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Call for Papers - Contribution from Selected Academics

As a part of its Annual Forum, Progressive Economy was delighted to host a series of academic sessions, as part of the inaugural Progressive Economy Annual Call For Papers. This call for papers is the first of its kind, and these sessions formed the final stage of a long and very competitive process.

Authors were invited to submit their abstracts in November. For each of the four research topics, the Scientific Board highlighted ten abstracts of particularly high quality, and invited the selected authors to submit their full papers, all of which are available online, at http://www.progressiveeconomy.eu/content/annual-call-papers-en.

The Forum saw four breakout sessions, each chaired by at least one member of the Scientific Board - Alternatives to Austerity (chaired by Stephany Griffith-Jones); Inequality and the Crisis (Kate Pickett & Frank Vandenbroucke); Reforming European Economic Governance (Louka Katseli); and Rethinking Economic Policy (James Galbraith & Jill Rubery). Each of the authors was asked to give a short presentation of their paper, and for each subject area, a winning paper was selected.

Given the outstanding quality of the presentations, in certain cases, joint winners were selected. Over the coming pages, you will find briefings by the winning authors, explaining their papers.

THE WINNERS WERE AS FOLLOWS:

Alternatives to Austerity

Giovanni Cozzi, Terry McKinley and Jo Michell – *Employment-focused Recovery for Europe: an Alternative to Austerity*

AND

Daniela Gabor – *A Step Too Far? The European Financial Transactions Tax and Shadow Banking*

Inequality & the Crisis

Sem Vandekerckhove, Guy van Gyes and Maarten Goos – *Reassessing the Impact of Minimum Wages on Wage Dispersion and Employment: Evidence from an Institutionalised Wage Bargaining System*

Reforming European Economic Governance

Jakob Kapeller, Bernhard Schütz and Dennis Tamesberger – *From Free to Civilised Markets: First Steps Towards Eutopia*

Rethinking Economic Policy

Ángeles Sánchez-Domínguez and María J. Ruiz-Martos – *A Progressive Approach to the Measurement of Regional Performance in the European Union*

AND

Georgia Kaplanoglou, Vassilis T. Rapanos and Ioanna C. Bardakas – *Does Fairness Matter for the Success of Fiscal Consolidation?*

Young Academic (proposed by Jean-Paul Fitoussi)

Matteo Laruffa – *The European Economic Governance: Problems and Proposals for Institutional Innovations*

AND

Christopher Rauh – *The Political Economy of Early and College Education – Can Voting Bend the Great Gatsby Curve?*

A Progressive Approach to the Measurement of Regional Performance in the European Union

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The primary goal of the Regional Cohesion Policy is the overall harmonious development in the European Union (EU), i.e., reducing disparities between the levels of development of the various regions and the backwardness of the least fortunate regions. Structural Funds, allocated by regional Gross Domestic Product (GDP) per capita,[1] are the main instrument used to achieve cohesion objectives. Empirical evidence shows that, despite recurrent economic and social cohesion goals, EU socio-economic inequalities between both people and regions have been rising in the majority of Member States over the last three decades, and are now higher than in 1980 (Eurostat) due to the impact of the economic crisis. This separation between economy and society could be potentially overcome by including a measure of social well-being in models of regional performance (Perrons, 2012). In effect, the Commission is increasingly demanding a more performance-oriented cohesion policy (Barca and McCann, 2011; European Commission, 2009a, 2009b), and several international organisations are currently constructing multidimensional indexes of development or quality of life (i.e., United Nations, World Bank and OECD).

Drawing from the capabilities approach (Sen, 1980, 1987, 1992; Nussbaum, 2000, 2011) and recent trends in well-being (i.e., Stiglitz et al., 2009), we present a multidimensional approach to the measurement of regional performance, an alternative to the single and strictly economic criterion of the GDP per capita. We attempt to measure regional performance in terms of people´s well-being and progress. That is, we aim to assess the degree of relative disadvantage of the European regions taking the achieved functionings[2] in relevant areas of well-being as reference points. With this in mind, we propose a composite index (RDI, Regional Development Index) that measures regional performance in the 269 regions of EU28 in 2009 from a multidimensional perspective, by including 16 indicators of health, education, employment, inequalities in income, inequalities in gender, and poverty.

The composite index is calculated using two distinct multivariate methods, Distance P_2 (Pena Trapero, 1977) and Principal Component Analysis (PCA). Distance P_2 and PCA are aggregation methods that map multiple dimensions into a one-dimensional index. For the Distance P_2, we have taken as each indicator baseline the worst possible value recorded for any of the variables, hence the results of the composite index show the level of development of each region in comparison to the remaining EU regions. PCA extracts from the multiple variables that jointly determine an underlying, non-measurable concept the principal triggering factors of that underlying concept. The Distance P_2 and PCA results provide a ranking of regions from high to low level of development and show which factors contribute the most to regional development.

We find that, given the indicators selected –conditioned on data availability- and independently of the multivariate method followed, Stockholm in Sweden and Severozapaden in Bulgaria are, respectively, the most developed and the least developed regions. Interestingly too, employment (female and male), related aspects and GDP per capita adjusted by inequality and education are key determining factors of regional development.

[1] Regions with GDP per capita below the threshold of the 75% of the EU average GDP per capita are eligible for Structural Funds support.
[2] Functionings can be understood as the person achievements in the distinct dimensions that constitute her life.

In addition and according to one of the mathematical properties of the Distance P_2 method, Stockholm's development level is three times larger than Severozapaden's. Hence, large territorial disparities exist within the EU.

Some regional policy implications arise from a change in the Structural Funds allocation rules. The application of the proposed multidimensional approach, instead of the traditional GDP per capita, and with an equivalent budgetary effort regarding the population benefited from these funds, results in a distinct map of priority regions. Some regions of Belgium, France, Greece, Germany, Italy and Spain –thus, of the old and Mediterranean Europe- would be considered as priority regions; whereas some other regions, mainly from Eastern Europe, would not be considered so (see Map 1). There is plenty material for discussion at the level of the EU Regional Policy.

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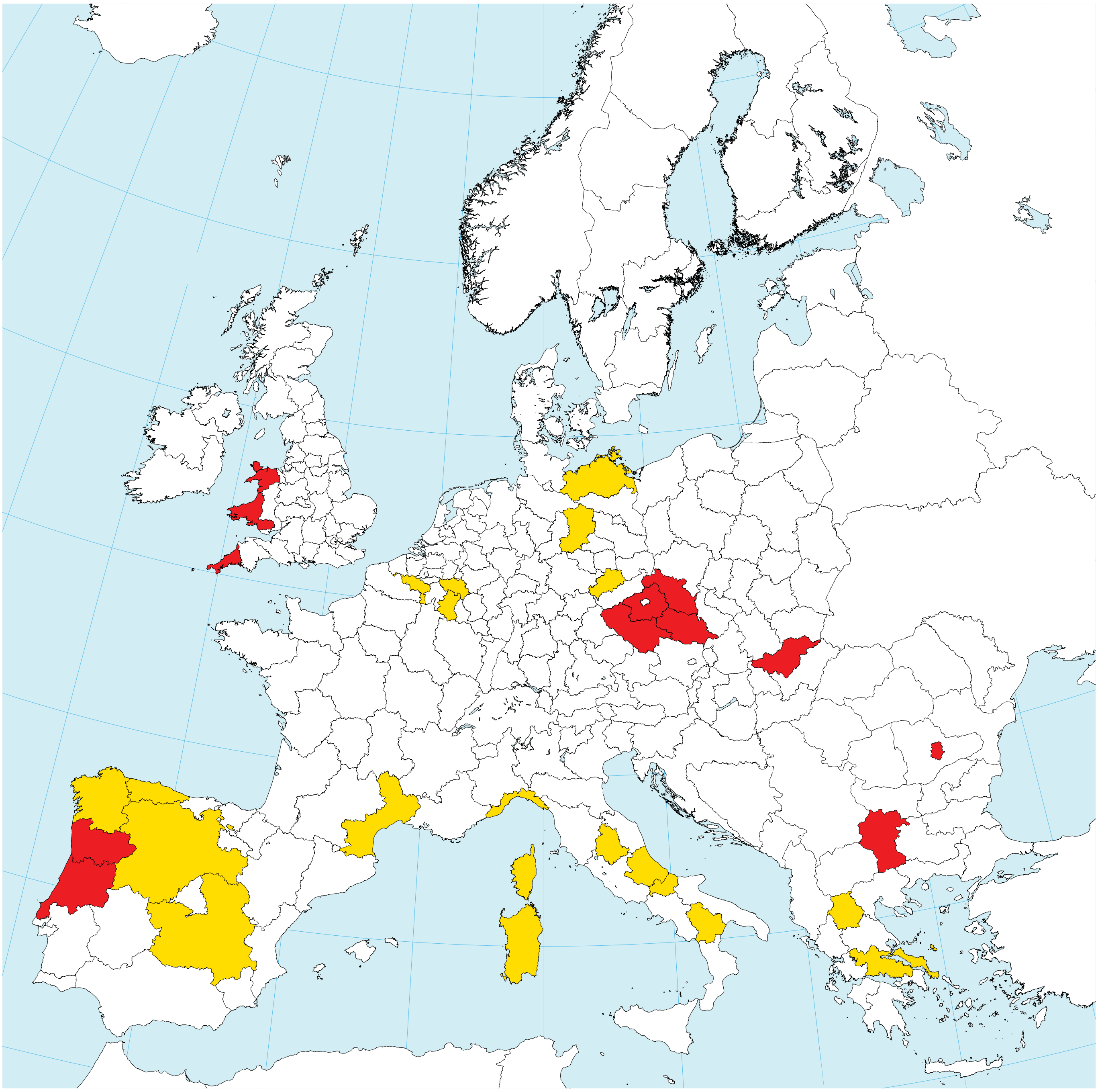

24 regions less developed according RDI with GDP per capita greater than 75% EU28 average.

15 regions more developed according RDI whit GDP per capita lower than 75% EU28 average.

A progressive approach to the measurement of regional performance in the European Union

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Abstract:

With a view to promote the European Union (EU) overall harmonious development, the EU Regional Policy –or Cohesion Policy- focuses on reducing disparities between the levels of development of the various regions and the backwardness of the least favoured regions. Structural Funds, the main instrument to achieve the EU Regional Policy objectives, are allocated by regional Gross Domestic Product (GDP) per capita. Furthermore, in the EU context, the socio-economic inequalities between both people and regions have been rising in the majority of Member States over the last three decades and are now higher than in 1980 regardless of consistent objectives for economic and social cohesion (Eurostat).

This separation between economy and society could be potentially overcome by including a measure of social well-being in models of regional performance. However, and despite economic and social cohesion being core EU objectives since its foundation, the community regional performance is defined in a strict economic sense by the size and growth of the economy. Regions whose per capita income falls short off the threshold of the 75% of the EU average GDP per capita are less developed regions, and are thus eligible for Structural Funds support.

The aim of this paper is to present a multidimensional approach to the measurement of regional performance as an alternative to a single criterion approach based on the GDP per capita. With this in mind:

1st. Drawing on the capabilities approach and the recent trends in well-being (i.e. Stiglitz-Sen-Fitoussi Report of 2009), we discuss the reasons that justify the revision of the current allocation mechanism of EU Structural Funds.

2nd. We develop a composite index to measure regional performance in the 269 regions of EU28 in 2009 from a multidimensional perspective (16 indicators of health, education, employment, inequalities, poverty, etc.) following two distinct multivariate methods (Principal Component Analysis and Distance P_2).

3rd. We discuss some regional policy implications of a change in the rules. That is, we analyse the consequences of applying a multidimensional approach instead of the traditional GDP based allocation mechanism. We find that, with an equivalent budgetary effort regarding the population benefited from these funds, a distinct map of priority regions results.

Based upon the indicators considered, Stockholm in Sweden is the most developed region with a development level that triples that achieved by the least developed region (Severozapaden in Bulgaria). Hence large territorial disparities exist. Employment (female and male) related aspects and GDP per capita adjusted by inequality are the key determining factors of regional development. Were the Structural Funds allocated by our regional development index instead of the GDP per capita, some regions of Belgium, France, Greece, Germany, Italy and Spain would be considered priority regions; whereas some other regions, mainly from Eastern Europe, would not be considered so.

Subject areas: Rethinking economic policy; Reforming European economic governance

Keywords: cohesion policy, human development, inequalities, structural funds, composite index, quality of life

JEL codes: C43, I31, O15, R15, R58

1. Introduction

The EU Regional Policy –or Cohesion Policy- aims to promote the European Union (EU) overall harmonious development, by reducing disparities between the levels of development of the various regions and the backwardness of the least favoured regions (Treaty on the Functioning of the EU, Article 174). The budgetary effort devoted to Regional Policy during the Multiannual Financial Frame (MFF) 2007-2013 has reached the 35.64% of EU27 Budget (European Commission, Financial Programming and Budget), and it is set to approximate the 33.88% of EU28 Budget during the MFF 2014-2020 (European Council 2013). That is, the EU Regional Policy is one of the key axes of EU integration, together with the single market and monetary union, which receives a substantial part of the EU Budget (Pellegrini et al. 2013).

Structural Funds constitute the main instrument to achieve the EU Regional Policy objectives. The European Commission has called for the development of indicators that complement Gross Domestic Product (GDP) to support policy decisions by more comprehensive information (Commission of the European Communities 2009b). However, the allocation of Structural Funds among regions follows the GDP per capita criterion. Regions whose GDP per capita falls short off the threshold of 75% of EU average GDP per capita are eligible for Structural Funds support. For the next planning period 2014-2020, every European region may benefit from Structural Funds, however there will be a distinction between less developed regions (which will receive the largest proportion of Structural Funds), transition regions and more developed regions[1] to ensure that Funds are allocated according to the GDP level (European Commission 2011, 2012; European Union 2011).

[1] Less developed regions are regions whose GDP per capita is less than 75% of the average GDP of the EU. Transition regions are regions with a GDP per capita between 75% and 90% of the EU average). More

This allocation mechanism is in line with traditional theoretical approaches and empirical analyses of regional performance based on the utilitarian/welfarist theories. That is, despite economic and social cohesion are core EU objectives since its foundation and the socio-economic inequalities between both people and regions have been growing in the majority of Member States over the last three decades (Eurostat 2010), the community regional performance is defined in a strict economic sense by the size and growth of the economy.

Although by the sixties practically all scholars interested in measuring economic and social progress were aware of the limits of Gross Domestic Product (GDP) (Michalos 2011), last decades have witnessed a growing acknowledgement among economists, social scientists, politicians and international organizations that GDP is not sufficient to analyse the overall societal development and progress. Several aspects such as general economic, social, political, environmental, and cultural conditions rather than income alone affect quality of life and inequality (Neumayer 2003; Nordhaus and Tobin 1972; Nussbaum 2000; Ram 1982; Sen 1987, 1992; Stiglitz et al. 2009; Van den Bergh 2007). In addition, the European Commission increasingly demands for a more performance-oriented EU cohesion policy (Barca and McCann 2011; European Commission 2010b). Hence, the measurement of regional development has to contend with the multidimensionality of the well-being and inequality concepts (Folmer and Heijman 2005).

The aim of this paper is to present a multidimensional approach to the measurement of regional performance as an alternative to a single criterion approach based on the GDP per capita. More specifically, we attempt to measure the regional performance in terms of people's well-being and progress. With this in mind:

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developed regions are regions whose GDP per capita is above 90 % of the average GDP of the EU, but are important challenges global competition in the knowledge-based economy and the shift towards the low carbon economy (European Union 2011, p. 5).

1st. Drawing on the capabilities approach and the recent trends in well-being, we discuss the reasons that justify the revision of the current allocation mechanism of EU Structural Funds.

2nd. We develop a composite index to measure regional performance in the 269 regions of EU28 in 2009 from a multidimensional perspective with information on other dimensions relative to people's quality of life, such as inequality in income and gender, education, health, poverty and employment. For this, we follow two distinct multivariate methods (Principal Component Analysis -PCA- and the Distance method P_2 or DP_2 of Pena Trapero 1977).

3rd. We discuss some regional policy implications of a change in the rules. That is, we analyse the consequences of applying a multidimensional approach instead of the traditional GDP based allocation mechanism by studying if the resulting maps of priority regions significantly differ.

The regional performance index we propose has two related purposes (see Bell and Morse 2003, 49): an useful Structural Funds allocation tool in contrast with a single criterion approach based on the GDP per capita; and a communication tool to raise EU population awareness of the importance of the European Cohesion Policy. The PCA and DP_2 results provide a ranking of regions from high to low level of development, and show which factors contribute the most to regional development. Moreover, the index calculated with the Distance P_2 allows a multidimensional analysis of regional inequality.

The remainder of this paper is organised as follows. In Sect. 2, we discuss about the GDP per capita alternatives for measuring regional performance. In Sect. 3, we describe the methodologies applied. In Sect. 4, we explain the statistical information used to elaborate the composite index of regional development. The empirical results and some regional policy implications are analysed in Sect. 5. The Sect. 6 provides some conclusions and discussion.

2. How measure the regional performance?

2.1. Background

The objective of promoting an overall harmonious development by reducing economic disparities between EU regions has been present since the EU foundation (Treaty on the Functioning of the EU, article 174). The creation in 1975 of the European Regional Development Fund marked the institutionalization of EU regional policy. The Treaty of Maastricht (1992) enshrined, along with the creation of the Single Market and Economic and Monetary Union, the economic and social cohesion as one of the basic objectives of the Union, then creating the Cohesion Fund. The Lisbon Treaty (2000) (article 3) makes territorial cohesion an explicit objective for the Cohesion Policy. "The goal of territorial cohesion is to encourage the harmonious and sustainable development of all territories by building on their territorial characteristics and resources" (Commission 2009b). However, in the EU context, the socio-economic inequalities between both people and regions have been rising in the majority of Member States over the last three decades and are now higher than in 1980, regardless of consistent objectives for economic and social cohesion (Eurostat 2010). Also, inequalities have been exacerbated by the crisis. The crisis brought to an end a long period during which regional disparities in GDP per head and unemployment were shrinking, and has increased the population at risk of poverty or social exclusion. Specifically, whereas the first quartile of population owns 10.8% of income -share of national equivalised income-, the fourth quartile receives 45.1% in 2011 (Eurostat for EU27); and a 16.9 % of the population of the EU28 was considered at-risk-of-poverty in 2011 (Eurostat, on the basis of the common threshold of the 60% of median equivalised disposable income). The future is not hopeful since the Eighth Progress Report on Economic, Social and Territorial Cohesion concludes that the crisis's impact on risk of poverty and exclusion is likely to be felt more in the future as the crisis is not over yet and the effect takes time to filter through (Commission 2013).

This separation between economy and society could be potentially overcome by including a measure of social well-being in models of regional performance (Perrons 2012, 18). As the European Commission has recognized, the conventional market-based measures of GDP need to be combined with others indicators of quality of life (e.g. human development, sustainability, vulnerability, accessibility of services) that provide more comprehensive information to support policy decisions (Commission 2009a, 2009b). The regional performance must be measured in terms of people's well-being and progress through appropriate indicators that contribute to assessing the policy effectiveness (Barca and McCann 2011)[2].

In this conceptual framework, there are distinct initiatives to construct multidimensional indexes of development or quality of life. Next we examine briefly the most relevant. The Human Development Index (HDI), calculated annually by the United Nations Development Program since 1990, is based on the capabilities concept (Nussbaum 2000, 2011; Sen 1980, 1990). Also since the 2010 edition, the Human Development Report includes, besides the HDI, three new indexes: the Inequality-adjusted Human Development Index (IHDI), the Gender Inequality Index and the Multidimensional Poverty Index. The World Bank calculates the adjusted net saving, a sustainability indicator building on the concepts of green national accounts. To measure quality of life, the Commission on the Measurement of Economic Performance and Social Progress (Stiglitz et al. 2009, 42) considers useful three conceptual approaches: the capabilities approach (Nussbaum 2000, 2011; Sen 1980, 1990); the subjective well-being approach, in close connection with psychology (Diener 2002; Easterlin 2001; Kahneman et al. 1999); and the notion of fair

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[2] This note (coordinated by Barca and McCann) was submitted to the High Level Group Reflecting on Future Cohesion Policy on February 15, 2011.

allocations, the standard approach in economics (Boadway and Bruce 1984). The OECD launched in 2011 the project "Better Life Initiative" where it establishes 11 essential dimensions of well-being, with 2-4 indicators per each dimension that include measures of subjective well-being (see http://www.oecd.org/betterlifeinitiative).

The European Union has started several initiatives to develop indicators that complement GDP in policy making and that include social and environmental achievements (such as improved social cohesion, accessibility and affordability of basic goods and services, education, public health and air quality) and losses (e.g., increasing poverty, more crime, depleting natural resources) (Commission of the European Communities 2009a, 3). Among them, these are remarkable:

- The Indicators for Social Inclusion in the European Union (Atkinson et al. 2001) adopted by the Laeken European Council in 2001, to be used in monitoring the performance of Member Estates in social policy.
- The EU Sustainable Development Indicators (SDIs) initiative aims to monitor the European Union Sustainable Development Strategy (Council of the European Union 2006), by supplying information on approximately 100 indicators grouped in 10 themes of the social, economic, environmental and governance spheres (see Eurostat website).
- The Europe 2020 Strategy (approved 2010) aims to coordinate all of the Member States' efforts to collectively exit stronger from the crisis and turn the EU into a smart, sustainable and inclusive economy characterized for high levels of employment, productivity and social cohesion (European Commission 2010a, preface). To accomplish these priorities, the Commission establishes eight targets that the Member States should met by 2020 on unemployment, investment in R&D, CO2 emission,

renewable energy, energy consumption, early school leaving, tertiary education and poverty.

- The Quality of Life Indicators is a project of the European Statistical System Committee (ESSC) approved in November 2011. The objective of the set of indicators is to provide an overall sense of how the country is doing in terms of the well-being of its citizens (Eurostat 2008). This indicators set combines data from several sources for measuring Quality of Life in the EU along the following dimensions: material living conditions, productive or main activity, health, education, leisure and social interactions, economic and physical safety, governance an basic rights, natural and living environment, and overall experience of life. For some indicators there are no estimates yet.

The starting point of all of the initiatives described above is that the GDP is a very specific measure focused solely on market values that can misrepresent well-being. Income and resources do not provide a satisfactory indicator of well-being as they only measure means (instead of ends). Well-being is a multidimensional concept that takes account of the objective circumstances of the person and her subjective evaluation of these. Given that both, the objective circumstances and perceptions of them, are located in society and also in the frames of meaning with which we live, well-being is a dynamic concept (Boulanger et al. 2009; Gough et al. 2006; Stiglitz et al. 2009) That is, well-being must be seen as a model in which functioning, personal resources, and external conditions fit together and determine one another (Eurostat 2008).

2.2. An alternative approach to measure the regional performance

Inspired by the capabilities approach and the recent trends in well-being, we present a Regional Development Index (RDI) to estimate EU regional performance in terms of people's well-being and progress, as an alternative to the GDP per capita. The capability approach was introduced by Sen (1980) and in subsequent papers (Sen 1985, 1987, 1990, 1992, 1993) he developed this approach and tried to establish capabilities as a general approach to evaluating human conditions. Subsequently Martha Nussbaum (2000, 2011) has developed an alternative notion of human capabilities, but very closely related with the Sen´s approach (see Gough et al. 2006; Robeyns 2005). The capability approach is a broad normative framework for the evaluation and assessment of individual well-being or the average well-being of the members of a group and the design of policies (Robeyns 2005, 94).

The capabilities approach focuses on the plural or multidimensional aspects of well-being and claims that income and resources do not provide a sufficient or satisfactory indicator of well-being as they measure means instead of ends. It is necessary to take into consideration what the persons are able to do not only with the instruments they have, but also, most importantly, with the capabilities they have. The capabilities framework 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 person´s opportunities (capabilities). There are two key analytical categories in the capability approach: functionings and capabilities. A functioning is "an achievement of a person: what he or she manages to do or to be" (Sen 1985, 10). A person's capability refers to the alternative combinations of functionings that are feasible for her to achieve (Nussbaum 2011, 20); it is equivalent to a person's opportunity set to choose and to act (Robeyns 2005, 100). Capability is thus a kind of freedom, what Sen (1992, 49) calls "the substantive freedom" to achieve alternative functioning combinations.

This approach breaks with traditional economics, which typically conflates wellbeing with either utility (happiness, satisfaction and desire-fulfilment) or with resources (income, expenditures or consumption) (Basu and López-Calva 2011; Gough et al 2006; Robeyns

2005). Following Lancaster´s work (1966), first, Sen distinguishes between a commodity and its characteristics or desirable properties. A good has certain characteristics, with makes it of interest to people. These characteristics of a good enable a functioning. Good and services (included income) undoubtedly contribute to well-being, but we observe that people typically differ in their capacity to convert a given bundle of commodities into valuable functionings (Gough et al. 2006). This can be explained by the existence of conversion factors that influence how a person can convert the characteristics of the commodity into a functioning. Robeyns (2005, 99) identify three groups of conversion factors. First personal conversion factors (e.g. metabolism, physical condition, sex, reading skills, intelligence); second, social conversion factors (e.g. public policies, social norms, discriminating practises, gender roles, societal hierarchies, power relations); and, third, environmental conversion factors (e.g. climate, geographical location). In addition to goods, the social, economic, familial, and political environment determines the creation or expansion of capabilities.

For both, Sen and Nussbaum, the quality of life or well-being for people are defined by their capabilities, since capability means opportunity to select or freedom to choose (Nussbaum 2011, 25; Sen 1992, 49-53). For this reason, capability, and not achieved functioning, would be the appropriate political goal (Robeyns 2005, 101). However, from the point of view of empirical research, the entire set of available options is not easily or directly observable, and it can only be estimated on a presumptive basis (Alkire 2005; Chiappero Martinetti 2000). Sen (1985, 1992, 1993) analyzes the relationship between capability, functionings and achieved well-being and suggests three different procedures for evaluating capability sets: 1) by the entire set of options available for the person; 2) by the option actually chosen; 3) by a maximally valued option from the capability set. If freedom had only instrumental importance and no intrinsic relevance for the individual’s well-being, the evaluation of the capability set under procedures 2) or 3) is simply the value of a particular element of it: the chosen one or the best one, respectively. If we also assume that the person chooses in a way that maximizes his o her well-being then these procedures will produce the same result. However, if the freedom of choice is seen as a part of living and we think that “doing x” is different from “choosing to do x and doing it”, the entire set of options open to the person must be considered.

Most applications of the capability approach based on empirical research have focussed on functionings rather than capabilities (see for instance, Robeyns 2006; Bilbao-Ubillos 2013; Chiappero Martinetti 2000; Distaso 2007; Herrero et al. 2012; Perrons 2012; Ramos and Silber 2005). The choice of the achieved functionings set seems to be the more practicable one (see also Basu 1987; Brandolini and D’Alessio 1998; Kuklys 2005; Robeyns 2006; Sen 1987). In fact, in some cases it may make more sense to investigate the achieved functionings rather than capabilities; for instance, if we want to measure well-being outcomes or when we work with large numbers[3] (Robeyns 2006).

According to the above and following Sen (1985, 7-10), the evaluation of a region's well-being in the functioning space involves the analysis of a vector of achieved functionings b_j of region j:

$$b_j = f_j\left[C(h_j)\middle| z_p, z_s, z_e\right] \quad \forall\, f_j \in F_j \text{ and } \forall\, h_j \in H_{ji} \qquad (1)$$

where h is a vector of market and non-market goods and services chosen by the individual; C(*) is a function that maps goods into the space of characteristics as in Lancaster (1966); z_p, z_s and z_e are, respectively, vectors of personal characteristics, social and environmental factors. f_j is a conversion function that maps characteristics of goods into states of being or activities bi, conditional on z_p, z_s, z_e; H_j is the resource constraint, corresponding to the budget

[3] In the case of elected or not fasting, pointed by Sen, Wolff and de-Shalit (2007) clarify that when a large number of people is analyzed, we can assume (except in special circumstances, such a during Ramadan in a Muslim community) that all people who have the opportunity of not being hungry would also choose not to be hungry, since there is no reason to believe that a large number of people would choose to fast. Hence if a few people choose to fast, they will statistically be “outliers” and not have a significant effect on the quantitative empirical results.

constraint in the standard model, but including non-market goods and services; F_j is the set of all possible conversion functions (see also Kuklys 2005, 32-33).

Essentially, the functionings achievement of an individual depends on the employed commodities, H_j and the conversion factors, z. Focussing on the achieved functionings, we assume that there is a function g which makes regional development for the region j (RDI_j) depend on the achieved functionings by the people of the region:

$$RDI_j = g(b_j) \tag{2}$$

This function of performance attempts to highlight the material and non-material circumstances that shape people's opportunity sets, and the circumstances (social institutions, legal norms, other people´s behaviour, environmental factors, etc.) that influence the choices that people make from the capabilities set. Thus, the RDI aims to offer a more accurate view on the diversity of economic and social development in the EU than that offered by the GDP per capita, and it will be analysed as an alternative allocation mechanism of the EU Structural Funds remittances.

3. Methods

In this paper we apply two multivariate methods to build two alternative composite indexes: Distance P_2 of Pena Trapero (1977) and PCA. These methods allows as measure regional development according the conceptual framework discussed in the previous section. That is, it will allow us define the function g in the equation (2).

The main pros of using composite indexes are that (Michalos et al. 2011; Nardo et al. 2005; OECD 2008, 13-14): summarise complex, multi-dimensional realities with a view to supporting decision-makers; are easier to interpret than a battery of many separate indicators: assess progress of territories over time, and facilitate communication with general public and promote accountability. The most troubling issues concerning the elaboration of composite indexes (see Booysen 2002; Cherchye et al. 2008; Nardo et al. 2005; Permanyer 2011; Ravallion 2010) are the treatment of measurement units (how to aggregate variables expressed in different units), and the weighting of variables in the composite index (how to aggregate the variables into a single index). The two proposal methods solve these problems and have some interesting advantages as composites indices-elaboration methods (see Table 1).

3.1. Distance P_2

The Distance P_2 or DP_2 is a multidimensional index of aggregating various functionings or indicators[4] of regional development as a weighted sum,

$$RDI_j = \sum_{k=1}^{k} w_k b_{jk} \tag{3}$$

where j is the region; w_k are the weights assigned to each achieve functioning; k is the number of functioning.

The point of departure of this method is a matrix X of order (m, n), in which m is the number of EU regions and n is the number of indicators. Each element of this matrix, x_{ji}, represents the state of the indicator i in the region j. Those indicators negatively related with regional development are incorporated into the model changing the sign (all their data must be multiplied by -1). Conversely, those indicators positively related with regional development remain unchanged. Thus, the increase (decrease) in the values of any indicator indicates an improvement (worsening) in regional development.

In a second stage, we compute a distance matrix D such that each element, d_i, for each region is defined as:

$$d_i = d_i\,(j,*) = |\,x_{ji} - x_{*i}\,| \tag{4}$$

where d_i is the difference in the region j with respect to the reference vector $X_*=\{x_{*1}, x_{*2}, \ldots, x_{*n}\}$. The composite index measures the distance, in terms of regional development, between

[4] One or more indicators can be used to account for each of the functionings.

each region and a fictitious reference. In this case, the reference vector comprises the results of a (hopefully) theoretical region with the worst possible scenario for all the indicators (the minimum of the indicators) and would therefore be attributed a value of zero in the composite development index (see Sánchez-Domínguez and Rodríguez-Ferrero 2003; Zarzosa Espina and Somarriba Arechavala 2013). Thus, a higher DP_2 value indicates a higher level of development as it represents a greater distance from the “least desirable” theoretical situation. In this way, the value of the composite index represents each region’ situation in comparison to the remaining regions. In addition, this property entails that spatial units may be ranked in terms of regional development.

In a third stage, with the view of expressing all of the indicators in comparable abstract units, a first global index is computed, the Frechet Distance (DF), which is defined as:

$$DF = \sum_{i=1}^{n} (d_i / \sigma_i) = \sum_{i=1}^{n} (| x_{ji} - x_{*i} | / \sigma_i) \; ; \qquad j = 1, 2, ..., m \tag{5}$$

where σ_i is the standard deviation of the indicator i. For each indicator, the distance between two spatial units d_i is weighted by the inverse of σ_i. That is, the contribution of each d_i to the composite index is inversely proportional to the standard deviation of its corresponding indicator. In this way, the distances corresponding to the indicators with a higher dispersion to the mean are less important in determining the composite index[5]. Also, by dividing distance by σi, i.e., d_i/σ_i, the indicator is expressed in abstract units, which solves the treatment of measurement units.

DF is a valid concept of distance only in a theoretical situation of uncorrelated indicators. When there is a direct relationship between the indicators (as it is usual), DF will include some duplicated information. Therefore, DF must be corrected so as to eliminate this dependence effect (i.e. the redundant information existent in other variables), which is

[5] This weighting scheme, which is similar to those used in heteroskedastic models, accords less importance to those distances with more variability, and vice versa (Montero et al. 2010, 444).

assumed to be linear. This is why, for each spatial unit j, DF is the maximum value that DP_2 can reach, which is defined as (Pena Trapero 1977; Zarzosa Espina 1996):

$$DP_2 = \sum_{i=1}^{n} (d_i / \sigma_i)\left(1 - R^2_{i,i-1,\ldots 1}\right) \tag{6}$$

with $R_1^2=0$, and where $R^2_{i,i-1,\ldots 1}$ is the coefficient of determination in the multiple linear regression of x_i over x_{i-1}, x_{i-2}, ... x_1, already included.

The coefficient of determination, $R^2_{i.i-1,\ldots 1}$, measures the percentage of the variance of each indicator explained by the linear regression estimated using the preceding variables (x_{i-1}, x_{i-2}, ... x_1). As a result, the correction factor ($1-R^2_{i.i-1,\ldots 1}$) avoids the duplication of information by eliminating the information contained in the preceding indicators. That is, as ($1-R^2_{i,i-1,\ldots 1}$) expresses the part of the variance of the indicator x_i not explained by x_{i-1}, x_{i-2}, ... x_1, the part already explained by the preceding indicators is obtained by multiplying each 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 entry order of the indicators changes. In this process, the first indicator (i = 1) will contribute all of its information to the composite 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 indicators attending to the information that each one of them contributes to the composite index (highest to lowest). That is, the first indicator to be included will 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 DF (5). In the fourth stage, we estimate the pairwise correlation coefficients r between each indicator and DF, and then sort the indicators from highest to lowest according to the absolute values of the pairwise correlation coefficient. Next, we calculate the first DP_2 for each region, incorporating the indicators in the resulting order. The classification of indicators is then performed by ordering them from highest to lowest in terms of the absolute value of the pairwise correlation coefficient between each indicator and the DP_2. The process continues iteratively until the difference between two adjacent DP_2s is zero. In the case of non convergent DP_2 values, one can choose the first DP_2 index or even the average of several calculates DP_2 (Zarzosa Espina 1996, 88).

The numerical value of the DP_2 index has no real meaning, but it is useful for comparing the state of different regions in terms of development. The results allow the ranking of regions from high to low level of development, and to identify which factors contribute the most to regional development. In addition, if the DP_2 method uses the same variables, it can compare the results for EU28 regions with those obtained for other regions or even at other points of time. DP_2 can be used to compare changes in relative positions and even to detect their causes.

3.2. Principal Components Analysis

PCA is a multivariate analysis technique that allows concepts that are not directly measurable and which are influenced by a large number of variables (i.e. regional performance) to be measure. It is a way of identifying patterns in data, and expressing the data in such a way as to highlight their similarities and differences. In this method, each functioning of region j is conceptualised as a latent variable which is indicated by a range of observable variables (m indicators). We start the analysis in the same matrix X of order (n, m) used in the DP_2 model, in which n is the number of regions, and m is the number of indicators. The objective is to explain the variance of the m observed correlated data (indicators), x_1, x_2,…,x_m, through a small number of variables p uncorrelated, so that $p \leq m$.

The p variables are the principal components and they are obtained as linear relations of the original data ($Y_1, Y_2, \ldots, Y_m$),.

$$
\begin{aligned}
Y_1 &= a_{11}x_1+a_{12}x_2+\ldots+a_{1m}x_m \\
Y_2 &= a_{21}x_1+a_{22}x_2+\ldots+a_{2m}x_m \\
&\ldots \\
Y_m &= a_{m1}x_1+a_{m2}x_2+\ldots+a_{mm}x_m
\end{aligned} \tag{7}
$$

The factor loadings a_{ji} applied to the variables x_j in (7) are chosen so that the principal components Y_i satisfy the following conditions (OECD 2008, 63-64):

1st. They are uncorrelated (orthogonal).

2nd. They are ordered so that the first principal component accounts for the maximum possible proportion of the variance of the set of indicators (x), the second principal component accounts for the maximum of the remaining variance, and so on until the last of the principal components absorbs all the remaining variance not accounted for by the preceding components, and

$$a_{i1}^2 + a_{i2}^2 + \ldots + a_{im}^2 = 1, \qquad \mathrm{i} = 1,2,\ldots,\mathrm{m}$$

where a_{ij} are the factor loadings, x_1, x_2,….x_m are the indicators, and m the number of indicators.

Having defined principal components, we need to know how to find them. PCA involves finding the eigenvalues λ_j , j=1,…,p, of the sample covariance matrix (CM),

$$CM = \begin{bmatrix} cm_{11} & cm_{12} & \ldots & cm_{1p} \\ cm_{21} & cm_{22} & \ldots & cm_{2p} \\ \ldots & & & \\ cm_{p1} & cm_{p2} & \ldots & cm_{pp} \end{bmatrix} \tag{8}$$

where the diagonal element cm_{ii} is the variance of x_i and cm_{ij} is the covariance of variables x_i and x_j. The eigenvalues of the matrix CM are the variances of the principal components and can be found by solving the characteristic equation $|CM-\lambda I| = 0$, where I is the identity matrix with the same order as CM and λ is the vector of eigenvalues. There are p eigenvalues, siendo $\lambda_1 \geq \lambda_2 \geq \ldots \geq \lambda_p \geq 0$.

In order to prevent one variable having an undue influence on the principal components, it is common to standardise the variables – x s – to have zero means and unit variances at the start of the analysis. The co-variance matrix CM then takes the form of the correlation matrix. An important property of the eigenvalues is that they add up to the sum of the diagonal elements of CM. That is, the sum of the variances of the principal components is equal to the sum of the variances of the original variables:

$$\lambda_1 + \lambda_2 + \ldots + \lambda_p = cm_{11} + cm_{22} + \ldots + cm_{pp}$$

The proportion of total variance explained by the j-th principal component is

$$\lambda_j/(\lambda_1 + \lambda_2 + \ldots + \lambda_p), \qquad j = 1, 2, \ldots, p$$

Usually, it is taken as composite index the first principal component, so the weights of the variables are the factorial loadings (a_{11}, a_{12},…,a_{1m}) (see for instance Folmer and Heijman, 2005; Madonia et al. 2013; Montero et al. 2010). Thus, a one-factor model may be written

$$RDI_j = \Lambda_i^{bf} b_{jf}^* + \varepsilon_f^i \tag{9}$$

where Λ_i^{bf} is a vector of factor loadings and ε_f^i is an error term. The numerical value of each functioning b_{jf}^* may be estimated and interpreted as the functionings achievement of region j for functioning f (Kuklys 2005, 37-38).

3.3. Comparison between DP_2 and ACP as composite indexes-elaboration methods

The DP_2 method has been applied to cross-section data sets in research on well-being or quality of life (Cuenca et al. 2010; Sánchez Domínguez and Rodríguez Ferrero 2003; Somarriba and Pena 2009; Zarzosa Espina and Somarriba Arechavala 2013) and environmental quality index (Montero et al. 2010) among others. The DP_2 index verifies the necessary properties for a multidimensional index 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). This index is a cardinal measure, and on the basis of the additive property it is also capable of analyzing disparities. The DP_2 method objectively assigns weights to the indicators, being these weights common for all the units analysed. The DP_2 solves the problems of aggregation of variables expressed in different measures, and avoids redundant information, thus it permits higher headroom in the variables selection. The DP_2 method incorporates an objective way for variables selection, so that those variables that do not provide new information on the phenomenon under study (correction factor equal to 0) are left out of the model. As remarkable limitations of the DP_2 method (1) the investigator defines variables with positive or negative impact on the well-being or development, so that some arbitrariness may be introduced into the model; and (2) it only analyzes lineal relationships between variables, and does not eliminate redundant information between variables of a quadratic or multiplicative nature, for example.

The PCA has been applied in well-being and quality of life studies (Distaso 2007; Maasoumi and Nicklesburg 1988; Madonia et al. 2013; Somarriba and Pena 2009), to measure poverty (Klasen 2000), and to estimate a multidimensional approach to regional inequality in the EU (Folmer and Heijman 2005), among others.

Compared with other statistical alternatives, PCA verifies many of the mathematical properties required for aggregation method (see Jolliffe 2002). However, in elaborating composite indexes with only the first component, PCA violates the property of exhaustivity as it ignores any useful non-redundant information present in the data (Mishra 2007). The weights are derived from the variance of the indicators themselves, and the weights are common for all the units analysed. PCA avoids duplicity of information. Other interesting aspect of PCA is that it is an useful method of selecting variables (Somarriba and Pena 2009).

PCA has no distributional assumptions (multivariate normality), and it is not necessary to establish hierarchies among variables (dependent or independent variables) (Jolliffe 2002). However, there are several “arbitrary” rules about how many cases (sample size) are necessary to perform PCA (see OECD 2008, 66). The least restrictive of them is that the cases-to-variables ratio should be no lower than three. Arguably, the mayor limitation of the PCA is that it does not measure disparities. As the PCA is an ordinary-type index, it only establishes a ranking of the spatial or time units being analyzed with regard to the object of study (Montero et al. 2010). According to PCA, weighting intervenes only to correct for overlapping information between two or more correlated indicators and is not a measure of the theoretical importance of the associated indicator (OECD 2008, 89); that is, the weights of indicators lack socio-economic interpretation. Finally and similarly to the P_2 Distance, the investigator defines the variables which have a positive or a negative impact on the object of study, so that some arbitrariness may be introduced into the model.

Table 1 shows the principal advantages and limitations of DP_2 and PCA as composites indices-elaboration methods.

Table 1. Comparison between DP_2 and PCA as composites indices-elaboration methods

Methods	Advantages	Limitations
DP_2	Verifies all mathematical properties for aggregation method Is a cardinal measure Measure disparities Objective weighting scheme Avoids redundant information Objective variables selection Cross-section and longitudinal analysis	Investigator defines variables with positive/negative impact on the model Only analyze linear relationships between variables
PCA	Verifies many mathematical properties for aggregation method Objective weighting scheme Avoids redundant information Distributional assumptions are not necessary Useful method of selecting variables Cross-section and longitudinal analysis	Removes useful information The cases-to-variables ratio should be no lower than three Is an ordinal measure Not measure disparities The weights of indicators lack socio-economic interpretation Investigator defines variables with positive/negative impact on the model

Source: the authors.

4. Indicators set

The next step is the selection of indicators that represent the best estimation of achieved functionings of every region in order to measure the regional performance in the EU. To elaborate the Regional Development Index (RDI), we focus on Eurostat information on the 269 regions (NUTS 2) of 28 Member States in 2009, except four regions of France for which information is not available for all the analyzed variables (Guadeloupe, Martinique, Guyane and Réunion).

Indicators have to be chosen carefully, meeting the following technical criteria (Advisory Committee on Official Statistics, 2009; Bell and Morse 2003; Guy and Kibert 1998):

- Relevance: an indicator must be relevant for an issue according to the definition used.
- Statistically sound: an indicator measurement needs to be methodologically sound and fit for the purpose to which it is being applied.
- Intelligible and easily interpreted: indicators should be sufficiently simple to be interpreted in practice and intuitively in the sense that it is obvious what the indicator is measuring.
- Relate where appropriate to other indicators: a single indicator often tends to show part of a phenomenon and is best interpreted alongside other similar indicators.
- Reliability: the data is of sufficiently reliable quality as to provide a basis for confident decision-making.
- Allow international comparison: indicators need to reflect the project specific goals, but where possible should also be consistent with those used in international indicator programs so that comparisons can be made.

Complementary, Ivanovic (1974) states that an indicator should be have a high power of discrimination, that is, its value varies in all geographical areas studied, because otherwise its contribution to regional development measurement would be reduced. To check this property, Ivanovic (1974) propose the discrimination coefficient (DC):

$$DC_i = \frac{2}{m(m-1)} \sum_{j,l>j}^{ki} m_{ji} m_{li} \left| \frac{x_{ji} - x_{li}}{\overline{X}_i} \right| \tag{10}$$

where m is the number of regions, x_{ji} is the value of indicator x_i in the region j, m_{ji} is the absolute frequency of x_{ji}, $\overline{X}_i$ is the mean of x_i, and k_i is the number of different values taken by x_i.

This coefficient ranges between 0 and 2 (Zarzosa, 1996). If an indicator takes the same value for all regions, DC equals zero, indicating that this indicator holds zero discriminant power. By contrast, if an indicator only has a value other than zero for one region (and in the remainder, m - 1 is equal to zero), DC is equal to two and the indicator has full discriminant power.

Taking into account these criteria, the indicators used in the international indicators programs shown in the previous section, the recommendations of Stiglitz et al. (2009) we have included 16 indicators of different dimensions (Table 2). Specially, we have considered the Indicators for Social Inclusion in the European Union, the EU SDIs, Quality of Life indicators, and the indicators of Strategy Europe 2020 in order to consider the principal priorities of economic, social and environmental progress of the political agenda of the EU, since these priorities represent a remarkable point of view able to address the action of EU. However, one of the limitations of the EU indicators mentioned is that only provides information at country level, so information at regional level or NUTS 2 is very scarce, particularly on environment indicators. In addition, the lack of primary data on citizens preferences and perceptions at the NUTS 2 level for all of the European regions has prevented us from incorporating subjective indicators in this study.

Table 2 shows the 16 indicators: title, definition, the relation between the indicator and the index RDI (what affects RDI the increase/decrease in the indicator), rationale (why the indicator is needed and useful to measure regional performance), the international programs that use the indicator, and the discrimination coefficients of Ivanovic (1974).

The comparison of the selected indicators with the criteria outlined above shows that all indicators meet most of the criteria. However there are three deviations: infant mortality, GDP per capita adjusted by the Gini index, and gender inequality employment. Infant mortality has virtually no discriminatory power (DC is very close to zero), as recorded values very close in most regions of the Member States. However it has been included because it is an indicator of poverty and child well-being included in various international programs.

With respect to the second (GDP per capita adjusted), the Report of CMEPSP (Stiglitz et al. 2009) recommends to analyse the average measure of income together with indicators that reflect it distribution. In the context of the UE, it is appropriate to include regional income inequality in the model of regional development, given that regional disparities in EU are positively correlated with personal income inequality (Montfort 2009). Also, the economic inequality (independently of the absolute level of income) is associated with a wide range of social ills, including higher rates of crime, ill-health, mortality and drug abuse (Wilkinson and Picket 2009). The indicator GDP per capita adjusted by the Gini index, proposed by Sen (1976), incorporates economic inequality, penalizing those Member States' GDP with inequality in the income distribution.

Besides income inequality, it is necessary to bring into the model other kinds of inequality, as "the extend of real inequality of opportunities that people face be readily deduced from the magnitude of inequality of incomes", because the variety of physical and social characteristics also affect people's life (Sen 1992, 28). Gender inequalities persist despite the Lisbon strategy also requires the EU to promote equality between men and women in pay, labour market segregation and decision-making jobs. In all the 269 European regions analyzed, the females employment rate is lower than that for males (in means: females = 46.53, standard deviation = 7.98; males = 59.84, standard deviation = 5.76, see Table 2); and the difference is statistically significant (ANOVA test: F = 492.24, p=0.0000). That is, what a person can do depends, to some extent, on her gender. Hence, the central capability "affiliation", pointed by Nussbaum (2011, 34), which would imply protection against sex-based discrimination, is not respected. The model incorporates the indicator gender inequality employment, with a negative sign, reflecting females disadvantage in employment. This indicator is equal to zero when women have the same opportunities than men, and it is equal to 1 when women do as badly as possible.

In any case, DP_2 can eliminate all the superfluous common variance selecting only that part of the information that is original. This property allows the inclusion of a great number of indicators since all useless redundant variance will be removed by the DP_2 process itself, so avoiding multicollinearity (Montero et al. 2010, 443).

Table 2. Indicators of regional performance

Title	Definition	Relation indicator/index	Rationale	International programs that use the indicator	DC_i
1 Life expectancy	Life expectancy at the age "less than 1 year" (numbers of years)	Positive	Measure of health, although it only takes into account the length of people's life and not their quality of life. It is an indicator of social development.	EU SDS, HDI, OECD, QoL, WB	0.03
2 Death rate	Crude death rate per 100,000 inhabitants	Negative	Measure of health.	WB	0.19
3 Infant mortality	Infant mortality rate per 100,000 inhabitants	Negative	Measure of child well-being and poverty.	MPI, WB	0.00
4 Transport accident	Transport accidents. Crude	Negative	Measure of sustainable	EU SDS	0.56

	death rate per 100,000 inhabitants		transport.		
5 Youth rate	Youth rate (% population under 15 years / total population)	Positive	Contributes positively to the labor market.	WB	0.16
6 Rate of aging	Rate of aging (% population over 65 years / total population)	Negative	It represents a risk to the sustainability of the current welfare state.	EU SDS, WB	0.20
7 Poverty	At-risk-of-poverty rate (% of total population)	Negative	Poverty represents a risk to health, a capability limitation of consume, of social connections, and of educational opportunities and employment.	EU SDS, QoL, WB	0.43
8 Males employment	Males employment rate 15 and over (%)	Positive	Work has economic benefits, helps individuals stay connected with society, build self-esteem and develop skills and competencies. Societies with high levels of employment are also richer, more politically stable and healthier.	EU SDS, WB	0.11
9 Females employment	Females employment rate 15 and over (%)	Positive		EU SDS, WB	0.19
10 Gender inequality employment	Gender inequality employment [1-(female employment rate/male employment rate)]	Negative	Condition for a full and balanced development of individuals and society at large.		0.13
11 Long-term unemployment	Long-term unemployment rate (% unemployed for 12 months or longer over total unemployment)	Negative	Long-term unemployment can have a large negative effect on feelings of well-being and self-worth and result in a loss of skills, further reducing employability. It is an indicator of social exclusion for UNDP and social cohesion for EU.	EU SDS, HPI, OECD, QoL, WB,	0.34
12 Males	Males	Negative	Access to the	EU SDS, QoL,	0.48

unemployment	unemployment rate 15 years or over (%)		labour market is a condition for well-being for all people.	WB	
13 Females unemployment	Females unemployment rate 15 years or over (%)	Negative		EU SDS, QoL, WB	0.54
14 Males terciary education	Males tertiary educational attainment (% age group 25-64)	Positive	Education plays a key role in providing individuals with the knowledge, skills and competences needed to participate effectively in society and in the economy. Higher educational attainment levels increase employability and reduce poverty.	EU SDS, QoL, WB	0.41
15 Females terciary education	Females tertiary educational attainment (% age group 25-64)	Positive		EU SDS, QoL, WB	0.40
16 GDP per capita adjusted	Gross Domestic Product (GDP) per inhabitant at current market prices adjusted by the Gini index [GDP per inhabitant*(1-Gini index)]. Gini index of income distribution in every country.	Positive	Money is an important means to achieving higher living standards and thus greater well-being. Fair distribution of prosperity is a condition for sustainability.		0.53

EU SDS: Strategy of Development Sustainable of European Union.
HDI: Human Development Index of United Nations Development Program.
HPI: Human Poverty Index of United Nations Development Program.
MPI: Multidimensional Poverty Index of United Nations Development Program.
OECD: project Better Life Initiative of OECD.
QoL: Quality of Life indicators of European Union.
WB: project Working for a World Free of Poverty of World Bank.

Source: Eurostat and the author.

As can be seen, the selected indicators provide information on relevant functionings that vary from such elementary things as being in good health, avoiding premature mortality, avoiding poverty, having employment, avoiding discrimination and having the same opportunities to more complex achievements such as high levels of education.

5. Results

5.1. Ranking of region and determinant factors of regional development

Table 3 shows the descriptive statistics of the indicators. Based on the statistic information supplied by the 16 indicators selected for the 269 regions in the EU28, and applying the methodology of the composite index DP_2, we calculate the RDI to compare regional performance. Out of the 269 regions, 129 regions comprising 47.06% of the EU28's population are in 2009 below the EU average RDI (24.16). To obtain the mean EU28 RDI, the weighted arithmetic mean of the RDI is the sum of the DP_2 value for each region multiplied by the region relative population with respect to the total population of all of the analysed regions (p_j) (Pena Trapero 1977, 201-220).

$$\mu = \sum_{j=1}^{m} p_j DP2_j \tag{11}$$

Table 3. Descriptive statistics, 2009 (N=269)

Indicators	Mean	Standard deviation	Median	Maxim	Minimun
Life expectancy	79.58	2.59	80.40	83.30	72.90
Death rate	1.00	0.17	0.99	1.82	0.52
Infant mortality	4.07	1.84	3.70	13.20	0.00
Transport accident	7.66	4.02	6.93	25.85	1.31
Youth rate	15.58	2.17	15.46	21.83	10.35
Rate of aging	17.46	3.07	17.27	26.78	9.20
Poverty	17.03	6.59	16.00	39.90	3.00
Males employment	59.84	5.76	59.50	79.20	45.90
Females employment	46.53	7.98	47.30	67.90	20.90
Gender inequality employment	0.23	0.09	0.20	0.55	0.04
Long-term unemployment	37.80	11.35	38.10	66.80	5.00
Males unemployment	8.44	3.84	7.80	25.50	1.90
Females unemployment	8.83	4.62	7.70	33.60	2.40
Males terciary education	23.86	8.66	24.60	52.20	7.70
Females terciary education	25.49	9.03	24.90	50.70	7.40
GDP per capita adjusted	15,955.41	7,892.52	16,029.00	53,241.60	1,931.40

Source: Eurostat and the author.

In addition, a PCA was carried out to obtain an alternative estimate to the RDI. The 16 indicators chosen passed the suitability test; that is, they are sufficiently related to warrant inclusion in a composite index (measure of Sampling Adequacy KMO=0.631, and p=0.000 in

Bartlett's test of sphericity; N=269). Using PCA, we take as composite index RDI the first factor or component that explains the 35% of the variance.

With both methods, Stockholm in Sweden is the most developed region in 2009; in contrast, Severozapaden in Bulgaria is the least developed region in 2009. Based on the DP_2' additivity property[6], it can be inferred that the most developed region (Stockholm with a RDI equal to 36.02) triples that of the least developed region (Severozapaden with a RDI equal to 11.09), showing the existence of large territorial disparities on the analysed indicators. Bulgary's low level of economic and social development is confirmed; five out of the six Bulgarian regions belong to the group of the 15 least developed regions in EU. Except for Sicily in Italy and two other regions in Greece, the remaining 15 least developed regions are in Eastern Europe.

For the 269 regions, the Spearman´s rank correlation coefficient between the RDI resulting from DP_2 and PCA is equal to 0.9926 (p=0.0000); that is, the ranking of regions in terms of regional performance obtained through DP_2 and PCA is basically the same. When comparing the ranking of regions between the RDI and the GDP per capita, one observes a lower, though also high, correlation (between GDP per capita and the RDI calculated via DP_2: rho = 0.8009, p = 0.0000; between GDP per capita and the RDI calculated via PCA: rho = 0.7743, p = 0.0000).

Table 4 shows the 16 indicators ranked according to their correlation with the first PCA component, and by entry order in the DP_2, the correction factor ($1-R^2$) of each one of them in the DP_2 method, and the absolute value of the pairwise correlation between indicators and DP_2 values. The p-values show that, in the DP_2 method, all of the indicators have a statistically significant relationship at the 1% level with the RDI, except for rate of aging

[6] Additivity (Zarzosa Espina and Somarriba Arechavala, 2013): The distance index defined for the comparison between the two territorial/temporary units has to be such that the difference obtained between them directly by the distance indicator is equal to which would be obtained comparing the composite indices of each territorial/temporary unit.

(p=0.0251). Specifically, the correlation values of the RDI are, respectively: 0.8154 with females employment; 0.7735 with GDP per capita adjusted; 0.7499 with males employment; etc.

Following both methods, the indicator most correlated with the composite index of regional performance is the female employment rate, and the least correlated is the rate of aging. The group of the four most influential factors of regional performance includes, besides female employment, adjusted GDP per capita, male unemployment, and male education. This implies that, despite the GDP per capita limitations as unique indicator of development or wellbeing, families' income and employment are the most influential aspects on social and economic development in the studied regions.

Table 4. Mains results of DP_2 and PCA computations for RDI (N=269)

Indicators	Ranking PCA	Ranking DP_2	Correction factor DP^2 $(1-R^2)$	Correlation coefficient |r| DP_2 (p-value)
Females employment	1	1	1.0000	0.8154 (0.000)
GDP per capita adjusted	4	2	0.7819	0.7735 (0.000)
Males employment	3	3	0.3929	0.7499 (0.000)
Males terciary education	2	4	0.4990	0.7206 (0.000)
Long-term unemployment	6	5	0.6415	0.6216 (0.000)
Death rate	10	6	0.6184	0.5990 (0.000)
Transport accident	9	7	0.6116	0.5896 (0.000)
Gender inequality employment	5	8	0.0103	0.5787 (0.000)
Life expectancy	11	9	0.4822	0.5725 (0.000)
Females unemployment	7	10	0.4663	0.5509 (0.000)
Females terciary education	8	11	0.2496	0.5385 (0.000)
Poverty	12	12	0.5834	0.5107 (0.000)
Infant mortality	13	13	0.3705	0.4976 (0.000)
Youth rate	15	14	0.4910	0.4161 (0.000)
Males unemployment	14	15	0.1614	0.3851 (0.000)
Rate of aging	16	16	0.0459	0.1366 (0.0251)

Fuente: the author.

In the DP_2 method, as R^2 measures the information of each indicator that has already been explained by the preceding indicators, an indicator's correction factor $(1-R^2)$ captures the new information explained by this indicator. For example, the correction factor of the indicator adjusted GDP per capita is 0.7819 because, approximately, the 31.81% of this indicator's information has already been explained by the preceding indicator, female employment. Another example is youth that, with a correction factor equal to 0.4910 and despite having the 14th order in the ranking, incorporates, approximately, a 49% of new information not supplied by the 13 preceding indicators.

5.2. Regional policy implications

The composite indicator derived from PCA is exclusively an ordinal indicator, so it does not allow to make inter-spatial or inter-temporary comparisons, only ordinal comparisons. Additionally, this procedure does not take into account all the non-redundant information as it only explains the variance in the first component (35% in this case) and can therefore remove useful information in the composite indicator (Montero et al. 2010; Somarriba and Pena 2009). On the basis of the PCA limitations with respect to the DP_2, in this section we will only consider the RDI obtained via DP_2.

Following the orthodox Structural Funds allocation mechanism, 75 regions of the EU28 are classified as priority regions because their 2009 GDP per capita falls below the 75% of the community average. This implies that a population equivalent to the 28.97% of the total EU28 population is susceptible of Structural Funds support. Now, the RDI could be the allocation mechanism of the Structural Funds by choosing a threshold such that a similar percentage of population would be covered so that the budgetary effort remains constant. That is, one could select the least developed regions in terms of the RDI until encompassing, approximately, the 28.97% of the EU28 population. Following this method, 84 regions with an RDI below a value of 21.84 (equivalent to the 90.37% of the EU average RDI), representing the 28.76% of the total EU28 population, would be recipients of the Structural Funds.

Comparing the two allocation mechanisms of the Structural Funds, the percentage of population benefited would be similar, but with the RDI more regions would be covered (84 instead of 75) and located in different Member States. More specifically, only 15 out of all of the regions that do not achieve the threshold of the 75% of the EU average GDP per capita would surpass the 90.37% of the EU average RDI (see Table 5). These 15 regions –primarily located in Member States of the previous Eastern Europe-, representing the 6% of the EU28 total population, would be negatively affected by this change in the rules of the game. However, 24 regions of the old and Mediterranean Europe would be positively affected since, despite surpassing the 75% of the EU average GDP per capita, have lower levels of regional performance in RDI terms than other regions with lower GDP per capita (Table 6). Thus, following the threshold of the 90.37% of the EU average RDI as allocation criterion, three regions of Belgium, two regions of France, three regions of Germany, three regions of Greece, six regions of Italy and seven regions of Spain, encompassing altogether the 5.80% of the total EU28 population, could be considered priority regions.

Table 5. Regions with RDI greater than 90.37% EU28 average RDI and GDP per capita lower 75% EU28 average GDP per capita

Region (Member State)	RDI	GDP per capita *
Yugozapaden (Bulgaria)	22.20	7,900
Strední Cechy (Czech Republic)	24.03	12,100
Jihozápad (Czech Republic)	23.47	11,600
Severovýchod (Czech Republic)	22.71	10,900
Jihovýchod (Czech Republic)	23.38	12,200
Észak-Magyarország (Hungary)	22.35	15,300
Mazowieckie (Poland)	23.49	13,000
Pomorskie (Poland)	22.09	7,900
Norte (Portugal)	22.59	12,600
Centro (Portugal)	22.19	13,200
Região Autónoma dos Açores (Portugal)	22.41	14,900
Bucuresti – Ilfov (Romania)	24.49	13,000
Vzhodna Slovenija (Slovenia)	23.03	14,200
Cornwall and Isles of Scilly (United Kingdom)	24.88	16,500
West Wales and The Valleys (United Kingdom)	24.15	15,700
90.37% EU28 average RDI	21.84	
75% EU28 average GDP per capita		17,536.29

*Euros at current market prices.
Source: Eurostat and the author.

That is, since the RDI has been constructed taking into account the most recent trends in development and wellbeing and, in addition, incorporates some of the targets set out by the Europe 2020 Strategy (European Commission 2010a) to exit stronger from the economic crisis (for instance, employment, education and poverty), the RDI resulting map of priority regions is more linked to the actual reality or development of the regions immersed in the economic crisis than the GDP per capita map.

Table 6. Regions with RDI lower 90.37% EU28 average RDI and GDP per capita greater than 75% EU28 average GDP per capita

Region (Member State)	RDI	Per capita GDP*
Prov. Hainaut (Belgium)	18.63	20,600
Prov. Liège (Belgium)	21.26	23,700
Prov. Luxembourg (Belgium)	21.59	21,400
Languedoc-Roussillon (France)	21.43	23,300
Corse (France)	18.95	24,400
Mecklenburg-Vorpommern (Germany)	20.55	27,900
Chemnitz (NUTS 2006) (Germany)	20.78	28,800
Sachsen-Anhalt (Germany)	19.55	28,200
Dytiki Makedonia (Greece)	18.13	21,200
Ionia Nisia (Greece)	20.43	20,900
Sterea Ellada (Greece)	15.57	21,100
Liguria (Italy)	21.83	27,100
Umbria (NUTS 2006) (Italy)	21.61	23,400
Abruzzo (Italy)	19.58	21,000
Molise (Italy)	17.82	20,500
Basilicata (Italy)	16.45	18,300
Sardegna (Italy)	18.65	19,500
Galicia (Spain)	21.65	20,500
Principado de Asturias (Spain)	21.43	21,200
Castilla y León (Spain)	21.45	21.900
Castilla-La Mancha (Spain)	20.58	18,500
Ciudad Autónoma de Ceuta (Spain)	19.49	20,700
Ciudad Autónoma de Melilla (Spain)	18.82	19,100
Canarias (Spain)	20.98	19,300
90.37% EU28 average RDI	21.84	
75% EU28 average GDP per capita		17,536.29

*Euros at current market prices.
Source: Eurostat and the author.

The differences in the map of priority regions could be a source of debate on the introduction of new game rules in terms of community regional policy. Specially so in the current institutional context in which the European Commission and the European Council co-decide or co-legislate at the same level everything relative to the Structural and Cohesion Funds; and, moreover, accounting for the predictable reduction in the EU budget for the next period 2014-2020[7].

[7] The Multiannual Financial Frame 2007-2013, reports commitment appropriations that amount to the 1.048% of Gross National Income (GNI), and, approximately the 35.64% of that total is devoted to regional development policy. (European Commission, Financial Programming and Budget). The next Multiannual Financial Frame

6. Conclusions and discussion

Despite European Union objectives for economic and social cohesion, current measures of regional development are defined in a strictly economic sense, reflecting the separation in policy and academia between economic and social issues. Taking into consideration the GDP per capita limitations as a unique indicator of development, well-being or social progress, this paper constructs a measure of regional development (RDI) for the EU28 regions via two distinct methodologies (DP_2 and PCA), and contrasts the results with orthodox GDP measures.

Our regional development concept is nested within the capabilities approach framework: we aim to assess the degree of relative disadvantage of the European regions taking the achieve functionings in relevant areas of well-being as reference points. In line with the most recent developments in the measurement of quality of life (Boulanger et al. 2009; Eurostat 2008; Michalos et al. 2011; OECD 2013; Stiglitz et al. 2009) and in cohesion policy in the EU (Barca and McCann 2011), we aim to measure regional performance in terms of people's well-being and progress. As the Structural Funds pursue to contribute to the development of the less developed regions, Structural Funds should be distributed according to the relative level of development and not to the production level (GDP).

Thus, we have constructed a multidimensional index of regional development (RDI), that incorporates indicators of both monetary and non-monetary dimensions relative to people's quality of life, such as income, inequality in income and gender, education, health, poverty, employment and demographic factors. The scarcity of NUTS 2 data in the EU has seriously restricted our purposes. Specifically, we have selected indicators whose potential responsiveness to a given policy measure is expected to be relatively great (for instance, unemployment, poverty or traffic accident), but also those indicators which, although being

2014-2020 agreed by the European Council in February 2013 diminishes the commitment appropriations to the 1% of GNI; and plans devoting the 33.88% of the EU28 budget to economic, social and territorial cohesion (European Council, 2013).

possibly affected by a given policy measure, are also expected to be influenced by so many other factors (for instance, life expectancy, infant mortality or gender inequality unemployment). The former are very interesting from a policy-makers view since they refer to specific dimensions of well-being that are expected to be modified by policy action (Barca and McCann 2011). However, the proposed synthetic index does not attempt to evaluate the effectiveness of a particular policy measure, but to study the degree of relative disadvantage of European regions and, given that situation, equitably distribute Structural Funds. For this reason, we believe that the capabilities approach does offer the right framework to accomplish our goal.

We are aware that the existing information limits make our indicators selection incomplete by several reasons. First, we should consider several indicators on the same dimensión or functioning. Distinct indicators can capture different aspects of the same dimension and can, thus, send different signals about whether well-being is improving or worsening (Barca and McCann 2011). For example, in our case, besides transport accident others mobility indicators should be included such as travelling time, because of the later might be decreasing but at the same time the share of lethal accidents might be increasing. Likewise, in addition to tertiary education, we should have included early leavers from education and training.

Second, social policy needs subjective indicators (Veenhoven 2002) and the more relevant recent developments on well-being measurement opt for incorporating subjective measures as well as objective measures (see Boulanger et al. 2009; Eurostat 2008; Michalos et al. 2011; OECD 2013; Stiglitz et al. 2009). Notwithstanding this, we have not incorporated subjective indicators in our model because we have not been able to find this information for all of the European regions. The development of official statistics in this direction would allow to take advantage of subjective indicators in the study of quality of life as well as to assist policy makers in decision making. However, some of the indicators included can be considered as proxy of subjective and objective substance (see Veenhoven 2002, 35-36). For instance, the unemployment has negative material effects, also on mental and physical health, and causes 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).

With respect to the methodology used to calculate the RDI, we would like to outline that DP_2 seems to us specially fit for evaluating the relative position of European regions in terms of development. Since it is a distance method, we have taken as each indicator baseline the worst possible value recorded for any of our variables, hence the results of the RDI obtained with DP_2 show the level of development of each region in comparison to the remaining EU regions.

The results by both methods, DP_2 and PCA, imply that the most influential indicators on the regional development index are female employment, adjusted GDP per capita, male employment, and male education. The RDI results via DP_2 show that, in 2009, inequalities between the most and the least developed regions are very high (more than triple). The most developed region is Stockholm in Sweden (RDI=36.02), and the least developed region is Severozapaden in Bulgaria (RDI=11.09). The regional rankings obtained from both DP_2 and PCA RDI are basically the same, whereas sensible differences arise with respect to the ranking obtained via GDP per capita.

Implementing the RDI –via DP_2 method- as allocation mechanism of the structural funds, instead of the GDP per capita, and with an equivalent budgetary effort regarding the population benefited from these funds, a distinct map of priority regions results. Specifically, a reference threshold of the 90.37% of the RDI, instead of the 75% of the GDP per capita, benefits the same percentage of the total population (approximately the 29% of the EU28 total population), does not benefit 15 regions mainly located in the previous Eastern Europe, and does benefit 24 regions located in Belgium, France, Germany, Greece, Italy and Spain. This change in the rules of the game would affect about the 6% of the EU28 population, but would probably imply an EU decision making mechanism in agreement with criteria more linked to the complexity of the economic and social development.

This paper attempts to contribute to the debate on a change in the rules of the game in the community regional policy by proposing a focus shift from GDP, as the single measure for societal progress, to measuring regional performance in terms of people's well-being and progress.

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