

The Construction of a Synthetic Index Comparing Multidimensional Well-Being in the European Union

Enrico Ivaldi · Guido Bonatti · Riccardo Soliani

Accepted: 23 December 2014 / Published online: 1 January 2015
© Springer Science+Business Media Dordrecht 2014

Abstract For many years, the quantification and measurement of level of well-being in a society has become an object of study by researchers, economists, international organizations and institutions. The purpose of these researches and applications is mainly the collection of data as accurate and complete as possible, dictating the paths of economic and social development policies, in order to help the economic problem of allocating scarce resources within a community, where not all individual needs can be fully met. The present work is intended as a part of that field. It will undertake the construction of a composite index of multidimensional well-being, through an aggregation of data, able to balance the trade-off between immediacy and completeness of information and to trespass the limits that characterize the commonly used income related measures. The method of factor analysis, which aims at detecting a statistically sufficient number of variables, is used to represent most of the explained variance of the phenomenon. Results are tested with different aggregative processes. This analysis is applied to the reality of the European Union, characterized by deep transformation and cultural, economic and social inequalities.

Keywords Multidimensional well-being · Composite index · Factorial analysis · MPI · European Union

1 Introduction

The analysis of quality of life and social well-being is considered one of the main issues of economic science in view of its important role in political, social and economic areas. The choice to evaluate well-being in the EU reflects the need to better understand a situation

E. Ivaldi (✉) · G. Bonatti · R. Soliani
Department of Economics, University of Genova, Via Vivaldi 5, 16126 Genoa, Italy
e-mail: enrico.ivaldi@unige.it

where, in recent years, the divide between income, access to services and growth prospects of the Northern countries and the Southern or “Mediterranean” ones is widening.

Indeed, politicians need precise information on how people live and how they perceive their lives in order to enhance economic integration and promote social cohesion. Possible disparities in well-being evidenced among nations, while having been for some time a matter of discussion in economic and political debate, are currently entering a phase in which their quantification is increasingly important (see for example: Grasso and Canova 2008; Somarriba and Pena 2009; Ivaldi and Testi 2011; Reig-Martínez 2013).

In the majority of cases, the analysis has been based on indices such as GDP, income or similar, combined with certain indicators of economic equity (obtaining inequality indices and deprivation indices). However, social progress is no longer exclusively associated with higher living standard, as the qualitative dimension must also be taken into consideration. The concepts of “quality of life” and “well-being” cannot be exclusively defined in terms of objective living conditions (income, house, etc.), and must also consider subjective aspects like the perception of the standard of living.

The main goal of this paper is to provide an approach to measuring well-being in the European Union 27-Countries¹ by creating a composite well-being index, the European Well-being Index (EWI), using the factorial analysis and adopting the social indicator approach. Such an aggregate indicator sets in the wake of well-known measures of socio-economic well-being in the European Union, enlarging the number of variables included: indeed the EWI is conceptually structured to describe the European reality and to appreciate which policies in different countries can ensure best results. Factor analysis has been identified as a useful tool to select a set of variables that explain as much as possible of the phenomenon concerned. With this quantitative exercise, we rank all countries according to their EWI score, and display their strength and weakness concerning specific facets of the index. Then the index will be compared with two indexes built on the same theoretical basis, but that differing in the methodology used: the additive index and the Pareto Mazziotta Index (MPI). This “non-compensatory” method of aggregation is specifically conceived to guarantee the “non-substitutability” of the dimensions; indeed they have equal importance and no compensation among them is allowed (Mazziotta and Pareto 2012).

In the first part, the paper briefly recalls the shortcomings of monetary well-being measures and illustrates the theoretical structure which EWI is built on. In the second part, it analyses well-being in the EU. In particular, we go through several sets of indicators to measure and analyse this concept in the group of European countries and try to find useful insights to better understand how well-being is distributed.

2 Well-Being and Shortcomings of GDP

Even though the concept of well-being itself remains hard to define, different conceptualizations are available, that can be used to quantitatively capture the concept of well-being. Among these the first ones were utilitarian—including both the “revealed preferences approach” and the “happiness approach”—that reduced well-being to well-feeling and further reducing it to a scalar of pleasure or utility. It subsequently became more common, and perhaps appropriate, to consider well-being as a multidimensional concept

¹ The exclusion of Croatia, which joined the European Union on July 1, 2013, is due to the lack of observations in most of the variables considered.

(Bleys 2012). In that regard, following McGillivray (2007), we can identify the capabilities approach (Sen 1982, 1985, 1993, among many other publications), the basic human values approach (Grisez et al. 1987), the intermediate needs approach (Doyal and Gough 1991, 1993), the universal psychological needs approach (Ramsay 1992), the axiological categories approach (Max-Neef 1993), the universal human values approach (Schwartz 1994), the domains of subjective well-being approach (Cummins 1996), the dimensions of well-being approach (Narayan et al. 2000), and the central human capabilities approach (Nussbaum 2000). This multiplicity of conceptualizations is often accompanied by a range of different expressions to label quite similar situations. Along with well-being, the most common ones include the quality of life, living standards and human development. Others include welfare, social welfare, well-living, utility, life satisfaction, prosperity, needs fulfilment, development, empowerment, capability expansion, poverty, human poverty and, more recently, happiness. Some have distinct meanings, but there is also a certain degree of overlap. Several studies tend to adopt a particular term, others use different terms interchangeably.

Since the Bretton Woods conference in 1944, GDP has become the primary tool to measure a country's economy, assuming great relevance in the literature even as an indicator of well-being. Many authors (Nordhaus and Tobin 1972; Khan 1991; Stewart 2005; Stiglitz et al. 2009), have raised criticism about this use of GDP per capita, since it only looks at the economic dimension of well-being, so that the estimate of such a multidimensional concept is strongly simplified.

In general, regarding the limits of GDP, a great part of the literature, including Hicks (1946), Galbraith and Crook (1958), Samuelson (1961), Mishan (1967), Nordhaus and Tobin (1972), Hirsch (1976), Sen (1976), Scitovsky (1976), Daly (1977), Frank (1985, 2004), Hartwick (1990), Tinbergen and Huetting (1992), Arrow et al. (2004), Weitzman and Löfgren (1997), Dasgupta and Mäler (2000), Dasgupta (2001), Kahneman et al. (2004), Van den Bergh (2009) has been discussing for long. Four main points have been singled out: (a) GDP measures only monetary issues; indeed they are excluded non-market activities that contribute to economic welfare, like charity activities and domestic work,² or the value of leisure³; (b) GDP considers all its figures as positive values without distinguishing between activities that cause a loss of welfare (regrettable expenditures, road accidents, etc.) and activities that increase it; (c) GDP does not consider the distribution of resources among individuals; (d) GDP is a measure of flows that does not take into account the stock of wealth in an economy and does not also consider environmental and social externalities associated with productive activities.

Focusing on “Quality of Life” and “Well-being”, the first term is mainly used when one speaks at the level of individuals, whilst the second is more frequent when one speaks about communities, localities, and societies. Similarly, “well-being” refers rather to actual experience, and “quality of life” to context and environments. However, in both cases the terms are used with a broad range of meanings, and the ranges frequently overlap (Gasper 2010). Given the difficulty in drawing the line which divides the two concepts, in this study

² If we consider what was claimed by Chadeau and Fouquet (1981) the term *domestic production activities* means any unpaid activity, carried out by a family member for his family, and the consequent creation of a good or a service necessary for the performance of everyday life, for which there is a replacement market within the existing social norms.

³ Since to draw the line between domestic production activities and leisure is puzzling, Roy (2011) proposes to refer to the guidelines specified by the Canadian Agency of Statistics, taking into account that from these activities can derive pleasure or not.

we have chosen to use “well-being”, with reference to Noll’s definition (2002), that is the constellation of good living conditions and positive subjective well-being.

3 Theoretical Basis of the European Well-Being Index

To go beyond the mere income-related aspect of well-being, it is necessary to consider well-being as a multidimensional phenomenon involving all aspects of people’s lives. This multidimensionality makes the assessment of well-being more complex, because most of its dimensions are hard to identify and quantify and depend on subjective assessments. To deal with this problem, the “Social and Economic well-being indicators approach”, inspired by Partha Dasgupta and already followed in literature (Grasso 2002; Distaso 2007; Grasso and Pareglio 2007) has been considered.

The need of social well-being indicators is synthesized by Dasgupta (2000) in five purposes. The theoretical framework, outlined by Dasgupta, captures the various dimensions and provides support to the choice and implementation of public policies.

In this context, measures of well-being can take one of the following two forms: they can reflect the constituents of well-being, or, alternatively, the access people have to the determinants of well-being. Indices of health, welfare, freedom of choice are constituents. Indices which reflect the availability of food, clothing, shelter, potable water, legal aid, education facilities, health care etc., could be considered as determinants of well-being. Changes in a suitable aggregate of either the constituents, or the determinants, can be made to serve as a measure of changes in the well-being (Dasgupta 2000; Dasgupta et al. 1972; Dasgupta and Weale 1992).

The point is what kind of constituents and determinants are to be considered and how to use them together. The conceptual framework, which we make reference to, is the following: participation in community life, satisfactory opportunity to choose and organize one’s social life, development of capabilities and independency, and possibility to live in a respectful, healthy and safe environment, where the opportunities of future generations are preserved. This is a portrait of a good and healthy society (Maggino 2009b). This approach follows the new methodological perspectives in measuring progress and also a policy view that looks at it in terms of good life, in which people feel good because the objective measurable conditions of lives deserve a positive evaluation (Michalos 2008). Such a comprehensive approach needs to integrate objective and subjective information (Diener and Suh 1997; Berger-Schmitt and Noll 2000; Dasgupta 2000; Goossens et al. 2007). In policy perspective, the need for subjective indicators arises during the assessment of policy results and the selection of policy objectives (Veenhoven 2002). The possibility to integrate objective and subjective information requires: (1) a precise definition of the two concepts; (2) an accurate clarification of the relationships between these components; (3) a methodological framework for integration (Maggino 2009b).

A distinction between objective and subjective definitions of well-being is provided by Sumner (1996). It is based on the selection process of the criteria that are used to judge individuals’ well-being. Objective definitions assume that the criteria can be set up without reference to the individuals’ own preferences, interests, ideals, values, and attitudes; whereas in the subjective definitions they matter. However, according to more detailed definitions (Cummins et al. 1998; Maggino and Ruvigliani 2008), the distinction between objective and subjective components of quality of life appears even more clearly: *Objective component at micro level (individual living conditions)*, referring to living conditions that can be taken back to widely accepted criteria and context indicators. Its specificity is

defining and recognizing external references; *Objective component at macro level*, referring to economic, social, and health contexts—e.g. GDP per capita, literacy rates, life expectancy; *Subjective component (subjective well-being)*, referring to the individual evaluation of one's life as a whole and/or in different specific contexts. It is assessed by individuals' or groups' responses to questions about happiness, life satisfaction, utility, or benefit. Contrarily to the objective measures at micro level, no explicit standard is defined and no external reference can be established.

As to the relationship between subjective and objective indicators, we have dealt: (1) with objective characteristics in terms of resources that people use to improve their lives and to pursue their life projects; (2) with subjective issues, instead, as evaluations of conditions of living. In this sense the terms “objective” and “subjective” should be respectively replaced with the terms “descriptive” and “evaluative” (Erikson 1993). Finally, we have elaborated the composite indicator of well-being. The aggregating process allows to obtain not really an exhaustive description of reality, but rather an “indication”, whose interpretation depends on the defined hierarchical design and applied methodology. The proposed composite indicator aims at describing synthetically a reality that is and remains complex (Maggino 2009b).

4 Methodology

As pointed out by Michalos et al. (2010), one may distinguish three approaches to the development of indicators and indices of well-being, namely, *Top-Down*: constructing a conceptual framework of some sort describing one's understanding of well-being, including its constituents and determinants; *Bottom-Up*: exploring the great variety of available data that might be relevant to most people's understanding of well-being; *Bi-Directional*: constructing and exploring somewhat simultaneously. One might characterize the Top-Down approach as theoretical, the Bottom-Up approach as empirical and the Bi-Directional approach as pragmatic.

We have decided to proceed in a pragmatic way with a Bi-Directional approach, following a consolidated methodology (Salzman 2003; Nardo et al. 2005; Maggino 2009a), which defines different stages in order to develop a composite indicator. Each stage requires specific decisions and choices about:

1. the analytical approach to verify the underlying dimensionality of selected elementary indicators (*dimensional analysis*);
2. the weights to define the importance of each elementary indicator to be aggregated (*weighting criteria*);
3. the aggregating technique to synthesize the elementary indicators values into composite indicators (*aggregating-over-indicators techniques*);
4. models and conceptual approaches to assess:
 - a. the robustness of the synthetic index;
 - b. the discriminant capacity of the index.

Then we have primarily chosen a theoretical apparatus, which is the cornerstone of our indicator, as well as the dimensions to aggregate. The selection of variables has been carried out exploring the great deal of available data that might be relevant, in part through a careful analysis of the literature.

4.1 Dimensional Analysis

The first decision is the choice of representative well-being dimensions. We decided to structure the EWI on the twelve dimensions proposed by the *Benessere Equo e Sostenibile* initial dashboard (CNEL-ISTAT 2012, 2013), that in the future will be jointly elaborated by the Italian National Institute of Statistics and the National Council of Economy and Labour to describe the Italian regional condition. This for two main reasons: first, it is among the most recent experiences in the field, and takes into account all latest theoretical developments, including the recommendations of the Stiglitz-Sen-Fitoussi Commission (Stiglitz et al. 2009). Secondly, the selected dimensions really cover the multidimensional nature of well-being: they are sufficiently different among themselves, fully describe the multidimensionality of the phenomenon and the risk of self correlation is avoided. The dimensions are listed below (Table 1):

With regard to “Health”, “Work and Life balance”, “Environment” (Zolotas 1981; Daly and Cobb 1989; Cuñado and de Gracia 2013) and “Economic well-being”—although in this case studies show some attenuation of the correlation between this last concept and well-being (Easterlin 1974; Scitovsky 1976; Oswald 1997)—no doubt exists on their importance in relation to well-being; but some clarification is needed about other dimensions, well summarized by CNEL-ISTAT (2012).

Education and training. Education, training and skill level affect the well-being and open up opportunities otherwise precluded. Not only is education an intrinsic value, but it affects the well-being even directly. People highly educated live better, healthier and longer, and have more opportunities to find a job and to work in less risky environments. In addition, higher achievements in terms of education and training bring about conscious access to cultural resources and creativity.

Social relationships. Relational networks represent important opportunities to pursue people’s own ends and widen their horizons. General interpersonal trust, high participation in associative networks and widespread presence of civic culture enhance both the individual and the social cohesion, enabling greater efficiency of public policies and lower transnational cost.

Security. Personal safety is a foundational element of society and individual well-being. The most important impact of crime on well-being of people is the sense of vulnerability that it determines. The fear of being a victim of crime can affect personal freedom, quality of life and even territorial development.

Table 1 European Well-being Index: dimensions

Health
Education and training
Work and life balance
Economic well-being
Social relationships
Politics and institutions
Security
Subjective well-being
Landscape and cultural heritage
Environment
Research and innovation
Quality of services

Landscape and cultural heritage. The degree of conservation of landscape and artistic and monumental heritage is an intrinsic value and can make a territory a source of wealth for the community.

Research and innovation. Research and innovation are indirect determinant of well-being and the basis of social and economic progress.

Quality of services. We assume that, generally, public investment ameliorates the human environment where people live and work.

Subjective well-being. As we have seen above (par. 3), the subjective indicators are useful complements to strictly objective indicators, as they allow us to assess the difference between what people report and what is captured by the objective indicators.

We have considered appropriate to construct an index based on currently available data, coming directly from certified sources. They do not require ad hoc surveys, with the double result of avoiding the creation of additional costs and updating it easily and continuously (Jarman 1983; Gordon and Pantazis 1997; Ivaldi and Testi 2011). The analysis of the literature offers several ways to derive a priori which should be the most suitable variables to insert in the index (Berger-Schmitt and Noll 2000; Michalos et al. 2011; CNEL-ISTAT 2013; Porter et al. 2013), even if the choice is conditioned, of course, both by the availability of data and the purpose of the index itself.

We have conducted a preliminary survey on the availability of data from Eurostat, WHO, OECD, European Commission and European Quality of Life Survey 2012. Once deleted the variables clearly incomplete or manifestly untrustworthy, we have ascertained that the data were comparable for all 27 countries. Indeed we have not kept values of the same indicator from different sources in different countries. At this step we found insufficient harmonized data at European level for the domains “Landscape and Cultural heritage”; for this reason we were compelled to eliminate that dimension from the Index.

Thus we have selected 162 variables, which should ensure sufficient completeness of information.

4.2 Weighting Criteria

In the absence of dominance of one dimension over all others, some combination or aggregation is necessary in order to make well-being inter-individually comparable. The weighting of the relevant life domains is deemed a crucial, but very difficult issue by many authors. Therefore we have opted for equal weighting.

Equal weighting may result either from an “agnostic” attitude and a wish to reduce interference to a minimum, or from the lack of information about some kind of “consensus” view (Brandolini 2008). Decancq and Lugo (2013) identify equal weighting as the preferred and facilitating procedure, adopted in most of the applications. This happens mainly when: the theoretical scheme attaches to each indicator the same adequacy in defining the variable to measure; it does not allow hypotheses consistently derived on differential weightings; the statistical and empirical knowledge is not sufficient for defining weights; there is not agreement about the application of alternative procedures (Maggino 2009a). Indeed, although it would be desirable to assign different weights to the various factors considered, there are no reliable basis for doing this (Mayer and Jencks 1989) and in any case this does not mean no weighting, because equal weighting does imply an implicit judgment on the weights being equal (Nardo et al. 2005).

4.3 Aggregating-Over-Indicators Technique

One of the major problems of constructing quality of life synthetic measures is determining an appropriate aggregation method to incorporate multi-dimensional variables into an overall index. Clustering the items in a limited number of dimensions can simplify the interpretation of the information available in the list of variables, also highlighting any different pattern of the quality of life in different countries. In order to do so, different techniques may be implemented. We can group the items together according to the meaning of their underlying characteristics on the basis of a priori criteria (for example all housing items together), or empirically, through data analysis. We have chosen the second way and carried out the study by the factor analysis.

Factor analysis is a statistical technique that aims at simplifying a complex data set by representing it in terms of a smaller number of underlying variables. This makes possible the study of the correlations between a large number of variables, grouping them around factors, so that they are arranged on factors highly correlated with each other (Dillon and Goldstein 1984). This methodology is attractive because of its flexibility: in fact, the only preliminary choice is the initial data set. Indeed, it allows explaining the variance of the phenomenon under scrutiny without requesting the estimation of parameters, which would compel to create a previous model. Such a method can summarise a set of sub-indicators while preserving the maximum possible proportion of the total variation in the original set. The largest factor loadings are assigned to the sub-indicators that have the largest variation across countries—a desirable property for cross-country comparisons, as sub-indicators that are similar across countries are of little interest and cannot possibly explain differences in performance (Nardo et al. 2005).

The factor analysis can be written algebraically as follows. If we have p variables X_1, X_2, \dots, X_p measured on a sample of n subjects, then variable x_j can be written as a linear combination of m factors F_1, F_2, \dots, F_m where $m < p$ (Härdle and Simar 2007). Thus,

$$x_j = k_{j1}F_1 + k_{j2}F_2 + \dots + k_{jm}F_m + e$$

where, $k_{j,h}$ ($h = 1, 2, 3, \dots, m$) are the factor loads for variable x_j ($j = 1, 2, 3, \dots, n$); e is the part of variable x_j that cannot be explained by the factors.

Factorial analysis summarize the information contained in a matrix of correlation or variance/covariance; it intends to identify statistically the latent and not directly observable dimensions of the observed phenomenon (Stevens 2002).

Since the variables can be saturated in almost the same way by different factors, the problem of the rotation of the factors does exist (Krzanowski and Marriott 1994). The rotation causes the reduction of factor loadings that already, in the first phase, were relatively small, and the increase of the absolute values of factor loadings that predominated in the first phase. The matrix of saturation does not have a single solution and, through its mathematical transformation, we can obtain infinite matrix of the same order. That is the reason why the factors can be transformed by a process of rotation of the axes. In fact, in an unrotated solution every variable is explained by two or more common factors, while in a rotated solution each variable is summarized by a single common factor. Also for rotations different methods are available; they are classified in orthogonal rotations, where the axis rotation is subject to the constraint of perpendicularity between the axes, and oblique rotations, where this constraint is released in whole or in part (Morrison 1976). The plurality of techniques for the rotation of factors causes indeterminacy in the factor solution, because one cannot decide which rotation is the best, not only when

choosing between orthogonal rotation and oblique rotation, but even within the two types of rotation. This implies that contradictory sets of factor scores are equally plausible and the choice of a solution rather than another appears to be arbitrary (all solutions explain the same variance); indeed this technique is sometimes criticised (Guilford and Hoepfner 1971; McKay and Collard 2003). As the analysis is data driven, different solutions can be obtained from different samples or from the same sample over time; anyway, in the analysis conducted to gain information about the latent structure of the observed data, the very existence of many mutually consistent interpretations can be considered a position of privilege and not a disadvantage (Johnson and Wichern 2002).

As for the present case, subsequent tests with different algorithms for extraction and rotation have showed a real stability of the extracted factors. However, it has seemed appropriate to apply the rotation Varimax that maximizes the variance between the factor loads with subsequent iterations; for each factor, high loads (correlations) result for a few variables, the rest being near zero (Kaiser 1958). This simplifies the interpretation because, after a Varimax rotation, each original variable tends to be associated with one (or very few) factors, and each factor represents only a small number of variables. In addition, the factors can often be interpreted as the opposition of a few variables with positive loadings to a few variables with negative loadings (Abdi 2003). Formally Varimax searches for a rotation (i.e., a linear combination) of the original factors such that the variance of the loadings is maximized, that amounts to maximizing:

$$V = \sum \left(k_{j,l}^2 - \bar{k}_{j,l}^2 \right)^2$$

where, $k_{j,l}^2$ is the squared loading of the j th variable; \bar{k} is the mean of squared loadings.

Finally, the interpretation of factors is identified through the factor score coefficient matrix $[c_{nj}]$; by inverting the equations X_j , one can obtain the equation of the factors, which are expressed as a linear combination of original variables (Härdle and Simar 2007).

$$F_h = c_{j1}x_1 + c_{j2}x_2 + \dots + c_{jn}x_n + e$$

This system of equations permits the estimation of well-being based on the information contained in the set of selected variables.

Before presenting the results, a few comments must be made about the application performed. It is necessary to explore and decide how many factors exist. The number of the latent data dimension to take into account in this case, is determined considering three different criteria (Kaiser 1958; Cattell 1966):

Criterion of explained variance: in this case, the element of choice is the cumulative explained variance. A level of explained variance of 65 % can be considered sufficiently significant;

Scree test: the method of the scree test determines the number of factors graphically described. A graph is drawn where the horizontal axis shows the number of the eigenvalues, while on the vertical axis lie their respective values. The eigenvalues are represented as points connected by a line. The choice of the factors should stop at the point where we observe a levelling of the trend of the line;

Kaiser criterion: according to this principle, we must keep only the factors whose eigenvalue is greater than one, since smaller values lead to factors that explain less than one variable does. This first exploratory factor analysis allows us to skim and identify the factors, and then the variables that describe significantly the dimensions involved. At the

end of this process the number of variables was reduced to 146, sufficient to describe the twelve well-being dimensions.

After excluding the variables that did not meet the three above mentioned criteria, now it is possible to use as index the factor score resulting from the factorial analysis on the partial indicators, which have been standardised to eliminate the possible effects of the distinct measurement units. The factor score quantifies the position of each country in the space of components and conveys the information of all partial indicators (Johnson and Wichern 2002; Hogan and Tchernis 2004). The calculation of factor scores, as a tool for constructing the index, has been used for each of the eleven domains. The scores obtained have been further aggregated by factor analysis, with the same methodological criteria described above, so reaching the overall Well-Being Index.

4.4 Robustness of the Index

A strong point of this composite index of well-being lies in the fact that the factor analysis carried out on the entirety of the variables has made a skimming. Thus it has been possible to consider only those variables that granted an amount of explained variance at least 70 % of each dimension. In this way, the variables making up the index convey a statistically significant portion of information provided by each of the eleven dimensions taken into account, i.e. of the overall well-being.

The index will be subsequently subjected to a test of robustness, through a sensitivity analysis, conducted by testing the general index subtracting in turn each of the eleven dimensions. Then the subtraction will cover two dimensions simultaneously. The index will be recalculate each time with this lacking part with factorial method and the results will be compared using the Spearman correlation coefficient.

5 Results

In this section, through the set of indicators defined above, we will assess and compare the results. The scores have been reckoned and the rankings set up. The first three columns show the number of classes, nations and scores. Then the classes are to be defined. The literature suggests dividing the index distribution on the basis of its parameters (Carstairs and Morris 1991), or on deciles of population. In our case, it seemed more appropriate the first method, which allows us to maintain the discriminatory features of the distribution (Carstairs 2000). Values $\pm(2/3) \sigma$, $\pm(4/3) \sigma$ have been used as a cut-off for classes, together with 0, the mean value of the factor scores' distribution. The fifth and sixth columns represent the cumulative percentage of population within each class and within macro-groups with positive and negative scores (Table 2; Fig. 1).

In Fig. 1 classes are highlighted with decreasing colour gradient.

The countries of the first class, Finland, Sweden, Denmark and the Netherlands, have reported high scores on almost all dimensions, positioning themselves in the first or second class in all of these. Sweden is the country that records the highest scores in "Health", "Economic Well-being", "Politics and Institutions". Finland emerges for "Education and Training" and "Research and Innovation"; Denmark reports the highest scores in "Work and Life balance", "Social Relationships", "Subjective Well-being", "Environment" and "Quality of Services". The only exception is constituted by the dimension "Security", where data are those recorded by authorities, based on the number of complaints made, and the value is higher in Northern Europe. This could be explained by the different culture of

Table 2 European Well-being Index: scores and population percentages

Class	Nation	Score	% Pop.	% Cumulative		
1	Denmark	1.82	1.11	7.43	63.69	
	Sweden	1.70	1.9			
	Finland	1.53	1.08			
	Netherlands	1.32	3.34			
2	Austria	1.07	1.68	18.09		
	Luxembourg	0.96	0.11			
	Germany	0.72	16.31			
3	United Kingdom	0.56	12.7	38.17		
	Belgium	0.53	2.22			
	Ireland	0.47	0.91			
	France	0.43	13.05			
	Spain	0.07	9.29			
4	Slovenia	-0.14	0.41	16.97	36.31	
	Estonia	-0.16	0.26			
	Malta	-0.21	0.08			
	Portugal	-0.32	2.09			
	Italy	-0.41	11.87			
	Cyprus	-0.42	0.17			
	Czech Republic	-0.51	2.09			
	Lithuania	-0.71	0.59			11.7
Latvia	-0.77	0.4				
5	Slovakia	-0.85	1.08			
	Hungary	-0.91	1.97			
	Poland	-1.02	7.66			
	Greece	-1.36	2.2			7.64
	Romania	-1.64	3.99			
6	Bulgaria	-1.71	1.45			

legality that exists among Northern, Mediterranean and Eastern European countries; not, that is, to such a real condition of reduced safety, but rather to factors such as mistrust of authority, different perception of crime and greater acceptance and use of “private safety” phenomena in Mediterranean and Eastern Europe.

The result of the second class, which includes Austria, Luxembourg and Germany, reflects the satisfactory scores in all dimensions, except “Security”, for which the above observations remain valid. Luxembourg has a good ranking, thanks to the results in “Economic well-being” and “Politics and Institutions”. A partial gap is evident about the domain “Environment”, where Austria shows a very high value, but Luxembourg and Germany record low scores; this can be justified, in the former case, by the small territorial size of Luxembourg and the lack of environmental guidelines and certifications, and, in the case of Germany, by the process of urbanization and industrialization, overall in its Eastern regions, where the current efforts in environmental protection, maybe, have not been rewarded yet by high positive values.

In the third class there are three of the biggest European countries: France, the United Kingdom and Spain. They account for about 35 % of European population. Here we find

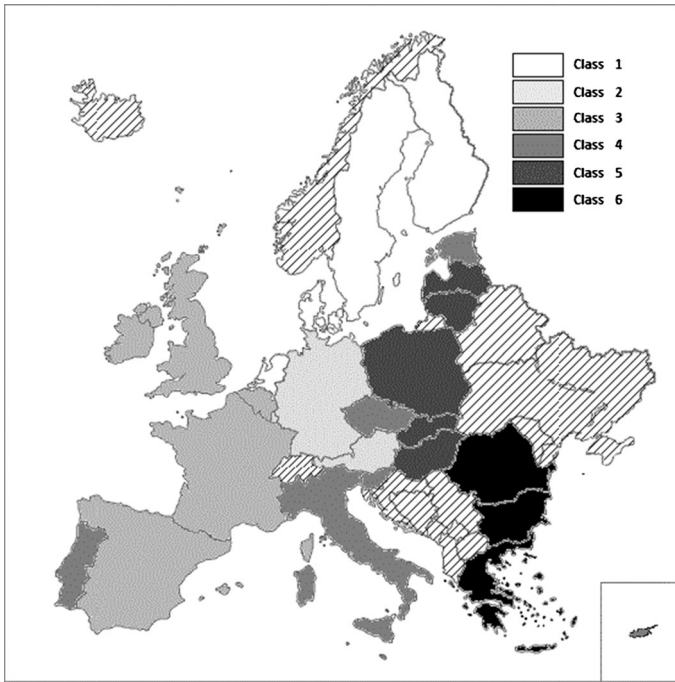


Fig. 1 European Well-being Index map and classes

articulated stratification and considerable complexity of the social structure, large migration phenomena, constant and widespread urbanization process and the consequences of industrialization, both in its last phase of sustained development (environmental depletion and massive exploitation of resources) and in the current slowdown (disadvantaged areas, deprivation and crime). This situation leads to a lacking distribution of well-being on all levels, due to the multiplicity of needs to meet, which make the choice of investment and allocation of resources difficult. France shows medium-high values in all dimensions, particularly regarding “Health”, and the United Kingdom with regard to “Research and Innovation” and “Work and Life balance”. Also the cases of Belgium and Ireland are interesting: the first one, apparently, has not been so heavily affected by the political deadlock experienced in recent years, bringing a fair result only in the domain “Politics and Institutions”; this country also records high level of “Quality of Services”. Ireland, within a framework of medium-high values, soars in the domain “Environment”. Finally Spain, counted among the PIIGS, obtains a quite good result, mainly thanks to its environmental protection policies.

As regards the fourth class, we can consider two situations for many aspects opposite: Italy and Estonia. Italy is one of the founding countries of the European Union, Estonia is a relatively young nation, that only in recent years has managed to engender a serious development of market economy. Even within the same class, these two nations are examples of very different situations: Italy is in the midst of an economic and political crisis with long lasting problems of social fragmentation and political instability, and applies policies aimed primarily at reducing its huge public debt. Estonia, despite past decades of economic immobility, has been able to emerge focusing on education and

research, setting goals not limited to the present, but projected on further development. The EWI has described this trend, assigning Estonia a better rank than Italy. Similar considerations can be made also for Slovenia and Czech Republic: in particular, the former reported values around the mean in various domains—and higher total score than Estonia, close to the nations with positive values. Finally, it should be noted, within the same class, the presence of Cyprus, Malta and Portugal.

In the last two classes are positioned countries characterized by economies that lag behind the others, but recently have begun a process of growth, helped by the “advantages of backwardness”. Greece probably would get a better result if not for its recent troubles, while for the case of Romania and Bulgaria, also considering the benefits received from the particular score derived from dimension “Safety”, lowest outcomes in nearly all domains have made their results hardly controvertible.

A final overview shows that small portions of population live in countries with extreme values of well-being—very high or very low—: namely 7.43 % belongs to the countries of the first class and 7.64 % to the countries of the sixth class. The majority of population lies in classes close to the average scores, the most populous of which is the third, where live 38.17 %, while only 28.67 % belong to the fourth and fifth class. This describes a situation where the majority of the European population stays in countries placed in classes with positive scores (63.69 %), and only a lower proportion (36.31 %) in countries with negative scores. This is not to be considered entirely negative, because out of this 36.31 %, almost two-thirds (20.07 % of total) live in Eastern European countries that joined the EU only recently, and over time should improve their condition thanks to such a membership.

6 Validation and Comparisons

6.1 Sensitivity Analysis

A sensitivity analysis was conducted to test the robustness. The procedure applied for the construction of the EWI was used without considering in turn each of well-being dimensions; subsequently the same procedure was performed excluding dimensions in pairs. We obtained in this way factor global scores based on the scores of the dimensions—in the first case—and nine dimensions—when were subtracted in pairs. The results were compared with each other through the Spearman rank correlation coefficient. The test showed a high correlation between the indices thus constructed—the coefficient of Spearman lowest obtained was 0,987—making it possible to say that the verification of robustness was successful.

6.2 Additive Model

To check the results, we have set up again the index using the unweighted sum of the selected variables. Since our partial indicators are often quantified in different units of measure, we have standardized them. Then we have calculated the *z-scores* for each variable under consideration, obtained by subtracting the mean value from each observation and dividing the result by the standard deviation. Each dimension is calculated through the sum of the *z-scores*, while the global indicator is the sum of the values obtained in the different dimensions, restandardized. The general formula is:

$$\sum_{ij} z_{i,j}$$

where $z_{i,j}$ is the *z-score* of each *j-th* variable of each *i-th* dimension, with μ_i and σ_i , mean and variance, respectively:

$$z_i = \frac{x_i - \mu_i}{\sigma_i}$$

Values $\pm(2/3) \sigma$, $\pm(4/3) \sigma$ have been used as cut-off for classes, together with 0, the mean value of the additive scores' distribution. The fifth and sixth columns represent the cumulative percentage of population within each class and within macro-groups with positive and negative scores respectively (Table 3).

We can use the Spearman rank correlation coefficient to compare the distribution of ranks of the index proposed with that obtained by the additive model.

The index shows a satisfying stability of the results obtained through the different methods: indeed the Spearman coefficient approaches unity (0.981).

Table 3 Additive Index: scores and population percentages

Class	Nation	Score	% Pop.	% Cumulative	
1	Denmark	15.31	1.11	4.09	63.69
	Sweden	14.14	1.90		
	Finland	13.07	1.08		
2	Netherlands	10.38	3.34	5.12	
	Austria	9.58	1.68		
	Luxembourg	7.80	0.11		
3	Germany	4.74	16.31	54.48	
	Belgium	3.29	2.22		
	Ireland	3.25	0.91		
	France	3.12	13.05		
	United Kingdom	2.88	12.70		
	Spain	0.24	9.29		
4	Slovenia	-1.20	0.41	15.96	36.31
	Estonia	-2.66	0.26		
	Malta	-2.71	0.08		
	Cyprus	-2.88	0.17		
	Portugal	-3.03	2.09		
	Slovakia	-3.32	1.08		
	Italy	-3.61	11.87		
5	Lithuania	-5.25	0.59	12.72	
	Poland	-5.50	7.66		
	Czech Republic	-5.73	2.09		
	Latvia	-6.04	0.40		
	Hungary	-7.85	1.97		
6	Romania	-10.51	3.99	7.64	
	Greece	-13.74	2.20		
	Bulgaria	-13.77	1.45		

6.3 Non-compensatory Index

Also a different methodology confirms our results. It is the so-called Mazziotta Pareto Index (MPI) (Mazziotta and Pareto 2007 and 2012), based on the assumption of “non-substitutability” of the dimensions, which are assumed have equal importance; no compensation between them is allowed. Applications of the MPI have been carried out in recent years to discuss the millennium development goals (MDG) (De Muro et al. 2009), to verify social inequality in the Italian regions (Mazziotta et al. 2010a, b), to measure the Italian health infrastructure endowment (Mazziotta and Pareto 2011) and to assess quality of life levels among Italian provinces (Mazziotta and Pareto 2012).

Therefore we have aggregated the indicators of each dimension by arithmetic mean and summarized the partial composite indices according to the MPI method. Then we have compared the results obtained through the MPI procedure and the EWI.

The steps in the construction of the MPI are the following: (1) normalization of the individual indicators by “standardization” and (2) aggregation of the standardized indicators by arithmetic mean with penalty function based on “horizontal variability”, i.e. the variability of standardized values for each unit. This variability, measured by the coefficient of variation, allows penalizing the score of the units which have higher imbalance between the values of the indicators. Finally, the use of the standardized deviation in reckoning the synthetic index sets up a measure which is robust and little sensitive to the elimination of a single elementary indicator (Mazziotta et al. 2010a, b). The normalization process is carried out as follows:

$$z_{ij} = 100 + \frac{(x_{ij} - \mu_j)}{\sigma_j} 10 \quad \text{if the } j\text{-th indicator is ‘‘positive’’}$$

$$z_{ij} = 100 - \frac{(x_{ij} - \mu_j)}{\sigma_j} 10 \quad \text{if the } j\text{-th indicator is ‘‘negative’’}$$

where, z_{ij} is the standardized value of each j -th variable of each i -th country; x_{ij} is the original value of each j -th variable of each i -th country; μ_j is the mean of each j -th indicator; σ_j is the standard deviation of each j -th indicator.

The characteristic “positive” or “negative” are interpreted with respect to well-being polarity: the polarity is “positive” if increasing values of the indicator correspond to positive variations of well-being, and is “negative” if increasing values of the indicator correspond to negative variations of well-being (Mazziotta and Pareto 2012). We have calculated the z -scores and the partial composite index for each k -th dimension, given by:

$$\bar{z}_{i,k} = \frac{\sum_{j=1}^n z_{i,j,k}}{n} \quad (k = 1, \dots, 11)$$

being $\bar{z}_{i,k}$ the partial composite index for the k -th dimension for each i -th country; $z_{i,j,k}$ the standardized value of each j -th variable of each i -th country for each k -th dimension.

The final step of this stage is the aggregation of the standardized values, to obtain the global MPI Index, and the comparison with the EWI. The MPI of well-being is obtained as:

$$MPI_i = \mu_{\bar{z}_i} - \sigma_{\bar{z}_i} cv_{\bar{z}_i}$$

where MPI_i is the value of MPI for each i -th country.

$$\mu_{\bar{z}_i} = \frac{\sum_{k=1}^{11} \bar{z}_{i,k}}{11}$$

$$\sigma_{\bar{z}_i} = \sqrt{\frac{\sum_{k=1}^{11} (\bar{z}_{i,k} - \mu_{\bar{z}_i})^2}{11}}$$

$$cv_{\bar{z}_i} = \frac{\sigma_{\bar{z}_i}}{\mu_{\bar{z}_i}}$$

This approach is characterized by the use of a function ($\sigma_{\bar{z}_i} cv_{\bar{z}_i}$), to penalize the units with “unbalanced” values of the partial composite indices. The penalty is based on the coefficient of variation and is zero if all values are equal. The purpose is to favour the provinces that, mean being equal, have a greater balance among the different dimensions of well-being (Mazziotta and Pareto 2012). Results of MPI are reported in Table 4. Even in this case, values $\pm(2/3) \sigma$, $\pm(4/3) \sigma$ have been used as a cut-off for classes, together with

Table 4 MPI: scores and population percentages

Class	Nation	Score	% Pop.	% Cumulative	
1	Denmark	108.33	1.11	4.09	63.69
	Sweden	108.22	1.90		
	Finland	107.46	1.08		
2	Netherlands	105.98	3.34	5.12	
	Austria	105.5	1.68		
	Luxembourg	104.55	0.11		
3	Germany	102.71	16.31	54.48	
	Belgium	102.01	2.22		
	France	101.91	13.05		
	United Kingdom	101.8	12.70		
	Ireland	101.52	0.91		
	Spain	100.14	9.29		
4	Slovenia	99.16	0.41	18.05	36.31
	Estonia	98.54	0.26		
	Malta	98.53	0.08		
	Cyprus	97.83	0.17		
	Portugal	97.7	2.09		
	Slovakia	97.65	1.08		
	Italy	97.57	11.87		
	Czech Republic	97.03	2.09		
5	Lithuania	96.81	0.59	10.62	
	Poland	96.54	7.66		
	Latvia	95.95	0.40		
	Hungary	95.26	1.97		
6	Romania	92.8	3.99	7.64	
	Greece	91.7	2.20		
	Bulgaria	91.56	1.45		

Table 5 EWI, GDP per capita, HDI and HDIi Spearman Rho coefficient

	GDP per capita	HDI	HDIi
EWI	0.897	0.842	0.846

the mean 100. The fifth and sixth columns represent the cumulative percentage of population within each class and macro-groups respectively.

Also in this case we can use the Spearman rank correlation coefficient to compare the distribution of ranks of the index proposed with those obtained by the additive and the MPI non-compensatory models. The Spearman coefficient between the EWI and the MPI is 0.985 and the Spearman coefficient between the additive and the MPI is 0.996. These results have great importance, as they show that the ranking obtained for EWI on the basis of the chosen variables is meaningful. Moreover, a similar output has been obtained both with a compensatory methodology (the simple additive process) and with a non compensatory construction (the MPI). Thus we can conclude that the selected variables guarantee a good base for the description of the phenomenon under scrutiny, since the ranking is not badly influenced by the compensation among dimensions.

6.4 EWI and HDI

We have also compared the EWI results with the GDP, the Human Development Index (HDI) and the Human Development Index adjusted for inequality (iHDI) through the Spearman rank correlation coefficient (Table 5).

The EWI is correlated more with the gross domestic product, than with the HDI and the HDIi. The discrepancy between the EWI and the indicators developed in the human development report arises because the latter uses a reduced number of dimensions and indicators. Although the degree of identification of the component of well-being for these macro-indicators diverges from that obtained with an indicator created ad hoc, the EWI is consistent with the objective of the HDI and HDIi. Indeed, HDI and HDI provide a description of human development for all countries in the world, including those where the availability of data is scarce, so that any measurement similar to the one just described would be very difficult, or even impossible.

On the other hand, the value of the Spearman coefficient between GDP and the EWI confirms that GDP per capita can be assumed as a reasonable approximation of well-being. Its value, however, suggests that this approximation is not complete and must be complemented by additional dimensions that income related indicators do not capture.

7 Conclusions

The quantitative exercise carried out here is the representation of a phenomenon, extrapolated from a set of proxies and elaborated through statistical tools. Even a large number of data can ensure just a fair approximation and its statistical synthesis inevitably leads to further loss of information. However, the measurement of well-being based only on economic parameters can be misleading and the addition of social indicators, always keeping in mind the due *caveats*, can be a way to overcome this obstacle.

Intertemporal analysis, currently impossible due to the lack of data, would demand a different, properly designed methodology. In this case, a specific study with time spans of about 5 years should provide useful information. However, we can note that even the simple updating of the indices with homogeneous data, that is the comparison between the year by year “photos” taken with our methodology, would make sense and offer interesting hints to whom interested in the short term, like policymakers usually are.

Besides the limits already underscored, we must remember that an index of this type offers a description of the national reality as a whole, not focusing on the important regional differences that distinguish each country. If one did the same exercise at NUTS 2 or NUTS 1 level, he/she might observe that the levels of well-being in Northern Italy regions could reach those of several territories in Central and Northern Europe, while Southern Italy would have an utterly different score. Reverse speech may cover areas such as the former Eastern Germany. What prevents an analysis of this kind is the lack of detailed harmonized data on a regional scale: were this type of data collected, we could obtain a more precise and correct perception of these realities.

The obtained results provide apparently conflicting outcomes: on the one hand, GDP per capita can be considered a reasonable approximation of well-being; but, on the other hand, it is not sufficient to give a complete and exhaustive description of the said well-being, making it useful to expand the amount of essential information to complete as much as possible the evaluation. The high value of the coefficient of Spearman leads us to think that GDP per capita may give a roughly similar result to EWI, but it does not convey several essential elements, such as social relations, the protection of environment or the political and institutional context that can create more or less useful basis for the improvement of well-being. Spain, for example, gets a positive result into the third class of countries with France and the United Kingdom thanks to its high score in the dimension “Environment”; considering only GDP per capita it would lie among countries with a value below the average.

Similar considerations can be made for Italy: the observation of the mere GDP per capita would suggest a position in line with the European average, but omitting a whole range of information through which one may deduce that its performance is not so positive. We should consider in this regard “Quality of Services”, where Italy gets by far a negative score: the GDP simply records the cost of services, but not their quality. Even Estonia probably would not get her result, if the level and quality of education were not allowed for. Similar remarks are possible for many specific situations in different countries. Therefore, the picture obtained from the calculation of EWI is consistent with the thesis of the Stiglitz-Sen-Fitoussi Commission, according to which GDP per capita can be a useful indicator, in order to measure well-being; the great error is assuming that this is enough, without performing a thorough analysis of the complementary data.

Moreover, although countries such as Germany, France or the United Kingdom are included in the upper classes, inequalities within them remain considerable. There are probably more people who endure a particular situation of poverty in one of these large countries, for example, than how many actually suffer it in one of the countries appearing in the last three classes. The EWI deals with the reduction of well-being induced by the existence of inequalities within each nation, using variables that try to capture it. Pockets of poverty within each of these countries are of not negligible magnitude, and certainly improvements in this sense are to be made.

Acknowledgments We wish to thank Prof. Bruno Soro (Department of Law, University of Genova) and Prof. Marco Mazzoli (Department of Economics, University of Genova) for their helpful comments and suggestions. Usual *caveat* applies.

Appendix 1: Selected Variables for the EWI Construction and Sources

See Tables 6.

Table 6 EWI indicators and sources

Dimension	Indicator	Source	
Health	Life expectancy (at 1 year)	Eurostat	
	Alcohol consumption among population	OECD	
	Cigarettes, cigars or pipes consumption	Special Eurobarometer	
	People suffering from tension	EQLS 2012	
	People discouraged or depressed	EQLS 2012	
	Death due to transport accidents	Eurostat	
	Death due to AIDS	Eurostat	
	Death due to cancer	Eurostat	
	Death due to diabetes mellitus	Eurostat	
	Death to diseases of nervous system	Eurostat	
	Death due to ischemic heart diseases	Eurostat	
	Death rate due to chronic diseases	Eurostat	
	Death to suicide	Eurostat	
	Obesity rate	WHO	
	Number of accidents at work	Eurostat	
	People practicing sport activities or physical exercise	EQLS 2012	
	Satisfaction with health	EQLS 2012	
	Infant mortality rate	Eurostat	
	Education and training	Early leavers from education and training	Eurostat
		Access to cinemas, theatres and cultural centres	EQLS 2012
Foreign language learning		Eurostat	
Young people not in employment and not in any education and training		Eurostat	
Life-long learning		Eurostat	
Reading skills		OECD	
Science skills		OECD	
Mathematic skills		OECD	
Individuals' level of computer skills		Eurostat	
Individuals' level of internet skills		Eurostat	
Total population having completed at least upper secondary education		Eurostat	
Persons with tertiary education attainment		Eurostat	
Participation in early childhood education		Eurostat	
People with low levels of education		Eurostat	
Satisfaction with education	EQLS 2012		
Work and life balance	Employees who can take a whole day off for family reasons	EQLS 2012	
	Employees with a contract of limited duration	Eurostat	
	Low-wage earners as a proportion of all employees	Eurostat	
	Underemployed part-time employees	Eurostat	

Table 6 continued

Dimension	Indicator	Source
Economic well-being	Employed persons working on Sundays	Eurostat
	Employed persons working at nights	Eurostat
	Hours worked per week of part-time employment	Eurostat
	Hours worked per week of full-time employment	Eurostat
	People with difficulties in fulfilling family responsibilities because of time absorbed by work	EQLS 2012
	People worried about finding a job of lower level in case of loss of employment	EQLS 2012
	Satisfaction with the amount of time devoted to work	EQLS 2012
	Satisfaction with current job	EQLS 2012
	Non-participation rate	Eurostat
	Unemployment rate	Eurostat
	Employment rate of elderly workers	Eurostat
	Time devoted to hobbies and interests	EQLS 2012
	Time spent in cooking or for housework	EQLS 2012
	Lack of bath or shower	EQLS 2012
	Lack of indoor flushing toilet	EQLS 2012
	Inability to make ends meet	Eurostat
	Gini coefficient of equivalised disposable income	Eurostat
	Lack of place to sit outside	EQLS 2012
	Enforced lack of a washing machine	Eurostat
	Enforced lack of a personal car	Eurostat
	Financial burden of the total housing cost	Eurostat
	Financial burden of the repayment of debts from hire purchases or loans	Eurostat
	Population in jobless households	Eurostat
	Possibility to have a meal with meat, chicken or fish every second day (if wanted)	EQLS 2012
	Possibility to keep the house warm	EQLS 2012
	Possibility to pay for holidays	EQLS 2012
	Per capita adjusted disposable income	Eurostat
	Family's financial situation compared to 12 months ago	EQLS 2012
	Financial situation expected in the next 12 months	EQLS 2012
	Satisfaction with housing	EQLS 2012
	Material deprivation rate	Eurostat
	At-risk-of-poverty rate	Eurostat
In work at-risk-of-poverty rate	Eurostat	
Overcrowding rate	Eurostat	
Social relationships	Generalized trust	EQLS 2012
	Enforced lack of a computer	Eurostat
	Enforced lack of a telephone	Eurostat
	Enforced lack of a colour TV	Eurostat
	Participation in religious functions except for weddings, funerals, baptisms	EQLS 2012

Table 6 continued

Dimension	Indicator	Source
	Participation in social activities of a club, a club or an association	EQLS 2012
	People practicing voluntary activities	EQLS 2012
	Persons taking care of other children or persons in need of care	Eurostat
	People taking care of children or grandchildren	EQLS 2012
	People who take care of elderly relatives or disabled	EQLS 2012
	People feeling marginalized by society	EQLS 2012
	People feeling alone	EQLS 2012
	Persons who reduced their working time to care for their youngest child aged less than eight	Eurostat
	Satisfaction with family life	EQLS 2012
	Social Exclusion Index	Eurostat
	Satisfaction with social life	EQLS 2012
Politics and institutions	Voter turnout	Eurostat
	Women executives in largest quoted companies	European Commission
	Trust in local authorities	EQLS 2012
	Trust in the government	EQLS 2012
	Trust in the parliament	EQLS 2012
	Trust in judicial system	EQLS 2012
	Trust in the press	EQLS 2012
	Trust in the police	EQLS 2012
	People signing a petition (also via e-mail or online)	EQLS 2012
	Participation in a protest or demonstration	EQLS 2012
	Participation in a meeting of a trade union, of a political party or of a action group	EQLS 2012
	Share of women elected in regional councils	European Commission
	Share of women elected in national government	European Commission
	Share of women elected in parliament	European Commission
	People contacting a politician or public official (other than routine contact through public services)	EQLS 2012
	Satisfaction with the economic situation of the country	EQLS 2012
Security	Number of police officers	Eurostat
	Assaults	UN
	Drug trafficking	Eurostat
	Violent crime	Eurostat
	Motor vehicle theft	Eurostat
	Domestic burglary	Eurostat
	Homicide	Eurostat
	Robbery	Eurostat
	Sexual violence	UN

Table 6 continued

Dimension	Indicator	Source
Subjective well-being	Optimism towards the future	EQLS 2012
	People struggling to find their own way	EQLS 2012
	People thinking that what they do is not recognized by others	EQLS 2012
	People thinking they have little time to do the things they really like	EQLS 2012
	People thinking that what they do in life is useful and interesting	EQLS 2012
	People feeling frustrated because of the working conditions or financial situation	EQLS 2012
	People feeling generally happy	EQLS 2012
	People who feel free to decide how to live life	EQLS 2012
	Satisfaction with the current standard of living	EQLS 2012
	Stress due to problems of balance between work and private life	EQLS 2012
Environment	Forests damaged by defoliation	Eurostat
	Average carbon dioxide emissions per km from new passenger cars	Eurostat
	Greenhouse gas emissions	Eurostat
	Emissions of sulphur oxides (SO _x)	Eurostat
	Share of energy from renewable sources	Eurostat
	Energy intensity of the economy	Eurostat
	Ecolabel licences	Eurostat
	EMAS-registered organisations and sites	Eurostat
	Problems with the quality of the air in the neighbourhood	EQLS 2012
	Problems of traffic congestion in the neighbourhood	EQLS 2012
	Generation of waste from the economic activity	Eurostat
	Water resources—long-term annual average	Eurostat
	Noise from neighbours or from the street	Eurostat
	Sufficiency of sites designated under the EU Habitats directive	Eurostat
Research and innovation	European high-technology patents	Eurostat
	European high-technology patents	Eurostat
	Level of Internet access	Eurostat
	Employment in high- and medium-high-technology manufacturing sectors	Eurostat
	Employment in knowledge-intensive service sectors	Eurostat
	Research and development personnel	Eurostat
	Share of government budget appropriations or outlays on research and development	Eurostat
	Human resources in science and technology as a share of labour force	Eurostat
	Total researchers	Eurostat
	Turnover from innovation	Eurostat

Table 6 continued

Dimension	Indicator	Source
Quality of services	Access to postal services	EQLS 2012
	Access to public transport infrastructure	EQLS 2012
	Judgment on the quality of child care services	EQLS 2012
	Judgment on the quality of long-term services	EQLS 2012
	Judgment on the quality of services relating to social housing	EQLS 2012
	Judgment on the quality of health services	EQLS 2012
	Judgment on the quality of public transport	EQLS 2012
	Judgment on the quality of the pension system	EQLS 2012
	Judgment on the quality of the education system	EQLS 2012
	Psychiatric care beds in hospitals	Eurostat
	Curative care beds in hospitals	Eurostat
	Problems with litter or rubbish on the street in the neighbourhood	EQLS 2012
	Problems with quality of drinking water in the neighbourhood	EQLS 2012
	Postal quality service	Eurostat
	Recovery rates for packaging waste	Eurostat
Recycling rates for packaging waste	Eurostat	

Appendix 2: Dimensions Ranking

See Tables 7, 8, 9, 10, 11, 12, 13, 14, 15, 16 and 17.

Table 7 Health ranking

Class	Nation	Score	% Pop.	% Cumulative
1	Sweden	2.33	1.90	1.90
2	Finland	1.23	1.08	18.75
	Cyprus	1.01	0.17	
	France	0.83	13.05	
	Netherlands	0.78	3.34	
	Denmark	0.7	1.11	
3	Spain	0.64	9.29	57.25
	Malta	0.58	0.08	
	Italy	0.57	11.87	
	United Kingdom	0.46	12.70	
	Austria	0.46	1.68	
	Ireland	0.45	0.91	
	Luxembourg	0.44	0.11	
	Belgium	0.22	2.22	
	Portugal	0.17	2.09	
Germany	0.16	16.31		

Table 7 continued

Class	Nation	Score	% Pop.	% Cumulative	
4	Greece	-0.11	2.20	2.87	22.10
	Slovenia	-0.18	0.41		
	Estonia	-0.56	0.26		
5	Czech Republic	-0.85	2.09	10.83	
	Slovakia	-0.91	1.08		
	Poland	-1.05	7.66		
6	Romania	-1.34	3.99	8.40	
	Lithuania	-1.41	0.59		
	Bulgaria	-1.44	1.45		
	Hungary	-1.51	1.97		
	Latvia	-1.71	0.40		

Table 8 Education and training ranking

Class	Nation	Score	% Pop.	% Cumulative	
1	Finland	1.8	1.08	5.53	57.33
	Denmark	1.46	1.11		
	Netherlands	1.33	3.34		
2	Sweden	1.09	1.90	2.01	
	Luxembourg	0.94	0.11		
3	Germany	0.64	16.31	49.80	
	Estonia	0.55	0.26		
	Belgium	0.54	2.22		
	United Kingdom	0.51	12.70		
	Austria	0.4	1.68		
	France	0.31	13.05		
	Slovenia	0.18	0.41		
	Slovakia	0.1	1.08		
	Czech Republic	0.02	2.09		
	4	Cyprus	-0.04		0.17
Ireland		-0.05	0.91		
Hungary		-0.17	1.97		
Lithuania		-0.19	0.59		
Poland		-0.26	7.66		
Latvia		-0.28	0.40		
Malta		-0.36	0.08		
Spain		-0.66	9.29		
5	Portugal	-0.87	2.09	23.24	
	Italy	-1	11.87		
6	Greece	-1.49	2.20	7.64	
	Bulgaria	-2.09	1.45		
	Romania	-2.43	3.99		

Table 9 Work and life balance ranking

Class	Nation	Score	% Pop.	% Cumulative	
1	Denmark	1.96	1.11	7.43	53.04
	Sweden	1.6	1.90		
	Finland	1.47	1.08		
	Netherlands	1.37	3.34		
2	United Kingdom	1.09	12.70	30.95	
	Germany	0.88	16.31		
	Austria	0.86	1.68		
3	Estonia	0.71	0.26	14.66	
	Ireland	0.46	0.91		
	France	0.37	13.05		
	Luxembourg	0.26	0.11		
4	Lithuania	0.04	0.59	20.65	46.96
	Latvia	-0.08	0.40		
	Belgium	-0.13	2.22		
	Slovenia	-0.37	0.41		
	Portugal	-0.4	2.09		
	Czech Republic	-0.41	2.09		
	Spain	-0.45	9.29		
	Romania	-0.52	3.99		
	Cyprus	-0.54	0.17		
	5	Slovakia	-0.68		
Italy		-0.83	11.87		
Malta		-1.02	0.08		
Bulgaria		-1.2	1.45		
Hungary		-1.23	1.97		
6	Poland	-1.24	7.66	2.20	
	Greece	-1.95	2.20		

Table 10 Economic well-being ranking

Class	Nation	Score	% Pop.	% Cumulative	
1	Sweden	1.34	1.90	1.90	56.99
2	Netherlands	1.29	3.34	23.62	
	Denmark	1.24	1.11		
	Finland	1.2	1.08		
	Luxembourg	1.1	0.11		
	Austria	1.04	1.68		
	Germany	0.78	16.31		
3	Belgium	0.64	2.22	31.47	
	France	0.61	13.05		
	United Kingdom	0.48	12.70		
	Czech Republic	0.46	2.09		

Table 10 continued

Class	Nation	Score	% Pop.	% Cumulative	
4	Slovenia	0.44	0.41	24.75	43.01
	Ireland	0.33	0.91		
	Malta	0.13	0.08		
	Italy	-0.17	11.87		
	Slovakia	-0.18	1.08		
	Cyprus	-0.23	0.17		
	Spain	-0.29	9.29		
	Portugal	-0.45	2.09		
5	Estonia	-0.55	0.26	12.42	
	Poland	-0.7	7.66		
	Hungary	-0.9	1.97		
	Greece	-0.97	2.20		
6	Lithuania	-0.98	0.59	5.84	
	Latvia	-1.56	0.40		
	Bulgaria	-1.93	1.45		
	Romania	-2.2	3.99		

Table 11 Social relationships ranking

Class	Nation	Score	% Pop.	% Cumulative				
1	Denmark	2.02	1.11	9.11	63.78			
	Sweden	1.75	1.90					
	Austria	1.43	1.68					
	Netherlands	1.34	3.34					
	Finland	1.32	1.08					
2	Germany	0.83	16.31	16.41				
	Luxembourg	0.72	0.11					
3	Ireland	0.63	0.91	38.25				
	United Kingdom	0.62	12.70					
	Belgium	0.27	2.22					
	France	0.21	13.05					
4	Malta	0.00292	0.08	6.65	36.22			
	Spain	0.00084	9.29					
	Cyprus	-0.00425	0.17					
	Portugal	-0.33	2.09					
	Slovenia	-0.39	0.41					
	Romania	-0.6	3.99					
	5	Estonia	-0.69			0.26	28.12	
		Slovakia	-0.72			1.08		
Italy		-0.77	11.87					
Lithuania		-0.85	0.59					
	Poland	-0.93	7.66					

Table 11 continued

Class	Nation	Score	% Pop.	% Cumulative
	Czech Republic	-1.03	2.09	
	Greece	-1.06	2.20	
	Hungary	-1.07	1.97	
	Latvia	-1.12	0.40	
6	Bulgaria	-1.6	1.45	1.45

Table 12 Politics and institutions ranking

Class	Nation	Score	% Pop.	% Cumulative	
1	Sweden	2.07	1.90	4.20	54.41
	Denmark	1.83	1.11		
	Finland	1.69	1.08		
	Luxembourg	1.45	0.11		
2	Netherlands	1.09	3.34	21.32	
	Austria	0.9	1.68		
	Germany	0.74	16.31		
3	France	0.51	13.05	28.88	
	Belgium	0.49	2.22		
	United Kingdom	0.24	12.70		
	Ireland	0.00386	0.91		
4	Spain	-0.02	9.29	31.65	45.59
	Malta	-0.08	0.08		
	Estonia	-0.16	0.26		
	Czech Republic	-0.44	2.09		
	Italy	-0.47	11.87		
	Latvia	-0.55	0.40		
	Poland	-0.61	7.66		
5	Cyprus	-0.68	0.17	11.74	
	Slovakia	-0.7	1.08		
	Portugal	-0.73	2.09		
	Lithuania	-0.85	0.59		
	Slovenia	-0.87	0.41		
	Bulgaria	-0.92	1.45		
	Hungary	-1.1	1.97		
	Romania	-1.14	3.99		
6	Greece	-1.63	2.20	2.20	

Table 13 Security ranking

Class	Nation	Score	% Pop.	% Cumulative				
1	Romania	2.97	3.99	5.06	22.09			
	Slovakia	2.57	1.08					
2	Poland	1.48	7.66	9.11				
	Bulgaria	0.82	1.45					
3	Cyprus	0.42	0.17	7.92				
	Greece	0.34	2.20					
	Latvia	0.23	0.40					
	Slovenia	0.21	0.41					
	Czech Republic	0.15	2.09					
	Lithuania	0.14	0.59					
	Malta	0.05	0.08					
	Hungary	0.04	1.97					
	4	Italy	-0.19		11.87	55.62	77.91	
		Estonia	-0.27		0.26			
France		-0.29	13.05					
Finland		-0.3	1.08					
Austria		-0.41	1.68					
Spain		-0.48	9.29					
Portugal		-0.52	2.09					
Germany		-0.55	16.31					
5		Luxembourg	-0.73	0.11	22.29			
		Ireland	-0.77	0.91				
	Netherlands	-0.92	3.34					
	Sweden	-0.95	1.90					
	United Kingdom	-0.98	12.70					
	Belgium	-0.99	2.22					
	Denmark	-1.01	1.11					

Table 14 Subjective well-being ranking

Class	Nation	Score	% Pop.	% Cumulative	
1	Denmark	1.96	1.11	7.43	50.73
	Netherlands	1.57	3.34		
	Finland	1.52	1.08		
	Sweden	1.45	1.90		
2	Austria	0.99	1.68	2.59	
	Ireland	0.84	0.91		
3	Germany	0.63	16.31	40.71	
	Luxembourg	0.62	0.11		
	Spain	0.47	9.29		
	Belgium	0.44	2.22		

Table 14 continued

Class	Nation	Score	% Pop.	% Cumulative	
4	United Kingdom	0.13	12.70		
	Malta	0.03	0.08		
	Slovenia	-0.06	0.41	35.93	49.27
	France	-0.14	13.05		
	Lithuania	-0.29	0.59		
	Italy	-0.31	11.87		
	Portugal	-0.37	2.09		
5	Estonia	-0.41	0.26		
	Poland	-0.59	7.66		
	Slovakia	-0.65	1.08	9.70	
	Latvia	-0.68	0.40		
	Cyprus	-0.73	0.17		
	Czech Republic	-0.77	2.09		
	Romania	-0.8	3.99		
6	Hungary	-0.97	1.97		
	Bulgaria	-1.64	1.45	3.65	
	Greece	-2.24	2.20		

Table 15 Environment ranking

Class	Nation	Score	% Pop.	% Cumulative	
1	Denmark	2.2	1.11	5.61	47.12
	Austria	1.93	1.68		
	Ireland	1.46	0.91		
	Sweden	1.33	1.90		
2	Spain	0.7	9.29	9.29	
3	Netherlands	0.65	3.34	32.23	
	Finland	0.59	1.08		
	Portugal	0.57	2.09		
	Latvia	0.44	0.40		
	Italy	0.23	11.87		
	France	0.22	13.05		
	Slovenia	0.03	0.41		
	Germany	-0.02	16.31	35.77	52.88
	Belgium	-0.05	2.22		
4	Hungary	-0.08	1.97		
	United Kingdom	-0.08	12.70		
	Luxembourg	-0.1	0.11		
	Greece	-0.35	2.20		
	Estonia	-0.53	0.26		
	Slovakia	-0.7	1.08	15.02	
	Romania	-0.9	3.99		

Table 15 continued

Class	Nation	Score	% Pop.	% Cumulative
	Lithuania	-0.92	0.59	
	Poland	-1.09	7.66	
	Malta	-1.24	0.08	
	Cyprus	-1.29	0.17	
	Bulgaria	-1.3	1.45	
6	Czech Republic	-1.68	2.09	2.09

Table 16 Research and innovation ranking

Class	Nation	Score	% Pop.	% Cumulative	
1	Finland	2.01	1.08	4.20	54.67
	Sweden	1.77	1.90		
	Denmark	1.52	1.11		
	Luxembourg	1.31	0.11		
2	Netherlands	1.04	3.34	45.40	
	United Kingdom	0.86	12.70		
	Germany	0.8	16.31		
	France	0.68	13.05		
3	Belgium	0.51	2.22	5.08	
	Austria	0.44	1.68		
	Ireland	0.25	0.91		
	Estonia	0.15	0.26		
4	Slovenia	-0.18	0.41	28.38	45.33
	Spain	-0.2	9.29		
	Czech Republic	-0.43	2.09		
	Malta	-0.46	0.08		
	Portugal	-0.58	2.09		
	Lithuania	-0.6	0.59		
	Italy	-0.63	11.87		
	Hungary	-0.64	1.97		
5	Cyprus	-0.68	0.17	11.51	
	Slovakia	-0.75	1.08		
	Latvia	-0.93	0.40		
	Poland	-0.94	7.66		
	Greece	-1.16	2.20		
6	Bulgaria	-1.42	1.45	5.44	
	Romania	-1.74	3.99		

Table 17 Quality of services ranking

Class	Nation	Score	% Pop.	% Cumulative	
1	Denmark	1.62	1.11	2.90	65.36
	Austria	1.49	1.68		
	Luxembourg	1.44	0.11		
2	Finland	1.28	1.08	24.84	
	Netherlands	1.24	3.34		
	Belgium	1.14	2.22		
	Germany	0.76	16.31		
	Sweden	0.74	1.90		
3	Spain	0.3	9.29	37.62	
	Malta	0.25	0.08		
	France	0.26	13.05		
	Slovenia	0.22	0.41		
	Czech Republic	0.11	2.09		
	United Kingdom	0.1	12.70		
4	Portugal	-0.2	2.09	15.70	34.64
	Ireland	-0.28	0.91		
	Estonia	-0.32	0.26		
	Cyprus	-0.44	0.17		
	Italy	-0.48	11.87		
	Latvia	-0.55	0.40		
5	Lithuania	-0.78	0.59	11.30	
	Slovakia	-0.81	1.08		
	Hungary	-0.9	1.97		
	Poland	-1.19	7.66		
6	Greece	-1.43	2.20	7.64	
	Romania	-1.52	3.99		
	Bulgaria	-2.04	1.45		

References

- Abdi, H. (2003). *Factor rotations in factor analyses. Encyclopedia for research methods for the social sciences* (pp. 792–795). Thousand Oaks, CA: Sage.
- Arrow, K., Dasgupta, P., Goulder, L., Daly, G., Ehrlich, P., Heal, G., et al. (2004). Are we consuming too much? *Journal of Economic Perspectives*, 18, 147–172.
- Berger-Schmitt, R., & Noll, H.-H. (2000). *Conceptual framework and structure of a European system of social indicators*. EuReporting Working Paper No. 9, Centre for Survey Research and Methodology (ZUMA), Social Indicators Department, Mannheim.
- Bleys, B. (2012). Beyond GDP: Classifying alternative measures for progress. *Social Indicators Research*, 109(3), 355–376.
- Brandolini, A. (2008). *On applying synthetic indices of multidimensional well-being: Health and income inequalities in selected EU countries* (Vol. 668). Banca d'Italia.
- Carstairs, V. (2000). Socio-economic factors at area level and their relationship with health. In P. Elliott, J. Wakefield, N. Best, & D. Briggs (Eds.), *Spatial epidemiology methods and applications* (pp. 51–68). Oxford: Oxford University Press.
- Carstairs, V., & Morris, R. (1991). *Deprivation and health in Scotland*. Aberdeen: Aberdeen University Press.

- Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioural Research*, 1(2), 245–276.
- Chadeau, A., & Fouquet, A. (1981). Peut-on mesurer le travail domestique? *Economie et Statistique*, 136(1), 29–42.
- CNEL-ISTAT. (2013). *Benessere Equo e Sostenibile*. Roma, Italia.
- CNEL-ISTAT, Comitato sugli indicatori di progresso e benessere. (2012). *La misurazione del Benessere Equo e Sostenibile*. Roma, Italia.
- Cummins, R. A. (1996). The domains of life satisfaction: An attempt to order chaos. *Social Indicators Research*, 38(3), 303–328.
- Cummins, R. A., Andelman, R., Board, R., et al. (1998). *Quality of life definition and terminology: A discussion document from the international society for quality of life studies*. The International Society for Quality-of-Life Studies (ISQOLS).
- Cuñado, J., & de Gracia, F. P. (2013). Environment and happiness: New evidence for Spain. *Social Indicators Research*, 112(3), 549–567.
- Daly, H. E. (1977). *Steady-state economics*. San Francisco: W. H. Freeman.
- Daly, H. E., & Cobb, J. J. (1989). *For the common good: Redirecting the economy toward community, the environment and a sustainable future*. Boston: Beacon Press.
- Dasgupta, P. (2000). *Valuation and evaluation: Measuring the quality of life and evaluating policy*. In Background paper prepared for the World Bank's annual World Development Report, World Bank.
- Dasgupta, P. (2001). *Human well-being and the natural environment*. Oxford: Oxford University Press.
- Dasgupta, P., & Mäler, K.-G. (2000). Net national product, wealth, and social well-being. *Environment and Development Economics*, 5(1–2), 69–93.
- Dasgupta, P., Sen, A., & Marglin, S. (1972). *Guidelines for project evaluation*. New York: United Nations.
- Dasgupta, P., & Weale, M. (1992). On measuring the quality of life. *World Development*, 20(1), 119–131.
- De Muro, P., Mazziotta, M., & Pareto, A. (2009). Composite indices for multidimensional development and poverty: An application to MDG indicators. In *Wye city group meeting. Held in Rome, Italy*. June. http://www.fao.org/es/ess/rural/wye_city_group
- Decancq, K., & Lugo, M. A. (2013). Weights in multidimensional indices of wellbeing: An overview. *Econometric Reviews*, 32(1), 7–34.
- Diener, E., & Suh, E. (1997). Measuring quality of life: Economic, social, and subjective indicators. *Social Indicators Research*, 40, 189–216.
- Dillon, W. R., & Goldstein, M. (1984). *Multivariate analysis: Methods and applications* (Vol. 45). New York: Wiley.
- Distaso, A. (2007). Well-being and/or quality of life in EU countries through a multidimensional index of sustainability. *Ecological Economics*, 64(1), 163–180.
- Doyal, L., & Gough, I. (1991). *A theory of human need*. Basingstoke and New York: Palgrave Macmillan.
- Doyal, L., & Gough, I. (1993). Need satisfaction as a measure of human welfare. In W. Blass & J. Foster (Eds.), *Mixed economies in Europe*. London: Edward Elgar.
- Easterlin, R. (1974). Does Economic growth improve the human lot? Some empirical evidence. In P. A. David & M. Reder (Eds.), *Nations and households in economic growth: Essays in Honor of Moses Abramowitz*. New York: Academic Press.
- Erikson, R. (1993). Description of inequality: The Swedish approach to welfare research. In M. Nussbaum & A. K. Sen (Eds.), *The quality of life*. Oxford: Oxford University Press.
- Frank, R. H. (1985). *Choosing the right pond: Human behaviour and the quest for status*. New York: Oxford University Press.
- Frank, R. H. (2004). Positional externalities cause large and preventable welfare losses. *American Economic Review*, 95(2), 137–141.
- Galbraith, J. K., & Crook, A. (1958). *The affluent society* (Vol. 534). Boston: Houghton Mifflin.
- Gasper, D. (2010). Understanding the diversity of conceptions of well-being and quality of life. *The Journal of Socio-Economics*, 39(3), 351–360.
- Goossens, Y., Mäkipää, A., Schepelmann, P., de Sand, I., Kuhndt, M., & Herrndorf M. (2007). *Alternative progress indicators to gross domestic product (GDP) as a means towards sustainable development*. Study provided for the European Parliament's Committee on the Environment, Public Health and Food Safety. PDESP/European Parliament.
- Gordon, D., & Pantazis, C. (1997). *Breadline Britain in the 1990s*. England: Ashgate Publishing Limited.
- Grasso, M. (2002). Una misurazione del benessere nelle regioni italiane. *Politica Economica*, 18(2), 261.
- Grasso, M., & Canova, L. (2008). An assessment of the quality of life in the European Union based on the social indicators approach. *Social Indicators Research*, 87(1), 1–25.
- Grasso, M., & Pareglio, S. (2007). Ranking well-being in the European Union. *Rivista Internazionale di Scienze Sociali*, 2, 242–263.

- Grisez, G., Boyle, J., & Finnis, J. (1987). Practical principles, moral truth and ultimate ends. *American Journal of Jurisprudence*, 32, 99.
- Guilford, J. P., & Hoepfner, R. (1971). *The analysis of intelligence*. New York: McGraw-Hill.
- Härdle, W., & Simar, L. (2007). *Applied multivariate statistical analysis* (Vol. 22007). Berlin: Springer.
- Hartwick, J. M. (1990). Natural resources, national accounting and economic depreciation. *Journal of Public Economics*, 43, 291–304.
- Hicks, J. R. (1946). *Value and capital* (Vol. 2). Oxford: Clarendon Press.
- Hirsch, F. (1976). *Social limits to growth*. Cambridge, MA: Harvard University Press.
- Hogan, J. W., & Tchernis, R. (2004). Bayesian factor analysis for spatially correlated data, with application to summarizing area-level material deprivation from census data. *Journal of the American Statistical Association*, 99(466), 314–324.
- Ivaldi, E., & Testi, A. (2011). Socio-economic conditions and health in Europe: A comparison among the 27 EU countries. In J. D. Rosen & A. P. Eliot (Eds.), *Social inequalities* (pp. 127–150). Hauppauge: Nova Science Publishers.
- Jarman, B. (1983). Identification of underprivileged areas. *British Medical Journal*, 1983(286), 1705–1709.
- Johnson, R. A., & Wichern, D. W. (2002). *Applied multivariate statistical analysis* (Vol. 5, No. 8). Upper Saddle River, NJ: Prentice Hall.
- Kahneman, D., Krueger, A., Schkade, D., Schwarz, N., & Stone, A. (2004). Toward national well-being accounts. *American Economic Review*, 94, 429–434.
- Kaiser, H. F. (1958). The varimax criterion for analytic rotation in factor analysis. *Psychometrika*, 23(3), 187–200.
- Khan, H. (1991). Measurement and determinants of socioeconomic development: A critical conspectus. *Social Indicators Research*, 24, 153–175.
- Krzanowski, W. J., & Marriott, F. H. C. (1994). *Multivariate analysis*. London: Edward Arnold.
- Maggino, F. (2009a). Towards more participative methods in the construction of social indicators: Survey techniques aimed at determining importance weights. In *Paper presented at the 62nd conference of the World Association for Public Opinion Research Public Opinion and Survey Research in a Changing World* (pp. 1–24). Swiss Foundation for Research in Social Sciences, University of Lausanne, Lausanne, Swiss, September 11–13, 2009.
- Maggino, F. (2009b). Methodologies to integrate subjective and objective information to build well-being indicators. In *Paper presented at the international conference from GDP to well-being: Economics on the road to sustainability* (pp. 1–27). Università Politecnica delle Marche, Ancona, Italy, December 3–5, 2009.
- Maggino, F., & Ruvigliani, E. (2008). Methodologies to integrate subjective and objective information to build well-being indicators. In *SIS, Atti della XLIV Riunione Scientifica* (pp. 383–390). Padova: CLEUP.
- Max-Neef, M. (1993). *Human scale development: Conception, application, and further reflections* (Vol. 1). London: Apex Press.
- Mayer, S. E., & Jencks, C. (1989). Poverty and the distribution of material hardship. *Journal of Human Resources*, 21, 88–113.
- Mazziotta, C., Mazziotta, M., Pareto, A., & Vidoli, F. (2010a). La sintesi di indicatori territoriali di dotazione infrastrutturale: Metodi di costruzione e procedure di ponderazione a confronto. *Rivista di Economia e Statistica del Territorio*, 1, 1–33.
- Mazziotta, M., & Pareto, A. (2007). Un indicatore sintetico di dotazione infrastrutturale: Il metodo delle penalità per coefficiente di variazione. In *Lo sviluppo regionale nell'Unione Europea—Obiettivi, strategie, politiche. Atti della XXVIII Conferenza Italiana di Scienze Regionali*, AISRe, Bolzano.
- Mazziotta, M., & Pareto, A. (2011). Un indice sintetico non compensativo per la misura della dotazione infrastrutturale: Un'applicazione in ambito sanitario. *Rivista di Statistica Ufficiale*, 13(1), 63–79.
- Mazziotta, M., & Pareto, A. (2012). A non-compensatory approach for the measurement of the quality of life. In F. Maggino & G. Nuvolati (Ed.), *Quality of life in Italy*. Social Indicator Research Series 48 (pp. 27–40). Netherlands: Springer.
- Mazziotta, M., Pareto, A., & Talucci, V. (2010b). *La costruzione di indicatori di disuguaglianza sociale: Il caso delle regioni italiane*. In XXXI Conferenza italiana di scienze regionali. http://www.grupposerviziambiente.it/aisre_sito/doc/papers/Mazziotta_Pareto_Talucci_AISRE.pdf
- McGillivray, M. (2007). Human well-being: Issues concept and measurement. In M. McGillivray (Ed.), *Human well-being. Concept and measurement* (pp. 1–22). Basingstoke and New York: Palgrave Macmillan.
- McKay, S., & Collard, S. (2003). *Developing deprivation questions for the family resources survey*. United Kingdom Department for Work and Pensions, Working Paper Number 13.
- Michalos, A. (2008). Education, happiness and wellbeing. *Social Indicators Research*, 87(3), 347–366.

- Michalos, A., Sharpe, A., & Muhajarine, N. (2010). *An approach to a Canadian Index of Wellbeing*. Working Paper prepared for the Atkinson Charitable Foundation, Toronto.
- Michalos, A.C., Smale, B., Labonté, R., Muhajarine, N., Scott, K., Moore, K., et al. (2011). *The Canadian Index of Wellbeing*. Technical Report 1.0. Canadian Index of Wellbeing and University of Waterloo, Waterloo, Canada.
- Mishan, E. J. (1967). *The cost of economic growth*. London: Staples Press.
- Morrison, D. F. (1976). *Multivariate statistical method*. New York: Mc Graw-Hill.
- Narayan, D., Chambers, R., Shah, M. K., & Petch, P. (2000). *Voices of the poor: Crying out for change*. New York: Oxford University Press for the World Bank.
- Nardo, M., Saisana, M., Saltelli, A., Tarantola, S., Hoffman, A., & Giovannini, E. (2005). *Handbook on constructing composite indicators: Methodology and user guide*. No. 2005/3. OECD publishing.
- Noll, H. H. (2002). Towards a European system of social indicators: Theoretical framework and system architecture. *Social Indicators Research*, 58(1–3), 47–87.
- Nordhaus, W. D., & Tobin, J. (1972). Is growth obsolete? In *Economic research: Retrospect and prospect Vol 5: Economic growth* (pp. 1–80). NBER.
- Nussbaum, M. (2000). *Women and human development: The capabilities approach*. Cambridge: Cambridge University Press.
- Oswald, A. J. (1997). Happiness and economic performance. *Economic Journal*, 107, 1815–1831.
- Porter, M., Stern, S., & Artavia Loria, R. (2013). *Social progress index 2013*. Washington, DC: Social Progress Imperative.
- Ramsay, M. (1992). *Human needs and the market*. Aldershot: Avebury.
- Reig-Martínez, E. (2013). Social and economic wellbeing in Europe and the Mediterranean Basin: Building an enlarged human development indicator. *Social Indicators Research*, 111(2), 527–547.
- Roy, D. (2011). *La contribution du travail domestique au bien-être matériel des ménages: une quantification à partir de l'enquête Emploi du Temps*. Document de travail. INSEE, Direction de Statistique Démographique et Sociales.
- Salzman, J. (2003). *Methodological choices encountered in the construction of composite indices of economic and social well-being*. Ottawa, CAN: Centre for the Study of Living Standards.
- Samuelson, P. A. (1961). The evaluation of 'Social Income': Capital formation and wealth. In F. A. Lutz & D. C. Hague (Eds.), *The theory of capital*. London: MacMillan.
- Schwartz, S. H. (1994). Are there universal aspects in the structure and contents of human values? *Journal of Social Issues*, 50(4), 19–45.
- Scitovsky, T. (1976). *The joyless economy*. New York: Oxford University Press.
- Sen, A. (1976). Real national income. *Review of Economic Studies*, 43(1), 19–39.
- Sen, A. (1982). *Choice, welfare and measurement*. Oxford: Basic Blackwell.
- Sen, A. (1985). *Commodities and capabilities*. Amsterdam: North-Holland.
- Sen, A. (1993). Capability and well-being. In A. Sen & M. Nussbaum (Eds.), *The quality of life*. Oxford: Clarendon Press.
- Somarriva, N., & Pena, B. (2009). Synthetic indicators of quality of life in Europe. *Social Indicators Research*, 94(1), 115–133.
- Stevens, J. (2002). *Applied multivariate statistics for social sciences*. Mahwah NJ: Lawrence Erlbaum Associates Inc.
- Stewart, K. (2005). Dimensions of well-being in EU regions: Do GDP and unemployment tell us all we need to know? *Social Indicators Research*, 73, 221–246.
- Stiglitz, J., Sen, A. K. & Fitoussi, J. P. (2009). *Report of the Commission on the measurement of economic performance and social progress*. http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf
- Sumner, L. W. (1996). *Welfare, happiness, and ethics*. Oxford: Clarendon Press.
- Tinbergen, J., & Huetting, R. (1992). GNP and market prices: Wrong signals for sustainable economic success that mask environmental destruction. In R. Goodland, H. Daly, & S. El Serafy (Eds.), *Population, technology and lifestyle: The transition to sustainability*. Washington DC: Island Press.
- Van den Bergh, J. C. (2009). The GDP paradox. *Journal of Economic Psychology*, 30(2), 117–135.
- Veenhoven, R. (2002). Why social policy needs subjective indicators. *Social Indicators Research*, 58(1–3), 33–46.
- Weitzman, M. L., & Löfgren, K.-G. (1997). On the welfare significance of green accounting as taught by parable. *Journal of Environmental Economics and Management*, 32, 139–153.
- Zolotas, X. (1981). *Economic growth and declining social welfare*. New York: University Press.