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## ***A Regional Human Development Index for Portugal***

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# A Regional Human 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 still a country very much marked by regional asymmetries and in need of better regional governance mechanisms and policies. In the face of these conclusions it becomes important to address the issue of constructing an index of regional development for Portuguese regions to better assess the evolution of the differential between regions. We propose a regional human 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 (UNDP). Results show us a country that has most of the highest ranked NUTS III positioned in the coastline, although some interior NUTS III regions improve their relative positions in the ranking between 2004 and 2008. Additionally to the traditional dimensions of the HDI, we also added two dimensions, that we choose to include, given the main criticisms pointed in the literature to the HDI - governance and environment. Results show some significative differences when we add the environment dimension, but in terms of governance they don't change significantly.

*JEL Classification:* C43, O15, O18, R11.

*Keywords:* Human Development Index, Regional Asymmetries, Portugal.

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# 1 Introduction

In a report from 2008 the Organization for Economic Cooperation and Development (OECD) came to the conclusion that Portugal is still a country very much marked by regional asymmetries and in need of better regional governance mechanisms and policies. In the face of these conclusions it becomes important to address the issue of constructing an index of regional development for Portuguese regions to better assess the evolution of the differential between regions. In this work we propose a regional human development index for Portugal at the NUTS III level (Nomenclature of Territorial Units for Statistics, level III), based on the Human Development Index (HDI) from the United Nations Development Programme (UNDP).

The first Human Development Report of the United Nations Development Programme (UNDP), that comprised the Human Development Index (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, brought a new perspective that is today an indisputable presence on the measurement of development. The designers of the index believed that the development of a country should be measured not only by its national or domestic income, but also by other dimensions, namely its life expectancy, and the educational level of its population, and believed that the index helped in distinguished between good and bad growth (Ravallion, 1997). The HDI, whose concept has been progressively developed and deepened over 20 years of Human Development Report of UNDP, has been replicated in numerous reports of national and regional levels in different countries, and used as reference for the creation of various indicators of development.

Internationally, the demand for indicators that incorporate other perspectives beyond the purely economic aspect in assessing the performance of countries, has been the focus of a series of initiatives in recent years. The adoption of complementary indicators to Gross Domestic Product (GDP) has also made the political agenda of the European Commission. The conference "Beyond GDP", held in 2007 by a group of entities, namely the European Commission, the European Parliament, Club of Rome, the World Wide Fund for Nature (WWF), and the Organization for Economic Cooperation and Development (OECD), revealed the relevance of this issue and received strong support from policymakers, experts of economic, social, and environmental fields, and also by civil society regarding the development of indicators that complement GDP. The Commission issued in August 2009 a communication to the Council and the European Parliament entitled

"Beyond GDP" which establishes an action plan for the integration of indicators that complement GDP in political decisions. The OECD Better Life Initiative is also another international project in which citizens of 34 countries can compare well-being based on eleven dimensions considered as essential. It is an interactive tool in which each citizen can choose the relevant dimensions in his/her opinion, so each person builds his/her own index and compare the relative position of his/her country. The Oxford Poverty and Human Development Initiative (OPHI) has also a multidimensional perspective (Alkire and Santos, 2010).

Over these 20 years the HDI has suffered many critiques. 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 didn't add nothing new to the already existing indexes. Higher correlation of the different components was also pointed out. Differences between measures for the variables (specially the ones related to education) in each year was also noticed. Noorbakhsh (1998b) also refers that the index is sensitive to the minimum and maximum range for each variable/dimension and also suffers from a scale effect in the education related variables (Noorbakhsh, 1998a). Sagar and Najam (1998) proposed technical modifications to the index, namely in terms of 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). These questions are also discussed in Herrero *et al.* (2010), in which the authors also proposed different variables to be used for the current dimensions of the HDI. A review of the main critiques can be found in Kovacevic (2011). Aguña and Kovacevic (2011) supply a overview of the methodological modifications suffered by the HDI over these 20 years and discussed the impacts of these modifications. Wolff *et al* (2011) identify sources of data error in the HDI and reach the conclusion that near 34% of countries represented in the index are poorly classified.

A critical discussion surrounding the concept of development involving the HDI but also other multidimensional indexes can be found in Alkire (2010). The inclusion of new variables, reflecting different dimensions than the ones presented in the HDI, are among the concerns related to the improvement of the index. Neumayer (2001, 2010) proposes a sustainability dimension related to the environment and Fuentes-Nieva and Pereira (2010) also discuss the environmental dimension and possible indicators. Graham (2010) discusses the implications of using happiness surveys.

Cheibub (2010) discusses the introduction of a dimension reflecting the political institutions and settings of countries. 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 - inequality, happiness, civil rights, freedom, violence, crime, environmental, governance, to name a few.

Some tentative efforts have been made in an already significative array of countries to measure human development at the regional level. The UNDP has information in its website about national and regional Human Development Reports, which are self-initiatives of the countries, made in close collaboration with the UNDP.<sup>1</sup> A review of these initiatives can be found in Gaye and Jha (2010) and also in Pagliani (2010). Some of these indexes have been used with the aim of helping regional policy formulation as it is the case of Noorbakhsh (2002, 2005) for Iran, Noorbakhsh (2003) for India, and Tadjoeeddin *et al* (2001) for Indonesia, to name a few. There are also research relating regional HDI with gender inequality as it is the case of Peinado and Céspedes (2004) for Spain and Basu and Basu (2005) for Australia states and territories and research relating the HDI with crime, violence, and inequality (Torre and Moreno, 2010).

In Portugal there are already some studies about using composite indicators for monitoring human development. There are works that merely take a look 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 Açores 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 built 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) provide studies that aim to reproduce the HDI for Portugal, at the national and regional level (NUTS II, NUTS III, and municipalities), and including some new variables related to comfort and technology, for example. Unfortunately the work from these authors stopped in 2001. In 2009, the National Statistics Office and the DPPRI (former DPP), in a joint collaboration, presented the new synthetic index of regional

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<sup>1</sup>[http://hdr.undp.org/external/toolkit/contents/hdr\\_included.html](http://hdr.undp.org/external/toolkit/contents/hdr_included.html).

development (SIRD) that is a compound of three dimensions - competitiveness, social cohesion, and environmental quality (INE, DPP, 2009). The series presents data since 2004 until 2008 (last update).

In this work we built a composite indicator, similar to the HDI and using its methodological framework, to measure the level of human development of Portuguese NUTS III regions, using the three basic dimensions of analysis of the referred composite index: a long and healthy life, access to knowledge, and a decent standard of living. Our work is similar to the work developed previously by the DPP. We did not include all the set of variables present in the SIRD, built by the INE and the DPPRI, since we think our index, which is similar to the HDI and uses the same dimensions, trying also to use the same variables, when available, allows for the possibility of making a comparison with other regional indexes for other countries, built with the same methodology. This is particularly important for the comparison of the efficiency of regional policy across the regions of European Union member countries. We make a comparison of the ranking positions of the NUTS III regions, also analyzing its dynamic evolution for the period between 2004 and 2008. We also added two extra dimensions to the HDI, reflecting the current critical discussion about future developments for the HDI - environment and governance. We compare the values we obtained for the value of the HDI for Portugal with the value obtained in the HDI of the UNDP and obtain close values and the same evolution presented in the HDI (UNDP). Our results still point to a particular important role for regional policy.

The remainder of this paper is structured as follows. In Section two we describe our data set, providing details on the construction of some variables. In Section three we describe our methodological procedure to construct our index and in Section four we analyze our results. Finally, Section five concludes.

## **2 Data**

In this section we describe the data used in this work. Our main data source is the Portuguese National Statistics Office. The Portuguese National Statistics Office (INE) not only produces statistics, but it gathers data from other institutions, that are also official and recognized producers of data. INE database also comprises information from these institutions.

Our variables are all regional, defined at the geographical level NUTS III, corresponding to

the Nomenclature of Territorial Units for Statistics, level III, representing thirty (30) regions of the Portuguese territory. The current division of NUTS III in Portugal was defined in 2002. See Appendix A for the complete list of NUTS III for 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 2009. The values for this indicator for 2005 and beyond reflect a different methodology from that used in the calculation for previous 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 it exists for the period between 1995 and 2008. Data have not been corrected for purchasing power parity, but this is not a problem since we are working with regions of the same country, and the inflation differentials between regions are less significative than the differentials between countries.
3. "*Access to knowledge*" - represented by means 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 enrolment 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 significantly different from these concepts. In this regional HDI we choose the following variables to be proxies of the two referred variables: Transition rate or regular secondary school completion (in percentage) - [secondary school pupils that at the end of the regular school year may carry over into the next school level/ pupils enrolled on

secondary education in this school year \* 100], to be a proxy of means 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 of expected years of schooling. This last indicator represents the proportion of resident population that is attending 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 spans from school year 2004/2005 to 2007/2008. Since we haven't got 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 hypothesis since we did not want to loose one extra year of data.

Concerning the temporal scope of the work, the resulting limitations of the available information restricted the analysis to the comparison between the years 2004 and 2008, which represents the longest interval of time for which information is available for each of the three basic indicators.

Since we agree with some of the critiques made to the original HDI, namely 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 the index for Portuguese NUTS III regions for the "standard" HDI and also including these two dimensions.

Two very common proxies used in the characterization of the governance dimension is the voter turnout and consultation on rule making OECD (2011). While the latter was not available on the NUTS III level, the former was available since 2001 for several types of elections. We choose to use the voter turner out of municipal election, that has data available for the years of 2001, 2005, and 2009, the years the municipal elections took place, because municipalities are the closest type of geographical unit to NUTS III level that perform elections. Since data available for the three original dimensions of the HDI begins in 2004 and ends in 2008, we assume in 2004 that the governance indicator has the value verified in 2005 and we assume in 2008 that the governance indicator has the value verified in 2009. The indicator supplied by the National Statistics Office - Voter turn out in elections for municipal councils - used to assess the governance component, is inversely proportional to the index that we want to assess. So we calculated the inverse of the referred indicator, which we designated by "participation rate in elections for municipal councils".

The choice of an environmental indicator was very difficult, since data is scarce at the NUTS

III level for these type of indicators. One of the most commonly used environmental indicators is the quality of the air. However, stations that measure the quality of air in Portuguese regions do not cover some of the NUTS III and others NUTS III have more than one station to measure the quality of air. This restrained us to use this indicator. The choice of an indicator related to urban waste would make the analysis very incomplete since the National Statistics Office only has data for selective urban waste, i.e., recyclable waste. The analysis could also be potentially biased for two reasons. First, a significant part of the population may not be served by this service, since the coverage of this service is not uniformly available through out the country. Second, lower income population usually produces less recyclable waste than higher income population. We choose to use the indicators percentage of population served by systems of sewerage, which is also used in the SIRD. The values for 2004 and 2005 were taken from the Environmental Survey - Characterization of Sanitation, while the figures for 2006 and subsequent years come from the database INSAAR (National Inventory of Water Supply Systems and Wastewater). Data is unavailable for this indicator in 2007 and 2008 for Açores and Madeira.

### 3 Methodology

This section describes the methodological choices adopted in the realization of this work, methods of standardization of basic indicators, and methods of aggregation and weighting of the indicators used in the construction of 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 Human Development Index (PRHDI) that will be calculated and analyzed in the present work. Despite the changes we did were kept to a minimum, a comparison between our PRHDI and the HDI from the UNDP must be done carefully.

Table 1 presents the variables that enter into the calculation of the PRHDI, showing the dimensions considered in the analysis and indicators and indices representing each dimension (partial indexes or sub-indices) that give rise to the PRHDI:

Table 1 - Schematic Presentation of the Calculation of Each Dimension

| <i>Dimensions</i> | <i>Indicators</i>                               | <i>Index of each dimension</i> |
|-------------------|-------------------------------------------------|--------------------------------|
| Longevity         | Life expectancy at birth                        | Life expectancy index          |
| Education         | Secondary school completion (%)                 | Educational achievement index  |
|                   | Gross enrolment rate in secondary education (%) |                                |
| Income            | GDP <i>per capita</i>                           | Income index                   |
| Governance        | Participation rate in elections (%)             | Governance index               |
| Environmental     | Population served by sewerage systems (%)       | Environmental index            |

Since the PRHDI 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 that have been identified in Table 1. For this normalization process was necessary to define the minimum and maximum limits for each indicator, which are shown in Table 2 below.

Table 2 - Boundaries for the definition of the dimensional indices and their sources

| <i>Indicator</i>                          | <i>Maximum</i>              | <i>Minimum</i>              |
|-------------------------------------------|-----------------------------|-----------------------------|
| Life expectancy at birth (years)          | The maximum value in sample | 20                          |
| Secondary school completion (%)           | The maximum % in sample     | 0%                          |
| Gross enrolment rate in secondary (%)     | The maximum % in sample     | 0%                          |
| GDP <i>per capita</i> (€)                 | The maximum value in sample | The minimum value in sample |
| Participation rate in elections(%)        | The maximum % in sample     | 0%                          |
| Population served by sewerage systems (%) | The maximum % in sample     | 0%                          |

Since we want to make comparisons between regions and also make a dynamic comparison through out time, i.e., to determine the distance in terms of development of each region to the level of development of the most developed region, in each indicator, it was assumed as the top boundary, the maximum value observed in each indicator in the analyzed period - 2004-2008. As for the minimum, we used the values that are considered to be understood as the minimum subsistence values or "natural" zeros , and thus the development and well-being are measured by comparison with the minimum requirements that a society needs (or perceives to need) to survive over time. The minimum value for life expectancy at birth - 20 years - is a value defined by the UNDP for the HDI, defined by empirical evidences 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. We built 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 enrolment rate in secondary education, the same as the methodology

applied by the UNDP. After we establish the minimum and maximum values, the sub-indices, at the exception of the income index, were calculated as follows:

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

As it happens with the original HDI, the income index is calculated based on the natural logarithm of the minimum and maximum values.

Once we have obtained all dimension indices, the PRHDI is calculated as the result of the geometric mean of the three dimension indices. 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 Results

In this section we present results drawn from the data collected and indicators calculated in this work, by the use of the methodology and data described in the previous two sections. Tables 3 and 4 present results for 2008 and 2004, respectively. In the text we choose to analyze the first and last years available. Results for 2005, 2006, and 2007 are in Appendix B, Tables B1, B2, and B3, respectively.

|                                     | Income |         | Education |         | Health |         | HDI   |         | Governance |         | HDI with Governance |         | Environment |         | HDI with Environment |         | HDI with Governance and Environment |         |
|-------------------------------------|--------|---------|-----------|---------|--------|---------|-------|---------|------------|---------|---------------------|---------|-------------|---------|----------------------|---------|-------------------------------------|---------|
|                                     | Index  | Ranking | Index     | Ranking | Index  | Ranking | Index | Ranking | Index      | Ranking | Index               | Ranking | Index       | Ranking | Index                | Ranking | Index                               | Ranking |
| Portugal                            | 0.604  | -       | 0.825     | -       | 0.975  | -       | 0.786 | -       | 0.797      | -       | 0.789               | -       | 0.734       | -       | n.a.                 | -       | n.a.                                | -       |
| Norte (8 NUTS)                      | 0.424  | -       | 0.803     | -       | 0.981  | -       | 0.694 | -       | 0.870      | -       | 0.734               | -       | 0.735       | -       | 0.704                | -       | 0.734                               | -       |
| Minho-Lima                          | 0.227  | 27      | 0.862     | 5       | 0.974  | 18      | 0.575 | 27      | 0.822      | 16      | 0.629               | 27      | 0.541       | 25      | 0.566                | 25      | 0.610                               | 26      |
| Cávado                              | 0.411  | 18      | 0.819     | 19      | 0.991  | 2       | 0.693 | 17      | 0.918      | 4       | 0.744               | 14      | 0.806       | 14      | 0.720                | 15      | 0.756                               | 11      |
| Ave                                 | 0.342  | 20      | 0.790     | 23      | 0.982  | 8       | 0.643 | 20      | 0.924      | 3       | 0.704               | 19      | 0.510       | 26      | 0.607                | 23      | 0.660                               | 23      |
| Grande Porto                        | 0.609  | 5       | 0.857     | 7       | 0.982  | 9       | 0.800 | 6       | 0.809      | 19      | 0.803               | 5       | 0.969       | 3       | 0.840                | 3       | 0.834                               | 3       |
| Tâmega                              | 0.167  | 30      | 0.665     | 30      | 0.974  | 17      | 0.476 | 30      | 0.970      | 1       | 0.569               | 30      | 0.490       | 27      | 0.480                | 28      | 0.552                               | 28      |
| Entre Douro e Vouga                 | 0.430  | 17      | 0.761     | 27      | 1.000  | 1       | 0.689 | 18      | 0.878      | 7       | 0.732               | 17      | 0.296       | 28      | 0.558                | 26      | 0.611                               | 25      |
| Douro                               | 0.290  | 24      | 0.841     | 13      | 0.961  | 24      | 0.617 | 24      | 0.873      | 10      | 0.673               | 23      | 0.898       | 11      | 0.678                | 18      | 0.713                               | 17      |
| Alto Trás-os-Montes                 | 0.267  | 26      | 0.835     | 15      | 0.976  | 14      | 0.602 | 26      | 0.816      | 18      | 0.649               | 26      | 0.857       | 13      | 0.657                | 21      | 0.686                               | 21      |
| Centro (12 NUTS)                    | 0.474  | -       | 0.837     | -       | 0.982  | -       | 0.731 | -       | 0.809      | -       | 0.750               | -       | 0.776       | -       | 0.742                | -       | 0.755                               | -       |
| Baixo Vouga                         | 0.516  | 9       | 0.777     | 25      | 0.983  | 7       | 0.733 | 11      | 0.766      | 26      | 0.741               | 15      | 0.765       | 18      | 0.741                | 11      | 0.746                               | 12      |
| Baixo Mondego                       | 0.609  | 5       | 0.956     | 1       | 0.988  | 3       | 0.831 | 4       | 0.784      | 22      | 0.819               | 3       | 0.806       | 14      | 0.825                | 4       | 0.817                               | 4       |
| Pinhal Litoral                      | 0.604  | 7       | 0.840     | 14      | 0.988  | 3       | 0.794 | 7       | 0.772      | 24      | 0.788               | 7       | 0.571       | 24      | 0.731                | 12      | 0.739                               | 14      |
| Pinhal Interior Norte               | 0.176  | 29      | 0.709     | 29      | 0.979  | 11      | 0.496 | 29      | 0.914      | 5       | 0.578               | 29      | 0.622       | 22      | 0.525                | 27      | 0.586                               | 27      |
| Dao-Lafões                          | 0.305  | 22      | 0.834     | 16      | 0.985  | 6       | 0.631 | 21      | 0.826      | 15      | 0.675               | 22      | 0.796       | 16      | 0.668                | 20      | 0.697                               | 20      |
| Pinhal Interior Sul                 | 0.328  | 21      | 0.771     | 26      | 0.947  | 27      | 0.621 | 23      | 0.939      | 2       | 0.688               | 20      | 0.612       | 23      | 0.619                | 22      | 0.672                               | 22      |
| Serra da Estrela                    | 0.202  | 28      | 0.829     | 18      | 0.959  | 26      | 0.543 | 28      | 0.872      | 11      | 0.611               | 28      | 0.673       | 21      | 0.573                | 24      | 0.623                               | 24      |
| Beira Interior Norte                | 0.298  | 23      | 0.831     | 17      | 0.976  | 15      | 0.623 | 22      | 0.877      | 8       | 0.679               | 21      | 0.908       | 9       | 0.684                | 17      | 0.719                               | 16      |
| Beira Interior Sul                  | 0.486  | 11      | 0.882     | 3       | 0.976  | 16      | 0.748 | 8       | 0.808      | 20      | 0.763               | 8       | 0.969       | 3       | 0.798                | 6       | 0.800                               | 7       |
| Cova da Beira                       | 0.275  | 25      | 0.844     | 12      | 0.979  | 12      | 0.610 | 25      | 0.846      | 12      | 0.662               | 24      | 0.908       | 9       | 0.674                | 19      | 0.705                               | 18      |
| Oeste                               | 0.550  | 8       | 0.782     | 24      | 0.971  | 19      | 0.748 | 9       | 0.784      | 22      | 0.756               | 11      | 0.918       | 8       | 0.787                | 7       | 0.786                               | 9       |
| Médio Tejo                          | 0.437  | 16      | 0.928     | 2       | 0.988  | 3       | 0.737 | 10      | 0.819      | 17      | 0.757               | 10      | 0.694       | 20      | 0.726                | 13      | 0.744                               | 13      |
| Lisboa (2 NUTS)                     | 0.864  | -       | 0.851     | -       | 0.977  | -       | 0.896 | -       | 0.682      | -       | 0.837               | -       | 0.969       | -       | 0.914                | -       | 0.862                               | -       |
| Grande Lisboa                       | 1.000  | 1       | 0.870     | 4       | 0.981  | 10      | 0.949 | 1       | 0.693      | 29      | 0.877               | 2       | 0.990       | 1       | 0.959                | 1       | 0.998                               | 1       |
| Península de Setúbal                | 0.363  | 19      | 0.800     | 21      | 0.969  | 20      | 0.655 | 19      | 0.655      | 30      | 0.655               | 25      | 0.939       | 6       | 0.717                | 16      | 0.704                               | 19      |
| Alentejo (5 NUTS)                   | 0.550  | -       | 0.833     | -       | 0.963  | -       | 0.761 | -       | 0.841      | -       | 0.780               | -       | 0.878       | -       | 0.789                | -       | 0.799                               | -       |
| Alentejo Litoral                    | 0.967  | 2       | 0.861     | 6       | 0.959  | 25      | 0.928 | 2       | 0.845      | 13      | 0.906               | 1       | 0.776       | 17      | 0.887                | 2       | 0.878                               | 2       |
| Alto Alentejo                       | 0.456  | 14      | 0.857     | 8       | 0.962  | 23      | 0.721 | 12      | 0.895      | 6       | 0.761               | 9       | 0.990       | 1       | 0.781                | 8       | 0.802                               | 6       |
| Alentejo Central                    | 0.449  | 15      | 0.853     | 9       | 0.978  | 13      | 0.721 | 13      | 0.841      | 14      | 0.749               | 13      | 0.939       | 6       | 0.720                | 10      | 0.784                               | 10      |
| Baixo Alentejo                      | 0.468  | 13      | 0.847     | 11      | 0.941  | 28      | 0.720 | 14      | 0.874      | 9       | 0.756               | 12      | 0.969       | 3       | 0.776                | 9       | 0.794                               | 8       |
| Lezíria do Tejo                     | 0.480  | 12      | 0.792     | 22      | 0.963  | 21      | 0.716 | 15      | 0.792      | 21      | 0.734               | 16      | 0.735       | 19      | 0.720                | 14      | 0.734                               | 15      |
| Algarve (1 NUTS)                    | 0.629  | 4       | 0.848     | 10      | 0.962  | 22      | 0.801 | 5       | 0.766      | 26      | 0.792               | 6       | 0.867       | 12      | 0.817                | 5       | 0.807                               | 5       |
| Região Autónoma dos Açores (1 NUTS) | 0.504  | 10      | 0.746     | 28      | 0.921  | 29      | 0.702 | 16      | 0.768      | 25      | 0.718               | 18      | n.a.        | n.a.    | n.a.                 | n.a.    | n.a.                                | n.a.    |
| Região Autónoma da Madeira (1 NUTS) | 0.801  | 3       | 0.816     | 20      | 0.906  | 30      | 0.840 | 3       | 0.743      | 28      | 0.815               | 4       | n.a.        | n.a.    | n.a.                 | n.a.    | n.a.                                | n.a.    |

Table 3 - Regional HDI Results for 2008

Notes: We don't have environmental data available for the Autonomous Regions of Açores and Madeira for 2008 and 2007.

Table 3 presents results for our calculations for 2008. Let us first compare the results obtained for Portugal in our index to the results of the HDI of the UNDP. The value of the HDI of the UNDP are available, in a comparable way, from 2005 to 2008. The values for the general ranking are above ours, but not by very much and our index follows the upward trend of the HDI. For 2005 to 2008, the values are respectively 0.789, 0.791, 0.798, and 0.802, while ours are, for the same period and in the same order, 0.732, 0.741, 0.773, and 0.786.

The NUTS III Grande Lisboa ranks number one in the HDI for 2008. Grande Lisboa includes the city of Lisboa, the capital of the country, and some surrounding urban and industrial areas. The NUTS III which are positioned in the coastline are the ones which achieved the ten first places at the ranking, at the exception of Beira Interior Sul, positioned in the interior of the country. In Appendix A we have a map of Portugal where we positioned the NUTS III, so one can easily see the geographical positioning of each NUTS. The first seven NUTS III in the HDI ranking have an index superior to the HDI for Portugal but they are not geographically concentrated in one NUTS II. The NUTS II Lisboa, Algarve, and Madeira present a index value superior to that of the country. The NUTS II Alentejo is the more homogenous group in the mainland, in terms of its relative position in the rankings, at the exception of Alentejo Litoral, which occupies the second position in our HDI. The NUTS II Norte, Centro, and Lisboa present a higher degree of heterogeneity. There are NUTS III that ranked very similar for the three dimensions (income, education, and health) - Grande Porto, Baixo Mondego, Pinhal Interior Sul, Grande Lisboa, Península de Setúbal, and Alentejo Central, and once again these NUTS III do not belong to the same NUTS II.

In a report from 2008, the OECD advances that these results reflect somehow 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 higher share of tertiary services than interior and rural regions. The capital, Lisboa, located in the NUTS III Grande Lisboa concentrates the majority of political, financial and business related services, while also being the headquarter of large economic groups and the region which most invests in R&D. The capital is also expanding the quality tourism. Also in the NUTS III Lisboa, the Península de Setúbal is a more industrialized region, with industries like ship repairing, steel, and chemical industries. The Northern NUTS III are very industrialized regions, but in decline, due to the

increasing competition from China and India in the traditional sectors (textile, footwear, leather, for example) and with workers exhibiting low labour skills and productivity. The NUTS III of Algarve, Açores, and Madeira based 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 a low incentive to increase their qualifications, due to the higher unemployment rate that is verified among high skilled workers in these regions.

Next we added the two extras dimensions - governance and environment. First, we added each one separately and build a new HDI index with the new dimension included for each one. Then, we built a new HDI with the two dimensions included (last two columns of each table). When we added the Governance dimension the HDI with Governance included does not change much, although the ranking of the dimension Governance is very different from the original HDI. Only five NUTS III have changes in their ranking placement more than three positions. On the other hand, when we added the Environment dimension, the HDI with Environment included changes substantially and almost half of the NUTS III change their ranking positions more than three positions. The results for the environmental dimension change the HDI substantially, even when the two dimensions are included in the calculations of the HDI (last two columns). In particular, most of the NUTS III that improve their relative position are located in the interior of the country. There are NUTS III at the top ten positions that leave the first ten positions, but even so they reach at least the top fifteen in the ranking. These results are related with the dispersion of the Portuguese population. The Portuguese population is more disperse in the coastal line and also in the North of the country, while the interior and the South of country are more concentrated, being less expensive and easier to install sewerage systems that serve a vast group of citizens.

|                                     | Income |         | Education |         | Health |         | HDI   |         | Governance |         | HDI with Governance |         | Environment |         | HDI with Environment |         | HDI with Governance and Environment |         |
|-------------------------------------|--------|---------|-----------|---------|--------|---------|-------|---------|------------|---------|---------------------|---------|-------------|---------|----------------------|---------|-------------------------------------|---------|
|                                     | Index  | Ranking | Index     | Ranking | Index  | Ranking | Index | Ranking | Index      | Ranking | Index               | Ranking | Index       | Ranking | Index                | Ranking | Index                               | Ranking |
| Portugal                            | 0.492  | -       | 0.789     | -       | 0.957  | -       | 0.719 | -       | 0.824      | -       | 0.744               | -       | 0.755       | -       | 0.728                | -       | 0.746                               | -       |
| Norte (8 NUTS)                      | 0.305  | -       | 0.748     | -       | 0.962  | -       | 0.603 | -       | 0.901      | -       | 0.667               | -       | 0.622       | -       | 0.608                | -       | 0.658                               | -       |
| Minho-Lima                          | 0.102  | 27      | 0.802     | 14      | 0.968  | 5       | 0.430 | 27      | 0.895      | 11      | 0.516               | 27      | 0.429       | 27      | 0.430                | 28      | 0.497                               | 28      |
| Cávado                              | 0.283  | 18      | 0.768     | 20      | 0.967  | 7       | 0.594 | 18      | 0.964      | 2       | 0.671               | 16      | 0.663       | 19      | 0.611                | 17      | 0.669                               | 16      |
| Ave                                 | 0.275  | 19      | 0.730     | 26      | 0.967  | 7       | 0.579 | 19      | 0.953      | 4       | 0.656               | 18      | 0.531       | 26      | 0.566                | 20      | 0.628                               | 20      |
| Grande Porto                        | 0.492  | 7       | 0.807     | 13      | 0.960  | 13      | 0.725 | 7       | 0.823      | 20      | 0.748               | 7       | 0.786       | 15      | 0.740                | 5       | 0.756                               | 6       |
| Tâmega                              | 0.000  | 30      | 0.619     | 30      | 0.950  | 17      | 0.000 | 30      | 1.000      | 1       | 0.000               | 30      | 0.367       | 29      | 0.000                | 30      | 0.000                               | 30      |
| Entre Douro e Vouga                 | 0.328  | 16      | 0.699     | 27      | 0.980  | 2       | 0.608 | 16      | 0.907      | 9       | 0.672               | 15      | 0.367       | 29      | 0.536                | 24      | 0.595                               | 24      |
| Douro                               | 0.131  | 25      | 0.775     | 19      | 0.944  | 24      | 0.457 | 26      | 0.920      | 7       | 0.545               | 25      | 0.827       | 12      | 0.530                | 25      | 0.592                               | 25      |
| Alto Trás-os-Montes                 | 0.149  | 23      | 0.751     | 21      | 0.957  | 15      | 0.475 | 25      | 0.870      | 15      | 0.552               | 24      | 0.867       | 10      | 0.552                | 22      | 0.605                               | 22      |
| Centro (12 NUTS)                    | 0.363  | -       | 0.804     | -       | 0.963  | -       | 0.655 | -       | 0.851      | -       | 0.700               | -       | 0.714       | -       | 0.670                | -       | 0.703                               | -       |
| Baixo Vouga                         | 0.430  | 8       | 0.743     | 23      | 0.968  | 5       | 0.677 | 9       | 0.809      | 24      | 0.708               | 11      | 0.602       | 21      | 0.657                | 15      | 0.685                               | 15      |
| Baixo Mondego                       | 0.516  | 5       | 0.919     | 1       | 0.965  | 9       | 0.770 | 4       | 0.823      | 20      | 0.783               | 4       | 0.704       | 18      | 0.753                | 4       | 0.767                               | 4       |
| Pinhal Litoral                      | 0.510  | 6       | 0.833     | 7       | 0.975  | 3       | 0.745 | 6       | 0.819      | 23      | 0.763               | 5       | 0.571       | 24      | 0.697                | 10      | 0.720                               | 10      |
| Pinhal Interior Norte               | 0.063  | 29      | 0.696     | 28      | 0.953  | 16      | 0.347 | 29      | 0.941      | 6       | 0.445               | 29      | 0.582       | 23      | 0.395                | 29      | 0.470                               | 29      |
| Dão-Lafões                          | 0.202  | 21      | 0.797     | 15      | 0.963  | 11      | 0.537 | 21      | 0.885      | 13      | 0.608               | 20      | 0.755       | 16      | 0.585                | 18      | 0.635                               | 19      |
| Pinhal Interior Sul                 | 0.149  | 23      | 0.739     | 25      | 0.950  | 17      | 0.471 | 24      | 0.958      | 3       | 0.563               | 23      | 0.633       | 20      | 0.507                | 26      | 0.576                               | 26      |
| Serra da Estrela                    | 0.083  | 28      | 0.788     | 17      | 0.864  | 29      | 0.383 | 28      | 0.907      | 9       | 0.476               | 28      | 0.939       | 4       | 0.480                | 27      | 0.545                               | 27      |
| Beira Interior Norte                | 0.176  | 22      | 0.791     | 16      | 0.960  | 13      | 0.511 | 22      | 0.943      | 5       | 0.596               | 21      | 0.827       | 12      | 0.576                | 19      | 0.636                               | 18      |
| Beira Interior Sul                  | 0.349  | 15      | 0.900     | 2       | 0.891  | 27      | 0.654 | 13      | 0.872      | 14      | 0.703               | 13      | 1.000       | 1       | 0.727                | 6       | 0.754                               | 7       |
| Cova da Beira                       | 0.121  | 26      | 0.810     | 11      | 0.982  | 1       | 0.458 | 25      | 0.895      | 11      | 0.542               | 26      | 0.959       | 3       | 0.551                | 23      | 0.607                               | 21      |
| Oeste                               | 0.370  | 13      | 0.742     | 24      | 0.947  | 23      | 0.638 | 14      | 0.807      | 26      | 0.677               | 14      | 0.888       | 9       | 0.693                | 11      | 0.715                               | 12      |
| Médio Tejo                          | 0.384  | 10      | 0.864     | 3       | 0.965  | 9       | 0.684 | 8       | 0.850      | 17      | 0.722               | 9       | 0.602       | 21      | 0.663                | 14      | 0.697                               | 14      |
| Lisboa (2 NUTS)                     | 0.772  | -       | 0.845     | -       | 0.960  | -       | 0.856 | -       | 0.695      | -       | 0.812               | -       | 0.980       | -       | 0.885                | -       | 0.843                               | -       |
| Grande Lisboa                       | 0.909  | 1       | 0.854     | 4       | 0.963  | 11      | 0.908 | 1       | 0.705      | 29      | 0.852               | 1       | 1.000       | 1       | 0.930                | 1       | 0.880                               | 1       |
| Península de Setúbal                | 0.243  | 20      | 0.819     | 10      | 0.949  | 20      | 0.574 | 20      | 0.664      | 30      | 0.595               | 22      | 0.939       | 4       | 0.649                | 16      | 0.652                               | 17      |
| Alentejo (5 NUTS)                   | 0.430  | -       | 0.798     | -       | 0.950  | -       | 0.689 | -       | 0.847      | -       | 0.725               | -       | 0.847       | -       | 0.725                | -       | 0.748                               | -       |
| Alentejo Litoral                    | 0.673  | 2       | 0.833     | 6       | 0.944  | 24      | 0.809 | 2       | 0.830      | 19      | 0.814               | 2       | 0.796       | 14      | 0.806                | 2       | 0.810                               | 2       |
| Alto Alentejo                       | 0.384  | 10      | 0.821     | 8       | 0.950  | 17      | 0.669 | 11      | 0.912      | 8       | 0.723               | 8       | 0.908       | 8       | 0.722                | 7       | 0.757                               | 5       |
| Alentejo Central                    | 0.370  | 13      | 0.819     | 9       | 0.973  | 4       | 0.666 | 12      | 0.849      | 18      | 0.708               | 10      | 0.918       | 7       | 0.722                | 8       | 0.745                               | 8       |
| Baixo Alentejo                      | 0.320  | 17      | 0.808     | 12      | 0.848  | 30      | 0.603 | 17      | 0.864      | 16      | 0.660               | 17      | 0.929       | 6       | 0.672                | 13      | 0.706                               | 13      |
| Lezíria do Tejo                     | 0.430  | 8       | 0.750     | 22      | 0.947  | 22      | 0.674 | 10      | 0.808      | 25      | 0.705               | 12      | 0.755       | 16      | 0.693                | 12      | 0.715                               | 11      |
| Algarve (1 NUTS)                    | 0.527  | 4       | 0.836     | 5       | 0.949  | 20      | 0.748 | 5       | 0.778      | 28      | 0.755               | 6       | 0.847       | 11      | 0.771                | 3       | 0.773                               | 3       |
| Região Autónoma dos Açores (1 NUTS) | 0.384  | 10      | 0.676     | 29      | 0.894  | 26      | 0.615 | 15      | 0.786      | 27      | 0.654               | 19      | 0.429       | 27      | 0.562                | 21      | 0.601                               | 23      |
| Região Autónoma da Madeira (1 NUTS) | 0.673  | 2       | 0.786     | 18      | 0.884  | 28      | 0.776 | 3       | 0.820      | 22      | 0.787               | 3       | 0.571       | 24      | 0.719                | 9       | 0.738                               | 9       |

Table 4 - Regional HDI Results for 2004

In Table 4 we present results for 2004. As we can concluded results are not very different from the ones presented for 2008 in all dimensions analyzed previously. In order to see more clearly if the differences are really not substantial between 2004 and 2008 we present in Table 5 the differential in ranking positions in all rankings between 2008 and 2004.

|                                            | Income | Education | Health | HDI  | Governance | HDI with Governance | Environment | HDI with Environment | HDI with Governance and Environment |
|--------------------------------------------|--------|-----------|--------|------|------------|---------------------|-------------|----------------------|-------------------------------------|
| <b>Portugal</b>                            | n.a.   | n.a.      | n.a.   | n.a. | n.a.       | n.a.                | n.a.        | n.a.                 | n.a.                                |
| <b>Norte (8 NUTS)</b>                      | n.a.   | n.a.      | n.a.   | n.a. | n.a.       | n.a.                | n.a.        | n.a.                 | n.a.                                |
| Minho-Lima                                 | 0      | -9        | 13     | 0    | 5          | 0                   | -2          | -3                   | -2                                  |
| Cávado                                     | 0      | -1        | -5     | -1   | 2          | -2                  | -5          | -2                   | -5                                  |
| Ave                                        | 1      | -3        | 1      | 1    | -1         | 1                   | 0           | 3                    | 3                                   |
| Grande Porto                               | -2     | -6        | -4     | -1   | -1         | -2                  | -12         | -2                   | -3                                  |
| Tâmega                                     | 0      | 0         | 0      | 0    | 0          | 0                   | -2          | -2                   | -2                                  |
| Entre Douro e Vouga                        | 1      | 0         | -1     | 2    | -2         | 2                   | -1          | 2                    | 1                                   |
| Douro                                      | -1     | -6        | 0      | -2   | 3          | -2                  | -1          | -7                   | -8                                  |
| Alto Trás-os-Montes                        | 3      | -6        | -1     | 3    | 3          | 2                   | 3           | -1                   | -1                                  |
| <b>Centro (12 NUTS)</b>                    | n.a.   | n.a.      | n.a.   | n.a. | n.a.       | n.a.                | n.a.        | n.a.                 | n.a.                                |
| Baixo Vouga                                | 1      | 2         | 2      | 2    | 2          | 4                   | -3          | -4                   | -3                                  |
| Baixo Mondego                              | 0      | 0         | -6     | 0    | 2          | -1                  | -4          | 0                    | 0                                   |
| Pinhal Litoral                             | 1      | 7         | 0      | 1    | 1          | 2                   | 0           | 2                    | 4                                   |
| Pinhal Interior Norte                      | 0      | 1         | -5     | 0    | -1         | 0                   | -1          | -2                   | -2                                  |
| Dão-Lafões                                 | 1      | 1         | -5     | 0    | 2          | 2                   | 0           | 2                    | 1                                   |
| Pinhal Interior Sul                        | -2     | 1         | 10     | -1   | -1         | -3                  | 3           | -4                   | -4                                  |
| Serra da Estrela                           | 0      | 1         | -3     | 0    | 2          | 0                   | 17          | -3                   | -3                                  |
| Beira Interior Norte                       | 1      | 1         | 2      | 0    | 3          | 0                   | -3          | -2                   | -2                                  |
| Beira Interior Sul                         | -4     | 1         | -11    | -5   | 6          | -5                  | 2           | 0                    | 0                                   |
| Cova da Beira                              | -1     | 1         | 11     | 0    | 1          | -2                  | 6           | -4                   | -3                                  |
| Oeste                                      | -5     | 0         | -3     | -5   | -4         | -3                  | -1          | -4                   | -3                                  |
| Médio Tejo                                 | 6      | -1        | -6     | 2    | 0          | 1                   | -1          | -1                   | -1                                  |
| <b>Lisboa (2 NUTS)</b>                     | n.a.   | n.a.      | n.a.   | n.a. | n.a.       | n.a.                | n.a.        | n.a.                 | n.a.                                |
| Grande Lisboa                              | 0      | 0         | -1     | 0    | 0          | 1                   | 0           | 0                    | 0                                   |
| Península de Setúbal                       | -1     | 11        | 0      | -1   | 0          | 3                   | 2           | 0                    | 2                                   |
| <b>Alentejo (5 NUTS)</b>                   | n.a.   | n.a.      | n.a.   | n.a. | n.a.       | n.a.                | n.a.        | n.a.                 | n.a.                                |
| Alentejo Litoral                           | 0      | 0         | 1      | 0    | -6         | -1                  | 3           | 0                    | 0                                   |
| Alto Alentejo                              | 4      | 0         | 6      | 1    | -2         | 1                   | -7          | 1                    | 1                                   |
| Alentejo Central                           | 2      | 0         | 9      | 1    | -4         | 3                   | -1          | 2                    | 2                                   |
| Baixo Alentejo                             | -4     | -1        | -2     | -3   | -7         | -5                  | -3          | -4                   | -5                                  |
| Lezíria do Tejo                            | 4      | 0         | -1     | 5    | -4         | 4                   | 3           | 2                    | 4                                   |
| <b>Algarve (1 NUTS)</b>                    | 0      | 5         | 2      | 0    | -2         | 0                   | 1           | 2                    | 2                                   |
| <b>Região Autónoma dos Açores (1 NUTS)</b> | 0      | -1        | 3      | 1    | -2         | -1                  | n.a.        | n.a.                 | n.a.                                |
| <b>Região Autónoma da Madeira (1 NUTS)</b> | 1      | 2         | 2      | 0    | 6          | 1                   | n.a.        | n.a.                 | n.a.                                |
| <b>Volatility</b>                          | 2.1    | 3.5       | 5.0    | 1.9  | 3.0        | 2.2                 | 4.4         | 2.3                  | 2.6                                 |

Table 5 - Rankings Differential Between 2008 and 2004

In the HDI ranking between 2008 and 2004 Baixo Vouga and Lezíria do Tejo left the top ten NUTS III and give way to Beira Interior Sul and Oeste. Beira Interior Sul is a NUTS III further way from the coastline. Other three interior NUTS III improve on their relative positions - Douro, Pinhal Interior Sul, and Baixo Alentejo in the HDI. The NUTS II Norte was the one that suffered most positive changes in their relative positions between these five years, if we consider the HDI which includes governance and the environment. The three NUTS III that suffered the most impressive change in the analyzed period, in terms of the HDI were Beira Interior Sul, Oeste, and Lezíria do Tejo. Beira Interior Sul and Oeste improved their ranking positions due to improvement in terms of health and income, respectively. Lezíria do Tejo worsened its position due a decrease in the relative position of income. When we analyze the changes in the HDI with the dimensions governance and environment included, the three NUTS III that suffered the biggest changes are Douro, Cávado, and Baixo Alentejo, mainly due to the changes verified in the environment dimension.

The last row of Table 5 shows the volatility (measured by the standard-deviation, in percentage) of the differentials calculated in each column. The dimensions which present more volatility are health (5%) and the environment (4.4%), meaning that it was in these dimensions that most changes took place in these five years, reflecting a possible intensification in economic policy towards these dimensions. The least volatile dimensions were income (2.1%) and governance (3%). The governance dimension reflects social and cultural characteristics of each population, and these features typically changed very slowly.

Results for 2005, 2006, and 2007, that are in Appendix B, are not significantly different from the ones presented above.

Since the SIDR published by the INE and the DPPRI has also data spanning between 2004 and 2008 we make a tentative comparison between the position of the NUTS III regions in ours and in their index. We only compare the years of 2004 and 2008 and use our HDI with Governance and Environment included since the other index also includes similar dimensions. Grande Lisboa is ranked number one in both indexes. The first fifteen positions are occupied with the same NUTS III regions, although at the exception of Grande Lisboa their relative positions in each index are different, exceptions being made for 2008, in their ranking, which does not include Algarve (17), Baixo Alentejo (18), Oeste (19), Médio Tejo (21), and Lezíria do Tejo (23). Numbers in

parenthesis are their ranking positions in the SIDR. For 2004 the SIDR does not include in the top fifteen positions Alentejo Litoral (24), Lezíria do Tejo (19), Oeste (22), Baixo Alentejo (23), and Médio Tejo (18), in the rest includes the other NUTS III that our includes. This comparison give us confidence about the trustworthiness of our results and ranking construction.

## 5 Conclusions

In this paper we build a regional human development index for Portuguese NUTS III regions, constructed in a way that resembles the methodology of the HDI by the UNDP. We also try, whenever they are available, to use the same variables used in the HDI. Results show us a country that has most of the highest ranked NUTS III positioned in the coastline, with Grande Lisboa occupying the first position in the ranking, although one NUTS III region that is in the interior, in 2008 took a place in the top ten - Beira Interior Sul - and other interior NUTS III regions improve their relative positions in the ranking. Maybe this repositioning in the ranking for some interior NUTS III regions could be a positive sign of a reduction of regional asymmetries, at least in some regions. However, the overall evolution that we have shown in this work shows a country that has a significative degree of regional asymmetries still and is still much in need of coherent and persistent regional policies. Results of our HDI for Portugal are very similar in value and in the upward trend to the results obtained in the HDI of the UNDP. We also have advanced with 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.

Additionally to the traditional dimensions of the HDI, income, health, and education, we also added two dimensions, that we choose to include, given the main criticisms pointed in the literature to the HDI - governance and environment. Results show some significative differences when we add the environment dimension, but in terms of governance they don't change significantly. 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 result is related with the dispersion of the population in the coastal line and also in the North of the country, while the interior and the South of country is more concentrated, being less expensive and easier to install sewerage systems that serve a vast group of citizens.

The dimensions which present a higher degree of volatility in the analyzed period are 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 very hard to change, specially the last dimension.

We also made a comparison with the recently published SIDR and results are very similar, since ten out of fifteen NUTS III regions are the same in the top fifteen ranking positions, although only Grande Lisboa maintains its relative position in the first place. This comparison confirms the reliability of our results and ranking construction.

Our index, since it is built with the methodology of the UNDP allows for international comparisons with other regional human development indexes which use the same methodology.

Future avenues for research include the continuity of this ranking in time and also 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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## 6 Appendix A - List of NUTS III for Portugal

### Portugal

#### Norte (8 NUTS)

Alto Trás-os-Montes

Ave

Cávado

Douro

Entre Douro e Vouga

Grande Porto

Minho-Lima

Tâmega

#### Centro (12 NUTS)

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 (2 NUTS)

Grande Lisboa

Península de Setúbal  
 Alentejo (5 NUTS)  
     Alentejo Central  
     Alentejo Litoral  
     Alto Alentejo  
     Baixo Alentejo  
     Lezíria do Tejo  
 Algarve (1 NUTS)  
 Região Autónoma dos Açores (1 NUTS)  
 Região Autónoma da Madeira (1 NUTS)



Figure A1 - Map of Portugal with NUTS III

## 7 Appendix B - Tables for the Regional HDI for 2005 to 2007

|                                     | Income |         | Education |         | Health |         | HDI   |         | Environment |         | HDI with Environment |         |
|-------------------------------------|--------|---------|-----------|---------|--------|---------|-------|---------|-------------|---------|----------------------|---------|
|                                     | Index  | Ranking | Index     | Ranking | Index  | Ranking | Index | Ranking | Index       | Ranking | Index                | Ranking |
| Portugal                            | 0.516  | -       | 0.789     | -       | 0.963  | -       | 0.732 | -       | 0.776       | -       | 0.743                | -       |
| Norte (8 NUTS)                      | 0.528  | -       | 0.748     | -       | 0.967  | -       | 0.619 | -       | 0.653       | -       | 0.627                | -       |
| Minho-Lima                          | 0.121  | 27      | 0.802     | 14      | 0.968  | 9       | 0.455 | 27      | 0.439       | 27      | 0.451                | 28      |
| Cávado                              | 0.298  | 18      | 0.768     | 20      | 0.967  | 10      | 0.605 | 18      | 0.673       | 19      | 0.621                | 17      |
| Ave                                 | 0.275  | 19      | 0.730     | 26      | 0.964  | 14      | 0.578 | 20      | 0.541       | 26      | 0.569                | 23      |
| Grande Porto                        | 0.516  | 6       | 0.807     | 13      | 0.967  | 12      | 0.738 | 7       | 0.857       | 11      | 0.766                | 6       |
| Tâmega                              | 0.032  | 30      | 0.619     | 30      | 0.960  | 19      | 0.267 | 30      | 0.378       | 29      | 0.291                | 30      |
| Entre Douro e Vouga                 | 0.349  | 17      | 0.699     | 27      | 0.977  | 3       | 0.620 | 17      | 0.388       | 28      | 0.552                | 24      |
| Douro                               | 0.185  | 26      | 0.775     | 19      | 0.951  | 24      | 0.514 | 26      | 0.827       | 14      | 0.579                | 22      |
| Alto Trás-os-Montes                 | 0.202  | 23      | 0.751     | 21      | 0.961  | 16      | 0.526 | 24      | 0.878       | 10      | 0.598                | 21      |
| Centro (12 NUTS)                    | 0.377  | -       | 0.804     | -       | 0.971  | -       | 0.665 | -       | 0.745       | -       | 0.684                | -       |
| Baixo Vouga                         | 0.449  | 8       | 0.743     | 23      | 0.977  | 2       | 0.689 | 9       | 0.663       | 20      | 0.682                | 14      |
| Baixo Mondego                       | 0.539  | 5       | 0.919     | 1       | 0.976  | 4       | 0.785 | 4       | 0.745       | 18      | 0.775                | 4       |
| Pinhal Litoral                      | 0.516  | 6       | 0.833     | 7       | 0.975  | 5       | 0.748 | 6       | 0.622       | 23      | 0.714                | 10      |
| Pinhal Interior Norte               | 0.083  | 29      | 0.696     | 28      | 0.957  | 21      | 0.381 | 29      | 0.592       | 25      | 0.425                | 29      |
| Dão-Lafões                          | 0.227  | 21      | 0.797     | 15      | 0.974  | 6       | 0.560 | 21      | 0.796       | 15      | 0.612                | 20      |
| Pinhal Interior Sul                 | 0.202  | 23      | 0.739     | 25      | 0.943  | 27      | 0.520 | 25      | 0.643       | 21      | 0.548                | 26      |
| Serra da Estrela                    | 0.102  | 28      | 0.788     | 17      | 0.960  | 17      | 0.426 | 28      | 0.888       | 8       | 0.512                | 27      |
| Beira Interior Norte                | 0.219  | 22      | 0.791     | 16      | 0.970  | 8       | 0.551 | 22      | 0.837       | 13      | 0.612                | 19      |
| Beira Interior Sul                  | 0.404  | 11      | 0.900     | 2       | 0.960  | 17      | 0.704 | 8       | 1.000       | 1       | 0.769                | 5       |
| Cova da Beira                       | 0.193  | 25      | 0.810     | 11      | 0.978  | 1       | 0.535 | 23      | 0.959       | 3       | 0.619                | 18      |
| Oeste                               | 0.370  | 15      | 0.742     | 24      | 0.957  | 20      | 0.641 | 15      | 0.888       | 8       | 0.695                | 12      |
| Médio Tejo                          | 0.377  | 14      | 0.864     | 3       | 0.966  | 13      | 0.680 | 10      | 0.643       | 21      | 0.671                | 15      |
| Lisboa (2 NUTS)                     | 0.797  | -       | 0.845     | -       | 0.964  | -       | 0.866 | -       | 0.980       | -       | 0.893                | -       |
| Grande Lisboa                       | 0.937  | 1       | 0.854     | 4       | 0.967  | 11      | 0.918 | 1       | 1.000       | 1       | 0.938                | 1       |
| Península de Setúbal                | 0.251  | 20      | 0.819     | 10      | 0.953  | 23      | 0.581 | 19      | 0.939       | 4       | 0.695                | 16      |
| Alentejo (5 NUTS)                   | 0.456  | -       | 0.798     | -       | 0.959  | -       | 0.704 | -       | 0.857       | -       | 0.739                | -       |
| Alentejo Litoral                    | 0.806  | 2       | 0.833     | 6       | 0.943  | 26      | 0.859 | 2       | 0.796       | 15      | 0.842                | 2       |
| Alto Alentejo                       | 0.391  | 12      | 0.821     | 8       | 0.957  | 22      | 0.675 | 11      | 0.929       | 5       | 0.731                | 8       |
| Alentejo Central                    | 0.384  | 13      | 0.819     | 9       | 0.971  | 7       | 0.674 | 12      | 0.908       | 7       | 0.726                | 9       |
| Baixo Alentejo                      | 0.356  | 16      | 0.808     | 12      | 0.937  | 28      | 0.646 | 14      | 0.929       | 5       | 0.707                | 11      |
| Lezíria do Tejo                     | 0.411  | 10      | 0.750     | 22      | 0.962  | 15      | 0.667 | 13      | 0.765       | 17      | 0.690                | 13      |
| Algarve (1 NUTS)                    | 0.561  | 4       | 0.836     | 29      | 0.949  | 25      | 0.763 | 5       | 0.857       | 11      | 0.786                | 3       |
| Região Autónoma dos Açores (1 NUTS) | 0.417  | 6       | 0.766     | 29      | 0.904  | 29      | 0.634 | 16      | 0.357       | 30      | 0.549                | 25      |
| Região Autónoma da Madeira (1 NUTS) | 0.706  | 3       | 0.786     | 18      | 0.892  | 30      | 0.791 | 3       | 0.612       | 24      | 0.742                | 7       |

Table B1 - Regional HDI Results for 2005

Notes: Governance data is unavailable between 2005 and 2007.

|                                     | Income |         | Education |         | Health |         | HDI   |         | Environment |         | HDI with Environment |         |
|-------------------------------------|--------|---------|-----------|---------|--------|---------|-------|---------|-------------|---------|----------------------|---------|
|                                     | Index  | Ranking | Index     | Ranking | Index  | Ranking | Index | Ranking | Index       | Ranking | Index                | Ranking |
| Portugal                            | 0.550  | -       | 0.764     | -       | 0.968  | -       | 0.741 | -       | 0.776       | -       | 0.750                | -       |
| Norte (8 NUTS)                      | 0.356  | -       | 0.726     | -       | 0.972  | -       | 0.631 | -       | 0.684       | -       | 0.644                | -       |
| Minho-Lima                          | 0.176  | 27      | 0.754     | 17      | 0.968  | 13      | 0.504 | 27      | 0.469       | 27      | 0.495                | 27      |
| Cávado                              | 0.335  | 16      | 0.756     | 16      | 0.976  | 7       | 0.623 | 18      | 0.673       | 20      | 0.609                | 17      |
| Ave                                 | 0.298  | 21      | 0.724     | 22      | 0.967  | 14      | 0.593 | 21      | 0.633       | 24      | 0.603                | 23      |
| Grande Porto                        | 0.533  | 7       | 0.779     | 12      | 0.974  | 8       | 0.739 | 7       | 0.878       | 8       | 0.772                | 6       |
| Tâmega                              | 0.102  | 30      | 0.597     | 30      | 0.967  | 14      | 0.389 | 30      | 0.408       | 28      | 0.394                | 30      |
| Entre Douro e Vouga                 | 0.377  | 17      | 0.689     | 27      | 0.988  | 1       | 0.636 | 17      | 0.357       | 30      | 0.550                | 26      |
| Douro                               | 0.235  | 25      | 0.745     | 18      | 0.955  | 24      | 0.551 | 26      | 0.837       | 12      | 0.612                | 22      |
| Alto Trás-os-Montes                 | 0.243  | 24      | 0.720     | 25      | 0.965  | 20      | 0.553 | 20      | 0.857       | 10      | 0.617                | 21      |
| Centro (12 NUTS)                    | 0.411  | -       | 0.785     | -       | 0.976  | -       | 0.680 | -       | 0.724       | -       | 0.691                | -       |
| Baixo Vouga                         | 0.456  | 10      | 0.738     | 20      | 0.981  | 4       | 0.691 | 11      | 0.704       | 17      | 0.694                | 13      |
| Baixo Mondego                       | 0.544  | 6       | 0.880     | 1       | 0.983  | 2       | 0.728 | 4       | 0.706       | 15      | 0.782                | 5       |
| Pinhal Litoral                      | 0.555  | 5       | 0.807     | 7       | 0.980  | 5       | 0.760 | 6       | 0.500       | 26      | 0.685                | 15      |
| Pinhal Interior Norte               | 0.131  | 28      | 0.661     | 29      | 0.966  | 18      | 0.437 | 29      | 0.561       | 25      | 0.465                | 29      |
| Dão-Lafões                          | 0.259  | 22      | 0.777     | 13      | 0.977  | 6       | 0.581 | 22      | 0.663       | 21      | 0.601                | 24      |
| Pinhal Interior Sul                 | 0.313  | 20      | 0.720     | 23      | 0.949  | 27      | 0.598 | 20      | 0.714       | 16      | 0.625                | 20      |
| Serra da Estrela                    | 0.131  | 29      | 0.741     | 19      | 0.960  | 22      | 0.453 | 28      | 0.643       | 23      | 0.494                | 28      |
| Beira Interior Norte                | 0.251  | 23      | 0.788     | 10      | 0.971  | 12      | 0.577 | 23      | 0.847       | 11      | 0.635                | 18      |
| Beira Interior Sul                  | 0.437  | 13      | 0.854     | 3       | 0.966  | 17      | 0.711 | 8       | 0.959       | 2       | 0.767                | 7       |
| Cova da Beira                       | 0.235  | 25      | 0.762     | 15      | 0.982  | 3       | 0.560 | 24      | 0.898       | 6       | 0.630                | 19      |
| Oeste                               | 0.456  | 10      | 0.737     | 21      | 0.966  | 16      | 0.687 | 12      | 0.867       | 9       | 0.729                | 10      |
| Médio Tejo                          | 0.404  | 14      | 0.864     | 2       | 0.973  | 9       | 0.698 | 10      | 0.663       | 21      | 0.689                | 14      |
| Lisboa (2 NUTS)                     | 0.822  | -       | 0.810     | -       | 0.969  | -       | 0.864 | -       | 0.969       | -       | 0.889                | -       |
| Grande Lisboa                       | 0.954  | 1       | 0.818     | 4       | 0.973  | 11      | 0.912 | 1       | 0.980       | 1       | 0.929                | 1       |
| Península de Setúbal                | 0.320  | 19      | 0.787     | 11      | 0.962  | 21      | 0.624 | 19      | 0.959       | 2       | 0.694                | 12      |
| Alentejo (5 NUTS)                   | 0.504  | -       | 0.758     | -       | 0.962  | -       | 0.746 | -       | 0.837       | -       | 0.745                | -       |
| Alentejo Litoral                    | 0.872  | 2       | 0.810     | 5       | 0.953  | 26      | 0.877 | 2       | 0.806       | 14      | 0.858                | 2       |
| Alto Alentejo                       | 0.404  | 14      | 0.720     | 24      | 0.957  | 23      | 0.653 | 16      | 0.959       | 2       | 0.719                | 11      |
| Alentejo Central                    | 0.404  | 14      | 0.808     | 6       | 0.973  | 9       | 0.682 | 13      | 0.888       | 7       | 0.729                | 9       |
| Baixo Alentejo                      | 0.492  | 8       | 0.771     | 14      | 0.944  | 28      | 0.718 | 9       | 0.949       | 5       | 0.763                | 8       |
| Lezíria do Tejo                     | 0.443  | 12      | 0.710     | 26      | 0.965  | 19      | 0.672 | 14      | 0.684       | 19      | 0.675                | 16      |
| Algarve (1 NUTS)                    | 0.598  | 4       | 0.795     | 8       | 0.955  | 25      | 0.769 | 5       | 0.827       | 13      | 0.783                | 3       |
| Região Autónoma dos Açores (1 NUTS) | 0.462  | 9       | 0.678     | 28      | 0.915  | 29      | 0.659 | 15      | 0.398       | 29      | 0.581                | 25      |
| Região Autónoma da Madeira (1 NUTS) | 0.751  | 3       | 0.792     | 9       | 0.895  | 30      | 0.810 | 3       | 0.704       | 17      | 0.782                | 4       |

Table B2 - Regional HDI Results for 2006

Notes: Governance data is unavailable between 2005 and 2007.

|                       | Income |         | Education |         | Health |         | HDI   |         | Environment |         | HDI with Environment |         |
|-----------------------|--------|---------|-----------|---------|--------|---------|-------|---------|-------------|---------|----------------------|---------|
|                       | Index  | Ranking | Index     | Ranking | Index  | Ranking | Index | Ranking | Index       | Ranking | Index                | Ranking |
| Portugal              | 0.588  | -       | 0.810     | -       | 0.972  | -       | 0.773 | -       | n.a.        | -       | n.a.                 | -       |
| Norte (8 NUTS)        | 0.404  | -       | 0.777     | -       | 0.977  | -       | 0.674 | -       | 0.714       | -       | 0.684                | -       |
| Minho-Lima            | 0.210  | 27      | 0.859     | 5       | 0.966  | 20      | 0.559 | 27      | 0.592       | 24      | 0.567                | 25      |
| Cávado                | 0.370  | 18      | 0.787     | 20      | 0.985  | 4       | 0.660 | 18      | 0.663       | 20      | 0.661                | 17      |
| Ave                   | 0.320  | 21      | 0.762     | 26      | 0.974  | 15      | 0.619 | 21      | 0.663       | 20      | 0.630                | 23      |
| Grande Porto          | 0.583  | 7       | 0.836     | 9       | 0.977  | 11      | 0.781 | 7       | 0.929       | 7       | 0.815                | 3       |
| Tâmega                | 0.149  | 29      | 0.639     | 30      | 0.969  | 17      | 0.452 | 30      | 0.418       | 27      | 0.443                | 28      |
| Entre Douro e Vouga   | 0.424  | 17      | 0.749     | 27      | 0.995  | 1       | 0.681 | 17      | 0.357       | 28      | 0.580                | 24      |
| Douro                 | 0.275  | 23      | 0.774     | 25      | 0.960  | 23      | 0.589 | 25      | 0.939       | 6       | 0.662                | 16      |
| Alto Trás-os-Montes   | 0.275  | 23      | 0.780     | 23      | 0.965  | 21      | 0.592 | 24      | 0.857       | 12      | 0.649                | 21      |
| Centro (12 NUTS)      | 0.456  | -       | 0.829     | -       | 0.978  | -       | 0.718 | -       | 0.745       | -       | 0.724                | -       |
| Baixo Vouga           | 0.504  | 9       | 0.781     | 22      | 0.983  | 6       | 0.729 | 11      | 0.714       | 18      | 0.725                | 11      |
| Baixo Mondego         | 0.593  | 6       | 0.941     | 1       | 0.986  | 2       | 0.819 | 4       | 0.765       | 15      | 0.806                | 4       |
| Pinhal Litoral        | 0.604  | 5       | 0.834     | 10      | 0.985  | 3       | 0.792 | 6       | 0.541       | 26      | 0.720                | 13      |
| Pinhal Interior Norte | 0.167  | 28      | 0.713     | 28      | 0.974  | 14      | 0.488 | 28      | 0.582       | 25      | 0.510                | 27      |
| Dão-Lafões            | 0.290  | 22      | 0.833     | 11      | 0.978  | 9       | 0.619 | 22      | 0.714       | 18      | 0.641                | 22      |
| Pinhal Interior Sul   | 0.335  | 20      | 0.790     | 18      | 0.956  | 25      | 0.633 | 20      | 0.735       | 16      | 0.657                | 19      |
| Serra da Estrela      | 0.149  | 29      | 0.789     | 19      | 0.968  | 18      | 0.485 | 29      | 0.653       | 22      | 0.522                | 26      |
| Beira Interior Norte  | 0.275  | 23      | 0.797     | 16      | 0.978  | 12      | 0.598 | 23      | 0.888       | 11      | 0.660                | 18      |
| Beira Interior Sul    | 0.474  | 13      | 0.898     | 3       | 0.974  | 13      | 0.746 | 8       | 0.959       | 3       | 0.794                | 6       |
| Cova da Beira         | 0.251  | 26      | 0.813     | 15      | 0.984  | 5       | 0.586 | 26      | 0.898       | 9       | 0.652                | 20      |
| Oeste                 | 0.498  | 10      | 0.776     | 24      | 0.971  | 16      | 0.721 | 12      | 0.898       | 9       | 0.762                | 9       |
| Médio Tejo            | 0.443  | 14      | 0.898     | 2       | 0.981  | 7       | 0.731 | 10      | 0.653       | 22      | 0.711                | 15      |
| Lisboa (2 NUTS)       | 0.853  | -       | 0.847     | -       | 0.975  | -       | 0.890 | -       | 0.969       | -       | 0.909                | -       |
| Grande Lisboa         | 0.984  | 1       | 0.860     | 4       | 0.979  | 8       | 0.939 | 1       | 0.969       | 2       | 0.946                | 1       |
| Península de Setúbal  | 0.363  | 19      | 0.815     | 14      | 0.967  | 19      | 0.659 | 19      | 0.949       | 5       | 0.722                | 12      |
| Alentejo (5 NUTS)     | 0.544  | -       | 0.812     | -       | 0.962  | -       | 0.752 | -       | 0.857       | -       | 0.777                | -       |
| Alentejo Litoral      | 0.912  | 2       | 0.819     | 13      | 0.954  | 27      | 0.893 | 2       | 0.827       | 13      | 0.876                | 2       |
| Alto Alentejo         | 0.443  | 14      | 0.845     | 6       | 0.959  | 24      | 0.711 | 15      | 0.990       | 1       | 0.772                | 8</     |

### Table B3 - Regional HDI Results for 2007

Notes: We don't have environmental data available for the Autonomous Regions of Açores and Madeira for 2008 and 2007. Governance data is unavailable between 2005 and 2007.