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GEOGRAPHICAL PATTERNS OF OVERALL WELL-BEING ACROSS MUNICIPALITIES OF ANDALUSIA

Ángeles Sánchez-Domínguez[1], Jorge Chica-Olmo[2] and Juan de Dios Jiménez-Aguilera[3]

Abstract

The aim of this paper is to analyse whether the well-being of the 770 municipalities of Andalusia (Spain) in 2009 responded to geographical patterns. We have developed a synthetic index of well-being via the P_2 Distance method that incorporates economic and non-economic indicators, and which proves more robust than traditional methodological approaches. The availability of high-speed networks, income and demographic factors have the greatest influence in determining well-being. About 52% of the population still enjoys a level of well-being above regional average. The well-being level is lower in rural municipalities than in urban municipalities. The spatial econometrics applications show that well-being is not geographically distributed in a random way in Andalusia, but exhibits spatial autocorrelation. We have quantified that the well-being measured in a given municipality is related to the well-being of its neighbouring municipalities up to a distance of about 38km. We have identified clusters of municipalities in terms of well-being, as well as the weak and strong points of each group. This paper highlights the need to coordinate policies that are currently designed and structured within a local context and, in a wider context, suggests that European regional policy should focus its efforts on improving the quality of life rather than simply trying to equalize incomes.

Keywords: well-being, spatial autocorrelation, cohesion policy, inequalities, urban planning, capabilities, synthetic index

[1] University of Granada, Departamento Economía Aplicada, Campus de La Cartuja s/n, 18071 Granada, sancheza@ugr.es
[2] University of Granada, Departamento Métodos Cuantitativos para la Economía, Campus de La Cartuja s/n, 18071 Granada, jchica@ugr.es
[3] University of Granada, Departamento Economía Aplicada, Campus de La Cartuja s/n, 18071 Granada, juande@ugr.es

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1. Introduction

The successive reports on economic and social cohesion of the European Commission underline the increasing significance of the spatial dimension of regional and local policies, as well as the importance of place assets and spatial qualities for local development strategies (see Servillo et al., 2012). In addition, the Sixth Progress Report on Economic and Social Cohesion highlights that economic and social disparities between territories at all levels (from the European Union –EU- to the regional and local level) need to be taken into account. "A good quality of life, equal opportunities and access to services of general interest in all territories are crucial both for solidarity and competitiveness" (Commission of the European Communities, 2009b: 12).

This article focuses on the analysis of geographical patterns of well-being across municipalities of Andalusia in 2009. To this end, we develop an index of well-being or quality of life that estimates economic and social disparities between territories, and we introduce the variable 'space' in the well-being analysis with the spatial econometrics methods.

Andalusia is a region of southern Spain which had a population of 8.3 million inhabitants in 2009. In comparative terms, Andalusia is the second most populated region (NUTS 2) of the European Union (EU-27) and has a larger population than many EU countries such as Ireland (4.4 million), Norway (4.7 million) and Denmark (5.5 million). Also, Andalusia is made up of 770 municipalities that have the ability to make independent decisions about a number of issues at local level, whose effects in many cases, are not constrained solely to the limits of the municipality itself.

In the last years, mobility has increased significantly on business days in Andalusia, especially between municipalities; for example, commuting to the workplace or to do leisure activities and shopping (Institute of Statistics and Cartography of Andalusia, 2012). Due to the mobility of people, decisions made by a municipality can generate benefits or costs to residents of other municipalities, that is, they can lead to spillover effects or positive and negative externalities (Solé Ollé, 2006). They can be positive, such as educational and job training expenditures that may lead to productivity gains in workplaces outside the community; or programmes

to control pollutant emissions from vehicles. In contrast, they can be negative, as in the case of “congestion externalities” that occur when non-resident visitors consume public services provided by the municipality, thus leading to increased spending on traffic control, cleaning, security, etc.; or when a municipality promotes urban growth with an adverse impact on natural spaces that are highly valued by residents of other jurisdictions. These spillovers have played an important role in the urban economic literature on local government and in the fiscal federalism literature (see, for example, Arnott and Grieson, 1981; Conley and Dix, 1999; Gordon, 1983).

Moreover, from the governance's viewpoint, the spillover effects of well-being would have implications for the discipline of politicians who would strive to improve their performance in relation to their neighbours (Besley and Case, 1995; Case et al., 1993).

Introducing the variable ‘space’ in the well-being analysis, we can examine the existence of spillover effects and synergies between the municipalities of Andalusia. The results lead to implications for the economic and social development policies of the municipalities from the EU less developed regions' group.

An important first step in our analysis is to develop a well-being index. The last decades have witnessed a growing demand for new methods to measure well-being, progress and quality of life of citizens, given that the GDP as sole indicator to describe and compare the well-being and progress of societies is obsolete. That is, several aspects –such as general economic, social, political, environmental, and cultural conditions– rather than income alone, affect quality of life (Dasgupta, 1990; Mazundar 1996; Nordhaus and Tobin, 1972; Nussbaum, 2000; Sen, 1987; Stiglitz, et al., 2009). Also, the subjective well-being approach calls for the incorporation of subjective well-being indicators in any assessment of social performance and people’s well-being (Kahneman et al., 1999; Diener, 2002; Easterlin, 2001). Despite the lack of statistical information at municipal level, we follow the guidelines proposed in the Stiglitz-Sen-Fitoussi Report (Stiglitz et al., 2009) to select a set of indicators that provide the best starting point to represent the multidimensional aspects of well-being in 770 municipalities of Andalusia in 2009. So, our proposal is developing an overall or multidimensional well-being index(1).

To achieve our goal, we use the P_2 Distance method or synthetic DP_2 index of Pena Trapero (1977). This method significantly solves the methodology difficulties related to the aggregation of different dimensions' indicators, such as the treatment of

measurement units and the weighting attached to each observable variable in the synthetic index. The Distance method P_2 allows a multidimensional analysis of municipal inequality, establishing a municipality well-being ranking for Andalusia and determining which factors have the greatest impact on well-being.

Once the well-being index is obtained for each municipality, we examine the interrelations between these municipalities and their effect on well-being, incorporating space in the analysis. Specifically, we perform a Moran's I test (Anselin, 1988) to analyse the presence of global spatial autocorrelation. Moreover, we estimate the distance between municipalities from which to stabilize spatial dependence in terms of well-being. Finally, to detect the presence of local spatial clusters we use the Local Indicator of Spatial Association (LISA) (Anselin, 1995).

The rest of the paper is structured as follows. In section 2, we discuss the measures of well-being. In section 3, we analyse the methodology applied. In section 4, we describe the relevant indicators to analyse well-being. In section 5, we present the empirical results. In section 6, we discuss the results and provide the conclusions and some public policy implications.

2. How measure well-being?

The GDP is an indicator of economic performance, but associating the notion of well-being to a one-dimensional variable, which measures the aggregate value of the market production of goods and services over a given period of time, seems debatable. From the seventies, the Social Indicators Movement (Andrews and Withey 1976), have argued in favour of measuring social performance on the basis of a large list of indicators, rather than relying on a single one. It was a critique, not only of the use of a single indicator to assess social performance, but also of the economic nature of the indicator used (Rojas, 2011).

The GDP per capita cannot be used as the only indicator of the overall or multi-dimensional well-being because it does not capture the real life conditions of the population and it does not consider the consequences of economic development on the lives of people, such as cost of urbanization, congestion, pollution, etc. (Hobijn and Franses, 2001; Madonia et al., 2013; Neumayer, 2003). The GDP per capita does not take into account the distribution of income or significant assets as educational opportunities, employment opportunities, political freedoms, and the quality of relations between sexes and races (Nussbaum, 2000). Neither GDP nor income, takes

into account the subjective aspects influencing well-being (Diener, 2002; Easterlin, 2001; Frey and Stutzer, 2002; Kahneman et al., 1999; Oswald, 1997). The predominance of GDP per capita as a measure of social performance is questioned from academic and political sectors, since the conception used to measure progress and social performance influences the design of public policies and the choice of development strategies. Thus, the discussion matters because it has an impact on people's quality of life (Rojas, 2011).

Within the framework of this debate, the Commission on the Measurement of Economic Performance and Social Progress (CMEPSP), led by Stiglitz, Sen and Fitoussi, has published its Report (Stiglitz, et al., 2009)(2). The Commission argues that conventional market-based measures of GDP need to be complemented by non-monetary indicators of quality of life (Stiglitz, et al., 2009: 144). To measure quality of life or overall well-being, the Commission (Stiglitz et al., 2009: 42) considers three conceptual approaches useful: the capabilities approach (in close connection with moral philosophy); the subjective well-being (in close connection with psychology); and the notion of fair allocations (in close connection with economy).

Introduced by Sen (1980), the capabilities approach maintains that income and resources do not provide a sufficient or satisfactory indicator of well-being because they measure means rather than ends. The capabilities approach conceives a person's life as a combination of various "doings and beings" (functionings), and assesses well-being in terms of a person's freedom to choose among the various combinations of these functionings (capabilities). As people in different places and times have different values and experiences, the list of the most relevant functionings depends on circumstances and on the purpose of the exercise (Sen, 2005). In this perspective, the well-being of a person is a summary of the person's functionings. So, resources are means that are transformed into well-being in ways that differ across people: people with greater capacities for enjoyment or greater abilities for achievement in valuable domains of life are better-off even if they command fewer economic resources.

The notion of subjective well-being tries to answer the question if people are happy and satisfied with their lives, rather than presuming it or prescribing normative recipes for a good life (Diener, 2002; Easterlin, 2001). This approach focuses on subjective and mental states, and incorporates all other aspects of quality of life in the analysis as potential determinants of well-being, by measuring how they impact individual perceptions. Studies using the subjective well-being approach show that

income plays a small role in explaining people's well-being and that there is more to life than the standard of living. Several methods have made subjective well-being amenable to systematic quantification (see Kahneman et al., 1999; Veenhoven, 201?).

Finally, welfare economics has traditionally relied on the notion of "willingness-to-pay" to extend the scope of monetary measures to non-market aspects of life (Boadway and Bruce, 1984). The basic idea of the notion of fair allocations is weighting the various non-monetary dimensions of quality of life in a way that respect people's preferences. One approach would be to use the revealed preference analysis to make quality of life comparisons (see Dowrick et al., 2003).

According to the Siglitz-Sen-Fitoussi Report (Stiglitz et al., 2009: 41): "Quality of life is a broader concept than economic production and living standards. It includes the full range of factors that influences what we value in living, reaching beyond its material side". That is, the Commission does not focus on improving the estimates of material well-being, but on the measurement of well-being to encompass multiple domains –the overall or multi-dimensional well-being– (Easterlin, 2010). To this end, CMEPSP identifies eight dimensions of well-being that should be considered simultaneously (Stiglitz et al, 2009: 14): material living standards, health, education, personal activities –including work–, political voice and governance, social connections and relationships, environment, and insecurity (of economic as well as physical nature).

From the publication of the Report, some authors have commented on it and related their work to some relevant aspects. Given the difficulty of combining the preference-theory arguments with the capabilities and the subjective well-being arguments, Rojas (2011) argues that the Report has to be understood as the result of a minimal compromise among the Commission's members. Also, Rojas (2011) notes that the Report is particularly weak in conceptualizing quality of life, but remarks that this weakness is structural and it cannot be considered as a Commission's fault; actually, there is a lack of progress by the scholars of quality of life towards a common understanding of this concept. For Easterlin (2010), a radical contribution of the Commission has been the inclusion of subjective measures, which requires from the statistical offices a new orientation of the entire measurement system and the inclusion of surveys about cognitive evaluations of one's life, happiness, satisfaction, positive emotions such as joy and pride, and negative emotions such as pain and worry. For Oswald (2010), the novel aspect of the Stiglitz-Sen-Fitoussi Report is its

emphasis on the need for measures of emotional prosperity (although it did not use that exact term in the Report) rather than merely the traditional ones, such as GDP, of pecuniary prosperity.

Following the recommendations of the CMEPSP, the OECD has developed the project Better Life Initiative where they establish 11 dimensions as essential to well-being. Furthermore, the European Commission has prepared a document containing a series of guidelines for the development of an economic accounting system that includes the Stiglitz-Sen-Fitoussi Report's recommendations (Commission of the European Communities, 2009a).

3. Methodology to develop a synthetic index of well-being

In this paper we apply the DP_2 synthetic index proposed by Pena Trapero (1977) that provides a measure of overall or multidimensional well-being. DP_2 is a multidimensional index capable of aggregating various partial indicators of social and economic areas expressed in different measurement units. But also, DP_2 is a quantitative distance index, allowing comparisons of well-being across several spatial units.

The point of departure of the whole process is a matrix X of order (m, n), in which m is the number of municipalities and n is the number of partial indicators. Each element of this matrix, xji, represents the state of the partial indicator i in the municipality j. Those indicators negatively related with well-being are incorporated into the model changing the sign (all their data must be multiplied by -1). Conversely, those indicators positively related with well-being remain unchanged. Thus, the increase (decrease) in the values of any simple indicator indicates an improvement (worsening) in well-being.

The synthetic index P_2 Distance is defined as follows:

$$DP_2 = \sum_{i=1}^{n} (d_i / \sigma_i)\left(1 - R^2_{i,i-1,\ldots 1}\right) \qquad (1)$$

with $R_1^2=0$,

and where:

- n is the number of simple or partial indicators.
- $d_i=d_i(j,*)=|x_{ji}-x_{*i}|$ is the difference between the value taken by the i-th partial indicator in the j-th municipality and the minimum of the partial indicator in the

least desirable theoretical situation taken as a base reference $X_*=\{x_{*1}, x_{*2}, \ldots, x_{*n}\}$.

- σi is the standard deviation of the partial indicator i.
- $R^2_{i,i-1,\ldots 1}$ is the coefficient of determination in the multiple linear regression of x_i over $x_{i-1}, x_{i-2}, \ldots x_1$, already included.

Thus defined, the synthetic index measures the distance or disparities, regarding well-being, between each municipality and a fictitious base reference. In this instance, the base reference (X_*) comprises the results from an imaginary municipality which reflects the worst possible scenario for all the partial indicators and would therefore be attributed a value of zero in the synthetic well-being index (see Sánchez-Domínguez and Rodríguez-Ferrero, 2003; Zarzosa Espina and Somarriba Arechavala, 2013). A higher DP_2 value therefore indicates a higher level of well-being as it represents a greater distance from the "least desirable" theoretical situation.

The DP_2 synthetic index solves both the treatment of measurement units and the weighting attached to each observable variable by dividing distance by σi, i.e., d_i/σ_i; thus, the partial indicator is simultaneously expressed in abstract units and weighted by the inverse of the standard deviation. This way, the distances corresponding to the indicators with a higher dispersion to the mean are less important in determining the synthetic index.

The coefficient of determination, $R^2_{i.i-1,\ldots 1}$, measures the percentage of the variance of each partial indicator explained by the linear regression estimated using the preceding variables ($x_{i-1}, x_{i-2}, \ldots x_1$). As a result, the correction factor ($1-R^2_{i.i-1,\ldots 1}$) avoids data duplication by eliminating the information contained in the preceding indicators. That is, if ($1-R^2_{i,i-1,\ldots 1}$) expresses the part of the variance of partial indicator x_i not explained by $x_{i-1}, x_{i-2}, \ldots x_1$, the part already explained by the preceding indicators is obtained by multiplying each partial indicator by the corresponding coefficient of determination $R^2_{i.i-1,\ldots 1}$. Notice that R^2 is an abstract concept unrelated to the measurement units of the indicators.

The result of the DP_2 varies when the input order of the partial indicators changes. In this process, the first indicator (i = 1) will contribute all its information to the synthetic index (d_1/σ_1). However, the second indicator (i = 2) will only add that part of its variance that is not correlated with the first indicator: $(d_2/\sigma_2)(1-R^2_{2.1})$. Similarly, the third indicator will contribute to DP_2 the part of its variance that is not

correlated with either the first or the second indicators: $(d_3/\sigma_3)(1-R^2_{3.2,1})$ and so forth. It is therefore necessary to order the partial indicators based on the information that each one of them contributes to the synthetic index (highest to lowest). That is, the first indicator to be included would be that which provides the greatest amount of information concerning the objective to be measured, and then so on and so forth.

We follow the ranking method proposed by Pena Trapero (1977), which is an iterative method based on the Fréchet Distance (DF) where all the coefficients of determination R^2 are set to zero:

$$DF = \sum_{i=1}^{n} (d_i / \sigma_i) = \sum_{i=1}^{n} (| x_{ji} - x_{*i} | / \sigma_i) \; ; \qquad j = 1, 2, ..., m \tag{2}$$

We then estimate the pairwise correlation coefficients r between each partial indicator and the Fréchet distance and sort the partial indicators from highest to lowest according to the absolute values of the pairwise correlation coefficient. Next, we calculate the first P_2 distance for each municipality, incorporating the partial indicators in the resulting order. The classification of indicators would then be performed by ordering them from highest to lowest in terms of the absolute value of the pairwise correlation coefficient between each component and the DP_2. The process continues iteratively until the difference between two adjacent DP_2s is zero.

The numerical value of the DP_2 index has no real meaning, but it is useful for comparing the state of different municipalities in terms of well-being. From the results can be established a ranking of municipalities from high to low level of development, and identifying which factors contribute the most to well-being. If it uses the same variables and method, it can compare the results for Andalusian municipalities with those obtained for other regions or countries. DP_2 can be used to compare changes in relative positions and even to detect their causes.

The DP_2 synthetic index verifies the properties a multidimensional index must fulfil in order to provide an acceptable measure or estimate: existence and determination, monotony, uniqueness quantification, invariance, homogeneity, transitivity, exhaustiveness, additivity, and invariance compared to the base of reference (see Zarzosa Espina and Somarriba Arechavala, 2013).

There are other approaches to aggregate the information on several indicators into a single index. The geometric mean is used by the HDI of the United Nations. The data envelopment analysis (DEA) has been used to estimate quality of life in Spanish provinces (Murias et al., 2006) and municipalities (Gonzalez et al., 2012).

The Principal Component Analysis (PCA) has been applied in well-being studies (Madonia et al., 2013) and to estimate a multidimensional approach to regional inequality in the EU (Folmer and Heijman, 2005).

Regarding the geometric mean, the DP_2 method presents at least two advantages. First, whereas the DP_2 index verifies all of the necessary properties for an acceptable aggregation method, the geometric mean is not unique to scale changes; hence she is affected by the measurement units of the variables. Second, the DP_2 method objectively assigns weights to the indicators; in the HDI all the indicators have the same weight. This is an arbitrary approach and, moreover, there is no rationale for assigning the same weight to different indicators (Folmer and Heijman, 2005: 342).

The primary limitation of the DEA method to elaborate a synthetic index is that it does not include a formal criterion for variables selection (Ganley and Cibin, 1992). Furthermore, the DEA is very sensitive to the selection of variables (Leibstein and Maital, 1992). The DP_2 method, however, incorporates an objective way for variables selection: those variables that do not provide new information on the phenomenon under study are left out of the model.

Probably, the mayor limitation of the PCA regarding the DP_2 method is that it does not measure disparities, as the PCA only establishes a ranking of the geographic or temporal aspects being analysed with regard to the object of study. In fact, this kind of analysis is usually accompanied by a distance analysis, such as the cluster analysis (see Larraz Iribas and Pavia, 2010). However, DP_2 is a cardinal measure, and it is also capable of determining how much higher/ lower is the development level in region A with respect region B.

4 Data

To elaborate the synthetic index of overall or multidimensional well-being in Andalusia (WI), we use the Multi-territorial Information System of Andalusia (SIMA) database, developed by the Institute of Statistics and Cartography of Andalusia. To perform the statistical analysis, we build a list of 17 partial indicators which allow us to take into account several aspects of a municipality's well-being in 2009, including economic, social and ecological factors (Table 1). To approximate the advantages of living in a municipality, we use 11 partial indicators, which are incorporated in the

model with its true value. To approximate the drawbacks of living in a municipality, we use six partial indicators, which are incorporated in the model changing the sign (multiplieding by -1). Partial indicators have been constructed by removing the effect size. Table 2 shows the descriptive statistics of partial indicators.

Insert Table 1 here

Insert Table 2 here

The choice of partial indicators has been guided by the recommendations of the Stiglitz et al. (2009), and the results of investigations (see Madonia et al., 2013; Murias et al., 2006; Zarzosa Espina and Somarriba Arechavala, 2013). Also, we follow Ivanovic (1974) regarding the two main properties that must be met by a partial indicator: (1) a high power of discrimination, which means that their value varies in all geographical areas studied; and (2) the greater the amount of information provided by an indicator not contained in the global information and indicators incorporated into the composite index, the better the partial indicator. Moreover, several tests have been performed with PCA and DP_2 methods, to select the variables finally included in the WI.

Considering the limited statistical information available, we are aware that our research lacks data about the evaluation individuals make of their health, education, income, personal fulfillment and social conditions. Regional and national statistics need to incorporate measures of life satisfaction and happiness. However, we have incorporated indicators that could be considered proxies of life satisfaction and happiness, as various investigations have shown.

Given that one or more indicators can be used to account for each of the underlying dimensions of well-being, the indicators that we use in this paper are representative of all of the dimensions proposed in the Stiglitz-Sen-Fitoussi Report (Table 3).

Insert Table 3 here

The relevance of the indicators measuring well-being in the municipalities of Andalusia, is briefly justified below.

Following recommendation 1 of Stiglitz et al. (2009: 39) that it is preferable to consider income and consumption rather than production, the model works with income per capita (INCOME). According to recommendation 2 of Stiglitz et al. (2009: 29-30), we discuss income and consumption jointly with wealth. As a proxy of municipalities' wealth, the model incorporates PROPERTY. BUSINESS is proxy

variable of economic activity. DSL, as a proxy of availability of high-speed networks, is a key factor for competitiveness, as it determines the capacity of territories to compete in and benefit from the global knowledge-based economy, technology and market (European Commission, 2011: 6; Tranos and Gillespie, 2009). All these indicators have a positive impact on the well-being of the municipality and can be framed in the *economic security* dimension.

However, DSL also provide information about the well-being measurement of *education,* because they permit the use of the Information and Comunication Technologies; *personal activities,* because they facilitate the reconciliation of work and family life; *social connections,* because they constitute the technological support of social networks; and *political voice and governance,* because internet and the social networks promote transparency.

Old age can imply *economic insecurity* due to uncertainty about needs and resources after withdrawal from the labour market (Stiglitz et al., 2009). Demographic forecasts for Spain predict that the dependent population will exceed the EU-27 average in 2040 and be more than four percentage points above the EU-27 average in 2060 (Observatory on Sustainability in Spain, 2011). Spain's demographic trends justify that our well-being measurement model incorporates DEPENDENCY with a negative sign to reflect its negative impact on well-being and, conversely, YOUTH and GROWTH remain unchanged(3).

Insecurity in the workplace or unemployment has negative material effects, but also on mental and physical health, and cause tensions in family life (Stiglitz, et al., 2009). Unemployment is a large source of unhappiness (Argyle, 1999; Oswald, 1997; Winkelmann and Winkelmann, 1998). The mental health of the unemployed deteriorates, with higher rates of depression, suicide, and alcoholism. Their health also worsens, and their death rate increases (Argyle, 1989). Exclusion from the labour market is a main form of exclusion, most visible in the form of unemployment, which has a direct impact on income inequalities (Eurostat, 2010). We have considered UNEMP has a negative impact on the *economic insecurity, health and personal activities* dimensions.

EDUCATION, DSL, ADULT and LIBRARY are indicators of the *education* dimension and they are also in line with recommendation 5 of Stiglitz et al. (2009: 14) of considering the leisure activities that people enjoy. Therefore, they can integrate

the *personal activities* (how people spend their time) dimension, as well as the *social connections* dimension.

VOTER is an indicator of *political voice and governance* with positive effects on well-being. Dorn et al. (2007) argue that democracy facilitates outcomes that are better in line with citizens' preferences. They also argue that the act of participating in the democratic process may in itself increase well-being. Considering that more and better educated people show a higher level of commitment with civil and political life (Stiglitz et al., 2009: 46), we consider EDUCATION in the *political voice and governance* dimension.

Health is a key element to determine people's life duration and quality (Nussbaum, 2000). As an approximation to the ability to have a long and healthy life, four partial indicators have been introduced in the model: PREVENT(4), GROWTH, DEPENDENCY and UNEMP.

As indicators of the *environmental or ecological conditions* dimension, we use FOREST, EROSION and MOTOR. Ecological conditions are important not only for sustainability issues, but also due to their immediate impact on the quality of people's lives. Specifically, forests perform multiple ecological, socioeconomic and cultural functions. Erosion affects the quality of ecosystems, limits the productive capacity of land, and is the leading cause of irreversible degradation in humid areas and desertification in arid areas. Motorisation rate is a proxy of consumption patterns and carbon dioxide (CO2) emissions for road vehicles. Nowadays in Spain, car traffic is the first cause of air pollution in cities. A large percentage of the population is exposed to pollution levels, which pose serious health risks, in addition to high economic and environmental costs (Observatory on Sustainability in Spain, 2011).

Finally, VIOLENT, that is deaths not caused by disease, is an indicator of the *personal insecurity* dimension, with negative effects on well-being.

5. Well-being Index results and spatial autocorrelation analysis

WI results show that about the 52% of the population still enjoyed a level of well-being above the regional average (56.30)(5) in 2009. When considering the classification by quartiles (Figure 1), we find that almost 70% of the population is in the fourth quartile (high WI) and the third quartile (high medium WI), while only 4.53% of the population shows a very low level of well-being (first quartile). In 2009, well-being inequalities among the municipalities with highest (75.52) and lowest

(34.60) well-being were more than double. Distinguishing between rural municipalities (population less than 10,000 inhabitants) and urban municipalities (population over 10,000), there are differences in well-being (for rural municipalities: mean = 54.09, standard deviation = 4.12, N = 619; for urban municipalities: mean = 56.81, standard deviation = 2.56, N = 151; t (768) = 7.76, p = 0.0000), and the effect size (Cohen´s d) is 0.55, indicating a small effect size (Cohen, 1988). That is, about 70% rural municipalities enjoy well-being bellow average well-being urban municipalities.

Insert Figure 1 here

Table 4 shows the ranking of the partial indicators obtained by the iterative calculation of the DP_2, the correction factor ($1-R^2$) of each indicator, the absolute pairwise correlation coefficients (r) and the p-values. The p-values show that all simple indicators keep a statistically significant relation below 1% with the WI. Specifically, there are correlations of 0.633 between DSL and WI, of 0.585 between INCOME and WI, of 0.521 between DEPEDENCY and WI, etc. Also a PCA was carried out, and the 17 partial indicators chosen passed the suitability test; that is, they are sufficiently related to warrant inclusion in a synthetic index (measure of Sampling Adequacy KMO = 0.824, and p = 0.000 in Bartlett's test of sphericity; N = 770).

Insert Table 4 here

According to the statistical information analysed, the indicators DSL, INCOME and the indicators of demography (DEPENDENCY, GROWTH and YOUTH) had the greatest influence in determining the well-being of Andalusian municipalities in 2009. By contrast, the indicators ADULT, PREVENT and VOTER ranked lowest, thus indicating that they are the less correlated with well-being.

Regarding the values of the correction factor ($1-R^2$), it could be argued that all the indicators analysed provide relevant information for determining well-being, that is, no indicator is redundant and none is eliminated by the selection criteria implicit in the DP_2. For example, the DSL indicator, which ranks first in explaining well-being, contributes 100% of its information to construct the WI (correction factor 1). Given that the YOUTH indicator shows a strong correlation with DEPENDENCY (in third place) and GROWTH (fourth place), a correction factor of 0.261 is applied to it because approximately 74% of the data for this indicator has already been explained by the four indicators which appear before it in the ranking. Continuing with the analysis, the weights of PREVENT and VOTER (0.866 and 0.738, respectively) show

that, despite occupying the last positions, these indicators contribute a very high percentage of new information on socioeconomic well-being that was not contributed by the 15 previous partial indicators.

Next, we examine whether the geographical distribution of WI is random or, conversely, it responds to certain patterns of agglomeration. To do so, we estimate the Moran's I statistic (Anselin, 1988) to detect the presence of spatial autocorrelation in well-being. We have used three different conceptualizations of spatial relationships: (1) inverse distance, (2) inverse distance squared between the centroids of municipalities, and (3) physical contiguity. In the last case, the spatial weight has 1 for two municipalities that have some common border and 0 otherwise. Results of Moran´s statistic (Table 5) reveal that the most appropriate specification of the spatial weights matrix is provided by the inverse of the distance (p-value = 0.000 and a higher Moran's I).

Insert Table 5 here

The value of Moran's I statistic is positive, thus indicating a positive correlation. This means that well-being in the municipalities of Andalusia is not distributed randomly in space but that municipalities with high levels of well-being are surrounded by municipalities with high levels of well-being and vice versa. These results could be partially explained by the existence of spillover effects in Andalusian municipalities for the different dimensions that affect well-being.

Figure 2a shows the WI correlogram using the distance between municipalities. As it can be observed, the typical decrease in Moran's I statistic shows that as the distance between municipalities increases, the relationship between municipalities' well-being decreases. Also note that for distances larger than 38.764 km, the Moran's I values stabilize, becoming so low that nearly indicate spatial independence. This informs us about the existence of a ceiling on this relationship between municipalities.

Insert Figure 2 here

In addition to the correlogram, we have developed a well-being variogram (Figure 2b) by fitting a spherical variogram model (Matheron, 1970):

$$\gamma(h) = c_0 + (c_1/2)[(3h/a_1) - (h/a_1)^3] \quad (3)$$

where c_0=11.101 (nugget effect), c_1=5.782 (partial sill), a_1=38.764 (range) and h is the distance between centroids of municipalities.

The value of the range (a1) represents the distance at which the variogram reaches the sill. That is, the well-being of a municipality is correlated with that of its neighbours, but this correlation decreases with the distance up to approximately 38km. This result agrees with that obtained by the correlogram of the distances shown in Figure 1. In other words, it would appear that, in middle terms, the decisions made by the Andalusian municipalities generate benefits and costs not only in terms of the well-being of the residents in the municipality, but also the well-being of citizens residing in other jurisdictions located within an area of about 38km. This is in line with Solé Ollé (2006), who developed a methodology for quantifying the spillover effects resulting from local expenditure policies in a sample of some 2,500 Spanish municipalities for the year 1999.

In order to determine the presence of groups or clusters of municipalities located in Andalusia in terms of well-being (WI), we have used the Local Indicator of Spatial Association (LISA) with a 95% confidence (Anselin, 1995).

Figure 3 shows the results. Of the 770 municipalities of Andalusia, 443 (57.53%) show no significant spatial autocorrelation with their neighbours. Of the remaining municipalities, 240 (31.16% of the total municipalities) exhibit a positive autocorrelation. Of these, 122 municipalities that represent the 33% of Andalusia's population belong to clusters of municipalities with high WI levels that are surrounded by others which also have high levels of WI (high-high or type A clusters), while 118 municipalities (9.5% of Andalusia's population) have low WI values and are surrounded by municipalities that also have low WI values (low-low or type B clusters).

Finally, the spatial heterogeneity between the municipalities, which is represented by the presence of a negative autocorrelation (high-low and low-high), affects only the 11.31% of Andalusian municipalities.

Insert Figure 3 here

Focusing on the type A clusters (high-high WI), there are seven clusters corresponding to geographic areas from east to west: Coast of Almeria (A1), Segura and Cazorla Mountain Range (Jaen) (A2), Metropolitan area of Granada (A3), Central node (Cordoba-Malaga-Seville) (A4), Municipalities of Costa del Sol (Malaga) (A5),

Metropolitan area of Seville and Aljarafe (A6), and Metropolitan area of Huelva and West Coast (A7).

In these groups, a municipality has a greater level of well-being not only due to its own endowment in the variables examined, but also due to access to the endowments of neighbouring municipalities (spillovers). That is, increases in the well-being of a municipality are linked to increases in the well-being of neighbouring municipalities. The strong points of these municipalities are based on the good behavior of demographic indicators (GROWTH, YOUTH and DEPENDENCY), EDUCATION, INCOME, UNEMP and BUSINESS. Weak spots would originate in the bad behavior of the ecological factors (FOREST, MOTOR and EROSION).

There are five type B clusters (municipalities that have low WI values and are surrounded by municipalities that also have low WI values) corresponding to geographic areas from east to west: Los Filabres and Almanzora Valley (Almeria) (B1), Alpujarras of Granada (B2), Eastern Mountains of Granada (B3), Malaga, Axarquia and Western Granada (Malaga-Granada) (B4), and Ronda and Cadiz Mountain Range (Malaga-Cadiz) (B5).

All type B clusters exhibited a lower WI than the average WI of the region. The municipalities of these five clusters share common characteristics that could explain their lower level of well-being compared to the whole region. These municipalities show very low levels in dimensions that positively impact well-being, such as GROWTH, YOUTH and FOREST, while indicators that negatively impact well-being, such as DEPENDENCY and VIOLENT, show values above the regional average.

7. Discussion and conclusions

In this paper we have estimated a synthetic index of multi-dimensional well-being (WI) for the 770 municipalities of Andalusia in 2009 using the P_2 Distance method which proves more robust than traditional methodological approaches. The WI incorporates information from 17 partial indicators on economic, social and ecological dimensions of well-being. In selecting and constructing the indicators, we have followed the guidelines of Stiglitz et al. (2009).

The results show that about 52% of the population still enjoys a level of well-being above regional average. According to the WI classification of municipalities by quartiles, almost 70% of the population is in the fourth quartile (high WI) and third

quartile (high-medium WI). As the Seventh Progress Report on Economic, Social and Territorial Cohesion concludes (European Commission, 2011: 13), the WI distribution between rural and urban municipalities shows that living in an urban area in a less developed region (Andalusia), has more advantages than living in a rural area or small town. However, if they were included in the study self-reported life satisfaction level, the results could be different (see Brereton et al., 2011).

Also, the results show that indicators of economic activity, education, personal activities and social connections (DSL) and INCOME, together with those on demography (DEPENDENCY, GROWTH and YOUTH) have the greatest influence in determining well-being. That is, as pointed out by further investigations, income remains an important variable, but non-economic variables are also key determinants of well-being (Madonia et al., 2012; Sánchez-Domínguez and Rodríguez-Ferrero, 2003). Specifically, the pairwise correlation test between the WI and INCOME in terms of the 770 municipalities analysed shows a correlation of 0.585 ($p = 0.000$).

The plural or multidimensional aspects of quality of life or well-being are a focal point of capabilities approach (see Nussbaum, 2000, 2011; Seen 1980) and Stiglitz-Sen-Fitoussi Report (Stiglitz et al, 2009). Our proposal highlights the multidimensional character of well-being. WI results show that all simple indicators keep a statistically significant relation with the WI, and all of them provide relevant information for determining well-being. Therefore, like other papers (Brereton et al., 2011; Perrons, 2012; Servillo et al., 2011), this paper suggests that an approach based solely on income measurement is defective and an approach that incorporates more components of quality of life and aims to provide greater equality in terms of economic and social opportunities would be more appropriate. In particular, European regional policy should focus its efforts on improving the quality of life rather than simply trying to equalize incomes.

Spatial analysis application to a synthetic index of well-being is a quite novel field. Some works with spatial econometrics applications use as welfare index the GDP, corrected by the Gini index (see Ezcurra et al., 2006). With our analysis, we have shown that socioeconomic well-being in Andalusia is not spatially distributed in a random way, but exhibits spatial autocorrelation. Thus space matters. We have quantified that well-being measured in a given municipality of Andalusia is related to its neighbouring municipalities up to a distance of about 38km. These results support the hypothesis of the existence of positive and negative externalities, for example,

policies or actions implemented in a municipality which affect the well-being of citizens residing in other jurisdictions.

We have identified clusters of municipalities in terms of their well-being and we have analysed their strengths and weaknesses. We have shown that almost 33% of the population of Andalusia resides in type A clusters (municipalities with a high level of well-being which are, in turn, surrounded by municipalities that also have a high level of well-being) and 9.5% in type B clusters (municipalities with low well-being surrounded by municipalities that also have low levels of well-being).

The results of our research have implications for regional and local level public policymaking. The existence of spillover effects and the presence of type A and B clusters highlights the need to coordinate policies that are currently designed and structured within a local context, such as urban planning, provision of industrial land, environmental policies, housing and immigration policies, public transport, and water and waste management, among others.

Furthermore, Andalusia has a high number of municipalities (770 municipalities) distributed in eight provinces. The provincial division of Spain dates back to 1883 and basically responds to historical criteria (former Spanish kingdoms), rather than criteria of effectiveness and efficiency in the provision of public goods and services. These circumstances, coupled with the evidence provided in this paper of the existence of clusters of municipalities in different provinces, might suggest, in line with what has been noted by (Haughwout, 1999), the advisability of fostering cooperation and coordination among the municipalities so as to internalize the externalities that affect citizens' well-being. An option would be the union of several small municipalities under a single municipal government.

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Notes

(1) The Stiglitz-Sen-Fitoussi Report establishes a conceptual distinction among four types of measures: 1) production (economic performance), 2) material living level (economic well-being), 3) overall (multi-dimensional) well-being, and 4) well-being of current versus future generations (sustainability) (Easterlin, 2010: 120).

(2) The aims of the Report were: "to identify the limits of GDP as an indicator of economic performance and social progress, including the problems with its measurement"; "to consider what additional information might be required for the production of more relevant indicators of social progress"; "to assess the feasibility of alternative measurement tools"; and, "to discuss how to present statistical information in an appropriate way" (Stiglitz et al., 2009: 7).

(3) Although population growth is generally seen as a major threat to sustainable development because it exerts pressure on the overall system, Hediger (2000) shows that population growth does not have a dominant impact on the formulation of the weak sustainability criterion.

(4) PREVENT denotes the percentage of deaths from diseases that could be prevented through medical care and primary prevention over total deaths.

(5) As stated in Pena Trapero (1977: 201-220), the values of WI by municipalities may be added in groups as arithmetic means weighted by the relative populations of the respective municipalities.

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Table 1. Partial indicators of multi-dimensional well-being

1	INCOME	PER CAPITA INCOME AS DECLARED IN INCOME TAX STATEMENTS
2	DSL	BROADBAND DSL (NUMBER OF ASYMMETRIC DIGITAL SUBSCRIBER LINE PER 100 INHABITANTS)
3	BUSINESS	TAX ON BUSINESS ACTIVITIES. BUSINESS AND PROFESSIONAL ACTIVITIES PER 100 INHABITANTS AS DECLARED ON BUSINESS INCOME TAX STATEMENTS
4	PROPERTY	ASSESSED URBAN AND RURAL RATE VALUE PER CAPITA AS DECLARED ON PROPERTY TAX STATEMENTS
5	GROWTH	NATURAL GROWTH (BIRTHS-DEATHS PER 1,000 INHABITANTS)
6	YOUTH	YOUTH RATE (% POPULATION UNDER 20 YEARS / POPULATION AGED 60 AND OVER)
7	DEPENDENCY(-1)	OLD-AGE-DEPENDENCY RATIO RATE OF AGING (% POPULATION AGED 65 AND OVER / POPULATION FROM 15 TO 64)
8	UNEMP(-1)	UNEMPLOYMENT RATE 15 YEARS OR OVER (%)
9	EDUCATION	PERCENTAGE OF SECONDARY AND HIGH SCHOOL STUDENTS AMONG THE POPULATION AGED 15 TO 24 YEARS
10	ADULT	ADULT EDUCATION (% OF STUDENTS IN THE POPULATION)
11	LIBRARY	NUMBER OF LIBRARY VISITS PER CAPITA
12	VOTER	VOTER TURNOUT. RATIO BETWEEN THE NUMBER OF VOTERS WHO CAST THEIR VOTES AND THE TOTAL ELIGIBLE VOTERS IN THE MUNICIPAL GOVERNMENT ELECTIONS OF 2007
13	PREVENT(-1)	PREVENTABLE DEATHS. DEATH BY TUMOURS AND DISORDERS OF THE CIRCULATORY AND RESPIRATORY SYSTEMS PER 10,000 DEATHS (CASES 2, 9 AND 10, RESPECTIVELY, TENTH REVISION OF WORLD HEALTH ORGANIZATION ICD)
14	FOREST	SURFACE TIMBER FOREST (% OF SURFACE TIMBER FOREST)
15	EROSION(-1)	PERCENTAGE OF HIGH AND VERY HIGH SOIL EROSION
16	MOTOR(-1)	MOTORISATION RATE (NUMBER OF CARS -EXCLUDING ELECTRIC AND HYBRID CARS- PER 100 INHABITANTS)
17	VIOLENT(-1)	DEATHS FROM EXTERNAL CAUSES PER 100,000 DEATHS (CASE 20, TENTH REVISION OF WORLD HEALTH ORGANIZATION ICD)

Source: SIMA, Institute of Statistics and Cartography of Andalusia and the authors.

Table 2. Descriptive statistics (N=770)

PARTIAL INDICATORS	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION (%)	MEDIAN	MAXIMUM	MINIMUM
INCOME	4,734.28	1,841.97	38.91	4,409.82	13,589.14	670.69
DSL	8.55	4.83	56.45	8.31	38.23	0.00
BUSINESS	8.48	2.91	34.31	8.29	27.52	0.00
PROPERTY	17,041.98	16,232.41	95.25	13,059.97	226,420.80	1,505.50
GROWTH	-1.32	7.12	541.28	-1.02	16.47	-38.46
YOUTH	26.11	11.02	42.20	25.27	76.83	4.26
DEPENDENCY	30.72	12.13	39.47	29.03	104.88	7.07
UNEMP	7.29	2.99	41.07	6.97	21.60	0.48
EDUCATION	34.19	27.78	81.25	30.84	164.24	0.00
ADULT	2.11	3.17	149.76	1.48	39.72	0.00
LIBRARY	1.23	1.57	127.44	0.78	12.92	0.00
VOTER	74.87	9.71	12.97	76.22	95.33	43.64
PREVENT	68.98	15.03	21.78	70.00	100.00	0.00
FOREST	10.28	14.99	145.80	2.66	80.20	0.00
EROSION	10.91	11.59	106.31	7.22	70.75	0.00
MOTOR	44.13	13.73	31.12	42.84	273.65	18.18
VIOLENT	40.47	66.05	163.20	23.53	763.36	0.00

Source: SIMA, Institute of Statistics and Cartography of Andalusia and the authors.

Table 3. Overall well-being dimensions from Stiglitz-Sen-Fitoussi Report

WELL-BEING DIMENSIONS	PARTIAL INDICATORS

ECONOMIC INSECURITY	INCOME, DSL, BUSINESS, PROPERTY, UNEMP, DEPENDCY, GROWTH, YOUTH
HEALTH	PREVENT, DEPENDCY, UNEMP, GROWTH
EDUCATION	SECONDARY, DSL, ADULT, LIBRARY
PERSONAL ACTIVITIES	UNEMP, DSL, LIBRARY, ADULT, SECONDARY
POLITICAL VOICE AND GOVERNANCE	VOTER, SECONDARY, DSL
SOCIAL CONNECTIONS	DSL, ADULT, LIBRARY, SECONDARY
ENVIRONMENTAL CONDITIONS	FOREST, EROSION, MOTOR
PERSONAL INSECURITY	VIOLENT

Source: Stiglitz et al. (2009) and the authors.

Table 4. Absolute pairwise correlation coefficients and weights of the simple indicators ranked in order of their absolute pairwise correlation with the WI

Position	Partial indicators	Weights ($1-R^2$)	Pairwise correlation |r| (p-value)
1	DSL	1	0,633 (0.000)
2	INCOME	0.494	0.585 (0.000)
3	DEPENDENCY	0.613	0.526 (0.000)
4	GROWTH	0.440	0.520 (0.000)
5	YOUTH	0.261	0.518 (0.000)
6	SECONDARY	0.783	0.471 (0.000)
7	IAE	0.843	0.460 (0.000)
8	EROSION	0.904	0.380 (0.000)
9	LIBRARY	0.938	0.337 (0.000)
10	IBI	0.826	0.318 (0.000)
11	VIOLENT	0.960	0.248 (0.000)
12	MOTOR	0.971	0.222 (0.000)
13	FOREST	0.925	0.206 (0.000)
14	UNEMP	0.706	0.188 (0.000)
15	ADULT	0.972	0.187 (0.000)
16	PREVENT	0.866	0.152 (0.000)
17	VOTER	0.738	0.144 (0.000)
N=770			

Source: SIMA, Institute of Statistics and Cartography of Andalusia and the authors.

Table 5. Spatial autocorrelation of well-being for different conceptualizations of spatial relationships (N=770)

W	Moran's I	z-score	p-value
Inverse distance	0.382	18.233	0.000
Inverse distance squared	0.326	0.710	0.477
First-order contiguity	0.281	13.263	0.000

Source: The authors.

Figure 1. Geographic distribution of well-being in Andalusia, 2009

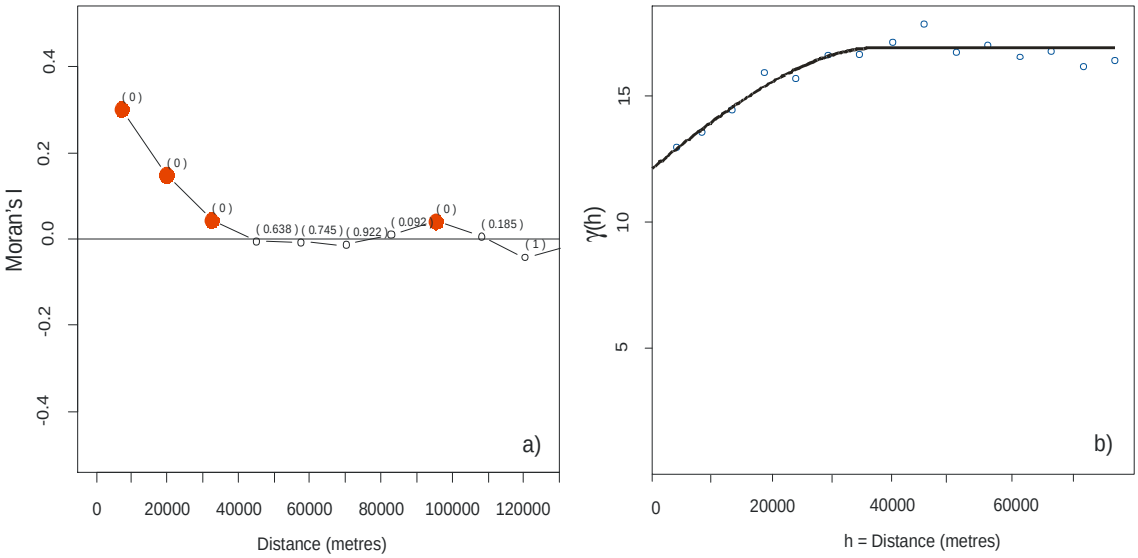

Figure 2. Correlogram (a) with p-value in brackets and variogram (b)

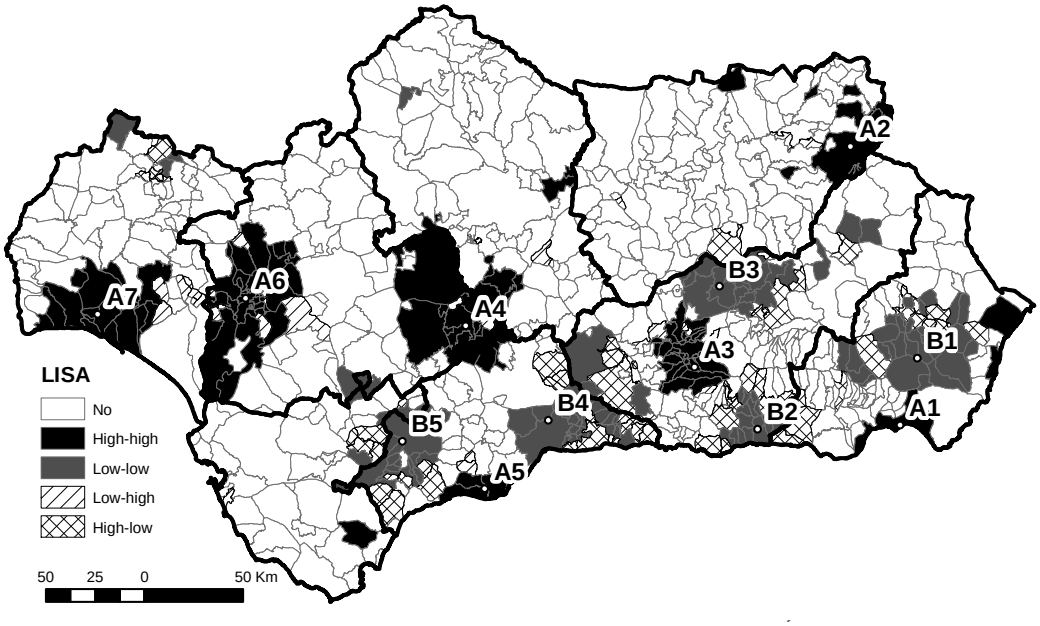

Figure 3. Well-being clusters, Andalusian municipalities 2009