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An index of multidimensional economic well-being for the Spanish regions

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AN INDEX OF MULTIDIMENSIONAL ECONOMIC WELL-BEING FOR THE SPANISH REGIONS

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Abstract

The paper we submit is a proposal for computing a multidimensional index of economic well-being for the Spanish regions. Following Osberg and Sharpe's methodology, we consider some dimensions as adjusted consumption, real wealth, equity and economic security. To combine those dimensions and building the index, we have used a set of uniform weightings and, later, those from factor analysis.

Besides, distance functions and therefore, efficiency analysis are applied to determine the weighting scheme and, thus, compute the index.

In the paper, we firstly analyze the situation in 2000 and, afterwards, study the evolution from 1980 until 2000

INTRODUCTION

The disparities in well-being observed in the Spanish regions should have a central role in the economic and political discussion in Spain.

First, the European Structural Fund or the Spanish Fund for Interterritorial Compensation (FCI, in Spanish) use mainly macromagnitudes[1] as an economic basis of the distribution. However, the quantification of this issue should be wider. On the other hand, there is an increasing interest in Spain on regional fiscal balances[2] related to changes in the regional financing system. This interest would have to entail a more exhaustive and wider indicator.

In a national and international perspective, the most of papers that analyze this issue lay in a macromagnitude as GDP or income combined with an indicator of economic equity (for example, inequality and/or poverty indices). These combinations are called "Abbreviated Social Welfare Functions".

Many authors[3] as Nordhaus and Tobin (1972), Sen (2001), Khan (1991) or Stewart (2005) have criticized the use of a single macromagnitude. Therefore, many articles have studied the social welfare instead of economic indicators. The measurement of the social welfare would include dimensions like material well-being, education, health, participation in the social activity or even consider issues as crime or weather that, despite of being clearly influential, increase the problem of arbitrariness in selecting variables and weightings.

Although the most of papers are focused on countries, one can observe some applications in the regional field in ---- for Canadian provinces and Stewart (2002 and 2005) for European regions. In this regional context, and focusing on Spain, Marchante et al. (2006) compute an index of well-being for the Spanish regions based on an extension of the Human Development Index (HDI) from the United Nations Development Program (UNDP) by using life expectancy, child survival rate, illiteracy,

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[1] The European Structural Funds have been distributed for regions objective 1 according to a proportion of the European mean per capita income. However, the FCI uses an expression that includes the Gross Value Added, the population, movements of migrants from and to each region, the number of unemployed people, the area of the region and the population density.

[2] The study "Las balanzas fiscales de las comunidades autónomas con la Administración Pública Central, 1991-2005" published in 2007 is the first academic survey about this topic, because the Spanish Government has not published any results related to this issue before.

[3] Besides of the references in the paper, one can review the attempts of measuring more topics in well-being in: Zolotas (1981), Daly and Cobb (1989), Cobb and Cobb (1994), Cobb, Halstead and Rowe (1995), Anielski and Rowe (1999), Jackson (2004) or Wolff, Zacharias and Caner (2005).

schooling and per capita gross value added (VAB p.c.). Besides Ayala et al (2006) calculate abbreviated welfare functions as a multiplicative trade-off between income and inequality for the same territorial units.

Papers as Osberg and Sharpe's (2000, 2003 and 2005 indicate) shows us that a wider notion of economic well-being should include dimensions of wealth, inequality and security. Really, Osberg and Sharpe considered that HDI is an index of social welfare (perhaps the most famous of the world) with three components: health, education and "economic resources". The authors focus the analysis in this topic because the index is based on per capita GDP trying to measure the capacity of people for "taking a long and healthful life, acquiring knowledge and to have access to the resources necessary to reach a decent standard of life" (UNDP, 2004, p. 127). They think that the measurement of the economic component HDI could be improved, proposing the construction of an index of economic well-being instead of GDP.

We think that their proposal is the most efficient as well as simplest index of economic well-being. Therefore, in this paper we propose an index of regional economic well-being following the structure they use to compare some developed countries.

It should remarked that our index is an "economic" one and, therefore, some include aspects as health or education, more related to social welfare, are not included.

The paper is structured in four sections. In Section 1, we define the dimensions and variables to be used in the manuscript. In Section 2, the indices for each region are computed by using two weighting schemes. In the next section, the temporal evolution is analyzed. Finally, the Section 4 presents the main conclusions that can be drawn from the analysis of simulation results.

METHODOLOGY

The index of well-being designed in this paper has been structured in four dimensions: Adjusted Consumption, Real Wealth, Inequality and Poverty and Economic Security. We think that the most important effects of the purely economic variables, that take part in the concept of economic well-being, are presented in these dimensions. Obviously, there are some topics outside because of their reduced influence or their lack of availability in regional databases (for instance leisure time and cost, natural resources, commuting costs, valuation of the informal sector…).

Perhaps, consumption flows are the most important factor in the economic well-being of households and people. In this dimension, consumption of market goods and services is considered as well as non-market or public goods and services provided by the Public Sector (national and regional). Some topics although affect the consumption flow as leisure, informal sector, health-adjusted life expectancy, commuting costs or drugs consumption, are not included in the paper because of their poor availability at the regional level.

The Adjusted Private Consumption is computed by using the monetary and non-monetary expenditures from the Spanish Continuous Budget Survey (ECPF, from now) for 2000. Besides, in both cases the household expenditures are adjusted by household sizes with a parametrical equivalence scale[4] with k equal to 0.5 and multiplied by the life expectancy.

On the other hand, the Adjusted Public Consumption is obtained from the series calculated by the Fundación de Cajas de Ahorros Confederadas (FUNCAS) and publishes in a survey entitled "Balance Económico Regional (Autonomías y Provincias) años 2000 a 2004" (Regional Economic Balance - Regions and Provinces from 2000 to 2004).

The measurement of well-being must consider intra and intergenerational fairness. Some variables are introduced to try to measure the legacy that the society leaves its successive generation, consisting of an accumulated capital that would serve as a productive structure for the future society. However, this transmission also would include an environmental fairness, a solidly based research and a controlled[5] national debt that does not reduce in excess the future capacities of the economy.

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[4] Specifically, we have used the equivalence scale proposed by Buhmann et al. whose expression is nk, where n is the household size and k a parameter that reflects the scale economies in the family.

[5] Although in a first stage, the regional public debt was considered in the variable, the weighting we obtained in the factor analysis recommends us to remove it. Besides, from a theoretical point of view, it is not the same case as the national debt because of three reasons:
- first, the regional debt is highly controlled and regulated by the national Treasury Department,
- second, the regional debt is mainly aimed at investments and so, it do not reduce the real wealth of the future generations and,
- finally, maybe it is not a complete data because the expenditures of the Regional Governments use to be higher than the budget.

Figure 1. Structure of the regional index of well-being

DIMENSIONS	INDICATORS	VARIABLES
1.- Adjusted Consumption	1.1.- Adjusted Private Consumption 1.2.- Adjusted Public Consumption	1.1.1.- Equivalent monetary expenditure 1.1.2.- Equivalent non-monetary expenditure 1.1.3.- Index of life expectancy 1.2.1.- Per capita Public Consumption
2.- Real wealth	2.1.- Physical Capital 2.2.- Human Capital 2.3.- R+D 2.4.- Environment	2.1. - Stock of net capital p.c. 2.2.- Rate of people with university degree 2.3. - Regional expenditure on R+D p.c. 2.4.-Companies expenditures on environmental protection
3.- Inequality and poverty	3.1.- (-) Index of Gini 3.2.- (-) Intensity of poverty	3.1.1.- Index of Gini 3.2.1.- Index FGT (Foster, Greer and Thorbecke) with alpha equal to 1
4.- Economic security	4.1.- (-) Risk of disease 4.2.- (-) Risk of old age 4.3.- (-) Risk of unemployment	4.1.1.- % of expenditure on health 4.2.1.- Rate of poverty for people in old age 4.3.1.- Rate of unemployment 4.3.2.- Unemployment cover

Although the macroeconomics theory shows one that the natural resources have not been a necessary condition for the economic growth of some countries (for example, Japan), in other cases it has been an inestimable aid (for example, the United States throughout the century XIX or Spain throughout the XVI…). Unfortunately, it is impossible for us to introduce some interesting topics as the value and conservation degree of the regional natural resources or historical patrimony.

Regarding the physical capital stock, we use the information from the series of current net capital stock computed by IVIE (Instituto Valenciano de Investigaciones Económicas – Valencia Institute of Economic Research) for the period 1964-2004.

The human capital stock is measured by the ratio of population in working age with university degree. The expenditure in R+D is the regional expenditure on R+D supplied by the Spanish National Statistical Institute. We take the regional expenditure on environmental protection from the same official source, specifically from the Survey on Company Expenditure on Environmental Protection.

Previously the importance of considering an intragenerational economic fairness was mentioned in the paper. This issue has been traditionally measured by using indices of inequality and poverty. For a more exhaustive analysis of the different indices of inequality in the Spanish regional context see Ayala et al. (2006). The indices of

inequality and poverty intensity used in the paper are Gini and FGT1, computed by the authors from the 2000 ECPF microdata provided by the Spanish National Statistical Institute.

Finally, the economic security is, in our opinion, one of the most important bases of well-being of the families living in developed countries. The economic problems caused by disease, divorces[6], old age or unemployment (especially in absence of cover) reduce the current economic well-being and the standard of life in the future.

Also coming from ECPF, the proportion of the household expenditure spent in health is computed. Regarding unemployment, the rate is supplied by the Spanish National Statistical Institute official figures and the data of unemployment of cover (number of beneficiaries on unemployed people) comes from the National Employment Service.

Calculating the index

In order to obtain the index of well-being from the indicators (central column in table 1), each of them has been rescaled at the interval [0, 1] following the methodology used by United Nations in building the Human Development Index. One takes the maximum and minimum values for each indicator. Later, by expression (1), the value of each indicator in every region is determined. These values will oscillate between 0, when the region shows the smallest value, and 1 in the opposite case.

$$indicator\ in\ region\ i = \frac{variable\ value\ in\ region\ i\ -\ minimum\ reference\ value}{maximum\ reference\ value\ -\ minimum\ reference\ value} \quad (1)$$

Once transformed the indicators into the [0, 1] interval, the values of each dimension of the regional economic well-being (adjusted consumption, real wealth, inequality and poverty and economic security) can be computed. Later, the average is calculated for each dimension, that is, an equal weighting scheme is applied.

After obtaining the values for each dimension, it is necessary to establish a weighting scheme that allows one to combine them and to construct the general index.

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[6] Initially, we included the divorce rate as a variable that reflects the risk of one-parent poverty. Nevertheless, the factor analysis shows a direct relationship between well-being and divorce rate. A higher divorce rate is related to a higher level of well-being. Perhaps, it happens because the richer families can afford the impoverishment caused by divorce more that the poorer ones. That is why we finally decide to remove this variable.

A methodological option is mixing them by supposing a uniform distribution. However, as Osberg and Sharpe (2000) expose, different weightings can be considered (for example, 40% for Adjusted Consumption, 10% for Real Wealth and 25% for each one of the remaining dimensions). Also, with regard to fairness or equality, from a Rawlsian point of view, it is possible to pay more attention to poverty than inequality with the corresponding changes in weightings.

Finally, after calculating the index of economic well-being, it is rescaled again in the interval (0, 1) to make the comparison easier.

It is necessary to consider that while a greater value of "Adjusted consumption" or "Real wealth" implies more well-being, the opposite happens with the other two components. That is, the higher is the value of "Adjusted consumption" or "Real wealth" and lesser is the value of "fairness" and "economic security", the higher is the regional index of well-being.

Estimating the index of well-being by factor analysis

An alternative methodology consists of the construction of an index of regional well-being by means of multivariate statistical techniques. Specifically, in measuring the well-being from a set of indicators, one tries to determine an unobserved variable (latent variable) from a set of observed ones. In the specialized literature, this class of models is called *latent variables models.* Depending on the measurement scale of observed and unobserved variables, one can define different models as shown in Figure 2.

Figure 2. Latent variables models

	Observed variables	
Latent variable	Continuous	Categorical
Continuous	Factor analysis	Latent trait model
Categorical	Latent profile model	Latent class model

Source: Bartholomew and others (2002)

In building a continuous index of well-being from some continuous variables, factor analysis will be the technique selected for estimating it. It is very similar to the standard regression model with a difference: some of the variables are unknown. Since it is not possible to know the value of the latter, this relationship is indirectly analyzed.

Let assumed p observed variables and q latent factors or variables. Then, the general model will have the following expression:

$$x_i = \alpha_{i0} + \alpha_{i1}y_1 + \alpha_{i2}y_2 + \cdots + \alpha_{iq}y_q + e_i, i = 1,\ldots,p \tag{2}$$

where y_1, y_2,…, y_q are the factors, e_i the residuals and α_{i0}, α_{i1},…, α_{iq} the factorial loadings. Among the assumptions of the model, one emphasizes that factors are considered as standardized variables[7], that is, with mean equal to zero and unitary variance. Usually, when this analysis is applied, the number of underlying factors is unknown. To decide the factors structure, the proportion of the variance explained by each factor must be examined[8].

However, whereas the equation (2) shows the observed variables as linear combinations of the factors, the objective of this paper implies the reversal of this relationship by to expressing the factors as linear combinations of the observed variables.

It can be demonstrated that equation (2) can be transformed into another model shown in the expression (3).

$$y_i = c_{i1}x_1 + c_{i2}x_2 + \cdots + c_{ip}x_p, i = 1,\ldots,q \tag{3}$$

This system of equations allows one to estimate the well-being being from the set of selected variables. Before displaying the results, one should make some comments on the application. First of all, since the different dimensions have been fixed before from the economic theory, it is not necessary to explore and to decide how many factors exist. In addition, to avoid possible interferences of some variables in other dimensions different from those from which is assigned, a double estimation process is done[9]: first, it is computed an index for each dimension and, from them, the joint index of well-being is estimated.

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[7] The indicators have been standardized to avoid the effects of using different measuring units.
[8] A usual criterion consists of analysing the eigenvalues of the correlation matrix and choosing those components with an eigenvalue higher than one.
[9] It is important to note that a weighting scheme is not determined now. We are only computing the effect of each variable on factors.

Adjusted Consumption = 0,2784*AdjPubCons + 0,3524*AdjMonExp+0,4370*AdjNonmonExp-0,2777*WorkHours

Real Wealth = 0,3863*R+DExp + 0,2757*PhyCap + 0,3714*HumCap + 0,2034*EnvironExp

Fairness = 0,5806*FGT(1) + 0,5806*Gini

Security = 0,4475*Health + 0,4475*OldagePov + 0,2473*Unemploy + 0,0601*Unemploycover

(4)

Once partial indicators are estimated, one can determine the model that allows one to calculate the index of regional well-being as equation (5) shows.

Well-Being = 0,3925*Adj.Consumption + 0,4373*Real Wealth - 0,2537*Fairness - 0,2522*Ec.Security (5)

The previous equations, estimated from the data, allow one to compute the indices for all the regions. Nevertheless, in order to make the comparison with the previous results easier, a weighting structure for each indicator and dimension can be determined.

The weightings are slightly different of those used in the previous section. One can observe that dimensions as Real wealth or Adjusted consumption are more significant in the economic well-being of the Spanish regions. Therefore, the indices will slightly differ and this methodology can help one to perform a sensitivity analysis of the weighting structure.

Table 1. Weighting scheme from factor analysis results

Variable	Weights
Adjusted public consumption	20.69%
Adjusted monetary expenditure	26.19%
Adjusted non-monetary expenditure	32.48%
Number of working hours	-20,64%
Adjusted consumption	**29.38%**
Expenditure on R+D	31.23%
Physical capital	22.29%
Human capital	30.03%
Expenditure on environment	16.44%
Real wealth	**32.74%**
FGT (1)	50.00%
Gini Index	50.00%
Fairness	**-18,99%**
Expenditure on health	37.21%
Poverty rate of people in old age	37.21%
Unemployment rate	20.57%
Unemployment cover	6.01%
Economic security	**-18,88%**

Source: Authors' elaboration.

On the other hand, these disparities from the uniform weightings are higher, and more interesting, within each dimension. For example, the expenditure on R+D or the human capital stock are the most important indicators within the most significant dimension, "real wealth". Thus, they stand out as two key facts to explain the regional differences of the economic well-being.

Estimating well-being by efficiency analysis

Efficiency analysis has been mainly used in production economics to estimate how production units maximize output given a set of inputs or, alternatively, how they minimize inputs given a set of outputs. There are few applications to the study of well-being or standard of living as Lovell et al. (1994), Ramos and Silber (2005) or Ramos (2008). Whereas in these papers, parametric distance functions are used to determine the weights of each indicator as well as to estimate the index of well-being, in this paper, Data Envelopment Analysis (DEA) is the technique used to summarize the information contained in the indicators set, to compute the weights of each variable and, finally, to estimate the index of well-being.

DEA was proposed by Charnes et al (1978)[10] to obtain an envelope that contains all the efficient units and leaves the rest of units below it. The efficiency measure provided by DEA is relative because every unit is compared with the rest of units. Therefore, the available data determine the shape and location of the production frontier. It involves solving a mathematical programming problem for each unit (in our case, region). The solution of this problem allows one to assign them an efficiency index.

The most intuitive approach is the fractional program, where a maximization or minimization (output-oriented or input-oriented) of a total productivity ratio for each unit we analysed.[11]:

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[10] This model is called CCR Model because of its authors' names.
[11] We only show the output-oriented problem because it is the formulation used in the empirical application.

$$Max\ h_0(u,v) = \frac{\sum\limits_{r=1}^{s} u_r y_{r0}}{\sum\limits_{i=1}^{m} v_i x_{i0}}$$

$$under\ \frac{\sum\limits_{r=1}^{s} u_r y_{rj}}{\sum\limits_{i=1}^{m} v_i x_{ij}} \leq 1;\ v_i, u_r \geq 0 \tag{6}$$

$$j = 1, \cdots, n \quad r = 1, \cdots, s \quad i = 1, \cdots, m$$

where h_0 is the efficiency measure of unit 0, y_{r0} is the amount of output produced by the unit, x_{i0} is the amount of input i used by the unit, y_{rj}, x_{ij} are the outputs and inputs of unit j and $v_i, u_r \geq 0$ are the weights determined by the solution of the problem.

This problem can be transformed into a linear program in order to solve it better. To achieve it, it is enough to maximize the numerator of the objective function keeping constant the denominator:

$$Max\ h_0(u) = \sum\limits_{r=1}^{s} u_r y_{r0}$$

$$under\ \sum\limits_{i=1}^{m} v_i x_{i0} = 1;\ \sum\limits_{r=1}^{s} u_r y_{rj} - \sum\limits_{i=1}^{m} v_i x_{ij} \leq 0;\ v_i, u_r \geq 0 \tag{7}$$

$$j = 1, \cdots, n \quad r = 1, \cdots, s \quad i = 1, \cdots, m$$

The linear program selects the weights that maximizes the virtual output of unit $(u_r y_{r0})$, given a virtual input $(v_i x_{i0})$ equal to one. Besides, the virtual output never can be bigger than the virtual input. However, computing efficiency indices is easier if the dual program is used:

$$Max\ \theta_0$$

$$under\ \sum\limits_{j=1}^{n} \lambda_j y_{rj} \geq \theta y_{r0};\ \sum\limits_{j=1}^{n} \lambda_j x_{ij} \leq x_{i0};\ \sum\limits_{j=1}^{n} e_{ij} \leq x_{i0};\ \lambda_j \geq 0 \tag{8}$$

$$j = 1, \cdots, n \quad r = 1, \cdots, s \quad i = 1, \cdots, m$$

where e_{ij} is a vector of ones.

EMPIRICAL RESULTS

Results by applying uniform weightings

By observing the index of well-being, two regions stand out in the top (Navarre and Basque Country) and three in the bottom (Extremadura, Andalusia and Canary Islands). The rest of regions could form a group where there are not excessive deviations from the average.

The case of Navarre is caused by its very high adjusted consumption supported by one of the highest per capita regional Budget in Spain. Since Navarre and Basque Country have two specific fiscal regimes (called Concierto y Convenio Económico), these Regional Governments present a huge financial and tax autonomy. They are competent to regulate and collect most of the taxes and contribute to the national budget for the non assumed competences by paying an annual contribution determined through a concert or agreement with the Central Government.

Table 2. Regional Indices by dimensions (uniform weightings)

Region	Adjusted consumption	Real wealth	Fairness	Economic security
Andalusia	0,1984	0,1412	0,8357	0,4971
Aragon	0,3820	0,3873	0,6292	0,0395
Asturias	0,1418	0,3117	0,4186	0,1268
Balearic Islands	0,2059	0,2718	0,3117	-0,1060
Basque Country	0,6334	0,6752	0,1224	0,1114
Canary Islands	0,3892	0,1140	0,8050	0,2841
Cantabria	0,2293	0,2433	0,7204	0,2647
Castile -Leon	0,2948	0,3326	0,6712	0,2317
Castile-La Mancha	0,0145	0,2112	0,1123	0,1953
Catalonia	0,3962	0,5554	0,2957	0,0744
Extremadura	0,0452	0,0128	0,7930	0,5878
Galicia	0,0125	0,1469	0,4038	0,2594
Madrid	0,6008	0,7444	0,5055	0,1552
Murcia	0,1346	0,2689	0,3298	0,3344
Navarre	0,4474	0,5399	0,1873	-0,0398
Rioja	0,3180	0,3398	0,3080	0,3030
Valencia	0,0864	0,3630	0,3787	0,1440

Source: Authors' elaboration.

Graph 1. Components of well-being 2000 (uniform weightings)
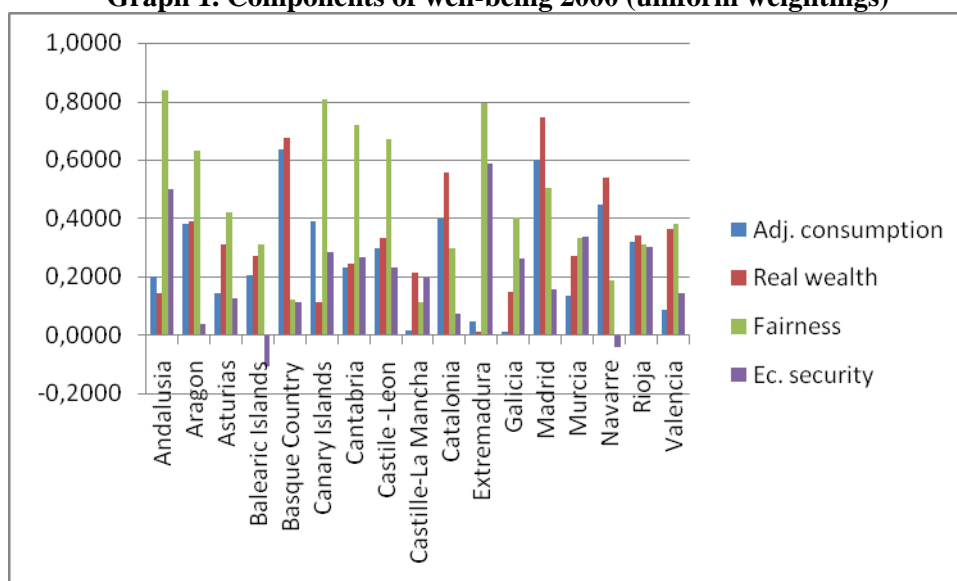
Source: Authors' elaboration.

In graph 1 the four components of the index of well-being are shown. One should consider that a higher value of "adjusted consumption" or "real wealth" implies more well-being, while the opposite happens with the other two components. That is, the higher is the value of "fit consumption" or "real wealth" and lesser the one of "fairness" and "economic security", the higher is the regional index of well-being.

**Table 3. Regional Index of well-being 2000. Uniform weightings**

Region	Well-being
Andalusia	0,1375
Aragon	0,5937
Asturias	0,5134
Balearic Islands	0,6651
Basque Country	1,0000
Canary Islands	0,3074
Cantabria	0,3379
Castile - Leon	0,4368
Castile-La Mancha	0,5175
Catalonia	0,7942
Extremadura	0,0000
Galicia	0,3416
Madrid	0,8372
Murcia	0,4430
Navarre	0,9020
Rioja	0,5712
Valencia	0,5212

Source: Authors' elaboration.

Observing the lower tail (tables 2 and 3) of the distribution, Extremadura and Andalusia show very low figures of adjusted consumption (especially Extremadura)
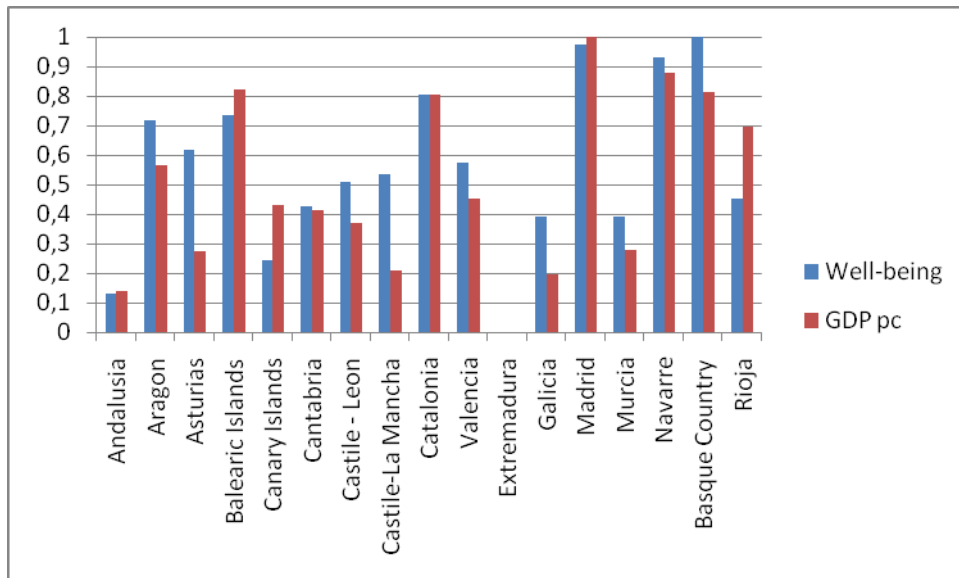
together with the worse levels of fairness and security in Spain. Canary Islands manages not to enter in the lower tail of the ranking because its degree of economic security is remarkably better than those observed in Andalusia and Extremadura.

Graph 2. Regional Index of well-being 2000. Uniform weightings
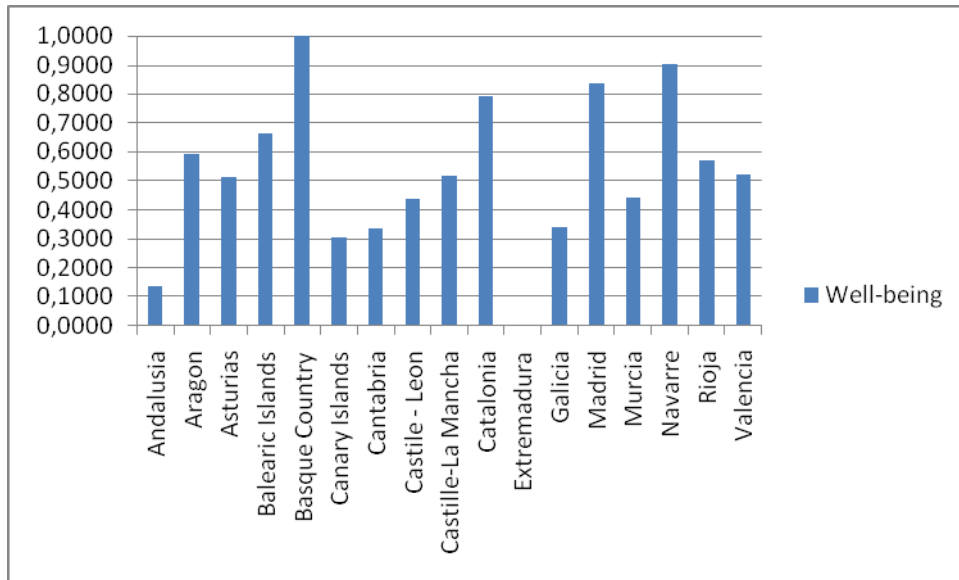
Graph 3. Well-being and GDP

As we explained in the introduction, the per capita GDP or an equivalent macromagnitude has been the most used indicator to measure the standard of life or well-being in different territorial units. In graph 3 one can compare the distributions generated by the index of multidimensional well-being proposed in this paper the one that come from the per capita GDP. Very important differences in some communities

are appraised and, in our opinion, support the necessity to build and use a multidimensional index. For example, two remarkable differences appear in Castile-La Mancha and Canary Islands because of their levels of fairness and economic security, respectively.

Results by factor analysis weightings

Although the same regions continue in the tails of the dimensions, a common distribution for the regions seems not to exist. Especially, Navarre, Catalonia and Madrid present the best situation in "Adjusted Consumption"; Madrid, Basque Country and Navarre in "Real Wealth"; Castile-La Mancha stands out in "Fairness" followed by Basque Country and Navarre; and in "economic Security" the best places are occupied by Navarre, Balearic Islands and Catalonia. That is: it is not a clear and unequivocal distribution of the indicators among the regions.

Table 4. Regional Indices by dimensions (factor analysis weightings)

| Region	Fit consumption	Real wealth	Fairness	Economic security
Andalusia	-0,7536	-0,8562	1,6148	2,1589
Aragon	0,4483	0,1545	0,726	-1,9208
Asturias	-0,2973	-0,2253	-0,177	-1,1316
Balearic Island	-0,2114	-0,4242	-0,6365	-2,3262
Basque Country	1,3987	1,6064	-1,449	-0,9911
Canary Islands	0,1704	-0,9665	1,475	1,7269
Cantabria	0,2638	-0,5436	1,1166	0,3624
Castile-La Mancha	-1,0057	-0,7176	-1,5089	-0,3288
Castile-Leon	-0,0375	-0,0778	0,9075	-0,2702
Catalonia	0,4254	1,0601	-0,6966	-0,8267
Extremadura	-1,5671	-1,4566	1,4051	2,433
Galicia	-0,5536	-0,8837	-0,245	0,6627
Madrid	1,836	2,5691	0,2118	-0,5126
Murcia	-0,7364	-0,3135	-0,5796	1,3871
Navarre	1,1204	0,9735	-1,1668	-1,3676
Rioja	0,2612	0,0105	-0,652	2,0979
Valencia	-0,7617	0,0910	-0,3455	-0,5880

Source: Authors' elaboration

In the opposite tail of the partial indices, Canary Islands, Extremadura and Andalusia stand out as the territories located in the worse ranks of the considered dimensions.

Finally, the situation of Cantabria and Castile-Leon is very appealing because of their very high values of the dimension "Fairness". This fact is caused by the high values of poverty intensity poverty and inequality observed in these regions.

In order to make easier the comparison with the results shown in table 2, one could choose an intermediate methodology: applying the weightings from factor analysis shown in table 1 to the indicators (between zero and one) used in the first exercise, instead of directly estimating the index of well-being by factorial analysis.

Graph 4. Regional Indices by dimensions (factor analysis weightings)
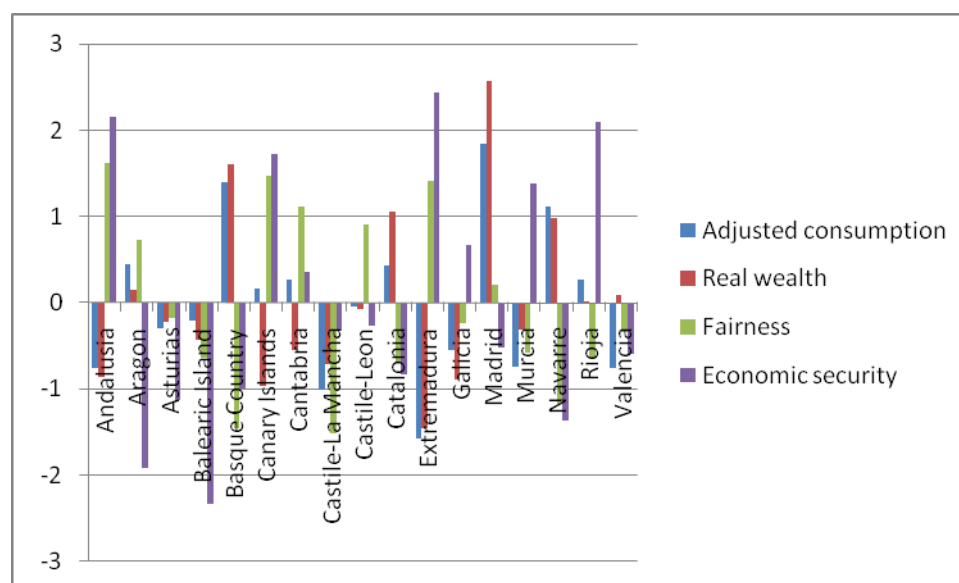
Source: Authors' elaboration

The differences with respect to the index obtained by the factorial analysis are very reduced and derived from the measurement unit of the indicators.

Table 5. Regional Indices by dimensions (factor analysis weightings and indicators 0-1)

| Region	Adjusted consumption	Real wealth	Fairness	Economic security
Andalusia	0,1748	0,4150	0,8357	0,5126
Aragon	0,2190	0,5345	0,6292	0,0300
Asturias	0,0661	0,3410	0,4186	0,1605
Balearic Islands	0,0878	0,3412	0,3117	-0,2208
Basque Country	0,4819	0,4441	0,1224	0,0971
Canary Islands	0,1917	0,4484	0,8050	0,0942
Cantabria	0,0314	0,4849	0,7204	0,2391
Castile-Leon	0,1225	0,5203	0,6712	0,2430
Castile-La Mancha	-0,0166	0,2663	0,1123	0,1733
Catalonia	0,3703	0,3795	0,2957	-0,0185
Extremadura	0,0193	0,5104	0,7930	0,6462
Galicia	-0,0095	0,2606	0,4038	0,1911
Madrid	0,5971	0,5570	0,5055	0,1196
Murcia	0,0484	0,4312	0,3298	0,2450
Navarre	0,4739	0,3980	0,1873	-0,1995
Rioja	0,1877	0,3372	0,3080	0,0730
Valencia	0,1068	0,3565	0,3787	0,1020

Source: Authors' elaboration

Table 6 and graph 5 show that the situation obtained in the partial analyses is observed again. Catalonia, Madrid, Navarre and Basque Country appear as the regions with a greater level of well-being, whereas, on the other hand, Extremadura, Andalusia and the Canary Islands are the most underdeveloped.[12]

Table 6. Regional Index of well-being 2000. Factor analysis weightings

Region	Well-being1	Well-being 2
Andalusia	0,1319	0,0909
Aragon	0,7187	0,5843
Asturias	0,6166	0,3863
Balearic Islands	0,7341	0,6783
Basque Country	1,0000	0,8903
Canary Islands	0,2444	0,3872
Cantabria	0,4265	0,2678
Castile - Leon	0,5093	0,3686
Castile-La Mancha	0,5348	0,4264
Catalonia	0,8045	0,7641
Extremadura	0,0000	0,0000
Galicia	0,3925	0,2755
Madrid	0,9751	0,8373
Murcia	0,3921	0,4279
Navarre	0,9308	1,0000
Rioja	0,4524	0,5637
Valencia	0,5731	0,4756

Source: Authors' elaboration

Graph 5. Regional Index of well-being 2000. Factor analysis weightings
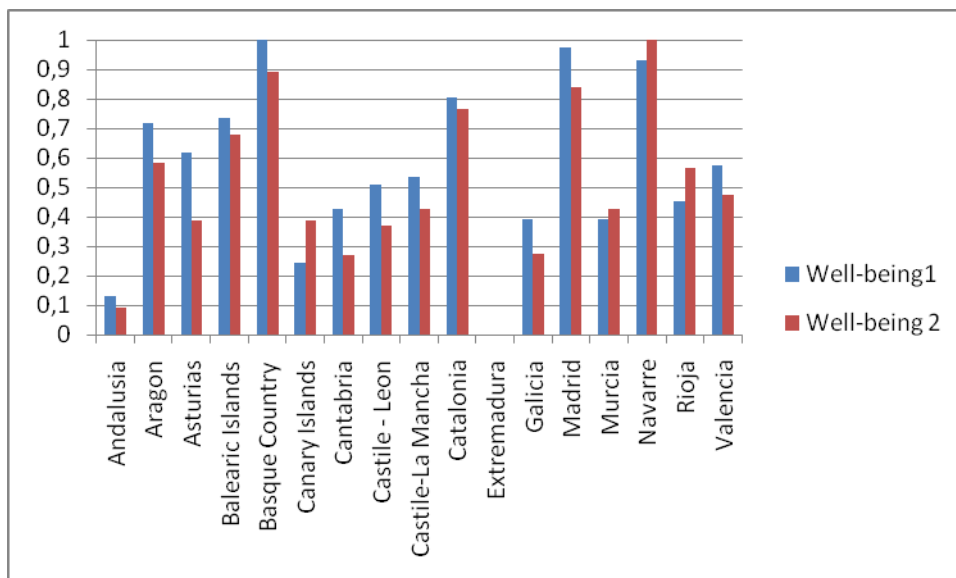
Source: Authors' elaboration

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[12] The indices have been rescaled to the interval [0,1] again. While the index "Well-being 1" comes directly from factor analysis, "Well-being 2" is computed by applying the factor analysis weightings to [0,1] indicators.

The consistency of the results obtained by both proposals should be emphasized because two much differentiated groups are observed in the tails of both distributions. There is only an interesting change in the upper tail: the second place occupied by Basque Country when uniform weightings are used, it is shared with Catalonia and Madrid when factor analysis is used. In the lower tail of the distribution, the distance between the last regions and the rest increase slightly.

At this point one should recall the divergences, though slight, between uniform and factor analysis weightings: the relative importance of Adjusted Consumption and Real Wealth, and within the latter, the weights of Expenditure on R+D and Human Capital stock are greater. Therefore, against the descriptive analysis of the uniform scheme, the factor analysis, directly applied or by providing a weightings structure, allows one to determine the more important issues to reduce regional disparities of well-being with their corresponding economic policy consequences. That is, the investment in research and development as well as the improvement of the human capital in a region stand out as the key tools for the regional development.

Results of DEA weightings

Although the weights from this technique can be different for each variable and region, allowing the regions to give more weight to their strong points, the results are very similar to the former. The Spanish regions can be divided in the same three clusters observed before.

Table 7. Regional Indices by dimensions (DEA weights)

Region	Adjusted consumption	Real wealth	Fairness	Economic security
Andalusia	0,1715	0,0700	0,9507	0,5804
Aragon	0,3791	0,4743	0,7184	0,3133
Asturias	0,5538	0,3573	0,5143	0,2495
Balearic Islands	0,3841	0,5631	0,3974	0,6364
Basque Country	0,3798	0,6436	0,2081	0,1820
Canary Islands	0,2510	0,1186	0,8348	0,5341
Cantabria	0,5917	0,3452	0,7993	0,3324
Castile-Leon	0,3425	0,4032	0,7723	0,2576
Castile-La Mancha	0,5083	0,2953	0,0337	0,3238
Catalonia	0,3285	0,5629	0,4660	0,3535
Extremadura	0,2398	0,0247	0,9379	0,7549
Galicia	0,6887	0,1347	0,4528	0,4198
Madrid	0,4105	0,8301	0,7570	0,2514
Murcia	0,3183	0,2587	0,2130	0,4791
Navarre	0,6479	0,6385	0,3086	0,5099
Rioja	0,4221	0,4654	0,3973	0,4909
Valencia	0,3901	0,4153	0,4992	0,2853

Source: Authors' elaboration

Graph 6. Regional Indices by dimensions (DEA weights)
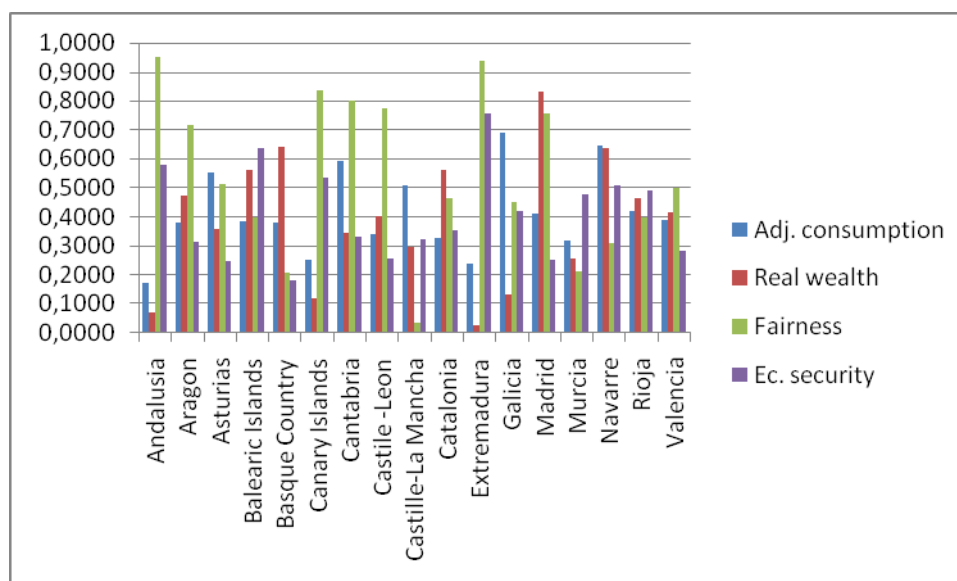
Source: Authors' elaboration

Table 8. Regional Index of well-being 2000. DEA weightings

Region	Well-being
Andalusia	0,1026
Aragon	0,7691
Asturias	0,7714
Balearic Islands	0,8249
Basque Country	0,8174
Canary Islands	0,0514
Cantabria	0,7078
Castile - Leon	0,7189
Castile-La Mancha	0,7941
Catalonia	0,8517
Extremadura	0,0000
Galicia	0,3860
Madrid	1,0000
Murcia	0,3589
Navarre	0,9567
Rioja	0,5914
Valencia	0,7762

Source: Authors' elaboration

Graph 7. Regional Index of well-being 2000. DEA weightings
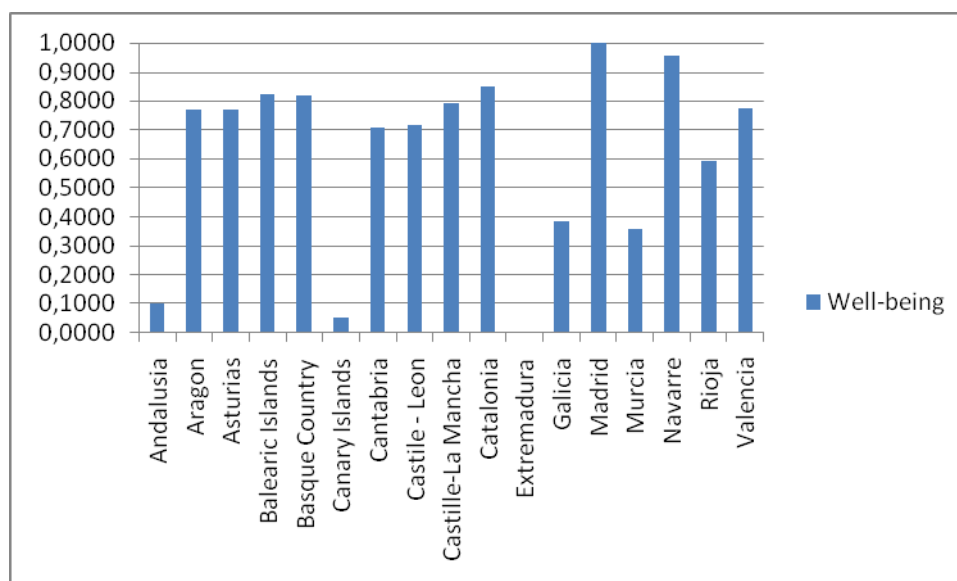
Source: Authors' elaboration

In sum, the application of DEA confirms the results obtained by the other techniques. Only two cases, Basque Country and Valencia, should be commented. While the relative location of the former is worse than the one estimated by uniform weights, the opposite happens with Valencia. The relevance of Real wealth stands out again as the key tool for improving the regional well-being.

ANALYSIS OF THE MULTIDIMENSIONAL ECONOMIC WELL-BEING BETWEEN 1980 AND 2000

For the temporal comparison the number of variables must be reduced because of their lack of availability in 1980. Thus, the rate of regional public debt, regional unemployment covering and expenditures on environmental protections are removed.

Some variables are computed from the Household Budget Survey 1980-1981 as private consumption, inequality and poverty indices, rate of expenditure on health over income and poverty rate of people in old age. Others come from the sources used in the 2000 index as physical and human capital stock and unemployment rate. Finally, the public consumption in 1984 is used in the index since this year was the first time that all regional budgets in Spain were published. Using the series of regional consumption prices, this variable is deflated in order to be measured in 1980 monetary units.

Regarding the methodology, the options used in the former section have been followed.

Table 9. Regional Indices by dimensions (uniform weightings)

Region	Well-being 1980	Well-being 2000
Andalusia	0,0000	0,1230
Aragon	0,4958	0,6201
Asturias	0,7044	0,5622
Balearic Islands	0,7642	0,6693
Basque Country	1,0000	1,0000
Canary Islands	0,5309	0,3228
Cantabria	0,8227	0,4104
Castile - Leon	0,5354	0,4729
Castile-La Mancha	0,3733	0,5534
Catalonia	0,8916	0,7908
Extremadura	0,3606	0,0000
Galicia	0,6300	0,4148
Madrid	0,8354	0,8713
Murcia	0,5462	0,4532
Navarre	0,9994	0,9443
Rioja	0,7297	0,5986
Valencia	0,6797	0,5271

Source: Authors' elaboration

**Graph 8. Regional Indices by dimensions (uniform weightings)**
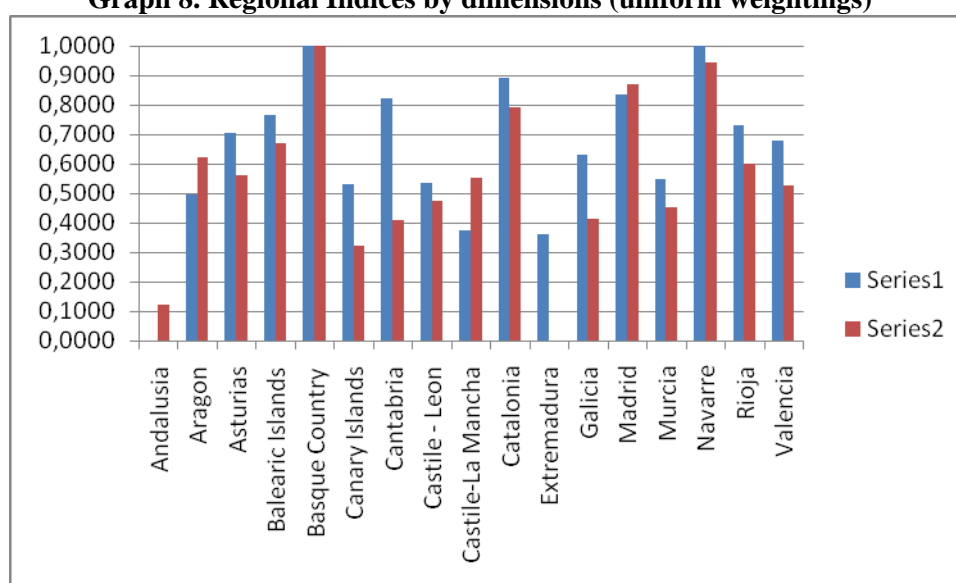
Source: Authors' elaboration

Using the uniform weightings, ten of the seventeen regions have improved their well-being throughout the period, five have got worse (Balearic Islands, Cantabria, Catalonia, Basque Country and Rioja) and two have kept their extreme places (Andalusia and Navarre). The increases of Castile-La Mancha, Galicia and Aragon stand out by their intensity, whereas the reductions are relatively moderate.

Table 10. Regional Index of well-being (factor analysis weightings)

Region	Well-being 1980	Well-being 2000
Andalusia	0,2624	0,1298
Aragon	0,4681	0,5851
Asturias	0,6850	0,5331
Balearic Islands	0,8120	0,7010
Basque Country	1	0,8572
Canary Islands	0,2551	0,2600
Cantabria	0,8760	0,4418
Castile-La Mancha	0,2211	0,5252
Castile-Leon	0,4338	0,4372
Catalonia	0,9594	0,8073
Extremadura	0	0
Galicia	0,3162	0,4289
Madrid	0,8848	0,8023
Murcia	0,4137	0,4503
Navarre	0,9765	1
Rioja	0,8988	0,6157
Valencia	0,7030	0,5816

Source: Authors' elaboration

Graph 9. Regional Index of well-being (factor analysis weightings)
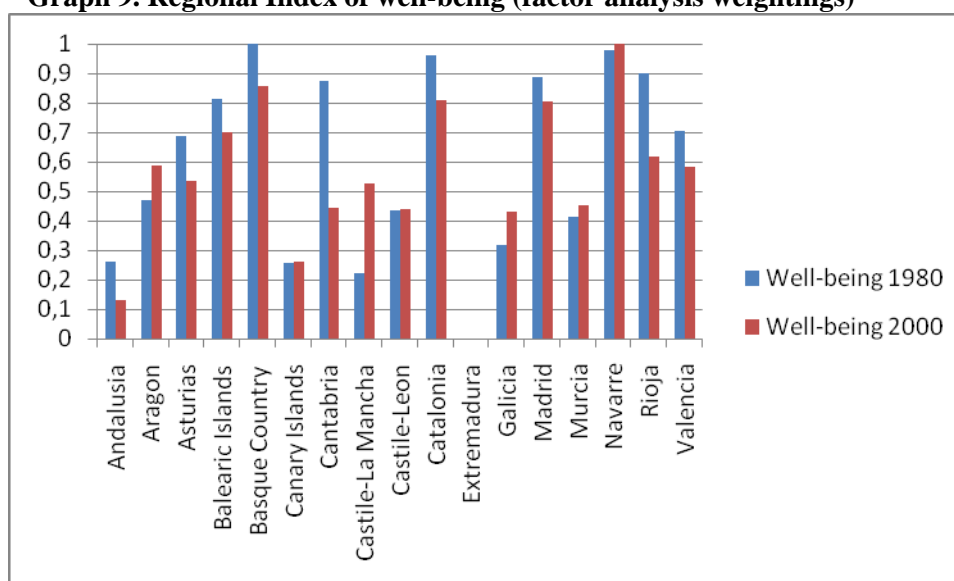
Source: Authors' elaboration

When the factor analysis weightings are applied, the results changes partially. Only seven regions improve their well-being, nine get worse and one keep the worst situation: Extremadura is the least developed region in both years.

Although one could think that these changes mean great differences, one should recall that, except for the great improvements of Castile-La Mancha, Aragon and Galicia, the other regions present quite slight variations and therefore, using an alternative methodology could easily change alter their values.

CONCLUSIONS

This paper is a first attempt of building an index of multidimensional economic well-being for the Spanish regions. Given the high degree of decentralization of the Administration in Spain and the necessity to have instruments of valuation and monitoring of the national public policies, we think that it is very interesting to assess and compare the effects of these policies on the well-being of the citizens.

For measuring that well-being, the limitations of the used indicator more, the Gross Domestic Product per capita have been tried to overcome, by adding topics as the accumulation of productive stocks as well as the heterogeneity of the individuals, in the present (distribution of the potential consumption, that is, poverty and inequality) and in the future introducing the insecurity of future incomes.

The empirical application of the proposed methodologies shows large differences in the national scope. It is possible to be observed that two groups appear in the tails of the distribution of the aggregate index as well as the most of the partial dimensions.

Navarre, Basque Country, Madrid and Catalonia stand out as the head group while Extremadura, Andalusia and the Canary Islands show the worse results. When we try to reduce arbitrariness in indicators and variables weightings by introducing factor analysis, some quite important changes appear: regarding the 2000 years, regions in those groups are nearer between them and further between groups. On the other hand, the mainly positive evolution in that period of two decades (1980-2000) observed with uniform weightings, becomes slightly negative if factor analysis is used.

Finally, some comments on the possible extensions of the paper should be made. It would be interesting to introduce some additional variables as leisure hours or to adjust consumption with these hours, commuting costs, the level of possession of durable goods of households, better data about the human and social capital stocks, to add to the regional budget the expenditure of Central government in every region or some information about regional schemes of basic incomes. So far, the limitation in the data availability is the main handicap for achieving of these advances.

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