well-being

$$SurveyWeightedBES(MPI)_{kt} = WM_{r_{kt}} - WS_{r_{kt}} wcv_{kt} \qquad \text{(A2.16)}$$

where:

$$M_{r_{kt}} = \frac{\sum_{i=1}^{d} CID_{ikt}}{d};\ WM_{r_{kt}} = \frac{\sum_{i=1}^{d} CID_{ikt}\, wp_i}{\sum_{i=1}^{d} wp_i};\ WS_{r_{kt}} = \sqrt{\frac{\sum_{i=1}^{d}(CID_{ikt} - M_{r_{kt}})^2 wp_i}{\sum_{i=1}^{d} wp_i}};$$

$$wcv_{kt} = \frac{WS_{r_{kt}}}{WM_{r_{kt}}} \qquad \text{(A2.17)}$$

Weighted Mazziotta-Pareto Index (with factor loading's weights)

For each domain

$$CID_{ikt} = WM_{r_{ikt}} - WS_{r_{ikt}} wcv_{ikt} \qquad \text{(A2.18)}$$

where:

$$M_{r_{ikt}} = \frac{\sum_{j=1}^{m} I_{ijkt}}{m};\ WM_{r_{ikt}} = \frac{\sum_{j=1}^{m} I_{ijkt} ws_j}{\sum_{j=1}^{m} ws_j};\ WS_{r_{ikt}} = \sqrt{\frac{\sum_{j=1}^{m}(I_{ijkt} - M_{r_{ikt}})^2 ws_j}{\sum_{j=1}^{m} ws_j}};$$

$$wcv_{ikt} = \frac{WS_{r_{ikt}}}{WM_{r_{ikt}}} \qquad \text{(A2.19)}$$

For aggregate well-being

$$StatisticallyWeightedBES(MPI)_{kt} = WM_{r_{kt}} - WS_{r_{kt}} wcv_{kt} \qquad \text{(A2.20)}$$

where:

$$M_{r_{kt}} = \frac{\sum_{i=1}^{d} CID_{ikt}}{d};\ WM_{r_{kt}} = \frac{\sum_{i=1}^{d} CID_{ikt}\, ws_i}{\sum_{i=1}^{d} ws_i};\ WS_{r_{kt}} = \sqrt{\frac{\sum_{i=1}^{d}(CID_{ikt} - M_{r_{kt}})^2 ws_i}{\sum_{i=1}^{d} ws_i}};$$

$$wcv_{kt} = \frac{WS_{r_{kt}}}{WM_{r_{kt}}} \qquad \text{(A2.21)}$$

Weighted Mazziotta-Pareto Index (with total weights (FQTS+FL))

For each domain

$$CID_{ikt} = WM_{r_{ikt}} - WS_{r_{ikt}} wcv_{ikt} \qquad \text{(A2.22)}$$

where:

$$M_{r_{ikt}} = \frac{\sum_{j=1}^{m} I_{ijkt}}{m};\ WM_{r_{ikt}} = \frac{\sum_{j=1}^{m} I_{ijkt}(ws_j + wp_j)}{\sum_{j=1}^{m}(ws_j + wp_j)};$$

$$WS_{r_{ikt}} = \sqrt{\frac{\sum_{j=1}^{m}(I_{ijkt} - M_{r_{ikt}})^2 (ws_j + wp_j)}{\sum_{j=1}^{m}(ws_j + wp_j)}};\quad wcv_{ikt} = \frac{WS_{r_{ikt}}}{WM_{r_{ikt}}} \qquad \text{(A2.23)}$$

For aggregate well-being

$$Stat\&SurveyWeightedBES\ (MPI)_{kt} = WM_{r_{kt}} - WS_{r_{kt}} wcv_{kt} \qquad \text{(A2.24)}$$

where:

$$M_{r_{kt}} = \frac{\sum_{i=1}^{d} CID_{ikt}}{d};\ WM_{r_{kt}} = \frac{\sum_{i=1}^{d} CID_{ikt}\,(ws_i + wp_i)}{\sum_{i=1}^{d}(ws_i + wp_i)};$$

$$WS_{r_{kt}} = \sqrt{\frac{\sum_{i=1}^{d}(CID_{ikt} - M_{r_{kt}})^2 (ws_i + wp_i)}{\sum_{i=1}^{d}(ws_i + wp_i)}};\ wcv_{kt} = \frac{WS_{r_{kt}}}{WM_{r_{kt}}} \qquad \text{(A2.25)}$$