

This is a postprint version of the following published document:

Grané, A., Albarrán, I. & Arribas-Gil, A. Constructing a Children's Subjective Well-Being Index: an Application to Socially Vulnerable Spanish Children. *Child Ind Res* **13**, 1235–1254 (2020).

DOI: [10.1007/s12187-019-09692-w](https://doi.org/10.1007/s12187-019-09692-w)

© Springer Nature B.V. 2019

Constructing a children's subjective well-being index: An application to socially vulnerable Spanish children

Aurea Grané⁽¹⁾, Irene Albarrán⁽¹⁾, Ana Arribas-Gil⁽²⁾

(1) *Universidad Carlos III de Madrid. Statistics Department.*

(2) *UC3M-BS Institute of Big Data. *†‡*

Abstract

It is well-known that traditional economic measures such as household income appear to play less of a role in explaining children's subjective well-being than adults'. This paper focuses on the construction of a children's well-being index taking into account subjective and emotional factors, such as children's experiences of material deprivation and bullying, the quality of family relationships and with peers, the quality of services in their neighbourhood and personal well-being. The index is constructed from principal component analysis and rescaled to 0-100% for better interpretation. Data comes from a survey run in Spain in 2016 by the largest humanitarian organization involved in social programs in the country, covering socially vulnerable children aged 8-11, with around 2,900 respondents. The main findings are: (i) bullying makes the difference between children being moderate or completely unsatisfied with their lives; (ii) there is no a single Spanish region reaching satisfying well-being levels across all the components of the index. The methodology proposed for the construction of the index is general enough to be applied to general child population, regardless their social vulnerability condition or even country, adapting the questionnaire appropriately.

Keywords: Early childhood, Bullying, Principal Component Analysis, Subjective well-being

AMS Subject Classification: 62-07, 62-09, 62H20, 62H99, 62P05.

1 Introduction

All European economies were affected by the Great recession, although its intensity was not the same in each country. In particular, Spain was hit hard, mainly because the Welfare state was created more recently than in other western European countries. The tremendous impact of this economic crisis in Spain, specifically on the population in situation of poverty and social vulnerability, has entailed the deepest shock

Finãncial support from research project MTM2014-56535-R by the Spanish Ministry of Economy and Competitiveness.

Authors' address: (1) Statistics Department, Universidad Carlos III de Madrid, C/ Madrid 126, 28903 Getafe, Spain. E-mails: I. A. Grané aurea.grane@uc3m.es, Albarrán irene.albarran@uc3m.es, A. Arribas-Gil ana.arribas@uc3m.es

Corresponding author: A. Grané; Date: October 16, 2019.

experienced by the Spanish society in the past 30 years. Since then, the decline in living standards of families is highly conditioned by unemployment and low impact of family benefits in the reduction of poverty. These risk factors are not only important because of the effects of deprivation on self-development, but also because they are the channel for the intergenerational transmission of poverty and for the increase of inequality.

According to UNICEF (2014) the evolution of child poverty rate in 41 OCDE countries between 2012 and 2008 ranged from the best, -8.67 points achieved by Chile, to the worst, 20.40 points registered in Iceland. Spain reached 8.10 points taking the 35th rank and falling to the 37th when other indicators related to feeding, stress, life satisfaction and opportunity to learn were considered.

Child poverty is high on the policy agenda in Spain and the European Union. However, poverty or social exclusion indicators such as AROPE (At Risk Of Poverty or social Exclusion index) are usually obtained by asking adults about their incomes, living standards and employment situation, and do not include any indicator on children's perception of "good life" or well-being. Indeed, traditionally, it was assumed that the results obtained from the adult population also apply to the entire population.

Nonetheless, a before and after in the way of considering child rights and perceptions was marked by the United Nations Convention on the Rights of the Child (CRC or UNCRC), adopted on November-20th 1989. Since then, the child is conceived as an active subject of rights, who must be heard and who has the right to freely express their opinion and participate in decisions that affect them (Act 12). The Committee on the Rights of the Child goes in the same line and recommends to give children a voice in order to study the real necessities and concerns of children and to obtain indicators attending to their opinions and answers (UNCRC 2009). Another fundamental principle of the CRC is the best interests of the child, stating that all measures and decisions adopted by the different levels of government having an impact on children must be oriented to guarantee their best interests. This principle can not be interpreted and applied without due consideration of the opinion of children when it comes to defining their best interests in each case.

In recent decades a certain scientific interest to study quality of life, happiness and subjective well-being (SWB) during childhood and adolescence has emerged. Extensive literature reviews can be found in Huebner et al. (2004), Casas et al. (2011), UNICEF (2012), Casas et al. (2013), Huebner et al. (2014), Gross-Manos et al. (2015), Dinisman and Ben-Arieh (2016), among others.

Adamson (2007) is probably the first international study that used objective and subjective indicators in order to measure children well-being. This UNICEF's report marked an important step towards the articulation of objective and subjective indicators for understanding children's living situations in different countries (Casas and Rees 2015).

Some efforts have been done to develop measures that capture children's SWB, which have been validated in many aspects and found reliable across countries, languages and age groups (Casas et al. 2013, Casas and Rees 2015, Huebner et al. 2011). However, there are still fewer studies focusing on children's SWB rather than on adults' (Casas et al. 2011, Huebner et al. 2004) as well as a need for further development of such measures (Gross-Manos et al. 2015).

Focusing on the Spanish case, in 2016 a pioneering study by the largest humanitarian organization operating in Spain analyzed the crisis' effects on the situation of childhood, from a children's self-perspective (Gil et al. 2016). The data from this survey is the basis for the development of a child-centric index of well-being, focused on their self-reality, either at home, at school or in their neighborhood.

1.1 Subjective Well-being

Campbell et al. (1976) were probably the first to define SWB as perceptions, evaluations and aspirations of people on their lives. According to Diener (1994), SWB refers to individuals' evaluation of the quality of their lives in general. It is a multidimensional construct that includes cognitive and affective components. Diener (1984) suggests that SWB has three main characteristics: (1) it is grounded in each person's perceptions and evaluation of his or her experiences; (2) it includes not only the absence of negative experiences but the presence of positive experiences as well; (3) it includes an overall view of life, usually labeled as "life satisfaction". Park (2004) considers that SWB has long been considered a central component of the good life. Subjective well-being of the population is a very important component of the quality of life, and this is also valid for the child population.

1.2 Research Aims and Questions

The broad aim of this work is the construction of a child-centric index of well-being (that we call CWEBI) using internationally accepted standard measures, such as those of The International survey of Children's Well-Being (funded by Jacobs Foundation). The overall question to be addressed in this paper is to analyze the impact of index components on the CWEBI and across the Spanish regions. Other questions to be solved are to what extent CWEBI variations are related to AROPE rate variations across the Spanish territory.

We are particularly interested on vulnerable Spanish children and want to be able to explain their well-being in relation to their fragile environment. Following the principle according to which "to improve something you first need to measure it", we believe that a good assessment is a key element for the elaboration of any public policy. Getting a thorough knowledge of the situation of vulnerable children in Spain and the level of compliance with their rights and well-being, will allow decision-making based on evidence and the development of coherent and effective policies.

Data comes from a survey run in 2016 by the largest humanitarian organization involved in social programs in Spain, covering children aged 8-11, with around 2,900 respondents. The questionnaire takes into account the approach of children's well-being, developed by the global network on Child and Youth Well-Being Indicators, funded by the Jacobs Foundation (The International Survey of Children's Well-Being). The questionnaire included around fifty questions that have been grouped in seven topics related to childrens material situation and their subjective well-being. In particular, children's experiences of material deprivation and bullying, the quality of family relationships, with peers and with their teachers, the quality of services in their neighbourhood and personal well-being.

The new index has been constructed applying principal component analysis to the

seven topics described above. For better interpretation, the index has been rescaled into 0-100% and the greater the index the worse the child situation. The main finding is that bullying makes the difference between children being moderate or completely unsatisfied with their lives. This finding goes in the line of International Amnesty report on bullying in Spain that concludes that bullying is a social problem that affects children’s capacity to fully enjoy their human rights (InternationalAmnesty 2019). Another interesting finding is that there is no a single Spanish region scoring low, that is, reaching satisfying levels, on all the components of the children’s well-being index.

The paper is organised as follows. In Section 2 we describe the dataset and the methodology to construct a children’s well-being index. In Section 3 we present the results and analyse the inequalities across Spanish territories according to this index. We close the paper in Section 4.

2 Method

2.1 Data Source

The analysis is based on a dataset coming from a survey carried out in 2016 by the largest humanitarian organization involved in social programs in Spain. The survey included 5,148 children, 67.3% aged 8-11 and 32.7% aged 12-14, actively participating in the program of “promotion of school success” of this non-profit organization throughout Spain. The project “promotion of school success” is a comprehensive program, which addresses educational and social integration aspects, as well as economic problems that affect the well-being of these children. In some cases, also their parents participate in other social projects of the organization, particularly in the case of people in situation of extreme vulnerability. In 2016, the total amount of children participating on this program all over Spain was 71,857, which represents a 2.13% of the Spanish child population (aged 8-14), according to the Spanish National Statistical Office (INE). They constitute a particularly vulnerable group of children: 52% of their families have encountered serious economic problems in the past year; 36% of them live in joblessness households (more details on the socio-economic characteristics can be found in Gil, Romera, and Grané (2016)).

For this study, we are particularly interested in early childhood, therefore we focus our attention on children aged 8-11. Due to some missing data, the final sample used for this study is formed by 2,908 children aged 8-11, that is, 84% of all children aged 8-11. We did not consider imputation methods. This is a representative sample of children of that age participating in the above mentioned programs, although it is not representative of the general Spanish children population. The focus of this study is on children in situations of social vulnerability.

The measures included in the analysis are drawn from child self-completion questionnaires (see Table 1). The questionnaire used takes into account the approach of children’s well-being, and was developed by the global network on Child and Youth Well-Being Indicators, funded by the Jacobs Foundation (The International Survey of Children’s Well-Being).

2.2 Measures

From all the questions in the questionnaire we have constructed seven indicators related to children’s experiences of material deprivation, the quality of family relationships, the quality of the relationship with their peers, the quality of the relationship with their teachers and the school environment, children’s experiences on bullying, the quality of services in their neighbourhood and their personal well-being.

In particular, material deprivation is a global indicator that measures child poverty as the impossibility to satisfy those material necessities that are common to children in the same society (González-Bueno 2014). The indicator on quality of family relationships includes also the adequacy of the house and security at home, since inadequate or insecurity households tend to negatively influence coexistence. Quality of relationship with their peers measures the frequency of playing and studying with friends during the week. The indicator on quality of the relationship with their teachers and school environment measures child satisfaction and security at school and the possibility to pay for extra materials/activities. Children’s experiences on bullying summarizes their experience on this matter during the last month. Bullying has harmful effects on the enjoyment of multiple human rights, such as health, education and adequate standard living (UN 2016). Quality of services in their neighbourhood is a global indicator measuring the neighbourhood equipment, since the environment in which children live, grow, play and develop is relevant in relation to equal opportunities and, therefore, to social cohesion. A well-endowed environment of infrastructures and services can partially compensate some economic deficiencies experienced by families, while an environment without affordable and effective services, with insecurity and social conflict, has the opposite effect (UNICEF 2012). Finally, personal well-being measures psychological well-being, happiness, life satisfaction and subjective quality of life (Casas and Bello 2012). For more detail on these indicators see Table 1.

Additionally, we have considered a control indicator that summarizes the self-opinion of their whole live at the time the survey was conducted. This indicator contains the answers to “my life is going well”, “my life is how I want it to be” and “I feel very loved”.

Initially, each indicator was constructed as the sum of the corresponding measures. For example, for each child, the material deprivation indicator was obtained by adding 19 binary measures, from ‘Have breakfast every day’ to ‘Toys and games’ in Table 1, yielding a range for this particular indicator between 0-19. Analogously, the family relationship indicator was calculated for each child by summing 4 measures in ordinal scale, from ‘My parents/tutors listen to me and consider my opinions’ to ‘I am not cold at home during winter’, yielding a range of 0-16, and so on.

For the sake of interpretability all indicators were rescaled to 0-10. In all cases, the greater the indicator, the worse the situation of the child. In Table 2 we give some descriptive statistics for these indicators together with a 95% confidence interval for the population mean and in Figure 1, the corresponding histograms.

2.3 Index Construction

Composite indexes are useful at summarizing complex phenomena with multidimensional implications, such as children subjective well-being, and analyzing their trends.

Table 1: Indicators, measures and values

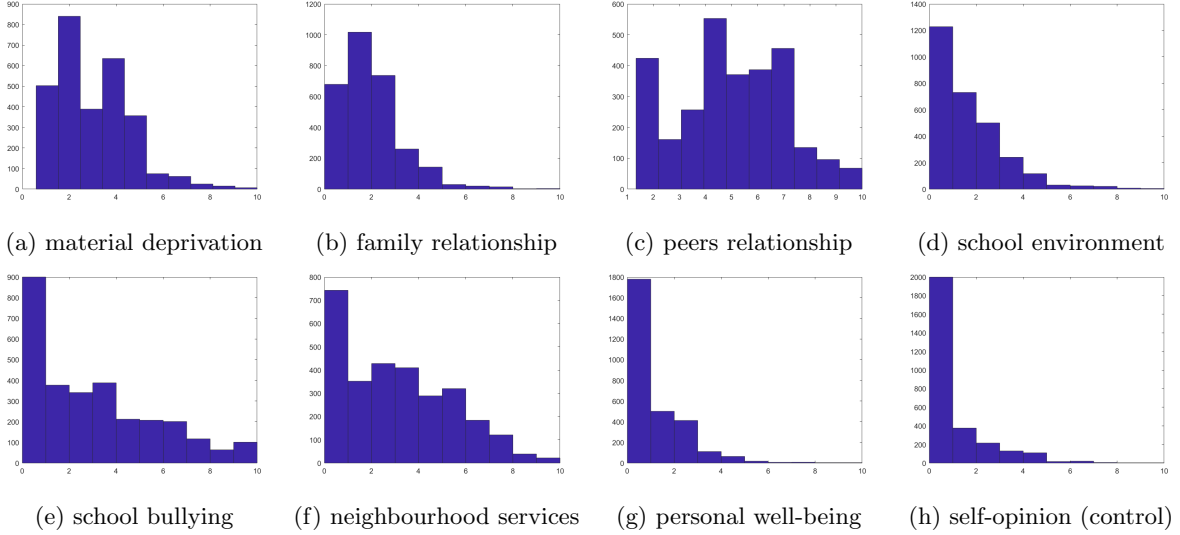
Indicator	Measures	Values
Material deprivation	Have breakfast every day	1=no/0=yes
	Eat something at midmorning every day	1=no/0=yes
	Have lunch every day	1=no/0=yes
	Snack every day	1=no/0=yes
	Have dinner every day	1=no/0=yes
	Clothes or uniform in good condition to go to school	1=no/0=yes
	Equipment to practice the sport he/she likes	1=no/0=yes
	Personal computer or tablet to study and play	1=no/0=yes
	Access to internet (wifi) at home	1=no/0=yes
	Musical instrument to study music	1=no/0=yes
	Family car	1=no/0=yes
	Mobile phone	1=no/0=yes
	Heating at home (during winter)	1=no/0=yes
	Television	1=no/0=yes
	Individual sleeping room	1=no/0=yes
	Pets	1=no/0=yes
	Books and stories	1=no/0=yes
	Videogames or consoles	1=no/0=yes
	Toys and games	1=no/0=yes
	Family relationship	My parents/tutors listen to me and consider my opinion
I have a quiet place to study at home		0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
I feel safe at home		0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
In my family we had a good time together		0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
I am not cold at home during winter		0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
Peers relationship (during the week)	Chat with them	0=every day/1=most of the days/2=once or twice/3=never
	Have fun together in the park, street, sports center, etc.	0=every day/1=most of the days/2=once or twice/3=never
	Send whatsapp, share videos with the mobile	0=every day/1=most of the days/2=once or twice/3=never
	Play videogames on the tablet, mobile, computer	0=every day/1=most of the days/2=once or twice/3=never
	Study together (out of the school or the NGO)	0=every day/1=most of the days/2=once or twice/3=never
School environment	My school tutor listens to me and considers my opinion	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	I like to go to school	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	My other teachers treat me well	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	I can go hiking with my classmates	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	I feel safe at school	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	I have no problems to take extra materials to school	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	My parents/tutors talk to my school tutor	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
School bullying (last month)	Times you were attacked at school	0=never/1=once/2=twice or three times/3=more than three times
	Times you were insulted at school	0=never/1=once/2=twice or three times/3=more than three times
	Times you were left alone during an activity or at recess	0=never/1=once/2=twice or three times/3=more than three times
Neighbourhood	Enough places to play and have fun	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	I feel safe in my neighbourhood	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	Sports center where I can practice sport	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	Cultural center where I can learn languages, music, etc.	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	Public library	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
Personal well-being	I am happy with my aspect	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	I am happy with my body	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	I am happy with what I do in my free time	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	I am happy with the treatment received from adults	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	I am happy with the love I get	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	I am happy with my behaviour at home and at school	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	I am happy with my life	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
Self-opinion (control)	My life is going well	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	My life is how I want it to be	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree
	I feel very loved	0=strongly agree/1=agree/2=regular/3=disagree/4=strongly disagree

Table 2: Descriptive statistics for the indicators and 95%-CI for the population mean

Indicator	mean	SD	95%-CI	median	min	max
1. material deprivation	3.02	1.61	2.96-3.08	2.94	0.59	10
2. family relationship	1.94	1.36	1.89-1.99	1.67	0	10
3. peers relationship	4.96	2.10	4.89-5.03	5.33	1.33	10
4. school environment	1.57	1.58	1.51-1.63	1.07	0	10
5. school bullying	2.89	2.87	2.79-2.99	2.22	0	10
6. neighbourhood	3.30	2.43	3.21-3.39	3.00	0	10
7. personal well-being	1.04	1.36	0.99-1.09	0.36	0	10
self-opinion (control)	0.97	1.44	0.92-1.02	0	0	10

They also facilitate ranking and comparisons across individuals or groups of them. The main steps on the construction of a composite index would be the identification

Figure 1: Histograms for the indicators



of relevant indicators, their normalization, the definition of a weighting system and aggregation (see Nardo et al. 2005). In our analysis, the first two points have been addressed in the previous section, and aggregation is done through a simple weighted arithmetic mean, as will be shown later. Then, the key point is the definition of a set of weights associated to the indicators. Among all the possible ways to achieve this, we decided to use principal component analysis, in order to obtain aggregation weights as objectively as possible.

Principal component analysis (PCA) is a classical multivariate analysis technique. It was pioneered in 1891 by Karl Pearson as a way of adjusting planes via orthogonal least squares, and developed further, in 1933, by Harold Hotelling in covariance and correlation analyses. Since then its popularity has increased well beyond the borders of the statistical community. Nowadays, PCA is one of the most widely used techniques, especially in those fields that deal with large data sets, where a dimensionality reduction is sought. Introduction to PCA can be found, for instance, in Johnson and Wichern (2014) or Rencher (1998). Some applications and R code can be found in Grané and Jach (2014).

Principal components account for much of the variance among the set of original variables. Each component is a linear weighted combination of the initial variables. The components are ordered so that the first component accounts for the largest possible amount of variation in the original variables. The second component, accounts for the maximum variation that is not accounted for the first, and so on. Their formal definition is as follows. Let \mathbf{X} be a $n \times p$ data matrix, containing the information on p quantitative variables, X_1, \dots, X_p , measured on a set of n individuals. The principal components of \mathbf{X} are p composite variables that are linear combinations of X_1, \dots, X_p , that is,

$$Y_j = X_1 t_{1j} + \dots + X_p t_{pj}, \quad j = 1, \dots, p.$$

The p vectors of coefficients $\mathbf{t}_j = (t_{j1}, \dots, t_{pj})'$, and hence the Y_j 's, are computed according to the following algorithm:

- (i) Vector \mathbf{t}_1 containing the coefficients of Y_1 is the one that maximizes the variance $\text{var}(Y_1)$ among all the linear combinations of the X_j 's. Additionally, it is required that $\mathbf{t}'_1 \mathbf{t}_1 = 1$, because otherwise the problem is indeterminate, since the variance $\text{var}(Y_1)$ can be artificially increased by multiplying vector \mathbf{t}_1 by a constant.
- (ii) Vector \mathbf{t}_2 containing the coefficients of Y_2 is the one that maximizes the variance $\text{var}(Y_2)$ among all the linear combinations of the X_j 's that are uncorrelated with variable Y_1 . As before, it is required that $\mathbf{t}'_2 \mathbf{t}_2 = 1$.
- (iii) Given variables Y_1, \dots, Y_k , for $k < p$, the vector \mathbf{t}_{k+1} containing the coefficients of Y_{k+1} is the one that maximizes the variance $\text{var}(Y_{k+1})$ among all the linear combinations of the X_j 's that are uncorrelated with variables Y_1, \dots, Y_k and verifying that $\mathbf{t}'_{k+1} \mathbf{t}_{k+1} = 1$.

In our case, the columns of matrix \mathbf{X} are the seven indicators described in Table 2 and the rows are the corresponding answers of the 2,908 surveyed children. We have applied PCA to matrix \mathbf{X} and results are shown in Table 3 and Figure 2. Individuals have been labelled according to the control indicator of self-opinion in order to show the concordance with the interpretation of the principal components.

Table 3: Results of PCA

Variable	\mathbf{t}_1	\mathbf{t}_2	\mathbf{t}_3	\mathbf{t}_4	\mathbf{t}_5	\mathbf{t}_6	\mathbf{t}_7
material deprivation	0.3397	-0.4699	0.2220	-0.2521	-0.7351	0.0515	0.0892
family relationship	0.4397	0.1259	-0.3389	-0.0246	-0.0291	-0.8213	-0.0028
peers relationship	0.2840	-0.6001	0.2148	-0.2629	0.6646	-0.0442	-0.0189
school environment	0.4969	0.1576	-0.2181	-0.0054	0.0030	0.3828	-0.7308
school bullying	0.1751	0.5823	0.6391	-0.4618	0.0578	-0.0690	0.0215
neighbourhood services	0.3252	0	0.4859	0.8082	0.0215	-0.0515	0.0432
personal well-being	0.4767	0.1981	-0.3124	-0.0170	0.1157	0.4087	0.6747
Percent of variance	36.01%	15.97%	12.92%	11.31%	9.58%	8.26%	5.94%

From Table 3 we see that with the first three Principal Components we are able to explain nearly 65% of the variation of the original dataset. Taking into account the indicators with highest loadings and their definitions in Table 1, the first principal component, Y_1 , can be interpreted as a representation of (the lack of) self-esteem and adult consideration (the feeling of being valued and loved by the child's adult environment). It takes greater values as indicators tend to increase. Therefore, worse situations are expected for large values of Y_1 . Looking at panels (a) and (c) of Figure 2, we can see that most of the children that are satisfied with their lives score low values in Y_1 . On the contrary, children that are very unsatisfied with their lives score large values in Y_1 .

The indicators with highest loadings in Y_2 are, on the one hand, bullying with a positive value and, on the other hand, material deprivation and peers relationship

both with negative values. This second component captures the feeling of (the lack of) a protected environment except at school. So, this second component increases as children suffer bullying at school although having their material necessities covered and good relationship with their peers (outside of school). On the contrary, this second component decreases for children suffering material deprivation and poor relationship with their peers. Looking at panels (b) and (c) of Figure 2, we can see that children that are very unsatisfied tend to score large values in Y_2 .

Finally, the third principal component, Y_3 , is mainly determined by bullying at school and neighbourhood services, both with positive loadings. It can be seen as a representation of children isolation at school and in their closest environment. In this case, the third component increases as children suffer bullying, although having good family relationship and good personal well-being. On the contrary, this third component decreases for children with poor family relationship and poor personal well-being. Looking at panel (a) of Figure 2, we can see that there are more children scoring positive values than negative values, meaning that there are more children with good family relationship and good personal well-being that conversely.

Note that bullying plays an important role in both second and third principal components.

Our proposal is to use PCA to obtain a children subjective well-being index. Two important questions to be solved are: (1) how many components should we used and (2) how we define the aggregation weights. Regarding the first point, there are several criteria that can be used (Kaiser’s criterion, Jolliffe’s criterion, Cattell’s scree graph, a predetermined percentage of explained variation, etc.). In our case, according to Kaiser’s criterion and Cattell’s scree graph two principal components are enough; however, since Jolliffe’s criterion recommends to add one more component, we decide to consider the first three principal components, leading to a percentage of explained variability greater than 60%. Concerning the second point, aggregation weights are defined as the percentage of explained variability of each component conveniently rescaled according to the number of components to be included in the index.

In particular, we define the index based on the first three Principal Components, conveniently standardize to 0-100, as follows:

$$\text{CWEBI} = \frac{I_0 - \min(I_0)}{\max(I_0) - \min(I_0)} \times 100, \quad (1)$$

where

$$I_0 = \frac{36.01}{64.90} \times Y_1 + \frac{15.97}{64.90} \times Y_2 + \frac{12.92}{64.90} \times Y_3. \quad (2)$$

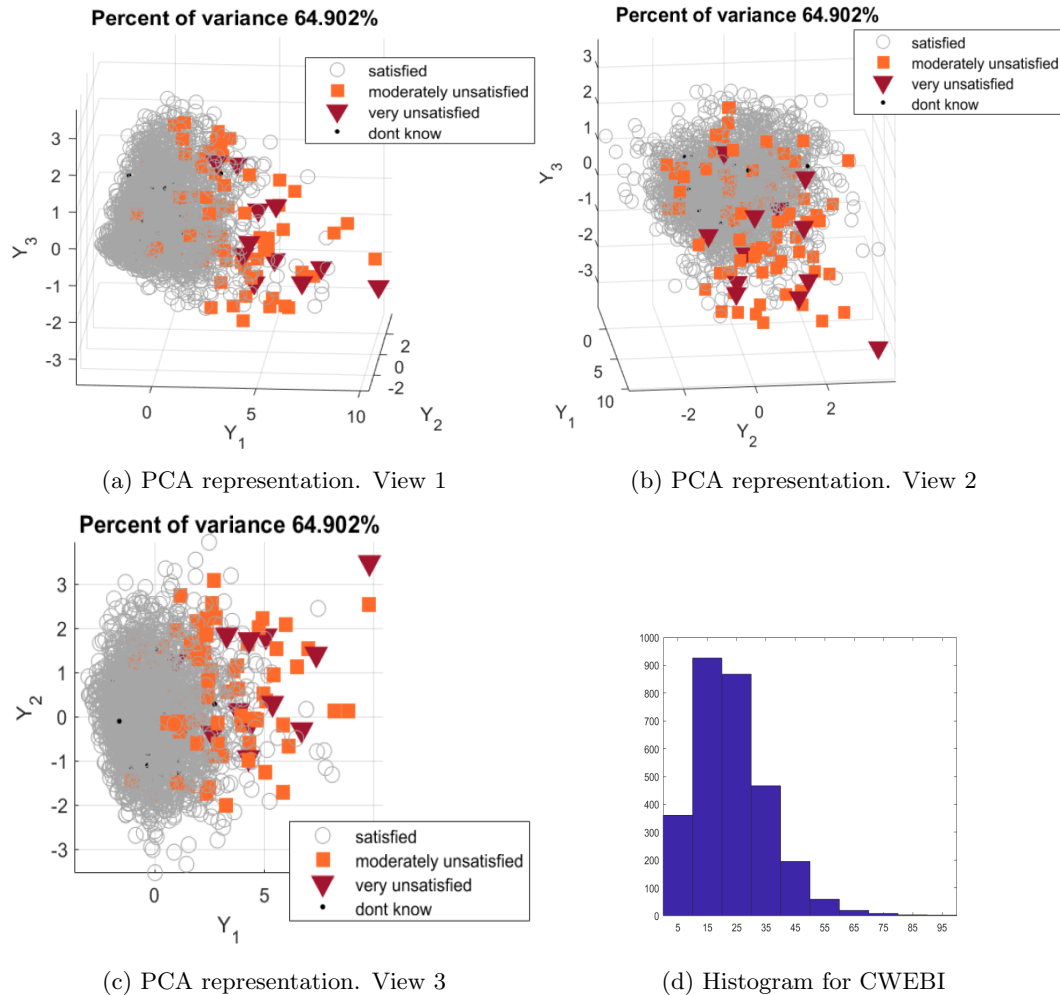
The histogram of this index across the children in the survey is shown in panel (d) of Figure 2. More comments are given in Section 3.

3 Results

3.1 Descriptive Statistics

Descriptive statistics for the seven indicator variables, plus the control variable, are shown in Table 2. Remind that the greater their values, the greater the unhappiness of the child. While many children in the sample are happy regarding the aspects of

Figure 2: PCA representation. Individuals labelled by self-opinion



their lives measured by these indicators, over 30% of them score 6 or more points (on a 10-point scale) concerning relationships with their peers and over 20% of them score 6 or more points on the indicator measuring their neighbourhood services; over 20% of them score over the mid-point on the bullying indicator and 10% of them score over the mid-point concerning material deprivation.

The distribution of the control variable is heavily skewed with a tail towards the positive end of the continuum (mean of 0.97 on a 10-point scale, median of 0, SD of 1.44, skewness of 1.95, kurtosis of 7.55), with around 3% of the children scoring 5 or more points on this measure, indicating a moderate or greater dissatisfaction with their life.

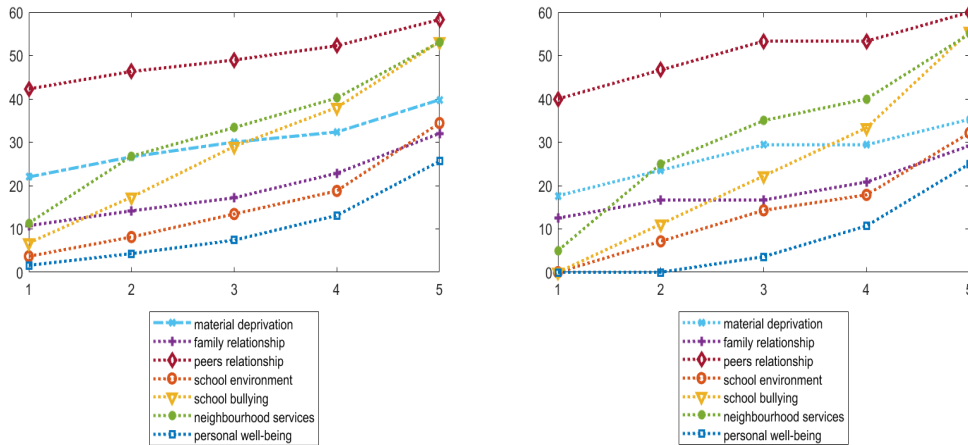
The distribution of the children subjective well-being index (CWEBI) is skewed with a tail towards the positive end of the continuum (see panel (d) of Figure 2), with a mean of 23.40 on a 100-point scale, median of 21.81, SD of 12.54, skewness of 1.04, kurtosis of 5.12. The 95%-CI for the population mean of the CWEBI ranges

between 19.96 and 20.84. Over 3% of the children scored over 50 points on the scale indicating that they tend to be more unhappy than happy with the various aspects of their lives included in the measure. At this point it is important to note that we are focusing on vulnerable Spanish children. Pearson’s correlation coefficient between CWEBI and the control variable is 0.56, which is statistically significant with a p-value of 0.000, indicating a moderate linear relationship between them. This leads us to conclude that the index proposed in formula (1) seems to capture children’s subjective well-being.

3.2 Index Components

A way to better understand the index is to represent the distribution of the seven indicators making part of it for each one of its quintiles. For this, we split the dataset in five groups of equal size according to the CWEBI values: the group with the lowest index values is the first quintile, the next group defines the second quintile and so on. For each one of these groups, the mean and median of the seven indicators is computed and presented in Figure 3. We can see that each indicator included in the CWEBI increases as the quintiles go from lowest (1) to highest (5) dissatisfaction. The steepest increase is experimented by school bullying, which makes the difference between scoring middle or highest values in the CWEBI. This finding goes in the line of Rees and Bradshaw (2018), who found that factors such as children’s experiences of bullying and the quality of family relationships play a much bigger role in explaining variations in their subjective well-being than socioeconomic factors.

Figure 3: CWEBI components by quintiles



(a) mean values

(b) median values

3.3 Inequality Across Spanish Territories

Spain is administratively organized in nineteen territories (seventeen autonomous regions and two autonomous cities), some of them having full competences on health,

education, justice and security. The 2008 economic crisis forced them to make relevant cuts in the provision of social services; For example, from 2009 to 2012 the expenditures on health and education experimented reductions of 9.3% (from €70.674 million to €64.078 million according to the Spanish Ministry of Health) and 13.4% (from €53.375 million to €46.215 million according to the Spanish Ministry of Education), respectively.

In 2012 the non-profit organization at the origin of the data launched its campaign "Now more than ever", a call for help addressed to the general population, public administrations, companies and other social agents, in order assist to 300,000 more people in situation of extreme vulnerability as a consequence of the economic crisis. According to Eurostat, in 2016 the social expenditure was 16.8% of the Spanish GDP, far from the 20% of the EU-zone.

From 2007 to 2015 the AROPE rate increased more than 5 points, reaching 28.5% in 2015, according to the Spanish Statistical Office (INE). This rate exhibited great variations across territories, ranging from 13% in Navarra to 43% in Andalucía. Regarding the European Union, the AROPE rate in 2015 was 23.7%.

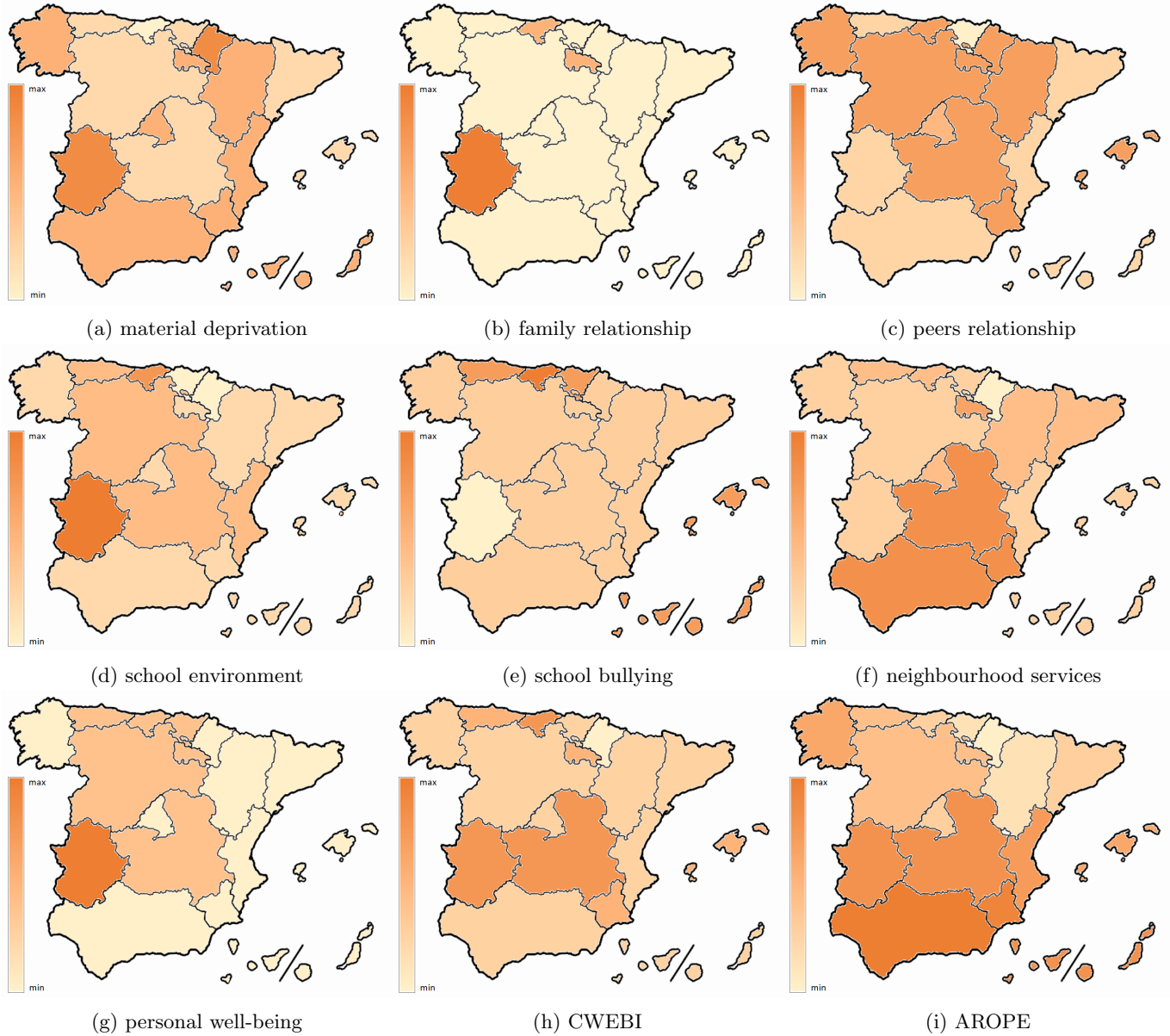
Our interest is to find out whether children well-being index presents variations across Spain and to what extent they are related to the variations in AROPE. This may help to identify and close gaps in equity of resource distribution among territories.

In Figure 4 we present several maps of Spain, where autonomous regions have been coloured according to CWEBI components (from a to g panels), CWEBI (h-panel), and AROPE (i-panel). The color scale ranges from light yellow (minimum value) to deep orange (maximum value) according to each indicator distribution. The particular median values of each indicator and index across regions can be found in Table 4.

Looking at panels (a)-(g) we can see that, first, there is no a single region scoring low on all the components of the CWEBI; at this point it is important to remind that we are focussing only on vulnerable children living in Spain. However, none of them scores high on all the CWEBI components. Second, school bullying is present in almost all the regions. This finding goes in the line of International Amnesty report (InternationalAmnesty 2019). Third, some regions, such as Extremadura or Cantabria, score high on three or more components of the CWEBI. Fourth, some components reach mid-top values on half of the Spanish territories; this is the case for peers relationship and of material deprivation, school environment or neighbourhood services to a lesser extend. Finally, comparing panels (h) and (i) we discover that CWEBI and AROPE present a different pattern across territories; Indeed, Pearson correlation coefficient between CWEBI and AROPE is around 0.4, indicating a low linear dependency between them and stressing that those indicators do not overlap although they are associated. This may suggest that traditional economic measures such as household income appear to play less of a role in explaining children's subjective well-being than adults' (Bastos et al. 2004, Adamson 2007, Rees 2018, Rees and Bradshaw 2018, Main and Bradshaw 2012) and that in developed countries increases in GDP are no longer associated with substantial increases in happiness (Wilkinson and Pickett 2010).

To sum up, in Table 4 we present the median values of CWEBI components across the Spanish territories, which are ranked according to median CWEBI. Light blue colour indicates values from 0 to 25th-percentile, middle blue goes from 26th-percentile to

Figure 4: CWEBI across Spanish territories (median values)



50th-percentile and dark blue stands for values over the 50th-percentile; percentiles are computed for each component.

From Table 4 it is easier to compare regions and identify different patterns across territories. For instance, regions in the top positions of the CWEBI present difficulties in at most three components, whereas in the bottom positions we find those regions with difficulties in at least three components. The former register the lowest scores in family relationship and personal well-being and latter reach the highest scores in school environment and personal well-being.

Table 4: Heat chart of CWEBI components across Spanish territories (median values)

CWEBI components	median CWEBI	material deprivation	family relationship	peers relationship	school environment	school bullying	neighbourhood services	personal well-being
Navarra	17.1	3.5	1.7	5.3	0.7	2.2	2.0	0.4
Islas Canarias	20.3	2.9	1.7	4.7	1.1	3.3	2.5	0.4
Comunitat Valenciana	20.6	2.9	1.7	4.7	1.4	2.2	2.5	0.4
Galicia	20.6	2.9	1.7	5.3	1.1	2.2	2.5	0.4
Catalunya	21.0	2.4	1.7	4.7	1.1	2.2	3.0	0.4
Madrid	21.2	2.9	1.7	5.0	1.1	2.2	3.0	0.4
Aragón	21.5	2.9	1.7	5.3	1.1	2.2	3.0	0.4
Castilla y León	21.5	2.4	1.7	5.3	1.4	2.2	2.5	0.7
Euskadi	21.6	2.4	1.7	4.0	0.7	3.3	2.5	0.7
Andalucía	21.7	2.9	1.7	4.7	1.1	2.2	4.0	0.4
Asturias	22.0	2.4	1.7	4.7	1.4	3.3	3.0	0.7
La Rioja	22.0	2.9	2.1	5.3	1.1	2.2	3.5	0.7
Región de Murcia	22.9	2.9	1.7	5.3	1.1	2.2	4.0	0.4
Illes Balears	23.3	2.5	1.7	5.3	1.1	3.3	2.5	0.4
Cantabria	24.7	1.8	2.1	5.3	2.1	4.4	3.0	0.7
Extremadura	25.1	3.5	2.5	4.7	2.5	1.1	2.5	2.1
Castilla La Mancha	25.6	2.4	1.7	5.3	1.4	2.2	4.0	0.7

4 Discussion

This study relies on child reported data focused on perceptions of family prosperity, conflict with friends, safety of the local area (school and neighbourhood) and most importantly frequency of being bullied. Other important issues such as household income, parental education as well as other socio-demographic variables, have not been considered because 8-11 year-old children might not be able to provide reliable information about them.

4.1 Key Messages and Implications

The fifty one questions of the self-administrated questionnaire were grouped in seven indicators according to the following topics: material deprivation, family relationship, peers relationship, school environment, school bullying, neighbourhood services and personal well-being. Applying principal component analysis, a new index (CWEBI) was constructed explaining nearly 65% of the variation. In particular, the CWEBI is a composite index of the first three principal components: The first one captures (the lack of) self-esteem and adult consideration, the second one represents the feeling of (the lack of) a protected environment except at school and the third one expresses children isolation at school and in their closest environment.

The main finding is that bullying makes the difference between children being moderate or completely unsatisfied with their lives. Moreover, school bullying is present in almost all the Spanish regions. International Amnesty report reinforces our finding, concluding that bullying is a social problem that affects children's capacity to fully enjoy their human rights (InternationalAmnesty 2019). Rees and Bradshaw (2018) found a strong association between frequency of being bullied and their well-being indicator. Recent research on the psychological consequences of bullying in Spanish children and adolescents confirms its relation with behavioural problems, childhood stress and suicidal ideation (Garaigordobil and Machimbarrena 2019, Iranzo et al. 2019); Miranda et al. (2019) show that the support of adults at home and school mitigate the negative effect of bullying victimization on life satisfaction. This effect

was captured by the second component of our index.

Another interesting finding related with the spatial distribution of the children well-being index is that there is no a single region scoring low on all the components of the CWEBI, that is, reaching satisfactory levels in all the index variables. This highlights the fact that, even in those Spanish regions with highest welfare levels, vulnerable children can experience situations of deprivation.

Comparing Spanish regions, we observe that those in the top positions of the CWEBI present difficulties in at most three components, whereas in the bottom positions we find those regions with difficulties in at least three components.

Finally, we discover that CWEBI and AROPE rate present a different pattern across territories. This finding goes in the line of Adamson (2007), Rees (2018), Rees and Bradshaw (2018), Main and Bradshaw (2012).

4.2 Strengths and Limitations

The methodology proposed for the construction of CWEBI index is general enough to be applied to general child population, regardless their social vulnerability condition or even country, adapting the questionnaire appropriately.

Necessarily, the statistical analysis presented in this paper is limited to the variables available in the survey data and to the target population, that is vulnerable families in Spain participating in the non-profit organization programs. However, the questionnaire covers a wide range of topics, in accordance with those usually considered in the construction of children well-being indexes.

Acknowledgements Financial support from research project MTM2014-56535-R by the Spanish Ministry of Economy and Competitiveness.

References

- Adamson, P. (2007). Child Poverty in perspective: An overview of child well-being in rich countries. Report Card 7. Innocenti Research Center. UNICEF.
- Bastos, A., G. Leao, and F. Passos (2004). Child income poverty and child deprivation: an essay on measurement. *International Journal of Social Economics* 31(11), 1050–1060.
- Campbell, A., P. Converse, and W. Rodgers (1976). The quality of American life: Perceptions, evaluations and satisfactions. New York: Russell Sage Foundation.
- Casas, F., A. Bello, M. González, and M. Aligué (2011). Subjective Social Indicators and Child and Adolescent Well-being. *Child Indicators Research* 4, 555–575.
- Casas, F., A. Bello, M. González, and M. Aligué (2013). Children’s Subjective Well-being Measured Using a Composite Index: What Impacts Spanish First-Year Secondary Education Students’ Subjective Wellbeing? *Child Indicators Research* 6, 433–460.

- Casas, F. and F. Bello (2012). Calidad de Vida y Bienestar Infantil Subjetivo en España. ¿Qué afecta al bienestar de niños y niñas españoles de 1º de ESO? UNICEF España.
- Casas, F. and G. Rees (2015). Measures of Children’s Subjective Well-being: Analysis of the Potential for Cross-National Comparisons. *Child Indicators Research* 8 (1), 49–69.
- Diener, E. (1984). Subjective well-being. *Psychological Bulletin* 95, 542–575.
- Diener, E. (1994). Assessing subjective well-being: Progress and opportunities. *Social Indicators Research* 31, 103–57.
- Dinisman, T. and A. Ben-Arieh (2016). The characteristics of childrens subjective well-being. *Child Indicators Research* 126, 555–569.
- Garaigordobil, M. and J. Machimbarrena (2019). Victimization and Perpetration of Bullying/Cyberbullying: Connections with Emotional and Behavioral Problems and Childhood Stress. *Psychosocial Intervention* 28 (2), 67–73.
- Gil, P., R. Romera, and A. Grané (2016). Lo que dicen los niños y las niñas. La situación de la infancia en vulnerabilidad social. Boletín sobre vulnerabilidad social, num 13, Cruz Roja Española (ed).
- González-Bueno, G. (2014). Pobreza infantil e impacto de la crisis en la infancia. *Educación y Futuro* 30, 109–125.
- Grané, A. and A. Jach (2014). Applications of principal component analysis (PCA) in food science and technology. In D. Granato and G. Ares (Eds.), *Mathematical and Statistical Methods in Food Science and Technology*, New Jersey, pp. 57–86. Wiley-Blackwell.
- Gross-Manos, D., E. Shimoni, and A. Ben-Arieh (2015). Subjective wellbeing measures tested with 12-year-olds in Israel. *Child Indicators Research* 8, 71–92.
- Huebner, E., S. Casas, K. Hills, A. Lewis, and R. Saha (2011). Stability and predictive validity of the brief multidimensional students’ life satisfaction scale. *Child Indicators Research* 4(1), 161–168.
- Huebner, E., K. Hills, X. Jiang, R. Long, R. Kelly, and M. Lyons (2014). Schooling and Children’s Subjective Well-Being. In A. Ben-Arieh, F. Casas, I. Frønes, and J. Korbin (Eds.), *Handbook of Child Well-Being. Theories, Methods and Policies in Global Perspective*, Dordrecht, pp. 797–819. Springer.
- Huebner, E., R. Valois, S. Suldo, L. Smith, C. McKnight, J. Seligson, and K. Zullig (2004). Perceived Quality of Life: A Neglected Component of Adolescent Health Assessment and Intervention. *Journal of Adolescent Health* 34 (4), 270–278.
- InternationalAmnesty (2019). Hacer la vista... gorda!: El acoso escolar en España, un asunto de derechos humanos. www.es.amnesty.org.
- Iranzo, B., S. Buelga, M. Cava, and J. Ortega-Barón (2019). Cyberbullying, Psychosocial Adjustment, and Suicidal Ideation in Adolescence. *Psychosocial Intervention* 28 (2), 75–81.
- Johnson, R. and D. Wichern (2014). *Applied Multivariate Statistical Analysis*. London: Pearson Education Ltd.

- Main, G. and J. Bradshaw (2012). A child material deprivation index. *Child Indicators Research* 5, 503–521.
- Miranda, R., X.Oriol, A.Amutio, and H. Ortúzard (2019). Adolescent Bullying Victimization and Life Satisfaction: Can Family and School Adult Support Figures Mitigate this Effect? *Revista de Psicodidáctica* 24 (1), 39–45.
- Nardo, M., M. Saisana, A. Saltelli, and S. Tarantola (2005). Tools for Composite Indicators Building. Joint Research Center, European Commission, EUR 21682 EN.
- Park, N. (2004). The role of subjective well-being in positive youth development. *The Annals of the American Academy of Political and Social Science* 591 (1), 25–39.
- Rees, G. (2018). The Association of Childhood Factors with Children’s Subjective Well-Being and Emotional and Behavioural Difficulties at 11 years old. *Child Indicators Research* 11 (4), 1107–1129.
- Rees, G. and J. Bradshaw (2018). Exploring low subjective well-being among children aged 11 in the uk: An analysis using data reported by parents and by children. *Child Indicators Research* 11 (1), 27–56.
- Rencher, A. (1998). *Multivariate Statistical Inference and Applications*. New York: John Wiley & Sons, Inc.
- UN (2016). Protecting children from bullying. Document A/71/150, United Nations.
- UNCRC (2009). United Nations Convention on the Rights of the Child, Article 12. CRC/C/GC/12. Geneva, 20 July 2009.
- UNICEF (2012). The State of the World’s Children 2012: Children in an Urban World. UNICEF.
- UNICEF (2014). Children of the Recession. the impact of the economic crisis on child well-being in rich countries. Innocenti Report Card 12. UNICEF Office of Research, Florence.
- Wilkinson, R. and K. Pickett (2010). *The spirit level*. London: Penguin.