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A Regional Development Index for Portugal

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Abstract In a report from 2008 the Organization for Economic Cooperation and Development came to the conclusion that Portugal is a country still very much marked by regional asymmetries and in need of better regional governance mechanisms and policies. We propose a regional development index for Portugal at the NUTS III level, based on the methodology of the human development index (HDI) from the United Nations Development Programme, which will be helpful to assess the evolution of the asymmetries between regions and evaluate the need for regional policy. Results show us a country that has most of the highest ranked NUTS III regions positioned along the coastline, although some interior NUTS III regions improved their relative positions in the ranking between 2004 and 2009. In addition to the three traditional dimensions of the HDI—income, education, and health—we include two more, given their increasing importance in the literature that criticizes the HDI and suggests the inclusion of new variables—governance and environment. Results show some considerable differences when we add the environment dimension: the interior regions improve their relative positions in the ranking, but in terms of governance they change little. Results also show that there is still the need for regional policy, although the dispersion in the ranking between the best and worst positioned NUTS III regions has decreased in all dimensions except education.

Keywords Regional development index · Income · Education · Health · Governance · Environment · Regional asymmetries · Portugal

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1 Introduction

In a report of 2008 the OECD came to the conclusion that Portugal remains a country very much marked by regional asymmetries and in need of better regional governance mechanisms and policies. In light of these conclusions it becomes important to address the issue of constructing an index of regional development for Portugal to better assess the evolution of the development differential between regions and also the need for regional policy. This index will act as a benchmark tool for the regions relative to other regions.

In this work we propose a regional development index for Portugal at the NUTS III level (Nomenclature of Territorial Units for Statistics, level III),[1] generally inspired by the human development index (HDI) from the United Nations Development Programme (UNDP). We use its methodological framework to measure the level of regional development of Portuguese NUTS III regions, starting with the three basic dimensions of analysis of the above-mentioned composite index: a long and healthy life, a decent standard of living, and access to knowledge. We then add two extra dimensions to our regional development index—environment and governance.

For Portugal there are already some studies using composite indicators to monitor human development. There are works that look only at the GDP per capita of the regions at the NUTS II and III level (Ramos and Rodrigues 2001). Diniz and Sequeira (2008) build a social and economic development index for Portuguese municipalities in the Mainland (excluding the Azores and Madeira) based on the HDI, but with seven dimensions—demography, education, employment, economy, business sector, health, and habitation—and perform cluster analysis with the constructed index. They find marked asymmetries between the littoral and interior municipalities. Conim (1998, 1999), Conim and Matias (2002), Matias (2002), and Carvalho and Matias (2004) (from the Department of Prospective and Planning (DPP) of the now Ministry of Agriculture, Sea, Environment, and Spatial Planning) provide studies that seek to reproduce the HDI for Portugal at the national and regional level (NUTS II, NUTS III, and municipalities), including some new variables related to comfort and technology, for example. Unfortunately the work of these authors stopped in 2001. In 2009, the Portuguese National Statistics Institute (INE) and the DPPRI (former DPP), in a joint collaboration, presented the new Synthetic Index of Regional Development (SIRD), comprising three dimensions—competitiveness, social cohesion, and environmental quality (INE, DPPRI 2009). The series presents data since 2004 from 2009 (last update).

Our work is similar to that developed previously by the DPP. We do not include all the variables present in the SIRD, since we think our index, which is similar to the HDI and uses the same dimensions, allows for the possibility of making a comparison with other regional indices for other countries, built with the same methodology. This is important for comparing the efficiency of regional policy across the regions of European Union member countries, for example. We make a comparison of the ranking positions of the NUTS III regions, also analyzing their dynamic evolution for the period between 2004 and 2009. We then add two extra dimensions to our regional development index, reflecting the current critical discussion about future developments for the HDI—environment and governance. We compare the values obtained with our index with those obtained in the HDI of the

[1] The NUTS III level (Nomenclature of Territorial Units for Statistics, level III) designates the sub-statistical regions that divide the Portuguese territory, in accordance with Regulation (EC) No. 1059/2003 of the European Parliament and of the European Council of 26 of May of 2003.

UNDP and find close values and the same evolution. Our results point to a continuing important role for regional policy.

The remainder of this paper is structured as follows. In Sect. 2 we provide an overview and critiques to the HDI in the literature. In Sect. 3 describe our data set, providing details on the construction of some variables. In Sect. 4 we describe our methodological procedure to construct our index, and in Sect. 5 we analyze our results. Section 6 concludes.

2 An Overview and Critiques to the HDI

The first Human Development Report of the UNDP brought a new perspective that is today very important in measuring development.[2] The designers of the index considered that the development of a country should be measured not only by its national or domestic income, but also by other dimensions, namely the life expectancy and educational level of its population, believing that the index helped to distinguish between good and bad growth (Ravallion 1997). The HDI has been constantly improved over the last 20 years and has been replicated in numerous reports of national and regional levels in different countries and served as the seed in the creation of various indicators of development.

Over the years the HDI has also been criticized. Initially, McGillivray and White (1993) stated that the index was useful to compare groups of countries with similar characteristics, but in terms of comparing very different countries it added nothing new to the indices already existing. Higher correlation of the different components was also pointed out. Differences between measures for the variables (especially those related to education) in each year were also noticed. Noorbakhsh (1998b) mentions that the index is sensitive to the minimum and maximum range for each variable/dimension and also suffers from a scale effect in the variables related to education (Noorbakhsh 1998a). Sagar and Najam (1998) proposed technical modifications to the index regarding the aggregation of the three dimensions, computation of GDP, and questions about inequality in each dimension. The inequality dimension is also discussed in Hicks (1997), Alkire and Foster (2010), and Kovacevic (2010). Aguña and Kovacevic (2011) supply an overview of the methodological modifications undergone by the HDI over these 20 years and discussed the impacts of these modifications. Wolf et al. (2011) identify sources of data error in the HDI and reach the conclusion that nearly 34 % of the countries represented in the index are poorly classified. An overview of the main critiques to the HDI can also be found in Kovacevic (2011).

A critical discussion surrounding the concept of development involving the HDI and other multidimensional indices can be found in Alkire (2010). The inclusion of new variables, reflecting dimensions different than those presented in the HDI, are among the concerns related to the improvement of the index. Among the variables/dimensions mentioned are the environment and governance. Regarding the environmental dimension, Neumayer (2001, 2010) proposes to add a sustainability dimension using a measure of net investment in physical and natural capital, because the HDI underestimates the potential of the society to provide for future generations, even in cases in which the HDI is high.

Also, the 2002 Human Development Report stresses that the HDI in its current form does not take into account the governance dimension. The report claims that this is one of the most important dimensions to examine, since there are several empirical studies with data for several countries in the world that have found an inverse relationship between bad

[2] Which comprised the HDI, designed by economist Mahbub ul Haq with the help of the conceptual framework of the capabilities approach of Amartya Sen's work (Sen 1984), and published in 1990.

governance (institutions, rules, and political processes) and development. Bad governance can be defined as a lack of participation or consultation of the community in the decision process, lack of accountability of policy makers, lack of transparent rules, etc.

Another argument in favor of analyzing the governance dimension is that the quality of governance is essential to assure a robust and balanced development of all three dimensions of the HDI. Pradhan and Sanyal (2011) found a positive relationship between good governance, human development in previous years, and the level of human development in present time. Burd-Sharps et al. (2010) provide a study for six countries: Australia, Canada, Japan, New Zealand, the United Kingdom, and the United States, in which new variables are added to the traditional dimensions of the HDI and new dimensions of development are analyzed, including the two additional dimensions that we use—environment and governance. The authors claim that the HDI with additional indicators provides a more detailed framework to study human development across countries, and that results for human development can change substantially with the inclusion of new dimensions.

Some tentative efforts have been made in many countries to measure human development at the regional level. The UNDP has information on its website about national and regional Human Development Reports, which are self-initiatives of the countries made in close collaboration with the UNDP.[3] A review of these initiatives can be found in Gaye and Jha (2010) and Pagliani (2010). Some of these indices have been used with the aim of helping regional policy formulation, as is the case of Noorbakhsh (2002, 2005) for Iran, Noorbakhsh (2003) for India, and Tadjoeddin et al. (2001) for Indonesia, to name a few. There is also research relating regional HDI with gender inequality, as in Peinado and Céspedes (2004) for Spain and Basu and Basu (2005) for Australian states and territories, and research relating the HDI with crime, violence, and inequality (de la Torre and Moreno 2010).

We are including two new dimensions—governance and the environment—in our regional development index, due to the importance of these dimensions stressed in the literature.

3 Data

Our main data source is the National Statistics Institute (INE—Instituto Nacional de Estatística). INE not only produces statistics, but gathers and compiles data from other official and recognized data-producing institutions.

Our variables are all regional, defined at the geographical level NUTS III, representing 30 regions of the Portuguese territory. The current division of NUTS III in Portugal was defined in 2002. See Appendix 1 for the complete list of NUTS III for Portugal and a map of the distribution of NUTS III in Portugal.

The HDI is a three dimensional index, comprising:

1. *A long and healthy life*—represented by the indicator life expectancy at birth. The official definition of this indicator for the UNDP is: Number of years a newborn infant could expect to live if prevailing patterns of age-specific mortality rates at the time of birth were to stay the same throughout the infant's life. Existing data for Portuguese NUTS III regions are between 2001 and 2010. The values for this indicator for 2005

[3] http://hdr.undp.org/external/toolkit/contents/hdr_included.html.

and thereafter reflect a different methodology from that used in the calculation for earlier years.

2. *A decent standard of living*—represented by the natural logarithm of GDP per capita at PPP (purchasing power parity). Data for Portuguese regions are for GDP *per capita* at current prices, and exist for the period between 1995 and 2010. The data have not been corrected for purchasing power parity, but this is not a problem, as we are working with regions of the same country and the inflation differentials between regions are less meaningful than the differentials between countries.
3. *Access to knowledge*—represented by mean years of schooling and expected years of schooling. The definitions for these two variables for the UNDP are: Mean years of schooling (of adults in years)—average number of years of education received by people ages 25 and older in their lifetime based on education attainment levels of the population converted into years of schooling based on theoretical durations of each level of education attended and expected years of schooling (of children in years) − number of years of schooling that a child of school entrance age can expect to receive if prevailing patterns of age-specific enrollment rates were to stay the same throughout the child's life. These variables in the HDI from UNDP are constructed with econometric estimations. Data that we can obtain at the regional level are considerably different from these concepts. In our regional development index we choose the following variables as proxies for the two variables: Transition rate or regular secondary school completion (in %) − [secondary school pupils that at the end of the regular school year may carry over into the next school level/pupils enrolled in secondary education in this school year × 100], to be a proxy for mean years of schooling and percentage of gross enrollment rate in secondary education − [(students enrolled in secondary education/resident population aged between 15 and 17 years) × 100], to be a proxy for expected years of schooling. This last indicator represents the proportion of resident population that is seeking an education degree, to the total resident population of the age group corresponding to the normal frequency of this age level of education. Our data span from school year 2004/2005–2010/2011. Since we have no data for the school year 2003/2004, we have assumed that data for 2004 are the same as data for the school year 2004/2005. We made this assumption in order not to lose the extra year of data.

Because we agree with some of the criticism of the original HDI (i.e., that the three dimensions represent a very narrow way to analyze development), we added two extra dimensions to the HDI—the governance and environmental dimensions. In the next sections we calculate development indices, one for Portuguese NUTS III regions for the benchmark index, and three others including these two dimensions.

Two very common proxies used in the characterization of the governance dimension are the voter turnout and consultation on rule-making (OECD 2011). While the latter was not available at the NUTS III level, the former was, since 2001 for several types of elections. We choose to use the voter turnout of municipal elections, which has data available for the years of 2001, 2005, and 2009, the years the municipal elections took place, because municipalities are the type of geographical unit closest to the NUTS III level that perform elections. The indicator supplied by the INE—"Voter turnout in elections for municipal councils"—used to assess the governance component, is inversely proportional to the index that we wish to assess. We therefore calculate the inverse of this indicator, which we designate "Participation rate in elections for municipal councils". Since data for the

original three dimensions begin in 2004 (the first year in which there are available data) we use the 2005 data in the year 2004.

The choice of an environmental indicator was very difficult, since data is scarce at the NUTS III level for this factor. One of the most commonly used environmental indicators is the quality of air. However, stations that measure the air quality in Portuguese regions do not cover some of the NUTS III regions and other NUTS III have more than one station, and we had to exclude this indicator as a result. An indicator related to urban waste would make the analysis very incomplete since INE has data only on the proportion of recyclable waste in the total urban waste collected. A waste-based analysis could be biased for two other reasons, as well. First, much of the population may not be served by this service, since the coverage of recycling is not uniform throughout the country. Second, lower income population usually produces less recyclable waste than higher income population. We choose to use the indicator percentage of population served by waste water treatment stations, which is also used in the SIRD. Data for 2004 and 2005 were obtained from the Environmental Survey—Characterization of Sanitation, while the figures for 2006 and subsequent years until 2009 (last year available) come from the database INSAAR (National Inventory of Water Supply Systems and Wastewater). Data are unavailable for this indicator in 2007, 2008, and 2009 for the Azores and Madeira.

For each of the original three dimensions data availability is between 2004 and 2010 (the longest interval of time for which information is available for each of the three original dimensions), but for the governance and environmental dimensions, data are available only until 2009. Hence, for compatibilization reasons, we have to shorten our sample to 2009 instead of 2010, in order to accommodate data availability for all five dimensions.

4 Methodology

This section describes the methodological choices adopted in the realization of this work, the methods of standardization of basic indicators, and the methods of aggregation and weighting of the indicators used in constructing the composite index intended for analysis.

Based on the variables identified in the previous section and maintaining the structure of the original HDI, we have constructed a composite index called Portuguese regional development index (PRDI) that will be calculated and analyzed in the present work. Despite minimizing the changes, a comparison between our PRDI and the HDI from the UNDP must be done carefully.

Table 1 shows the variables that enter into the calculation of the PRDI, including the dimensions considered in the analysis and indicators and indices representing each dimension (partial indices or sub-indices) that give rise to the PRDI.

The sub-indices (with the exception of the income index) were calculated as follows:

$$Dimension\ Index = \frac{Actual\ Value - Minimum\ Value}{Maximum\ Value - Minimum\ Value}.$$

Once we have obtained all dimension indices, the PRDI is calculated as the result of the geometric mean of the three dimension indices.[4] When we add the fourth and fifth dimension we also perform a geometric mean of the dimension indices to keep the original data treatment and assign the same weight to all dimensions.

[4] We follow the methodology of UNDP for the HDI in the construction of the sub-indices and in the aggregation of the dimensions to obtain the PRDI.

Table 1 Schematic presentation of the calculation of each dimension

Dimensions	Indicators	Index of each dimension
Longevity	Life expectancy at birth	Life expectancy index
Education	Secondary school completion (%)	Educational achievement index
	Gross enrollment rate in secondary education (%)	
Income	GDP per capita	Income index
Governance	Participation rate in elections (%)	Governance index
Environmental	Population served by waste water treatment stations (%)	Environmental index

Because the PRDI is a composite index, it was necessary to normalize the core indicators in order for each indicator to take the same units of measurement and common scales, a process that gave rise to the five dimension indices identified in Table 1. For this normalization process it was necessary to define the minimum and maximum limits for each indicator, which are shown in Table 2.[5]

As we wish to make comparisons between regions and also make a dynamic comparison throughout time (to determine the distance in terms of development of each region to the level of development of the most developed region), for each indicator we assumed as the top boundary the maximum value observed in each indicator in the period analyzed—2004–2009. For the minimum we used the values that are understood as the minimum subsistence values or "natural" zeros, and the development and well-being are thus measured by comparison with the minimum requirements that a society needs (or perceives to need) to survive over time, using the methodology and benchmark values of the UNDP for the HDI (UNDP 2013). The minimum value for life expectancy at birth—20 years—is a value defined by the UNDP for the HDI, defined by empirical evidence found in Maddison (2010) and Riley (2005). We choose a 0 % rate for the two education indicators, based on the assumptions made by the UNDP, since a person can survive without (formal) education, and assumed the same premise with respect to the governance and environment indicators. We build our education indicator by considering a weight of (1/2) for the variable secondary school completion, and a weight of (1/2) for the variable gross enrollment rate in secondary education, as in the methodology applied by the UNDP.

The only exception to this rule is the minimum value of GDP per capita, which was taken from our sample. As with the original HDI, the income index is calculated based on the natural logarithm of the minimum and maximum values.

5 Results

Tables 3 and 4 present results for 2009 and 2004, respectively. In the text we choose to analyze the first and last years available. Results for 2005, 2006, 2007, and 2008 are in Appendix 2, Tables 6, 7, 8, and 9, respectively.

Table 3 shows results for 2009. Let us first compare the results obtained for Portugal in our index to the results of the HDI of the UNDP. The values of the HDI are available, in a comparable way, from 2005 to 2009. The values for the general ranking are higher than ours, but not by very much, and our index follows the upward trend of the HDI. For

[5] Çolak and Ege (2013) also use the methodology for normalization of the HDI, when calculating a composite index to assess the EU 2020 Growth Strategy.

Table 2 Boundaries for defining the dimensional indices and their sources

Indicator	Maximum[a]	Minimum
Life expectancy at birth (years)	81	20
Secondary school completion (%)	85.6	0
Gross enrollment rate in secondary (%)	243.8	0
GDP per capita (€)	26,910	7,220[b]
Participation rate in elections (%)	74	0
Population served by waste water treatment stations (%)	100	0

[a] Maximum values in the sample

[b] Minimum value in the sample

2005–2009, the values are respectively 0.796, 0.798, 0.806, 0.811, and 0.813, while ours are, for the same period and in the same order, 0.673, 0.679, 0.708, 0.717, and 0.761.

The NUTS III Grande Lisboa ranks number one in the PRDI for 2009. Grande Lisboa includes the city of Lisbon, the capital of the country, and some surrounding urban and industrial areas. Appendix 1 includes a map of Portugal showing the NUTS III regions. The NUTS III regions on the coast occupy the first seven places in the ranking. Beira Interior Sul, Baixo Alentejo, and Alentejo Central (positioned in the interior of the country) occupy the last three positions of the top ten. The first eight NUTS III regions in the PRDI ranking have an index greater than the PRDI for Portugal, but are not geographically concentrated in one NUTS II. The NUTS II Lisboa, Algarve, and Madeira present an index value greater than that of the country. The NUTS II Alentejo is the most homogenous group in the mainland, in terms of its relative position in the rankings, with the exception of Alentejo Litoral, which occupies the second position in our PRDI. The NUTS II Norte, Centro, and Lisboa show greater heterogeneity. There are NUTS III regions that ranked very similarly in the three dimensions (income, education, and health)—Baixo Mondego, Pinhal Interior Sul, and Península de Setúbal, and once again these NUTS III regions do not belong to the same NUTS II.

In a report of 2008, the OECD advances a belief that these results somehow reflect the specialization pattern of the country and each region, and also the capacity for growth for each NUTS III level (OECD 2008). The coastal and more urbanized regions have a greater share of tertiary services than do interior and rural regions. The capital, Lisbon, located in the NUTS III Grande Lisboa concentrates the majority of political, financial, and business related services, as well as the headquarters of large economic groups, and is also the region that most invests in R&D. The capital is also expanding in quality tourism. Also in the NUTS II Lisboa, the Península de Setúbal is a more industrialized region, with industries that include ship repair, steel, and chemicals. The Northern NUTS III are very industrialized regions, but in decline, due to increasing competition from China and India in the traditional sectors (e.g., textiles, footwear, and leather) and with workers exhibiting low labor skills and productivity. The NUTS III of Algarve, Açores, and Madeira base their economic specialization on tourism. Interior regions are mainly specialized in agriculture, a sector in decline. Workers in these regions, who have low skills, have little incentive to increase their qualifications, due to the higher unemployment rate that is found among high-skilled workers in these regions.

We next added the two extra dimensions—governance and environment. First, we added each one separately and built a new PRDI index with the new dimension included for each one. Then, we built a new PRDI with the two dimensions included (last two columns of each table). When we added the Governance dimension, the PRDI with Governance included changed little, although the ranking of the Governance index is very

Table 3 Portuguese regional development index for 2009

	Income		Education		Health		PRDI		Governance	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Portugal	0.598	–	0.754	–	0.978	–	0.761	–	0.797	–
Norte (8 NUTS)	0.424	–	0.749	–	0.982	–	0.678	–	0.870	–
Minho-Lima	0.300	25	0.799	11	0.976	15	0.616	25	0.822	16
Cávado	0.403	18	0.751	18	0.992	2	0.670	17	0.918	4
Ave	0.341	22	0.695	27	0.983	9	0.615	26	0.924	3
Grande Porto	0.607	5	0.789	15	0.982	10	0.777	5	0.809	19
Tâmega	0.143	29	0.645	28	0.971	19	0.448	30	0.970	1
Entre Douro e Vouga	0.407	17	0.739	20	1.000	1	0.670	16	0.878	7
Douro	0.284	27	0.801	10	0.966	22	0.604	27	0.873	10
Alto Trás-os-Montes	0.310	23	0.859	3	0.986	5	0.640	19	0.816	18
Centro (12 NUTS)	0.458	–	0.770	–	0.983	–	0.702	–	0.809	–
Baixo Vouga	0.518	10	0.698	26	0.983	8	0.708	11	0.766	26
Baixo Mondego	0.587	7	0.876	2	0.984	7	0.797	3	0.784	22
Pinhal Litoral	0.593	6	0.795	13	0.989	3	0.775	6	0.772	24
Pinhal Interior Norte	0.253	28	0.714	23	0.980	11	0.561	28	0.914	5
Dão-Lafões	0.348	20	0.738	21	0.988	4	0.633	20	0.826	15
Pinhal Interior Sul	0.345	21	0.731	22	0.943	27	0.619	22	0.939	2
Serra da Estrela	0.125	30	0.842	5	0.964	23	0.467	29	0.872	11
Beira Interior Norte	0.305	24	0.792	14	0.978	13	0.618	23	0.877	8
Beira Interior Sul	0.486	11	0.979	1	0.973	17	0.774	8	0.808	20
Cova da Beira	0.291	26	0.825	7	0.978	14	0.617	24	0.846	12
Oeste	0.449	14	0.699	25	0.971	18	0.673	15	0.784	22
Médio Tejo	0.410	16	0.796	12	0.986	6	0.685	14	0.819	17
Lisboa (2 NUTS)	0.857	–	0.767	–	0.976	–	0.862	–	0.682	–
Grande Lisboa	0.990	1	0.788	16	0.978	12	0.914	1	0.693	29

Table 3 continued

	Income		Education		Health		PRDI		Governance	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Península de Setúbal	0.348	19	0.709	24	0.970	20	0.621	21	0.655	30
Alentejo (5 NUTS)	0.520	–	0.806	–	0.962	–	0.739	–	0.841	–
Alentejo Litoral	0.753	3	0.815	9	0.956	26	0.837	2	0.845	13
Alto Alentejo	0.446	15	0.821	8	0.958	25	0.705	12	0.895	6
Alentejo Central	0.454	13	0.851	4	0.974	16	0.722	10	0.841	14
Baixo Alentejo	0.552	8	0.828	6	0.940	28	0.755	9	0.874	9
Lezíria do Tejo	0.474	12	0.750	19	0.964	24	0.700	13	0.792	21
Algarve (1 NUTS)	0.641	4	0.761	17	0.967	21	0.778	4	0.766	26
Açores (1 NUTS)	0.551	9	0.588	30	0.918	29	0.668	18	0.768	25
Madeira (1 NUTS)	0.805	2	0.638	29	0.906	30	0.775	7	0.743	28

	PRDI with governance		Environment		PRDI with environment		PRDI with governance and environment	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Portugal	0.770	–	n.a.	–	n.a.	–	n.a.	–
Norte (8 NUTS)	0.722	–	0.650	–	0.671	–	0.707	–
Minho-Lima	0.662	25	0.520	25	0.591	23	0.631	23
Cávado	0.725	12	0.680	18	0.672	16	0.716	13
Ave	0.681	20	0.620	22	0.616	22	0.668	21
Grande Porto	0.785	4	0.830	10	0.790	5	0.794	5
Tâmega	0.543	30	0.350	27	0.421	28	0.497	28
Entre Douro e Vouga	0.717	15	0.310	28	0.553	26	0.606	26
Douro	0.662	26	0.860	6	0.660	19	0.698	18
Alto Trás-os-Montes	0.680	21	0.810	11	0.679	14	0.705	15
Centro (12 NUTS)	0.728	–	0.720	–	0.707	–	0.726	–
Baixo Vouga	0.722	13	0.700	17	0.706	11	0.718	12

Table 3 continued

	PRDI with governance		Environment		PRDI with environment		PRDI with governance and environment	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Baixo Mondego	0.794	3	0.740	15	0.782	7	0.783	7
Pinhal Litoral	0.774	8	0.530	24	0.705	12	0.718	11
Pinhal Interior Norte	0.634	27	0.600	23	0.571	25	0.627	25
Dão-Lafões	0.676	22	0.770	13	0.665	18	0.694	20
Pinhal Interior Sul	0.687	19	0.490	26	0.584	24	0.642	22
Serra da Estrela	0.545	29	0.870	4	0.545	27	0.599	27
Beira Interior Norte	0.675	23	0.790	12	0.657	20	0.696	19
Beira Interior Sul	0.782	6	0.920	1	0.808	3	0.808	3
Cova da Beira	0.668	24	0.850	7	0.668	17	0.701	17
Oeste	0.699	17	0.840	8	0.711	10	0.725	10
Médio Tejo	0.716	16	0.650	20	0.676	15	0.703	16
Lisboa (2 NUTS)	0.813	–	0.830	–	0.854	–	0.817	–
Grande Lisboa	0.853	1	0.910	2	0.913	1	0.864	1
Península de Setúbal	0.630	28	0.630	21	0.623	21	0.630	24
Alentejo (5 NUTS)	0.763	–	0.760	–	0.744	–	0.762	–
Alentejo Litoral	0.839	2	0.750	14	0.815	2	0.821	2
Alto Alentejo	0.749	11	0.870	4	0.743	8	0.771	8
Alentejo Central	0.750	10	0.740	15	0.727	9	0.748	9
Baixo Alentejo	0.783	5	0.880	3	0.784	6	0.801	4
Lezíria do Tejo	0.722	14	0.660	19	0.690	13	0.709	14
Algarve (1 NUTS)	0.775	7	0.840	8	0.793	4	0.788	6
Açores (1 NUTS)	0.691	18	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Madeira (1 NUTS)	0.767	9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

We have no environmental data available for the Autonomous Regions of the Azores and Madeira for 2007, 2008, and 2009

Table 4 Portuguese regional development index for 2004

	Income		Education		Health		PRDI		Governance	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Portugal	0.515	–	0.592	–	0.953	–	0.662	–	0.824	–
Norte (8 NUTS)	0.330	–	0.561	–	0.958	–	0.562	–	0.901	–
Minho-Lima	0.163	24	0.602	14	0.965	5	0.455	24	0.895	11
Cávado	0.301	18	0.576	20	0.963	7	0.551	18	0.964	2
Ave	0.280	19	0.547	26	0.963	7	0.528	21	0.953	4
Grande Porto	0.533	6	0.605	13	0.956	13	0.675	7	0.823	20
Tâmega	0.000	30	0.464	30	0.946	17	0.000	30	1.000	1
Entre Douro e Vouga	0.367	17	0.524	27	0.976	2	0.572	17	0.907	9
Douro	0.085	28	0.581	19	0.940	24	0.360	27	0.920	7
Alto Trás-os-Montes	0.145	25	0.563	21	0.953	15	0.426	25	0.870	15
Centro (12 NUTS)	0.389	–	0.603	–	0.960	–	0.608	–	0.851	–
Baixo Vouga	0.478	8	0.557	23	0.965	5	0.636	8	0.809	24
Baixo Mondego	0.506	7	0.689	1	0.961	9	0.695	5	0.823	20
Pinhal Litoral	0.542	5	0.624	7	0.971	3	0.690	6	0.819	23
Pinhal Interior Norte	0.135	26	0.522	28	0.950	16	0.406	26	0.941	6
Dão-Lafões	0.262	21	0.598	15	0.960	11	0.531	20	0.885	13
Pinhal Interior Sul	0.088	27	0.554	25	0.946	17	0.359	28	0.958	3
Serra da Estrela	0.004	29	0.591	17	0.861	29	0.130	29	0.907	9
Beira Interior Norte	0.178	22	0.593	16	0.956	13	0.466	23	0.943	5
Beira Interior Sul	0.376	14	0.674	2	0.887	27	0.608	13	0.872	14
Cova da Beira	0.170	23	0.607	11	0.978	1	0.466	22	0.895	11
Oeste	0.412	12	0.556	24	0.943	22	0.600	14	0.807	26
Médio Tejo	0.372	16	0.648	3	0.961	9	0.614	12	0.850	17
Lisboa (2 NUTS)	0.779	–	0.633	–	0.956	–	0.778	–	0.695	–
Grande Lisboa	0.908	1	0.640	4	0.960	11	0.823	1	0.705	29

Table 4 continued

	Income		Education		Health		PRDI		Governance	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Península de Setúbal	0.263	20	0.614	10	0.945	20	0.535	19	0.664	30
Alentejo (5 NUTS)	0.457	–	0.599	–	0.946	–	0.638	–	0.847	–
Alentejo Litoral	0.673	3	0.624	6	0.940	24	0.734	2	0.830	19
Alto Alentejo	0.404	13	0.616	8	0.946	17	0.618	11	0.912	8
Alentejo Central	0.423	11	0.614	9	0.969	4	0.632	9	0.849	18
Baixo Alentejo	0.375	15	0.606	12	0.844	30	0.577	16	0.864	16
Lezíria do Tejo	0.449	9	0.563	22	0.943	22	0.620	10	0.808	25
Algarve (1 NUTS)	0.594	4	0.627	5	0.945	20	0.706	4	0.778	28
Açores (1 NUTS)	0.441	10	0.507	29	0.890	26	0.584	15	0.786	27
Madeira (1 NUTS)	0.683	2	0.589	18	0.880	28	0.707	3	0.820	22

	PRDI with governance		Environment		PRDI with environment		PRDI with governance and environment	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Portugal	0.700	–	0.620	–	0.651	–	0.683	–
Norte (8 NUTS)	0.632	–	0.520	–	0.551	–	0.608	–
Minho-Lima	0.539	24	0.370	27	0.432	25	0.500	25
Cávado	0.633	17	0.590	14	0.560	16	0.624	16
Ave	0.612	19	0.500	21	0.521	19	0.588	18
Grande Porto	0.710	7	0.650	9	0.669	5	0.697	6
Tâmega	0.000	30	0.330	28	0.000	30	0.000	30
Entre Douro e Vouga	0.642	15	0.240	30	0.461	23	0.527	23
Douro	0.455	28	0.530	19	0.397	27	0.469	27
Alto Trás-os-Montes	0.510	25	0.610	13	0.466	22	0.528	22
Centro (12 NUTS)	0.662	–	0.590	–	0.604	–	0.647	–
Baixo Vouga	0.675	10	0.580	16	0.621	12	0.655	12

Table 4 continued

	PRDI with governance		Environment		PRDI with environment		PRDI with governance and environment	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Baixo Mondego	0.725	4	0.630	11	0.678	4	0.705	5
Pinhal Litoral	0.720	6	0.570	17	0.658	7	0.687	7
Pinhal Interior Norte	0.501	26	0.480	24	0.424	26	0.497	26
Dão-Lafões	0.604	20	0.630	11	0.554	17	0.609	17
Pinhal Interior Sul	0.458	27	0.490	23	0.388	28	0.465	28
Serra da Estrela	0.211	29	0.640	10	0.193	29	0.263	29
Beira Interior Norte	0.555	22	0.480	24	0.469	21	0.539	20
Beira Interior Sul	0.665	12	0.890	1	0.669	6	0.705	4
Cova da Beira	0.548	23	0.400	26	0.448	24	0.515	24
Oeste	0.646	14	0.670	8	0.617	13	0.651	13
Médio Tejo	0.666	11	0.550	18	0.597	15	0.641	15
Lisboa (2 NUTS)	0.757	–	0.770	–	0.776	–	0.759	–
Grande Lisboa	0.792	1	0.870	2	0.835	1	0.807	1
Península de Setúbal	0.564	21	0.500	21	0.526	18	0.551	19
Alentejo (5 NUTS)	0.685	–	0.690	–	0.650	–	0.686	–
Alentejo Litoral	0.757	2	0.700	5	0.725	2	0.745	2
Alto Alentejo	0.681	8	0.700	5	0.637	10	0.685	9
Alentejo Central	0.680	9	0.690	7	0.646	9	0.682	10
Baixo Alentejo	0.638	16	0.830	3	0.632	11	0.672	11
Lezíria do Tejo	0.662	13	0.590	14	0.612	14	0.647	14
Algarve (1 NUTS)	0.723	5	0.780	4	0.724	3	0.734	3
Açores (1 NUTS)	0.629	18	0.280	29	0.486	20	0.535	21
Madeira (1 NUTS)	0.734	3	0.520	20	0.655	8	0.685	8

different from the original PRDI. Only four NUTS III regions changed their ranking placement more than three positions. On the other hand, when we added the Environment dimension, the PRDI with Environment included changed considerably, and almost half of the NUTS III changed their ranking positions more than three positions. The results for the environmental dimension changed the PRDI substantially, even when the two dimensions were included in the calculations of the PRDI (last two columns). In particular, most of the NUTS III regions that improved their relative position are located in the interior of the country. There are NUTS III regions in the top 10 positions that fell out, but even so they remained among the top fifteen in the ranking. These results reflect the major investments made on sewer systems in the interior regions of the country aimed at meeting the goals defined in the Strategic Plan for Water Supply and Sewerage (PEAASAR II), which are: continuity, quality of service, and universality, for which PEAASAR II establishes a target rate of at least 70 % of population coverage for each sewer system.

Table 4 shows results for 2004. As we see, results are not very different from those for 2009, in all dimensions.

In order to see more clearly if the differences are really not substantial between 2004 and 2009, in Table 5 we show the differential in ranking positions in all rankings between these 2 years. Additionally, Figs. 1 and 2 show the best and worst performing NUTS III regions in 2004 and 2009 (ranked according to results for 2009) for the PRDI without the governance and environmental dimensions and for the PRDI with these two dimensions included, respectively.

Numbers in bold in Table 5 represent the greatest changes between 2004 and 2009. In the PRDI ranking between 2004 and 2009 Baixo Vouga and Lezíria do Tejo left the top 10 NUTS III, giving way to Beira Interior Sul and Baixo Alentejo, two NUTS III regions furthest from the coastline. Another three interior NUTS III regions improved their relative positions—Alto Trás-os-Montes, Pinhal Interior Sul, and Baixo Alentejo in the PRDI. The NUTS II Norte underwent the most positive changes in their relative positions during these years, if we consider the PRDI that includes governance and the environment. The NUTS III that saw the most impressive change, in terms of the original PRDI, were Ave and Madeira (which lost five and four positions in the ranking, respectively) and Baixo Alentejo, Alto Trás-os-Montes, Pinhal Interior Sul, and Beira Interior Sul, which climbed respectively, seven, six, six, and five positions in the ranking. Ave's position fell due to losses in the income and health dimensions, and Madeira lost especially as a result of the education dimension. Baixo Alentejo climbed in the ranking due to improvements in the income and education dimension, as did Pinhal Interior Sul. Alto Trás-os-Montes had an increase in both the education and health dimension, and for Beira Interior Sul it was mostly due to the health dimension. When we analyze the changes in the PRDI with the dimensions governance and environment included, the NUTS III that change the most are Douro (−9), Alto Trás-os-Montes (−7), Cova da Beira (−7), Baixo Alentejo (−7), Pinhal Interior Sul (−6), Península de Setúbal (+5), and Pinhal Litoral (+4), due mainly to the changes in the environment dimension, with the exception of Pinhal Interior Sul, Península de Setúbal, and Baixo Alentejo, in which changes in the governance dimension had a greater impact.

The last row of Table 5 shows the volatility (measured by the standard-deviation, in %) of the differentials calculated in each column. The dimensions with the greatest volatility are education (6.7 %), environment (5.5 %), and health (5.4 %), meaning that it was in these dimensions that most changes took place in the period analyzed, reflecting a possible intensification in economic policy toward these dimensions. The least volatile dimensions were income (2.2 %) and governance (3.0 %). The governance dimension reflects social and cultural characteristics of each population, and these features typically change very slowly.

Table 5 Rankings differential between 2009 and 2004

	Income	Education	Health	PRDI	Governance	PRDI with governance	Environment	PRDI with environment	PRDI with governance and environment
Portugal	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Norte (8 NUTS)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Minho-Lima	1	−3	**10**	1	**5**	1	−2	−2	−2
Cávado	0	−2	**−5**	−1	2	**−5**	4	0	−3
Ave	3	1	2	**5**	−1	1	1	3	3
Grande Porto	−1	2	−3	−2	−1	−3	1	0	−1
Tâmega	−1	−2	2	0	0	0	−1	−2	−2
Entre Douro e Vouga	0	**−7**	−1	−1	−2	0	−2	3	3
Douro	−1	**−9**	−2	0	3	−2	**−13**	**−8**	**−9**
Alto Trás-os-Montes	−2	**−18**	**−10**	**−6**	3	−4	−2	**−8**	**−7**
Centro (12 NUTS)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Baixo Vouga	2	3	3	3	2	3	1	−1	0
Baixo Mondego	0	1	−2	−2	2	−1	4	3	2
Pinhal Litoral	1	**6**	0	0	1	2	**7**	**5**	4
Pinhal Interior Norte	2	**−5**	**−5**	2	−1	1	−1	−1	−1
Dão-Lafões	−1	**6**	**−7**	0	2	2	2	1	3
Pinhal Interior Sul	**−6**	−3	**10**	**−6**	−1	**−8**	3	−4	**−6**
Serra da Estrela	1	**−12**	**−6**	0	2	0	**−6**	−2	−2
Beira Interior Norte	2	−2	0	0	3	1	**−12**	−1	−1
Beira Interior Sul	−3	−1	**−10**	**−5**	**6**	**−6**	0	−3	−1
Cova da Beira	3	−4	**13**	2	1	1	**−19**	**−7**	**−7**
Oeste	2	1	−4	1	−4	3	0	−3	−3
Médio Tejo	0	**9**	−3	2	0	**5**	2	0	1
Lisboa (2 NUTS)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Table 5 continued

	Income	Education	Health	PRDI	Governance	PRDI with governance	Environment	PRDI with environment	PRDI with governance and environment
Grande Lisboa	0	**12**	1	0	0	0	0	0	0
Península de Setúbal	−1	**14**	0	2	0	**7**	0	3	**5**
Alentejo (5 NUTS)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Alentejo Litoral	0	3	2	0	**−6**	0	**9**	0	0
Alto Alentejo	2	0	**8**	1	−2	3	−1	−2	−1
Alentejo Central	2	**−5**	**12**	1	−4	1	**8**	0	−1
Baixo Alentejo	**−7**	**−6**	−2	**−7**	**−7**	**−11**	0	**−5**	**−7**
Lezíria do Tejo	3	−3	2	3	−4	1	**5**	−1	0
Algarve (1 NUTS)	0	**12**	1	0	−2	2	4	1	3
Açores (1 NUTS)	−1	1	3	3	−2	0	n.a.	n.a.	n.a.
Madeira (1 NUTS)	0	**11**	2	4	**6**	**6**	n.a.	n.a.	n.a.
Volatility	2.2	6.7	5.4	2.7	3.0	3.6	5.5	2.9	3.2

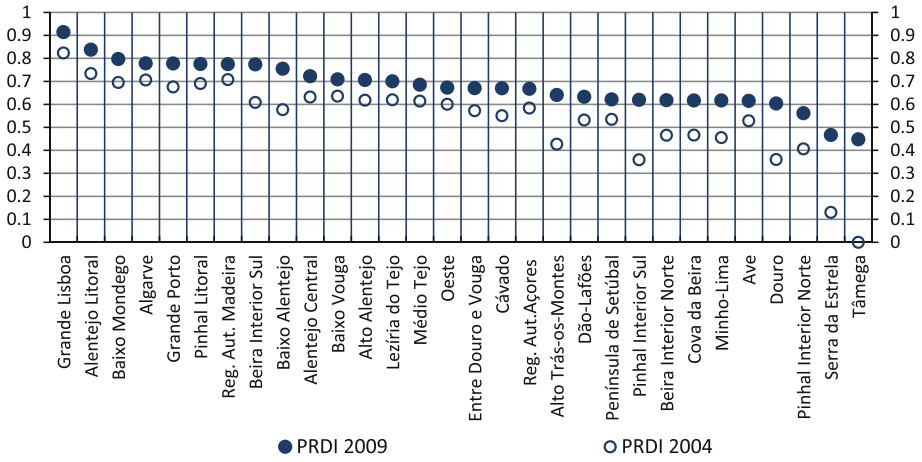

Fig. 1 Best and worst performing NUTS III regions—PRDI without the governance and environmental dimensions

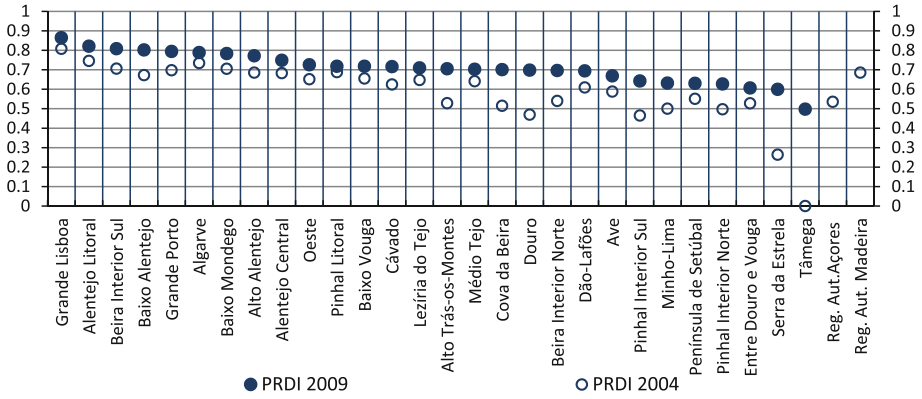

Fig. 2 Best and worst performing NUTS III regions—PRDI with the governance and environmental dimensions

If we look at the differences in the value of the PRDI (original and the final one with the governance and environmental dimensions included) between the first and the last NUTS III in the ranking, we can see that the dispersion between the two has decreased, although differences are still considerable. In all the individual dimensions it was the same, with the exception of education, which slightly increased the spread between the first and last NUTS III in the ranking.

Figures 1 and 2 corroborate these conclusions—both differences between years and also between indexes calculated using the governance and environmental dimensions or calculated without the governance and environmental dimensions.

Results for 2005, 2006, 2007, and 2008, which are in Appendix 2, differ little from those reported above.

Because the SIRD, published by the INE and the DPPRI, also has data spanning from 2004 to 2009, we make a tentative comparison between the position of the NUTS III regions in our index and theirs. We compare only the years of 2004 and 2009 and use our PRDI with Governance and Environment included since the other index also includes similar dimensions. Grande Lisboa is ranked number one in both indices. In the first 15

positions the two indicators share more than 50 % of the same NUTS III regions, although with the exception of Grande Lisboa, and Pinhal Litoral in 2009, whose relative positions in each index are different. This comparison provides confidence about the trustworthiness of our results and ranking construction.

6 Conclusions

In this paper we built a regional development index for Portuguese NUTS III regions (PRDI), constructed in a way that resembles the methodology of the HDI by the UNDP. We also used the same variables used in the HDI whenever they are available. Results show us a country that has most of the highest ranked NUTS III regions positioned on the coast, with Grande Lisboa occupying the first position in the ranking, although three NUTS III regions that are in the interior moved into the top 10 in 2009—Beira Interior Sul, Baixo Alentejo, and Alentejo Central—and other interior NUTS III regions improved their relative positions in the ranking. Perhaps this repositioning in the ranking for some interior NUTS III regions signals a reduction of regional asymmetries, at least in some regions. Our simple calculation of the dispersion between the first and the last positioned NUTS III in 2004 and 2009, shows a decrease in the dispersion in all dimensions, except education. However, the overall evolution that we have revealed in this work shows a country that still has considerable regional asymmetries and is much in need of coherent and persistent regional policies. Results of our PRDI for Portugal are very similar in value and in the upward trend to the results obtained in the HDI of the UNDP. We have also advanced some tentative explanations for our results based on a report from OECD (2008) that justifies the regional asymmetries present in Portugal with the specialization pattern of each region and its capacity for growth.

In addition to the traditional dimensions of the HDI—income, health, and education—we included governance and environment, given the main criticisms pointed out in the literature about HDI. Results show some considerable differences when we add the environment dimension, but in terms of governance they change little. When the environmental dimension is added, most of the NUTS III regions that improve their relative position in the ranking are located in the interior of the country. This finding reflects the goal defined by environmental public policies to achieve at least a 70 % coverage rate of sewer systems, especially in the regions with lower coverage rates.

The dimensions with the greatest volatility in the period analyzed are education, health, and the environment, possibly reflecting some reinforcement of economic policies in these areas. The least volatile dimensions are income and governance, which reflect sociocultural characteristics of the population that are very hard to change, especially the last dimension.

We also made a comparison with the recently published SIRD and results are very similar, with the majority of the NUTS III regions the same in the top 15 ranking positions, although only Grande Lisboa maintains its relative position in the first place (and Pinhal Litoral in the 6th position in 2009 in both rankings). This comparison confirms the reliability of our results and ranking construction.

Since it is built with the methodology of the UNDP, our index allows for international comparisons with other regional development indices that use the same methodology.

Avenues for future research include the continuity of this ranking in time and the use of the ranking in econometric estimations in order to understand the main determinants of regional asymmetries in Portugal. A comparison with other European countries in which regional policy is also applied can be made. This research could help to improve the efficiency of regional policy in Portugal.

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Appendix 1: List and Map of NUTS III for Portugal

Portugal (*NUTS I*)

Norte (*NUTS II–8 NUTS III*)

Alto Trás-os-Montes
Ave
Cávado
Douro
Entre Douro e Vouga
Grande Porto
Minho-Lima
Tâmega

Centro (*NUTS II–12 NUTS III*)

Baixo Mondego
Baixo Vouga
Beira Interior Norte
Beira Interior Sul
Cova da Beira
Dão-Lafões
Médio Tejo
Oeste
Pinhal Interior Norte
Pinhal Interior Sul
Pinhal Litoral
Serra da Estrela

Lisboa (*NUTS II–2 NUTS III*)

Grande Lisboa
Península de Setúbal

Alentejo (*NUTS II–5 NUTS III*)

Alentejo Central
Alentejo Litoral
Alto Alentejo
Baixo Alentejo
Lezíria do Tejo

Algarve (*NUTS II–1 NUTS III*)
Região Autónoma dos Açores (*NUTS II–1 NUTS III*)
Região Autónoma da Madeira (*NUTS II–1 NUTS III*)

See Fig. 3.

Fig. 3 Map of Portugal with NUTS III

Appendix 2: Tables for the Portuguese Regional Development Index for 2005–2008

See Tables 6, 7, 8 and 9.

Table 6 Portuguese regional development index for 2005

	Income		Education		Health		PRDI		Environment		PRDI with environment	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Portugal	0.536	–	0.592	–	0.959	–	0.673	–	0.640	–	0.664	–
Norte (8 NUTS)	0.354	–	0.561	–	0.963	–	0.576	–	0.550	–	0.569	–
Minho-Lima	0.187	25	0.602	14	0.964	9	0.477	24	0.390	27	0.454	26
Cávado	0.317	18	0.576	20	0.964	10	0.560	18	0.590	18	0.567	17
Ave	0.288	19	0.547	26	0.961	14	0.533	21	0.510	21	0.527	19
Grande Porto	0.557	5	0.605	13	0.963	12	0.687	7	0.730	6	0.698	5
Tâmega	0.035	29	0.464	30	0.956	19	0.250	29	0.350	28	0.272	30
Entre Douro e Vouga	0.380	16	0.524	27	0.973	3	0.579	17	0.260	29	0.474	23
Douro	0.144	28	0.581	19	0.947	24	0.429	26	0.550	19	0.457	25
Alto Trás-os-Montes	0.190	24	0.563	21	0.958	16	0.468	25	0.640	12	0.506	20
Centro (12 NUTS)	0.403	–	0.603	–	0.967	–	0.617	–	0.630	–	0.620	–
Baixo Vouga	0.493	8	0.557	23	0.974	2	0.644	8	0.640	12	0.643	12
Baixo Mondego	0.523	7	0.689	1	0.972	4	0.705	5	0.660	10	0.693	6
Pinhal Litoral	0.542	6	0.624	7	0.971	5	0.690	6	0.620	15	0.672	7
Pinhal Interior Norte	0.149	27	0.522	28	0.953	21	0.420	28	0.500	22	0.438	28
Dão-Lafões	0.284	20	0.598	15	0.970	6	0.548	19	0.650	11	0.572	16
Pinhal Interior Sul	0.150	26	0.554	25	0.939	27	0.427	27	0.500	22	0.444	27
Serra da Estrela	0.021	30	0.591	17	0.956	17	0.229	30	0.640	12	0.296	29
Beira Interior Norte	0.219	23	0.593	16	0.966	8	0.501	23	0.490	25	0.498	21
Beira Interior Sul	0.414	13	0.674	2	0.956	17	0.644	9	0.890	1	0.698	4
Cova da Beira	0.228	22	0.607	11	0.974	1	0.512	22	0.430	26	0.490	22
Oeste	0.417	12	0.556	24	0.954	20	0.605	15	0.670	9	0.621	13
Médio Tejo	0.360	17	0.648	3	0.962	13	0.607	14	0.600	16	0.606	15
Lisboa (2 NUTS)	0.801	–	0.633	–	0.960	–	0.787	–	0.770	–	0.782	–

Table 6 continued

	Income		Education		Health		PRDI		Environment		PRDI with environment	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Grande Lisboa	0.933	1	0.640	4	0.963	11	0.832	1	0.880	2	0.844	1
Península de Setúbal	0.272	21	0.614	10	0.949	23	0.541	20	0.500	22	0.531	18
Alentejo (5 NUTS)	0.476	–	0.599	–	0.955	–	0.648	–	0.700	–	0.661	–
Alentejo Litoral	0.780	2	0.624	6	0.940	26	0.771	2	0.700	7	0.752	2
Alto Alentejo	0.404	14	0.616	8	0.953	22	0.619	11	0.740	5	0.647	11
Alentejo Central	0.431	10	0.614	9	0.968	7	0.635	10	0.700	7	0.651	10
Baixo Alentejo	0.403	15	0.606	12	0.933	28	0.611	13	0.840	3	0.661	9
Lezíria do Tejo	0.426	11	0.563	22	0.958	15	0.613	12	0.600	16	0.609	14
Algarve (1 NUTS)	0.619	4	0.627	5	0.945	25	0.716	4	0.790	4	0.734	3
Açores (1 NUTS)	0.471	9	0.507	29	0.901	29	0.599	16	0.210	30	0.461	24
Madeira (1 NUTS)	0.702	3	0.589	18	0.889	30	0.716	3	0.540	20	0.667	8

Governance data are unavailable between 2005 and 2008

Table 7 Portuguese regional development index for 2006

	Income		Education		Health		PRDI		Environment		PRDI with environment	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Portugal	0.566	–	0.573	–	0.965	–	0.679	–	0.760	–	0.698	–
Norte (8 NUTS)	0.382	–	0.545	–	0.968	–	0.586	–	0.640	–	0.599	–
Minho-Lima	0.231	25	0.565	17	0.964	13	0.501	24	0.450	25	0.488	25
Cávado	0.343	18	0.567	16	0.972	7	0.574	19	0.650	18	0.592	18
Ave	0.305	21	0.543	22	0.963	14	0.543	21	0.750	10	0.588	19
Grande Porto	0.578	5	0.584	12	0.970	8	0.689	7	0.790	7	0.713	7
Tâmega	0.089	29	0.448	30	0.963	14	0.337	29	0.350	27	0.340	30
Entre Douro e Vouga	0.398	16	0.517	27	0.984	1	0.587	17	0.250	29	0.474	27
Douro	0.189	28	0.559	18	0.952	24	0.465	27	0.800	6	0.532	23
Alto Trás-os-Montes	0.223	26	0.540	25	0.961	20	0.487	26	0.780	8	0.548	21
Centro (12 NUTS)	0.431	–	0.589	–	0.972	–	0.627	–	0.650	–	0.633	–
Baixo Vouga	0.502	10	0.553	20	0.977	4	0.647	10	0.650	18	0.648	11
Baixo Mondego	0.542	7	0.659	1	0.979	2	0.704	5	0.740	12	0.713	6
Pinhal Litoral	0.577	6	0.605	7	0.976	5	0.698	6	0.450	25	0.626	14
Pinhal Interior Norte	0.202	27	0.495	29	0.962	18	0.458	28	0.550	24	0.479	26
Dão-Lafões	0.320	20	0.582	13	0.973	6	0.566	20	0.620	20	0.579	20
Pinhal Interior Sul	0.245	24	0.540	23	0.945	27	0.500	25	0.680	16	0.540	22
Serra da Estrela	0.059	30	0.556	19	0.956	22	0.315	30	0.620	20	0.373	29
Beira Interior Norte	0.267	23	0.591	10	0.967	12	0.534	22	0.830	5	0.596	17
Beira Interior Sul	0.451	12	0.640	3	0.962	17	0.652	9	1.000	1	0.726	5
Cova da Beira	0.272	22	0.571	15	0.978	3	0.534	23	0.330	28	0.473	28
Oeste	0.440	14	0.552	21	0.962	16	0.616	13	0.750	10	0.647	12
Médio Tejo	0.395	17	0.648	2	0.969	9	0.628	12	0.620	20	0.626	13
Lisboa (2 NUTS)	0.824	–	0.607	–	0.966	–	0.785	–	0.830	–	0.796	–

Table 7 continued

	Income		Education		Health		PRDI		Environment		PRDI with environment	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Grande Lisboa	0.949	1	0.613	4	0.969	11	0.826	1	0.890	3	0.842	1
Península de Setúbal	0.343	19	0.590	11	0.958	21	0.579	18	0.660	17	0.598	16
Alentejo (5 NUTS)	0.519	–	0.568	–	0.958	–	0.656	–	0.730	–	0.674	–
Alentejo Litoral	0.845	2	0.608	5	0.950	26	0.787	2	0.720	13	0.770	2
Alto Alentejo	0.406	15	0.540	24	0.954	23	0.594	16	0.920	2	0.662	9
Alentejo Central	0.443	13	0.606	6	0.969	9	0.638	11	0.700	15	0.653	10
Baixo Alentejo	0.524	8	0.578	14	0.940	28	0.658	8	0.850	4	0.701	8
Lezíria do Tejo	0.455	11	0.532	26	0.961	19	0.615	14	0.600	23	0.611	15
Algarve (1 NUTS)	0.649	4	0.596	8	0.951	25	0.716	4	0.770	9	0.729	4
Açores (1 NUTS)	0.502	9	0.509	28	0.911	29	0.615	15	0.250	29	0.491	24
Madeira (1 NUTS)	0.780	3	0.594	9	0.892	30	0.745	3	0.720	13	0.739	3

Governance data are unavailable between 2005 and 2008

Table 8 Portuguese regional development index for 2007

	Income		Education		Health		PRDI		Environment		PRDI with environment	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Portugal	0.603	–	0.607	–	0.969	–	0.708	–	n.a.	–	n.a.	–
Norte (8 NUTS)	0.427	–	0.582	–	0.973	–	0.623	–	0.590	–	0.615	–
Minho-Lima	0.254	26	0.644	5	0.962	20	0.540	24	0.450	24	0.516	23
Cávado	0.389	18	0.590	20	0.981	4	0.608	18	0.610	18	0.609	17
Ave	0.351	21	0.571	26	0.970	15	0.580	21	0.350	26	0.511	24
Grande Porto	0.627	5	0.627	9	0.973	11	0.726	6	0.840	5	0.753	3
Tâmega	0.138	29	0.479	30	0.965	17	0.400	29	0.300	27	0.372	28
Entre Douro e Vouga	0.443	15	0.562	27	0.991	1	0.627	17	0.260	28	0.503	25
Douro	0.219	28	0.580	25	0.956	23	0.495	28	0.860	4	0.569	20
Alto Trás-os-Montes	0.258	25	0.585	23	0.961	21	0.525	26	0.820	7	0.587	19
Centro (12 NUTS)	0.465	–	0.621	–	0.975	–	0.655	–	0.650	–	0.654	–
Baixo Vouga	0.541	9	0.586	22	0.979	6	0.677	10	0.620	17	0.662	10
Baixo Mondego	0.575	7	0.705	1	0.982	2	0.736	5	0.710	13	0.729	6
Pinhal Litoral	0.613	6	0.625	10	0.982	3	0.722	7	0.450	24	0.641	13
Pinhal Interior Norte	0.235	27	0.535	28	0.970	14	0.496	27	0.500	22	0.497	26
Dão-Lafões	0.355	20	0.624	11	0.975	9	0.600	19	0.690	15	0.622	16
Pinhal Interior Sul	0.261	24	0.593	18	0.953	25	0.528	25	0.710	13	0.569	21
Serra da Estrela	0.082	30	0.591	19	0.965	18	0.361	30	0.480	23	0.387	27
Beira Interior Norte	0.291	22	0.598	16	0.971	12	0.553	22	0.810	8	0.608	18
Beira Interior Sul	0.481	12	0.673	3	0.970	13	0.680	8	0.960	1	0.741	5
Cova da Beira	0.282	23	0.610	15	0.980	5	0.552	23	0.550	21	0.552	22
Oeste	0.470	13	0.582	24	0.967	16	0.642	14	0.770	9	0.672	9
Médio Tejo	0.434	17	0.673	2	0.977	7	0.659	11	0.600	19	0.643	12
Lisboa (2 NUTS)	0.860	–	0.635	–	0.971	–	0.809	–	0.850	–	0.819	–

Table 8 continued

	Income		Education		Health		PRDI		Environment		PRDI with environment	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Grande Lisboa	0.988	1	0.644	4	0.975	8	0.853	1	0.890	3	0.862	1
Península de Setúbal	0.365	19	0.611	14	0.963	19	0.599	20	0.740	11	0.631	15
Alentejo (5 NUTS)	0.548	–	0.609	–	0.958	–	0.684	–	0.720	–	0.693	–
Alentejo Litoral	0.872	2	0.614	13	0.950	27	0.798	2	0.730	12	0.781	2
Alto Alentejo	0.437	16	0.634	6	0.955	24	0.642	15	0.930	2	0.704	8
Alentejo Central	0.463	14	0.630	7	0.973	10	0.657	12	0.560	20	0.631	14
Baixo Alentejo	0.556	8	0.595	17	0.943	28	0.678	9	0.840	5	0.716	7
Lezíria do Tejo	0.488	11	0.587	21	0.961	22	0.651	13	0.640	16	0.648	11
Algarve (1 NUTS)	0.686	4	0.628	8	0.952	26	0.743	4	0.770	9	0.749	4
Açores (1 NUTS)	0.534	10	0.523	29	0.916	29	0.635	16	n.a.	n.a.	n.a.	n.a.
Madeira (1 NUTS)	0.793	3	0.623	12	0.894	30	0.762	3	n.a.	n.a.	n.a.	n.a.

We have no environmental data available for the Autonomous Regions of the Azores and Madeira for 2007, 2008, and 2009. Governance data are unavailable between 2005 and 2008

Table 9 Portuguese regional development index for 2008

	Income		Education		Health		PRDI		Environment		PRDI with Environment	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Portugal	0.614	–	0.618	–	0.972	–	0.717	–	n.a.	–	n.a.	–
Norte (8 NUTS)	0.444	–	0.602	–	0.977	–	0.639	–	0.650	–	0.642	–
Minho-Lima	0.285	26	0.646	5	0.970	18	0.563	26	0.480	25	0.541	23
Cávado	0.418	17	0.614	19	0.987	2	0.632	17	0.690	16	0.646	15
Ave	0.368	20	0.593	23	0.978	8	0.597	21	0.360	27	0.526	24
Grande Porto	0.639	5	0.643	7	0.978	9	0.738	6	0.900	3	0.775	2
Tâmega	0.150	29	0.498	30	0.970	17	0.417	29	0.370	26	0.405	28
Entre Douro e Vouga	0.439	15	0.570	27	0.996	1	0.629	18	0.250	28	0.500	26
Douro	0.264	27	0.630	13	0.958	24	0.542	27	0.890	5	0.614	21
Alto Trás-os-Montes	0.303	23	0.626	15	0.973	14	0.569	23	0.810	11	0.622	18
Centro (12 NUTS)	0.464	–	0.627	–	0.979	–	0.658	–	0.720	–	0.673	–
Baixo Vouga	0.535	9	0.582	25	0.980	7	0.673	9	0.740	14	0.689	9
Baixo Mondego	0.586	7	0.716	1	0.984	3	0.745	5	0.750	12	0.746	5
Pinhal Litoral	0.610	6	0.630	14	0.984	3	0.723	7	0.520	24	0.666	12
Pinhal Interior Norte	0.236	28	0.531	29	0.976	11	0.497	28	0.610	22	0.523	25
Dão-Lafões	0.359	21	0.625	16	0.981	6	0.604	19	0.750	12	0.637	16
Pinhal Interior Sul	0.350	22	0.578	26	0.943	27	0.575	22	0.590	23	0.579	22
Serra da Estrela	0.114	30	0.622	18	0.955	26	0.408	30	0.650	20	0.458	27
Beira Interior Norte	0.299	24	0.623	17	0.972	15	0.566	25	0.820	10	0.621	19
Beira Interior Sul	0.482	12	0.662	3	0.972	16	0.677	8	0.950	1	0.737	6
Cova da Beira	0.295	25	0.633	12	0.975	12	0.567	24	0.840	7	0.626	17
Oeste	0.454	14	0.587	24	0.967	19	0.636	16	0.830	9	0.680	11
Médio Tejo	0.412	18	0.696	2	0.984	3	0.656	13	0.660	19	0.657	14
Lisboa (2 NUTS)	0.871	–	0.638	–	0.973	–	0.815	–	0.840	–	0.821	–

Table 9 continued

	Income		Education		Health		PRDI		Environment		PRDI with Environment	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Grande Lisboa	1.000	1	0.652	4	0.977	10	0.861	1	0.900	3	0.870	1
Península de Setúbal	0.379	19	0.600	21	0.965	20	0.603	20	0.670	17	0.619	20
Alentejo (5 NUTS)	0.548	–	0.625	–	0.959	–	0.690	–	0.760	–	0.707	–
Alentejo Litoral	0.888	2	0.645	6	0.955	25	0.818	2	0.650	20	0.772	3
Alto Alentejo	0.437	16	0.642	8	0.958	23	0.646	15	0.920	2	0.705	8
Alentejo Central	0.481	13	0.639	9	0.974	13	0.669	11	0.730	15	0.684	10
Baixo Alentejo	0.507	10	0.635	11	0.938	28	0.671	10	0.870	6	0.716	7
Lezíria do Tejo	0.493	11	0.594	22	0.959	21	0.655	14	0.670	17	0.659	13
Algarve (1 NUTS)	0.688	4	0.636	10	0.958	22	0.748	4	0.840	7	0.770	4
Açores (1 NUTS)	0.561	8	0.559	28	0.918	29	0.660	12	n.a.	n.a.	n.a.	n.a.
Madeira (1 NUTS)	0.826	3	0.611	20	0.903	30	0.770	3	n.a.	n.a.	n.a.	n.a.

We have no environmental data available for the Autonomous Regions of the Azores and Madeira for 2007, 2008, and 2009. Governance data are unavailable between 2005 and 2008

References

Aguña, C. G., & Kovacevic, M. (2011). *Uncertainty and sensitivity analysis of the human development index*. Human Development Research Paper 2010/47, February.

Alkire, S. (2010). *Human development: Definitions, critiques, and related concepts*. Human Development Research Paper 2010/01, June.

Alkire, S., & Foster, J. (2010). *Designing the inequality-adjusted human development index (IDHI)*. Human Development Research Paper 2010/28, October.

Basu, S., & Basu, P. (2005). Regional disparity in Australia: Analysis of gender development index. *International Review of Business Research Papers, 1*(2), 56–66.

Burd-Sharps, S., Lewis, K., Guyer, P., & Lechterman, T. (2010). *Twenty years of human development in six affluent countries: Australia, Canada, Japan, New Zealand, the United Kingdom, and the United States*. Human Development Research Paper 2010/27, October.

Carvalho, A. C., & Matias, S. (2004). Índices de Desenvolvimento para as Regiões Portuguesas—2001. *Prospectiva e Planeamento, 10*, 87–161.

Çolak, M. S., & Ege, A. (2013). An assessment of EU 2020 strategy: Too far to reach? *Social Indicators Research, 110*, 659–680.

Conim, C. N. P. S. (1998). Desenvolvimento Humano—Uma perspectiva de sistematização (1970–1995). *Prospectiva e Planeamento, 3*(4), 279–307.

Conim, C. N. P. S. (1999). *População e Desenvolvimento Humano—Uma perspectiva de quantificação*. Lisboa: DPP.

Conim, C. N. P. S., & Matias, S. (2002). *População e Desenvolvimento Humano—Uma perspectiva de quantificação 1970–1999*. Lisboa: DPP.

de la Torre, R., & Moreno, H. (2010). *Advances in sub-national measurement of the human development index: The case of Mexico*. Human Development Research Paper 2010/23, July.

Diniz, F., & Sequeira, T. (2008). Uma possível hierarquização através de um índice de desenvolvimento económico e social dos concelhos de Portugal Continental. *Interacções, 9*(1), 19–28.

Gaye, A., & Jha, S. (2010). *A review of conceptual and measurement innovations in national and regional human development reports, 1998–2009*. Human Development Research Paper 2010/21, July.

Hicks, D. A. (1997). The inequality-adjusted human development index: A constructive proposal. *World Development, 25*(8), 1283–1298.

INE, DPPRI. (2009). *Índice Sintético de Desenvolvimento Regional*. Portugal: Instituto Nacional de Estatística, Departamento de Prospectiva e Planeamento e Relações Internacionais.

Kovacevic, M. (2010), *Measurement of inequality in human development—A review*. Human Development Research Paper 2010/35, November.

Kovacevic, M. (2011). *Review of HDI critiques and potential improvements*. Human Development Research Paper 2010/33, February.

Maddison, A. (2010). *Historical statistics of world economy: 1–2008 AD*. Paris: Organization for Economic Cooperation and Development.

Matias, S. (2002). Tendências da Evolução do Desenvolvimento Humano em Portugal. *Prospectiva e Planeamento, 8*, 47–84.

McGillivray, M., & White, H. (1993). Measuring development? The UNDP's human development index. *Journal of International Development, 5*(2), 183–192.

Neumayer, E. (2001). The human development index and sustainability—A constructive proposal. *Ecological Economics, 39*, 101–114.

Neumayer, E. (2010). *Human development and sustainability*. Human Development Research Paper 2010/05, June.

Noorbakhsh, F. (1998a). A modified human development index. *World Development, 26*(3), 517–528.

Noorbakhsh, F. (1998b). The human development index: Some technical issues and alternative indices. *Journal of International Development, 10*, 589–605.

Noorbakhsh, F. (2002). Human development and regional disparities in Iran: A policy model. *Journal of International Development, 14*, 927–949.

Noorbakhsh, F. (2003). Human development and regional disparities in India. University of Glasgow Business School Working Paper Series 2003–12.

Noorbakhsh, F. (2005). Spatial inequality, polarization and its dimensions in Iran: New empirical evidence. *Oxford Development Studies, 33*(3–4), 473–491.

OECD. (2008). *OECD territorial reviews*. Portugal: OECD.

OECD. (2011). *OECD better life initiative compendium of OECD well-being indicators*. Portugal: OECD.

Pagliani, P. (2010). *Influence of regional, national and sub-national HDRs*. Human Development Research Paper 2010/19, July.
Peinado, J. M., & Céspedes, G. C. (2004). Gender and regional inequality in human development: The case of Spain. *Feminist Economics, 10*(1), 37–64.
Pradhan, R., & Sanyal, G. S. (2011). Good governance and human development: Evidence from Indian States. *Journal of Social and Development Science, 1*(1), 1–8.
Ramos, P. N., & Rodrigues, A. (2001). Porque é diferente o PIB per capita das Regiões Portuguesas? *Cadernos Regionais, 13*, 5–14.
Ravallion, M. (1997). Good and bad growth: The human development reports. *World Development, 25*(5), 631–638.
Riley, J. C. (2005). *Poverty and life expectancy*. Cambridge, UK: Cambridge University Press.
Sagar, A. D., & Najam, A. (1998). The human development index: A critical review. *Ecological Economics, 25*, 249–264.
Sen, A. (1984). *Resources, values, and development*. Oxford: Basil Blackwell.
Tadjoeddin, M. Z., Suharyo, W. I., & Mishra, S. (2001). Regional disparity and vertical conflict in Indonesia. *Journal of the Asia Pacific Economy, 6*(3), 283–304.
UNDP. (2013). *Human development report 2013—The rise of the south, human progress in a diverse world*. Technical Notes. United Nations Development Programme.
Wolf, H., Chong, H., & Auffhammer, M. (2011). Classification, detection, and consequences of data error: Evidence from the human development index. *The Economic Journal, 121*(553), 843–870.