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Modelling subjective well-being dimensions through an IRT bifactor model: evidences from an Italian study

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The investigation of individual and community well-being has acquired a particular relevance over time for governments to develop strategies and identify resources for improving standards of living. To this aim, it is necessary to analyse changes at the overall level and examine how subjective well-being differs between different sub-groups of the population as well as across local areas. Using data measuring the well-being of residents in the Romagna area (Italy), we propose a multidimensional approach within the item response theory (IRT) framework to estimate an overall score of community Subjective Well-Being (SWB) and individual scores reflecting specific dimensions, taking into account for the ordinal polytomous nature of the items. The results show that aspects dealing with Life Evaluation mainly affect the overall SWB, while issues pertaining to Community and Environment are less important. The proposed approach is effective in developing an indicator which takes into account the multidimensionality of SWB and estimating individual scores reflecting the heterogeneity among residents.

keywords: Subjective Well-Being, graded response data, item response theory, bifactor model.

1 Introduction

The awareness for individual and community well-being has reached a greater relevance in the territorial governance and in the improvement of living standards. Having a

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good level of well-being, intended as personal satisfaction (happiness), is an individual aspiration as well as a collective objective for society (Veenhoven, 2012).

Recently, measuring well-being directly through a subjective evaluation of a person's happiness has received a growing attention due to two main reasons. First, it provides a direct measure of the individual's cognitive and affective reactions to her or his whole life (for a review, see Diener, 1984; Diener et al., 1999). Second, it can be based on the different dimensions of well-being, allowing for an explicit consideration of the multidimensional concept of Subjective Well-Being (SWB) (Sirgy, 2002; Van Praag et al., 2011; Van Praag, 2007, 2011).

The SWB may be usefully measured by means of the so-called satisfaction questionnaires, including questions on both life domains and general well-being. Then, self-reported satisfaction measures can be usefully used to evaluate individual well-being and preferences and plan socio-economic policies improving the well-being of a community or selecting actions directed to specific life-domains (Ferrer-i Carbonell and Frijters, 2004; Van Praag, 2007).

The well-being of Italian residents is measured through the "Multipurpose Survey on Households: Aspects of Daily Life" (HADL) carried out yearly by ISTAT (ISTAT, 2017). The survey focuses on the overall life satisfaction and covers only a few of the main domains of individual life; moreover, the measurement of each domain is based on a single item only, limiting the capability to deeply evaluate the citizens' happiness. In order to overcome these issues, the University of Bologna conducted in 2012 a survey on a representative sample of people living in the Romagna area (located in the North-East of Italy), for which several aspects of SWB as well as a large number of items for each life domain are observed. The Romagna is an interesting area where evaluating SWB because it is a developed territory, with homogeneous economic and social standards, it is technologically equipped and organized, and it is one of the main top ranked destinations for well-being (Il Sole24ore, 2011).

These data are investigated by using the item response theory (IRT; Hambleton et al., 1991) approach. In particular, we suggests using a statistical model-based approach for measuring the different dimensions (latent traits or domains) of satisfaction based on judgments expressed in an ordinal scale. IRT models have a number of interesting features for the measurement of SWB focusing both on item- and person-level analysis. For each item, the model includes crucial characteristics, as the threshold parameters, which can be interpreted as the item criticity levels in satisfaction analysis (Bernini et al., 2015a,b) and the discrimination parameters, expressing the strength of the relationship between each item and the underlying latent traits. IRT models also allow for the estimation of individual scores, which can be interpreted as measures of general and specific indicators for the overall SWB and its determinants. Consequently, using the estimated trait scores, an IRT model makes it possible to control for heterogeneity in the well-being of the community taking into account the residents' characteristics (Bernini et al., 2015a,b).

Given the complex structure of citizens' SWB, we propose the use of a multidimensional model that enables the measurement of a general construct for the overall SWB and a set of specific constructs for the SWB determinants. In particular, we consider

an IRT bifactor model for graded response data (Gibbons and Hedeker, 1992; Cai et al., 2011b), where different weights can be assigned to each item based on the discrimination parameters. To our knowledge, no empirical studies have used such an IRT model to estimate community SWB. Specifically, in the literature, the bifactor model is used in its original formulation for continuous data (see, e.g. Chen et al., 2006; Jovanović, 2015), without taking into account the categorical nature of the item responses and, as a consequence, producing biased parameter estimates (Asún et al., 2016). This paper expands the existing literature in two ways. First, we propose the use of the IRT bifactor model for graded response data in the context of SWB to jointly estimate the categorical item characteristics, an overall score of community SWB, and scores representing specific SWB dimensions related to Community and Environment, Personal Life, Leisure Activities, and Life Evaluation. Second, the overall SWB score and the specific scores are used to investigate heterogeneity of SWB and its different components with respect to residents' characteristics.

The paper is organized as follows. Section 2 describes the main features of the IRT approach and the bifactor model, Section 3 includes a description of the questionnaire and the sample, Section 4 reports the main results on the item parameters and individual scores, and Section 5 concludes the paper with a discussion.

2 IRT multidimensional models

Traditionally, IRT models (Lord and Novick, 1968; Hambleton et al., 1991) have been employed in the field of educational and psychological measurement to characterize the conditional probability of categorical item responses as a function of single or multiple latent variables (traits or factors) and a set of item parameters. Under the unidimensionality assumption, the categorical observed variables are explained by the existence of a single continuous latent variable. When two or more latent variables are assumed to underlie the response process, multidimensional item response theory (MIRT) models, either confirmatory or exploratory, are used (see, e.g. Reckase, 2009).

Under a confirmatory approach, the simplest model is the multi-unidimensional model (see, e.g. Sheng and Wikle, 2007), also known as the correlated factor model with simple structure, where each observed variable is related to a single latent variable, and the traits are allowed to correlate. In the bifactor model (Gibbons and Hedeker, 1992), the response to a test item is directly affected by both a general and a set of specific latent traits. The general and the specific traits are set orthogonal for model identification purposes. Potentially, the specific traits can be correlated. Within a Bayesian framework, by setting strongly informative priors, all traits are allowed to correlate in the so called additive model (Sheng and Wikle, 2009). The bifactor model has a high capacity for fitting the data well, thanks to its general structure. Other possible confirmatory latent structures deal with MIRT hierarchical models, where items in the same subtest measure a specific trait and, in turn, each specific trait is influenced by a general trait or vice versa, constituting an actual hierarchy (Sheng and Wikle, 2008). On the other hand, exploratory models (Reckase, 2009) are used when there is no prior information

on the number of dimensions. In the following section, the bifactor model for ordinal polytomous data is presented.

2.1 The bifactor model for graded data

In social and behavioral research, the item responses are often ordinal with more than two categories, expressing a judgement or an agreement. Different models for graded data have been developed depending on the number of estimated parameters (e.g., the partial credit model, the graded response model). In a multidimensional context, while models for binary data are frequently applied, models for ordinal polytomous data are still uncommon. In this paper we use an extension of the unidimensional graded response model for ordinal data (Samejima, 1969) to a multidimensional bifactor structure (see, e.g. Gibbons et al., 2007; Cai et al., 2011b).

The bifactor model for continuous data was originally introduced to extend the Spearman's one-factor model for intelligence tests to include so-called "group factors". Including these mutually uncorrelated factors enables the researcher to explain departures from the general (overall) factor. Indeed, according to a bifactor structure, each item response is related to a primary dimension (the overall, general trait θ_0) and one secondary dimension (the specific trait θ_v, where $v = 1, ..., V$ and V is the total number of secondary dimensions).

Let Y_{iv} be the variable expressing the response of an individual to item i belonging to the group v that can take values in the set $\{1, ..., m\}$, where m is the number of response categories which could differ for each item. It is assumed that an individual can reach a specific category level of an ordinal test item only if he/she is also able to reach all the lower categories on the same item, i.e., the item necessitates an amount of steps and the accomplishment of a step requires the achievement of the previous one. The graded bifactor model is specified in two steps. In the first step, the probability that the item response will fall in category j or higher, conditional to the latent traits, with $j = 2, ..., m$, is defined as the following cumulative response probability (Cai et al., 2011b)

$$P^*_{ijv} = P(Y_{iv} \geq j|\theta_0, \theta_v) = \frac{\exp(a_{i0}\theta_0 + a_{iv}\theta_v + d_{i(j-1)})}{1 + \exp(a_{i0}\theta_0 + a_{iv}\theta_v + d_{i(j-1)})}, \tag{1}$$

where a_{i0} is the discrimination parameter (slope) of item i on the general trait, a_{iv} is the discrimination parameter of item i on the specific trait, and $d_{i(j-1)}$ is the threshold (intercept) parameter. For each item, Equation (1) is specified $m - 1$ times because, by definition, for the first category ($j = 1$) we have

$$P^*_{i1v} = P(Y_{iv} \geq 1|\theta_0, \theta_v) = 1. \tag{2}$$

Each item i thus has $m - 1$ thresholds $d_{i1}, ..., d_{im}$ which are strictly ordered. It is important to note that both general and specific abilities are involved in determining the response probability, following a compensatory approach. In the second step, the

probability that the subject will select the j-th category for item i is determined as the difference of the corresponding two cumulative response probabilities as follow

$$P_{ijv} = P(Y_{iv} = j|\theta_0, \theta_v) = P^*_{ijv} - P^*_{i(j+1)v}. \tag{3}$$

For an item i with $j = 1, ..., m$ response categories, the probabilities in (3) are then determined as follows

$$\begin{aligned} P_{i1v} &= 1 - P^*_{i2v} \\ P_{i2v} &= P^*_{i2v} - P^*_{i3v} \\ &\cdots \\ P_{ijv} &= P^*_{ijv} - P^*_{i(j+1)v} \\ &\cdots \\ P_{imv} &= P^*_{imv}. \end{aligned} \tag{4}$$

One feasible approach for estimating the parameters is based on full-information maximum marginal likelihood (Gibbons and Hedeker, 1992; Gibbons et al., 2007; Cai et al., 2011b). If there are more than four dimensions, as in our work, model parameter estimation is handled most effectively by using the Metropolis-Hastings Robbins-Monro algorithm (Cai, 2010a,b).

Once the item and person parameters are estimated, it is possible to use the overall and the specific scores to investigate the heterogeneity of the sample with respect to the observed covariates. To analyse the underlying distributions of the latent traits and to detect the differences among them, we take advantage from the kernel density estimates. The kernel density plot approximates the probability density function of the population from which the data were sampled and plots the contour of that function. By doing so, the kernel density plot retains the ability to present the precise shape of a distribution. The application of the kernel distribution statistics to our data provides an objective mean to assess the nature of the latent trait distributions and variability which could be used to both visualize and interpret the results. Moreover, the kernel density estimates have the advantages of being smooth and independent of the choice of origin, allowing a better comparison among distributions (Salgado-Ugarte et al., 1993; Smith and Prentice, 1993).

Moreover, given the availability of subjects' covariates, it is desiderable to conduct a differential item functioning (DIF) analysis to investigate if the items function differently, i.e. they exhibit DIF, for some focal group with respect to some reference group. In the context of IRT, a DIF analysis is performed to understand if the trace lines differ for the groups. A relatively recent approach is based on the Langer's (2008) multiple-group Wald DIF test (Langer, 2008) and its extension to the bifactor analysis (Cai et al., 2011b), where the item parameters are directly compared across groups. In this way, the DIF null hyphotheses are turned into linear hypotheses that allow for the Wald tests.

3 Data

3.1 The SWB questionnaire

The investigation of SWB is not an easy matter because it requires directly asking people to evaluate their feeling. In order to define a multidimensional structure for SWB, different aspects should be measured. The European Commission (2013) suggests including aspects related to the life, which involve a cognitive evaluation of life as a whole, and measures of affect (positive and negative), which capture the feelings experienced by the respondent with respect to a variety of aspects of their life. The questionnaire used in the survey was constructed to capture the residents' evaluations of their personal well-being in the Romagna area. Four main domains were used: Community and Environment (8 items), Personal Life (5 items), Leisure Activities (7 items), and Life Evaluation (4 items). Satisfaction with the community and local features of the area where people live are known to largely affect SWB (Sirgy, 2002; Sirgy et al., 2008), which in turn can be measured by satisfaction with government services, businesses, non-profit services, community services and conditions, and neighbourhood features (see, among others Sirgy and Cornwell, 2002; Sirgy et al., 2008). Personal life pertains to the non-community domain and corresponds to several aspects of individual life, such as health, work, marriage and family, physical fitness, income, standard of living, and neighbourhood (Diener et al., 2003; Sirgy and Cornwell, 2002). Having satisfied basic biological needs, the fulfilment of psychological needs and pursuit of leisure may become an important source of SWB (Diener et al., 1999; Bernini et al., 2013). We suggest introducing leisure as an additional domain and measuring it by means of satisfaction for individual activities in recreation. Finally, life evaluation is considered as a determinant of an individual overall well-being (Stiglitz et al., 2009). A description of the dimensions and items can be found in Table 2. To complete the questionnaire, residents were asked to score each item on the basis of seven-point Likert-scale, ranging from 1 = extremely unsatisfied to 7 = extremely satisfied.

3.2 The sample

The sampling design was based on a stratification of the provinces of Romagna (Rimini, Forlì and Cesena, Ravenna) and the Republic of San Marino, and the demographic characteristics of residents (age and gender). A total of 850 questionnaires were obtained via a telephone survey (some personal interviews were also administered to complete the survey and guarantee the sample representativeness); 36 cases were excluded from the analysis, due to inconsistency or lacking a part of the questionnaire. The sample is composed of 44.2% males and 55.8% females; the average age of the participants is 48.6 years (SD = 16.2; range 18-83 years), the youngest people (under 25 years old) are 11% and the over 65 are 25.6%. About half of the participants (45.7%) had completed 13 years of formal education, and almost the half is employed (43.9%). The detailed characteristics of the sample are summarised in Table 1.

4 Results

4.1 Preliminary analyses

Before presenting the main results, some preliminary analyses are reported. The average of responses for each item is shown in Table 2. On average, the level of satisfaction is quite high and for most items the average values are above the median level. The analysis reveals that life evaluation comprises the most satisfying aspects for residents in the Romagna area as well as some items related to their relationships with relatives and friends. The lowest satisfaction scores are assigned to some characteristics of the environment (i.e., traffic, recreational offers), to the working condition and to some leisure activities.

A reliability analysis was performed on the response data. The results based on the point biserial correlation and the Cronbach's Alpha (α) are very satisfactory. The α value ranges between 0.70 for the second subtest (Personal Life) and 0.92 for the last subtest (Life Evaluation), showing fairly good reliability. The biserial correlation ranges from 0.5 to 0.8, except for the two items of Community and Environment on personal economic and working conditions. In the literature, the threshold for the biserial correlation is usually set at 0.3, so the performance on most items is fairly correlated to the performance on the test as a whole.

In order to choose the model with the best fit, we compared several models for graded data, which differ for structure and number of factors. The computer program IRTPRO 2.1 (Cai et al., 2011a) was used and the model parameters were estimated by using the Metropolis-Hastings Robbins-Monro algorithm. On the basis of goodness of fit indexes typically used for nested models (e.g., Bayesian information criterion (BIC)), we decided to consider four specific latent traits which, as described earlier, represent Community and Environment (θ_1), Personal Life (θ_2), Leisure Activities (θ_3), and Life Evaluation (θ_4). We estimated a unidimensional model, a multi-unidimensional model with the aforementioned specific traits, and a bifactor model, adding an overall trait θ_0, which can be interpreted as the overall SWB. Table 3 provides the values of BIC for the estimated models.

As shown in Table 3, the bifactor model should be preferred because it is associated with the lowest BIC value. The unidimensional model fits the data better than the multi-unidimensional and this result supports the presence of a strong overall trait. By introducing the specific factors, in addition to the general one, the model fit is improved, confirming the theory on the presence of several aspects in well-being.

4.2 The estimated item parameters for the bifactor model

On the basis of the results on the estimated discrimination parameters, we decided to eliminate the two items on personal economic and working conditions that were not consistent with the other items of the same specific trait θ_2 (Personal Life). In Table 4 the estimated discrimination parameters are reported. These parameters are all largely positive for almost items, suggesting that a coherent choice of the chosen latent structure was made. Indeed, the ability of an item to differentiate individuals with different level

of satisfaction increases as the discrimination parameters increase. The discrimination parameters associated to the overall trait are all rather high, confirming the presence of a general dimension which identifies the satisfaction level as a whole (i.e., the SWB). The aspects, which mainly affect and identify the overall SWB, as proved by the highest discrimination parameter values, pertain to the Life Evaluation domain. On the contrary, the least relevant issues deal with traffic, recreational and cultural activities, and safety, which belong to the Community and Environment domain. Looking at the specific discrimination parameters, some interesting findings emerge. With respect to the first specific trait related to the Community and Environment, all the specific discrimination parameters (a_1) are higher than the corresponding general discrimination parameters (a_0), except for economic condition and recreational and cultural activities. Therefore, most items belonging to the first group have an influence based on their specificity, while the items belonging to the second trait (Personal Life) have general discrimination parameters which are higher than the specific discriminations (a_2). As for the third domain (Leisure Activities), some items present a stronger relationship with the overall trait, while some others with the specific trait. The last factor (Life Evaluation) is associated to similar and high weights for both the general and the specific traits. Indeed, these items try to tease out the satisfaction level on aspects of life which are at the same time general and close to personal life.

According to the bifactor model, by fixing $\theta_0, \theta_1, ..., \theta_V$ at their average equal to zero, it is possible to use the threshold parameters to compare the response probabilities for each item category. Indeed, the threshold parameters reflect the quality or appreciation level related to the specific item issue. In particular, high threshold parameter estimates characterize the items, which are answered in the highest satisfaction categories more frequently. In Figure 1, a graphical representation of the $m-1$ estimated threshold parameters $d_{i(j-1)}$ for each item i with $j = 1, ..., m$ response categories, is given. We estimated 6 threshold parameters for each item.

The threshold parameters reflect the probability of moving from a certain response category to the following categories in the response choice. In particular, by comparing the thresholds of a given category of two different items, it is possible to understand which item has the highest probability of answering in that category or higher and, as a consequence, to identify the item describing the highest quality aspects, i.e. the particular issues for which it is easier to be satisfied. Considering the items within the Community and Environment trait, the item dealing with recreational and cultural activities shows, for each threshold, the lowest values turn out to be the most critical aspects, followed by the items on public services and traffic. On the other hand, the items associated to the highest thresholds describe the aspects for which it is easier to be satisfied: welcome and economic condition of life. In the Personal Life domain, the threshold parameters of the same category are similar and rather high for the highest categories, meaning that these items report values of general satisfaction, in particular for friend relationships. For the Leisure Activities trait, we can see important differences among the aspects with recreational activities and social relationships obtaining the highest satisfaction scores. Indeed, the threshold parameters are very high for the highest response categories. The most critical aspects deal with sport, hobby, and shopping

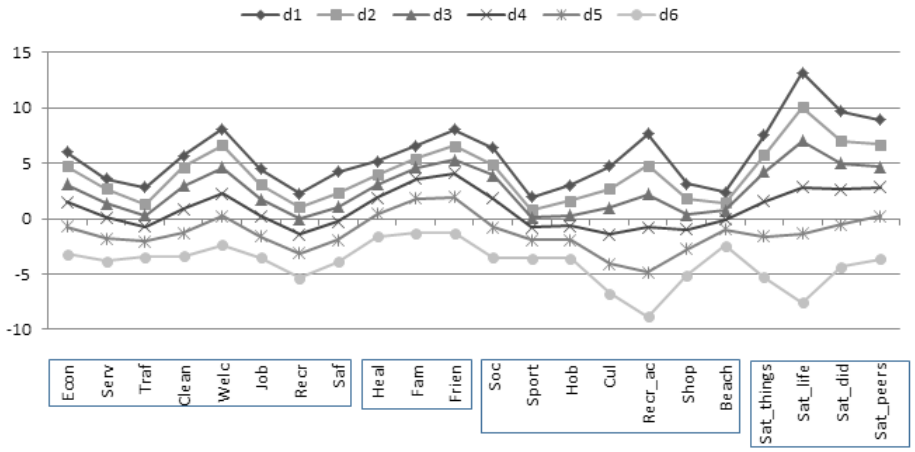

Figure 1: Graphical representation of the estimated threshold parameters for each item for the bifactor model with four specific traits

where the first threshold parameters are very low. The last factor shows that there is a high level of satisfaction, in particular concerning the satisfaction with most aspects of life and for what one did. By comparing all items, it is possible to highlight that the quality aspects deal with the private life, while the issues dealing with the environment and the recreational activities represent the most critical ones. As expected, the results on the threshold parameters are coherent with the discrimination parameters. Therefore, we can conclude that the choice of the general factor is the most appropriate in defining a synthetic indicator of SWB, because it is able to summarize the different aspects involved in the phenomenon. When considering the specificities related to the different personal and social fields, we believe that it is also important to account for the specific traits to define well-being in a broad and well-structured framework.

4.3 Latent trait distributions among residents

To capture the residents heterogeneity, the mean scores for the general and specific latent traits are calculated and compared on the basis of some socio-demographic characteristics (Table 5). On average, residents in the Romagna area show a positive well-being (0.53), mainly associated to their leisure activities and aspects of their own life, while the environment contributes less. The results support the hypothesis that being satisfied with one's own life and aspects related to daily life are the main factors related to the SWB (Soukiazis and Ramos, 2016). However, these relationships may vary within the community, and the investigation of how perceptions and attitudes differ among residents is a relevant issue for policymakers and local actors.

In general, overall SWB increases with both the level of education and the position in the labour market (Di Tella et al., 2001; Cracolici et al., 2013; Bernini et al., 2013); while a decreasing relation with age has been detected (Brajša-Žganec et al., 2011; Lloyd and

Auld, 2002). The condition of being a widow or widower and living in the area from birth strongly and negatively affects well-being. A large heterogeneity has been found within the different domains. Leisure Activities are mainly appreciated by the youngest residents, by the ones with at least a high school diploma, and by the single and divorced; as for occupational status, only the retired appreciate less activities in leisure. On the contrary, in Life Evaluation, old people, managers and entrepreneurs, or people with a low education assign high values, reflecting a different evaluation scheme. Becoming old seems to be associated with a reconsideration of what matters for well-being, how things were, most aspects of life, what one did and compared with peers. High values of Personal Life (comprising economic and working conditions, health, familiar and friend relationships) are expressed by young and middle age people, people that are looking for a job or already employed, and people with a family. Of particular interest is the evaluation of well-being related to the Environment, as it is a domain outside the direct control of residents. As mentioned, it is the dimension of well-being for which residents are most critical. In particular, the worst evaluations are expressed by highly educated residents as well as by the youngest, people looking for a job, and the divorced or single. The picture that emerges is that the Romagna area should do more to respond well to the needs of residents in terms of services and environmental aspects.

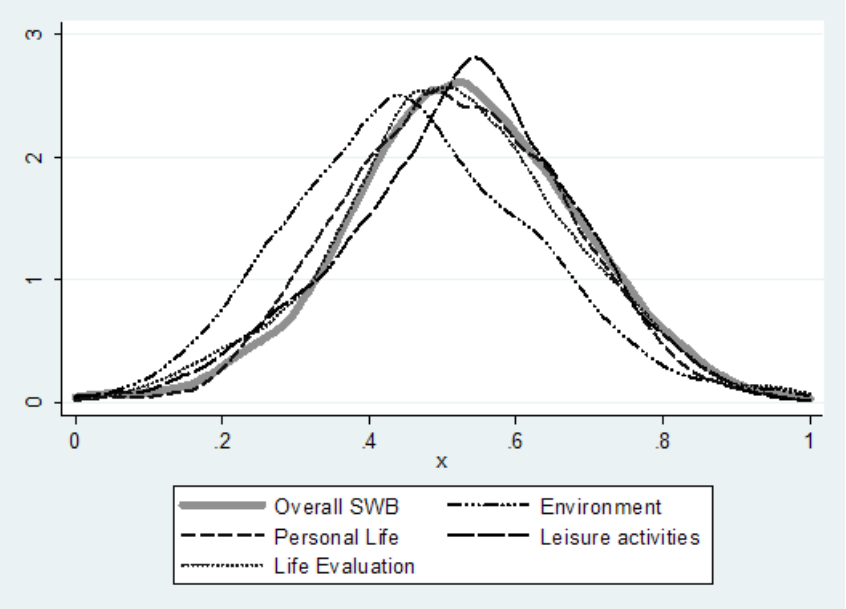

Figure 2: Latent trait kernel distributions

The kernel distribution of the latent traits and of the SWB indicator (Figure 2) confirms the large variability of perceptions within the community as well as the differences across domains. The SWB and Personal Life distributions are similar, confirming the strong relationships between these two aspects of well-being; while Community and Envi-

ronment is confirmed as the domain with the largest distance from the SWB distribution. The distribution of the Leisure Activities overlaps with the SWB in the right tail of the distribution, suggesting that these two aspects of life are mainly related with residents with high levels of happiness.

To analyse the heterogeneity among different groups, a preliminary multi-group analysis was also conducted to identify the possible presence of items with different response behaviors among groups. The analysis plans to evaluate if the items exhibit DIF with respect to the item discrimination and threshold parameters according to the Wald tests (Langer, 2008; Cai et al., 2011b). Given the model complexity and the presence of several categories for the covariates which are scarsely frequent in the data, the analysis was conducted following a unidimensional approach and with two groups for each covariate. On the basis of the results, some important findings emerged. Males and females, as well as working and not working people, show a difference in the weights (discrimination parameters) given to the items. On the contrary, the educational level, the age and the marital status define the differences especially in terms of ways of considering the item response categories (threshold parameters). These results may be ascribed to the small sample size, especially at a disaggregated level, and to the large number of response categories. Therefore, in the future investigation of the heterogeneity, an in-depth analysis of differential item functioning is recommended with a revised questionnaire in terms of response categories and with an increased sample size.

5 Discussion

The bifactor IRT approach reveals that a general dimension which identifies the satisfaction level as a whole as well as specific dimensions related to the Community and Environment, Leisure activities, Personal Life, and Life Evaluation can be identified and measured. Among these determinants, the aspects primarily affecting the overall SWB pertain to the Life Evaluation domain; conversely, Community and Environment is the domain that the less is related to the overall trait, as underscored by the general discrimination parameters. These findings suggest that citizens are able to distinguish between external and personal aspects of their own life in identifying what it is relevant for their well-being.

The analysis enables us to identify the items describing the highest quality aspects of life, or items for which it is easier to be satisfied. Community recreational and cultural activities, public services and traffic are the most critical issues for residents in the Romagna area. Welcome and economic condition of life as well as friend relationships, personal recreational activities, social relationships are the aspects for which it is easier to be satisfied. In general, residents identify the aspects related to their private life as quality aspects, while the issues dealing with the environment and the community activities represent the most critical ones.

The proposed approach shows a large heterogeneity within the community. The results show that the overall SWB increases with the level of education and the position in the labour market. Older people are likely to better evaluate what matters for their

happiness, which are all the aspects related to their own life. Young and middle age people assign more value to the aspects of their daily life such as economic and working conditions, health, familiar and friend relationships. Working people are the most dissatisfied with the environment.

These results may support local governments and policymakers in order to successfully improve the well-being of the community. Local authorities should pay more attention to Environment and Leisure activities, in order to support the life of the working and middle age people, both by monitoring traffic conditions, public services, cleanness and green areas, and by supporting job opportunities and cultural activities. Social and inclusion policies directed at enhancing the life of residents, and in particular of older people, should be considered in order to reduce social inequality within a community and boost initiatives to improve the role of personal life evaluation.

In the future developments of the research it would be important to conduct a DIF analysis once the sampling strategy is modified to take into account the covariates and the questionnaire is revised in terms of number of item response categories. The work done has represented an opportunity to discuss both the analysis of the citizens' behaviors and the limitations and the potentialities of the survey instrument.

Table 1: The profile of respondents

		Nr	%
Gender	Female	454	55.8
	Male	360	44.2
Education	Primary school certificate	87	10.7
	Middle school certificate	158	19.4
	High school certificate	372	45.7
	University degree	197	24.2
Age (years)	≤ 25	90	11.1
	$26 - 45$	258	31.7
	$46 - 65$	258	31.7
	> 65	208	25.6
Years in Romagna	≤ 25	125	15.4
	$26 - 45$	263	32.3
	$46 - 65$	238	29.2
	> 65	188	23.1
Occupational status	Manager/Entrepreneur	131	16.1
	Employee/Laborer	226	27.8
	Looking for job	39	4.8
	Retired	216	26.5
	Other	202	24.8
Marital status	Single	225	27.6
	Married	490	60.2
	Divorced	43	5.3
	Widower	56	6.9
Total		814	100.0

Table 2: Descriptive analyses on item responses

Item	Description	Average	Std. Dev.
Community and Environment			
Econ	Economic condition of life	5.152	1.059
Serv	Public services	4.364	1.389
Traf	Traffic	3.817	1.729
Clean	Cleanness and green areas	4.876	1.236
Welc	Welcome	5.502	1.119
Job	Job opportunities	4.554	1.326
Recr	Community recreational and cultural activities	3.397	1.373
Saf	Safety	4.190	1.544
Personal Life			
Per_econ	Personal economic condition	4.614	1.287
Heal	Health	5.521	1.366
Fam	Familiar relationships	5.937	1.139
Frien	Friend relationships	5.962	1.133
Work	Working	3.914	1.959
Leisure Activities			
Soc	Social relationships	5.199	1.209
Sport	Sport and fitness	3.756	2.003
Hob	Hobby	4.002	1.707
Cul	Personal cultural activities	3.923	1.606
Recr_ac	Personal recreational activities	4.232	1.719
Shop	Shopping	3.864	1.778
Beach	Beach and sea	4.351	2.045
Life Evaluation			
Sat_things	Satisfaction for how things were	4.937	1.318
Sat_life	Satisfaction with most aspects of life	5.147	1.215
Sat_did	Satisfaction for what did	5.287	1.244
Sat_peers	Satisfaction when comparing with peers	5.434	1.268

Table 3: Bayesian information criterion (BIC) for the estimated models

Model	BIC
Unidimensional	55425.37
Multi-unidimensional	57252.24
Bifactor	51805.53

Table 4: Estimated discrimination parameters and standard errors (s.e.) for the bifactor model with four specific traits

Item	a_0	s.e.	a_1	s.e.	a_2	s.e.	a_3	s.e.	a_4	s.e.
Community										
and Environment										
Econ	1.20	0.10	0.48	0.08	0.00	—	0.00	—	0.00	—
Serv	0.80	0.08	0.90	0.09	0.00	—	0.00	—	0.00	—
Traf	0.33	0.08	1.39	0.11	0.00	—	0.00	—	0.00	—
Clean	0.67	0.09	1.75	0.12	0.00	—	0.00	—	0.00	—
Welc	1.14	0.10	1.86	0.15	0.00	—	0.00	—	0.00	—
Job	0.94	0.09	0.94	0.09	0.00	—	0.00	—	0.00	—
Recr	0.61	0.08	0.25	0.08	0.00	—	0.00	—	0.00	—
Saf	0.52	0.08	1.65	0.13	0.00	—	0.00	—	0.00	—
Personal Life										
Heal	1.52	0.12	0.00	—	0.43	0.11	0.00	—	0.00	—
Fam	1.78	0.15	0.00	—	1.31	0.20	0.00	—	0.00	—
Frien	2.39	0.19	0.00	—	1.39	0.27	0.00	—	0.00	—
Leisure Activities										
Soc	2.06	0.13	0.00	—	0.00	—	0.83	0.09	0.00	—
Sport	1.28	0.10	0.00	—	0.00	—	1.40	0.10	0.00	—
Hob	1.19	0.09	0.00	—	0.00	—	1.00	0.09	0.00	—
Cul	2.10	0.12	0.00	—	0.00	—	2.87	0.16	0.00	—
Recr_ac	3.41	0.29	0.00	—	0.00	—	4.91	0.45	0.00	—
Shop	1.64	0.11	0.00	—	0.00	—	2.05	0.12	0.00	—
Beach	1.42	0.10	0.00	—	0.00	—	0.93	0.09	0.00	—
Life Evaluation										
Sat_things	2.43	0.15	0.00	—	0.00	—	0.00	—	2.30	0.13
Sat_life	3.67	0.29	0.00	—	0.00	—	0.00	—	3.95	0.36
Sat_did	2.26	0.14	0.00	—	0.00	—	0.00	—	2.74	0.17
Sat_peers	2.20	0.14	0.00	—	0.00	—	0.00	—	2.53	0.16

Table 5: Latent trait mean scores

		Community and Environment	Personal Life	Leisure Activities	Life Evaluation	Overall SWB
Gender	Female	0.470	0.515	0.523	0.511	0.523
	Male	0.450	0.516	0.523	0.521	0.535
Education	Primary school certificate	0.550	0.483	0.349	0.562	0.449
	Middle school certificate	0.477	0.496	0.459	0.498	0.472
	High school certificate	0.450	0.524	0.567	0.506	0.546
	University degree	0.429	0.530	0.570	0.525	0.576
Age	≤ 25	0.417	0.523	0.609	0.506	0.602
	$26 - 45$	0.442	0.519	0.580	0.511	0.569
	$46 - 65$	0.467	0.513	0.518	0.515	0.522
	> 65	0.513	0.491	0.401	0.530	0.451
Years in Romagna	≤ 25	0.528	0.505	0.541	0.608	0.518
	$26 - 45$	0.440	0.519	0.574	0.506	0.563
	$46 - 65$	0.468	0.516	0.515	0.518	0.512
	> 65	0.516	0.489	0.403	0.533	0.451
Occupational status	Manager/Entrepreneur	0.427	0.532	0.562	0.556	0.559
	Employee/Laborer	0.452	0.525	0.534	0.493	0.542
	Looking for job	0.415	0.593	0.583	0.388	0.507
	Retired	0.505	0.485	0.420	0.525	0.456
	Other	0.452	0.516	0.573	0.511	0.558
Marital status	Single	0.437	0.519	0.602	0.486	0.576
	Married	0.467	0.526	0.503	0.531	0.522
	Divorced	0.431	0.501	0.570	0.502	0.515
	Widower	0.526	0.425	0.353	0.508	0.405
Total		0.461	0.516	0.523	0.515	0.528

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