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(Directorate General for Regional Policies)

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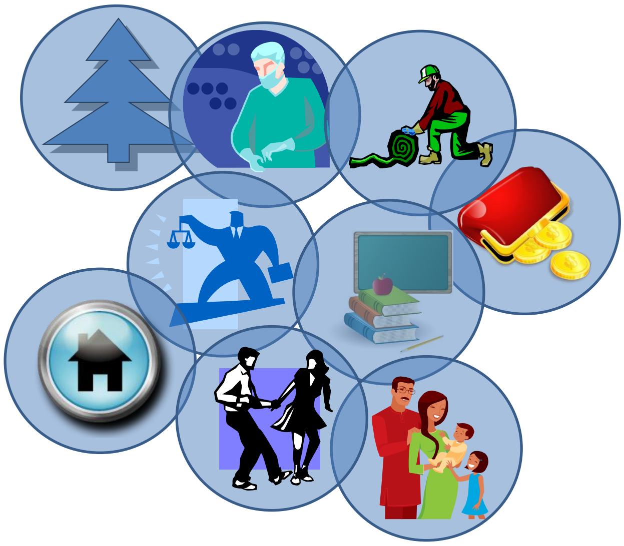

Quality of Life at the sub-national level: an operational example for the EU

Paola Annoni and Dorota Weziak-Bialowolska

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Lewis Dijkstra

European Commission - DG for Regional Policies

Executive Summary

This study is the outcome of the European Commission joint project DG JRC / DG REGIO on the measure of quality of life of European regions. European Union cohesion policy supports the economic and social development of regions, especially lagging regions, throughout an integrated approach with the ultimate goal of improving citizens' wellbeing. In this setting, measuring quality of life at the sub-national level is the first step for assessing which regions can assure or have the potential to assure good quality of life and which cannot.

The definition of the concept to be measured is the first and often most difficult phase of the measuring process. In the context of people's well-being the task is particularly complex. Concepts like quality of life, happiness, well-being and life satisfaction are so interconnected with each other that it is difficult to clearly distinguish their different meaning and implications. On the basis of a broad literature review, we decided to focus our measure on **basic functionings** like being adequately nourished and educated, affording and receiving proper health-care, having decent housing, etc. Basic functionings share two important characteristics: are elementary preconditions for complex ones, playing a crucial role in the development of acquired capabilities, and are more easily amenable to social policy interventions. The measure we are seeking is then best defined by ***Quality of Life*** - QoL hereafter - then *Wellbeing* that in our mind covers a broader range of human aspects.

To our best knowledge, this project simultaneously features three innovative points. First the attempt to measure QoL for the European Union regions (NUTS1/NUTS2). Second, the adoption of a type of aggregation, at the lowest level of QoL dimensions, which penalizes inequality across indicators, for mitigating compensability. Third, the inclusion of housing costs in the computation of individual's disposable income take into account different cost of living. Let's briefly address them.

We agree that **QoL is a multi-dimensional concept** comprising objective measures, describing economic and social opportunities, and people's perceptions of these resources, which we understand as subjective measures of objective aspects. Therefore our measure of QoL envisages the measurement of several dimensions. Each dimension is also multidimensional and consists of different sub-dimensions, that we call components. Both objective and subjective indicators populate each QoL dimension. Objective indicators are intended as 'drivers' of QoL and subjective measures are used to gauge the actual effectiveness of the drivers, in other term to assess how good they are perceived. Objective and subjective indicators are separated into different components within each dimension. This Report presents the first results and focuses on two major dimensions of QoL, Living Standards and Health. Preliminary results of the dimension on Inequality are also shared.

In populating the QoL dimensions our requirement is twofold: describing the **sub-national level** and the **interactions** across different QoL aspects. To comply with this, the starting point was **micro-data analysis** for setting up as many indicators as possible at the regional NUTS1/NUTS2 level. Our core data source is cross-sectional data in European Statistics on Income and Living Conditions, EU-SILC, three waves: 2007, 2008 and 2009. EU-SILC links different aspects of QoL at the household and individual level. It also allows for the analysis of interdependencies across different QoL aspects, which are used for estimating inequality levels. Unfortunately a fair amount of countries in EU-SILC - Germany, Denmark, The Netherlands, Portugal, Slovakia and the United Kingdom -

does not provide regional identifiers making impossible to disaggregate the analysis at the sub-national level. This is indeed consistent with the fact that the survey sample is designed to be representative at the national level only. This point will be shortly addressed.

Supplementary country specific data sources are used for regional analysis of the two major countries lacking regional identifiers in EU-SILC: the German Socio-Economic Panel SOEP, 2008 and 2009 waves, and the United Kingdom Understanding Society Survey USS, 2009 wave. Many comparability problems arose in the process of merging indicators from EU-SILC with those from these country specific surveys, SOEP and USS, resulting in a partial regional analysis for Germany and United Kingdom.

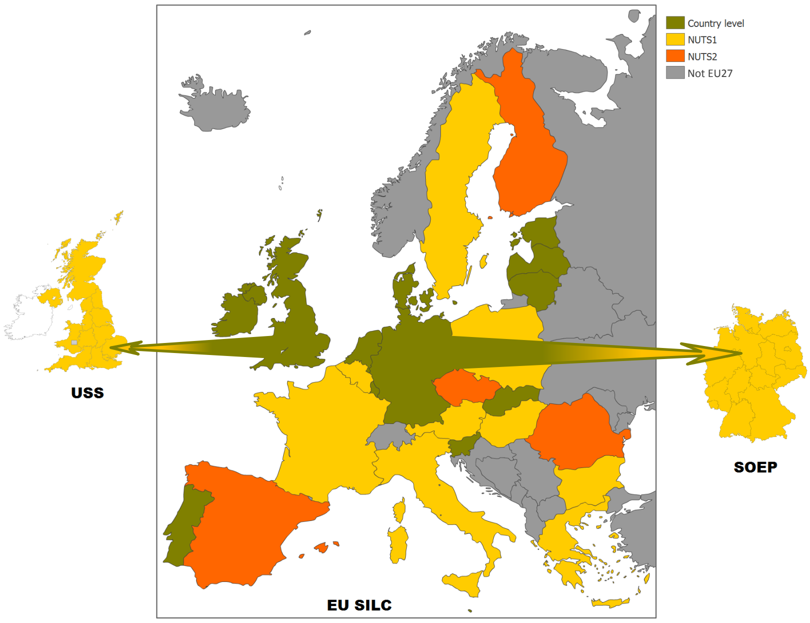
Indicators from Eurostat Regional Statistics have been also included when available at the NUTS2 level.

EU-SILC is designed to provide reliable estimates at the national level and for the subgroups such as sex, household size, household type and socioeconomic groups. The same is valid for SOEP and USS. Using data from surveys not designed to properly describe the sub-national population gives rise to the issue of non representativeness at a sub-national level. Having said that, one of our main goals is to provide estimates at the sub-national level as we are aware of the limits of a purely national approach when measuring QoL. Our decision is then to keep the sub-national level whenever possible. This does not mean that we are not aware of the shortcomings and limitations of this approach. On the contrary, we consider our analysis as an exercise which should foster national statistical offices not to collect more data but to properly collect them at the sub-national level, either regional or, al least, by degree of urbanisation. Following this line of reasoning, the goal of this study is to describe all the steps undertaken and all the lessons learnt instead of proposing an ultimate QoL multi-dimensional measure.

All these points considered, we still tried to make the best use of currently available data. To this aim sub-national data reliability is assessed by comparing the weighted sample size for different gender-age classes in the different surveys with Eurostat based population share in the same gender-age classes within each region (source: Eurostat Regional Statistics). Both descriptive and inferential statistics are employed for the comparison. Results suggest that in terms of sub-national representativeness: *a.* EU-SILC, wave 2007, is the least reliable among the three analysed due to almost all French NUTS2 regions and the two Spanish North-African regions (Ciudad Autónoma de Ceuta and de Melilla); *b.* USS is quite reliable; *c.* SOEP shows some problems and results from this survey shall be taken cautiously. To reduce the impact of sample sizes not reliable enough, the geographical level for France was moved from NUTS2 to NUTS1 and the two problematic Spanish regions were discarded while keeping the NUTS2 level for the rest of the country. The final geographical level adopted in the analysis is shown in the map below.

To further enhance the quality of sub-national analysis, final EU-SILC indicators are computed as arithmetic means across three waves, 2007, 2008 and 2009. For indicators extracted from SOEP and USS this is not feasible as the same questions are not available for multiple waves.

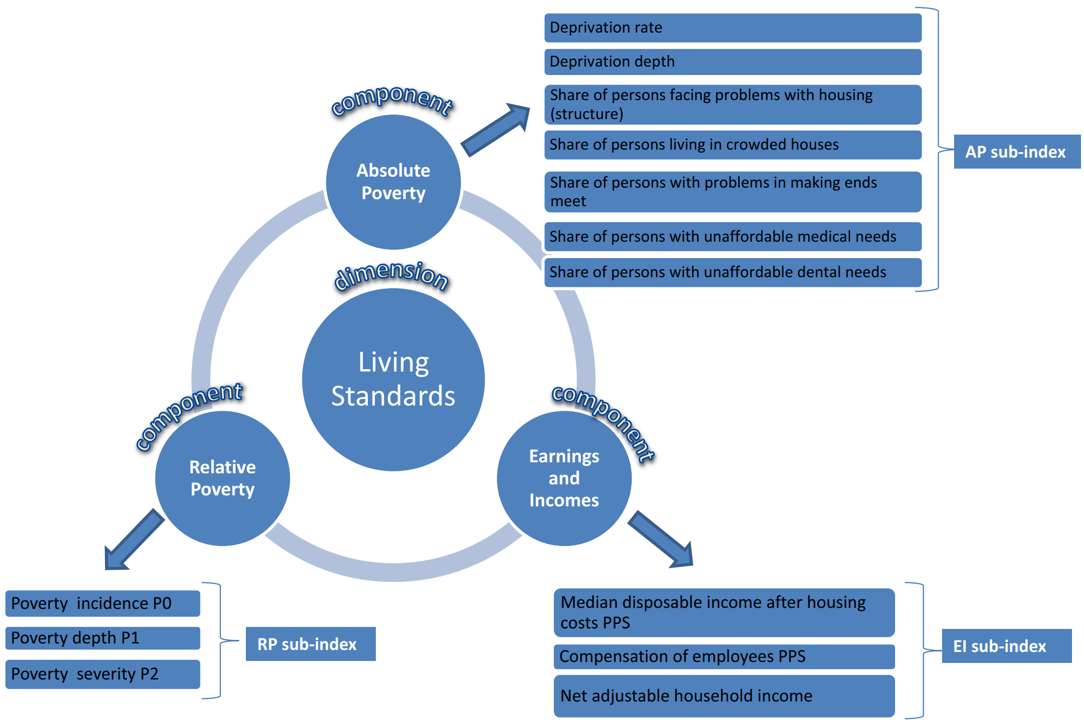
Following recommendations by different scholars on the topic, no aggregation is neither performed across different dimensions nor their components. Composite indexes are computed only within each component by means of an **inequality-adverse type of aggregation** - generalized mean with power $\beta = 0.5$ - in order to mitigate possible compensability effects among indicators. The measure computed at the component level is called sub-index.



Final NUTS level considered for different countries.

Three components are included in the **Living Standards dimension** describing monetary and non-monetary aspects: 1. Absolute Poverty; 2. Relative Poverty and 3. Earnings and Incomes, since income and wealth by themselves are not sufficient determinants of peoples standards of living. The three components included in the Living Standards dimension try to meet the challenge of a multi-dimensional measure of poverty. Absolute Poverty includes non-monetary indicators of material deprivation rate and intensity, capacity of making ends meet, quality of the housing and affordability of health and dental care. Relative Poverty includes three classical poverty measures, poverty incidence, depth and severity, measured on the basis of national poverty lines. The third component of the Living Standards dimension describes monetary aspects. It includes the median regional income, computed from the individual income distribution within each region, and two other measures from regional accounts Eurostat data: compensation of employees and net adjustable household income.

Individual income from EU-SILC is adjusted by the inclusion of **housing costs**. Housing costs are introduced in order to get a better estimate of the real disposable income which takes into account different costs of living in different regions. Housing costs are included in the computation of both individual income and poverty lines. The analysis shows that the inclusion of housing costs considerably changes regional rankings with respect to the scenario without housing costs. The Relative Poverty component is particularly affected by the inclusion of housing costs. Two clearly distinguished groups of regions are spotted: 1. regions where more people are considered poor with the inclusion of housing costs and 2. regions where less people are classified as poor by including housing costs (people are on average assumed to be richer). The former group of regions are those where housing costs are relatively high with respect to incomes, typically large urban areas, while in the latter group housing costs are lower. Housing costs proved to be a relevant source of variation at the regional level with effects depending on the type of region likely linked to the urbanisation level of the area. We observed that not

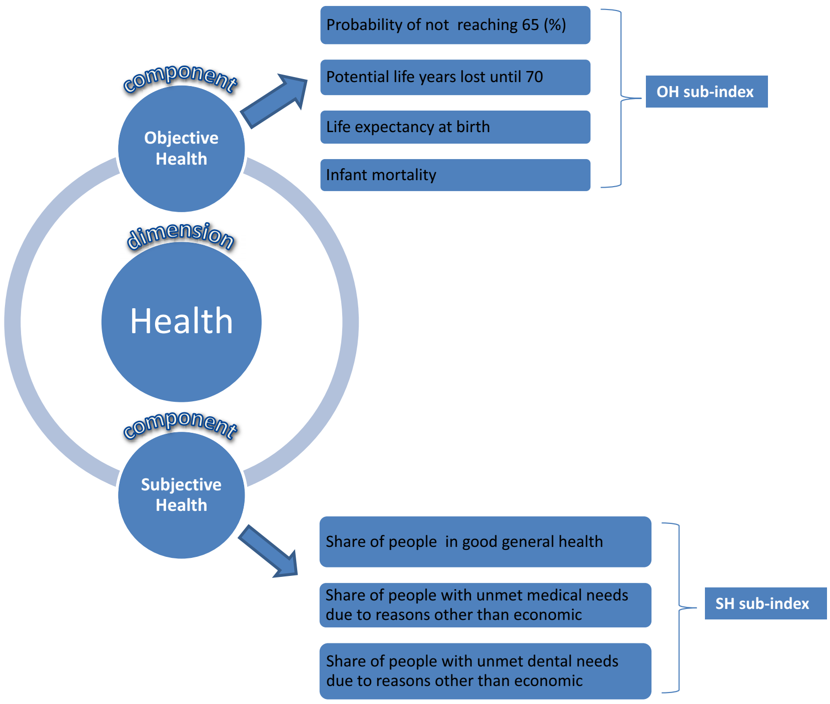


Framework of the Living Standards dimension

adjusting for differences in housing costs leads to a relevant overestimation of poverty in low cost areas and an underestimation of poverty in high cost areas.

The three sub-indexes in the Living Standards dimension describe the concept of poverty from completely different perspectives. In many cases the region rank according to one sub-index is very different from its rank according to another sub-index. This should suffice to explain why further aggregation is not feasible in this case. It can be noted the presence of some regions where, despite a rather good level of Earnings and Incomes, feature high levels of Absolute Poverty and especially Relative Poverty. This is found for example for two, out of three, NUTS1 regions in Belgium - Région de Bruxelles-Capitale plus Hoofdstedelijk Gewest Vlaams Gewest (BE1) and Région Wallonne (BE3). In other cases the Relative Poverty level is quite good but levels of Absolute Poverty are high or Earnings and Incomes are generally low. This is the case for example of Cyprus, two Czech regions - Stredni Cechy (CZ02), Jihozapad (CZ03) - and the Hungarian region Kozp-Magyarorszag (HU1) and corresponds to a condition of ‘homogeneous poverty’ where inequality is not really an issue as people are on average not wealthy. The opposite can be said for United Kingdom, where good levels of Earnings and Incomes and Material Deprivation sub-indexes correspond to high levels of Relative Poverty. This signals the presence of pockets of deprivation in a country with high inequality. The sub-national analysis of USS data shows that the London region is the most responsible for this.

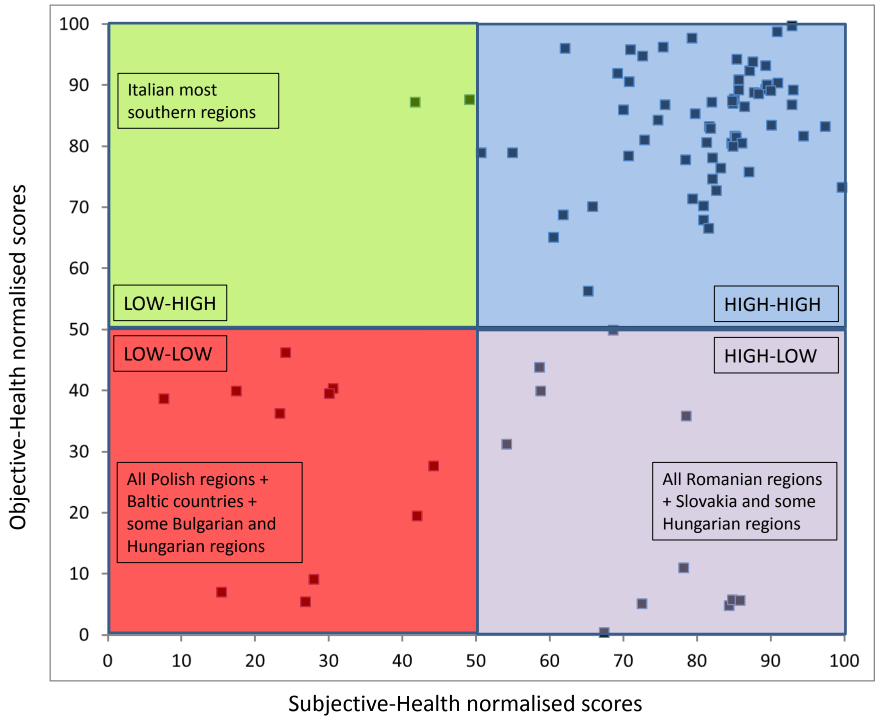
The Health dimension describes objective and subjective aspects. Objective component includes infant mortality, life expectancy, potential life years lost until 70 and probability of not reaching the age of 65. They are available in Eurostat Regional Statistics at the NUTS2 level for all Member States. Indicators included in the Subjective Health component describe self-reported health status and perceived quality of the health-care system: share of people declaring to have good general health, share of people declaring they experienced unmet medical or dental need due to reasons related to health-care system efficiency, accessibility and/or trust.



Framework of the Health dimension

It is well known that objective and self-reported indicators are intrinsically different and this is even more valid in case of health, which is the most important aspect in one's life. The two sub-indexes of objective and subjective health are compared in the scatter-plot below.

The plot is divided into four quadrants and it can be noted that for most regions subjective and objective health measures matches (high-high and low-low quadrants) with a prevalence of high-high points that means that most people are, thankfully, in good health. Romanian regions behave in a peculiar way: although people perceive to be in good health, the level of objective health is low. This can be related to the *awareness issue* which can bias self-reported health measures, as suggested by some experts in the field. A person living in a community with many diseases and poor health-care system may be inclined to underestimate her/his own health condition, taking as normal symptoms which are clinically preventable and/or treatable. It is also worth noting the two most souther Italian regions which, even if very close to the border, are the only ones belonging to the low-high quadrant. People there behave in the opposite way than Rumanians: they report not to be in good health condition despite



Subjective sub-index vs Objective sub-index (normalized min-max values).

a pretty good objective health. Are they incline to complain? It can be. But other reasons certainly underly this outcome, reasons that are not correctly captured by our limited set of indicators.

The importance of measuring inequality in the various aspects of QoL is undoubtable and stressed by all the scholars in the field. The QoL project will eventually include an **Inequality dimension** describing classical measures of income inequality and also the interconnections between income level and other aspects of QoL, like education, heath-care accessibility, work-life balance, etc. A necessary condition for the analysis of interdependencies is the possibility of observing different QoL indicators simultaneously with income and other monetary indicators for the same individual. Only multi-dimensional social-economic surveys like EU-SILC, which is indeed our core data source, allow for this kind of analysis. The preliminary results of inequality assessment are discussed in this report. Only three indicators of inequality levels at the regional level are included so far from EU-SILC micro-data: 1. the quantile ratio $\frac{S_{80}}{S_{20}}$ as income inequality; 2. the difference in share of population affording medical treatments between people in the lowest income class and those in the top income class; 3. the difference in share of population not affording dental treatments between people in the lowest income class and those in the top income class. The last two indicators are an attempt to measures the cross-dependency between health-care and income level. The major drawback of this approach is related to sample sizes: by splitting the sample in each region into the sub-populations of poor and rich the sample representativeness is weakened even further. Aware of that, only a qualitative statistical analysis is provided. Inequality indicators are categorized into five classes according to percentiles P_{20}, P_{40}, P_{60} and P_{80}. The least unequal regions are in Finland and the Czech Republic, plus the Vlaams Gewest region in Belgium and some Spanish regions in the North West. The most unequal countries, with all regions showing high levels of inequality, are Bulgaria, Greece, Latvia, Portugal and Romania. Other countries have some highly unequal regions: it is the case of Italy with its two most southern regions (Sud e Isole) and Poland with the capital region (Centralny) and the south-western region (Poludniowo-Zachodni).

Contents

Chapter 1

What, why, how

1.1 Introduction

This project is the outcome of the European Commission joint project DG JRC / DG Regio on the measure of social economic quality of life (hereafter referred to as QoL) at the regional level.

European Union cohesion policy supports the economic and social development of regions, especially lagging regions, through an integrated approach. Cohesion policy lies at the core of the EUs policy objective of improving the quality of life of its citizens formulated in the Well-being 2030 project. To be able to do this, it is important to know how we can measure social economic QoL at the sub-national level. The importance of the theme is strengthen by the strategy of the European Commission for Europe 2020 which calls for *smart, sustainable* and *inclusive* growth.

It has long been acknowledged by economists and social scientists that judging the success of society through objective economic indicators is by far not enough. But it is only since recently that this view has been adopted by policy makers and the general public. A recently published Newsletter by *The Nation* reports the economist Kenny's quotation that 'The biggest success of development has not been making people richer but, rather ... making the things that really matter - things like health and education - cheaper and more widely available' (TheNation, 2011). This fosters the measurement of a broader concept related to QoL and well-being to overcome the GDP limitations by including non-monetary indicators. Scholars have been calling for measuring quality of life and well-being beyond purely economic factors since the 1960s. See Sirgy et al. (2006) for an overview of the 'quality-of-life movement'. With this respect, the Bhutan case may serve as an example with its Gross National Happiness Index (GNH) launched in 2008 and recently published for the second time (Ura et al., 2012). It comprises nine different domains, including psychological well-being and governance. In Europe national and super-national institutions started only recently a debate which involves official statistics, policy makers and the general public. A relevant example is the Organisation for Economic Co-operation and Development (OECD) with its Global Project on Measuring the Progress of Societies and the European Commission Communication 'GDP and Beyond: Measuring Progress in a Changing World'. One of the most influential initiatives is the Commission on the Measurement of Economic Performance and Social Progress headed by Professors Stiglitz, Sen and Fitoussi which, in its final report from autumn 2009 (Stiglitz et al., 2009), called for a "shift [of] emphasis from measuring economic production to measuring people's well-being." The rethinking of economic growth following the economic and financial crisis added another impetus to developing alternative measures of socioeconomic well-being. While there are numerous initiatives and concrete examples of well-being and QoL indicators at the national level, the availability of regional indicators is very scarce and usually limited to one country. Given the relatively unexplored nature of regional well-being indicators, developing one at the EU regional level (NUTS1) provides an important added value to the research area itself. Alongside these initiatives and drawing on the most recent research and experience in well-being measurement, the goal of this project is to develop a measure of QoL, at the level of the European regions, there where most of the aspects of peoples lives are formulated.

In this Chapter we try to answer the *what*, *why* and *how* questions of the project.

1.2 What

The definition of the concept to be measured is the first and often most difficult phase of the measuring process. In the context of QoL the task may be particularly complex. Concepts like quality of life, happiness, well-being, life satisfaction and many others are so much interconnected with each other that it is frequently difficult to clearly distinguish their different meaning and implications. One of the authors of the Canadian Index of Wellbeing (Section 2.7), recently wrote that 'human beings are complex organisms living in very complex social, political, economic and environmental conditions, and that a plausible measure of progress will almost certainly have to be very complex' (from Michalos (2011), p. 128). We need then to clearly define *what* we want to measure.

First, the QoL is a concept which must regard individuals. The individual level is thus the one of interest here even if the final outcome is aggregated to describe the 'average' level of QoL for a certain group of individual, at the regional and the country level. As individual are the focus of the measurement process, the conceptualization of the measurement process can follow either in the *capability* or the *functioning* approach. We do not want to enter here the heated debate on capability and functioning approaches but a short comment is due at this point. Amartya Sen, one of the authors of the report by Stiglitz et al. (2009), has long been promoting the capability approach in contrast to the functioning one (Sen, 1985). He is in favour on what a person *can* do or *can* be - capabilities - instead on what she/he actually is - realised capabilities, also functionings. His argument is that it is up to individuals whether they realise their capabilities or not. But, then data requirement for the actual implementation of the capability approach is tremendous, as also pinpointed by the authors of the feasibility study for Well-Being Indicators (Eurostat, 2010b), and applied research is restricted to the description of functionings. Apart from data requirements, other scholars (see Michalos (2011) as a recent example) argue that this in inconsistent with the Aristotelian view that 'the quality of a person's or of a community's life is a function of the actual conditions of that life and what a person or community makes of those conditions' (from Michalos (2011), p. 120). In other words the freedom to choose our own life is only a necessary condition for a good life. Putting all these things together we decided to focus our measure on realised capacities and we refer to it as Quality of Life, QoL. The term well-being is avoided in this analysis as it might be argued, as it indeed was (Rojas, 2011), that there is no objective well-being and no distinction between subjective and objective variables does apply in the case of measuring well-being. Our position is then far from this as quality of life is considered here to be a multi-dimensional concept comprising objective measures, describing economic and social opportunities, and people's perceptions of these resources, which we understand as subjective measures of objective substances. A comment is in due at this point. In the wellbeing literature subjective wellbeing encompasses aspects like cognitive evaluations of one's life, happiness, satisfaction, positive emotions (joy, pride) and negative emotions (pain, worry). However, to incorporate these notions into a measure at the European level one needs reliable and consistent data and European official statistics are not yet ready to provide large-scale data on that. Some recent initiatives, the most relevant may be the Stiglitz-Sen-Fitoussi report (Stiglitz et al., 2009), have the merit of having fostered the debate within official statistics on the supply of information for measuring wellbeing and social progress. For the time being, the lack of this kind of data at the EU level induced us to consider subjectivity from another perspective.

The QoL measure we propose includes objective living conditions, such as disposable income, material deprivation, quality of housing, and subjectively reported perceptions about these factors, like perceived level of rule of law, institutions corruption or quality of public services. Objective living conditions are intended as 'drivers' of QoL and subjective measures are used to gauge the actual effectiveness of the drivers, in other term to assess how well they function. Our choice about subjective measures is then not to include personal feelings and attitudes. For instance, questions of the type 'Subjective general health' or 'How satisfied with life as a whole' are not included, while questions 'State of health services nowadays' or 'How satisfied with national government' are included[1]. We are aware that our approach completely ignores individual attitudes and happiness and that much wider definition of QoL are under debate within the international community. But we must limit our ambitions. First because we are going to provide a measure based on variables[2] on which the governments and the European Commission can have a political impact. We take the view that, although research on psychological dispositions of individuals does add valuable insights to our knowledge on well being (see, for instance, Kahneman and Krueger (2006), Schokkaert (2007) or Fleurbaey (2009) on the measurement of subjective wellbeing), such emotional states are less amenable to social policy interventions. In other words, there is very little that policies could do to change the subjective component of people's happiness. Second because questions about life satisfaction can be influenced by different noises like the mood of the moment, comparisons with other people or past experiences, incidental events which temporarily affects one's mood and even the weather (Fleurbaey, 2009; Kahneman et al., 2004). Individual attitudes and happiness are then prone to different biases and may be (partly) attributable to personal cultural and historical factors.

These reasons suggested us to focus more on 'quality of life' instead of 'well-being' as the latter should include factors as self-reported happiness, life satisfaction, feelings, autonomy and self esteem not included in the this project. Our definition of QoL draws upon the two concepts of well-being described by Zuleeg et al. (2010). They argue that well-being encompasses two broadly different concepts: quality of life and subjective well-being,

[1] The questions given as example are from the European Social Survey

[2] The words *variable* and *indicator* are used as synonymous in this Report.

alias happiness. The former '... is based on measurement of objective determinants of people's quality of life such as the material resources available to them. Subjective well-being is based on measurements of how people feel' (from Zuleeg et al. (2010) p. 12). The two concepts are obviously related, but their relationship is far from straightforward. Our measure can be only viewed as a necessary condition for individuals' well-being, but the actual realization of one's happiness is completely another thing.

1.3 Why

The ambition of this project is to provide a sound measure of QoL of European citizens which should be ultimately used by decision makers to guide cohesion policy across EU regions. The cohesion policy mandate is to deliver high and sustainable level of QoL to people across the European Union irrespective of the place where they live. Many aspects of life and well-being have a straightforward link to policies most of which are defined at regional and local level. Our measure comprises a variety of aspects on which policies can clearly act. For example, indicators describing the level work-life balance (from European Social Survey and Eurobarometer) are taken into account. A household with a penalizing work-life balance may suffer if with small kids and with no affordable access to childcare services. Besides, the impact of these disadvantages is generally higher for women than for men, thus decreasing social cohesion and equality. A possible policy action to alleviate these problems is improving availability/affordability of child care.

Besides the political utility, we would like the QoL measure to be useful also to the man-in-the-street. The QoL measure is designed to capture regions' adaptability and resilience, investment in the future - e.g. access to all levels of education and equity and fairness. *In summa* a kind of viability index. People may read this measure and all its components to decide where to live and, even more, where they want their kids to settle down. We understand high levels of QoL as describing regions which are able to embrace post modern challenges, while low levels of QoL as describing regions which duck their head in the sand (A. Saltelli, personal communication).

1.4 How

Actually the *How* question is the topic of this report. We provide here a brief outline of the different steps carried out while building the QoL measure.

The definition of the concept allows us to focus our analysis and to set up the theoretical framework which is broadly inspired by the dimensions of well-being discussed in the Stiglitz et al. (2009). It is worth noting that, as discussed in the next Chapter (Chapter 2), there is a general agreement across the recent relevant initiatives on the dimensions to be included.

Having designed the general framework, each dimension has been populated by candidate indicators to measure both objective drivers and their perceived quality to provide a dual description of QoL components. Objective aspects, like net household income or university accessibility, are understood as inputs to QoL with respect to the dimension under analysis. They contribute to people's QoL by helping them in realising their capabilities. For each QoL component subjective measures are also included, depending on data availability, to capture the perceived effectiveness of these conditions: building hospitals or increasing the number of hospital beds is one thing, delivering satisfactory health care is another. Whenever possible our measure incorporates simultaneously objective and subjective indicators for describing each dimension. The search of candidate indicators is carried out by looking at different data sources like European Social Survey, EU-Silc, Eurostat-Labor Force Survey, European Working Conditions Survey, European Quality of Life Survey, Eurobarometer and Eurostat. The challenge is to find a set of indicators which reliably represent the regional, sub-national dimension. The quality of the data is then inspected by statistical methods and a subset of feasible indicators is eventually included in the framework. Within each dimension, ad hoc methodologies are used to treat differently objective and subjective data. The treatment of objective variables when measuring latent concepts is quite well established and it is based on the use of multivariate statistical techniques to check data consistency and isolate the relevant information. Treatment of subjective data may pose more difficulties as data are collected in surveys. Responses to surveys are in general influenced by various contextual factors such as question ordering, question wording, social desirability (respondents do not want to look bad in front of the interviewer) or wrong attitude (Bertrand and Mullainathan, 2001). To cope with these disturbing factors, specific statistical methods can be used to simultaneously extract the important components and assess the quality of the questions.

An important step of the analysis is the inclusion of inequality indicators. The feeling of QoL is indeed strongly influenced by inequalities in the society, especially for economic aspects. For instance, the idea that the social welfare depends on average income *and* inequality of incomes has a long tradition in welfare economics (Osberg and Sharpe, 2002). Just to quote one recent example from *The Economist*: 'More unequal countries have worse indicators, a poorer human-development record, and higher degrees of economic insecurity and anxiety' (TheEconomist, 2011). Wilkinson and Pickett (2009) argue that inequality 'gets under the skin' and makes everyone worse off, not just the poor. But as Adam Smith stated, inequality is local (TheEconomist, 2011) and this supports once more the idea of local (at least regional) measures of QoL. To incorporate inequality in the measure of QoL it is necessary to compute both average measures, like average disposable income, and distribution measures, like the Gini coefficient or the quantile ratio of the distribution of income. This is taken into account as the QoL measure is based, when available, on micro-data at the regional level. (some more on this when we will agree on the best practice to use in our case).

Once the framework and all its indicators are set-up the key question in QoL measures is: shall it be a dashboard or a composite indicator? The issue whether aggregating or not is not peculiar to well-being indices but to all the cases of measuring multi-dimensional, complex phenomena. Nonetheless, if aggregate measures are quite well accepted in the quantification of economic quantities, composites are more controversial when measuring well-being and other human aspects. In the well-being case the compensability among dimensions, which is one of the critical aspects of aggregate indexes, is generally viewed as non appropriate as dimensions like health and education are hardly seen as substitutable. On the other hand composite indicators - CIs - appeal policy-makers, journalists and the public because allow for unique rankings. Being an aggregate measure, one of the most crucial

choice in building CIs is deciding the weights to be assigned to different aspects and the way in which they are combined. Both Stiglitz et al. (2009) and Atkinson et al. (2010) recommend a portfolio of indicators instead of a composite index aggregating performance into a single number.
The analytical form of most composite indicators is a weighted arithmetic mean. Two major issues can be envisaged with this: 1. weights should be set taking into consideration their role in determining the trade-off between indicators/dimensions; 2. when measuring QoL, the synergic effect of multiple disadvantages is highly important, as 'having multiple disadvantages far exceeds the sum of their individual effects' (from Stiglitz et al. (2009), p. 15). In our QoL measure, both issues are taken into account and alternative solutions are implemented.

Finally, robusteness analysis (complete this when UA will be done).

Chapter 2

Literature review

2.1 An overview

Concepts as well-being and quality of life have been studied since long as being the final goal of human life. A wide set of literature is therefore available. Within this there exist many examples of QoL measure, which is the focus here (for a review of quality of life indexes published between 1970 and 2000 see Hagerty et al. (2001). Some of these studies discuss important conceptual and methodological aspects, others actually develop aggregate or composite indicators of well-being. These composite measures range from very basic indicators, like the UN Human Development Index, launched for the first time in 1990, to more complex and multi-faceted indices, like the Canadian Index of Well-Being (Michalos et al., 2010).

A global movement for the reformulation of societal progress in terms of well-being was initiated in 2004 with the first OECD World Forum on *Statistics, Knowledge and Policy* which had the merit of spreading the need of going beyond GDP to general public. In that very same year the center for well-being at the New Economics Foundation - **nef**, a think-and-do tank on different areas - started the process of conceptualizing well-being of societies in its *Well-being Manifesto for a Flourishing Society* (Shah and Marks, 2004). Then in 2007 at the end of the second OECD World Forum the 'Istanbul declaration', issued by the European Commission, OECD, Organisation of the Islamic Conference, UNDP and the World Bank, gave more impetus to political and institutional initiatives on the subject. Within others, **nef** in collaboration with the Belgian think tank IDEA Consult and other partners, were commissioned by the European Statistics Agency (Eurostat) to carry out a Feasibility Study to explore how well-being could be measured across Europe, which consists of four tasks published between 2009 and 2010 (Eurostat, 2009, 2010b).

The 2008 economic and financial crisis acted as a booster rather than a killer of the debate around wellbeing and in 2009 the Sarkozy's Commission Report (Stiglitz et al., 2009) composed by eminent economists, provides guidelines for the measurement of societal wellbeing. The report is considered as the *summa* of what available about the measurement of economic performance and social progress. In the same year, 2009, the 'Well-being 2030' initiative started as a two-year research project co-funded by the European Policy Centre and the European

Commission. The project has the aim of investigating which policy choices are more likely to deliver high level of well-being for European citizens by the year 2030, in line with the Lisbon Treaty mandate ‘to promote peace, its values and the well-being of its peoples’ (Zuleeg et al., 2010). The following year the Franco-German Ministerial Council commissioned a report on monitoring economic performance, quality of life and sustainability to the French Conseil d’Analyse Économique and the German Council of Economic Experts (de Boissieu et al., 2010). In the same year the Sofia Memorandum was signed by the Director General of Europe’s National Statistical Offices. The Memorandum recognizes the importance of measuring progress, well-being and sustainable development and asks Eurostat to carry out further work on the topic.

At the end of 2010 the British Prime Minister David Cameron announced the plans to measure well-being in the United Kingdom, after the British Office for National Statistics communication that ‘UK level of life satisfaction and happiness have not risen since the 1950s, despite unprecedented economic growth’. As a consequence, Mr. Cameron requested the National Statistics Office to organize a national debate on measuring well-being and to develop appropriate measures.

At the end of 2010, a joint CNEL-Istat project has been launched for the measurement of wellbeing in Italy, which involves many societal stake-holders (entrepreneurs, unions, citizens representatives, non-profit organisations, . . .). The purpose is to set up a specific measure which describes the Italian situation and uses the richness of indicators already available, sometimes even at the regional level.

Several other important initiatives have been recently launched in different countries to improve existing metrics of well-being and progress. These initiatives range from nation-wide consultations (such as the aforementioned one in the United Kingdom), to parliamentary commissions (such as the ones established in Germany and Finland), to expert round tables tasked with proposing indicator sets based on existing statistics (such as in Japan, Italy and Spain), to conceptual frameworks integrating progress measures with policy (Australia and Scotland), and to initiatives to develop new statistics (such as new surveys launched in Morocco, Japan and Europe, and the methodological activities undertaken by the OECD and the European Statistical System). All these initiatives are a clear sign of the need to collect more data on a large scale and to provide sound measures of societal welfare for driving policies at the European level.

In this Chapter we will not cover all the huge literature on the topic but we limit our review to what we consider the most prominent initiatives with respect to the goal of this project, measuring the level of QoL in European regions. They are: the Sarkozy’s Commission Report (Stiglitz et al., 2009) (Section 2.2); the Eurostat feasibility study for well-being indicators (Eurostat, 2010b) (Section 2.3); the Well-being 2030 initiative (Zuleeg et al., 2010) (Section 2.4); the OECD compendium (OECD, 2011a) (Section 2.5) the Canadian Index of Wellbeing (Michalos et al., 2010) (Section 2.7) and the joint initiative by the German Council of Economic Experts and The Conseil d’Analyse économique (de Boissieu et al., 2010) (Section 2.6). Not all these initiatives lead to a single, quantitative score of well-being. The Canadian case is the only one which actually produces a single aggregate index (for Canada at the national level) from quite a large number of dimensions and indicators; the OECD compendium is the preparatory study of a wider document (to be issued in October 2011) which provides the conceptual framework and associated indicators to measure well-being in OECD countries in the near future. Eurostat explores the feasibility of a set of indicators for measuring well-being, some of them already gathered in official surveys while others recommended for future inventory. Country profiles are also provided, represented by spider graphs, on the basis of available data-sets. The report by Stiglitz et al. (2009) and the Well-being 2030 initiative give general guidelines and recommendations on the issue without attempting to construct a final index. Last, the Franco-German study strictly follows the recommendations by Stiglitz et al. (2009) and is clear in suggesting a dashboard of headline indicators rather than an aggregate measure.

Despite their intrinsic diversity, all these studies recommended the different aspects to be considered when assessing well-being. Table 2.1 summarizes these recommendations[1]. It must be noted that the distinction between the different dimensions of well-being is sometimes vague and aspects included in one dimension in one study may fall in another dimension in another study. For example, the dimension Public Services, explicitly recommended by the Well-being 2030 team, includes indicators related to health, education and work-life balance which are also recommended by other studies but in other dimensions (specifically the corresponding Health, Education and Job components). With Table 2.1 we try to provide the overall picture of recommended well-being dimensions, with some approximation due to the above mentioned difficulties. From Table 2.1 one can easily see that there is an overall high level of agreement across different studies, i.e. almost all the dimensions are included in all the studies. Well-being 2030 stands out as it is the only one explicitly including the Public Services and Long-term sustainable public finances components, whilst the OECD compendium is the only one including a direct measure of subjective well-being (life-satisfaction). In this chapter the single initiatives are briefly discussed, with particular emphasis on the recommendations we have followed for our measure of QoL.

2.2 Sarkozy's Commission Report

The report by Stiglitz et al. (2009), commissioned by the French President N. Sarkozy, is one of the most notable reference for a general conceptualization of the measurement of economic performance and social progress. Its value is not in the call for going 'beyond GDP', as the limits of GDP have been fully recognized since the 1960s (Michalos, 2011), but rather as a critical summary of all the contributions that scholars in the field provided in the last 50 years or so. Plus, the Commission's analysis has the merit of being a stimulus for the debate on the measurement of well-being within official statistical offices, policy makers and the general public (Noll, 2011). After its publication most of the initiatives on the topic refer in a way or another to this report, *de facto* assigning to it the value of landmark study in the field.

The rational of the study is that, despite the increasing demand and availability of statistics and statistical indicators, there is often a relevant distance between standard social economic indicators and people's perceptions. Human psychology is for sure one of the drivers of this phenomenon but the gap is so large that psychology

[1] The Franco-German initiative is not included in Table 2.1 because its dimensions are exactly the same as the ones suggested by Stiglitz et al. (2009)

	Stiglitz et. al report	Eurostat feasibility study	Well-being 2030	OECD compendium	Canadian Index of Wellbeing
Material living standards	YES	YES in the 'Decent income' determinant	YES in Economic well-being macro dimension, pillars: Income and wealth and housing	YES	YES
Health	YES	YES in the Good health determinant	YES in Quality of life macro dimension, Health status pillar	YES	YES
Education	YES	YES in the Good education determinant	YES in Quality of life macro dimension, Education and skills pillar	YES	YES
Jobs	YES in Personal activities	YES in the Safety-security component group, economic security component	YES in the Labor Market Participation determinant	YES in the Economic wellbeing macro dimension, jobs and earnings pillar	YES
Leisure activities	YES in Personal activities	NO	YES in the Work-life balance determinant to assess whether too many working hours	YES in the Quality of life macro dimension, Work and Life pillar	YES
Political voice, governance, freedom	YES	YES in the Safety-Security component group, political safety component	NO	YES in Quality of Life macro dimension, civic engagement and governance pillar	YES
Physical environment	YES	YES in the Safety-Security component group, political environment component	YES in the Security determinant	YES in Quality of Life macro dimension, Environmental quality pillar	YES
Economic security	YES with Physical safety	YES	YES in the Welfare state determinant, social safety nets	NO	YES in the Living Standards dimension
Personal security	YES with Economic safety	YES	YES in the Security determinant	YES in Quality of Life macro dimension, Personal security pillar	YES in the Community vitality dimension
Public services	YES distributed across other components	NO	YES in the Welfare state determinant, public services	NO	NO
Social connections (individual level)	YES	YES in the Relatedness-belonging component group, social interactions component	NO	YES in Quality of Life macro dimension, Social connections pillar	YES in the Community vitality dimension
Social cohesion/ solidarity	NO	NO	YES related to immigration issues and integration policies	NO	YES in the Community vitality dimension
Sustainability	YES	NO	YES in Long-term sustainable public	YES as future dimension	YES in Living standards dimension an an indicator in the Aggregate Economic Security Index
Competence and self-esteem	YES proxied by social connections	YES	NO	NO	NO
Subjective wellbeing	YES distributed across all the components	YES distributed across all the components and as an outcome variable	YES distributed across all the components	YES measured solely with the indicator on self-reported life satisfaction	YES distributed across all the components

Table 2.1: Different components of wellbeing recommended by some reviewed initiatives.

alone cannot fully explain it. Stiglitz et al. (2009) argue that there are many other possible reasons to explain the inadequacy of commonly used statistics in describing societal well-being. The most relevant are:

- Incorrect measurement process of correctly defined concepts. Better metrics are needed.
- Inequality measures not included. Starting from micro-data, indicator distributions have to be characterized by both central tendency and asymmetry;
- Not inclusion of environmental related, non-monetary concepts. For instance, indicators of traffic jams, noise and air pollution should be included in the measurement process.
- Statistics not properly used or reported. Net national income or real household income are much better descriptors of economic well-being than GDP (also recently pinpointed by Michalos (2011)).

The structure of the report consists of three main themes: 1. classical GDP issues, 2. quality of life and 3. sustainable development and environment, each of them assigned to different working groups within the Commission. The main messages conveyed by the Commission, particularly relevant to our measure, are briefly discussed in this Section.

Current & future well-being: The focus of the study is both on the present and the future, the former assessed by current well-being, the latter by sustainability or future well-being. Current well-being includes people's economic resources, like income and consumption on goods, and also non-economic aspects of people's life, the quality of their main and leisure activity and how they feel. Sustainability describes whether these levels of well-being can be sustained over time and this depends on the quantities and qualities of natural resources, and of human, social and physical capital which are passed to future generations. Stiglitz et al. (2009) recommendation is to keep the two types of well-being separated and, accordingly, to provide two distinct measures as current well-being may increase at the expenses of future well-being. This is for example the reason why income and consumption, which relate to current well-being, should come along with information on wealth, which is central to measuring sustainability. However, '...the right valuation of these stocks [capital stocks] plays a crucial role, and is often problematic' (from Stiglitz et al. (2009), p. 13). Moreover, in some cases it is not clear whether an indicator pertains to current or future well-being. For instance, '...literacy performance matters for both current well-being and future growth' (from Stiglitz et al. (2009), p. 63). Given the intrinsic difficulty in measuring sustainability, our measure of QoL will solely include indicators pertaining to current well-being and those pertaining to both current and future well-being.

Inputs & Outputs: The role of governments is crucial in our economies. They provide collective services, like security, and individual ones, like health system, education system and sport facilities. These services are generally 'badly measured' (from Stiglitz et al. (2009), p. 11). Most often, in fact, they are measured in terms of inputs used to produce them, such as number of hospital beds or level of expenditure, while it is recommended to assess them in terms of actual outputs produced, such as the number of particular medical treatments or the people's level of satisfaction. This change in the way of measuring does not come with no cost. There are methodological disagreements on how to properly measure government service outputs. As a way to overcome these deficiencies, we propose to include in our project, whenever possible, people's perception to assess the effectiveness of the socioeconomic system.

Objective & Subjective: Objective and subjective data are both necessary to cover all the dimensions of well-being. While there is a common agreement on the definition of objective data, the definition of subjective type of measure is more articulated. For Stiglitz et al. (2009) subjective components of well-being are aspects like cognitive evaluation of one's life, hedonic experience, happiness, satisfaction, positive emotions (joy, pride, satisfaction) and negative emotions (pain, worry, delusion). Despite the difficulties that clearly exist in measuring these subjective factors, the report's authors strongly recommend their inclusion in the well-being measurement. They are encouraging official statistical offices to keep on with their effort in the setting up of specific surveys to this aim.
We anticipate that our measure of QoL includes subjective measures but only with the aim of better describing objective substances. As detailed in Section 2.3 we do not try to measure subjective well-being such as: feelings of positive or negative affect, specific feelings of fear or joy, racism, sexism, beliefs, self-competence and esteem, life satisfaction. Therefore our QoL measure is not a comprehensive measure of well-being but limited to some basic aspects of every-day-life for which data are available and reliable at the EU level. Having said that, we are certainly interested in relating the QoL measure(s) to indicators of subjective well-being already collected at the national level. This will serve as an ex post analysis of the level of goodness of our measure(s), in order to assess whether it is good enough in capturing relevant aspects of our life.

Inequality measures: Most components of well-being require appropriate measures of inequality. Average measures of income, consumption and wealth are not properly describing living standards. Increasing average measures which are associated to inequitable distributions across people groups lead to worse social conditions. Using medians instead of averages helps in better reflecting this effect. Also, it is important to describe what is happening in the bottom part of the distribution, which shapes the actual living condition of the poor.

Multi-dimensionality and multi-disadvantage: The concept of well-being is by all means a multi-dimensional one. The recommended set of dimensions are listed in Table 2.1 (first column). With such a richness of components, one key question immediately arises: composite index or dashboard? The authors claim that 'such a system must, of necessity, be plural because no single measure can summarize something as complex as the well-being of the members of society, our system of measurement must encompass a range of different measures. The issue of aggregation across dimensions [...], while important, is subordinate to the establishment of a broad statistical system that captures as many of the relevant dimensions as possible' (from Stiglitz et al. (2009), p. 12), while the Commission's ninth recommendation says that 'Statistical offices should provide the information needed to aggregate across quality-of-life dimensions, allowing the construction of different indexes' (from Stiglitz et al. (2009), p. 12). The recommendation is contradictory. Our guess is that the Commission's recommendation is to be, at least, cautious when taking the decision of aggregating the different components of well-being. Indeed the Commission's authors argue that the procedures used to weight the components of a composite index are generally arbitrary. The problem not being in the lack of transparency or non-replicability but rather in the lack of clear normative implications.
Another critical point related to aggregation is the multiple disadvantage issue because '...the consequences for QoL of having multiple disadvantages far exceed the sum of their individual effects' (from Stiglitz et al. (2009), p.

15). This is directly connected to social exclusion which is what can happen when people have a combination of problems, such as unemployment, discrimination, poor skills, low incomes, poor housing, high crime and family breakdown. These problems are linked and mutually reinforcing (Speight et al., 2010).

2.3 Eurostat feasibility study

Eurostat feasibility study may be considered as the counterpart of the Stiglitz. et al report at the European level. It is the outcome of a joint effort of a team of consultancy partners and advises Eurostat on how to measure well-being across Europe (Eurostat, 2009, 2010b). The study discusses a number of issues about methodological and operational aspects. The most interesting for our project are:

- Distinction between different types of measures;
- Conceptual framework;
- Data sources;
- Main methodological issues.

Objective vs subjective measures: Like in the report by Stiglitz et al. (2009), the distinction between objective and subjective inidcators is an important point. Objective variables are a way to measure objective facts while subjective variables are those which capture perceptions/feelings/fears. Most of wellbeing aspects can be measured in a twofold way. For instance, in the description of individual/professional activities one may choose to include the variable ‘job satisfaction’, which is subjective, or the variable ‘amount of working hours’, which measures an objective substance.

The distinction between subjective and objective indicators can be made in at least two ways (Eurostat, 2010b). First, they are different in what they capture: either objective or subjective substance. Second, they can differ on the way they are measured: subjective matters can be only measured by subjective questions - ‘How safe do you feel?’ - but objective matters might be measured by subjective questions. For instance the assessment of the crime level can be done by looking at police records (objective measure of objective substance) or by asking people how high they think the crime level is (subjective measure of objective substance). The distinction can then be subtle.

In the QoL project the goal is to quantify objective aspects of QoL by including both objective and subjective measures. There is in fact a general consensus on the fact that objective and subjective indicators are complementary to each other (Eurostat, 2009). Specifically, ‘. . . we suggest merging both approaches [objective and subjective] into a complete set of relevant components’ (from Eurostat (2010b), Section 3.3.1).

In measuring QoL we include objective and subjective measures of objective aspects. As aforementioned (Section 1.2) the distinctive feature of our approach is the exclusion of subjective substances in QoL measurement.

Conceptual framework: The conceptualization of well-being is structured on a clear distinction between drivers and outcomes.

Drivers are understood as determinants of well-being. They are included in the conceptual framework which defines the multidimensional concept of well-being. The framework recommended by Eurostat (2010b) consists of 10 components (dimensions) grouped in 5 classes (Table 2.2 and Table 2.1, second column).

Component group	**Component**
Physiological needs	Income and housing
	Health
	Basic rights on health and income
Safety-security	Physical and political safety
	Economic security (education, skills, job)
	Physical environment
Individual valued activities	Autonomy and freedom
Relatedness-belonging	Social interactions
	Basic rights at social/societal level
Competence and self-esteem	Competence and self-esteem

Table 2.2: Conceptual framework for measuring well-being from Eurostat (2010b), Table 1.

It is worth noting that the component Income and Housing includes the crucial indicator on income inequality measured by distributional statistics as also recommended by the report by Stiglitz et al. (2009), see Section 2.2(more on this shortly below). The study is also suggesting to include a component related to purely psychological aspects like competence, personal effectiveness and feeling of meaning in life, and self esteem, perception of personal resources. However, it is clearly mentioned that ‘further work would need to be done to ascertain the best set of indicators for this set of concepts’ (from Eurostat (2010b), Section 4.6). This means that despite the need of considering subjective measures of well-being, in line with the report by Stiglitz et al. (2009), proper indicators at the European level are still missing. As mentioned before, this dimension will not be considered in the QoL measure proposed in this project.

Regarding the outcome of well-being, Eurostat (2010b) suggests to include a compound indicator called ‘satisfaction adjusted life expectancy’ (SALY). The SALY indicator is computed as average of z-scores of two variables: the ‘overall satisfaction’ variable from European Social Survey and the ‘life expectancy at birth’ from Eurostat. A driver-outcome analysis is then performed, within each framework component, to sort the variables which have the highest prediction power on the country-wise variation in the SALY indicator. In most cases this is done by univariate linear regressions between each driving variable in the same component and the outcome SALY[2] Only drivers with a statistically significant coefficient of at leats 95% are retained for final analysis (Eurostat, 2009).

Data sources: A set of candidate indicators is listed for all the components. Being a feasibility study, some variables are not existing yet but are suggested as variables to be included in future surveys. In general it is recommended to start from individual data which can be aggregated into proper groups. In some (but not all the)

[2] Authors use univariate regression analysis to avoid collinearity across regressors.

cases, this allows for analysis at the sub-national level, which is also the goal of our own project. Another crucial recommendation is to choose surveys which are replicated over time in order to be able to follow the evolution of the well-being measure. We also follow this criterion in the choice of data sources for the QoL project.
The geographical level of Eurostat feasibility study is the national one. Major suggested data sources are:EU Statistics on Income and Living Conditions - SILC; European Social Survey - ESS; Eurostat and Labor Force Survey - LFS; Eurofond; European Value Study - EVS; European Community Household Panel - ECHP; International Labor Organization - ILO; Eurobarometer; European Health Information Survey. Most of them have been analysed for our own project.

Methodological issues: Some interesting methodological issues are discussed in the Report which we consider crucial for the QoL project as well. The most relevant ones are in common with those recommended by the report by Stiglitz et al. (2009) (Section 2.2).
First, the role of inequalities in the societal welfare. Inequalities, with respect not only to income but also to health, education, institutions, are more and more recognized as direct cause of poor human-development and high levels of insecurity and stress. When talking of quality of life then necessary to take into account distributional measures, such as the Gini coefficient or the income quintile share ratio. To quantify inequality one has to choose the appropriate level of data disaggregation, country, regions, counties.
Second, the study does not provide a single, aggregate measure of well-being. To cope with communication complexity that this approach implies, it is suggested to choose headline indicators for each component (at most 2) and restrict the discussion for the public to them. The recommendation is then not to aggregate the well-being components. The underlying assumption is that well-being is ‘too much multidimensional’ to be quantified by a single, combined measure.

2.4 Well-being 2030

Well-being 2030 is a two-year project co-funded by the European Policy Centre - EPC, and the European Commission which started in 2009 (Zuleeg et al., 2010). The project’s aim is of investigating what policy choices are most effective in delivering high levels of well-being for the European citizens by the year 2030, in line with the mandate of the Lisbon Treaty, which states that: ‘The Union’s aim is to promote peace, its values and the well-being of its peoples’. This means the the Well-being 2030 perspective is directly related to policy relevance at the European level. The Well-being 2030 team is also contributing to the survey Qualitative Eurobarometer, carried out by TNS Opinion and DG Employment, to investigate how citizens make social policy choices using focus groups.

In order to assess the implications of different policy choices, one should first identify the social outcomes directly related to people’s life satisfaction or to a well-functioning society which is the necessary condition for citizen’s well-being. The geographical level of analysis of the project is the national one. Three different macro-dimensions are recommended by Zuleeg et al. (2010):

1. Economic resources and opportunities, which includes income, income inequality, labor market participation.

2. Social progress, which includes social cohesion, security, balance between work and free/family time, health, education.

3. Welfare state, which includes public services, care affordability and accessibility, public finances.

It is worth noting that the three macro-categories do not encompass subjective well-being. The focus of the Well-being 2030 study is indeed only on those factors of well-being which are easily amenable to social policy interventions. The project deals with quality of life which is 'based on measurements of objective determinants of people's quality of life such as material resources available to them' (from Zuleeg et al. (2010) p. 12). The second component of well-being is subjective well-being, that is happiness, which is instead based on measurement of how people feel or how they relate with others (for example relationships with family and friends). The two concepts are related but their relationship is far from straightforward, at least on the basis of the available evidence Zuleeg et al. (2010). In line with the measurement of QoL we are proposing and accordingly to its policy support spirit, the Well-being 2030 project is 'limited' to factors related to quality of life more than happiness.

For each macro-category listed above, a set of policy choices is suggested which can have an impact on it (Table 2.3) and different dimensions of people's quality of life are recommended (Table 2.1, third column).

Direct determinant of individual well-being	**Policy choices with a positive impact on well-being determinants**
Decent income	Social safety nets, sustainable public finances
Labour-market participation	Affordability and availability of care, social cohesion/diversity
Good education	Higher-quality public services, sustainable public finances
Good health	Higher-quality public services, sustainable public finances
Work-life balance	Higher-quality public services, affordability of care, security
Less inequality	Higher-quality public services, affordability and availability of care, security, social cohesion/diversity, social safety nets

Table 2.3: Relationship between well-being determinants and policy interventions, from Zuleeg et al. (2010), Table 1.

Two aspects distinguish this initiative: the inclusion of the dimensions Social chohesion/diversity and the Long-term sustainable public finances. Social cohesion is meant to describe immigration issues as the immigration rates, mostly from non EU countries, are constantly rising. This increases the disparities across EU countries, which are already facing many difficulties in managing societal integration. The preservation of societal integration is considered a key-ingredient for economic and social prosperity. Long-term sustainability of public finances describes the level of solidarity between generations and the country capacity of guaranteeing medium and long-term quality of life, in line with the future well-being approach of the report by Stiglitz et al. (2009).

2.5 OECD Better Life initiative

For almost ten years, the Organisation for Economic Co-operation and Development - OECD - has been actively involved in various initiatives on well-being, in line with its motto *better policies for better lives*. The measure of well-being and progress is a key priority for OECD which has been trying to look into the diverse experience and living conditions of people.
The first major initiative can be traced back to 2004 when OECD held the First Forum on ‘Statistics, Knowledge and Policies’ in Italy (Palermo). Then in 2007 and 2009 two more Forums, sponsored by OECD, took place in Turkey (Istanbul) and Vietnam (Corea). These initiatives, among others, fostered government and international bodies to take actions for measuring well-being and progress (for a list of most relevant national and international initiatives refer to OECD (2011a)).

The OECD Better Life Initiative, launched in May 2011, brings together different activities undertaken by OECD on measuring well-being and progress in OECD and selected nn-OECD countries. It includes the *Compendium of OECD well-being indicators* (OECD, 2011a), the interactive tool *Your Better Life Index* (www.oecdbetterlifeindex.org) and the publication *How’s Life* (OECD, 2011b). The Compendium discusses a total of 21 indicators populating 11 dimensions of well-being at the national level (OECD, 2011a): Housing, Income, Jobs, Community, Education, Governance, Health, Life Satisfaction, Safety and Work-Life Balance (see Table 2.1, fourth column). In line with most of the literature on the topic, OECD suggests to:

- Focusing on the individual/household level rather than macro-economic performance;
- Including measures of inequality;
- Including outcome indicators to describe well-being achievements;
- Including both objective and subjective measures.

In many cases indicators proposed in the Compendium are the best feasible proxies of broader concepts which, presently, cannot be better measured. As better measures will be developed, OECD will constantly update and refine the set of candidate indicators.

Related to the Compendium is an web-based interactive tool to set up the so called ‘user’s own weighted average

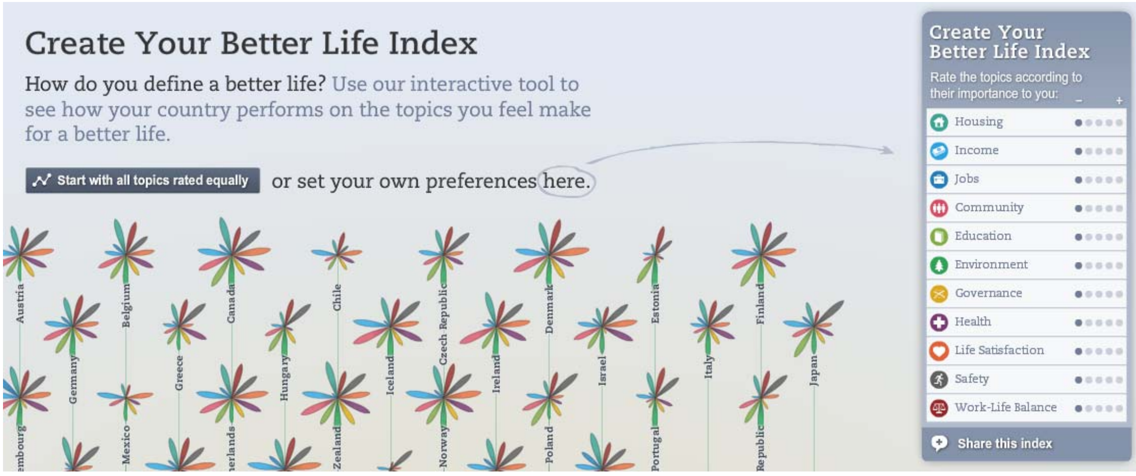


Figure 2.1: OECD web-based interactive tool to set up an aggregate measure of country well-being (May 2011).

of countries' mean achievements' (OECD, 2011a). A composite index of well-being implies the choice of a set of weights for the single well-being dimensions which might be easily criticised as being arbitrary or dependent on exogenous value judgements. As before mentioned (Section 1.4), this issue is well known to composite index developers and is a very sensitive point especially when aggregating measures of people's quality of life, where compensability effects are rarely acceptable. OECD decided to make citizens choose themselves the weights to be assigned to the 11 different average achievements of well-being by means of the on-line tool which enables people to compute their own composite score for the country they are interested in by defining their own personal weights (Figure 2.1). By the end of July 2011, the *Your Better Life Index* website was visited by over half a million visitors. The effect of different sets of weights on the overall well-being composite index is discussed in OECD (2011b) and shows that the scores obtained when the weights are set equally across the 11 dimensions are substantially the same as the scores obtained when they are set according to the interactive tool users (i.e. country averages of the weights given by users). This may have a twofold explanation: users have mainly chosen equal weighting across dimensions, which is the 'easy' no-a-priori-information approach, or/and the index is robust with respect to the choose of weights, as supported by the index developers.

The OECD Better Life initiative also include the recently published *How's Life* Report (OECD, 2011b) which gathers and analyses the indicators included in the Compendium while proposing some indicators of environmental sustainability: Change in production- and demand-based CO_2 emissions; Intensity of forest resource use; Land use for agriculture; Nitrogen surplus and Freshwater abstractions. These indicators are meant to describe a sustainability dimension which is still under development.

In addition to the How's life project, the OECD just launched, at the time of the writing of this Report, a project to advance the measurement agenda on well-being and progress at the sub-national level. The project, which goes under the name of 'How's life in your region?', starts from the recognition that the factors that most influence people's perceptions of well-being - employment opportunities, health-care and education services or levels of pollution and crime - can vary dramatically across a single country. Plus, more fine-grained measures of well-being help policymakers to targeting policies at the local level, which is the level with the most direct effect on people's lives. The project is expected to last about two years and foresees the following steps:

1. Fall 2012-Spring 2013: Case study missions, data collection and analysis.
2. June 2013: Interim expert meeting.
3. Fall 2013 - Spring 2014: Analysis and progress report for Territorial Development Policy Committee meeting at Ministerial level.
4. October 2014: Final report publication.

2.6 The Franco-German report

At the end of 2010 a joint report by the the Conseil d'Analyse économique and the German Council of Economic Experts (Franco-German report hereafter) is published at the request of the French President and the German Chancellor (de Boissieu et al., 2010). It is meant to be a pragmatic guide but the authors consider it as a provisional study which may be subject to modifications[3]. The study is basically inspired by the Stiglitz et al. (2009) report.

The main characteristics of the study are:

- the definition of 3 domains of wellbeing;
- definition of a dashboard of headline indicators rather than an aggregate measure;
- the practical implementation of the measurement of sustainability (for France and Germany).

The 3 domains of wellbeing of the Franco-German report are meant to describe: 1. economic performance and material wellbeing, 2. non material aspects (termed 'quality of life') and 3. sustainability. These domains are in line with the Stiglitz et al. (2009) and the OECD (2011a) approaches. The dimensions which describe the three domains are precisely those recommended by Stiglitz et al. (2009). The Franco-German report follows a so called bottom-up strategy which starts from individual aspects of people's life and moves towards an overall assessment of well-being. The strategy is empirically applied and tested on two countries, France and Germany, for 3 different years.

The domain of economic performance and material wellbeing includes 6 indicators; the non material domain includes 7 aspects (pillars in the Stiglitz's report) described by one headline indicator each; while the sustainability domain includes 12 indicators. Appendix 3 lists the full set of headline indicators in each domain.

It must be noted that each non material dimension is described by only one headline indicator which comes from a wider set of individual indicators. The process that guided de Boissieu et al. (2010) in defining the headline indicators consists of the following steps for each quality of life dimension (save the material wellbeing one): 1. defining a wider set of individual indicators and selecting a possible headline indicator among them on the basis

[3]For example some headline indicators in the quality of life domain are defined as favorites for future regular reporting on wellbeing.

of a priori reasoning; 2. whenever possible, performing a principal component analysis separately for France and Germany on the basis of yearly temporal series of the individual indicators; 3. assessing the representativeness of the first component (in terms of amount of variance explained); 4. assessing the overall trend of the first component across years; 5. comparing the first component trend with the one showed by the headline indicator; 6. confirming the ex ante proposed headline indicator if its trend is in agreement with that of the first PCA component. The procedure seems to be highly subjective even if, in the authors' intention, the PCA analysis should serve as an objective supporting tool. For instance, what about the other individual indicators' trend? What if most of them have the same trend with respect to the PCA one? Why choosing that particular headline indicator?

The most interesting part of the Franco-German report is the one addressing sustainability. de Boissieu et al. (2010) provide a framework for measuring the impact of present activities on the wellbeing of future generations. They propose to split sustainability into 2 domains: economic and environmental sustainability (Figure 2.2). Economic sustainability is further divided into the pillars describing growth sustainability, fiscal sustainability and financial sustainability. Environmental sustainability is divided into 3 pillars describing emission levels, fairness across generations and biodiversity. In Appendix 3 the indicators proposed to populate these pillars are listed.

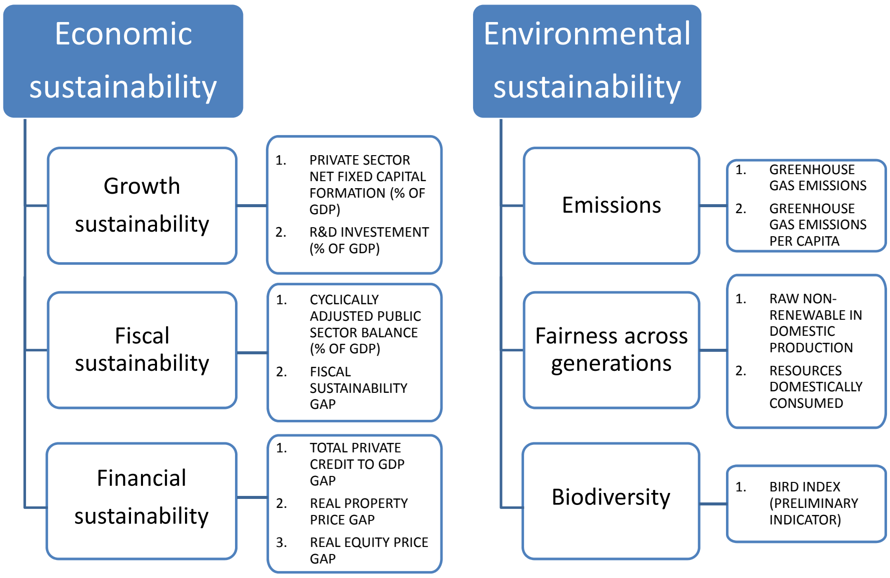


Figure 2.2: The framework to measure sustainable wellbeing as proposed by the Franco-German report.

2.7 Overseas indices: the Canadian Index of Wellbeing

In recent years many communities in United States, Australia and Canada have developed measures of the welfare condition of their citizens. For instance, the San Francisco-based Redefining Progress organization, a think tank founded in 1994, designed a measure called Genuine Progress Indicator (GPI). In Australia, the Australian Unity, a national company providing healthcare, financial and retirement services, in partnership with the Australian Centre on Quality of Life at Deakin University, regularly measure how satisfied Australians are with their lives by means of the Australian Unity Wellbeing Index. In Canada The CIW Network is an independent, based at the University of Waterloo - Faculty of Applied Health Sciences - which reports on the wellbeing of Canadians through the Canadian Index of Wellbeing, CIW. We discuss in the following this last index (Michalos et al., 2010).

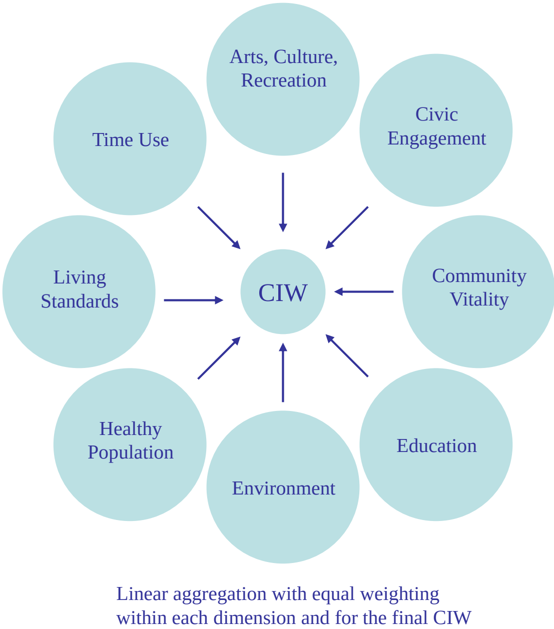


Figure 2.3: The eight dimensions of the CIW.

The CIW is a composite index aggregating 8 different domains of people's wellbeing (Table 2.1, fifth column). While CIW's developers are aware of pitfalls of presenting aggregate measures of wellbeing (and of latent, multidimensional phenomena in general) they find the purported advantages of composite indices 'attractive enough to warrant serious consideration' (from Michalos et al. (2010), p. 7). Figure 2.3 shows CIW's framework. The CIW is the outcome of a working group consisting of different expert teams for each well-being dimension. Each team identified a set of headline indicators which are used to construct the domain-specific indexes that are added to form the composite CIW. Each dimension is discussed in different reports available at www.ciw.ca/en/TheCanadianIndexOfWellbeing. The CIW reports have been published between June 2009 (dimension *Living standards*) and April 2011 (dimension *Environment*). All the indicators for all the dimensions are collected for the period 1994-2008 and re-scaled by taking 1994 as reference year. Rescaled indicators are then linearly combined with equal weights. The choice of equal treatment of indicators within each dimension is justified by the need of constructing an index which is meant to be 'a common or generally accepted measure of wellbeing' (from Michalos et al. (2010), p. 19). The final CIW is computed as simple arithmetic average of the 8 wellbeing indexes. Authors are aware of compensatory issues which are likely to affect the index but they argue that the lack of a good reason for assigning a particular indicator a higher/lower importance with respect to the others justifies the equal treatment of all indicators chosen for CIW.

Figure 2.3 shows CIW's framework while the list of indicators included in the CIW is provided in Appendix 2.

The second edition of the CIW has been released in October 2012.

2.8 What we learnt

The different initiatives just reviewed make us aware of what one must do when measuring QoL and what is still controversial. Here is the list of what we took as main practical lessons having in mind that our goal is to explore the realm of the feasible in measuring QoL.

Level The level of interest of the analysis is the individual or the household level. The individual level allows for analysis by certain subgroups (for example at the sub-national level) and for the computation of distributional measures to capture inequality issues.

Realised opportunities In the field of social indicators there are two reference sets: the capability and the functioning set. Capability refers to what one can do or can be, functioning refers to the set of achievements actually reached by one person. We base our approach on the functioning set because: functionings are easier to observe than capabilities; some functionings (like health or income) are direct determinants of capabilities; we consider individual achievements better than pure potentialities from the normative point of view.

Multi-dimensionality QoL is a multi-dimensional concept. The general recommendation is not to aggregate the different dimensions which describe QoL. The recommended dimensions are broadly the same in all of the most recent initiatives in the field. We include those recommended by Stiglitz et al. (2009) (save for the one related to sustainability) which received a general consensus since its publication.

Multi-sources Multi-dimensionality implies that many different indicators are in principle needed for the measuring and monitoring process. To this aim many different data sources shall be used. This in turn means that the information about correlation between indicators at the individual level is not available and it is not possible to assess whether, for instance, being richer implies being healthier and more educated (Fleurbaey, 2009). This is the cost to be paid for enriching the framework.

Multi-disadvantage The consequences of experiencing simultaneous multiple disadvantages exceed the sum of their individual effects for people's QoL. Therefore one has to be cautious when aggregating different dimensions of QoL as the risk is to fail in capturing the negative, synergic effect of multi-disadvantage. We follow two different approaches for the across-dimensions analysis: a scoreboard of sub-indexes, one for each dimension, and a modelling approach, including multi-criteria methods, to get an overall picture across dimensions.

Subjectivity up to a point The assessment of QoL shall comprise subjective measures together with objective living conditions. In our measure we include subjectivity by taking into account, whenever possible, people's perception of objective aspects of QoL. Our focus is then on resources/opportunities and their quality as perceived by the citizens. Purely subjective wellbeing, including factors like hedonic experience, emotions, happiness, etc., is not included in our measure. The reason for this is twofold: the difficulty of finding large-scale, homogenous data for describing subjective wellbeing and the intrinsic complexity of the analysis of such data. Subjective wellbeing is instead used for an ex-post analysis of association with our QoL measure.

Time horizon Almost all the initiatives recommend to assess whether the current level of QoL can be maintained for future generations. At the same time, most of the initiatives admit that lack of data makes this task a very hard challenge. While recognizing the ethical value of incorporating sustainability, our empirical measure focuses in (all) present generations. Therefore the QoL measure we propose has a short-to-medium term horizon.

Chapter 3

Micro-data sources

3.1 EU SILC

3.1.1 Brief description

The European Statistics on Income and Living Conditions (EU-SILC) is considered the core instrument of this analysis for two main reasons: it connects different aspects of QoL at the household and individual level, allowing for the analysis of interdependencies across QoL aspects, and it enables the sub.national analysis, at least for some countries and to a certain extent.

EU-SILC was launched in 2003. The survey was firstly carried out in only six Member States (namely Belgium, Denmark, Greece, Ireland, Luxembourg and Austria) and in Norway. The waves 2007 - 2009, used in our analysis have been carried out in all Member States plus Iceland, Turkey, Switzerland and Norway (Eurostat, 2012). Only EU Member States are included in the analysis[1].

The aim of the survey is to provide comparable cross-sectional and longitudinal multidimensional microdata on income, poverty, social exclusion and living conditions. EU SILC data are of two types:

1. cross-sectional data,
2. longitudinal data (with the most important objective to allow for the calculation of the structural indicators of social cohesion, like at-risk-of poverty rate, P80/P20 and gender pay gap),

both at the individual and at the household level. Given the aim of the QoL project, cross-sectional data only are considered in the analysis.

Four types of variables are available in the EU SILC database:

- variables measured at the household level,
- information on household size and composition and basic characteristics of household members,

[1] Norway, originally included in the analysis, was subsequently discarded as no regional identifier is available in the dataset. Switzerland data are not available in the standard data files while Iceland does not have NUTS1 nor NUTS2 regions.

- income and other more complex variables termed 'basic variables'(education, basic labour information and second job) measured at the personal level, but normally aggregated to construct household-level variables,
- variables collected and analyzed at the person-level, called 'detailed variables'(health, access to health care, detailed labour information, activity history and calendar of activities).

The importance of EU-SILC relies also in the fact that is represents the main source for the compilation of Eurostat statistics on income, social inclusion and living conditions (from Eurostat web-site).
EU-SILC target population includes all private households with all their members residing in the territory of the country at the time of data collection. The sampling procedure should ensure that the sample is nationally representative, irrespective of language, nationality or legal residence status. Since all private households and all persons aged 16 and over within the household are eligible for the sampling, the representativeness shall be achieved both for households and for individual persons in the target population.
The minimum size of the sample of the overall population, which is surveyed every year, is of:

1. about 130,000 households and 270,000 persons aged 16 and more for cross-sectional data,
2. about 100,000 households and 200,000 persons aged 16 and more are for longitudinal data.

The survey provides reliable data at EU level, national level and for the subgroups such as sex, household size, household type and socioeconomic groups (Atkinson et al., 2010).
EU-SILC does not rely on a common questionnaire or a survey but on the idea of a 'framework'which defines:

- the harmonized lists of target primary (annual) and secondary (every four years or less frequently) variables to be transmitted to Eurostat,
- common guidelines and procedures,
- common concepts (household and income),
- common classifications aimed at maximizing comparability of the information produced.

Although the common 'framework'is designed and accepted by all participating countries, differences across countries are still present. From the point of view of this project it is important to note that the dissemination of national micro-data is subject to the acceptance by the competent national authorities (Article 6.1 of regulation 831/2002 and further updates). For instance for 2007 and 2008 Malta national authority decided not to disseminate micro-data, whereas 2009 data are available. The dissemination of the regional identifer is also subject to the decision of the national authority as can be seen from Table 3.1 which shows the lowest possible regional level available for 2007, 2008 and 2009 surveys.
Considering different NUTS levels one can see that in the EU SILC database there are countries for which the regional identifier is not provided in the standard data set. These are Germany, Denmark, the Netherlands, Portugal, Slovakia and United Kingdom. To cope with this lack of data at least for the two biggest countries, Germany and United Kingdom that accounts for something as 29% of overall EU27 population, two country specific surveys -

Country	NUTS2 regions in the country	2007	2008	2009
AT	9	NUTS1	NUTS1	NUTS1
BE	11	NUTS1	NUTS1	NUTS1
BG	6	NUTS0	NUTS1	NUTS1
CY	1	NUTS0	NUTS0	NUTS0
CZ	8	NUTS2	NUTS2	NUTS0
DE	39	NUTS0	NUTS0	NUTS0
DK	5	NUTS0	NUTS0	NUTS0
EE	1	NUTS0	NUTS0	NUTS0
ES	19	NUTS2	NUTS2	NUTS1
FI	5	NUTS2	NUTS2	NUTS0
FR	26	NUTS2	-	NUTS1
GR	13	NUTS1	NUTS1	NUTS1
HU	7	NUTS1	NUTS1	NUTS1
IE	2	NUTS0	NUTS0	NUTS0
IT	21	NUTS1	NUTS1	NUTS1
LT	1	NUTS0	NUTS0	NUTS0
LU	1	NUTS0	NUTS0	NUTS0
LV	1	NUTS0	NUTS0	NUTS0
MT	1	-	-	NUTS0
NL	12	NUTS0	NUTS0	NUTS0
PL	16	NUTS1	NUTS1	NUTS1
PT	7	NUTS0	NUTS0	NUTS0
RO	8	NUTS0	NUTS2	NUTS1
SE	8	NUTS0	NUTS1	NUTS1
SI	2	NUTS0	NUTS0	NUTS0
SK	4	NUTS0	NUTS0	NUTS0
UK	37	NUTS0	NUTS0	NUTS0

Table 3.1: Regions in EU SILC (‘- ’means that there are no data for the country for that year)

the SOEP and Understanding Society - are analysed (described in Sections 3.2 and 3.3). However, comparability across the three surveys is often problematic as discussed further in this report. For this reason the analysis of the two country-specific surveys SOEP and USS is for comparisons across German and UK regions only. For comparability issues we do not recommend to jointly consider EU-SILC derived indicators with those from SOEP or USS.

For small countries like Cyprus, Estonia, Lithuania, Latvia, Luxembourg and Malta, there is no need to have the regional identifier because they do not have regions, neither NUTS2 nor NUTS1. For these countries we are able to provide reliable statistics as the EU-SILC weights are designed to provide national representative measures. For the other countries the situation is more problematic. EU SILC data and weights reliability is clearly granted only at the country level, even for the countries which allowed for the disclosure of the regional identifier, either at the NUTS1 or NUTS2 level. Given the small number of households generally covered at the sub-national level, the major issue is the sample representativeness of the structure of the population within each region. Due to the lack of alternative, more reliable micro-data sources at the EU level, we decided to go for the regional description whenever possible. This said, some basic checks are necessary to assess how representative the sample of people surveyed is of the population of the regions concerned (Ward, 2009). In order to assess whether the regions are acceptably represented we compute the weighted proportion of the sampled units in various gender-age classes and compare it to the true, population based proportion within each region. It is worth noting that '... although any significant differences between the two sets of figures would not necessarily imply that the (income) data reported by EU-SILC for the region in question is unrepresentative, it would give rise to some doubts', as recently pointed out by Ward (2009), pg. 104. This is rightly the approach we followed for the QoL project. The outcomes of these basic checks are discussed in Section 3.5 for all the surveys analysed.

As a last remark on EU-SILC, it is worth mentioning that, driven by the strong demand for indicators that complement GDP with more comprehensive information, EU-SILC is currently in the process of developing an instrument for the measurement of quality of life dimensions not already covered by other statistical sources. The aim is to get comparable data from all European countries by means of an ad-hoc module on subjective well-being planned for 2013. Some pre-tests are going on as, for instance, the one in Statistics Finland (Kallio-Peltoniemi, 2012).

3.1.2 EU SILC - Weights

There are several types of weights available in EU SILC: for respondent individuals, for all enumerated individuals and for households. All of them are available in two versions: for cross-sectional and for longitudinal analysis. Since we are interested in the cross-sectional analysis, only the basic information on cross-sectional weights are here presented.

Sample weights are defined for all units enumerated in the survey. They take into account the selection probabilities (design weights), the patterns of non-response (non-response weights), other shortcomings in the sample, and adjustments of the sample to external control distributions (post-stratification) (EC, 2010a). For the cross-sectional analysis the following weights are available:

- household cross-sectional weight used for all households (DB090),
- personal cross-sectional weight used for all household members, all ages (RB050),
- personal cross-sectional weight used for all household members aged 16 and over (PB040),
- personal cross-sectional weight for selected respondent used for selected respondents for some variables in some countries where not all eligible household members were interviewed (PB060). This applies to some countries (DK, FI, SE and SI) for some variables.

The detailed information on the weights can be found in EC (2010a).

Given the complex structure of EU-SILC data and weights, a tailor-made analysis is necessary for each variable and each country to decide the proper set of weights to be applied. In the description of each variable within each component we indicate the proper weight used.

3.2 SOEP - German household survey

3.2.1 Brief description

The German Social Economic Panel (SOEP) is a longitudinal survey of private households and persons in the Federal Republic of Germany (Soep, Soep). The SOEP survey was introduced in 1984 and it is carried out regularly on a yearly basis. Every year not only is the original sample from the first wave surveyed, but also households and persons that entered the survey at later points in time (i.e., individuals who move out and form their own households, 'new sample member 'to whom an original sample member gives birth). The survey provides the country-level representative micro-data on households and individuals. Unfortunately, although the variable enabling the regional (NUTS1) identification is available in the survey, data from Federal States (Bundeslander) cannot be evaluated as representative due to not large enough sample size. The only exceptions are the highly populous states, e.g., Baden-Wuerrttemberg, Bavaria, and North Rhine-Westphalia that can be used for regional (NUTS1) analysis given the large sample size (Knies and Spiess, 2007). Despite these limitations and due to the lack of other more reliable micro-data at the sub-national level, we carried out the analysis at the NUTS1 level. Simple checks of data reliability at the sub-national level are described later in Section 3.5 as for EU-SILC surveys.

The subjects covered by the survey are very broad. Data collected describe both objective and subjective aspects of individuals' life and the situation of their households. Objective aspects refer to demographic situation, education, training, qualifications, labor market status and occupational dynamics, earnings, income and social security, housing, health and household production. Subjective aspects refer to preferences, values, satisfaction with life in general and with various aspects. Additionally, since the survey is longitudinal, the stability and change in living conditions are traced as well as the retrospective information on biographical history are collected.

Each year a set of the questions, the same every year, is included in the standard questionnaires. These are household questionnaire and individual questionnaire for each household member aged 16 and over. Special topics are investigated every five years, such as social security, time use and preferences, further education and training.

Data are generally collected using the face-to-face individual interviews with all household members aged 17 or above. However it is worth noting that Computer Assisted Personal Interviewing (CAPI) is stepwise implemented since 1998.

3.2.2 Weights

There are two general types of weights available in the analysis of the SOEP data. These are the cross-sectional and longitudinal weights. Since we are interested in the cross-sectional analysis, only the basic information on cross-sectional weights is presented. Additionally, since we are interested in the analysis of the data on the individual level, we limit the presentation of weights only to cross-sectional individual-level weights.

The cross-sectional individual-level weights take into account the marginal distributions with respect to age groups

$(0-15, 15-20, 20-25, 25-30, 30-35, 35-40, 40-45, 45-50, 50-55, 55-60, 60-65$, and 65 or older), gender and the number of inhabitants with non-German nationality (Kroh, 2009). These weights are post-stratified and corrected for non-response.

The post-stratification strategy employed by SOEP is aimed at adjusting the sample structure to the population structure with respect to marginal distributions of age, gender, household size and regional distribution of households in Germany which included size of communities and states (Bundeslander). For adjusting for non-response the SOEP weights take into account many factors, among others (Kroh, 2009):

- demographic characteristics of the population (e.g. age structure, natural balance, life expectancy),
- situation on the labour market (e.g. unemployment rate, labor force participation rate, trends in the labor force participation rate),
- characteristics of the economy (e.g. tax revenues, per capita GDP with regard to the present situation and trends, building land prices,

Sample weights used in the analysis are those called ‘individual weight, all samples’ (variables ‘zphrf’ and ‘yphrf’ for 2009 and 2008 waves respectively).

3.3 USS - UK household survey

3.3.1 Brief description

Understanding Society Survey (USS) is a new UK longitudinal household-based survey, launched in 2009, in which every adult member of sampled households is interviewed. Similarly to SOEP, every year not only is the original sample from the first wave surveyed, but also households and persons that entered the survey at later time points. USS took the place of the British Households Panel Survey - BHPS - with a relevant increase of the sample size, especially at the regional level. A total number of 40,000 households are included in the panel as a nationally representative sample of people living in UK (McFall, 2011). Such a relatively big number of households and thus individuals allows for focused analysis on specific sub-populations like older people, parents, people from ethnic minorities or people with low incomes.

The main objective of the survey is to provide data on the following topics (McFall, 2011): (1) social-demographic characteristics, (2) labour market and occupation, (3) income, taxes and social security, (4) housing, (5) health, (6) education, training, (7) qualification, (8) neighborhood and social networks, (9) wealth and assets, (10) health-related behaviours, (11) basic orientation, (12) characteristics of new home (after a move), (13) new employment. Some aspects mentioned above are investigated at every wave (topics 1-7) and some are covered periodically (topics 8-11) and some occasionally after occurrence of an event (topics 12-13).

The survey is based on a set of questionnaires. These are household questionnaire, individual questionnaire for each household member aged 16 and over and a self-completion questionnaires (for adult and children) with subjective or attitudinal questions. Data are currently collected by the Computer Assisted Personal Interviewing (CAPI).

Like in the EU-SILC and SOEP cases, the survey is designed to be nationally representative even if the regional identifier (NUTS1) is available. Similarly to the other surveys, the level of reliability at the sub-national level is tested by simple checks and the analysis is carried out at the NUTS1 level (more details in Section 3.5).

3.3.2 Weights

Several types of weights are foreseen in future waves of USS. At the time this document is written, the 2009 wave is available so that only cross-sectional weights are available for respondent individuals, for all enumerated individuals and for households.

The weighting system employed includes (McFall, 2011):

- for households:
  1) adjustment of weights for unequal selection probabilities (design weights); (2) adjustment of weights for non-response;

- for individuals:
  1) adjustment of weights for unequal selection probabilities (design weights); (2) adjustment of weights for non-response at the household level; (3) adjustment of weights for non-response of individuals within re-

sponding households; (4) post-stratification to population characteristics (sex, age and geographical region-NUTS1);

3.4 Eurobarometer surveys

3.4.1 Special Eurobarometer EB-327 - Patient safety and quality of healthcare

The aim of conducting the Special Eurobarometer (EB-327) - Patient safety and quality of healthcare was to explore Europeans perceptions regarding patient safety and their attitudes toward the quality of healthcare in their country and cross-border (EC, 2010c). To be more specific the respondents were asked about the extent to which they perceive they are likely to be harmed by hospital- and non-hospital care, to what extent they feel they are at risk of experiencing specific adverse events and to what extent they are informed about safety measures in their own country and in other EU Member States.

The survey was carried out between the 11th of September and the 5th of October 2009 by TNS Opinion and Social and was a part of wave 72.2. It covered the population of the respective nationalities of the 27 European Union Member States, resident in each of the Member States and aged 15 years and over. The data were gathered in people's homes and in the appropriate national language using face-to-face interviews or - where this technique was available - CAPI.

The sample design applied in all the countries ensures that the survey is representative at the national level according to the Eurostat NUTS2 (or equivalent) and according to the distribution of the resident population of the respective nationalities in terms of metropolitan, urban and rural areas. Additionally, data from each country are weighted for taking into account gender, age, region and size of locality. For international weighting (i.e. EU averages), the total population figures (population aged 15 or above) are used. Taking into regard the sample design and the sample size, the data can be analyzed at three levels: the average for the 27 Member States (EU27), the national average and social-demographic analysis (e.g. age, gender). No regional identifier is available and, anyway, the national sample size is so small that no sub-national analysis would be reasonable. The country level is the only possible level of analysis for Eurobarometer surveys.

3.4.2 Flash Eurobarometer 356 - Public opinion in EU regions

The Flash Eurobarometers are ad hoc telephone interviews conducted at the request of the European Commission enabling it to obtain results relatively quickly and to focus on specific target groups, as and when required. Flash Eurobarometer 356 (EC, 2012) is a recent survey at the regional level to get information about opinions, judgements and expectations of EU citizens. It was conducted by telephone (fixed-line and mobile phone) between 20 August and 15 September 2012 on a representative sample of population aged 15+ living in 170 NUTS1 and NUTS2 regions of 27 EU Member States. A total of 50,746 persons were interviewed.

Relevant questions for the QoL project refer to: the economic situation, quality of life, unemployment, health care system, educational system, crime, immigration and environment. Given the regional focus of the survey, some questions are analyised here and compared to our results (see Section 5.2).

3.5 Sub-national data reliability

Micro-data used in this project come from nationally representative surveys: EU-SILC, SOEP, USS and Eurobarometer. Apart from Eurobarometer surveys, which do not always provide the regional identifier and, in any case, are based on very small sample size within each country, the other three surveys theoretically allow for a regional analysis as they provide region identifiers.

EU-SILC is designed to provide reliable estimates on income, poverty, social exclusion and various related issues at EU level, national level and for the subgroups such as sex, household size, household type and socioeconomic groups (Atkinson et al., 2010). The same rules apply to SOEP, USS and Eurobarometer. Additionally, EU-SILC, SOEP and USS household surveys all employ data post-stratification by adopting a complex weighting scheme (see Sections 3.1.2, 3.2.2, 3.3.2). The aim is to adjust the sample actually observed to the target population to cope with non-response and other sample design issues at the national level. Both sample design and weighting are meant to make the data represent at best the population at the country level. Using data coming from surveys not designed to properly describe sub-national population structure gives rise to the issue of non representativeness at a sub-national level.
This said, one of our main goals is to provide estimates at the sub-national level as we are aware of the limits of a purely national approach when measuring many different social-economic phenomena (see Dijkstra et al. (2011) for an example on territorial competitiveness). Our decision is then to keep the sub-national level whenever possible. This does not mean that we are not aware of the limits of our analysis. On the contrary, we consider this exercise, instead of being definitive, should foster national statistical offices not to collect more data but to properly collect them at the sub-national level. We still tried to make the best use of currently available data.

Different methodological approaches have been proposed to increase the reliability at the sub-national level of data designed to be representative at the national level. This kind of problem is broadly described in the literature devoted to the use of EU-SILC data but the proposed solutions can be apply to any source of data. We found that common procedures in such a case are:

1. estimate at the sub-national level the variables of interest directly from the survey data by first checking what is the most appropriate sub-national level to be considered (Lelkes and Zolyomi, 2008; Ward, 2009);
2. if more than one wave is available for a certain survey, compute the sub-national level of the variables of interest for each wave separately and then compute average values, by assigning the same weight to each wave (Verma et al., 2010);
3. if more than one wave is available for a certain survey, cumulate the data over several waves in order to increase the amount of the data available and thus the precision of the estimates (Verma et al., 2010);
4. use small area estimation techniques (Fabrizi et al., 2009; Longford et al., 2010; Verma et al., 2010; Zieba, 2009).

Of all the above procedures the most correct one, but also the most complex, is applying small area estimation techniques - SME. These techniques are generally applied to estimate the variable of interest, like income, on small geographical areas like municipalities or counties, which are much smaller than the administrative areas official surveys are usually based on. SME are statistical random effect models, one model for each variable to be estimated, with a set of explanatory variables that must be observed both in the survey and in the census (Cuong et al., 2010). It is easy to understand that this approach is not feasible in our case where the interest is in a wide set of variables describing different aspects of citizens' QoL. If SME techniques were to be applied in the QoL case, as many models as the variables to be estimated should be set-up and the corresponding sets of census explanatory variables should be used. In short, SME is not a practicable solution in our case.

What we adopt instead is a very pragmatic approach, which is a combination of the first two procedures listed above. Our aim was to have the spatially disaggregated data as robust as possible. First, we compute weighted sample size $\widehat{p}$ in different gender-age classes within each region (using appropriate weights provided by the different surveys) and compare it with Eurostat based population share p in different gender-age classes within each region (Eurostat Regional Statistics). Then, we calculate:

- relative percentage difference $\frac{\widehat{p-p}}{p} \cdot 100$ (results presented in the form of histograms 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
- t-statistics to check the significance of the difference between $\widehat{p}$ and p.

The gender-age classes used are shown in Table 3.2.

gender	age classes				
female	$0-14$	$15-34$	$35-54$	$55-74$	75 and over
male	$0-14$	$15-34$	$35-54$	$55-74$	75 and over

Table 3.2: Gender-age classes used for checking data reliability for EU-SILC, SOEP and USS

It must be noted that the statistical t-test used to assess the significance level of the proportion difference is affected by two problems: biased estimation of the standard error of survey proportions and dependency across proportions.

As for the first issue, the weights and other elements of the sample design, such as stratification and/or clustering all have an impact on the standard errors of any statistical estimates derived from survey data (Purdon and Pickering, 2001). In the computation of the standard errors we are able to include the weights, provided by the surveys, but not the elements characterizing the sample design. The sample design in EU-SILC and in the other two surveys is indeed very complex and can vary from country to country. It is not clear, at least to our knowledge, what could be the effect of not including the sample design in the standard error estimates. According to Purdon and Pickering (2001) the impact on standard errors tends to vary from estimate to estimate, even if it can be said that, by and large, the effect of the stratification is to slightly reduce the standard errors[2]. Thus we can say that, by not including the design features, our standard errors are likely to be higher than the true, unbiased ones and this in turn means that the power of the test is lower (it is more likely that it fails in rejecting the null hypothesis

[2]As the effect of stratification is to increase the efficiency of the estimator, this assumption is indeed reasonable.

of no difference when it is false). We are then likely to slightly underestimate the number of cases with significant differences.

As for the dependency across proportions, within each region the percentage of people in different gender-age classes follows a multinomial distribution, so the correct approach would be to simultaneously test the different proportions by a χ^2 test. Unfortunately, given the relatively high weighted sample sizes in each region, the values of the χ^2 statistics are always very high and, consequently, the test always rejects the null hypothesis of no difference. This test is thus not applicable in our case.

Given these arguments we computed t-tests together with a simple descriptive analysis of the percentage differences within each region. The summary of the comparisons for all the three surveys is presented in the Table 3.3. Values referring to relative differences are computed on a absolute values.

Survey	Year	Relative difference in percentages			Significant difference; $\alpha = 0.05$	
		Max	Average	Median	Count	%
EU SILC	2007	122.7	7.3	3.7	59	7.7
EU SILC	2008	35.5	4.4	2.9	27	4.0
EU SILC	2009	24.6	4.0	2.7	0	0.0
SOEP	2008	77.4	14.4	9.9	15	9.4
SOEP	2009	89.8	16.5	10.9	19	11.9
USS	2009	12.0	2.8	1.4	0	0.0

Table 3.3: Regional representativeness of EU SILC, SOEP and USS - summary statistics

The best results are those obtained for Understanding Society Survey, which proved to be an actual improvement of the former British Household Panel Survey. For USS there are no significant discrepancies and the median relative difference in proportions is only 1.4%. The worst survey, from the point of view of data reliability at the regional level, is the German survey (SOEP) with median discrepancies of about 11% and a share of significant differences between 9% and 12% for 2008 and 2009 respectively. As for EU SILC data the best results are for the wave 2009 and the worst for EU SILC 2007, which proves that from year to year the data reliability improves.

Concerning EU SILC 2007 the number of cases with the percentage difference higher than 30%, a value that we fixed as a threshold between serious and acceptable cases, amounts to 29 cases (out of 770 cases[3]). Three out of these 29 cases are associated to two Spanish regions: twice to ES64, (Ciudad Autonoma de Ceuta) and once to ES63 (Ciudad Autonoma de Melilla). One case is associated to the Finnish region FI1A, which is the northern most Finnish region. The 25 remaining ones are all French NUTS2 regions evenly spread across the country. As regards the type of gender-age most distorting classes, 18 out of 29 are related to the age group of elderly people, aged 75 and above. However the direction of distortion is generally two-sided. As for France, the most frequently occurring distortion refers to the oldest age group of 75 and above (15 out of 25 cases) but the second most frequent one is connected with the youngest group, aged $0 - 14$ (5 out of 25 cases) followed by the groups aged $15 - 34$ (3 out of 25 cases) and $55 - 74$. Results are much better for EU-SILC 2008. There are only two

[3]The total number of cases is the product of number of regions and the 10 gender-age classes

cases with the relative percentage difference exceeding 30%, for Spanish ES63 and Finnish FI1A. Both of them refer to the oldest age group, 75 and above. In EU-SILC 2008 France is available only at the country level. The best results are for EU SILC 2009. There is no significant differences between the sample and the population proportions and there is not any case with the percentage difference higher than 30%.

Figures 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7 and 3.8 show the histograms of the relative difference expressed in percentages for each country and each survey[4] which confirm that: 1. SOEP data are the least reliable in terms of regional representativeness; 2. EU-SILC 2008 and 2009 are acceptable in terms of regional data reliability; 3. EU SILC 2007 is acceptable except for two regions in Spain and France as a whole.
Overall, this simple analysis enables us to draw the following conclusions about data reliability at the sub-national level:

1. German surveys are relatively least reliable, even if the amount of distortion is acceptable. No remedying action can be taken for Germany as the regional identifier is at the NUTS1 level;
2. For EU-SILC 2007 the most distorting regions are in France, spread across the country, and two regions in Spain;

To solve the French problem a higher level of geographical aggregation is chosen, from NUTS2 to NUTS1 level, as also recently suggested by Ward (2009) who used EU-SILC 2006 data for poverty analysis at the regional level. This ensures higher precision of estimates as can be seen from Figure 3.9 which shows that, considering the NUTS1 level, relative percentage difference exceeds $\pm 30\%$ in only 4% of the cases. For Spain the two problematic regions ES63 and ES64, which are two cities along the North-African coast, are simply discarded from the analysis.
Once all the variables of interest are computed for all the available waves, the arithmetic mean across waves is computed for each indicator and each region in order to improve the precision of regional indicators. This approach is an alternative option with respect to cumulating data over waves, even if the difference between the two approaches is minor, insofar the sample sizes in different waves are similar (Verma et al., 2010). For EU-SILC data the average is taken across 2007, 2008 and 2009 waves. In computing the arithmetic mean across the waves we chose to exclude the country level estimate if for at least one wave the sub-national level is available. In this way the lowest, most appropriate (in terms of regional representativeness) geographical level is considered for each country, that is:

- NUTS2 for CZ, ES, FI and RO;
- NUTS1 for AT , BE, BG, FR, GR, HU, IT, PL and SE
- NUTS0 for the remaining countries.

In the case of SOEP survey not all the indicators of interest here are available for different years. Two years, 2008 and 2009, are considered in the analysis and no merging of the waves could be carried out. In the UK case, as

[4] A missing figure means that either no region identifier or no data is available for that country for that year.

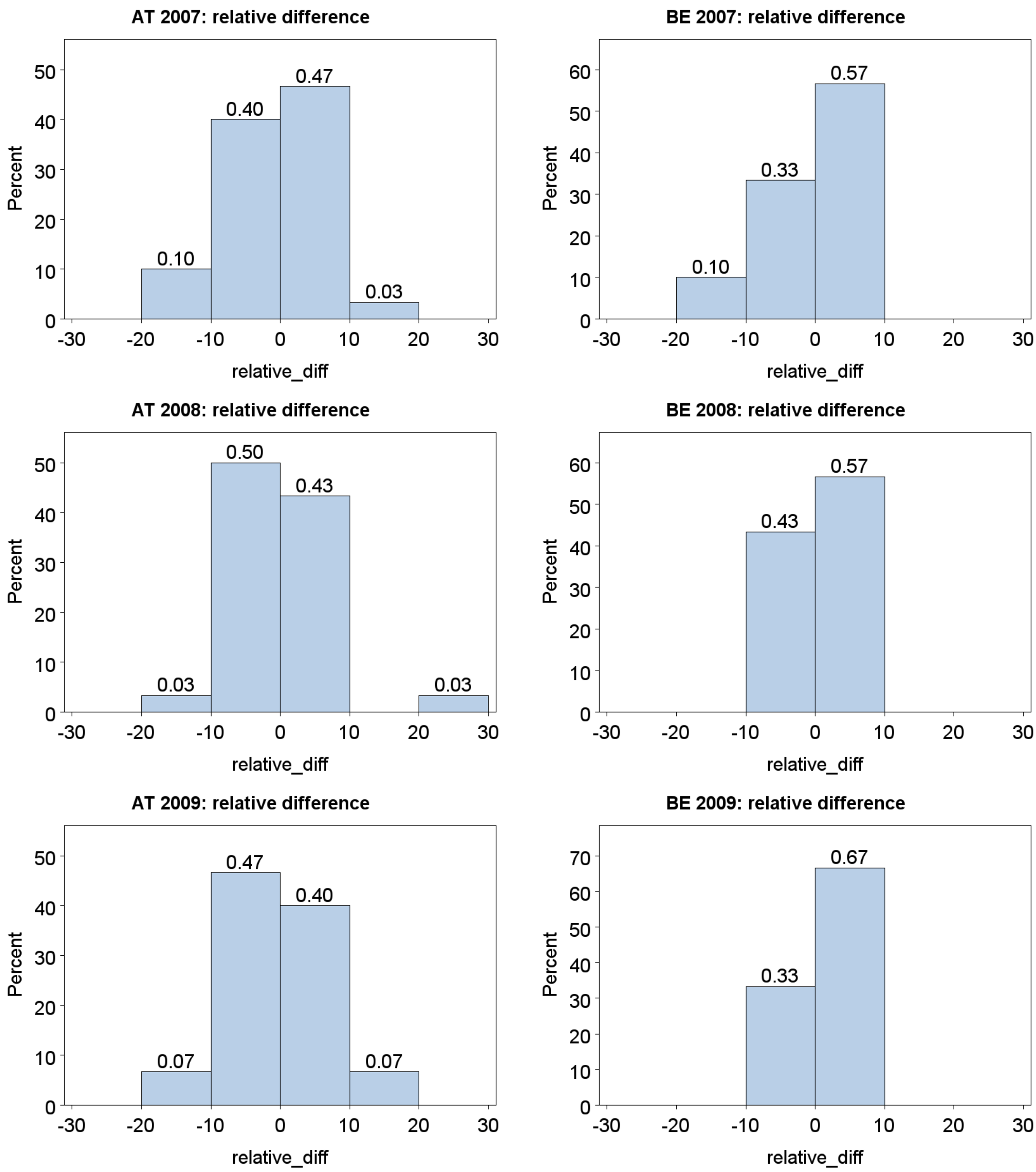


Figure 3.1: Population proportion comparisons: AT and BE.

aforementioned, USS is a new survey for which only the first year, 2009. In both cases the available geographical level is the NUTS1. Figure 3.10 and Table (3.4) show the regional level eventually considered in this analysis for the different countries.

As aforementioned, having thoroughly considered the comparability issues with regard to the variables calculated from different surveys, our advise is not to merge variables extracted from British and German surveys with the ones extracted from EU SILC.

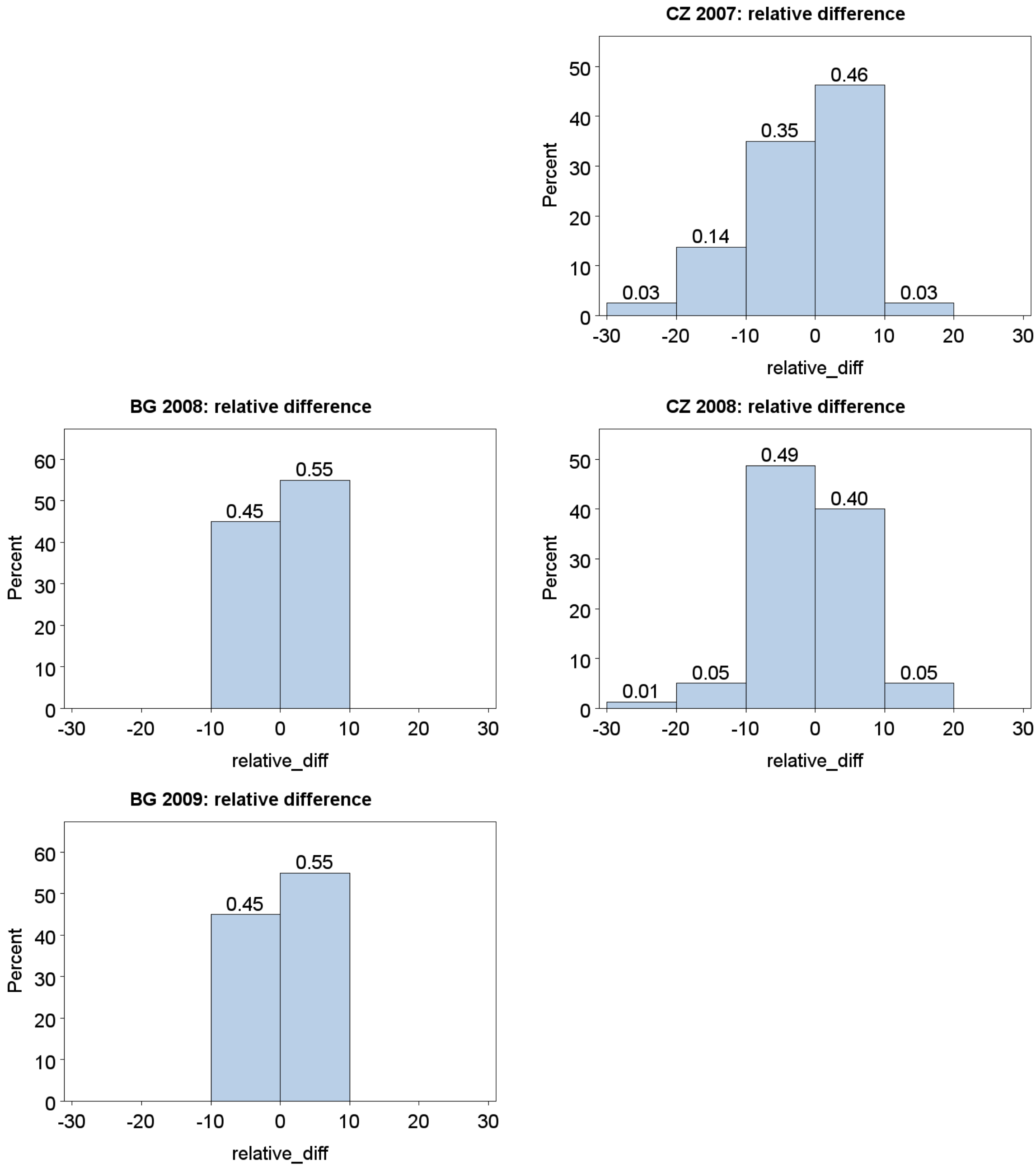


Figure 3.2: Population proportion comparisons: BG and CZ (a blank cell means that no regional identifier is available for that country for that wave).

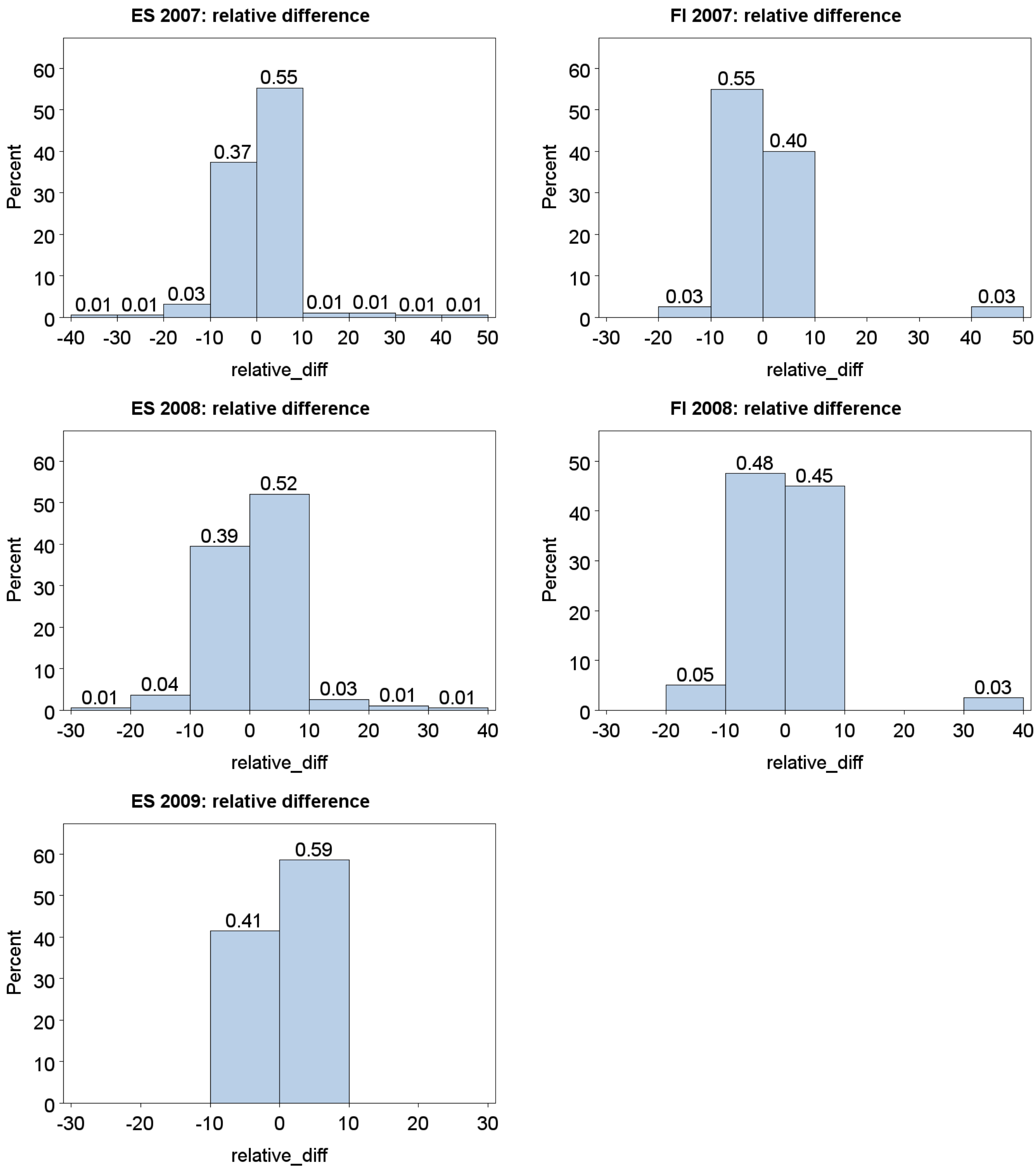


Figure 3.3: Population proportion comparisons: ES and FI (a blank cell means that no regional identifier is available for that country for that wave).

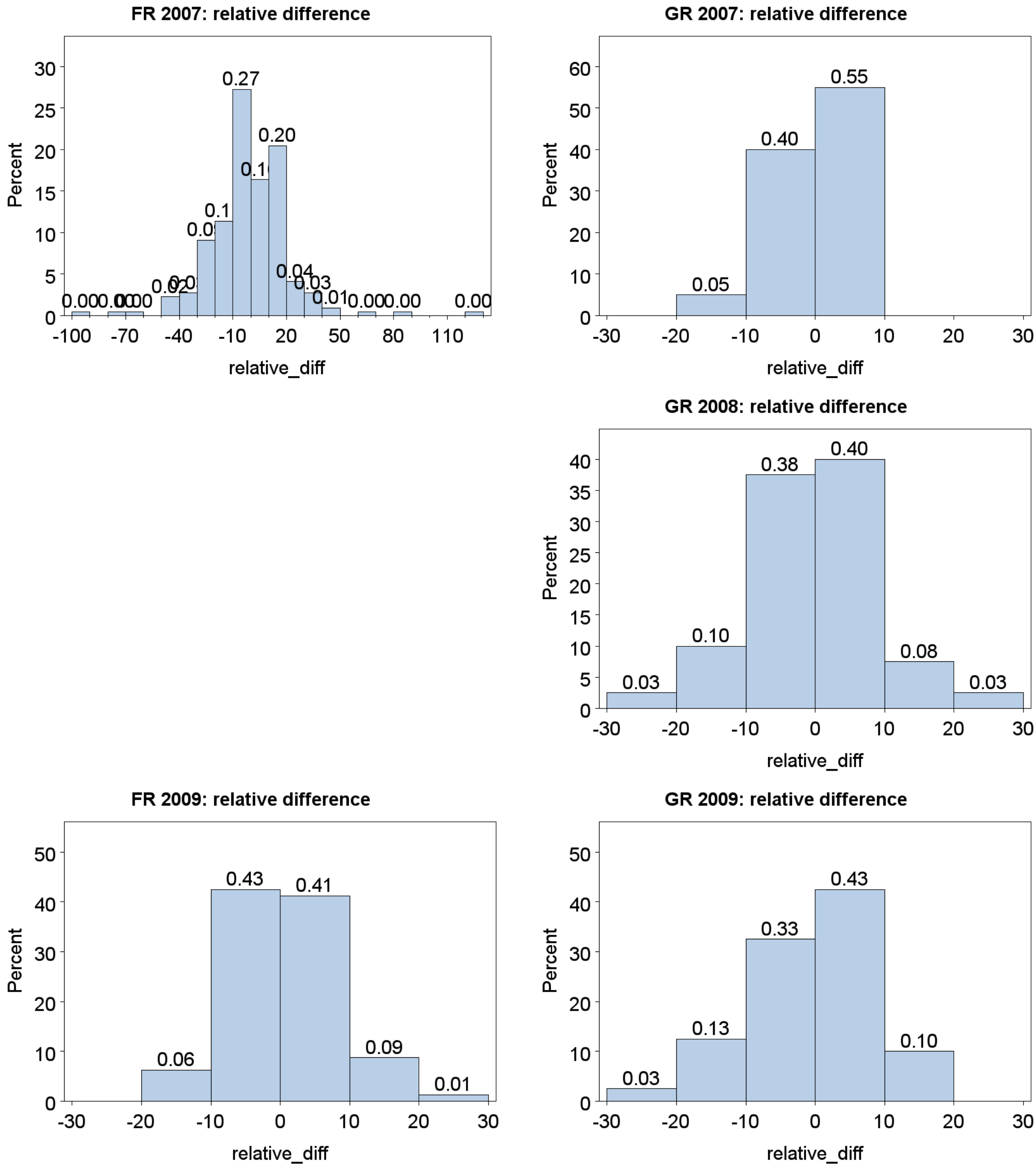


Figure 3.4: Population proportion comparisons: FR and GR (a blank cell means that no regional identifier is available for that country for that wave).

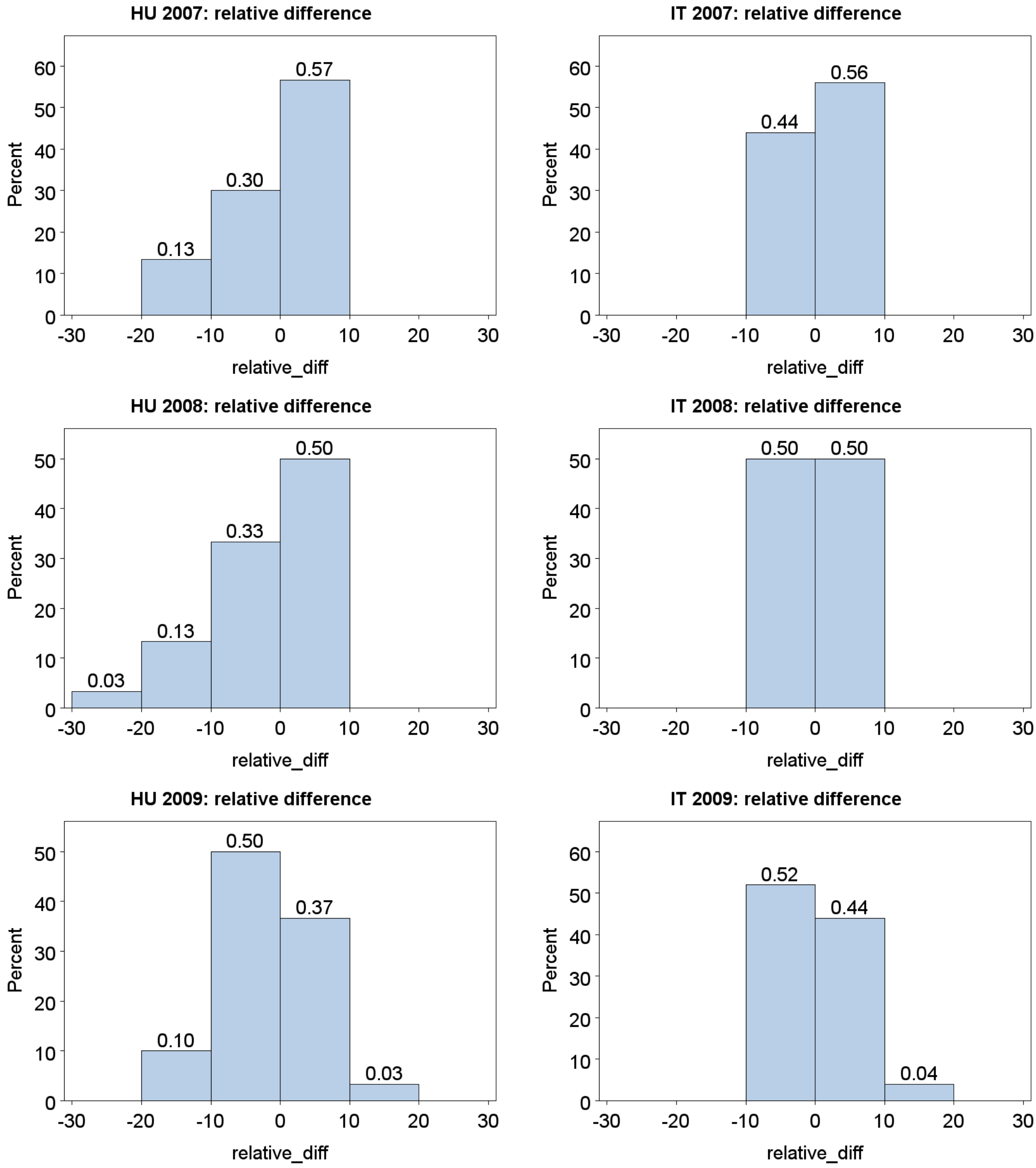


Figure 3.5: Population proportion comparisons: HU and IT.

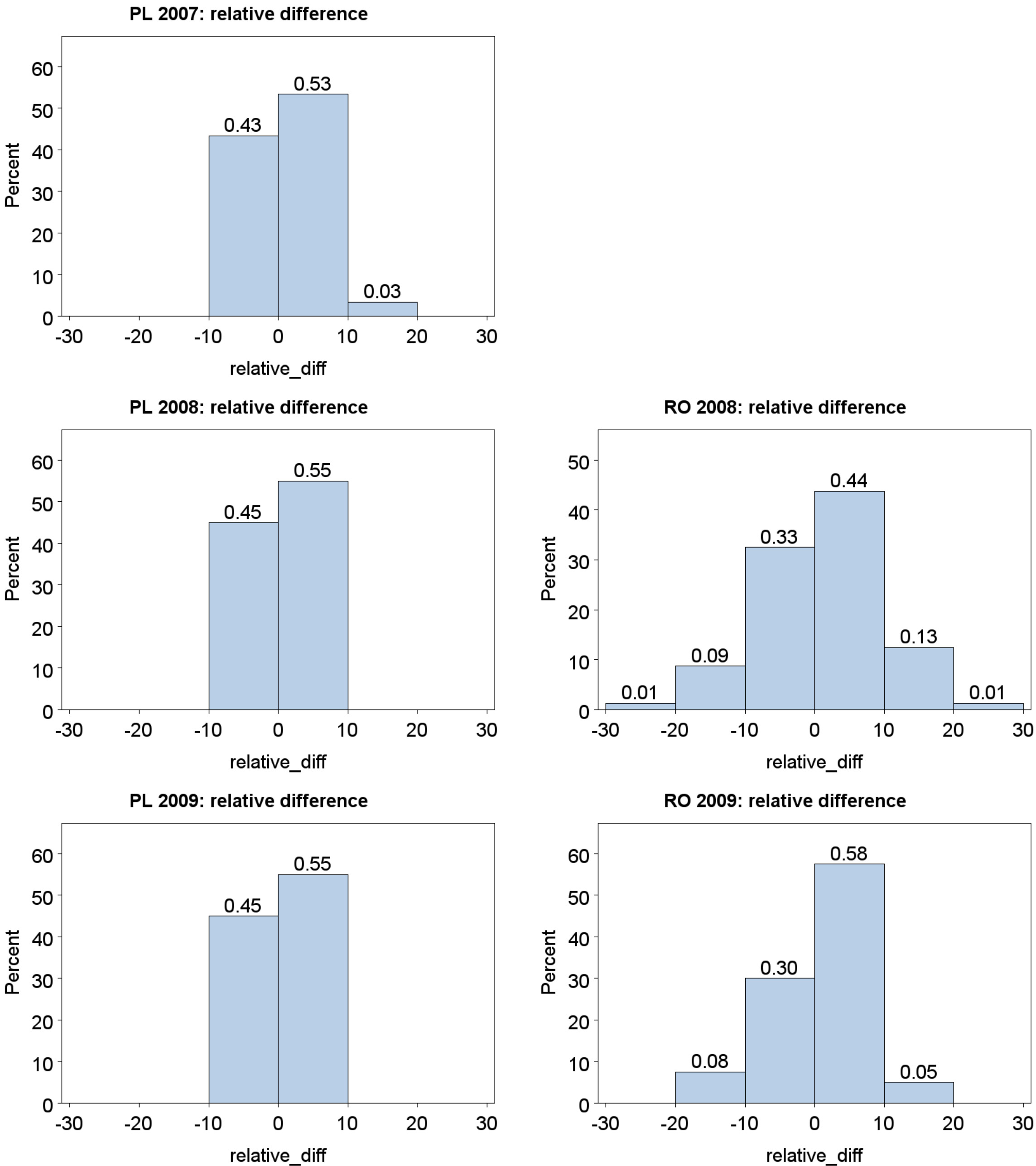


Figure 3.6: Population proportion comparisons: PL and RO (a blank cell means that no regional identifier is available for that country for that wave).

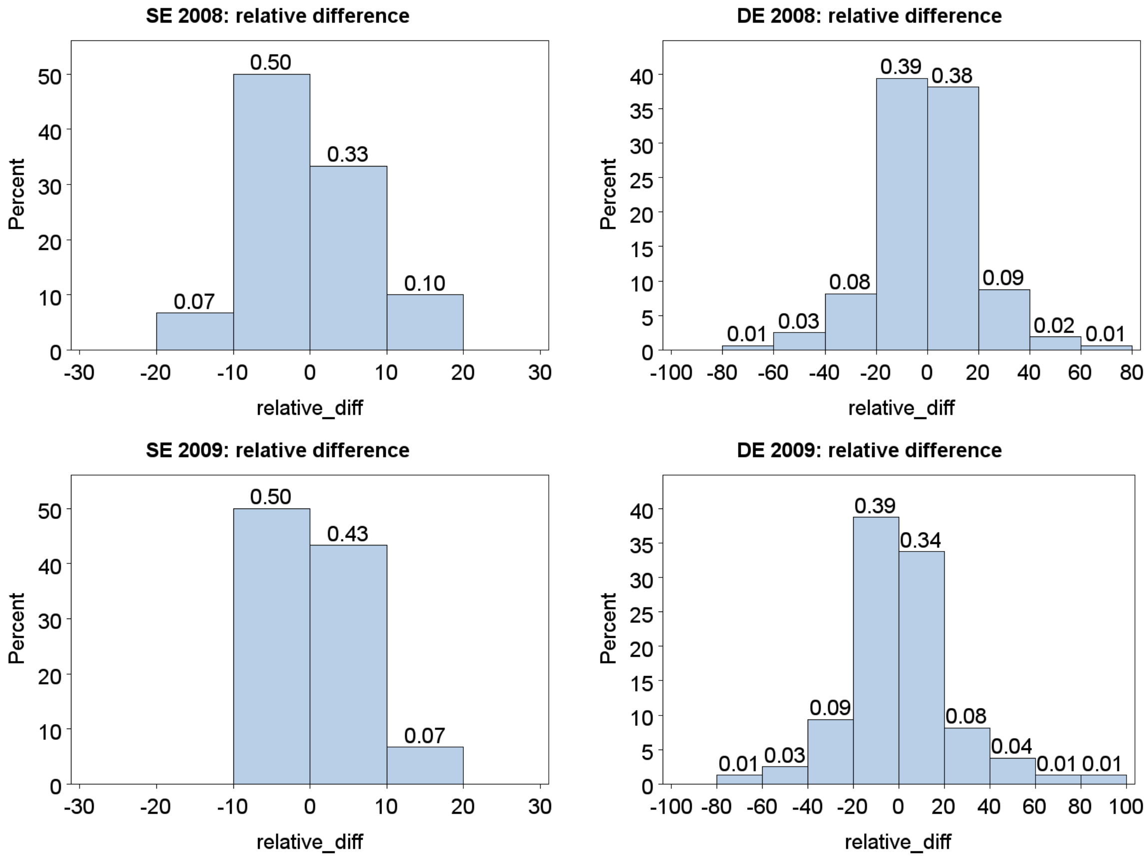


Figure 3.7: Population proportion comparisons: SE and DE (SOEP).

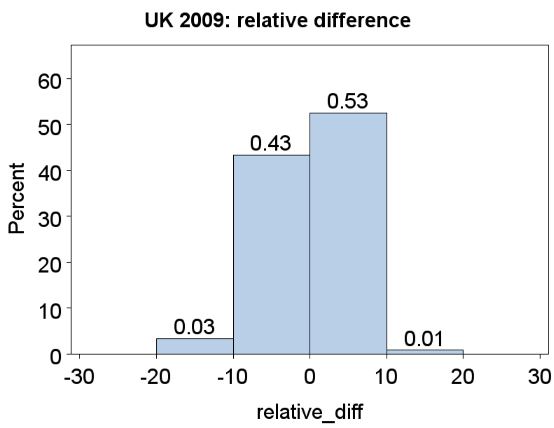


Figure 3.8: Population proportion comparisons: UK (USS).

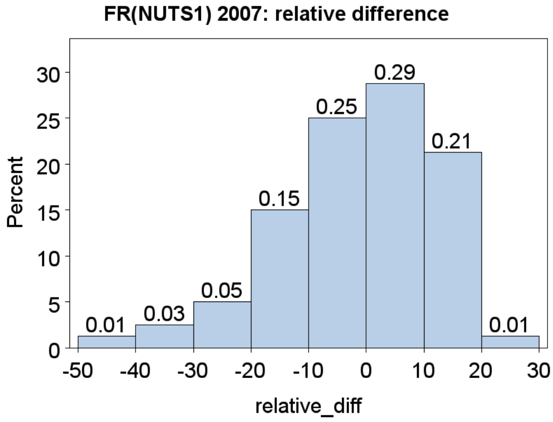


Figure 3.9: Population proportion comparisons: FR 2007 at NUTS1.

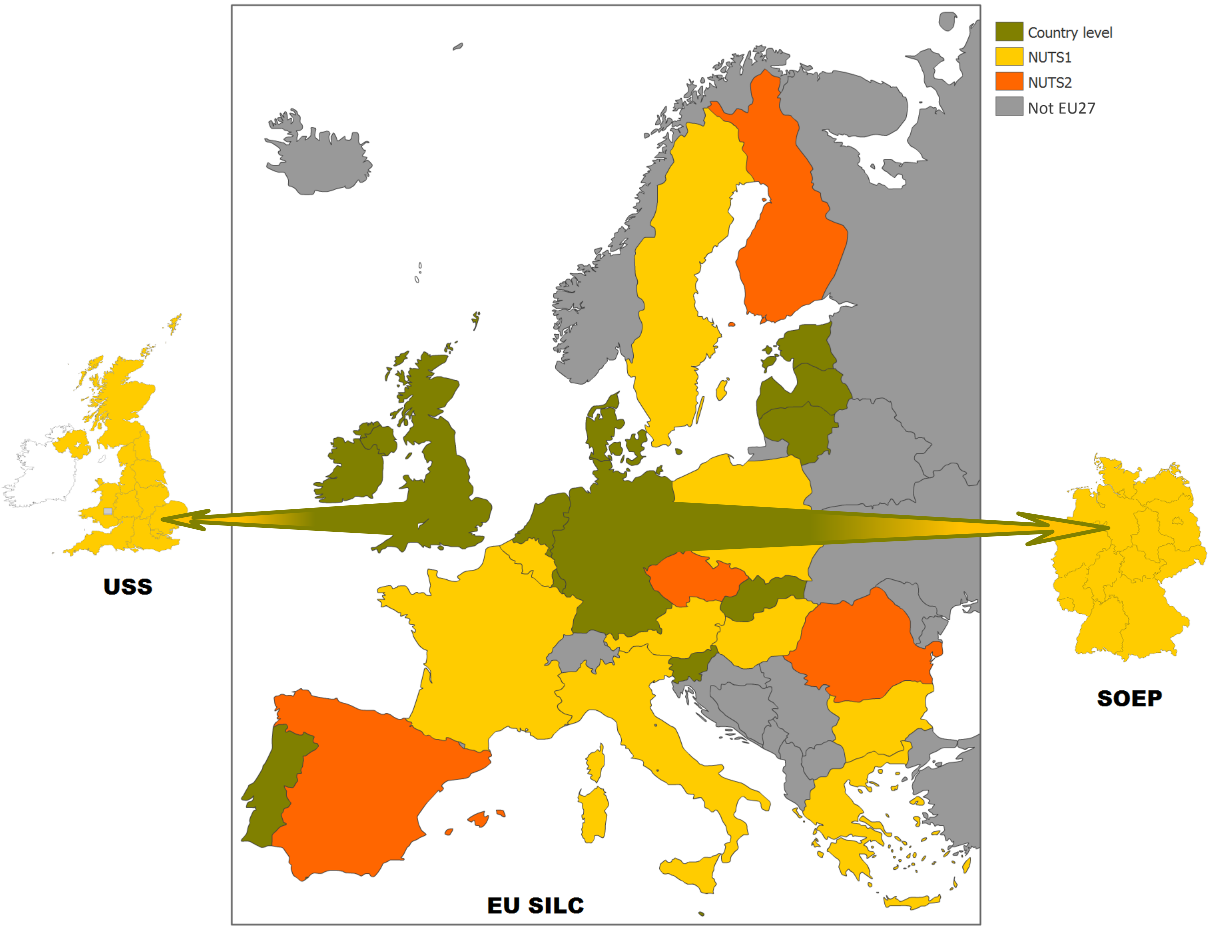


Figure 3.10: Final NUTS level considered for different countries.

Country	NUTS level	NUTS Name
AT	NUTS1	AT1=Ostösterreich, AT2=Südösterreich, AT3=Westösterreich
BE	NUT1	BE1=Région de Bruxelles-Capitale/Brussels Hoofdstedelijk Gewest, BE2=Vlaams Gewest, BE3=Région Wallonne
BG	NUTS1	BG3=Severna i Iztochna Bulgaria, BG4=Yugozapadna i Yuzhna Centralna Bulgaria
CY	NUTS0	----
CZ	NUTS2	CZ01=Praha, CZ02=Střední Čechy, CZ03=Jihozápad, CZ04=Severozápad, CZ05=Severovýchod, CZ06=Jihovýchod, CZ07=Střední Morava, CZ08=Moravskoslezsko
DE	NUTS0	----
DK	NUTS0	----
EE	NUTS0	----
ES	NUTS2	ES11=Galicia, ES12=Principado de Asturias, ES13=Cantabria, ES21=País Vasco, ES22=Comunidad Foral de NavarraES23=La Rioja, ES24=Aragón, ES30=Comunidad de Madrid, ES41=Castilla y León, ES42=Castilla-La Mancha, ES43=Extremadura, ES51=Cataluña, ES52=Comunidad Valenciana, ES53=Illes Balears, ES61=Andalucía, ES62=Región de Murcia, ES70=Canarias
FI	NUTS2	FI13=Itä-Suomi, FI18=Etelä-Suomi, FI19=Länsi-Suomi, FI1A=Pohjois-Suomi
FR	NUTS1	FR1=Île de France, FR2=Bassin Parisien, FR3=Nord-Pas-de-Calais, FR4=Est, FR5=Ouest, FR6=Sud-Ouest, FR7=Centre-Est, FR8=Méditerranée
GR	NUTS1	GR1=Voreia Ellada, GR2=Kentriki Ellada, GR3=Attiki, GR4=Nisia Aigaiou, Kriti
IE	NUTS0	----
HU	NUTS1	HU1=Közép-Magyarország, HU2=Dunántúl, HU3=Alföld És Észak
IT	NUTS1	ITC=Nord-Ovest, ITD=Nord-Est, ITE=Centro (I), ITF=Sud, ITG=Isole
LT	NUTS0	----
LU	NUTS0	----
LV	NUTS0	----
MT	NUTS0	----
NL	NUTS0	----
PL	NUTS1	PL1=Region Centralny, PL2=Region Południowy, PL3=Region Wschodni, PL4=Region Północno-Zachodni, PL5=Region Południowo-Zachodni, PL6=Region Północny
PT	NUTS0	----
RO	NUTS2	RO11=Nord-Vest, RO12=Centru, RO21=Nord-Est, RO22=Sud-Est, RO31=Sud-Muntenia, RO32=Bucureşti-Ilfov, RO41=Sud-Vest Oltenia, RO42=Vest
SE	NUTS1	SE1=Östra Sverige, SE2=Södra Sverige, SE3=Norra Sverige
SI	NUTS0	----
SK	NUTS0	----
UK	NUTS0	----

Table 3.4: Final NUTS level considered for different countries.

Chapter 4

Living Standards

As we have seen (Chapter 2), academic research and concrete measurement initiatives all agree on well-being as a multidimensional concept including aspects like material living standards, health, education, personal activities (including work and family life), political voice and social connections. Each dimension is then, in turn, multi-dimensional and this makes the measurement task even more difficult.
Among these QoL dimensions, material living standards and health play a peculiar role being the necessary, even if not sufficient, condition for a happy and satisfying life. Our exercise starts from these two dimensions that can be seen as elementary functionings which are pre-condition for complex ones. Being adequately nourished, making ends meet, having decent housing, affording adequate health care and being in good health clearly correspond to basic needs, all necessary for higher aspirations (Boulanger et al., 2009). This is what Living Standards and Health dimensions are designed to measure in our analysis.
This Chapter focuses on the Living Standards components while Chapter 5 discusses the Health dimension and its components.

In the Living Standards dimension three components are included describing monetary and non-monetary aspects: 1. Absolute Poverty; 2. Relative Poverty and 3. Earnings and Incomes. Income and wealth by themselves are not sufficient determinants of people's standards of living (Ruiz, 2011). The three components included in the Living Standards dimension try to meet the challenge of a multi-dimensional measure of poverty. Absolute Poverty measures the individual capacity of affording basic needs. It is based on non-monetary indicators of material deprivation including material deprivation rate and intensity, as classically defined in the literature (Sauli and Törmälehto, 2010), capacity of making ends meet, quality of the housing and affordability of health and dental care. Absolute poverty is measured on the same measurement scale for all the regions taken into consideration.
The Relative Poverty component includes the three main poverty measures, poverty incidence, depth and severity, measured on the basis of national poverty lines (adjusted for different cost of living by introducing housing costs). They capture the condition of the individual as compared to the people surrounding him and, by definition, are not based on the same measurement scale. Measures of relative poverty are approximate measures of income inequality. A society with a more equal income distribution, will have low relative poverty.

The two concepts of Absolute and Relative Poverty can then have opposite directions, and we will see it in our analysis. A reduction in Absolute Poverty may correspond to an increase in Relative Poverty.

The third component of the Living Standards dimension describes the monetary aspects. It includes the median regional income, computed from the individual income distribution within each region, and two other measures derived from regional accounts Eurostat data: compensation of employees and net adjustable household income. The choice of the median instead of the mean in the computation of regional average incomes is driven by the fact that '. . . Median consumption (income, wealth) provides a better measure of what is happening to the 'typical' individual or household than average consumption (income or wealth) . . . ' (from Stiglitz et al. (2009), pp. 13-14). The indicator on compensation of employees captures the working condition in the region, in terms of salaries, while the net adjustable household income provides the income corrected for the bias due to services financed or subsidised by government. Net adjustable income includes the 'transfers in kind', which are services such as education, health care and other public services that are provided by the government for free or below provision cost. Without this type of adjustment, household income is generally underestimated in countries with extensive public services (like the Nordic Member States) and overestimated in those where households have to pay for most of these services (EC, 2010b).

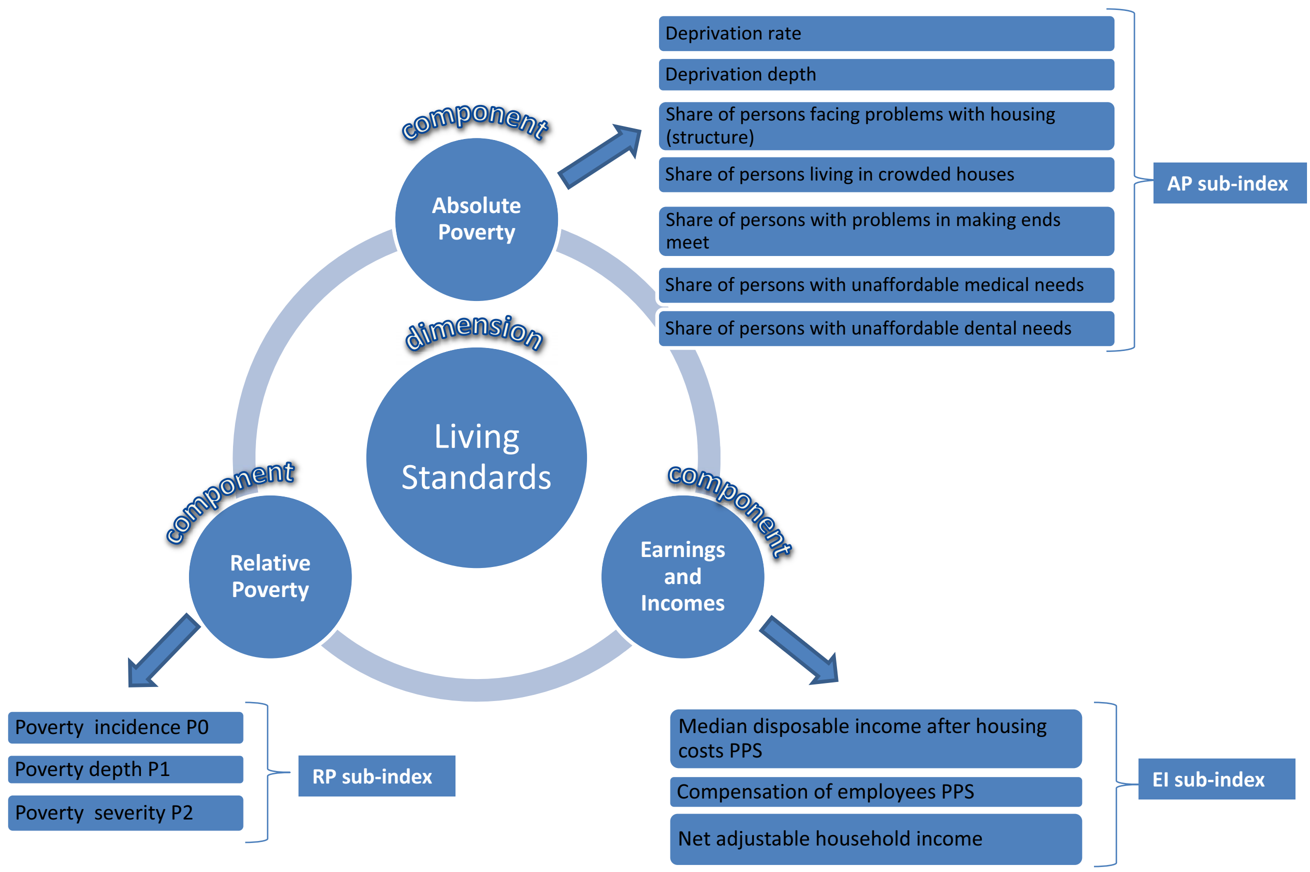


Figure 4.1: Living Standards dimension: framework.

Given all these theoretical considerations, the choice of the final indicators populating the Living Standards components has been also driven by data availability in EU-SILC, our major data source. Only a subset of indicators have been computed from the other two national surveys considered in the analysis, SOEP and USS, due to the lack of comparable measures.
The framework of the Living Standards dimension is shown in Figure 4.1. All the indicators initially included in the framework have been confirmed by the statistical analysis. Indicators listed in Figure 4.1 are those which finally enter the different components of the Living Standards dimension of our measure of regional QoL. For each component a sub-index is computed using an inequality-adverse type of aggregation as described in the following of this Chapter. Univariate analysis, multivariate analysis and uncertainty analysis are separately carried out for each sub-index. No further aggregation is then undertaken across the sub-indexes.

4.1 Absolute poverty

This component is meant to describe the absolute level of people's poverty and ideally includes the following indicators estimated at the regional level:

1. Material deprivation rate;
2. Intensity of material deprivation;
3. Percentage of people who have difficulties in making ends meet;
4. Percentage of people experiencing problems with their dwelling;
5. Percentage of people living in over-crowded houses;
6. Percentage of people who cannot afford necessary medical treatments;
7. Percentage of people who cannot afford necessary dental treatments;

Unfortunately it was not possible to compute all above indicators for all the surveys included in the analysis. EU-SILC is the only one which allowed us to extract all the variables of interest and for this reason it is the reference survey in our analysis. A subset of variables could be extracted from the German and British surveys. The rest of the discussion is provided for the three surveys separately.

4.1.1 EU-SILC

All the seven indicators which populate the Absolute poverty component are computed for EU-SILC countries, all waves. The first two indicators refer to material deprivation and represent absolute, non-monetary measures of exclusion. They are considered as 'absolute'measures of poverty as they are based on a set on EU commonly agreed set of items (commodities), each with the same weight, that are equal across all countries (Fusco et al., 2010). This reinforces the absolute character of the measures as opposite to indicators based on nationally defined poverty thresholds (Section 4.2). They refer 'to a state of economic strain and durable strain, defined as the enforced inability (rather than the choice not to do so) to pay unexpected expenses, afford a one-week annual holiday away from home, a meal involving meat, chicken or fish every second day, the adequate heating of a dwelling, durable goods like a washing machine, colour television, telephone, car, experiencing payment arrears (mortgage or rent, utility bills, hire purchase instalments or other loan payments)'(from Eurostat Glossary: Material deprivation).

Material deprivation rate is defined as a proportion of people lacking at least 3 items among the 9 following items (Sauli and Törmälehto, 2010) - in brackets the indicator label used in EU-SILC:

1. ability to keep home adequately warm (HH050);
2. arrears on:
   (a) utility bills (electricity, water, gas) in last 12 months (HS020);
   (b) hire purchase instalments or other loan payments in last 12 months (HS030);
3. capacity to afford paying for one week annual holiday away from home (HS040;
4. capacity to afford a meal with meat, chicken, fish (or vegetarian equivalent) every second day (HS050);
5. capacity to face unexpected financial expenses (HS060);
6. capacity to afford a telephone, including mobile phone, if needed (HS070);
7. capacity to afford a color TV (HS080);
8. capacity to afford a washing machine (HS100);
9. capacity to afford a car (HS110)

All original indicators are recoded in order to identify persons experiencing specific deficiencies: e.g not having a car because cannot afford. If the respondent declares that she/he does not have a car for reasons other than economic, the answer is considered as equivalent to 'having a car'. Variables HS020 and HS030 are merged into a single dichotomous one which has value '1'if person declares having experienced some problems in paying utility bills and/or loans. Material deprivation rate is therefore an indicator that expresses the inability to afford some items considered by most people to be desirable or even necessary to lead an adequate life. They focus on some key aspects of material living conditions.

The intensity of material deprivation is defined as the (unweighted) mean number of items lacked by the deprived population (Eurostat, 2010a).

In order to calculate the percentage of people who have difficulties in making ends meet we used EU-SILC variable: HS120: 'Ability to make ends meet'. The original variable scale comprises six possibilities (1-with great difficulty; 2-with difficulty; 3-with some difficulty; 4-fairly easily; 5-easily; 6-very easily). It is recoded into a dichotomous variable with value '1' if person declares having experienced difficulty or great difficulty in making

ends meet, '0' otherwise. The share of population experiencing this kind of difficulty is then computed for the available regions.
The variable describing problems with the dwelling is computed by combining two EU-SILC variables: HH040, indicating the presence of leaking roof, damp walls/floors/foundation, rot windows or floor, and HS160 indicating other problems with the dwelling like not enough light. The variable 'problems with dwelling'is a dichotomous one which is equal to '1'if person declares having experienced at least one of the above problems with its dwelling.
The percentage of persons living in over-crowded houses is computed by means of the crowding index, denoted by the number of co-residents per room. Household density has been considered since long as an indicator of low socioeconomic status and poor health conditions (Melki et al., 2004). Crowding index is computed using EU-SILC variables household size (HX040) and number of rooms available to the household (HH030)[1]. A threshold value of 2 is chosen to define crowded houses. Some previous analyses show that values of the crowding index higher than 2 are associated to critically low socioeconomic status (Melki et al., 2004). The share of people living in houses with crowding index higher than 2 is computed at the regional level.
The last two variables included in the Absolute poverty component are related to the affordability of medical and dental treatments. They are computed as the percentage of people needing medical/dental treatments but not affording them and are derived by combining two questions in EU-SILC: PH040 and PH050 for medical treatments - PH060 and PH070 for dental treatments (Table 5.2 in Section 5).

4.1.2 SOEP

As absolute measures of poverty, the following indicators are computed at the regional level:

- Percentage of people experiencing problems with their dwelling;
- Percentage of people living in over-crowded houses;

No data on material deprivation are available in the German survey.
The variable describing problems with the dwelling is computed using zh13 SOEP variable ('How would you characterize the condition of the house in which you live: 1-in good condition, 2-partly in need of renovation, 3-in need of complete renovation, 4-ready for demolition '). This variable is recoded into a dichotomous one with '1 'indicating having problems with dwelling (2-partly in need of renovation, 3-in need of complete renovation, 4-ready for demolition).
Percentage of persons living in over-crowded houses is computed, as for the other surveys, by means of the crowding index. To calculate it we use the variables zh11 - number of all rooms 6 m^2 or more that are not kitchen nor bathroom - and d1110609 - number of persons in the household. Then, the share of people living in houses with crowding index higher than 2 is finally computed at the regional level.

[1] A room is defined in EU-SILC as a space of a housing unit of at least 4 square meters such as normal bedrooms, dining rooms, living rooms and habitable cellars and attics with a high over 2 meters and accessible from inside the unit. The following space of a housing unit does not count as rooms: kitchens, with some exceptions, bathrooms, toilets, corridors, utility rooms and lobbies.

4.1.3 USS

As absolute measures of poverty, the following indicators are computed at the regional level:

- Material deprivation rate;
- Intensity of material deprivation;
- Percentage of people living in over-crowded houses;

It must be noted that not all the items included in the classical definition of material deprivation rate are available in USS. In particular no questions on affordability of a protein meal and capacity to face unexpected financial expenses are available. In order to compute a proxy of material deprivation rate for UK regions the following seven items are considered (in brackets the indicator label used in USS):

1. ability to keep accommodation warm enough (a_hheat);
2. arrears on:
   (a) utility bills (electricity, water, gas) in last 12 months (up to date with all bills a_xphsdba);
   (b) hire purchase instalments or other loan payments in last 12 months, (behind with rent/mortgage a_xphsdb);
3. capacity to afford paying for one week annual holiday away from home, (a_matdepa);
4. capacity to afford a telephone, including mobile phone, if needed (a_cduse12 (mobile) or a_cduse13 (landline));
5. capacity to afford a color TV (a_cduse1);
6. capacity to afford a washing machine (a_cduse6);
7. capacity to afford a car (a_ncars)

Similarly to EU-SILC, all the variables are recoded in order to identify persons experiencing specific deficiencies: e.g not having a car, not having a washing machine. Variables on arrears (a_xphsdba and a_xphsdb) are merged into a single dichotomous one which has value '1'if person declares having experienced some problems in paying utility bills or loans.

Material deprivation rate is approximated in this case as the share of people deprived in at least two out of the seven items available in USS, which represents about 3% of not affordable items (compared to about 3.3% - 3 out of 9 - of the classical definition of material deprivation).

The intensity of material deprivation is defined as the (unweighted) mean number of items lacked by the deprived population (Eurostat, 2010a). In the USS case the minimum number of lacked items is 2 instead of 3 for EU SILC. All these limitations due to data comparability have to be considered when comparing results from USS with results from EU-SILC.

Percentage of persons living in over-crowded houses is calculated by means of the crowding index, denoted by the number of co-residents per room. Crowding index is computed using USS variables household size (a_hhsize - number of persons in the household) and the total number of rooms available to the household which we compute by adding the number of bedrooms (a_hsbeds) to the number of other rooms excluding kitchens and bathrooms (a_hsrooms). As in the EU-SILC case, a threshold value of 2 is chosen to define crowded houses (Melki et al., 2004).

4.2 Relative poverty

Well-being depends not only on absolute standards of living but also on relative ones: people may feel worse off not because they are really poor but because they are the bottom of the particular group they find themselves in. Relative measures of poverty are then of key relevance for measuring the actual level of satisfaction. With the Relative poverty component we try to capture this aspect by means of three aggregate poverty measures proposed by Foster et al. (1984), poverty incidence P_0, poverty depth P_1 and poverty severity P_2. The general formulation of a decomposable poverty measure is defined for each $\alpha \geq 0$ as:

$$P_\alpha(y, z) = \frac{1}{n} \sum_{i=1}^{q} (\frac{g_i}{z})^\alpha \tag{4.1}$$

where $y = (y_1, y_2, \ldots, y_n)$ is a vector of properly defined (individual) income in increasing order, $z > 0$ is a predefined poverty line, $g_i = z - y_i$ is the income gap of individual i, $q = q(y, z)$ is the number of individuals having income not greater than z and n is the total number of individuals with non-zero income. The three classical measures of poverty are defined for:
$\alpha = 0$:

$$\text{Incidence} \quad P_0 = \frac{1}{n} \sum_{i=1}^{q} 1 = \frac{q}{n} \tag{4.2}$$

or for $\alpha = 1$:

$$\text{Depth} \quad P_1 = \frac{1}{n} \sum_{i=1}^{q} \frac{z - y_i}{z} \tag{4.3}$$

or for $\alpha = 2$:

$$\text{Severity} \quad P_2 = \frac{1}{n} \sum_{i=1}^{q} \frac{(z - y_i)^2}{z^2} \tag{4.4}$$

P_0 is the share of poor people, where ‘poor’ is defined with respect to the poverty line which is defined as 60% of country median net disposable income. P_1 is the normalised income gap measure and indicates the average relative gap between the incomes of poor individuals and the poverty line. Assuming perfect targeting of transfers, the poverty depth index describes the minimum amount of wealth (in terms of income) that needs to be transferred to pull poor people up to the poverty line. P_2 is understood as severity index because it measures the degree of

inequality in the distribution of income within poor people. As it gives greater importance to the bottom of the income distribution, the higher P_2, the higher the level of inequality across the sub-population of poor.
The three measures P_0, P_1 and P_2 are computed at the available regional level for all the countries[2].
It is important to remark that the three indexes P_0, P_1 and P_2 are additively decomposable measures of poverty: if the incomes in a given subgroup of individuals change, the rest remaining fixed, the three measures move in the same direction. If the subgroup gets poorer, the indexes reflect this change with the proper sign and according to subgroup share weight (Foster et al., 1984).

The three relative measures of poverty depends on the definition of the poverty line. The poverty line is classically computed as the 60% of the national median income and it is the approach adopted here. This means that, even if the relative poverty indicators are computed regionally, the reference poverty line is at the national level. This has the effect of highlighting the differences across regions within the same country while considering regional poverty lines - computed from regional median incomes - generally decreases the variability across regions, as it measures inequality only within each region. A recent discussion about this is provided by Betti et al. (2012).

Now the question is: What income to consider for computing the share of poor people? The issue of comparability of household income measures is a very delicate point whenever the aim is to merge different surveys (see for example Frick and Krell (2010) for recent comparison of EU-SILC and SOEP incomes). As there are considerable differences among the three surveys analyzed here, a separate description is provided in the following together with a brief discussion on the opportunity of including housing costs in our measure of disposable income in the EU-SILC case.

4.2.1 Disposable income in EU-SILC and the inclusion of housing costs

In EU-SILC variable 'total disposable household income '- HY020 - represents a comparable measure of household income across EU and is used as the basis for individual income computations in this analysis. Disposable income is the most common indicator of economic resources used in poverty studies (McNamara et al., 2006). EU-SILC defines disposable income as the sum of a number of household and personal income components (Eurostat, 2010a):

1. gross (or net) personal income components of all household members, like employee income, company car, profits or losses from self-employment, unemployment benefits and other benefits (+)
2. gross (or net) income components at household level, like income from rental of a property or land, family or housing related allowances, interests or profit from capital investments, regular inter-household cash transfers received and other types of household incomes (+)

[2] Negative incomes may be present in the EU-SILC Users' Data Base (UDB). In in the computation of P_1 and P_2, and only in this case, negative incomes are treated as null incomes. This is equivalent to assigning the maximum gap, equal to the poverty line z, to individuals with negative incomes and is necessary to cope with the distortion of P_1 and P_2 values in presence of negative incomes with high absolute values. In Appendix 5 minimum individual incomes from EU-SILC are shown for the three UDBs under analysis. The column named 'without housing costs' refers to the EU-SILC variable HX090, while column 'with housing costs' refers to individual income corrected for housing costs.

3. deductions, like taxes on income, social insurance and wealth, inter-household cash transfer paid (-)

All the income components are multiplied by the 'within-household non-response inflation factor '- HY025 - which is necessary to correct the effect of non-responding individuals within a household, otherwise, income of individuals not interviewed is not added up into the total household income (from EU-SILC Description Target Variables). At the individual level , the equivalised disposable income (HX090) is used in the analysis:

$$HX090 = \frac{(HY020 \cdot HY025)}{HX050} \tag{4.5}$$

where $HX050$ is the equivalised household size defined according to the modified OECD approach, which is very well recognised internationally:

$$HX050 = 1 + 0.5(HM_{14+} - 1) + 0.3 * HM_{13-} \tag{4.6}$$

where HM_{14+} is the number of household members aged 14 and over and HM_{13-} is the number of household members aged 13 or less.
Some other important income components are mandatory in SILC since the 2007 data collection:

- imputed rent (positive component);
- interest paid on mortgage (as deduction);
- value of goods produced for own consumption (as a positive component);
- employer's social insurance contributions (as deduction);
- non cash employee income other than a company car (positive components).

However they are not yet included in the process of calculation of EU-SILC household disposable income HY020 variable. At the time this report was written, a decision of the The Indicators' Sub-Group (ISG) of the European Commission of the Social Protection Committee (SPC) on alternative calculations of disposable income in EU-SILC was still pending.
Adding imputed rent to household income is considered '. . . an important move towards a more complete measure of economic well-being '(from Sauli and Törmälehto (2010), pg. 156). Other studies confirm the importance of imputed rent (Frick et al., 2010). Unfortunately EU-SILC imputed rent is not yet sufficiently harmonised across EU countries. A recent study on 2007 EU-SILC data shows that many issues in imputed rent computation remain unsolved and that imputed rent is highly sensitive to underlying data and theoretical methods used for estimation (Sauli and Törmälehto, 2010). In order to incorporate imputed rent into the EU-SILC income further validation would be necessary (Atkinson et al., 2010) but this is beyond the scope of our analysis. For these reasons we opted for not including imputed rent in the computation of total disposable income.
As an alternative we considered to deduct housing costs from household income. Housing costs represent the biggest source of variation in living costs and have the advantage of not being estimated by models but directly

asked to people interviewed (still they may be affected by self-estimation issues). Including housing costs in income computation has the effect of diminishing the income values for all the individuals, as we are deducting housing costs from the income, but, at the same time, allows for taking into account regional costs of living which generally show a high level of within-country variability. We believe that measuring income after housing costs may provide a better indication of financial disadvantage, as discussed in McNamara et al. (2006).
There are no harmonised data on differences of living costs within a country for EU member states. Such figures would indicate how much a standardised set of goods and services would cost in different areas of the country. In absence of rigorous data, we cannot establish for certain which goods or services contribute most to differences in cost of living. Services such telecom, postal services, energy are provided at the same cost throughout a country. Most tradable goods do not differ substantially in cost between different parts of EU countries. Real estate costs, however, do measurably differ substantially between different areas of a country and are seen in the literature as one of the key contributors to differences in cost of living in developed countries (Kemeny and Storper, 2012; McNamara et al., 2006). As a result, we consider housing costs as the main driver of differences in cost of living. Not adjusting for differences in cost of living would lead to a significant overestimation of poverty in low cost areas and an underestimation of poverty in high cost areas, as recently discussed in Dijkstra (2012). Specifically, the at-risk-of-poverty rate classical definition has two methodological issues which weaken the link with low living standards: i) It does not differentiate between home-owners and tenants; ii) It does not take into account differences in living costs between different areas in a country. Both issues lead the EU-SILC-based indicator to count some people as ‘at-risk-of-poverty’ while others with a lower standard of living are not identified as at-risk. Following a suggestion from Eurostat, housing costs are here deducted from both income and the poverty line. This solves both the problems identified shortly above and increases the link with low living standards. As people with a low income tend to spend a higher share of their income on housing, deducting housing costs from income and the poverty line increases the at-risk-of-poverty rate and the other related poverty measures. On the contrary, deducting housing costs only from income and not from the poverty line would lead to very high at-risk-of-poverty rate. This is such an increase of the poverty rate that it would become more difficult to interpret and the link to low living standards becomes too diluted.

In EU-SILC total housing costs variable - HH070 - refers to monthly costs connected to the households right to live in the accommodation. These costs include:

- structural insurance,
- services and charges (sewage removal, refuse removal etc.),
- taxes on dwelling,
- regular maintenance and repairs,
- cost of utilities (water, gas, electricity and heating),
- mortgage interest payments for owners,

- rent payments for tenants,
- housing benefits for households whose house is rented for free.

Individual income adjusted for housing costs is computed as total household disposable income (HY020) minus annual housing costs (HH070· 12), multiplied by the within-household non-response inflation factor (HY025) and divided by the equivalised household size HX050 as defined in formula 4.6:

$$\text{adjusted disposable income:} \quad I_{adj} = \frac{(HY020 - HH070 \cdot 12) \cdot HY025}{HX050} \tag{4.7}$$

The sample weight used in the calculations of aggregates at the sub-national level for both types of individual incomes is the personal cross-sectional weight used for all household members, all ages - RB050 (see Section 3.1.2).

Table 4.1 shows median incomes in the case of the unadjusted disposable income and the one adjusted for housing costs. Adjusted national median incomes are used in the computation of poverty lines for indicators P_0, P_1 and P_2 in the Relative Poverty component (Section 4.2).

	EU-SILC 2007 median individual disposable income (euros)		EU-SILC 2008 median individual disposable income (euros)		EU-SILC 2009 median individual disposable income (euros)	
country	without housing costs	with housing costs	without housing costs	with housing costs	without housing costs	with housing costs
AT	18156	15334	19011	16250	19886	16986
BE	17566	14505	17985	14413	19313	16136
BG	1481	1093	2171	1691	2828	2385
CY	16014	14282	16765	14928	17432	15580
CZ	5423	4230	6068	4687	7295	5796
DE	17777	12362	18309	12933	18586	13288
DK	23341	17500	24161	17433	24933	17260
EE	4448	3859	5547	4849	6209	5382
ES	12038	10521	12950	11094	13300	11320
FI	18703	15722	19815	16683	20962	17544
FR	16441	13547	-	-	19760	16631
GR	10200	7843	10800	8148	11496	8574
HU	3936	3114	4400	3377	4739	3708
IE	22065	19373	22995	20157	22432	19336
IT	15011	12767	15639	13203	15637	13357
LT	3276	2808	4169	3656	4815	4188
LU	29892	26705	30917	27724	31764	28544
LV	3350	2790	4832	4125	5474	4677
MT	-	-	-	-	9933	8978
NL	18244	13200	19522	14283	20156	14874
PL	3502	2771	4155	3315	5097	4114
PT	7573	6361	8143	6915	8282	7101
RO	1658	1247	1953	1446	2162	1632
SE	18845	15321	20573	16813	21248	16982
SI	9903	8707	10878	9519	11863	10440
SK	3972	2969	4792	3995	5671	4524
UK	21014	15752	18923	14448	16265	12268

Table 4.1: EU-SILC national median incomes, without and with housing costs, used in the computation of poverty lines for EU-SILC variables extraction.

Figure 4.2 shows the distribution of regional median incomes across EU-SILC regions in both cases.

As expected, income is consistently lower when housing costs are considered and income distributions are different. Table 4.2 shows regional median incomes as original in EU-SILC and adjusted for housing costs for the three waves analysed, while Table 4.3 shows the coefficient of variation $CV \equiv \frac{\sigma}{\mu}$, where σ is the sample standard

deviation and μ is the sample mean, computed at the regional level for the two cases. In all cases the coefficient of variation is higher when incomes include housing costs suggesting that including housing costs increases the degree of variability of the income within each country.
All the indicators extracted from EU-SILC are also computed without including housing costs and are available from the authors upon request.

4.2.2 Disposable income in SOEP

The SOEP survey, described in Section 3.2, collects detailed information on personal income which are included in the $PEQUIV file. This file includes a set of constructed variables (for example pre- and post-government income or international household equivalence weights) that are not directly available on the original surveys and can be used for country comparisons (Frick et al., 2007). The income file used in this analysis has these features:

1. includes 100% of the original sample,

2. income variables are expressed in current year euro and are all non-negative,

3. covers all single income components considered in aggregated annual income figures (they correspond to the originally surveyed information (which are stored in the $P, $PKAL, $H files) with some important amendments (Grabka, 2011):

   - income variables are harmonized with respect to the periodicity and refer to annual income (as of the previous calendar year),
   - any missing income information due to item-non response is imputed,
   - any missing income information due to partial unit non response (PUNR, non responding individuals in households with at least one successful interview) is imputed,
   - six income components are imputed: individual labour income (I11110$$), social security pensions (I11108$$), unemployment benefits (IUNBY$$), maternity benefits (IMATY$$), student grants (ISTUY$$) and private transfers (IELSE$$). This information is also used to generate a more thorough measure for taxes and social contributions paid by private households.

The income variable used in our analysis is the yearly household disposable income called ‘Household Post-Government income’(I11102$$). Its exact definition is provided by Grabka (2011), pg. 45: ‘...This variable is the sum of total family income from labor earnings, asset flows, private retirement income, private transfers, public transfers, and social security pensions minus total family taxes. Labor earnings include wages and salary from all employment including training, self-employment income, bonuses, overtime, and profit sharing. Asset flows include income from interest, dividends, and rent. Private transfers include payments from individuals outside of the household including alimony and child support payments. Public transfers include housing allowances, child benefits, subsistence assistance from the Social Welfare Authority, special circumstances benefits from the

Social Welfare Authority, government student assistance, maternity benefits, unemployment benefits, unemployment assistance, and unemployment subsistence allowance. Social security pensions include payments from old age, disability, and widowhood pension schemes. The tax burdens provided here are based upon updated and modified tax calculation routines developed by Schwarze. The tax burden includes income taxes and payroll taxes (health, unemployment, retirement insurance and nursing home insurance taxes)...'.
Equivalised household size is computed according to the modified OECD approach (see def. 4.6):

eq_household_size=1+0.5*(d1110609-h1110109-1)+0.3*h1110109

where: d1110609 is number of persons in the household and h1110109 is the number of persons aged 0-14.
Weights used for individual income computations is the cross-sectional weight, enumerated individuals - W1110709, wave 2009 (see Section 3.2.2). The national median income computed from SOEP is equal to 18935 euros and is used for the computation of the poverty line for indicators P_0, P_1 and P_2 of the Relative poverty component.
There is no direct variable describing the housing costs in SOEP. Similarly to USS, there are some variables which may enable its computation. However, due to comparability issues with EU-SILC, we do not provide any scenario including housing costs for Germany.

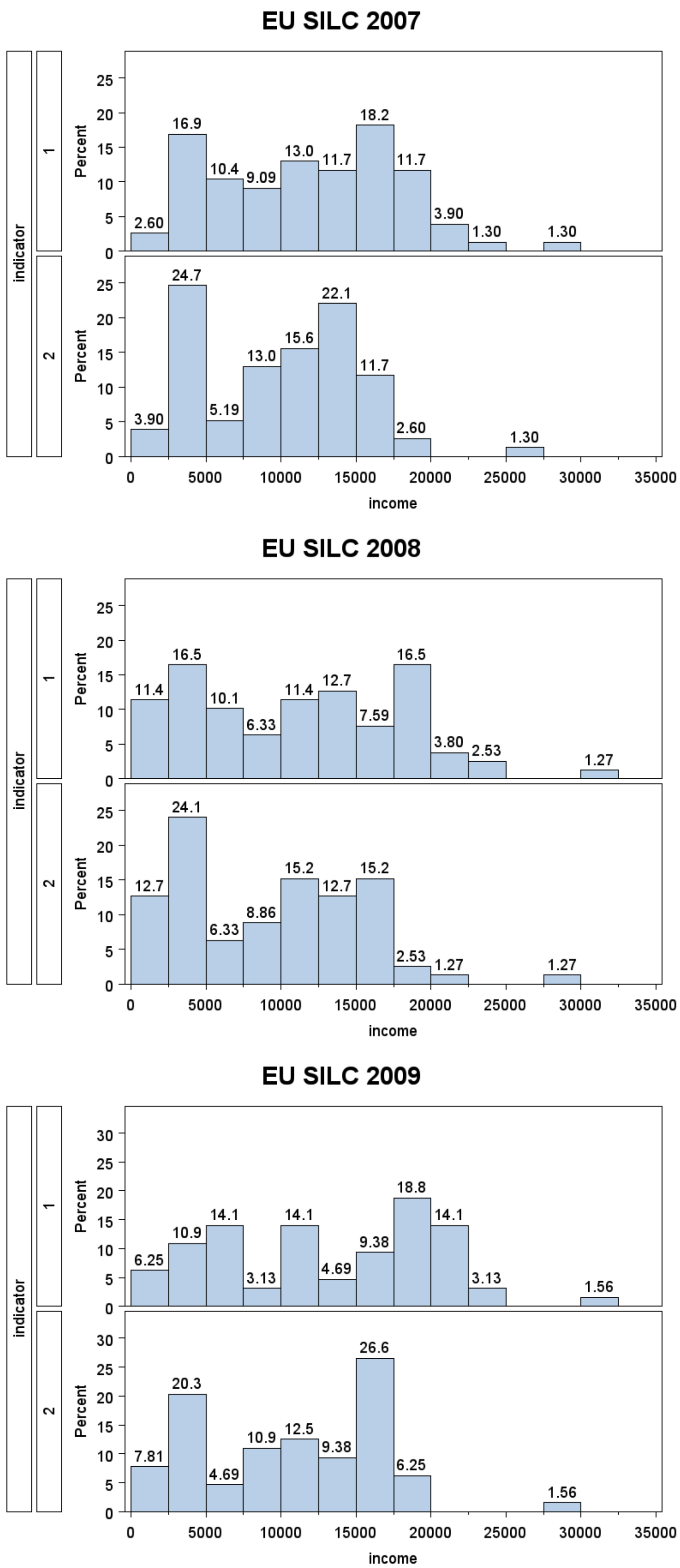


Figure 4.2: Comparison of individual disposable income not adjusted for housing costs (indicator = 1) and adjusted for housing costs (indicator = 2).

EU-SILC 2007 median individual disposable income (euros)			EU-SILC 2008 median individual disposable income (euros)			EU-SILC 2009 median individual disposable income (euros)		
region	without housing costs	with housing costs	region	without housing costs	with housing costs	region	without housing costs	with housing costs
AT1	18827	15789	AT1	19819	16713	AT1	20677	17470
AT2	17990	15371	AT2	18805	16445	AT2	19096	16815
AT3	19034	16335	AT3	19688	16830	AT3	20805	17919
BE1	14599	11176	BE1	14875	10969	BE1	16850	12652
BE2	18544	15813	BE2	19107	15722	BE2	20282	17306
BE3	16388	13315	BE3	17057	13058	BE3	18497	15131
BG0	1492	1121	BG3	1955	1488	BG3	2599	2159
CY0	16090	14421	BG4	2452	1929	BG4	3046	2573
CZ01	6864	5447	CY0	16834	15039	CY0	17361	15589
CZ02	5667	4465	CZ01	7615	5992	CZ0	7391	5863
CZ03	5640	4615	CZ02	6486	4994	DE	18549	13379
CZ04	5089	3913	CZ03	6414	5131	DK0	27424	19370
CZ05	5337	4136	CZ04	5646	4385	EE0	6198	5382
CZ06	5398	4221	CZ05	5958	4596	ES1	13072	11594
CZ07	5275	4095	CZ06	6022	4513	ES2	16583	14614
CZ08	5123	3958	CZ07	5869	4578	ES3	16153	13464
DE	17548	12411	CZ08	5740	4521	ES4	11950	10372
DK0	23415	17488	DE	18189	13017	ES5	14400	12335
EE0	4432	3840	DK0	24058	17340	ES6	11333	9715
ES11	11070	10180	EE0	5517	4837	ES7	11517	10127
ES12	13082	11590	ES11	12133	11084	FI1	20964	17419
ES13	13316	12070	ES12	13821	12236	FR1	23410	19627
ES21	14819	13063	ES13	14161	12219	FR2	19260	16297
ES22	16748	14793	ES21	16207	13748	FR3	18180	15217
ES23	11924	10841	ES22	17388	15200	FR4	19930	16878
ES24	14038	12256	ES23	13633	11807	FR5	20120	17318
ES30	14278	12332	ES24	14562	12958	FR6	19650	16973
ES41	11408	10183	ES30	15769	13293	FR7	20820	17313
ES42	9724	8661	ES41	12625	10979	FR8	19310	16241
ES43	8733	7921	ES42	11238	9703	GR1	10381	7739
ES51	13632	11635	ES43	9115	7876	GR2	10213	7805
ES52	12030	10565	ES51	14826	12486	GR3	13044	9736
ES53	14033	11930	ES52	12896	10795	GR4	12242	9437
ES61	9762	8653	ES53	14304	11966	HU1	5536	4394
ES62	10992	9764	ES61	10640	9371	HU2	4867	3880
ES70	10213	9024	ES62	12468	11098	HU3	4308	3389
FI13	16857	14337	ES70	11553	9890	IE0	22843	20060
FI18	20152	16932	FI13	18282	15604	ITC	18363	15541
FI19	18098	15432	FI18	21376	17721	ITD	18421	15791
FI1A	17390	14818	FI19	19196	16444	ITE	17092	14748
FR10	19455	15611	FI1A	18443	15784	ITF	12670	11098
FR20	15990	13387	GR1	9867	7104	ITG	11776	10267
FR30	15030	12398	GR2	9968	7313	LT0	4847	4218
FR40	16313	13503	GR3	12762	9442	LU0	32223	29366
FR50	16667	13893	GR4	11410	8806	LV0	5473	4696
FR60	16137	13284	HU1	5117	3984	MT0	10212	9238
FR70	17271	14177	HU2	4552	3584	NL	20573	15345
FR80	16308	13533	HU3	4005	3078	PL1	5407	4394
GR1	8976	6680	IE0	23469	20552	PL2	5521	4407
GR2	9424	7267	ITC	18080	15334	PL3	4421	3602
GR3	11855	9414	ITD	18125	15438	PL4	5046	4100
GR4	10490	8437	ITE	17180	14802	PL5	5431	4507
HU1	4560	3618	ITF	12544	10920	PL6	5011	4027
HU2	4102	3319	ITG	12087	10309	PT	8412	7260
HU3	3621	2863	LT0	4201	3700	RO1	2350	1849
IE0	22432	19920	LU0	31674	28305	RO2	1977	1525
ITC	17304	14767	LV0	4833	4139	RO3	2428	1923
ITD	17661	15039	NL	19896	14643	RO4	2071	1536
ITE	16627	14252	PL1	4412	3502	SE1	23039	18536
ITF	11675	10124	PL2	4546	3601	SE2	21658	17163
ITG	11447	9743	PL3	3667	2923	SE3	20218	15690
LT0	3283	2809	PL4	4160	3350	SI	11063	9485
LU0	30364	27299	PL5	4633	3762	SK0	5721	4583
LV0	3338	2782	PL6	4012	3151	UK	16714	12683
NL	18641	13614	PT	8270	7039			
PL1	3741	2978	RO01	1744	1293			
PL2	3812	2986	RO02	1827	1333			
PL3	3119	2483	RO03	1843	1407			
PL4	3540	2840	RO04	1590	1142			
PL5	3811	3046	RO05	2170	1684			
PL6	3478	2745	RO06	2151	1640			
PT	7660	6481	RO07	2102	1489			
RO0	1686	1269	RO08	3208	2509			
SE0	19227	15548	SE1	21844	17647			
SI	9981	8757	SE2	20707	16813			
SK0	4002	3000	SE3	19938	16151			
UK	21557	16383	SI	10941	9564			
			SK0	4828	4033			
			UK	19496	14980			

Table 4.2: EU-SILC regional median individual disposable incomes not adjusted for housing costs and adjusted for housing costs, different wave years.

CV individual disposable income (euros)		
region	without housing costs	with housing costs
AT1	1437	1630
AT2	1133	1310
AT3	1239	1413
BE1	2124	2631
BE2	1343	1583
BE3	1342	1617
BG0	2025	2540
CY0	724	788
CZ01	1432	1757
CZ02	1225	1488
CZ03	918	1105
CZ04	1934	2415
CZ05	1006	1232
CZ06	987	1233
CZ07	933	1140
CZ08	927	1137
DE	3626	4864
DK0	2229	2931
EE0	1115	1033
ES11	2067	2221
ES12	1286	1421
ES13	1358	1453
ES21	1806	2014
ES22	1418	1588
ES23	916	1039
ES24	1536	1761
ES30	3416	3889
ES41	1980	2183
ES42	1849	2053
ES43	1721	1858
ES51	2665	3077
ES52	2485	2757
ES53	1704	2001
ES61	2600	2822
ES62	1538	1711
ES70	2191	2462
FI13	1454	1693
FI18	1625	1904
FI19	977	1097
FI1A	966	1134
FR10	2902	6547
FR20	2736	3215
FR30	2725	3226
FR40	2366	2827
FR50	3984	4709
FR60	2853	4489
FR70	2483	3815
FR80	2660	3232
GR1	1729	2132
GR2	1986	2373
GR3	2364	2736
GR4	1575	1864
HU1	1262	1555
HU2	982	1227
HU3	1249	1542
IE0	1301	1441
ITC	2411	2776
ITD	1834	2107
ITE	2151	2379
ITF	2452	2772
ITG	2608	2885
LT0	1132	1246
LU0	420	466
LV0	1036	1176
NL	1852	2819
PL1	2897	3389
PL2	1897	2276
PL3	1635	1902
PL4	1880	2219
PL5	2000	2358
PL6	1773	2061
PT	2480	2745
RO0	2603	3142
SE0	1662	2005
SI	636	740
SK0	1013	1319
UK	4410	5866

CV individual disposable income (euros)		
region	without housing costs	with housing costs
AT1	1496	1716
AT2	1189	1352
AT3	1659	1887
BE1	2562	3211
BE2	2066	2527
BE3	2202	2796
BG3	2109	2506
BG4	1787	2117
CY0	680	735
CZ01	1424	1778
CZ02	1392	1768
CZ03	729	1058
CZ04	1479	1850
CZ05	828	1092
CZ06	872	1180
CZ07	875	1108
CZ08	940	1219
DE	3925	5246
DK0	2181	2903
EE0	632	685
ES11	1729	1855
ES12	1252	1360
ES13	1117	1249
ES21	1761	1968
ES22	1058	1197
ES23	803	932
ES24	1481	1660
ES30	2970	3347
ES41	1862	2023
ES42	2210	2425
ES43	1714	1851
ES51	2515	2929
ES52	2535	2844
ES53	1650	1986
ES61	2691	2967
ES62	1571	1762
ES70	1916	2132
FI13	1067	1246
FI18	1545	1796
FI19	1376	1577
FI1A	1110	1203
GR1	1678	2160
GR2	1952	2369
GR3	1998	2445
GR4	1427	1759
HU1	1301	1614
HU2	1036	1285
HU3	945	1190
IE0	1272	1415
ITC	2375	2762
ITD	1915	2215
ITE	2030	2309
ITF	2254	2546
ITG	2346	2590
LT0	1251	1384
LU0	429	468
LV0	1093	1218
NL	1801	2432
PL1	3003	3471
PL2	1837	2175
PL3	1606	1876
PL4	1968	2340
PL5	1927	2239
PL6	2042	2389
PT	2380	2652
RO01	2778	3321
RO02	2916	3733
RO03	2240	2736
RO04	2650	3326
RO05	1864	2300
RO06	2088	2484
RO07	1907	2423
RO08	2327	2859
SE1	2281	2753
SE2	1454	1793
SE3	1525	1915
SI	617	705
SK0	902	1076
UK	5506	6863

CV individual disposable income (euros)		
region	without housing costs	with housing costs
AT1	1425	1621
AT2	1193	1349
AT3	1279	1463
BE1	2271	2786
BE2	1897	2221
BE3	1500	1783
BG3	1502	1713
BG4	1464	1648
CY0	672	721
CZ0	1316	1591
DE	3400	4455
DK0	165	225
EE0	620	675
ES1	1657	1832
ES2	1479	1681
ES3	2937	3358
ES4	1995	2218
ES5	2318	2684
ES6	2458	2787
ES7	2367	2638
FI1	138	160
FR1	5131	5935
FR2	3037	3495
FR3	3389	3925
FR4	3538	4054
FR5	3558	4070
FR6	4077	4652
FR7	3703	4275
FR8	3921	4473
GR1	1550	2002
GR2	1767	2253
GR3	2125	2649
GR4	1581	1948
HU1	1054	1278
HU2	1004	1206
HU3	883	1075
IE0	1160	1277
ITC	2510	2900
ITD	2023	2310
ITE	2062	2332
ITF	2240	2528
ITG	2582	2860
LT0	1307	1449
LU0	452	489
LV0	1101	1233
MT0	387	423
NL	1778	2212
PL1	3046	3512
PL2	1785	2108
PL3	1569	1799
PL4	1862	2203
PL5	2212	2582
PL6	2626	3091
PT	2365	2605
RO1	1759	2085
RO2	2821	3388
RO3	2411	2797
RO4	2242	2719
SE1	142	168
SE2	103	127
SE3	95	122
SI	79	91
SK0	903	3001
UK	4086	5050

Table 4.3: Coefficient of variation - CV - of EU-SILC individual disposable incomes not adjusted for housing costs and adjusted for housing costs, different wave years.

4.2.3 Disposable income in USS

Understanding Society Survey (Section 3.3) collects detailed information on personal income. All individuals aged 16 or more are asked to report (McFall2011, p.22):

- wages,
- self-employment earnings,
- second job earnings,
- interests and dividends,
- pensions (National Insurance/state retirement pension, pension from a previous employer, pension from a spouse's previous employer, private pension/annuity, widow's or war widow's pension, widowed mother's allowance or widowed pension),
- benefits (severe disablement allowance, disability living allowance, war disablement pension, attendance allowance, carer's allowance, incapacity benefit, income support, job seeker's allowance, national insurance credits, child benefit, child tax credit, working tax credit, maternity allowance, housing benefit, council tax benefit, foster allowance/guardian allowance/rent rebate, rate rebate, employment and support allowance, respond to work credit, sickness and accident insurance, in-work credit for lone parents and pension credit),
- other income sources (educational grant, trade union and friendly society payment, maintenance or alimony, payments from a family member not living together, amount for rent from boarders or lodgers, rent from any other property).

All these income variables are corrected to cope with within-household non-response. The total monthly individual net income is computed in two steps:

1. all income variables are recalculated to be expressed in monthly amounts,
2. some of the income variables are converted to net amounts (second job gross earnings, carer's allowance, incapacity benefit, job seeker allowance, rent from any property - excluding rent from boarders or lodgers, and employment and support allowance);

Total household net income is computed in USS by adding reported or imputed total net income for all household members. The net household income is net of income tax, National Insurance Contribution, pension and union dues but not of Council Tax [3]. No negative incomes are present in the database.

The yearly personal net income used in our analysis is computed by multiplying the monthly net household income (a_fihhmnnet_dv) by 12 and dividing by the modified OECD equivalised household size (a_ieqmoecd_dv) [4]. As the UK data analysis is kept separated from the rest of the analysis (similarly to the German survey), income unit

[3] More information in Understanding Society User Support: http://data.understandingsociety.org.uk/support/issues/28.

[4] This approach is the same as the one adopted in UK SILC - see Atkinson et al. (2010), pg. 102.

of measurement is left in pounds. The national median individual income from USS used for computation of the poverty line is 13308 pounds.
USS does not include an aggregated variable on housing costs but provides a series of variables related to that, like rent/mortgage payments, expenditures on housing services and the Council Tax on the accommodation. In theory it would be possible to set-up a housing costs variable for USS but full comparability with EU-SILC cannot be ensured. For instance we found some problems with different time periods of different payments made (weeks covered by last rental payment USS variable: a_rentwc), with the rent composition (whether the rent includes only rent or also heating/lighting/water etc.) and with the estimation of the council taxes. Similarly to the German case, for British regions all the computations are carried out without including housing costs in the estimation of disposable income.

4.3 Earnings and Incomes

As discussed at the beginning of this Chapter, the Earnings and Incomes component is strictly related to monetary aspects of people's living standards. It includes three indicators:

- median incomes in PPS (EU-SILC - SOEP - USS)
- compensation of employees PPS (derived from regional accounts data, Eurostat)
- average net adjustable household income (derived from regional accounts data, Eurostat).

The choice of the median instead of the mean in the computation of the average income is driven by the need of having a measure more robust with respect to extreme values. Compensation of employees describes working condition, in terms of salaries, and net adjustable household income is an income corrected for bias due to services possibly financed by the government.

4.4 Living standards dimension: Statistical assessment

4.4.1 Univariate analysis

This Section provides the univariate statistical analysis of the indicators which populate the components of the Living Standards dimension of QoL: absolute poverty, relative poverty and income. For each indicator we provide a brief description, the data source, its orientation with the latent concept of quality of life (upward arrow for positive orientation, downward arrow for negative orientation), arithmetic mean (mean), standard deviation (sd), coefficient of variation (cv=sd/mean), skewness, kurtosis, quartiles (p25, p50=median and p75), interquartile range (p75-p25), maximum value (max), region corresponding to the maximum value, minimum value (min) and the region corresponding to the minimum value. Indicators maps and distributions are also shown.
Separate tables are presented for indicators extracted from EU-SILC, SOEP and USS surveys. It is important to remark that in the case of EU-SILC income related indicators refer to disposable incomes adjusted for housing costs while in the case of SOEP and USS incomes are not adjusted. The reader should be aware of this when comparing results from different surveys. Also, the complete list of indicators is available only for EU-SILC data. For SOEP and USS only a subset of indicators could be computed. The subscript *mean* used for the names of indicators from EU-SILC means that they are computed as averages across 2007-2008-2009 waves.
Histograms and maps are also provided for each indicator. Please note that maps are only meant to give an approximate picture of the indicators distribution across EU regions. For technical reasons, the geographical level of maps for EU-SILC indicators is the NUTS2 level for all the countries while the actual geographical level differs from country to country and is shown in figure 3.10. For all the maps the darker the color the higher the living standards level.

Absolute poverty

The full description of the indicators included in the Absolute poverty component is presented in Section 4.1. This Section provides the univariate analysis of each of the following indicators (in brackets the indicator name):

1. percentage of people materially deprived (AP1),
2. mean number of lacked items (AP2),
3. percentage of people living in houses with problems (AP3),
4. percentage of people living in crowded houses (AP4),
5. percentage of people with problems with making ends meet (AP5),
6. percentage of people with unaffordable medical need (AP6),
7. percentage of people with unaffordable dental need (AP7).

Tables 4.4, 4.5, 4.6 show the descriptive statistics for the indicators extracted from the three data-sources, whose histograms are shown in Figures 4.3 - 4.5.

short label	AP1_mean	AP2_mean	AP3_mean	AP4_mean	AP5_mean	AP6_mean	AP7_mean
indicator description	% of people materially deprived	Mean number of lacked items	% of people living in houses with problems	% of people living in crowded houses	% of people with problems in making ends meet	% of people with unaffordable medical need	% of people with unaffordable dental need
source	EU SILC 2007-2009	EU SILC 2007-2009	EU SILC 2007-2009	EU SILC 2007-2009	EU SILC 2007-2009	EU SILC 2007-2009	EU SILC 2007-2009
indicator orientation	↓	↓	↓	↓	↓	↓	↓
mean	17.48	3.57	21.25	3.10	29.78	2.16	4.28
sd	13.81	0.25	6.43	4.00	15.19	2.86	3.58
cv	0.79	0.07	0.30	1.29	0.51	1.32	0.84
skewness	1.07	1.11	-0.08	1.15	0.29	1.65	1.35
kurtosis	3.03	3.75	2.42	2.88	2.10	4.88	4.65
p25	7.08	3.39	16.59	0.14	17.10	0.13	1.54
p50	12.07	3.51	21.40	0.93	27.88	0.93	3.37
p75	25.92	3.74	26.10	4.78	42.28	3.01	5.68
interquartile range	18.85	0.35	9.51	4.64	25.18	2.88	4.14
max	56.39	4.32	35.23	14.08	64.54	11.52	17.08
region corresponding to maximum value	BG3	BG3	PL5	RO11	BG3	BG3	BG3
min	2.42	3.22	6.99	0.00	7.17	0.00	0.17
region corresponding to minimum value	LU	ES41	FI1A	FI19 ES52	LU	ES23 ES24	SI

Table 4.4: EU-SILC - Absolute poverty - Descriptive statistics.

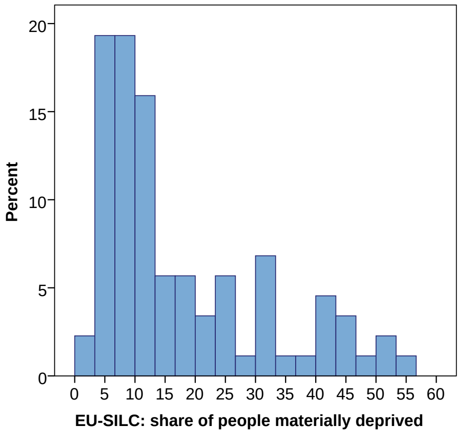
short label	AP3_mean	AP4_mean
indicator description	% of people living in houses with problems	% of people living in crowded houses
source	SOEP 2009	SOEP 2009
indicator orientation	↓	↓
mean	33.93	0.11
sd	3.53	0.43
cv	0.10	3.81
skewness	0.17	3.61
kurtosis	1.92	14.04
p25	30.73	0.00
p50	33.82	0.00
p75	36.55	0.00
interquartile range	5.81	0.00
max	40.26	1.74
region corresponding to maximum value	DE8	DE3
min	28.83	0.00
region corresponding to minimum value	DE9	DE1 DE4 DE5 DE6 DE7 DE8 DEA DEB DEC DED DEE DEF DEG

Table 4.5: SOEP - Absolute poverty - Descriptive statistics.

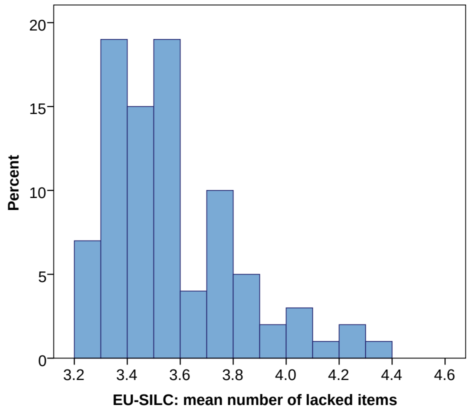
For a quick glance to the regions performance on absolute poverty, Figures 4.6 to 4.12 show the maps of the indicators included in the component for EU-SILC, SOEP and USS. Values of each indicator are classified into five groups according to the distribution percentiles P20, P40, P60 and P80. No map is provided for indicator AP4 (share of people living in crowded houses) for SOEP as it shows almost no variation. Please note that in the EU-SILC case for technical reasons the regional level of the maps is NUTS2 for all the countries even if the actual level of the variables represented is the EU-SILC one and varies according to the country.

short label	AP1_mean	AP2_mean	AP4_mean
indicator description	% of people materially deprived	Mean number of lacked items	% of people living in crowded houses
source	USS 2009	USS 2009	USS 2009
indicator orientation	⇩	⇩	⇩
mean	6.77	2.21	0.14
sd	1.83	0.07	0.17
cv	0.27	0.03	1.22
skewness	1.32	0.97	1.41
kurtosis	4.93	2.69	4.26
p25	5.69	2.16	0.01
p50	6.62	2.19	0.06
p75	7.40	2.24	0.24
interquartile range	1.70	0.08	0.22
max	11.53	2.35	0.57
region corresponding to maximum value	UKI	UKE	UKI
min	4.60	2.14	0.00
region corresponding to minimum value	UKJ	UKF	UKC

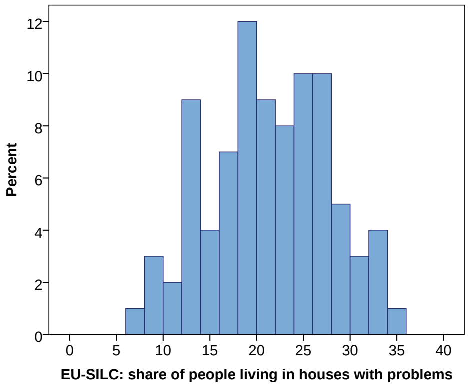
Table 4.6: USS - Absolute poverty - Descriptive statistics.



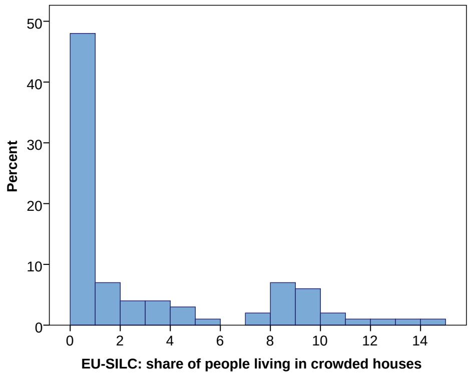
(AP1_mean)



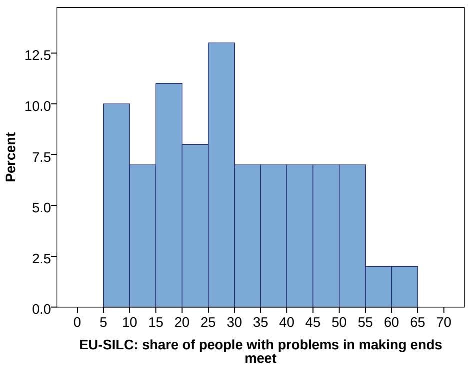
(AP2_mean)



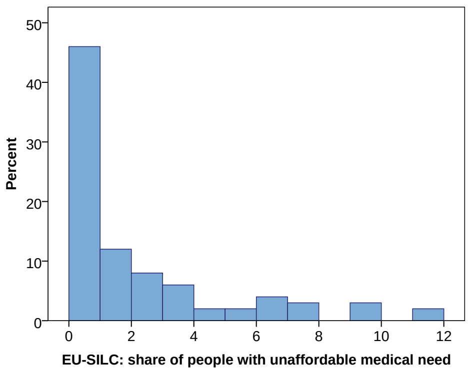
(AP3_mean)



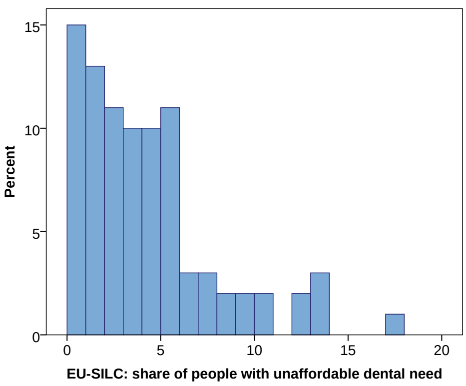
(AP4_mean)



(AP5_mean)

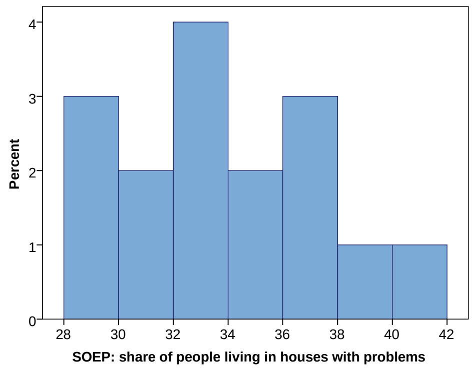


(AP6_mean)

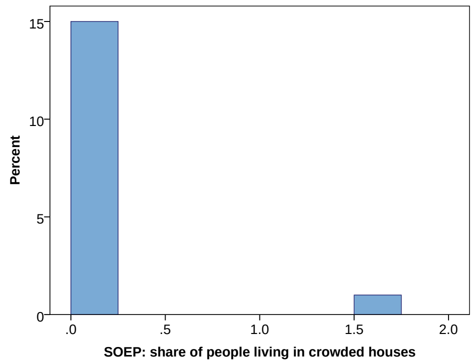


(AP7_mean)

Figure 4.3: EU-SILC - Absolute poverty component - Histograms.

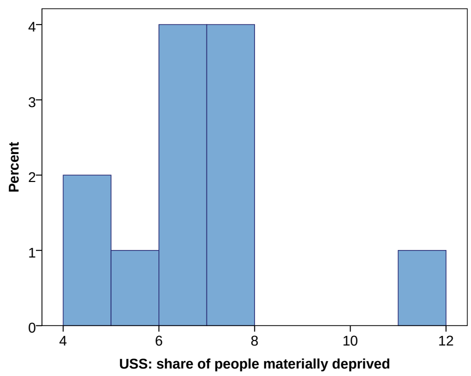


(AP3)

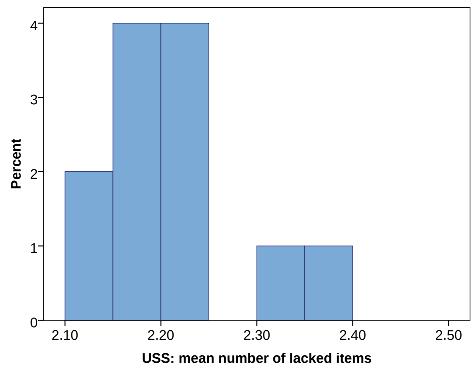


(AP4)

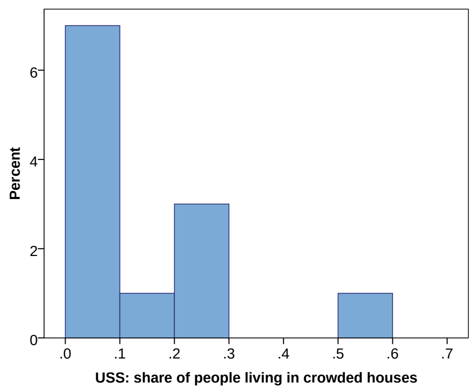
Figure 4.4: SOEP - Absolute poverty component - Histograms.



(AP1)

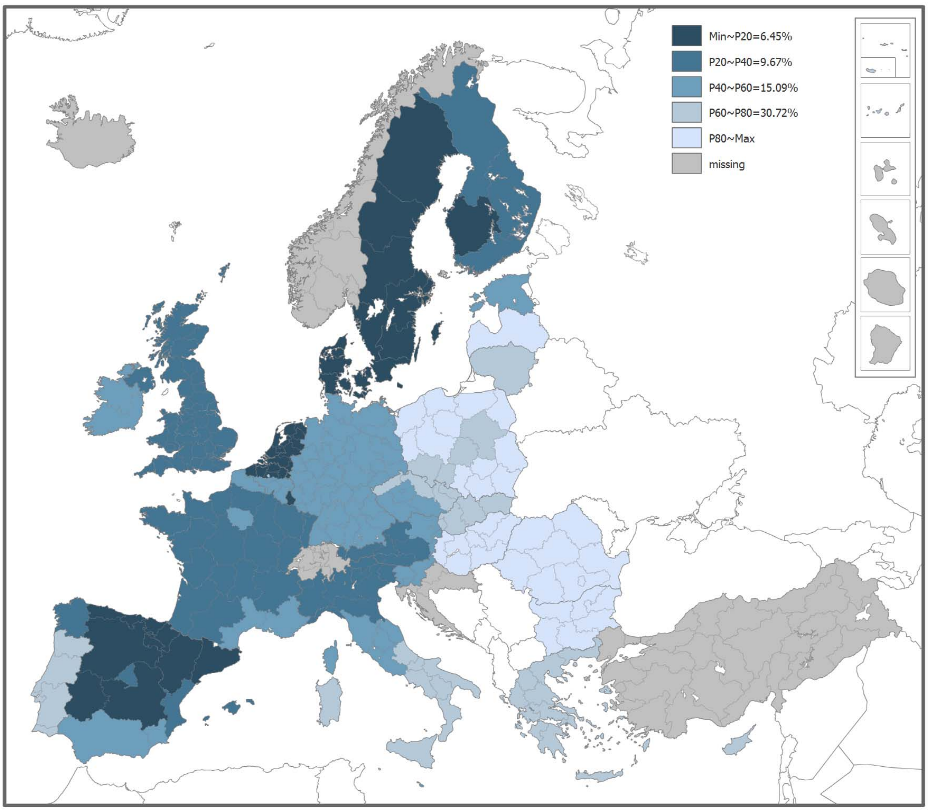


(AP2)

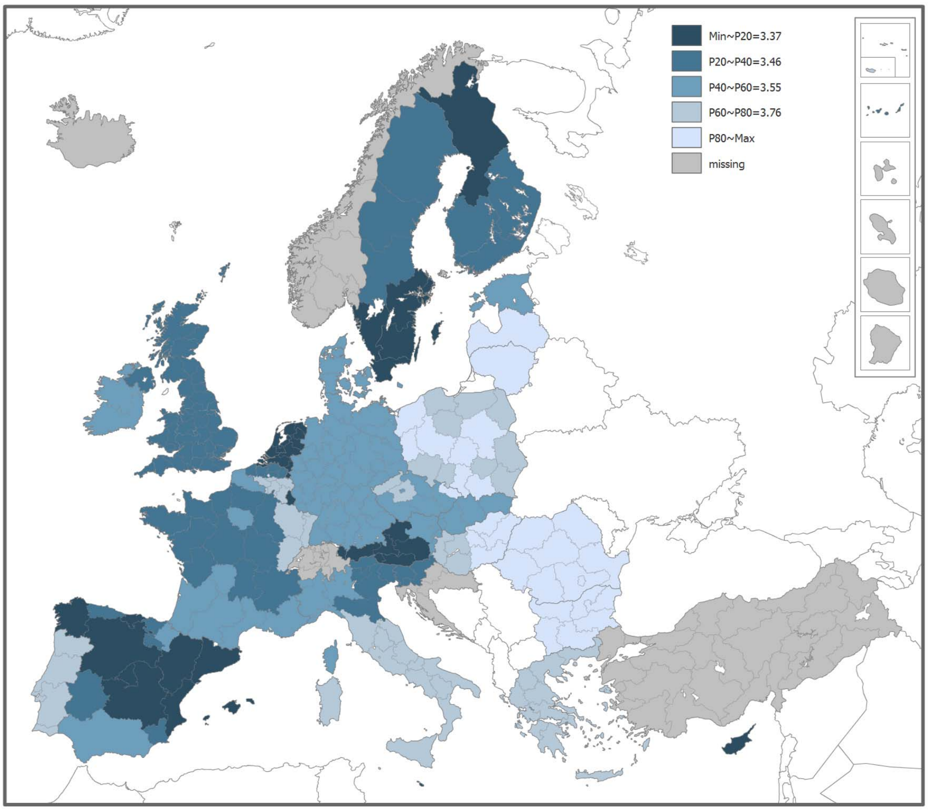


(AP4)

Figure 4.5: USS - Absolute poverty component - Histograms.

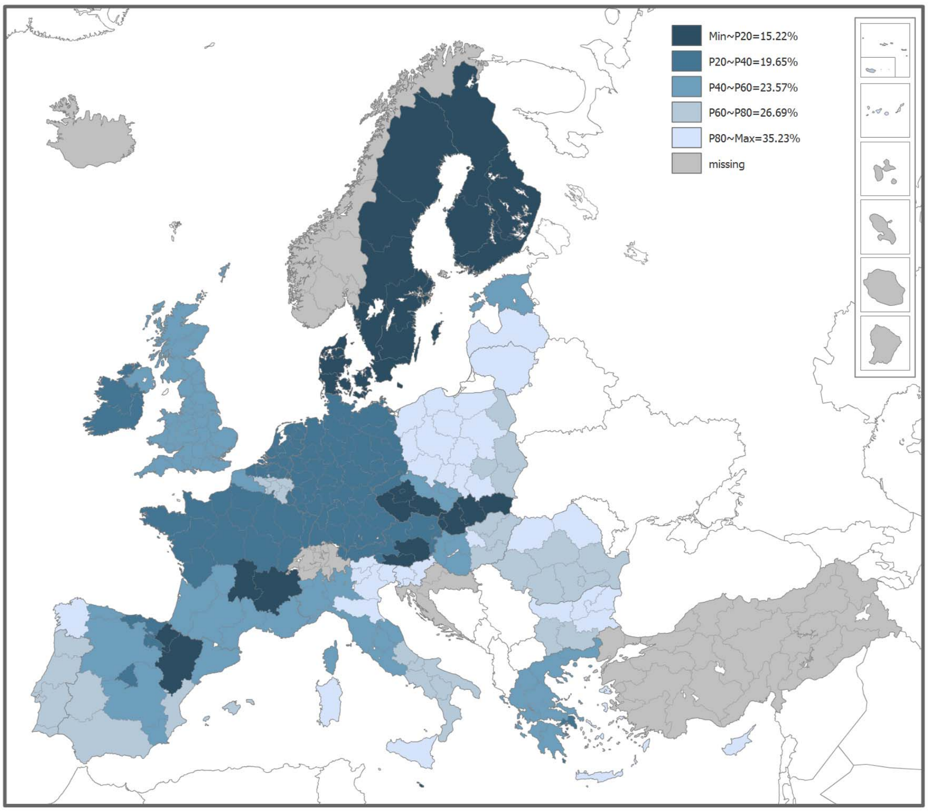


EU-SILC: share of people materially deprived

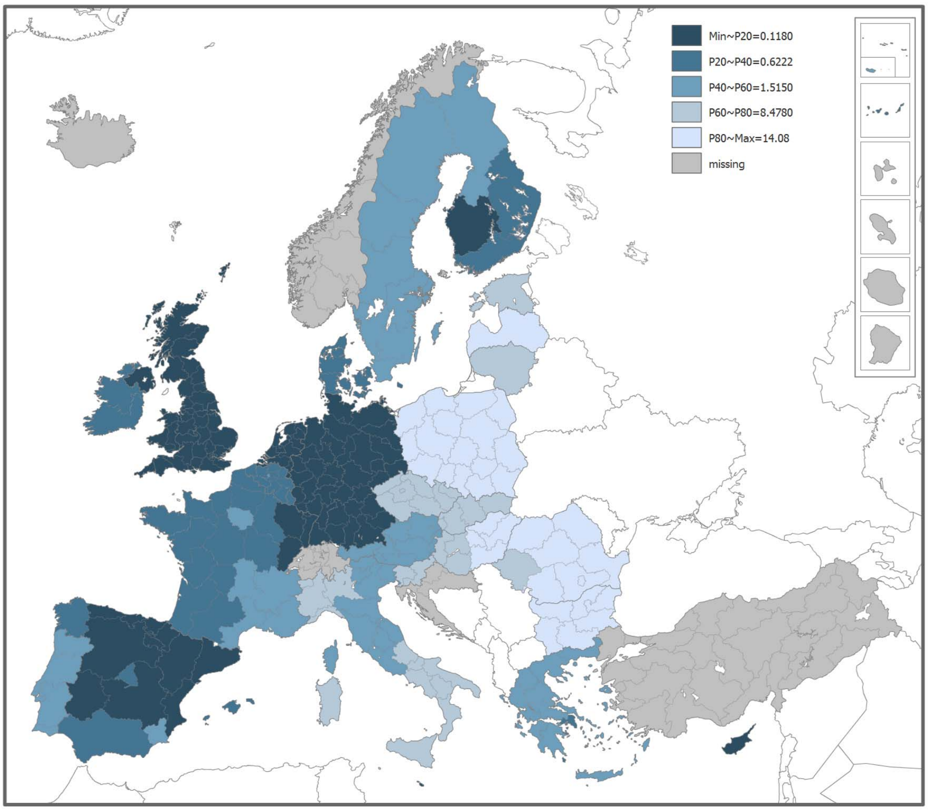


EU-SILC: mean number of lacked items

Figure 4.6: EU-SILC - Absolute poverty component - Maps (values recoded into five classes).

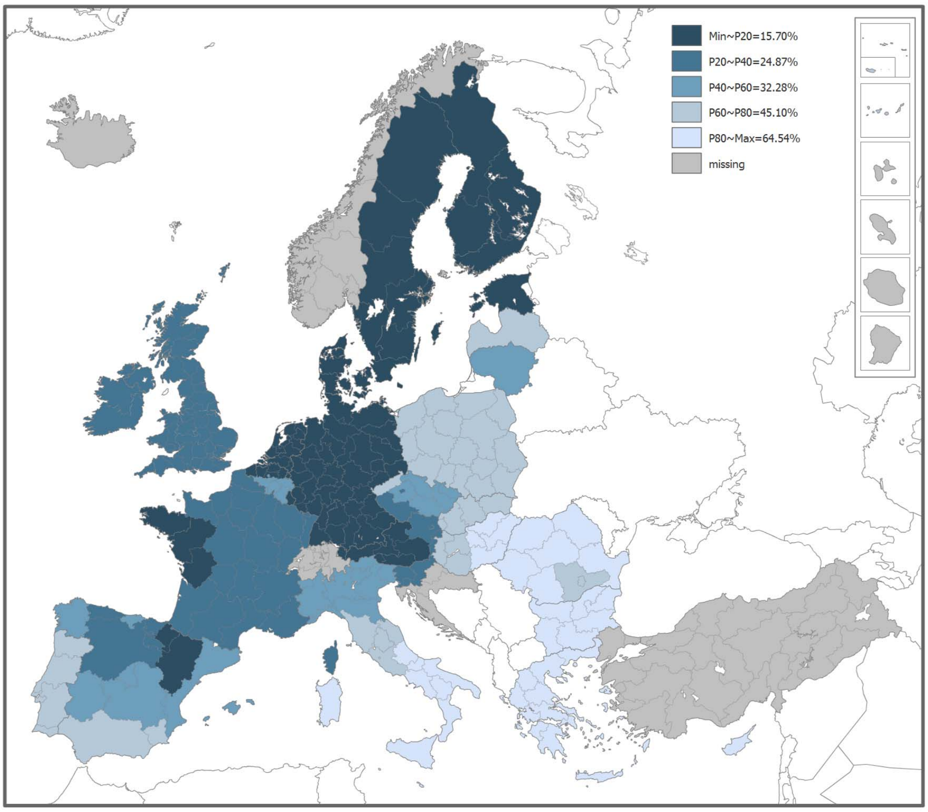


EU-SILC: share of people living in houses with problems

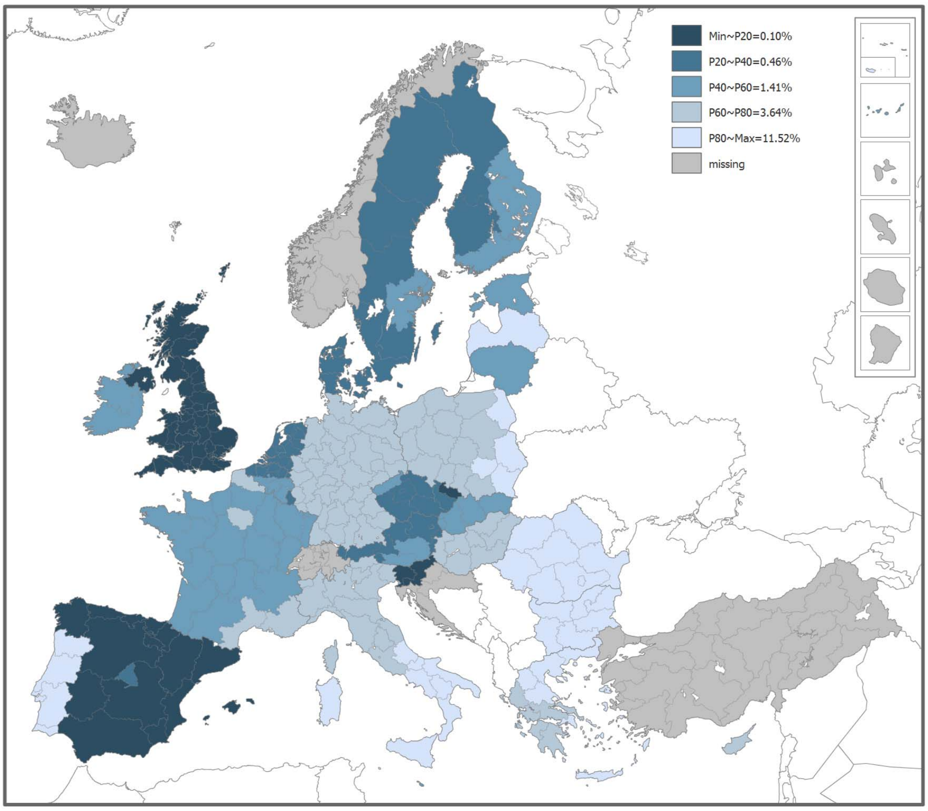


EU-SILC: share of people living in crowded houses

Figure 4.7: EU-SILC - Absolute poverty component - Maps (values recoded into five classes).

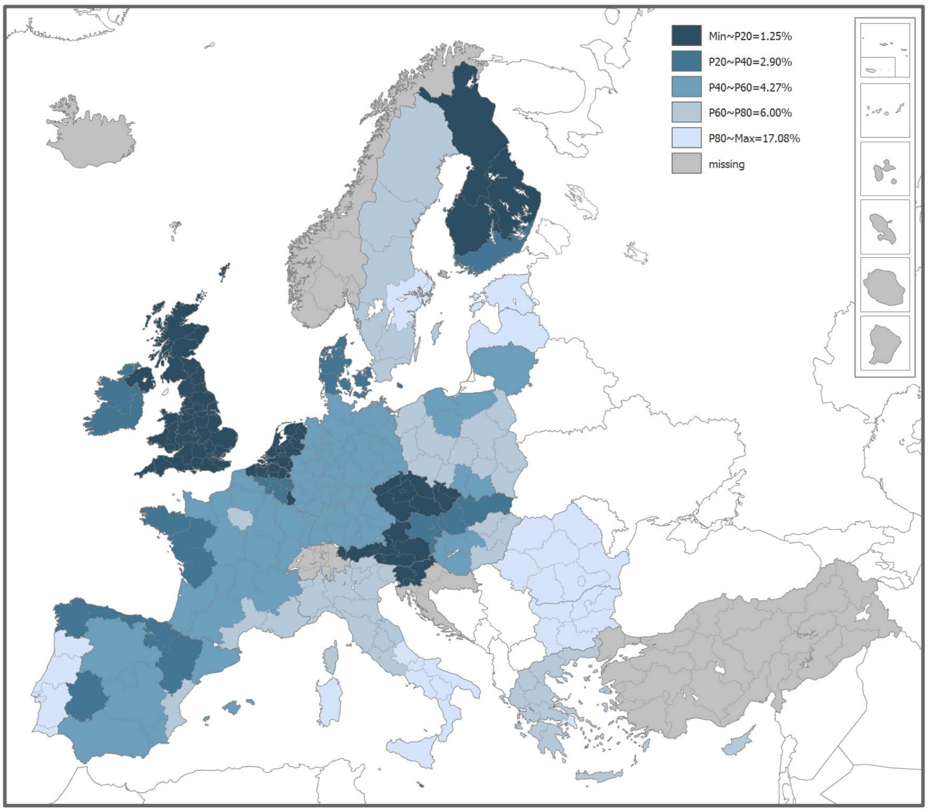


EU-SILC: share of people with problems in making ends meet



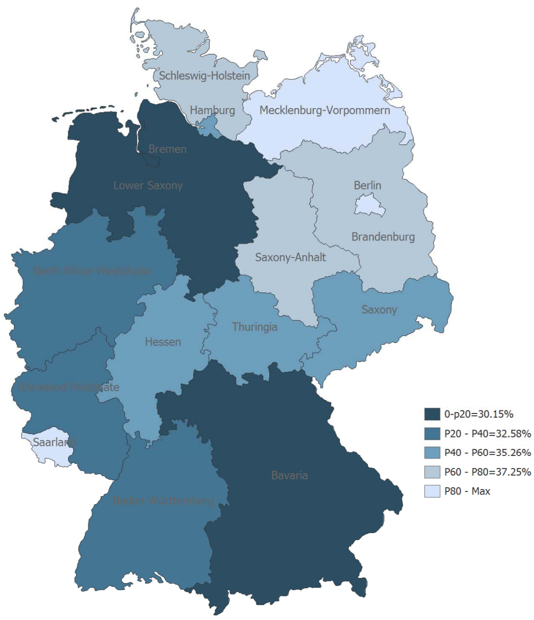
EU-SILC: share of people with unaffordable medical need

Figure 4.8: EU-SILC - Absolute poverty component - Maps (values recoded into five classes).



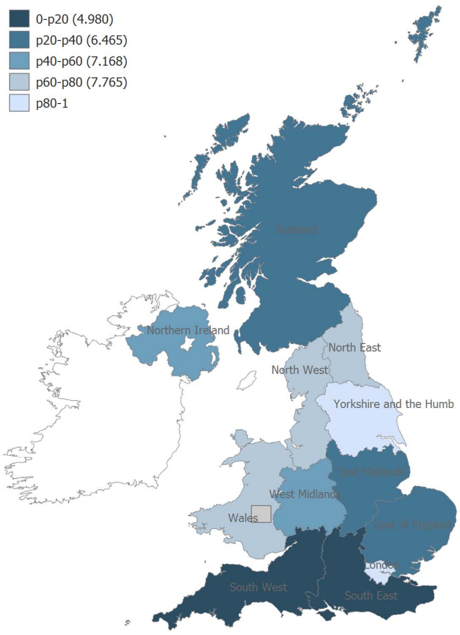
EU-SILC: share of people with unaffordable dental need

Figure 4.9: EU-SILC - Absolute poverty component - Maps (values recoded into five classes).

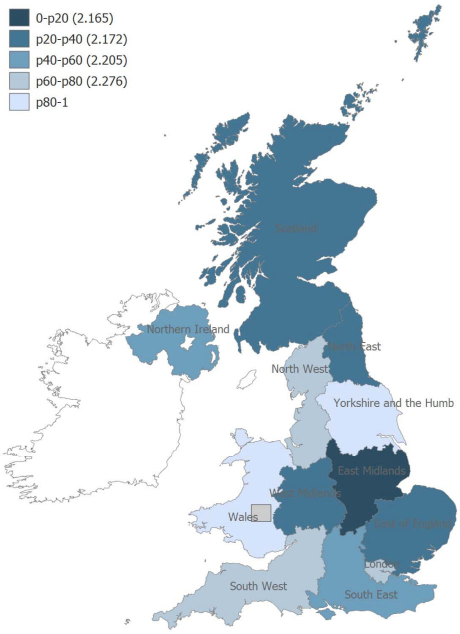


% of people living in houses with problems

Figure 4.10: SOEP - Absolute poverty component - Maps (values recoded into five classes).

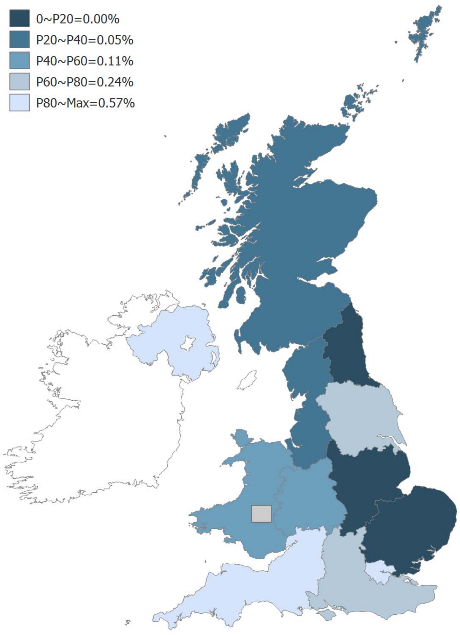


% of people materially deprived



Mean number of lacked items

Figure 4.11: USS - Absolute poverty component - Maps (values recoded into five classes).



% of people living in crowded houses

Figure 4.12: USS - Absolute poverty component - Maps (values recoded into five classes).

Relative poverty

The full description of the indicators included in the component on relative poverty is presented in Section 4.2. Indicators included in this component are (in brackets short labels):

1. Percentage of people at risk of poverty (RP1),
2. Poverty depth (RP2),
3. Poverty severity (RP3).

Tables 4.7, 4.8 and 4.9 report basic descriptive statistics of the three indicators included, while their histograms are shown in Figures 4.13, 4.14 and 4.15.

short label	RP1_mean	RP2_mean	RP3_mean
indicator description	P0 - % of people at risk of poverty	P1 - poverty depth	P2 - poverty severity
source	EU SILC 2007-2009	EU SILC 2007-2009	EU SILC 2007-2009
indicator orientation	↓	↓	↓
mean	21.65	0.08	0.05
sd	5.93	0.03	0.02
cv	0.27	0.37	0.44
skewness	0.89	0.90	0.88
kurtosis	3.40	3.03	2.98
p25	17.19	0.06	0.03
p50	20.58	0.08	0.04
p75	24.41	0.10	0.06
interquartile range	7.23	0.04	0.03
max	39.76	0.17	0.12
region corresponding to maximum value	BE1	RO22	RO22
min	11.27393	0.0422452	0.0197932
region corresponding to minimum value	ES22	FR50	CY0

Table 4.7: EU-SILC - Relative poverty - Descriptive statistics.

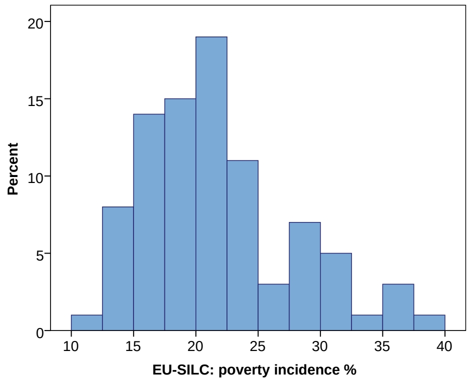
Figures 4.16 to 4.21 show the maps of the indicators included in the component for the three surveys. Values of each indicator are classified into five groups according to the distribution percentiles P20, P40, P60 and P80. As aforementioned, in the EU-SILC case, for technical reasons, the regional level of the maps is NUTS2 for all the countries even if the actual level of the variables represented is the EU-SILC one and varies according to the country.

short label	RP1_mean	RP2_mean	RP3_mean
indicator description	P0 - % of people at risk of poverty	P1 - poverty depth	P2 - poverty severity
source	SOEP 2009	SOEP 2009	SOEP 2009
indicator orientation	⬇	⬇	⬇
mean	15.40	0.04	0.02
sd	4.51	0.01	0.01
cv	0.29	0.31	0.51
skewness	-0.03	0.25	2.30
kurtosis	2.51	2.76	8.45
p25	11.72	0.03	0.01
p50	15.61	0.04	0.01
p75	18.91	0.05	0.02
interquartile range	7.20	0.01	0.01
max	24.17	0.06	0.04
region corresponding to maximum value	DEC	DEF	DEF
min	6.62	0.02	0.01
region corresponding to minimum value	DE6	DE6	DE6

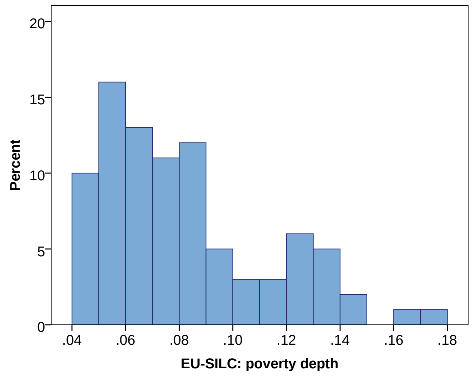
Table 4.8: SOEP - Relative poverty - Descriptive statistics.

short label	RP1_mean	RP2_mean	RP3_mean
indicator description	P0 - % of people at risk of poverty	P1 - poverty depth	P2 - poverty severity
source	USS 2009	USS 2009	USS 2009
indicator orientation	⬇	⬇	⬇
mean	22.94	0.08	0.05
sd	2.86	0.01	0.02
cv	0.12	0.18	0.37
skewness	-0.48	0.99	1.10
kurtosis	1.93	3.84	2.65
p25	20.61	0.07	0.04
p50	23.53	0.08	0.05
p75	25.63	0.09	0.06
interquartile range	5.02	0.02	0.02
max	26.31	0.12	0.09
region corresponding to maximum value	UKN	UKH	UKM
min	18.03	0.06	0.03
region corresponding to minimum value	UKH	UKI	UKI

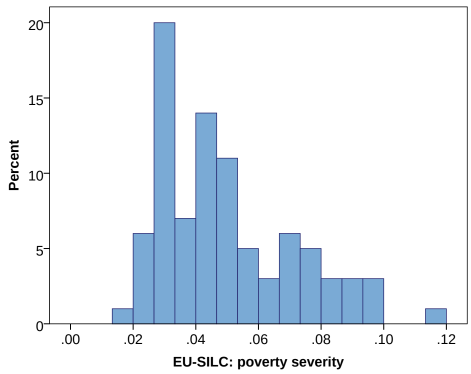
Table 4.9: USS - Relative poverty - Descriptive statistics.



(RP1_mean)



(RP1_mean)



(RP3_mean)

Figure 4.13: EU-SILC - Relative poverty component - Histograms.

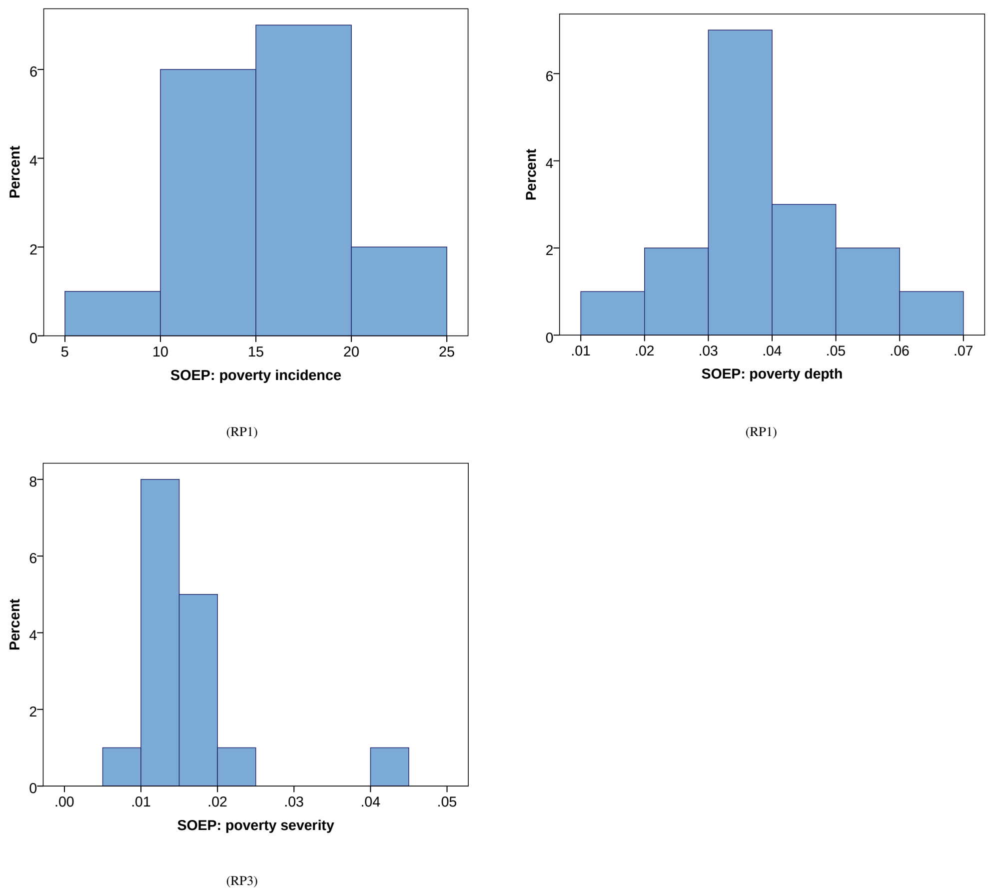
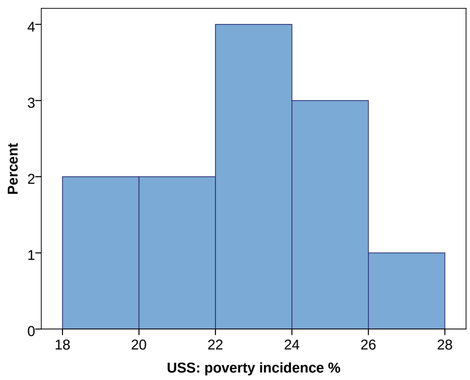
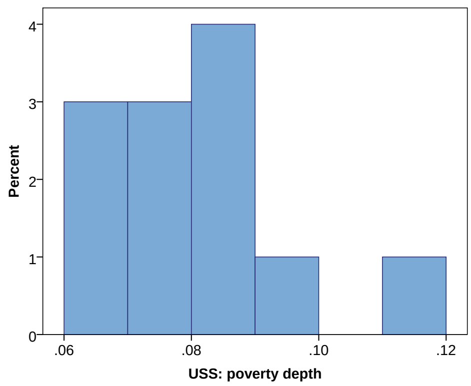


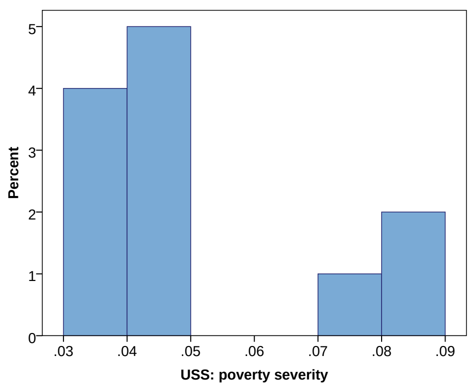
Figure 4.14: SOEP - Relative poverty component - Histograms.



(RP1)

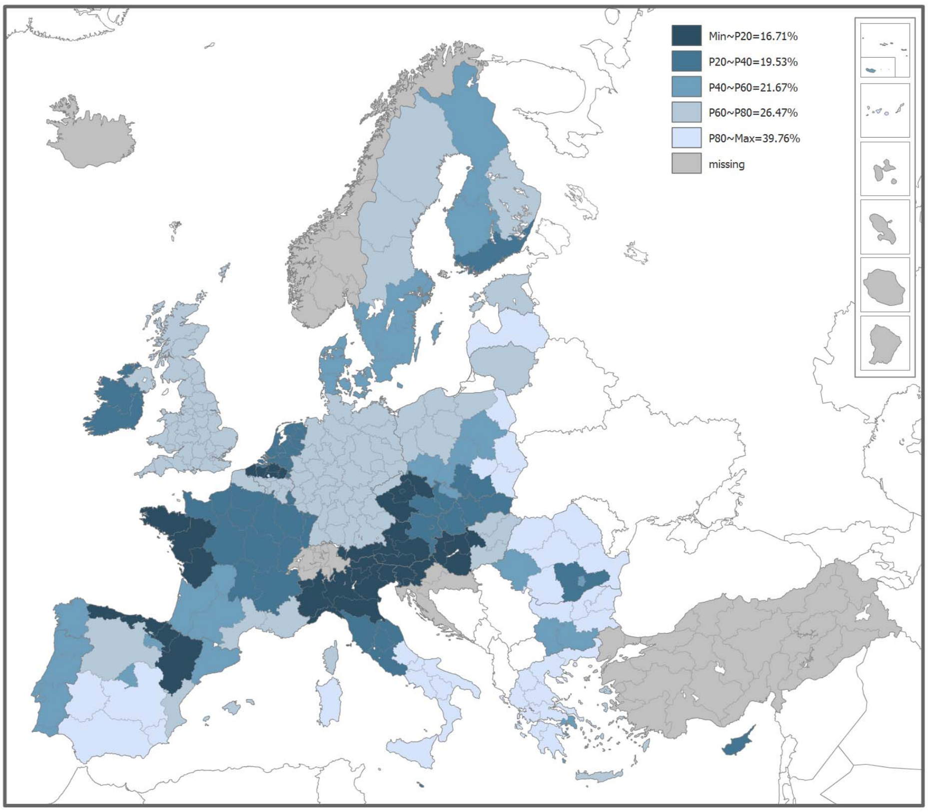


(RP1)

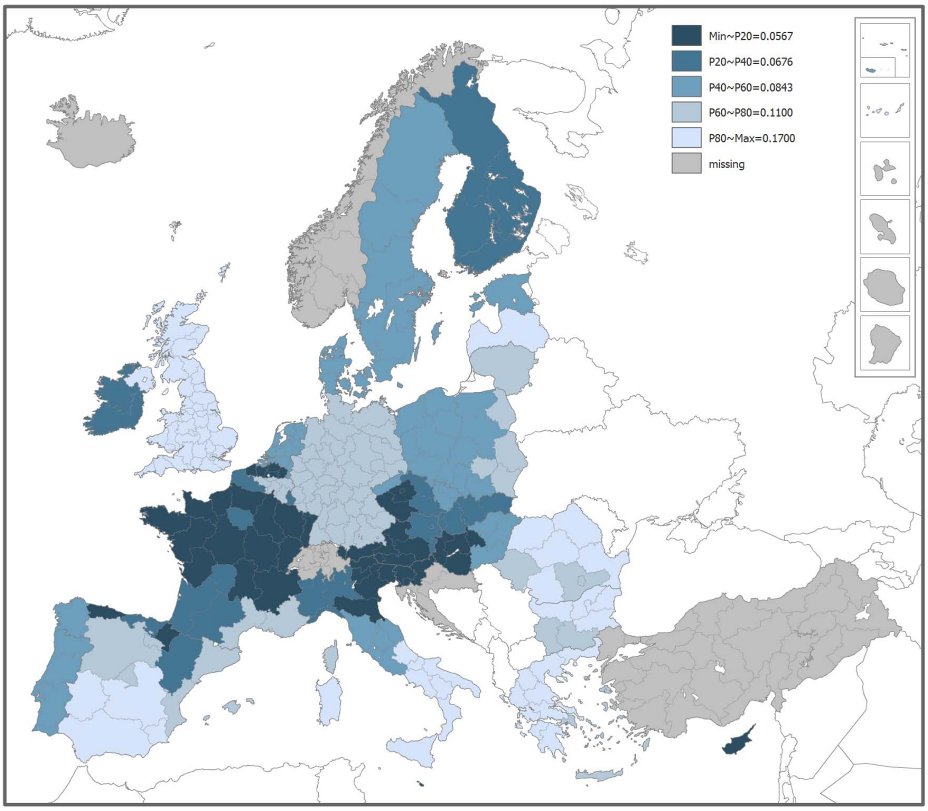


(RP3)

Figure 4.15: USS - Relative poverty component - Histograms.

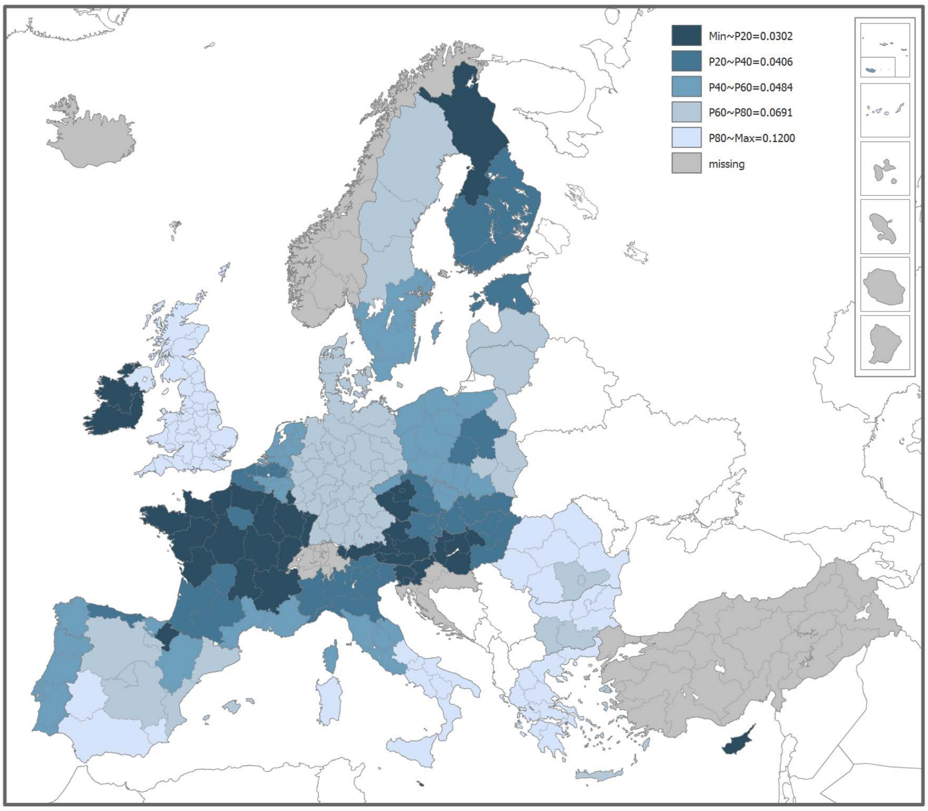


EU-SILC: poverty incidence %



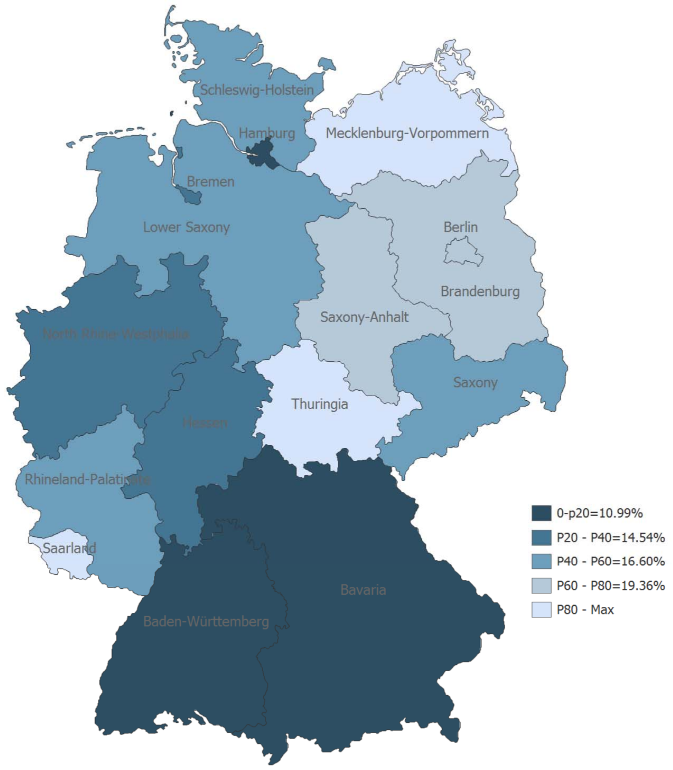
EU-SILC: poverty depth

Figure 4.16: EU-SILC - Relative poverty component - Maps (values recoded into five classes).

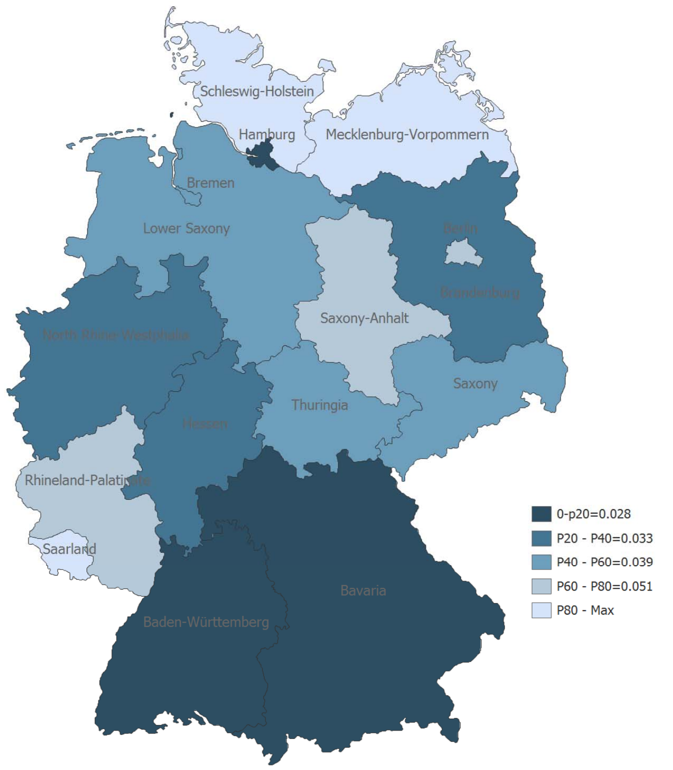


EU-SILC: poverty severity

Figure 4.17: EU-SILC - Relative poverty component - Maps (values recoded into five classes).

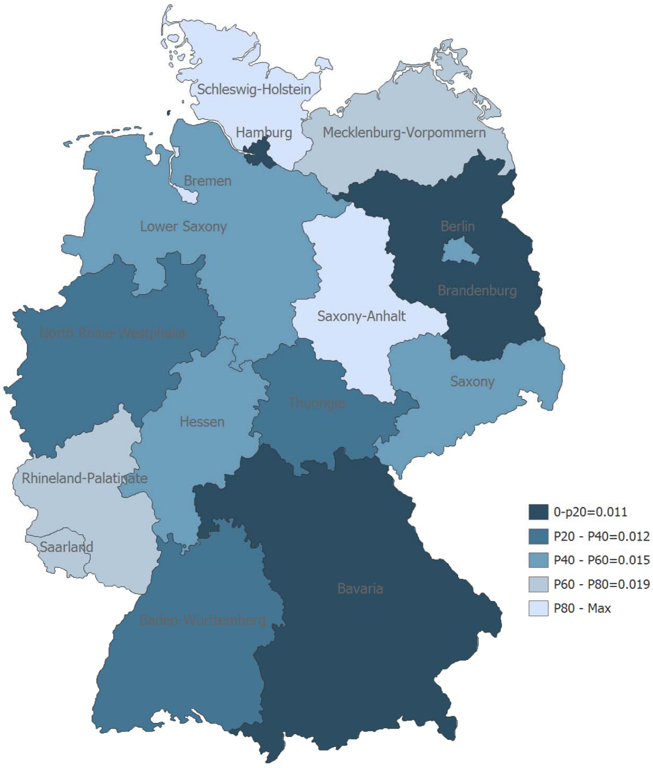


SOEP: poverty incidence %



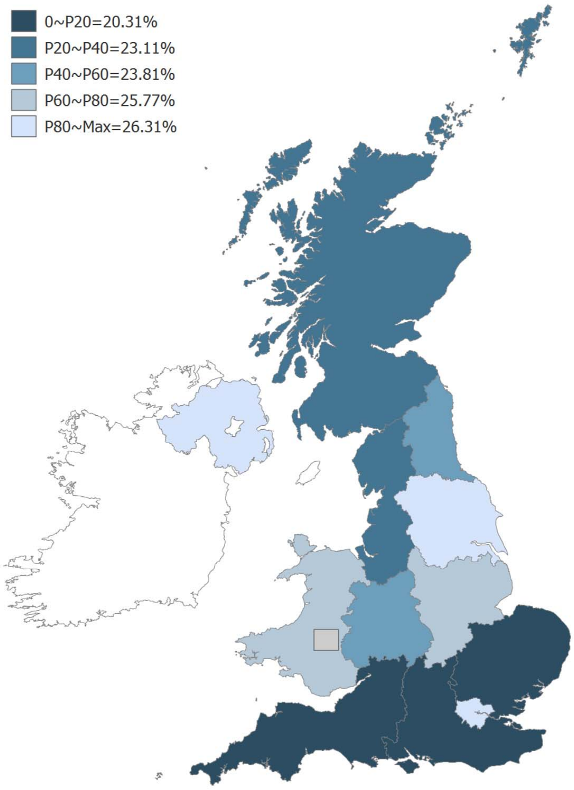
SOEP: poverty depth

Figure 4.18: SOEP - Relative poverty component - Maps (values recoded into five classes).

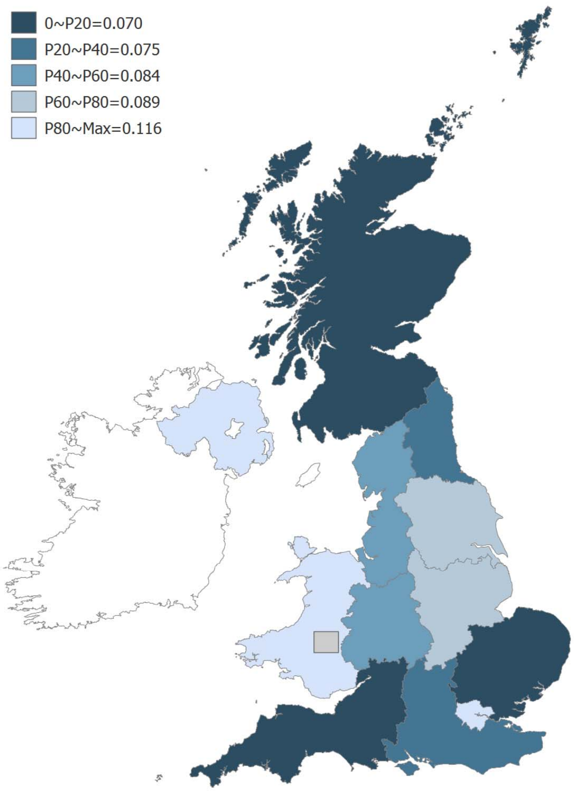


SOEP: poverty severity

Figure 4.19: SOEP - Relative poverty component - Maps (values recoded into five classes).

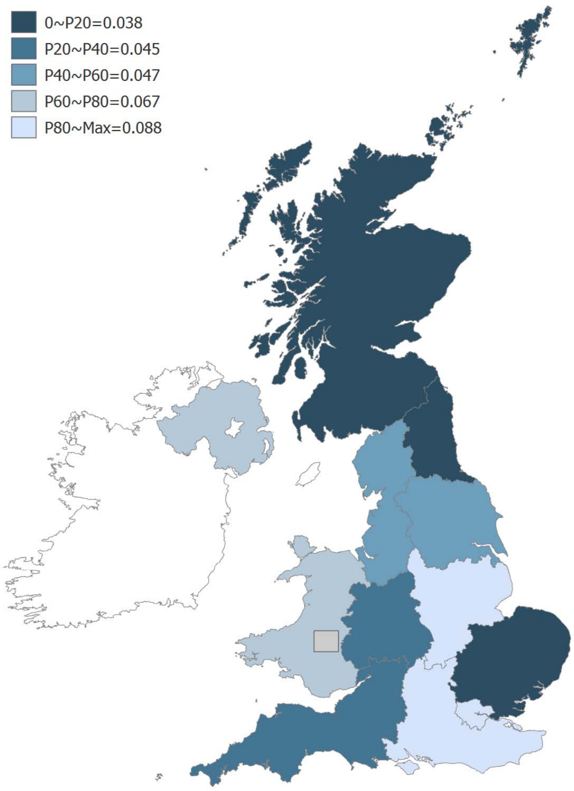


USS: poverty incidence %



USS: poverty depth

Figure 4.20: USS - Relative poverty component - Maps (values recoded into five classes).



USS: poverty severity

Figure 4.21: USS - Relative poverty component - Maps (values recoded into five classes).

Earnings and incomes

The full description of the indicators included in the component on income is presented in Section 4.3. This Section provides some basic descriptive analysis of the indicators included in the component: (in brackets short labels):

1. Median income in PPS (I1),
2. Compensation of employees PPS (average 2006-2008) (I2),
3. Net adjustable household income EU=100 (average 2007-2008) (I3).

Tables 4.10, 4.11 and 4.12 report basic descriptive statistics of the three indicators included, while their histograms are shown in Figures 4.22, 4.23 and 4.24.

short label	I1_mean	I2_mean	I3_mean
indicator description	Median income in PPS	Compensation of employees PPS (average 2006-2008)	Net adjustable household income EU=100 (average 2007-2008)
source	EU SILC 2007-2009	EUROSTAT	EUROSTAT
indicator orientation	⬆	⬆	⬆
mean	10154.71	29447.68	88.49
sd	4448.68	5456.00	34.70
cv	0.44	0.19	0.39
skewness	-0.03	0.61	0.56
kurtosis	2.65	3.85	4.98
p25	6177.24	25991.39	61.39
p50	10903.90	29377.81	91.01
p75	13646.90	32002.88	114.57
interquartile range	7469.66	6011.49	53.18
max	24138.93	46545.66	235
region corresponding to maximum value	LU0	CZ01	LU0
min	2035.9	18797.61	24.7143
region corresponding to minimum value	RO22	RO21	BG3

Table 4.10: EU-SILC - Earnings and incomes - Descriptive statistics.

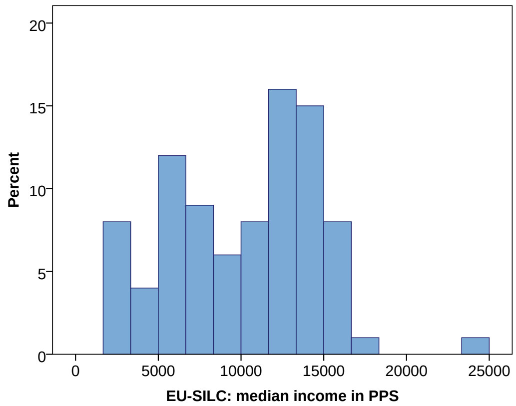
Figures 4.25 to 4.30 show the maps of the indicators included in the component. As for the previous components, values of each indicator are classified into five groups according to the distribution percentiles P20, P40, P60 and P80. We also remind the reader that, in the EU-SILC case, for technical reasons, the regional level of the maps is NUTS2 for all the countries even if the actual level of the variables represented is the EU-SILC one and varies according to the country.

short label	I1_mean	I2_mean	I3_mean
indicator description	Median income in PPS	Compensation of employees PPS (average 2006-2008)	Net adjustable household income EU=100 (average 2007-2008)
source	SOEP 2009	EUROSTAT	EUROSTAT
indicator orientation	↑	↑	↑
mean	17202.53	29452.29	116.79
sd	1671.77	3688.18	16.34
cv	0.10	0.13	0.14
skewness	0.00	-0.08	0.24
kurtosis	2.32	1.79	2.11
p25	16174.17	25263.97	100.73
p50	16933.17	30075.55	117.94
p75	18403.67	31971.43	128.29
interquartile range	2229.51	6707.45	27.56
max	20130.00	35607.96	150.12
region corresponding to maximum value	DE6	DE7	DE6
min	14314.67	24138.82	95.81
region corresponding to minimum value	DEG	DE8	DE8

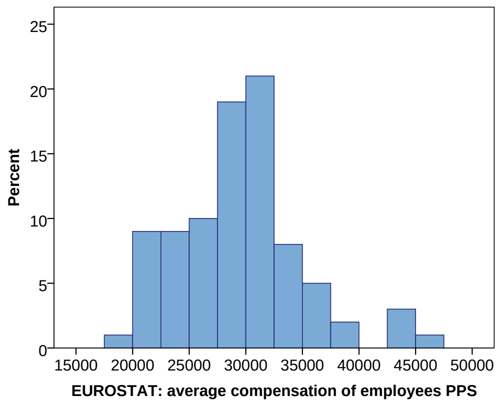
Table 4.11: SOEP - Earnings and incomes - Descriptive statistics.

short label	I1_mean	I2_mean	I3_mean
indicator description	Median income in PPS	Compensation of employees PPS (average 2006-2008)	Net adjustable household income EU=100 (average 2007-2008)
source	USS 2009	EUROSTAT	EUROSTAT
indicator orientation	↑	↑	↑
mean	13123.36	28851.77	116.59
sd	819.37	4414.59	15.79
cv	0.06	0.15	0.14
skewness	0.68	2.30	1.40
kurtosis	2.44	7.52	4.07
p25	12380.92	26657.29	106.23
p50	12941.65	27630.52	110.02
p75	13692.69	29154.31	122.53
interquartile range	1311.76	2497.02	16.30
max	14815.39	41832.23	155.4847
region corresponding to maximum value	UKJ	UKI	UKI
min	12207.35	24819.95	100.7848
region corresponding to minimum value	UKN	UKN	UKC

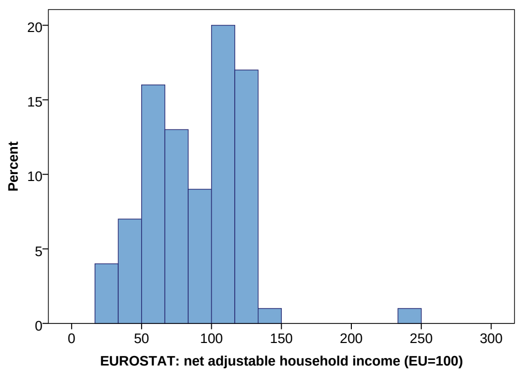
Table 4.12: USS - Earnings and incomes - Descriptive statistics.



(I1_mean)

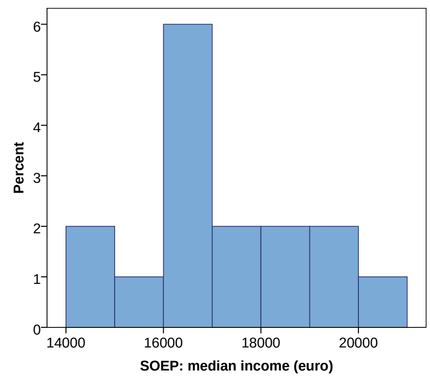


(I2)

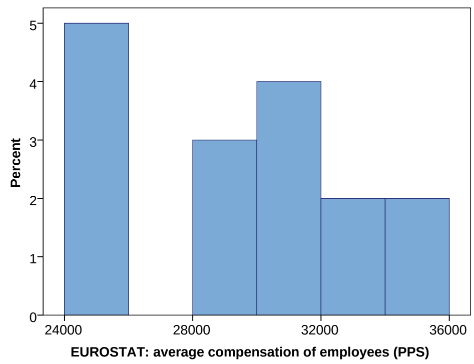


(I3)

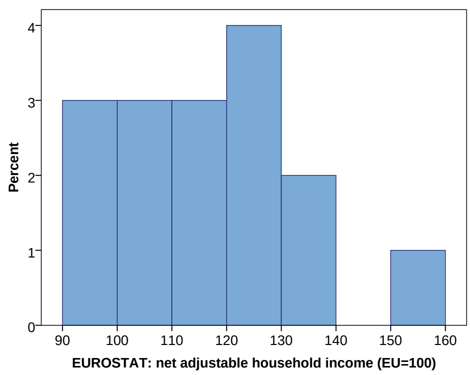
Figure 4.22: EU-SILC and EUROSTAT- Earnings and incomes component - Histograms.



(I1)

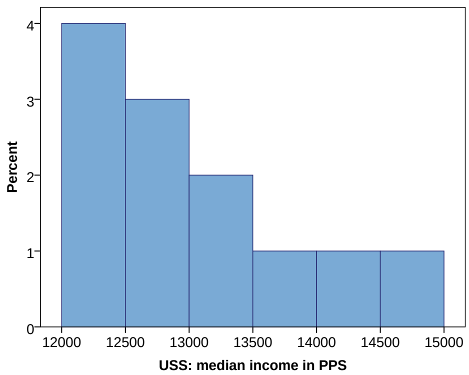


(I2)

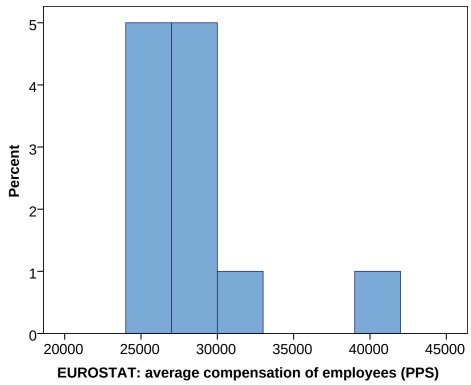


(I3)

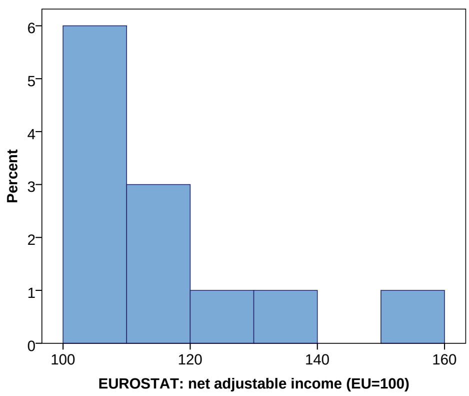
Figure 4.23: SOEP and EUROSTAT- Earnings and incomes component - Histograms for Germany.



(I1)

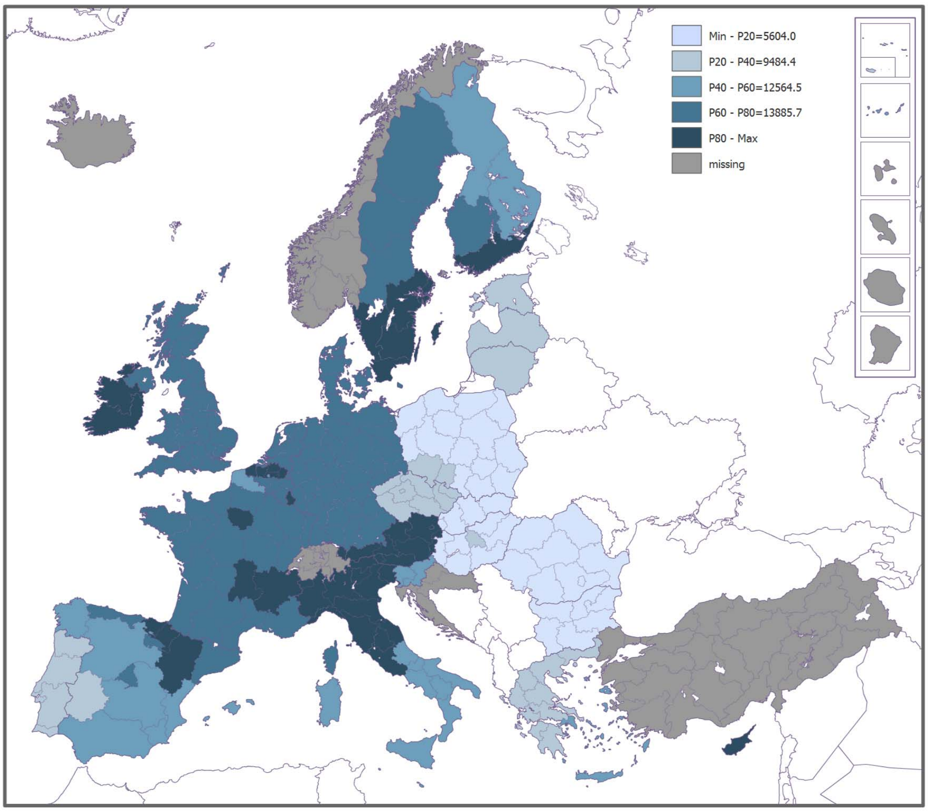


(I2)

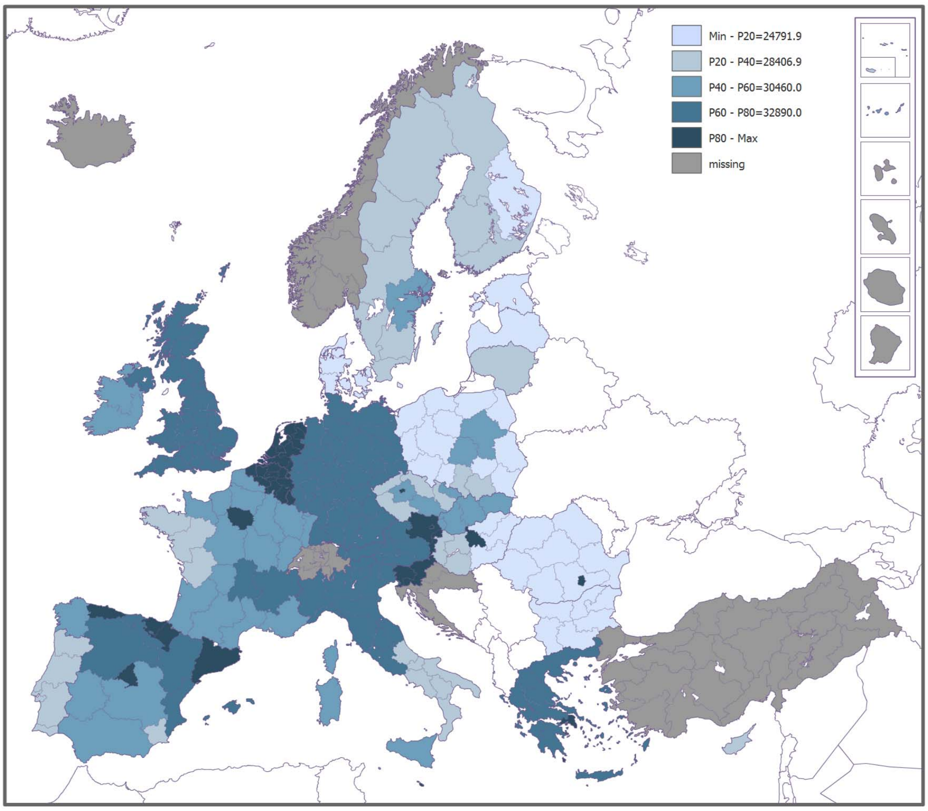


(I3)

Figure 4.24: USS and EUROSTAT- Earnings and incomes component- Histograms for United Kingdom.

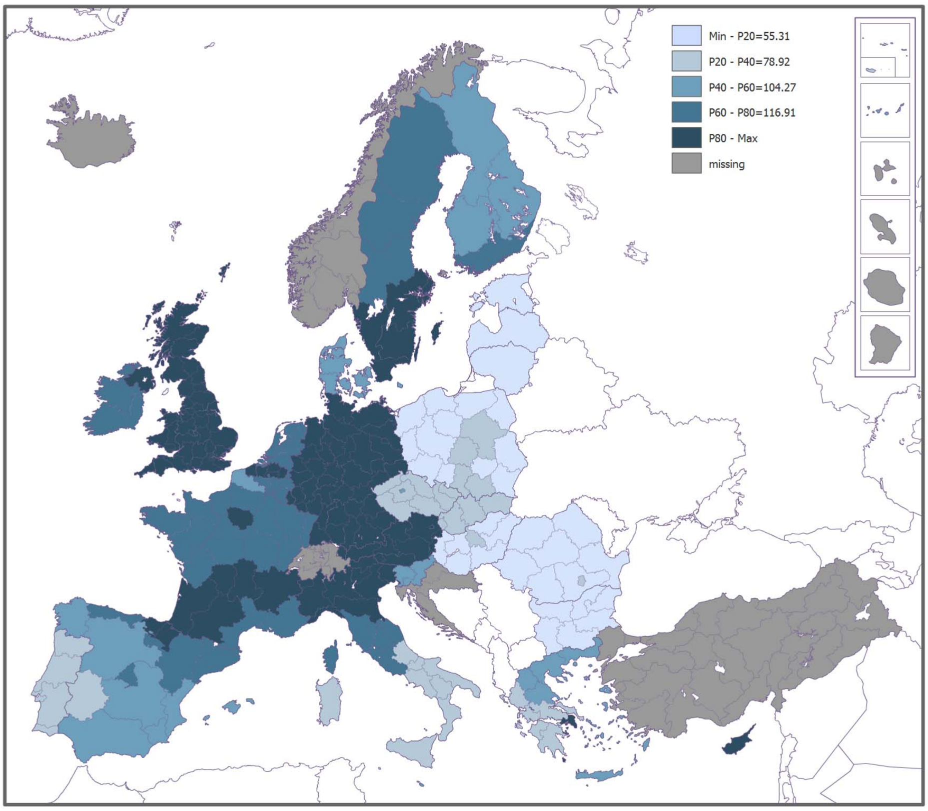


EU-SILC: median income PPS



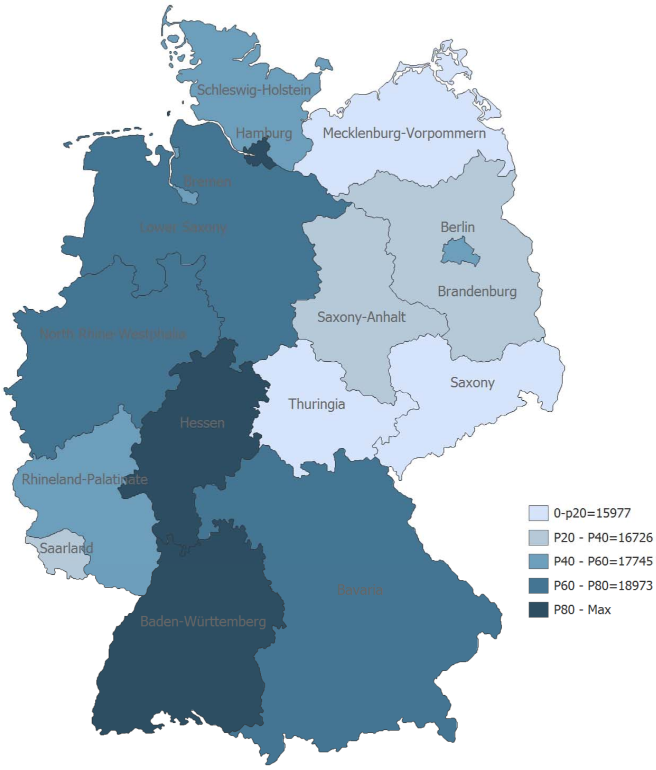
EUROSTAT: compensation of employees PPS

Figure 4.25: EU-SILC and EUROSTAT - Earnings and incomes component - Maps (values recoded into five classes).

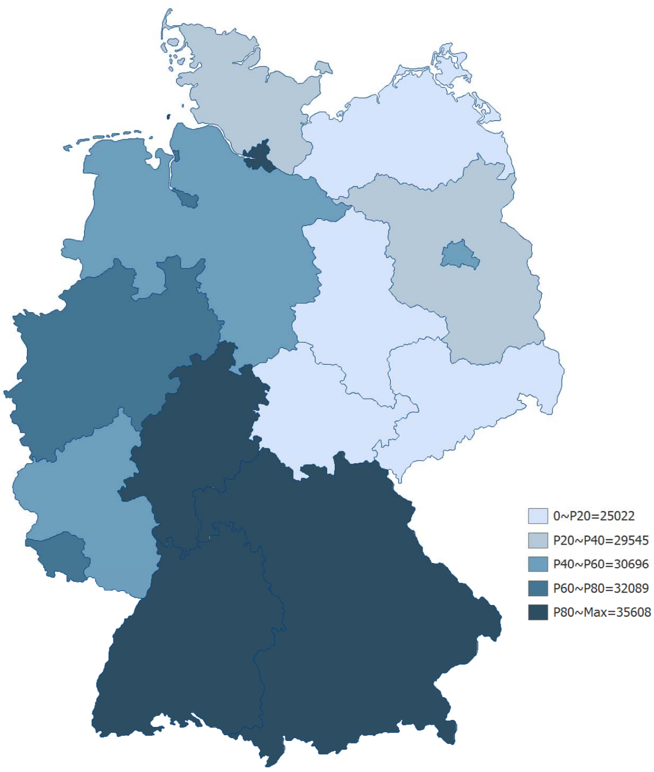


EUROSTAT: net adjustable household income (EU=100)

Figure 4.26: EU-SILC and EUROSTAT - Earnings and incomes component - Maps (values recoded into five classes).

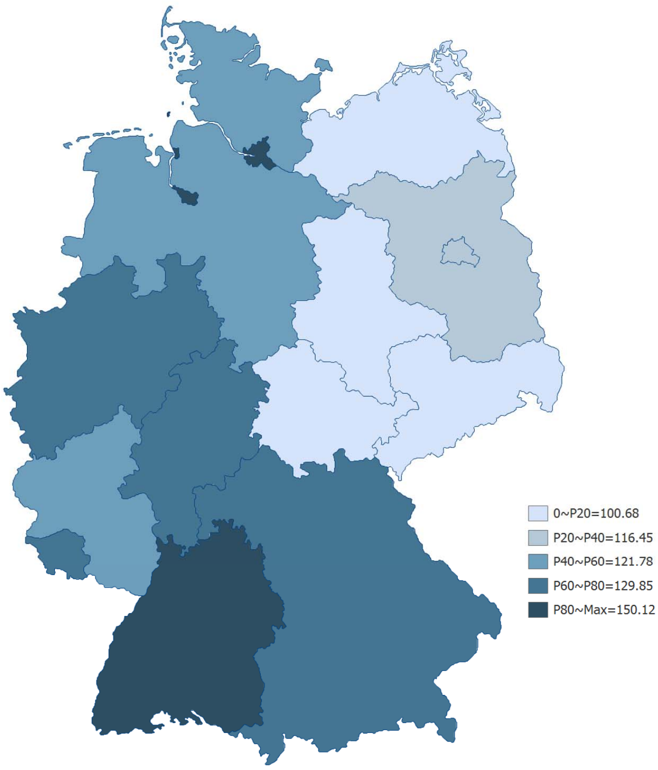


SOEP: median income (Euro)



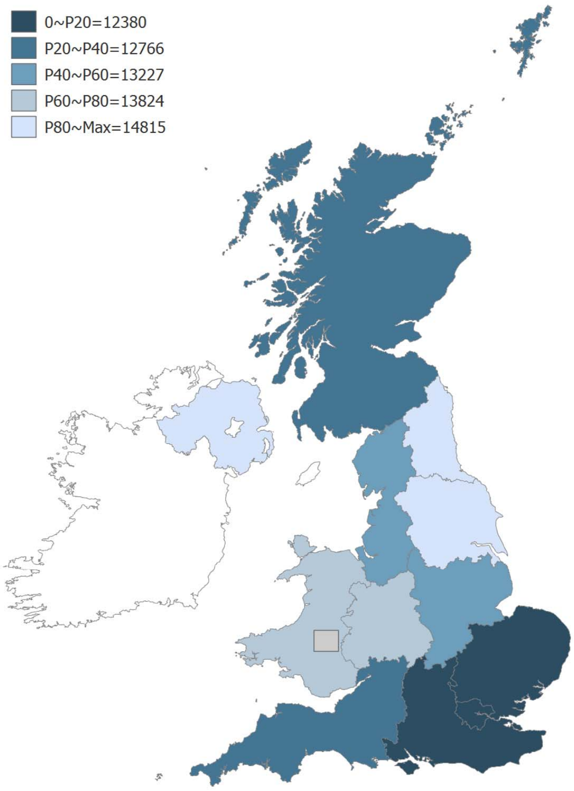
EUROSTAT: compensation of employees PPS

Figure 4.27: SOEP and EUROSTAT - Earnings and incomes component - Maps (values recoded into five classes).

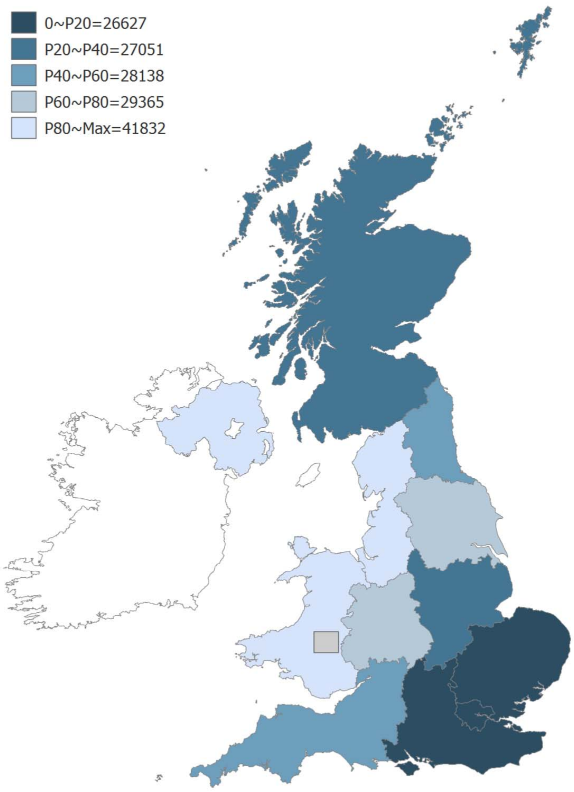


EUROSTAT: net adjustable household income (EU=100)

Figure 4.28: SOEP and EUROSTAT - Earnings and incomes component - Maps (values recoded into five classes).

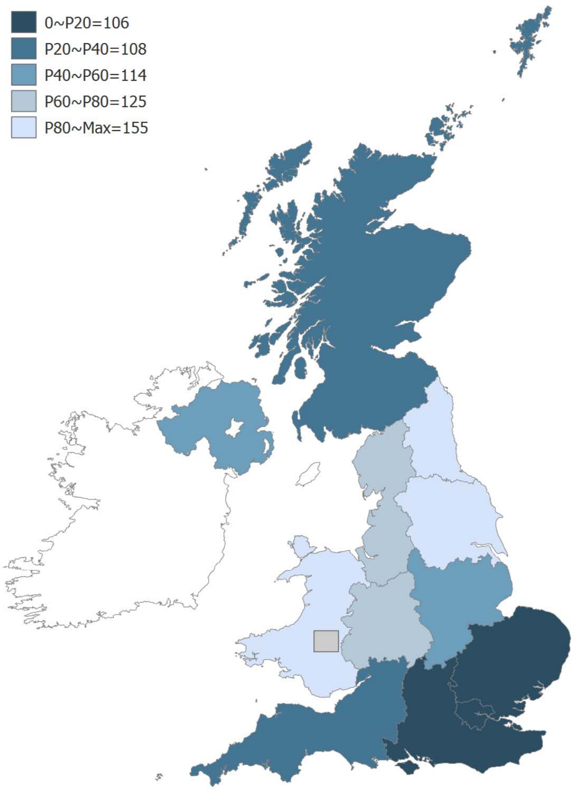


USS: median income (pounds)



EUROSTAT: compensation of employees PPS

Figure 4.29: USS and EUROSTAT - Earnings and incomes component - Maps (values recoded into five classes).



EUROSTAT: net adjustable household income (EU=100)

Figure 4.30: USS and EUROSTAT - Earnings and incomes component - Maps (values recoded into five classes).

4.4.2 Multivariate analysis

In building up aggregated measures of latent phenomena there are different schools with different belief whether multivariate statistical analysis is needed, at what point in the analysis and to what purpose. We believe in the usefulness of multivariate analysis, specifically Principal Component Analysis (PCA). PCA is a multivariate explorative technique (Morrison, 2005) that allows for checking internal data consistency of the variables populating each dimension/component (see Dijkstra et al. (2011) for a recent example of PCA use in setting up composite indicators). Among multivariate methods, PCA is particularly suitable as it provides a data summary in a parsimonious way. It is in fact a dimensionality reduction technique which is designed to capture all relevant information within the starting set of variables into a small number of transformed variables. In our view, the usefulness of PCA in building aggregated measures consists of the fact that each dimension is designed to describe a particular aspect of the latent phenomenon to be measured (for instance the level of absolute or relative poverty). As these aspects are not directly observable, they are measured by a set of observable variables which, by definition, are related to the aspect they are supposed to describe and, consequently, to each other. In an ideal situation, each dimension should show a unique most relevant PCA component accounting for a large amount of variability associated to the full set of indicators. Plus, all the indicators should contribute roughly to the same extent and direction to the most relevant component. If this is not the case, it means that more than one latent phenomenon is underlying the set of variables and these additional phenomena are generally described by those variables which are not contributing mostly to the first PCA component. It should be well understood that multivariate analysis, and more generally exploratory statistical analysis, only indicates but does not explain. Deciding whether 'misbehaving' variables are to be excluded or not from the analysis is a task for the analyst. The goal of statistical analysis is to detect certain behaviors in the data by letting data speak; the final decision clearly rests with the analyst.

PCA is here applied to check the internal consistency of each QoL component within different QoL dimensions. The aim is to detect possible non-influencing variables or variables describing something different or something more than they are supposed to. Therefore, PCA helps us in refining the set of variables included in each QoL component. If for each QoL component the revised indicator set shows a clear unique underlying factor with a well-balanced contribution of each indicator to this most relevant factor, the component can be considered statistically sound and consistent with the latent phenomenon to be measured. Plus, in composite index analysis assessing the level of correlation among indicators has a special meaning as the higher the correlation the lower the effect of different weighting scheme on the final index (Hagerty and Land, 2007; Michalos, 2011).

The description of PCA outcomes for the three Living Standards components is provided for EU-SILC indicators. We specifically present ((Morrison, 2005)):

- correlation coefficients and associated p-values
- eigenvalues of PCA components and associated scree plot
- correlations between each indicator and the PCA components (eigenvectors)

For SOEP and USS only the correlation matrix is presented.

Absolute poverty

In the case of the absolute poverty component, pairwise Pearson's correlations are all positive (all the indicators have the same orientation with respect to the latent phenomenon) and significant (Table 4.13). The lowest, still significant, values are those referring to the share of people living in houses with problems (AP3_mean). PCA analysis highlights a clear, prevalent component accounting for 74.5% of total variance (Figure 4.31. The second component explains only about 10% of total variation. The first component is described almost equally by the variables included (contribution of each indicator to the first PC (comp1 on Figure 4.14) is at approximately the same level. However there is one exception - AP3_mean indicator with the contribution measured by the first component loading of 0.289, which is considerably lower than others (and results from the aforementioned low Pearson correlation).

	AP1_mean	AP2_mean	AP3_mean	AP4_mean	AP5_mean	AP6_mean	AP7_mean
AP1_mean	1.0000						
AP2_mean	0.9201 0.0000	1.0000					
AP3_mean	0.5477 0.0000	0.4347 0.0000	1.0000				
AP4_mean	0.8768 0.0000	0.8064 0.0000	0.4623 0.0000	1.0000			
AP5_mean	0.7735 0.0000	0.6674 0.0000	0.6617 0.0000	0.5612 0.0000	1.0000		
AP6_mean	0.8443 0.0000	0.8406 0.0000	0.4715 0.0000	0.6782 0.0000	0.7287 0.0000	1.0000	
AP7_mean	0.7331 0.0000	0.7278 0.0000	0.4962 0.0000	0.5753 0.0000	0.6578 0.0000	0.9154 0.0000	1.0000

Table 4.13: Absolute poverty component: Correlation matrix and p-values (EU-SILC related indicators)

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7
AP1_mean	0.4215	-0.1440	0.2355	-0.1462	-0.0580	-0.0609	-0.8472
AP2_mean	0.4016	-0.3070	0.1271	-0.0756	-0.7405	0.2517	0.3330
AP3_mean	0.2879	0.8036	0.2031	0.4213	-0.2108	-0.0903	0.0113
AP4_mean	0.3668	-0.2648	0.5926	0.2369	0.5381	0.0344	0.3119
AP5_mean	0.3688	0.3733	-0.0915	-0.7709	0.2472	0.1436	0.2004
AP6_mean	0.4066	-0.1630	-0.4061	0.0656	0.0179	-0.7827	0.1608
AP7_mean	0.3773	-0.0574	-0.6022	0.3750	0.2298	0.5388	-0.0891

Table 4.14: Absolute poverty component: Correlation coefficients between indicators and principal components (EU-SILC related indicators).

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	5.16141	4.40162	0.7373	0.7373
Comp2	.759789	.216153	0.1085	0.8459
Comp3	.543636	.247554	0.0777	0.9235
Comp4	.296082	.155254	0.0423	0.9658
Comp5	.140828	.084685	0.0201	0.9860
Comp6	.056143	.0140275	0.0080	0.9940
Comp7	.0421155	.	0.0060	1.0000

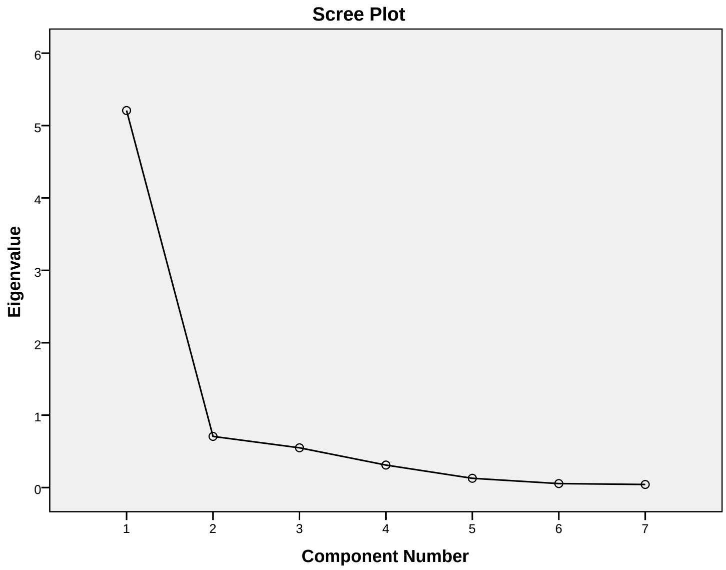


Figure 4.31: Absolute poverty component: Explained variance and scree plot (EU-SILC related indicators).

Considering PCA results, the Absolute poverty component can be considered statistically consistent with one major latent phenomenon underlying the indicator set and all the indicators roughly contributing to the same extent to the most relevant component. This is a rather satisfying result also considering that the indicators included in this component are computed on the basis of rather different EU-SILC questions.

Only two indicators related to housing conditions could be extracted from SOEP survey: percentage of people living in houses with problems (AP3) and percentage of people living in crowded houses (AP4). One of these two (AP4) shows almost no variation at all across regions (see Table 4.5). No correlation matrix is then computed for the German case.

The correlation matrix for USS indicators is shown in Table 4.15. Please note that, due to data availability, material deprivation indicators extracted from USS are only proxies of classical material deprivation ones as they are based on a subset of items (seven items instead of nine).

	AP1_mean	AP2_mean	AP4_mean
AP1_mean	1.0000		
AP2_mean	0.2002 0.5328	1.0000	
AP4_mean	0.5820 0.0471	0.2395 0.4533	1.0000

Table 4.15: USS - Absolute poverty - Correlation matrix and p-values.

Relative poverty

Correlation matrix for the three indicators included in the Relative poverty component is shown in Table 4.16. A high correlation across the indicators is expected as they are all strictly related to the poverty level (see Section 4.2 for the description of the indicators). However it must be noticed that the correlation coefficients between AP1 and AP3 for SOEP and USS surveys are not so high and both are insignificant. In the case of Germany, this is mainly due to the high discrepancies between these two indicators observed in 3 regions: Brandenburg (DE4), Thuringia (DEG) and Bremen (DE5). In the former two regions there is relatively high percentage of people with income below the poverty line but the inequality with regard to income level observed among them is low. Quite adverse situation is observed in Bremen. The percentage of people with income below the poverty line observed there is low comparing to other German regions, while the income inequality among poor is relatively high. In the case of UK, the situation is not so differentiated. Generally regions where there is high percentage of the poor are the same as the ones with high income inequality among the poor. It holds for all regions with one exception - South East England (UKJ). In this region comparing to the others the percentage of people with income below the poverty line is the second lowest, whereas according to the level of the poverty severity this region is the second worst.

The high correlation level observed for EU-SILC data is also confirmed by PCA results shown in Figure 4.32 and Table 4.17 which highlight the presence of a unique latent factor explaining 95% of data variability and equally described by all the three indicators.

	RP1_mean	RP2_mean	RP3_mean
RP1_mean	1.0000		
RP2_mean	0.9335 0.0000	1.0000	
RP3_mean	0.8543 0.0000	0.9824 0.0000	1.0000

Table 4.16: Relative poverty component: Correlation matrix and p-values (EU-SILC related indicators)

Variable	Comp1	Comp2	Comp3
RP1_mean	0.5648	0.7778	0.2757
RP2_mean	0.5914	-0.1485	-0.7926
RP3_mean	0.5755	-0.6107	0.5438

Table 4.17: Relative poverty component: Correlation coefficients between indicators and principal components (EU-SILC related indicators).

Correlation matrices for Relative poverty indicators from SOEP and USS are displayed in Tables 4.18 and 4.19

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	2.84783	2.69692	0.9493	0.9493
Comp2	.150906	.14964	0.0503	0.9996
Comp3	.00126643	.	0.0004	1.0000

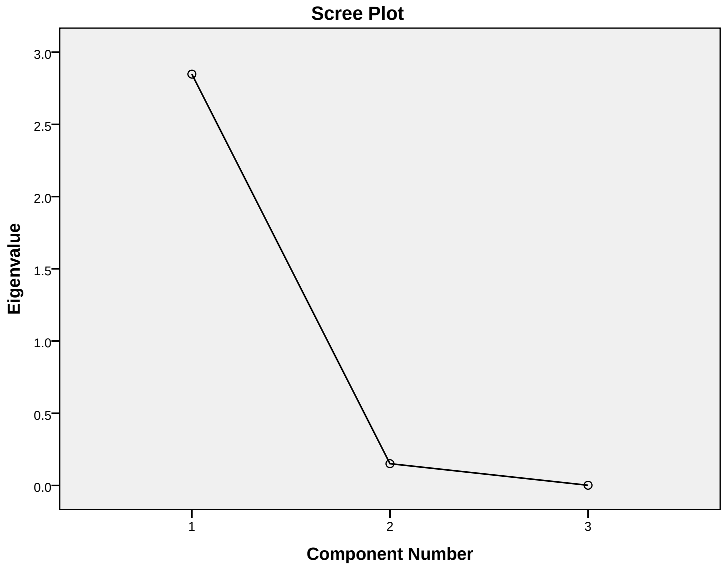


Figure 4.32: Relative poverty component: Explained variance and scree plot (EU-SILC related indicators).

	RP1_mean	RP2_mean	RP3_mean
RP1_mean	1.0000		
RP2_mean	0.7863	1.0000	
	0.0003		
RP3_mean	0.3019	0.8005	1.0000
	0.2557	0.0002	

Table 4.18: SOEP - Relative poverty - Correlation matrix and p-values.

	RP1_mean	RP2_mean	RP3_mean
RP1_mean	1.0000		
RP2_mean	0.8040	1.0000	
	0.0016		
RP3_mean	0.1108	0.5820	1.0000
	0.7316	0.0471	

Table 4.19: USS - Relative poverty - Correlation matrix and p-values.

Earnings and Incomes

Table 4.20 displays the correlation matrix of the three indicators included in the Earnings and Incomes component. Even if not as high as for the relative poverty indicators, correlation are all significant. PCA outcomes show also in this case the existence of a prevalent latent factor accounting for about 81% of total variance (Figure 4.33) to which all the indicator are almost equally contributing (the lowest correlation coefficient is the one describing the compensation of employees - I2_mean (Table 4.21).

	I1_mean	I2_mean	I3_mean
I1_mean	1.0000		
I2_mean	0.5343 0.0000	1.0000	
I3_mean	0.9561 0.0000	0.6277 0.0000	1.0000

Table 4.20: Earnings and incomes component: Correlation matrix and p-values.

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	2.42907	1.89496	0.8097	0.8097
Comp2	.53411	.497288	0.1780	0.9877
Comp3	.0368219	.	0.0123	1.0000

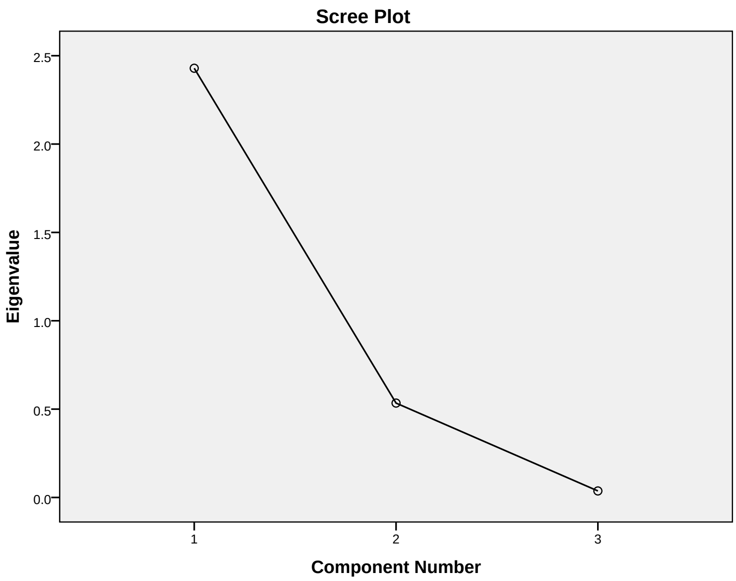


Figure 4.33: Earnings and incomes component: Explained variance and scree plot (EU-SILC related indicators).

Variable	Comp1	Comp2	Comp3
I1_mean	0.6030	-0.4333	0.6698
I2_mean	0.4989	0.8600	0.1072
I3_mean	0.6225	-0.2695	-0.7347

Table 4.21: Earnings and incomes component: Correlation coefficients between indicators and principal components.

4.4.3 Inequality-adverse aggregation and uncertainty analysis

The issue of aggregating multidimensional indices into a single, composite index is a widely debated topic in socioeconomics, especially when measuring poverty and quality of life. The aggregation process always implies, explicitly or implicitly, the choice of weights to be assigned to different, suitably selected and scaled. This plays a crucial role in determining the trade-offs between the different aspects measured.

The approach adopted here is to aggregate statistically consistent indicators (see Section 4.4.2) at the component level only. No further aggregation is undertaken to get a single, combined dimension score.

The Living Standards dimension is described by three different sub-indexes. To the purpose, the following steps are carried out:

1. with the help of multivariate analysis a subset of consistent indicators are selected for each component within QoL dimensions ;
2. indicators are transformed into population weighted z-scores, reversed if necessary in order to be positively oriented with respect to the concept of QoL and shifted to be always positive;
3. transformed indicators are aggregated by using a inequality-adverse type of aggregation, i.e. a generalized mean of order $\beta = 0.5$;
4. an uncertainty analysis on the influence of the order β on final scores and ranks is carried out by varying β in the interval [0,1].

The first step is described in Section 4.4.2. For all the three components all the starting indicators show a good level of consistency with respect to the latent factor they are expected to capture as confirmed by the multivariate analysis which shows a single, relevant factor described in a balanced way by the indicators.

As for the type of aggregation at the component level, our choice is intermediate between a purely compensatory average - the arithmetic mean - a partially compensatory one - the geometric mean. In the following the focus is at the component level. Let x_{ij} denote the value of indicator $j = 1, \dots, q$ for region $i = 1, \dots n$. For each region the array $\underline{x} = (x_1, \dots, x_q)$ is available at certain time point with the same positive orientation with respect to the latent phenomenon under analysis. Choosing the type of aggregation entails choosing the parameters of the following family of indices:

$$I(\underline{x}, \beta, \underline{w}) = \left[\frac{w_1 f(x_1)^\beta + \ldots + w_q f(x_q)^\beta}{w_1 + \ldots + w_q} \right]^{1/\beta} \tag{4.8}$$

The index $I(\underline{x}, \beta, \underline{w})$ is defined as generalized mean[5] of order, or curvature, $\beta \in \Re$ of the transformed indicators $f(x_j)$ with weights $\underline{w} = (w_1, \dots, w_q)$ (Decancq and Lugo, 2009). Generalized means of the type 4.8 satisfy a series of mathematical properties, axioms, required to aggregated measures especially in the field of welfare and inequality (Ruiz, 2011). The curvature parameter β, which defines the order of the mean, has the role of balancing the achievements between different indicators for each individual. Given that the orientation of the indicators is

[5]Generalized means are also called weighted means.

positive (the higher the better), one can see that as β increases, more importance is given to the upper tail of the distribution; while as β decreases greater weight is given to the lower tail. The natural 'watershed' is $\beta = 1$ corresponding to the arithmetic mean, which is called an inequality-neutral type of aggregation. If $\beta < 1$ the generalised mean is said to be inequality adverse: a rise of the level of an indicator in the lower tail of the distribution will increase the mean by more than a similar rise in the upper tail, thus putting more importance in low levels. Conversely, if $\beta > 1$ the generalised mean is said to be equality-adverse: a rise of an indicator in the upper tail of the distribution will increase the generalised mean by more than a similar rise in the lower tail (Ruiz, 2011).
In our analysis, we start from positively oriented indicators which are transformed by a positively shifted standardization weighted by population[6], population weighted z-scores, with $w_j = 1$ for all j. The order β is chosen in the interval $[0, 1]$, where $\beta = 0$ corresponds to the geometric mean and $\beta = 1$ corresponds to the arithmetic mean. The order used to compute the reference value of the indices is $\beta = 0.5$. Our choice is then of an inequality-adverse type of aggregation. As discussed shortly above, the order of a weighted mean of the type (4.8) is related to the gain a region needs to obtain on the level of a certain indicator $x_k, 1 \leq k \leq q$ per unit decrease in the level of another indicator $x_m, 1 \leq m \leq q; m \neq k$. It can be easily shown that, for positively oriented indicators (i.e. for which the orientation is the higher the better), values of β between 0 and 1 ensures that the lower the level of x_k, the higher the improvement (increase) on x_m needed to compensate for a unit loss of x_k in order to get the same value of the aggregated index I (keeping fixed the level of all the other indicators). It is remarkable that for $\beta \in [0, 1)$ marginal substitution rates are not constant, as for the case $\beta = 1$ (arithmetic mean), but depends on the levels of the indicators (Decancq and Lugo, 2009). In the context of the measurement of QoL this plays a very important role: by choosing a weighted mean of order $0 \leq \beta < 1$ in between 0 and 1 we reduce the effect of compensability across indicators which are no longer perfect substitutes as for the case of arithmetic mean. A value of $\beta \in [0, 1)$ has the effect of penalizing losses in the levels of one indicator and this penalization gets higher as the level of the indicators gets lower. This effect is the highest for the geometric mean $\beta = 0$, which is the type of aggregation chosen for the Human Development Index since 2010 (Ravallion, 2010).
By moving from 0 to 1 it is possible to continuously test the effect of different marginal substitution rates on scores and ranks. To this purpose, we choose a reference value of $\beta = 0.5$ for component scores and assess by means of an Uncertainty Analysis - UA - the stability of regions scores/ranking with respect to different orders β randomly sampled from the uniform distribution $U[0, 1]$. A total number of 2000 different scenarios are simulated by randomly sampling β values. Each scenario corresponds to a different generalized mean.
In addition, the influence of each indicator on the sub-index score is assessed for each component. Results are discussed in the following Sections for each Living Standards component separately.

4.4.4 UA on Absolute Poverty component

The original indicators included in the Absolute Poverty components are firstly reversed, in order to be positively oriented with respect to QoL, and aggregated using the generalised mean of order $\beta = 0.5$. The final sub-index is

[6] The shift is needed to ensure positive values for the computation of generalised means.

then reversed again to be consistent with the common polarity of poverty measures.

The effect of region scores of different β values is displayed in Figure 4.34 which shows for each region the boxplot of the distribution of the percentage score differences with respect to the reference score, computed with $\beta = 0.5$. The effect of different values of β can be considered negligible and this is due to the high consistency of the indicators included in the component (see Section 4.4.2).

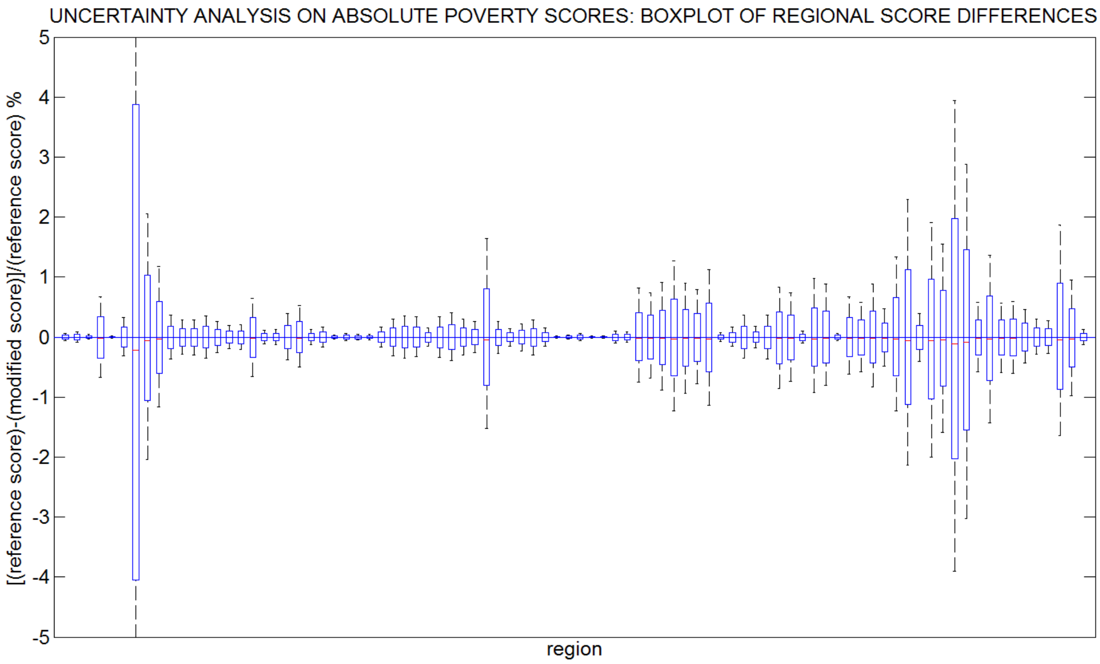


Figure 4.34: Absolute Poverty component: effect of different β values on region scores.

In terms of rankings, Table 4.22 shows the median rank of the regions and the associated 90% confidence interval - CI - estimated from the 2000 scenarios. Only regions associated to non-zero width confidence intervals are displayed and reordered from best to worst according to their reference Absolute Poverty rank (the lower the rank, the lower the level of absolute poverty). CI widths are at maximum equal 5, meaning that the ranks are stable with respect to the choice of the type of aggregation.

Finally, Table 4.23 shows the frequency matrix of modified ranks which displays, for each region, the percentage of times the region ranks in certain rank interval calculated over all the 2000 simulated scenarios. The frequency matrix shows most and least stable regions and provides a synthesized picture of the overall regional ranking stability. Frequency distribution is classified into 17 intervals 5 ranks wide, with the exception of the last interval which is 8 ranks wide ($[1, 5], [6, 10], \ldots [81, 88]$). Regions are reordered from best to worst according to their reference Absolute Poverty rank. A region is considered 'stable' if its rank frequency is higher or equal to 95% (highlighted in blue in Table). 'Volatile' countries are instead those with rank values spanning at least three rank intervals (highlighted in yellow in Table 4.23). Overall almost all the regions are pretty stable. Best regions are Finland regions FI1A, FI19 FI13, FI18 and Luxembourg LU0 which are always among the top five, whatever the order β adopted for the mean. At the lower, right end of the frequency matrix, the following regions can be found:

Region label	Absolute poverty rank	median rank	rank P5%	rank P95%	90% CI
FI18	4	4	4	5	1
LU0	5	5	4	5	1
ES22	11	11	11	12	1
SE3	12	12	11	12	1
BE2	13	13	13	14	1
SE2	14	14	13	14	1
ES23	17	17	17	18	1
SE1	18	18	17	18	1
UK	20	20	20	21	1
FR50	21	21	20	22	2
ES41	22	22	21	22	1
CZ01	23	23	23	24	1
ES12	24	24	23	24	1
CZ06	25	25	25	26	1
FR20	26	26	25	28	3
CZ03	28	28	26	29	3
DE	29	29	28	29	1
AT1	32	32	32	34	2
ES42	33	33	32	33	1
MT0	34	34	32	36	4
IE0	35	35	34	35	1
FR40	36	36	35	36	1
FR60	37	37	37	38	1
ES43	38	38	37	38	1
FR30	41	41	41	43	2
CZ07	42	42	41	42	1
ES52	43	43	41	43	2
CZ05	46	46	46	47	1
SK0	47	47	46	47	1
FR80	51	51	51	52	1
CZ04	52	52	51	52	1
ITD	53	53	53	54	1
EE	54	54	54	55	1
SI	55	55	53	55	2
BE1	58	58	58	59	1
ES70	59	59	58	59	1
CY0	60	60	60	61	1
GR3	61	61	60	61	1
PL4	71	71	71	72	1
PL1	72	72	71	72	1
ITG	74	74	74	75	1
PL5	75	76	75	76	1
HU3	76	76	75	77	2
PL6	77	77	74	77	3
RO11	85	85	85	86	1
RO22	86	86	85	86	1

Table 4.22: Absolute Poverty component: effect of different β values on region ranks (median and estimated 90% CI).

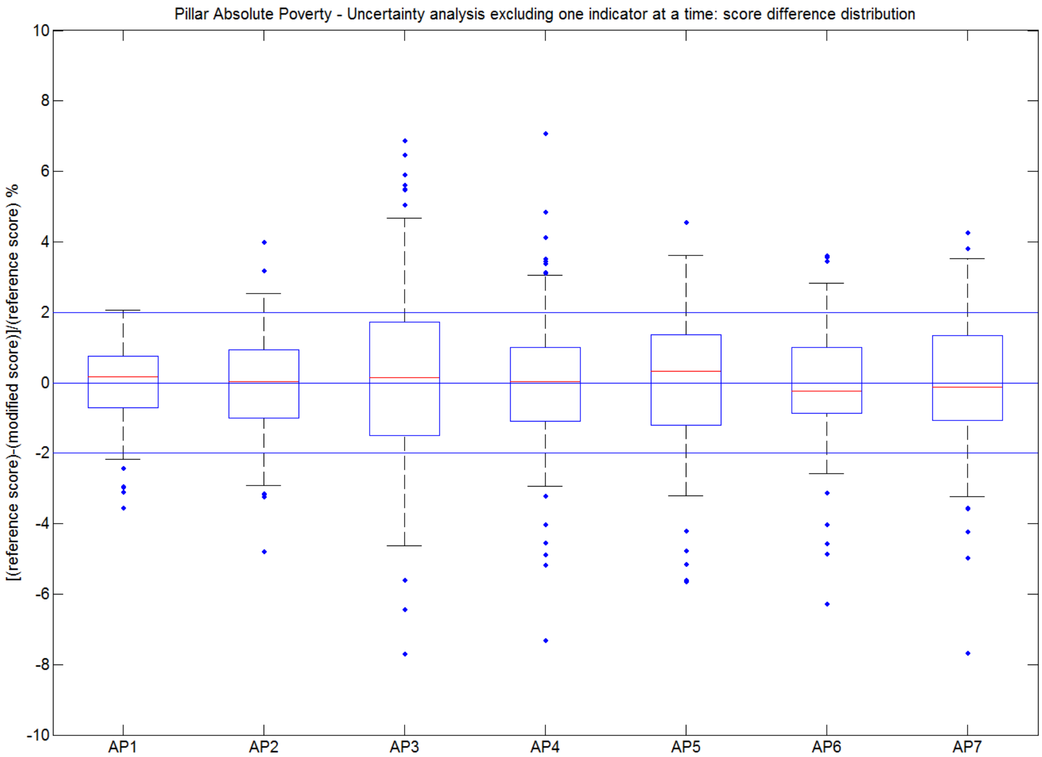
Romanian regions, RO11 RO12 RO21 RO22 RO32, whole Bulgaria, BG3 BG4, and Latvia LV0 (see Table 3.4 for the correspondence between region codes and names). These regions are stable, low performers in all simulations as they rank among the worst eight for all the 2000 different choices of mean order β.

The effect of each single indicator on Absolute Poverty scores is assessed by setting the order of the weighted mean to its reference value $\beta = 0.5$ and computing region scores and ranks discarding one indicator at a time for a total number of seven simulations. Figure 4.35 summarizes the outcome of this analysis. Boxplots refer to the seven different simulations and the discarded indicator is on the horizontal axis. Boxplot whiskers indicate 1.5*IQR (interquartile range), both upwards and downwards, whilst dots are outliers, i.e. observations falling outside the interval [(P25-1.5*IQR),(P75+1.5*IQR)]. Figure 4.35(top) shows differences in scores as percentage difference with respect to the reference Absolute Poverty scores, which includes all the indicators. The percentage difference is almost always in the range $\pm 2\%$ with indicator AP3 (percentage of people living in houses with problems) being the most influencing indicator. It is interesting to note that AP3 is indeed the indicator which only frequencies >5%

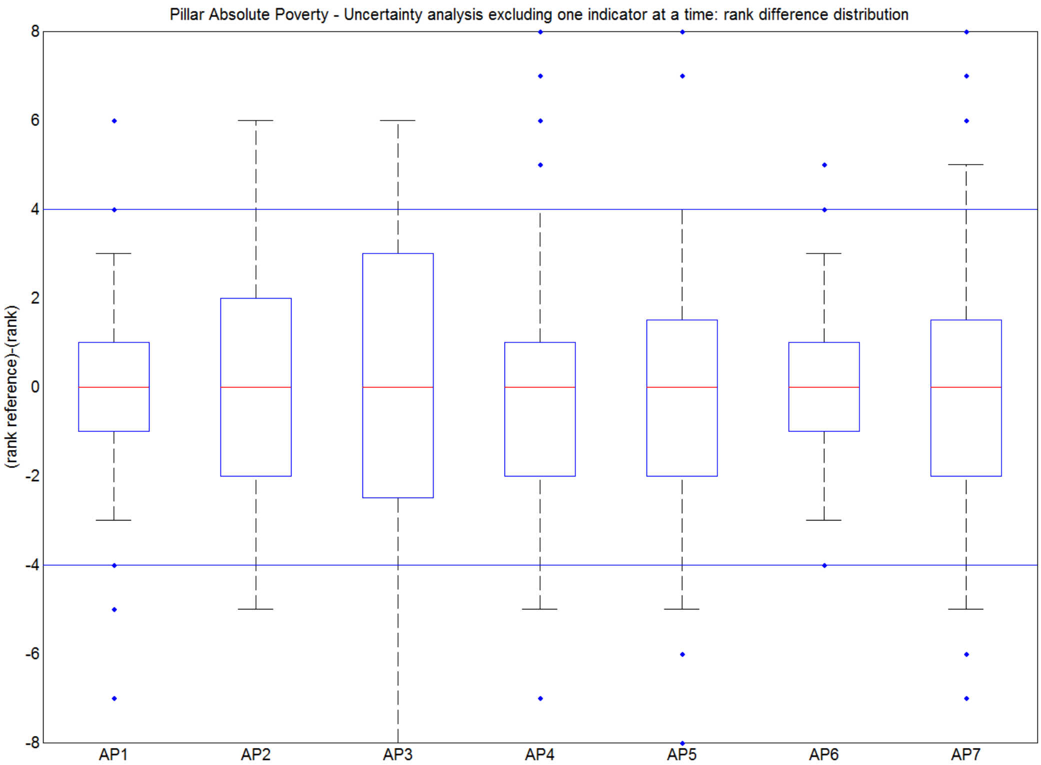
Country	[1,5]	[6,10]	[11,15]	[16,20]	[21,25]	[26,30]	[31,35]	[36,40]	[41,45]	[46,50]	[51,55]	[56,60]	[61,65]	[66,70]	[71,75]	[76,80]	[81,88]
FI1A	100																
FI19	100																
FI13	100																
FI18	100																
LU0	100																
ES24		100															
NL		100															
DK		100															
AT3		100															
AT2		100															
ES22			100														
SE3			100														
BE2			100														
SE2			100														
ES13			100														
ES21				100													
ES23				100													
SE1				100													
FR70				100													
UK				78	22												
FR50				22	78												
ES41					100												
CZ01					100												
ES12					100												
CZ06					83	17											
FR20					17	83											
ES30						100											
CZ03						100											
DE						100											
CZ02						100											
ES51							100										
AT1							100										
ES42							100										
MT0							77	23									
IE0							100										
FR40							23	77									
FR60								100									
ES43								100									
ES11								100									
ES53								100									
FR30									100								
CZ07									100								
ES52									100								
ES62									100								
FR10									100								
CZ05										100							
SK0										100							
BE3										100							
ITC										100							
ES61										100							
FR80											100						
CZ04											100						
ITD											100						
EE											100						
SI											100						
CZ08												100					
ITE												100					
BE1												100					
ES70												100					
CY0												55	45				
GR3												45	55				
GR1													100				
GR2													100				
HU2													100				
PT													100				
LT0														100			
GR4														100			
ITF														100			
PL2														100			
HU1														100			
PL4															100		
PL1															100		
PL3															100		
ITG															100		
PL5															39	61	
HU3															25	75	
PL6															35	65	
RO31																100	
RO42																100	
RO41																100	
LV0																	100
RO32																	100
BG4																	100
RO12																	100
RO11																	100
RO22																	100
RO21																	100
BG3																	100

Table 4.23: Absolute Poverty component: UA on different β values - frequency matrix.

shows the lowest correlation in the Absolute Poverty component (see Table 4.13) so it has the highest influence on final scores, as expected. Figure 4.35(bottom) shows boxplots of differences in ranks. All the interquartile ranges are within the band ± 4, meaning that for all the simulations the maximum shift of the region rank is up to 4 positions in the 50% of the cases. This confirms that, on average, all the indicators contribute in a balanced way to the Absolute Poverty score.



Percentage differences in scores



Differences in ranks

Figure 4.35: Absolute Poverty component: UA on the influence of the indicators.

4.4.5 UA on Relative Poverty component

Indicators included in the Relative Poverty component are reversed to be positively oriented and aggregated using a generalised mean of order $\beta = 0.5$. The Relative Poverty sub-index is then reversed in order to have high scores associated to high levels of relative poverty (the higher the worse), as in the classical definition of poverty measures (the same is done for the Absolute Poverty sub-index, see previous Section). The effect on region scores of different β values can be seen in Figure 4.36 showing for each region the boxplot of the distribution of the percentage score differences with respect to the reference score ($\beta = 0.5$). The boxes, which represents 50% of the distribution, are always well between the band $\pm 1\%$. Also in this case, the effect of different values of β is negligible and this is due to the high consistency of the indicators included in the component (see Section 4.4.2).

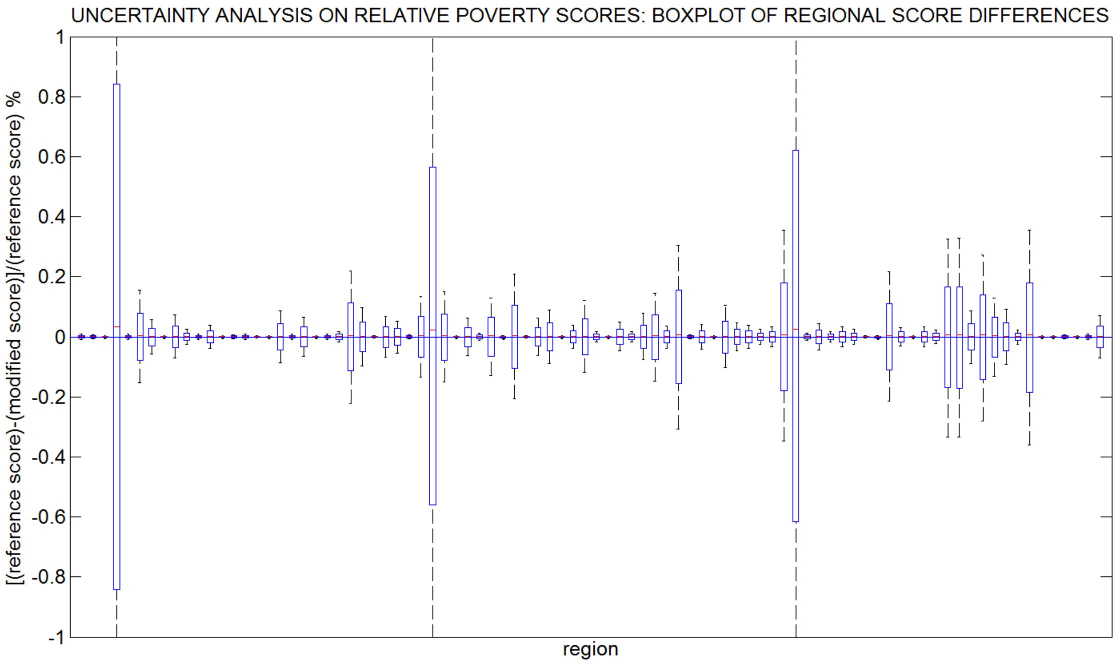


Figure 4.36: Relative Poverty component: effect of different β values on region scores.

Table 4.24 shows the median rank of the regions and the associated 90% CI computed across all the 2000 scenarios (only for regions with CI width above 0). Regions are reordered from best to worst according to their reference Relative Poverty rank. Only 11 out of 88 regions have a non-zero CI width. As expected from the strong correlation pattern, the robustness of final ranks with respect to different aggregation methods is even higher than the one in the Absolute Poverty component.

Finally, Table 4.25 shows the frequency matrix of modified ranks which displays, for each region, the percentage of times the region ranks in certain rank interval calculated over all the 2000 simulated scenarios. The frequency matrix shows most and least stable regions and provides a synthesized picture of the overall regional ranking stability. Regions are reordered from best to worst according to their reference Relative Poverty rank. A region is considered 'stable' if its rank frequency is higher or equal to 95% (highlighted in blue in Table). As expected there is almost no volatility in ranks, all the regions are stable with respect to the type of aggregation. Regions with low

Region label	Absolute poverty rank	median rank	rank P5%	rank P95%	90% CI
CY0	10	10	9	10	1
CZ05	21	21	21	22	1
DE	70	70	69	70	1
ES21	22	22	21	22	1
ES62	78	78	78	79	1
FR70	9	9	9	10	1
GR2	84	84	84	85	1
GR4	68	68	68	69	1
ITG	85	85	84	85	1
RO12	79	79	78	79	1
RO42	69	69	68	70	2

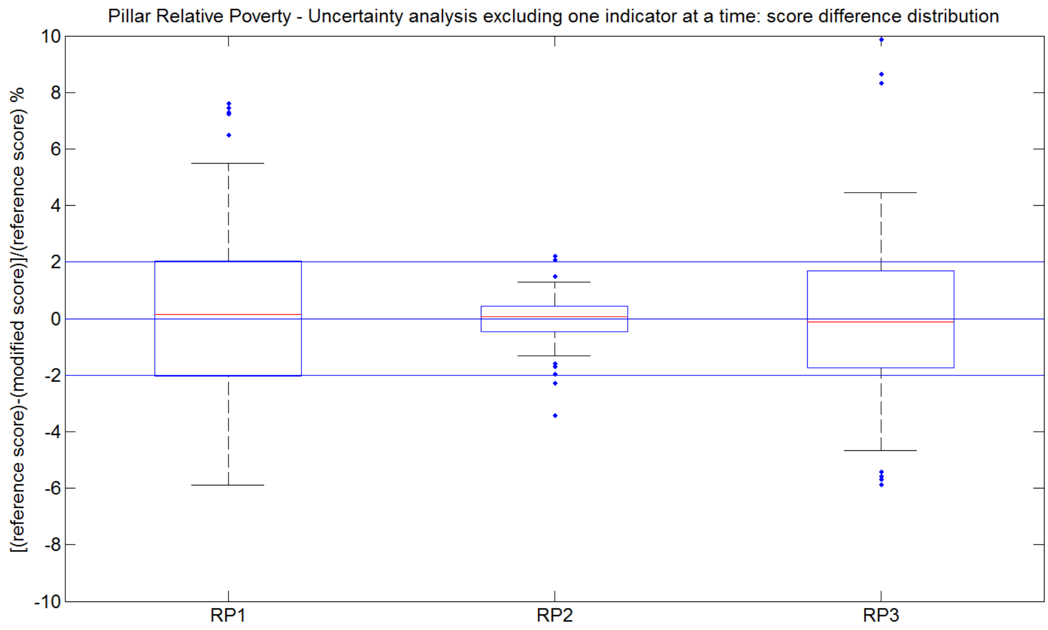
Table 4.24: Relative Poverty component: effect of different β values on region ranks (median and estimated 90% CI).

and stable levels of relative poverty are ES22 (Comunidad Foral de Navarra), FR50 (Ouest), AT3 (Westösterreich) and two regions in the Czech Republic (CZ01 and CZ03). At the opposite side we find the region of Bruxelles-Capitale (BE1), Extremadura in Spain (ES43), two Italian southern regions South and Islands (ITF and ITG), two Romanian regions Nord-Vest and Sud-Est (RO11 and RO22) and two Greek regions Voreia and Kentriki Ellada (GR1 and GR2). In these regions the level of relative poverty is high and stable in all the simulations with different choices of the order β.

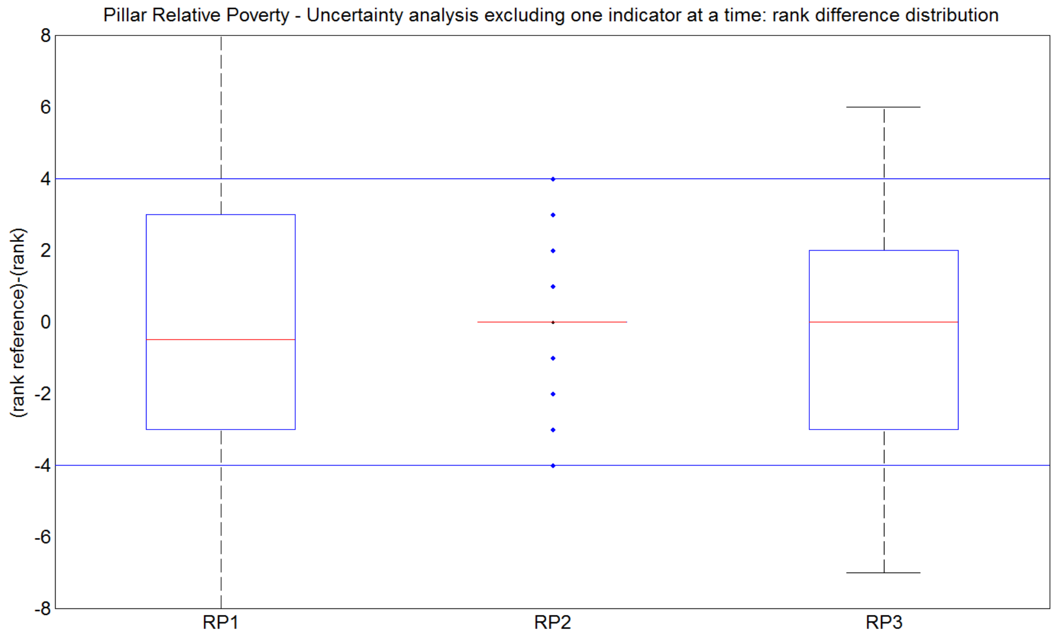
The effect of each single indicator on Relative Poverty scores is assessed by setting the order of the weighted mean to its reference value $\beta = 0.5$ and computing region scores and ranks discarding one indicator at a time for a total number of three simulations (the number of indicators included in the component). Figure 4.37 summarizes the outcome of the analysis. Boxplots refer to the three different simulations and the discarded indicator is on the horizontal axis. Figure 4.37(top) shows the differences in scores as percentage difference with respect to the reference Realtive Poverty scores, with all the indicators included. The percentage difference is almost always in the range $\pm 2\%$ with indicator RP2 (poverty depth) being the least influencing indicator. Figure 4.37(bottom) shows boxplots of differences in ranks. All the interquartile ranges are within the band ± 4, meaning that for all the simulations the maximum shift of the region rank is up to 4 positions in the 50% of the cases.

	only frequencies >5%															
region code	[1,5]	[6,10]	[11,15]	[16,20]	[21,25]	[26,30]	[31,35]	[36,40]	[41,45]	[46,50]	[51,55]	[56,60]	[61,65]	[66,70]	[71,75]	[76,80]	[81,88]
ES22	100																
FR50	100																
AT3	100																
CZ01	100																
CZ03	100																
HU1		100															
CZ02		100															
FR40		100															
FR70		100															
CY0		100															
AT2			100														
SI			100														
FR20			100														
HU2			100														
ITD			100														
BE2				100													
ES12				100													
MT0				100													
ES13				100													
FR10				100													
CZ05					100												
ES21					100												
FI18					100												
LU0					100												
CZ06					100												
IE0						100											
AT1						100											
SK0						100											
FI1A						100											
ITC						100											
ES24							100										
FR60							100										
FI19							100										
ITE							100										
CZ07							100										
PL1								100									
NL								100									
FI13								100									
FR30								100									
PL2								100									
SE1									100								
ES11									100								
PL5									100								
PT									100								
PL6									100								
EE										100							
HU3										100							
SE2										100							
DK										100							
PL4										100							
RO31											100						
CZ08											100						
CZ04											100						
ES30											100						
BG4											100						
ES23												100					
SE3												100					
ES51												100					
LT0												100					
ES52												100					
FR80													100				
RO32													100				
BE3													100				
PL3													100				
GR3													100				
ES53														100			
ES41														100			
GR4														100			
RO42														100			
DE														100			
LV0															100		
UK															100		
ES42															100		
ES70															100		
BG3															100		
RO21																100	
ES61																100	
ES62																100	
RO12																100	
RO41																100	
ES43																	100
ITF																	100
RO11																	100
GR2																	100
ITG																	100
GR1																	100
BE1																	100
RO22																	100

Table 4.25: Relative Poverty component: UA on different β values - frequency matrix.



Percentage differences in scores



Differences in ranks

Figure 4.37: Relative Poverty component: UA on the influence of the indicators.

4.4.6 UA on Earnings and Incomes component

For the Earnings and Incomes component, the effect of region scores of different β values is shown in Figure 4.38. The boxes are always within the band $\pm 1.5\%$, meaning that for all regions the score change is less that 1% for most cases.

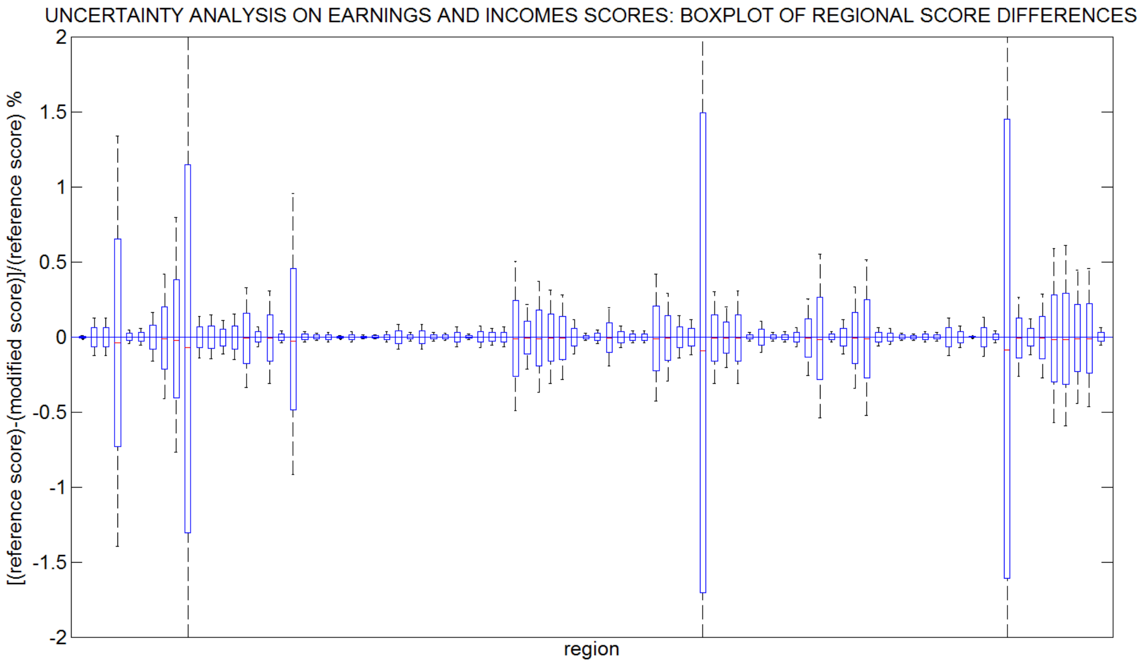


Figure 4.38: Earnings and Incomes component: effect of different β values on region scores.

Table 4.26 shows the median rank of the regions and the associated 90% CI estimated from the 2000 scenarios (only for in the cases where CI width is above 0). Regions are reordered from best to worst according to their reference Earnings and Incomes rank. Also in this case the rank volatility is almost negligible.

Table 4.27 shows the frequency matrix of modified ranks based on 2000 simulations as for the other two components. Regions are reordered from best to worst according to their reference Earnings and Incomes rank. A region is considered 'stable' if its rank frequency is higher or equal to 95% (highlighted in blue in Table). All the regions are pretty stable with respect to the type of aggregation. Regions with high levels of earnings and incomes are Luxembourg (LU0), Île de France (FR10) and two regions in Spain, País Vasco and Comunidad Foral de Navarra (ES21 and ES22). At the opposite side we find the Bulgarian region Severna i Iztochna (BG3) and almost all Romanian regions (RO11, RO12, RO21, RO22, RO31, RO41 and RO42). These regions are characterized by the lowest aggregate level of earnings and incomes which is stable across all the simulations.

The effect of each single indicator on Earnings and Incomes scores is shown in Figure 4.39 where boxplots refer to the three different simulations and the discarded indicator is on the horizontal axis. Figure 4.39(top) shows differences in scores as percentage difference with respect to the reference Earnings and Incomes scores, which includes all the indicators and is computed as a generalized mean of order $\beta = 0.5$. The percentage difference is almost always in the range $\pm 5\%$ with indicator I2 (compensation of employees in PPS) being the most influencing

Region label	Absolute poverty rank	median rank	rank P5%	rank P95%	90% CI
BE2	5	5	5	6	1
NL	6	6	5	7	2
AT1	7	7	6	8	2
BE1	8	8	7	8	1
ES30	9	9	9	10	1
AT3	10	10	10	11	1
ITC	11	12	11	12	1
AT2	13	13	12	13	1
ITD	15	15	14	16	2
CY0	16	16	15	16	1
IE0	28	28	28	29	1
ES53	29	29	28	29	1
FI18	36	37	36	37	1
MT0	37	38	36	38	2
SE2	38	37	36	38	2
SE3	41	41	41	42	1
ES52	42	42	42	43	1
ES11	43	43	43	44	1
HU1	44	44	41	46	5
GR4	45	45	44	45	1
FI19	46	46	45	46	1
FI1A	48	48	48	49	1
ES42	49	49	48	49	1
ES61	51	51	51	52	1
ES62	52	52	52	54	2
DK	53	53	51	56	5
FI13	54	54	53	54	1
GR2	55	55	55	56	1
ITG	56	56	53	56	3
PT	59	59	59	60	1
CZ02	60	60	60	61	1
CZ06	62	62	62	63	1
CZ03	63	63	61	63	2
CZ05	65	65	65	66	1
PL1	66	66	65	66	1
RO31	85	85	85	86	1
BG3	86	86	85	86	1

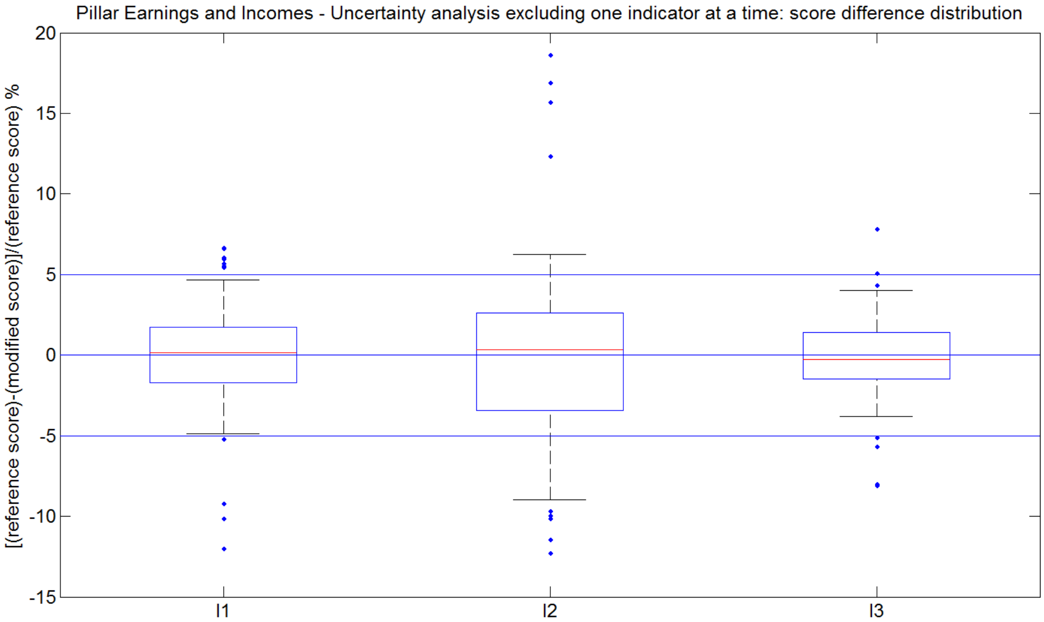
Table 4.26: Earnings and Incomes component: effect of different βs on region ranks (median and estimated 90% CI).

one. Figure 4.39(bottom) shows boxplots of differences in ranks. All the interquartile ranges are within the band ± 5, meaning that for all the simulations the maximum shift of the region rank is up to 5 positions in the 50% of the cases.

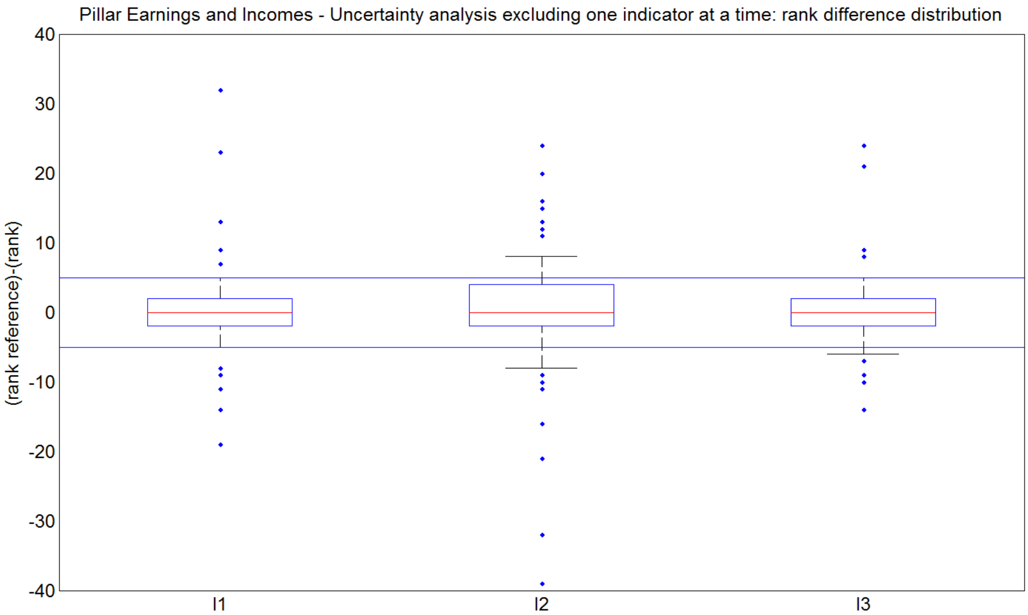
The overall effect of different orders β on scores/ranks of the Living Standards components is negligible. This is due to the high level of correlations of the indicators within each component.

	only frequencies >5%																
region code	[1,5]	[6,10]	[11,15]	[16,20]	[21,25]	[26,30]	[31,35]	[36,40]	[41,45]	[46,50]	[51,55]	[56,60]	[61,65]	[66,70]	[71,75]	[76,80]	[81,88]
LU0	100																
FR10	100																
ES21	100																
ES22	100																
BE2	81	19															
NL	19	81															
AT1		100															
BE1		100															
ES30		100															
AT3		68	32														
ITC			100														
CZ01		32	68														
AT2			100														
SE1			100														
ITD			77	23													
CY0			23	77													
ES24				100													
FR70				100													
ES51				100													
ITE				100													
UK					100												
BE3					100												
DE					100												
ES12					100												
FR40					100												
FR60						100											
GR3						100											
IE0						100											
ES53						100											
ES23						100											
FR80							100										
ES13							100										
FR20							100										
FR50							100										
SI							100										
FI18								100									
MT0								100									
SE2								100									
ES41								100									
FR30								100									
SE3									100								
ES52									100								
ES11									100								
HU1									94	6							
GR4									100								
FI19									6	94							
ES70										100							
FI1A										100							
ES42										100							
GR1										100							
ES61											100						
ES62											100						
DK											84	16					
FI13											100						
GR2											74	26					
ITG											42	58					
ITF												100					
ES43												100					
PT												100					
CZ02												53	48				
RO32												48	53				
CZ06													100				
CZ03													100				
CZ08													100				
CZ05													51	49			
PL1													49	51			
CZ07														100			
SK0														100			
CZ04														100			
LT0														100			
HU2															100		
PL2															100		
EE															100		
PL5															100		
PL4															100		
PL6																100	
HU3																100	
LV0																100	
BG4																100	
PL3																100	
RO42																	100
RO41																	100
RO11																	100
RO12																	100
RO31																	100
BG3																	100
RO22																	100
RO21																	100

Table 4.27: Earnings and Incomes component: UA on different β values - frequency matrix.



Percentage differences in scores



Differences in ranks

Figure 4.39: Earnings and Incomes component: UA on the influence of the indicators.

4.4.7 Living Standards sub-indexes

As discussed in Section 4.4.3, the effect of different values of the curvature β of the generalised mean used for aggregation is substantially not affecting scores and ranks of the Living Standards components. For reasons related to marginal substitution rates across indicators, the choice is here to aggregate (scaled) indicators at the component level using a generalized mean of order $\beta = 0.5$. Prior to aggregation, indicators are normalized using population weighted z-scores, reversed if necessary to be positively oriented with respect to the level of QoL and shifted to avoid negative values. Then, once the sub-indexes are computed we go back to the original orientation with respect to QoL, which is: negative for Absolute Poverty and Relative Poverty (the higher the worse) and positive for Earnings and Incomes (the higher the better). This has no effect at all on final regional rankings and it is possible because no further aggregation across sub-indexes is undertaken. The choice of keeping Absolute Poverty and Relative Poverty measures counter-oriented with respect to the level of QoL is driven by the need of not causing interpretation problems. The general understanding of the concept of poverty is that high levels are bad while low levels are good. We want to stick to this.

Three Living Standards sub-indexes are computed:

- Absolute Poverty sub-index (AP) with negative polarity with respect to QoL;
- Relative Poverty sub-index (RP) with negative polarity with respect to QoL;
- Earnings and Incomes sub-index (E&I) with positive polarity with respect to QoL.

Table 4.28 shows descriptive statistics of the three sub-indexes.
Sub-index scores and region ranks are presented in the Tables 4.29, 4.30 and 4.31 for Absolute Poverty, Relative Poverty and Earnings and Incomes respectively. In each table regions are presented in alphabetical order with their respective score and rank.
Reordered regions, from best to worst in terms of QoL levels, are shown in Figures 4.40, 4.41 and 4.42 for the three components. The scores displayed in the Figures are min-max transformed for an easy interpretation.
In terms of Absolute Poverty the group of regions in the top 20% of the distribution, which corresponds to the lowest levels of absolute poverty, includes all Finnish and Swedish regions, two out of three Austrian regions (AT2=Südösterreich and AT3=Westösterreich), the Netherlands, Denmark [7], Luxembourg, Belgian region BE2=VlaamsGewest and few regions in the northern part of Spain (ES13, from ES21 to ES24). Among the bottom 20% in the score distribution there are all Romanian and Bulgarian regions, five out of six Polish regions, Latvia, one Italian (ITG=Isole) and one Hungarian (HU3=Alföld És Észak) region. The differences among regions are quite large in two last quintile groups, and the largest in the last group. This is also evident from the distribution of the min-max normalised sub-index, Figure 4.43, which is highly negatively skewed meaning that there are quite a few regions with critically low levels of absolute poverty. These regions deserve special attention as they are clearly lagging behind.

[7] In EU-SILC the Netherlands and Denmark are at the country level only.

short label	AP	RP	E&I
sub-index description	Absolute poverty sub-index	Relative poverty sub-index	Earnings and incomes sub-index
source	EU SILC 2007-2009	EU SILC 2007-2009	EU SILC 2007-2009
sub-index orientation	↓	↓	↑
mean	29.64	31.90	38.21
median	20.58	27.90	41.10
sd	22.67	23.43	18.79
interquartile range	30.09	29.87	25.61
p20	11.32	11.76	20.43
p40	17.05	20.86	35.64
p60	26.79	31.66	46.93
p80	49.23	51.22	53.03
max	100	100	100
region corresponding to maximum value	BG3	RO22	LU
min	0	0	0
region corresponding to minimum value	FI1A	ES22	RO21

Table 4.28: Descriptive statistics of Living Standards sub-indexes.

With respect to Relative Poverty the group of best regions (with scores lower than P_{20} percentile) includes four French regions, Bassin Parisien, Est, Ouest and Centre-Est (FR20, FR40, FR50, FR70), three Czech regions, Praha, Střední Čechy and Jihozápad (CZ01, CZ02, CZ03), two Hungarian regions, Közp-Magyarország and Dunántúl (HU1, HU2), two Austrian regions, Südösterreich and Westösterreich (AT2, AT3), two Spanish regions, Principado de Asturia and Comunidad Foral de Navarra (ES12, ES22), one Italian region, Nord-Est (ITD), one Belgian region, VlaamsGewest (BE2), Cyprus, Slovenia and Malta. Among the worst performers (scores above P_{80}) there are Latvia, United Kingdom[8], five out of eight Romanian regions, two Greek regions, Voreia Ellada and Kentriki Ellada (GR1, GR2), two southern Italian regions, Sud and Isole (ITG, ITF) and one Bulgarian region, Severna i Iztochna Bulgaria (BG3). It is worth noting that Italy and Spain have both top and bottom regions and this strengthens, if needed at this point, the importance of a sub-national analysis in measuring poverty. The differences among regions in the bottom group of regions are higher than for the other regions as also confirmed by the distribution of the min-max normalize sub-index shown in Figure 4.44. As for the Absolute poverty case, the distribution is characterized by a left-hand tail that indicates the presence of very low scoring regions.

In the Earnings and Incomes component the group of best performers includes Luxembourg (with a very high score), the Netherlands, Cyprus, all Austrian regions, two French regions, Île de France and Centre-Est (FR10, FR70), two Belgian regions, Région de Bruxelles-Capitale and VlaamsGewest (BE1, BE2), three Spanish regions, País Vasco, Comunidad Foral de Navarra and Comunidad de Madrid (ES21, ES22, ES30), two northern Italian

[8]In EU-SILC, UK is available at the country level only

Region	Absolute poverty norm score	Absolute poverty rank		Region	Absolute poverty norm score	Absolute poverty rank		Region	Absolute poverty norm score	Absolute poverty rank
AT1	16.28	32		ES43	18.14	38		ITF	46.92	68
AT2	7.51	10		ES51	15.52	31		ITG	53.85	74
AT3	7.00	9		ES52	19.64	43		LT0	43.24	66
BE1	34.80	58		ES53	18.87	40		LU0	5.03	5
BE2	9.03	13		ES61	24.89	50		LV0	70.08	81
BE3	23.61	48		ES62	20.49	44		MT0	16.60	34
BG3	100.00	88		ES70	35.32	59		NL	6.37	7
BG4	76.64	83		FI13	3.90	3		PL1	49.94	72
CY0	36.51	60		FI18	5.02	4		PL2	47.95	69
CZ01	13.72	23		FI19	3.17	2		PL3	50.36	73
CZ02	15.29	30		FI1A	0.00	1		PL4	49.83	71
CZ03	14.57	28		FR10	20.67	45		PL5	54.50	75
CZ04	25.83	52		FR20	14.42	26		PL6	54.74	77
CZ05	21.72	46		FR30	19.55	41		PT	40.61	65
CZ06	14.27	25		FR40	17.12	36		RO11	81.71	85
CZ07	19.57	42		FR50	13.27	21		RO12	77.17	84
CZ08	28.94	56		FR60	17.93	37		RO21	87.95	87
DE	14.72	29		FR70	11.95	19		RO22	82.17	86
DK	6.61	8		FR80	25.79	51		RO31	62.17	78
EE	27.03	54		GR1	37.66	62		RO32	71.21	82
ES11	18.63	39		GR2	38.45	63		RO41	63.78	80
ES12	13.83	24		GR3	36.53	61		RO42	62.53	79
ES13	9.32	15		GR4	45.36	67		SE1	10.90	18
ES21	9.76	16		HU1	48.34	70		SE2	9.12	14
ES22	8.09	11		HU2	40.22	64		SE3	8.22	12
ES23	10.78	17		HU3	54.58	76		SI	27.40	55
ES24	5.79	6		IE0	16.79	35		SK0	22.02	47
ES30	14.50	27		ITC	24.71	49		UK	13.19	20
ES41	13.54	22		ITD	26.73	53				
ES42	16.37	33		ITE	29.73	57				

Table 4.29: Absolute Poverty component: scores and ranks.

regions, Nord-Ovest and Nord-Est (ITC, ITD), the Czech region of Praha (CZ01) and the Swedish capital region (SE1). At the bottom end of the distribution, where scores are below the P_{20} percentile, one can find almost all Romanian regions (apart from the capital region RO32), two Bulgarian regions, Severna i Iztochna (BG3) and the region including the capital (BG4), Latvia, Estonia, five out of six Polish regions and two Hungarian regions, Dunántúl and Alföld És Észak (HU2 and HU3). With respect to the other two sub-indexes, in this case the distribution is quite symmetric with only one outlier in the right-hand part of the distribution corresponding to Luxembourg, which is known as being characterized by very high incomes.

In order to spatially visualize the distribution of the sub-indexes scores we classify the min-max normalized values of each index into five groups according to the distribution percentiles P_{20}, P_{40}, P_{60} and P_{80} and present the results in Figures 4.46 and 4.47 respectively. We remind the reader that even if the maps display the NUTS2 level for all

Region	Relative poverty norm score	Realtive poverty rank	Region	Relative poverty norm score	Realtive poverty rank	Region	Relative poverty norm score	Realtive poverty rank
AT1	16.40	27	ES43	71.25	81	ITF	71.75	82
AT2	7.82	11	ES51	34.36	58	ITG	75.53	85
AT3	1.44	3	ES52	35.07	60	LT0	34.93	59
BE1	94.61	87	ES53	42.68	66	LU0	13.36	24
BE2	9.05	16	ES61	67.49	77	LV0	54.91	71
BE3	39.25	63	ES62	68.09	78	MT0	11.58	18
BG3	64.74	75	ES70	62.72	74	NL	21.47	37
BG4	32.20	55	FI13	22.14	38	PL1	20.92	36
CY0	7.31	10	FI18	13.08	23	PL2	24.56	40
CZ01	2.13	4	FI19	19.43	33	PL3	41.45	64
CZ02	5.80	7	FI1A	17.01	29	PL4	30.53	50
CZ03	4.54	5	FR10	12.44	20	PL5	26.86	43
CZ04	31.57	53	FR20	8.34	13	PL6	28.18	45
CZ05	12.66	21	FR30	22.74	39	PT	27.63	44
CZ06	14.03	25	FR40	6.91	8	RO11	74.17	83
CZ07	20.63	35	FR50	1.04	2	RO12	68.19	79
CZ08	31.00	52	FR60	19.11	32	RO21	66.99	76
DE	45.69	70	FR70	7.25	9	RO22	100.00	88
DK	29.34	49	FR80	36.25	61	RO31	30.84	51
EE	28.28	46	GR1	82.01	86	RO32	36.68	62
ES11	25.66	42	GR2	75.15	84	RO41	70.05	80
ES12	11.55	17	GR3	42.29	65	RO42	45.51	69
ES13	12.03	19	GR4	45.21	68	SE1	25.22	41
ES21	12.74	22	HU1	5.56	6	SE2	29.06	48
ES22	0.00	1	HU2	8.57	14	SE3	33.70	57
ES23	32.71	56	HU3	28.66	47	SI	7.92	12
ES24	18.45	31	IE0	15.54	26	SK0	16.78	28
ES30	32.02	54	ITC	17.13	30	UK	56.97	72
ES41	43.42	67	ITD	8.67	15			
ES42	57.39	73	ITE	20.59	34			

Table 4.30: Relative Poverty component: scores and ranks.

the countries, the actual geographical level of the sub-indexes is driven by EU-SILC data availability and varies according to the country (see Figure 3.10).

Region	Earnings and incomes norm score	Earnings and incomes rank	Region	Earnings and incomes norm score	Earnings and incomes rank	Earnings and incomes score	Earnings and incomes norm score	Realtive poverty rank
AT1	61.67	7	ES43	33.86	58	ITF	34.44	57
AT2	55.17	13	ES51	52.70	19	ITG	35.29	56
AT3	57.41	10	ES52	42.82	42	LT0	21.33	70
BE1	60.45	8	ES53	49.17	29	LU0	100.00	1
BE2	62.02	5	ES61	35.92	51	LV0	13.82	78
BE3	50.91	22	ES62	35.82	52	MT0	46.75	37
BG3	3.73	86	ES70	39.01	47	NL	61.81	6
BG4	10.97	79	FI13	35.56	54	PL1	25.56	66
CY0	54.11	16	FI18	46.77	36	PL2	18.37	72
CZ01	56.49	12	FI19	39.72	46	PL3	8.80	80
CZ02	29.22	60	FI1A	37.65	48	PL4	16.39	75
CZ03	28.31	63	FR10	75.85	2	PL5	17.24	74
CZ04	22.66	69	FR20	48.04	33	PL6	14.92	76
CZ05	25.57	65	FR30	45.32	40	PT	30.15	59
CZ06	28.32	62	FR40	49.98	25	RO11	4.29	83
CZ07	23.83	67	FR50	47.94	34	RO12	3.90	84
CZ08	26.20	64	FR60	49.90	26	RO21	0.00	88
DE	50.69	23	FR70	53.26	18	RO22	3.03	87
DK	35.67	53	FR80	49.00	31	RO31	3.79	85
EE	17.94	73	GR1	37.07	50	RO32	29.06	61
ES11	42.30	43	GR2	35.31	55	RO41	5.25	82
ES12	50.22	24	GR3	49.78	27	RO42	7.86	81
ES13	48.70	32	GR4	40.41	45	SE1	54.66	14
ES21	64.07	3	HU1	41.78	44	SE2	46.74	38
ES22	62.30	4	HU2	19.83	71	SE3	43.30	41
ES23	49.05	30	HU3	14.81	77	SI	47.59	35
ES24	53.31	17	IE0	49.31	28	SK0	23.24	68
ES30	58.66	9	ITC	56.49	11	UK	51.95	21
ES41	46.02	39	ITD	54.50	15			
ES42	37.56	49	ITE	52.18	20			

Table 4.31: Earnings and Incomes component: scores and ranks.

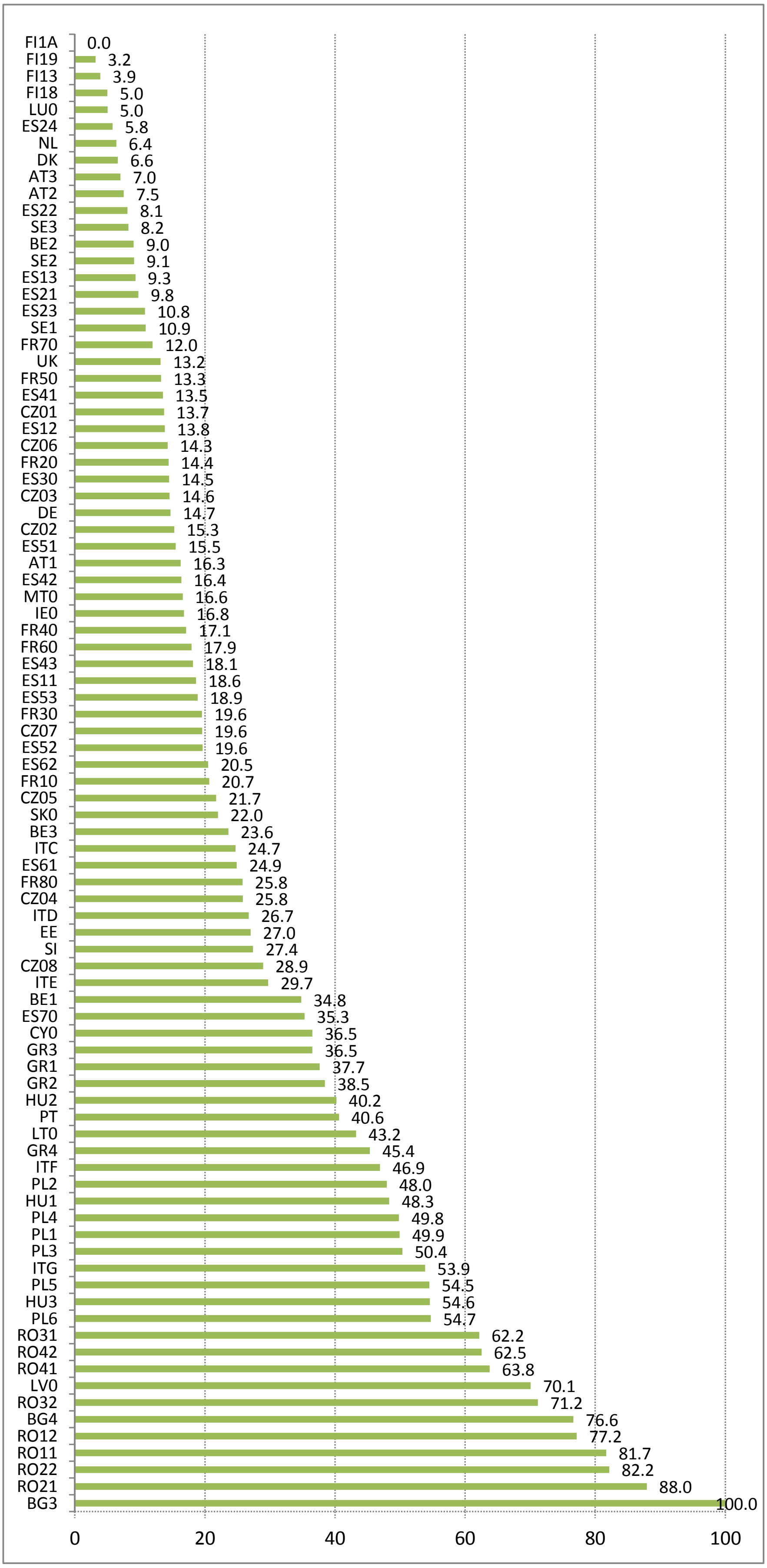


Figure 4.40: Absolute Poverty component: ranking.

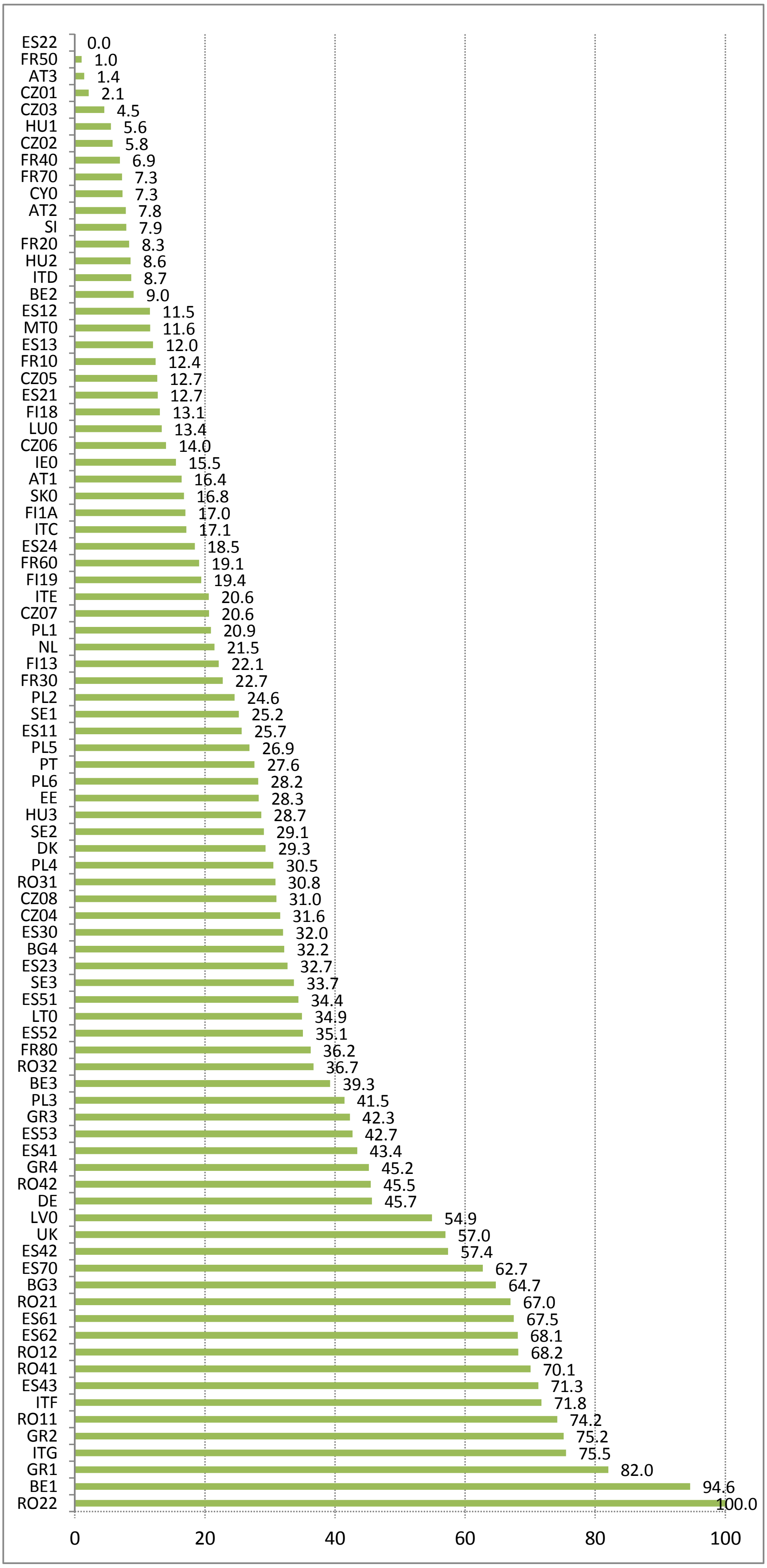


Figure 4.41: Relative Poverty component: ranking.

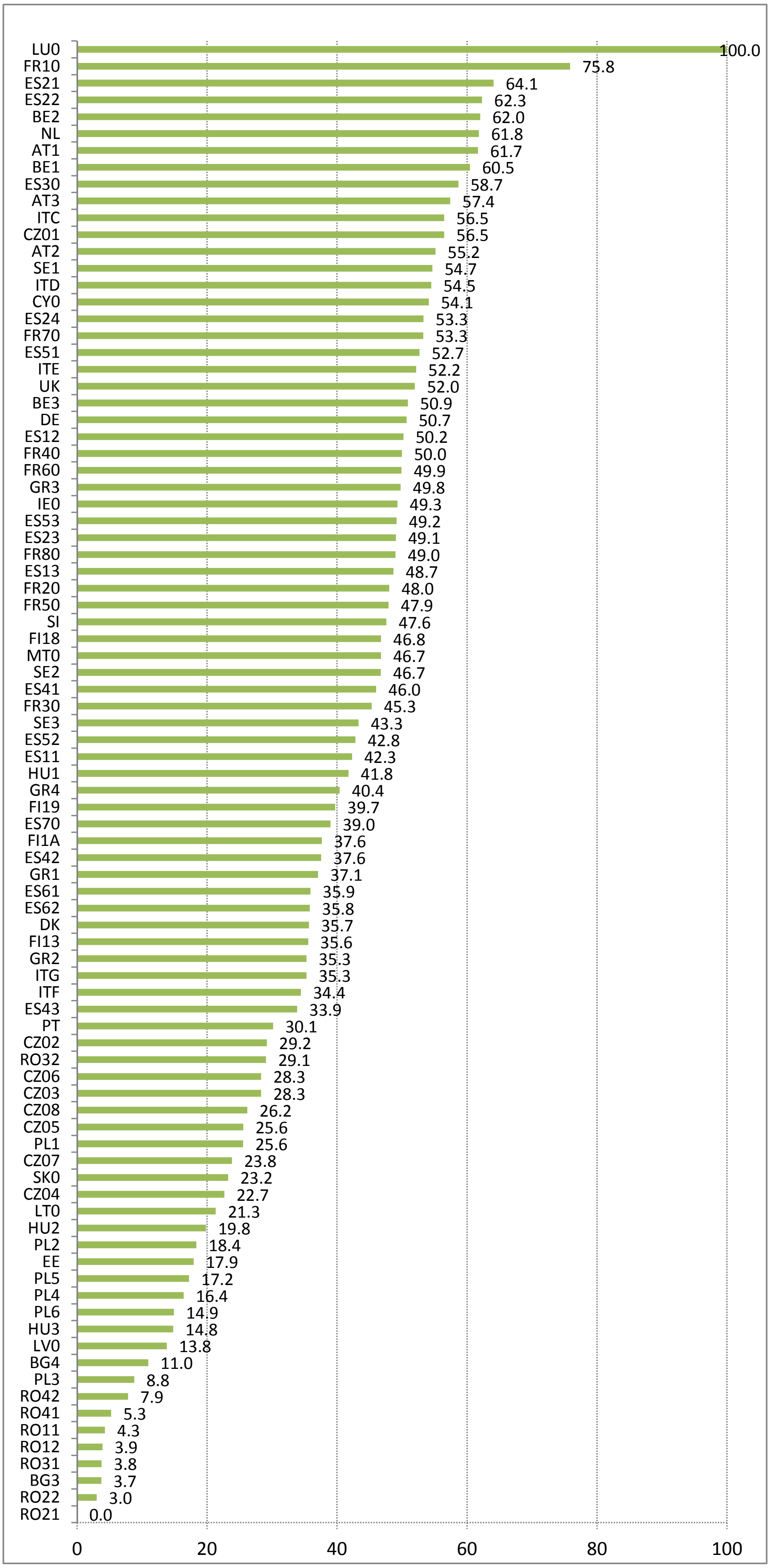


Figure 4.42: Earnings and Incomes component: ranking.

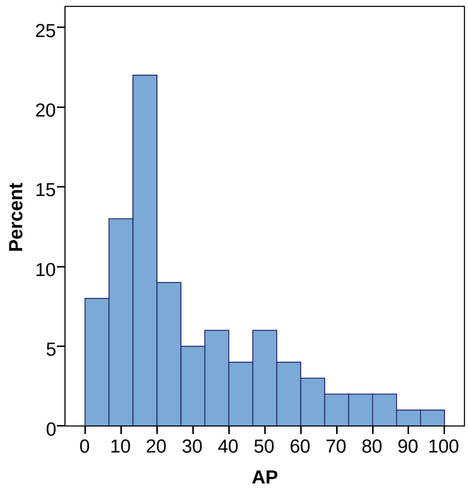


Figure 4.43: Absolute Poverty component: min-max normalized sub-index distribution.

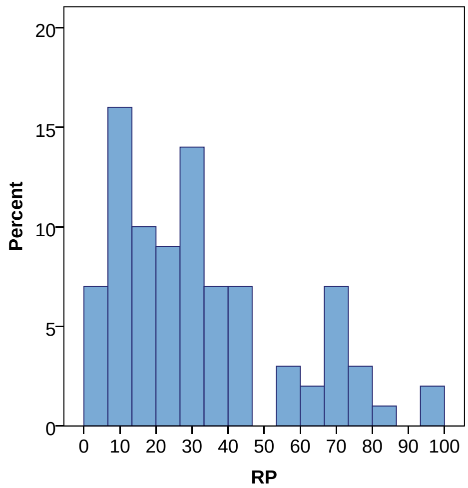


Figure 4.44: Relative Poverty component: min-max normalized sub-index distribution.

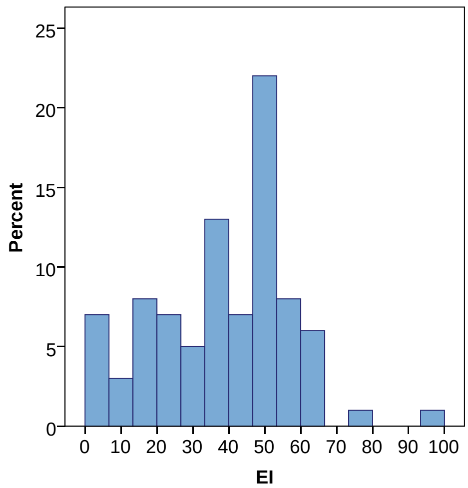
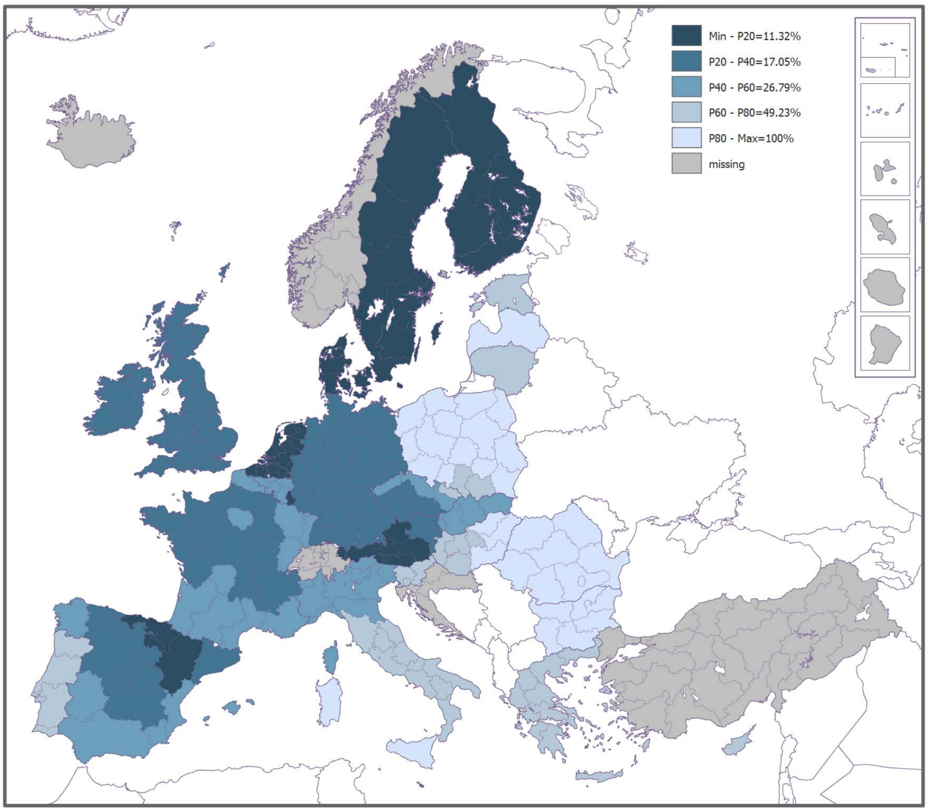
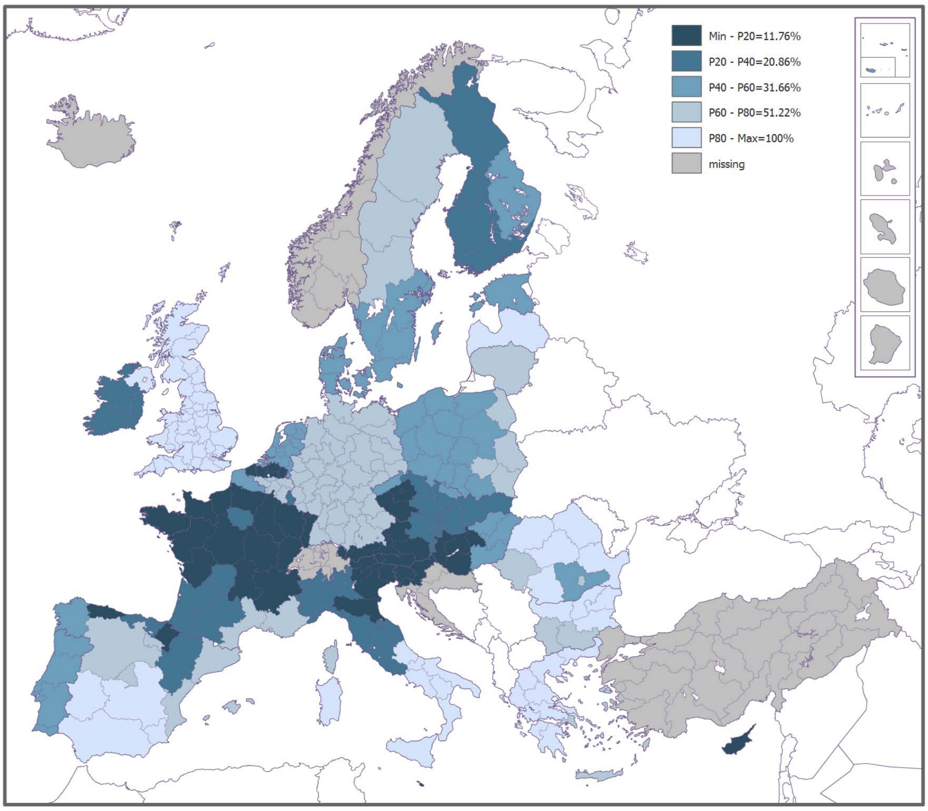


Figure 4.45: Earnings and Incomes component: min-max normalized sub-index distribution.

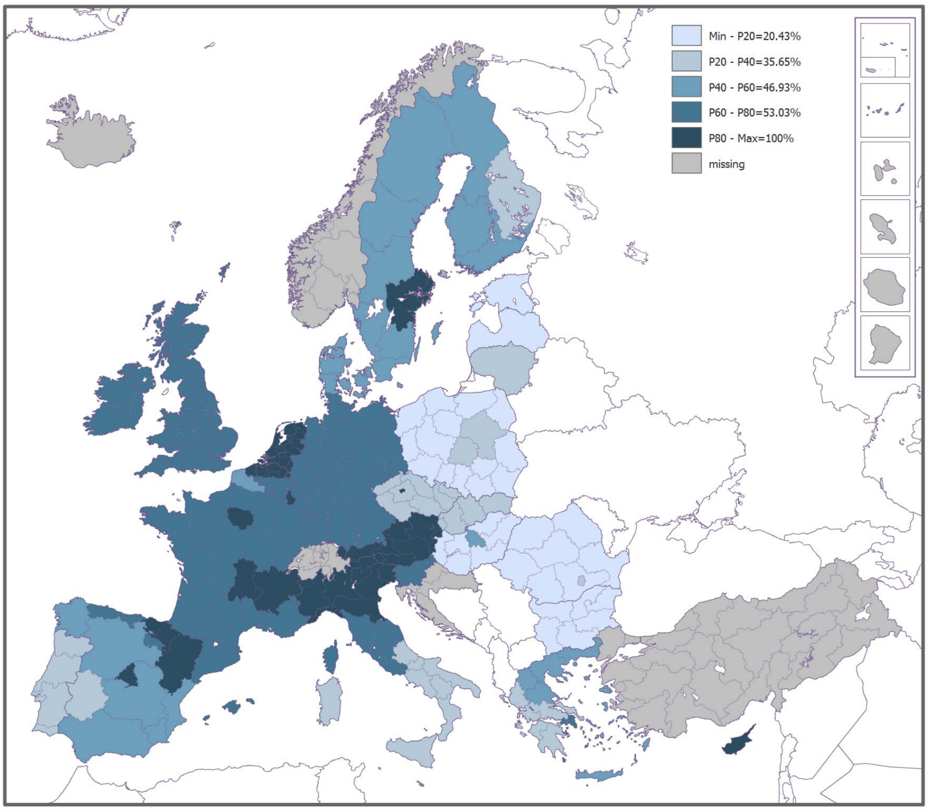


Absolute poverty index - Map (normalized values recoded into five classes)



Relative poverty index - Map (normalized values recoded into five classes)

Figure 4.46: Living Standards sub-indexes - Absolute poverty (top) and Relative poverty (bottom).



Earnings and Incomes - Map (normalized values recoded into five classes)

Figure 4.47: Living Standards sub-indexes - Earnings and Incomes.

Finally, Table 4.32 show the correlation matrix between the sub-indexes. All the correlations are significant at the 0.01 level. It is interesting to note the Relative Poverty sub-index is the one with the lowest correlation level with the other two sub-indexes. The measure of relative poverty is indeed intrinsically different from absolute poverty and level of income.

	AP sub-index	RP sub-index	E&I sub-index
AP sub-index	1		
RP sub-index	0.542	1	
E&I sub-index	-0.751	-0.415	1

Table 4.32: Living Standards dimension: sub-indexes correlation matrix.

Absolute Poverty vs Relative Poverty

The concepts of absolute and relative poverty are substantially different and sometimes even in conflict. The scatterplot in Figure 4.48 compare the absolute poverty with the relative poverty sub-indexes, min-max normalized. The scatterplot is divided into four quadrants - low-low, high-low, high-high and low-high, for an easier interpretation. Most of the regions are in the low-low or high-high quadrant, meaning that for these regions low absolute poverty corresponds to low relative poverty (bottom-left quadrant) - overall people are well-off - or high absolute poverty corresponds to high relative poverty (top-right quadrant), a situation of deep poverty. Some Rumanian regions, Latvia, the Northern part of Bulgaria (BG3) and the two biggest Italian islands (Sardinia and Sicily, ITG) are in this problematic situation.

It is also interesting to note the regions in the low-high or high-low quadrants where absolute poverty and relative poverty measure are in conflict. The top-left part of the plot, low-high quadrant, includes regions experiencing a high level of living standards inequality where, despite low absolute poverty levels, relative poverty can be deep and severe. This emphasizes the presence of pockets of deprivation. This is the case of United Kingdom, some Spanish regions - Extremadura (ES43), Castilla-La Mancha (ES42), the two southernmost regions ES61, ES62, and Canarias (ES70) - the north-western regions in Greece (GR1 and GR2) and the southern region in Italy ITF (even if it very close to the quadrant border). The contrary can be said for the regions in the bottom-right part of the scatterplot, the high-low quadrant, which includes regions from Bulgaria, Hungary, Poland and Romania. Here high material deprivation is associated with rather low relative poverty meaning that people are deprived but the deprivation is almost equally spread across the population. Is it better or worse than the former case? Nobody can say. It is surely a critical condition even if intrinsically different from the one of the low-high quadrant.

Living Standards sub-indexes for Germany

As clearly stated previously the analysis for German regions should not be combined with its EU-SILC counterpart. However it is still worthwhile to disaggregate the Living Standards dimension across German regions. Following the structure of the previous section we first present descriptive statistics of two sub-indexes, i.e. Relative Poverty and Earnings and Incomes (Table 4.33). As for EU-SILC case, Relative Poverty sub-index is negatively

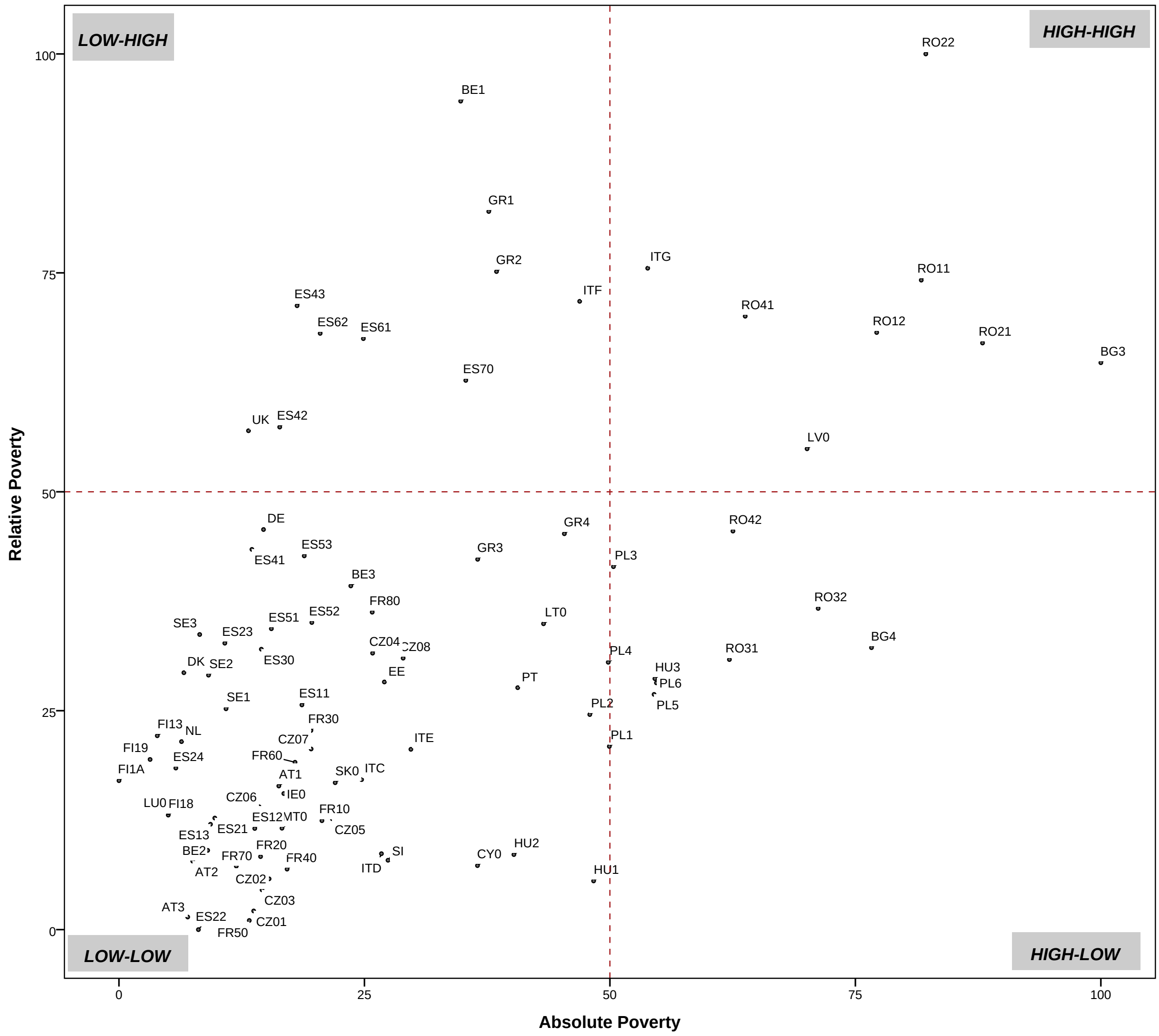


Figure 4.48: Comparison of absolute poverty and relative poverty sub-indexes for European regions (min-max normalized sub-indexes).

oriented while Earnings and Incomes sub-index is positively oriented with respect to QoL. Intentionally we do not present the absolute poverty sub-index as we were not able to extract from SOEP all the variables needed to the sub-index calculation (see section 4.1.2).

Sub-index scores and rankings are presented in Table 4.34 for Relative Poverty and Earnings and Incomes. Regions are presented in alphabetical order according to the region NUTS1 code with their scores and ranks.

As one can easily see the best scoring German region in both Relative Poverty and Earnings and Incomes components is Hamburg (DE6). Among the best five ones in both sub-indexes are also Baden-Wurttemberg (DE1), Bayern (DE2), Hessen (DE7) and Nordhein-Westfalen (DEA). With exception of Hamburg, they are located in the southern part of the country. However the worst scoring regions in each component are different. According to Relative Poverty sub-index the worst scoring region is Schleswig-Holstein (DEF) and its score differs notably

short label	RP	E&I
su-index description	Relative poverty sub-index	Earnings and incomes sub-index
source	SOEP 2009	SOEP 2009 EUROSTAT
sub-index orientation	↓	↑
mean	44.07	44.07
median	41.47	41.47
sd	23.37	23.37
interquartile range	23.77	23.77
p20	29.10	29.10
p40	37.72	37.72
p60	47.80	47.80
p80	60.83	60.83
max	100	100
region corresponding to maximum value	DEF	DE6
min	0	0
region corresponding to minimum value	DE6	DE8

Table 4.33: Descriptive statistics of Living Standards sub-indexes for Germany.

Region	Relative Poverty norm score	Relative Poverty rank	Earnings and Incomes norm	Earnings and Incomes rank
DE1	20.58	3	79.45	2
DE2	19.08	2	69.39	4
DE3	50.60	12	34.19	11
DE4	37.72	7	19.71	12
DE5	41.04	8	59.09	6
DE6	0.00	1	100.00	1
DE7	29.49	5	74.91	3
DE8	67.93	14	0.00	16
DE9	35.34	6	49.39	7
DEA	29.10	4	59.40	5
DEB	48.01	11	44.92	8
DEC	75.79	15	43.71	10
DED	41.89	9	14.22	13
DEE	60.83	13	13.12	14
DEF	100.00	16	44.12	9
DEG	47.80	10	2.04	15

Table 4.34: Relative Poverty and Earnings & Incomes components for Germany: scores and ranks.

from the remaining ones. According to Earnings and Incomes sub-index there are two low scoring regions which differ considerably from the others: Mecklenburg-Vorpommern (DE8) and Thuringen (DEG).

Reordered regions, from best to worst, are shown in Figures 4.49 and 4.50 for two components. The scores displayed in the Figures are min-max transformed to facilitate interpretation.

In order to spatially visualize the distribution of the sub-indexes scores we classify the min-max normalized scores of each sub-index into five groups according to the distribution percentiles P_{20}, P_{40}, P_{60} and P_{80} and present the results in Figures 4.51 and 4.47 respectively. In both maps the darker the color the better the QoL level.

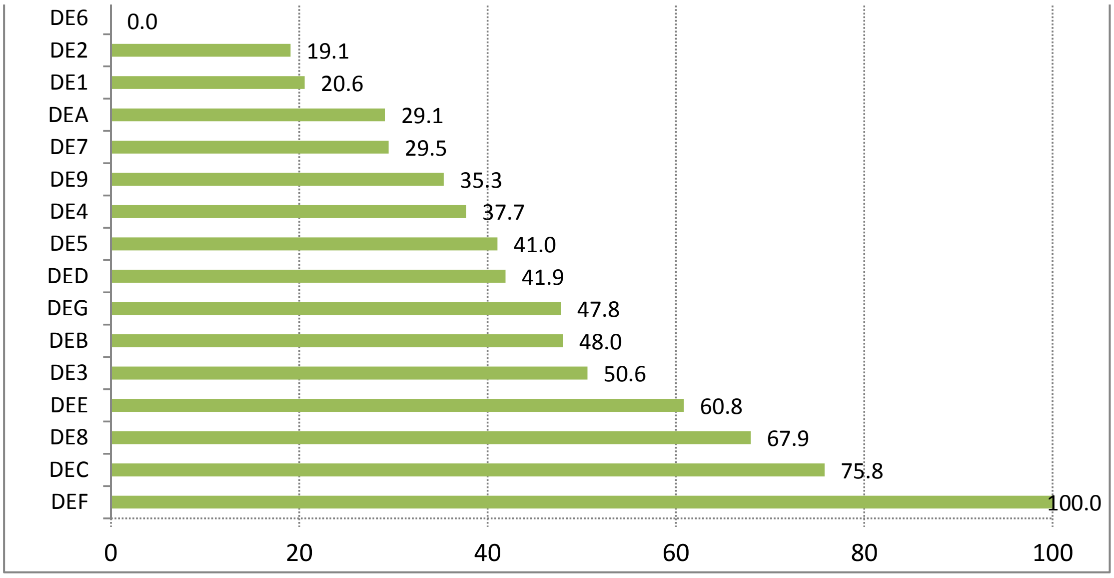


Figure 4.49: Relative Poverty component for Germany: ranking.

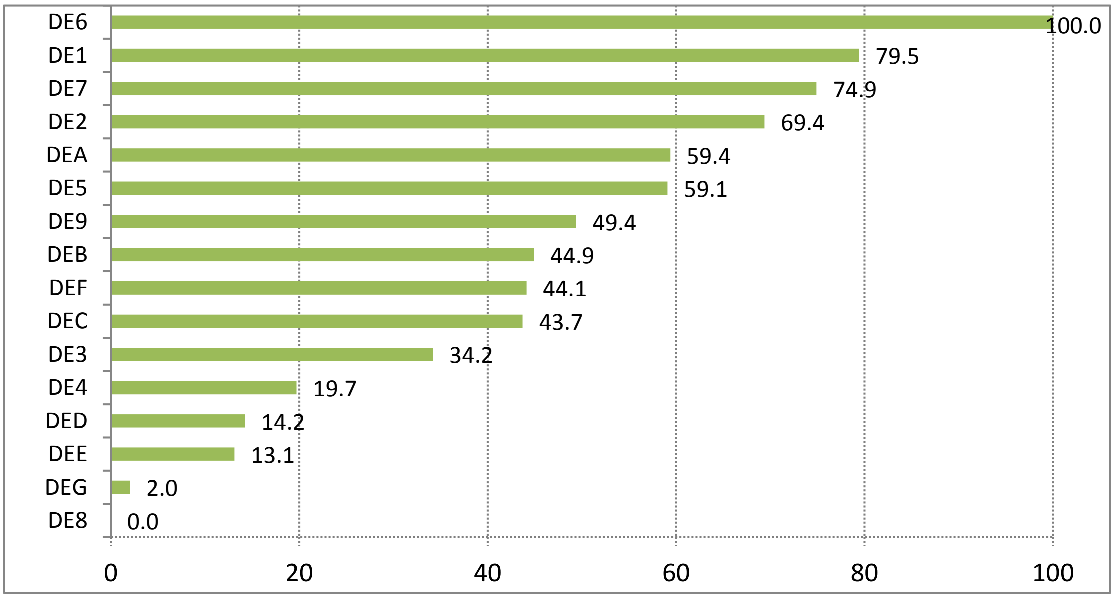
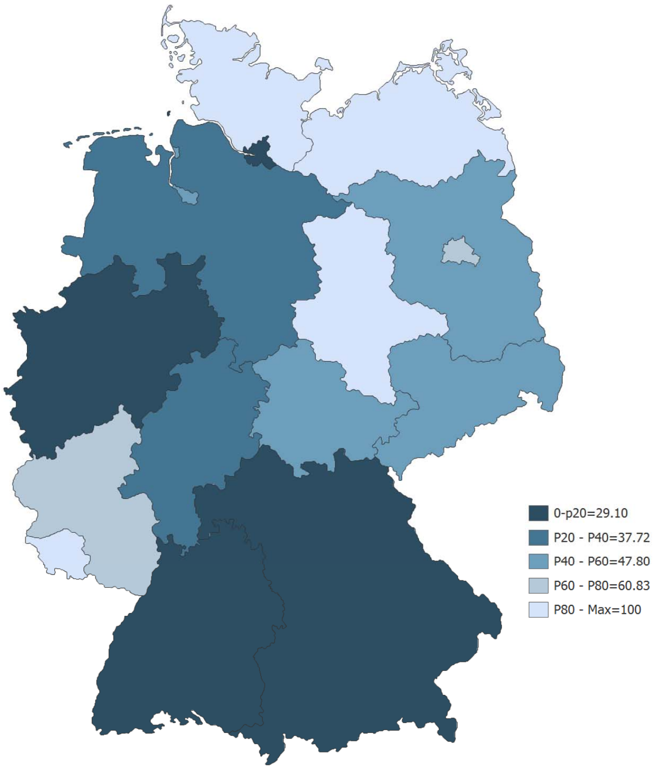
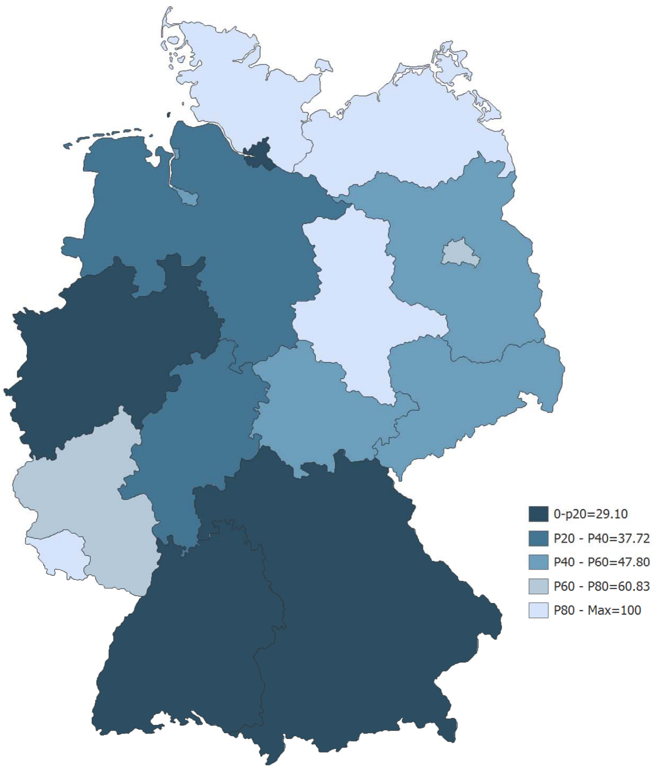


Figure 4.50: Earnings and Incomes component for Germany: ranking.



Relative poverty index - Map (normalized values recoded into five classes)



Earnings and Incomes index - Map (normalized values recoded into five classes)

Figure 4.51: Living Standards sub-indexes for Germany - Relative poverty (top) and Earnings and Incomes (bottom).

Living Standards sub-indexes for UK

As clearly stated previously the analysis for British regions should not be combined with EU-SILC analysis. However it is worthwhile to have a look at sub-national distribution of Living Standards sub-indexes. Following the structure of the previous sections we first present descriptive statistics of Relative Poverty and Earnings and Incomes sub-indexes (Table 4.35). The analysis of Absolute Poverty is not possible for USS data as not all the variables needed to the sub-index calculation are available in the survey (see section 4.1.3). Also in this case, Relative Poverty is negatively oriented and Earnings and Incomes is positively oriented with respect to QoL.

short label	RP	E&I
su-index description	Relative poverty sub-index	Earnings and incomes sub-index
source	USS 2009	USS 2009 EUSROSTAT
sub-index orientation	⇩	⇧
mean	42.97	28.68
median	40.84	17.91
sd	25.61	30.21
interquartile range	30.59	33.20
p20	18.37	3.62
p40	38.61	11.59
p60	49.90	28.12
p80	60.62	47.11
max	100	100
region corresponding to maximum value	UKI	UKI
min	0	0
region corresponding to minimum value	UKH	UKN

Table 4.35: Descriptive statistics of Living Standards sub-indexes for UK.

Sub-index scores and rankings are presented in Tables 4.36 for Relative Poverty and Earnings and Incomes respectively. Regions are presented in alphabetical order according to the region NUTS1 code with associated scores and ranks.

Reordered regions, from best to worst, are shown in Figures 4.52 and 4.53 for two components. The scores displayed in the Figures are min-max transformed.

In order to spatially visualize the distribution of the sub-indexes scores we classify the min-max normalized values of each index into five groups according to the distribution percentiles P_{20}, P_{40}, P_{60} and P_{80} and we present the results in Figures 4.54. As for all the maps in this report, the darker the color the better the QoL level.

Looking at the two rankings one can notice that there is one distinctive region - UKI = Inner and Outer London. It features the highest level of Relative Poverty with the highest level of Earnings and Incomes. This means that it is a rich region with high levels of income inequality.

Region	Relative Poverty norm score	Relative Poverty rank		Earnings and Incomes norm score	Earnings and Incomes rank
UKC	30.96	4		2.50	11
UKD	37.65	5		13.85	7
UKE	55.42	8		3.73	9
UKF	61.72	10		21.96	6
UKG	41.62	7		10.07	8
UKH	0.00	1		50.82	3
UKI	100.00	12		100.00	1
UKJ	40.05	6		73.14	2
UKK	15.22	3		32.22	5
UKL	56.24	9		3.60	10
UKM	15.01	2		32.26	4
UKN	61.73	11		0.00	12

Table 4.36: Relative Poverty and Earnings & Incomes components for UK: scores and ranks.

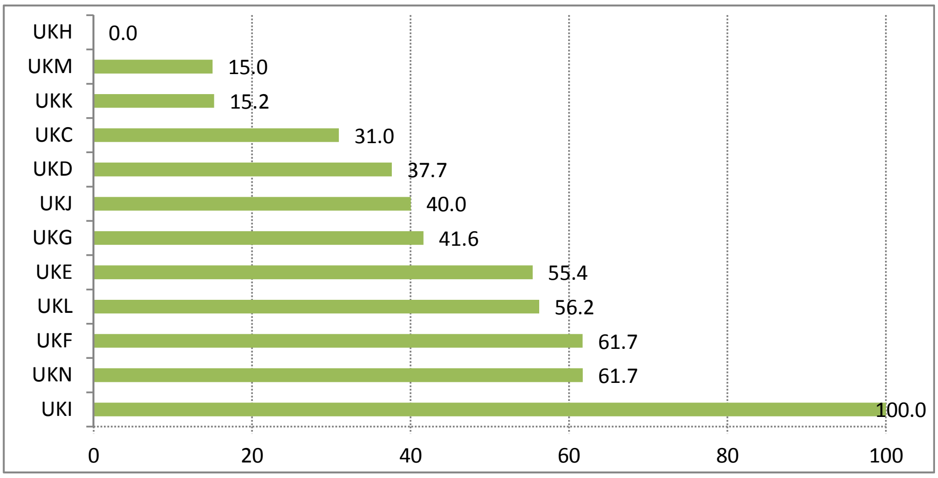


Figure 4.52: Relative Poverty component for UK: ranking.

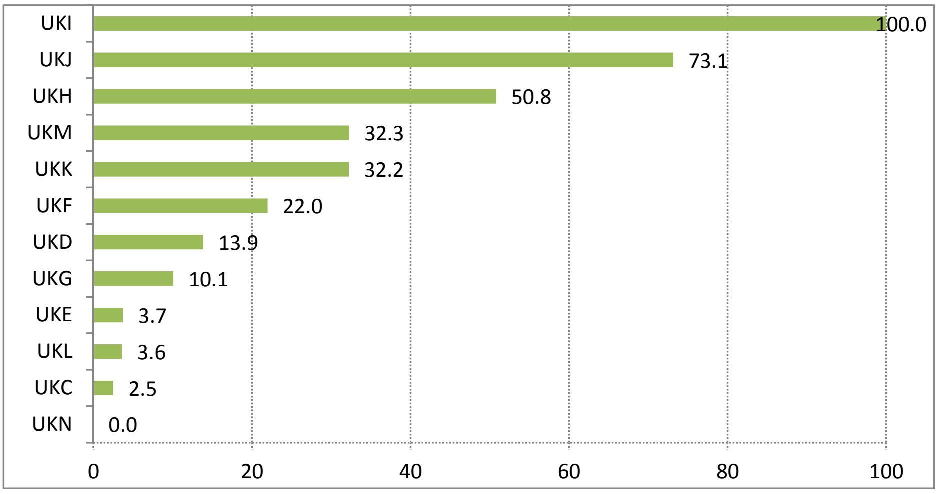
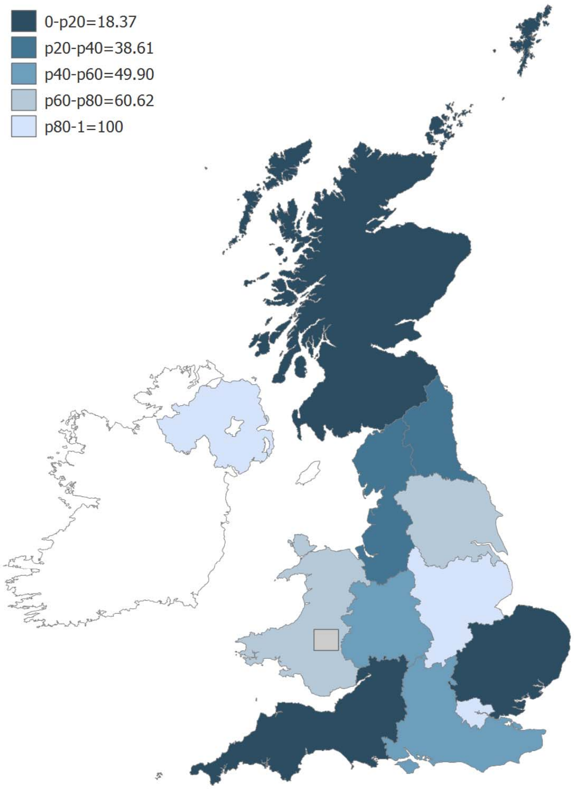
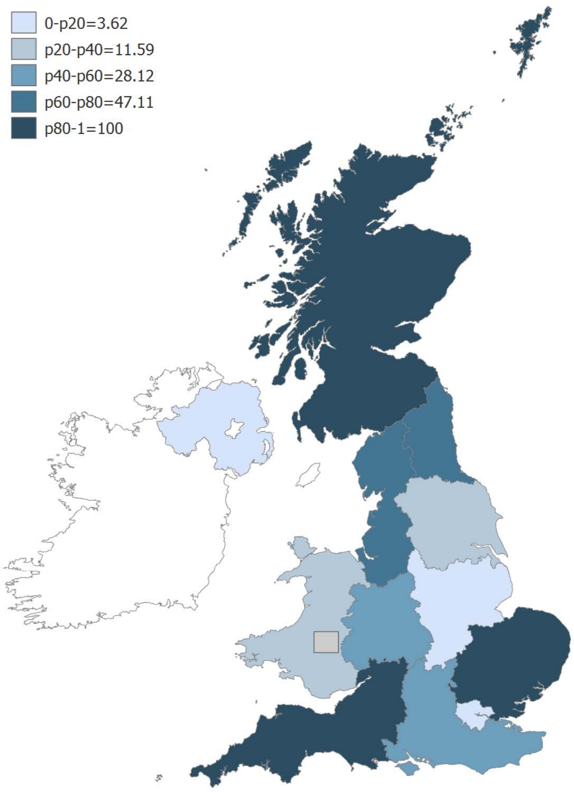


Figure 4.53: Earnings and Incomes component for UK: ranking.



Relative poverty index - Map (normalized values recoded into five classes)



Earnings and Incomes index - Map (normalized values recoded into five classes)

Figure 4.54: Living Standards sub-indexes for UK - Relative poverty (top) and Earnings and Incomes (bottom).

4.5 Living Standards components: regional rankings

The overall picture of living standards conditions in European regions is given by Table 4.37 where separate regional rankings are shown for the three components Absolute Poverty, Relative Poverty and Earnings and Incomes. The first two sub-indexes are negatively oriented while the third one is positively oriented with respect to QoL. Ranks are then computed in order to have always low ranks indicating *good* QoL and high ranks *bad* QoL. We remind the reader that sub-national data availability is linked to the availability of regional identifiers in the analysed EU-SILC waves, 2007, 2008 and 2009 (see Table 3.4).

Living Standards dimension Regional ranking (source EU-SILC 2007-2009)					Living Standards dimension Regional ranking (source EU-SILC 2007-2009)			
Region	Absolute Poverty	Relative Poverty	Earnings and Incomes		Region	Absolute Poverty	Relative Poverty	Earnings and Incomes
AT1	32	27	7		FR40	36	8	25
AT2	10	11	13		FR50	21	2	34
AT3	9	3	10		FR60	37	32	26
BE1	58	87	8		FR70	19	9	18
BE2	13	16	5		FR80	51	61	31
BE3	48	63	22		GR1	62	86	50
BG3	88	75	86		GR2	63	84	55
BG4	83	55	79		GR3	61	65	27
CY0	60	10	16		GR4	67	68	45
CZ01	23	4	12		HU1	70	6	44
CZ02	30	7	60		HU2	64	14	71
CZ03	28	5	63		HU3	76	47	77
CZ04	52	53	69		IE0	35	26	28
CZ05	46	21	65		ITC	49	30	11
CZ06	25	25	62		ITD	53	15	15
CZ07	42	35	67		ITE	57	34	20
CZ08	56	52	64		ITF	68	82	57
DE	29	70	23		ITG	74	85	56
DK	8	49	53		LT0	66	59	70
EE	54	46	73		LU0	5	24	1
ES11	39	42	43		LV0	81	71	78
ES12	24	17	24		MT0	34	18	37
ES13	15	19	32		NL	7	37	6
ES21	16	22	3		PL1	72	36	66
ES22	11	1	4		PL2	69	40	72
ES23	17	56	30		PL3	73	64	80
ES24	6	31	17		PL4	71	50	75
ES30	27	54	9		PL5	75	43	74
ES41	22	67	39		PL6	77	45	76
ES42	33	73	49		PT	65	44	59
ES43	38	81	58		RO11	85	83	83
ES51	31	58	19		RO12	84	79	84
ES52	43	60	42		RO21	87	76	88
ES53	40	66	29		RO22	86	88	87
ES61	50	77	51		RO31	78	51	85
ES62	44	78	52		RO32	82	62	61
ES70	59	74	47		RO41	80	80	82
FI13	3	38	54		RO42	79	69	81
FI18	4	23	36		SE1	18	41	14
FI19	2	33	46		SE2	14	48	38
FI1A	1	29	48		SE3	12	57	41
FR10	45	20	2		SI	55	12	35
FR20	26	13	33		SK0	47	28	68
FR30	41	39	40		UK	20	72	21

Table 4.37: Living Standards dimension: regional rankings in the three components.

From the analysis of Table 4.37 it is clear that the three sub-indexes describe poverty from completely different perspectives. The differences observed among them are rather impressive. This should suffice to explain why further aggregation is not feasible in this case. In many cases the region rank according to one sub-index is very different from its rank according to another sub-index. This is for example the case of two, out of three, NUTS1 regions in Belgium - Région de Bruxelles-Capitale plus Hoofdstedelijk Gewest Vlaams Gewest (BE1) and Région Wallonne (BE3) - which, despite a rather good level of Earnings and Incomes, have high levels of Absolute Poverty and especially Relative Poverty [9]. Other cases worth mentioning are Cyprus, two Czech regions - Stredni Cechy (CZ02), Jihozapad (CZ03) - and the Hungarian region Kozp-Magyarorszag (HU1). People living there do not experience serious poverty in relative terms but are not very well-off as these regions perform poorly on either Absolute Poverty or Earnings and Incomes. This depicts a condition of 'homogeneous poverty' where inequality is not really an issue but on average people are not wealthy. The opposite can be said for UK, where good levels of Earnings and Incomes and Material Deprivation sub-indexes correspond to high levels of relative poverty. This signals the presence of serious pockets of poverty in a country with high inequality and the region most responsible for this if the London region, as shown by the sub-national analysis based on USS (see Section 4.4.7).

It is important to remark that our analysis is based on an adjusted disposable income which includes housing costs - HC - for EU-SILC derived indicators (Section 4.2.1). Housing costs are included in the computation of both the individual income and the poverty line. For checking what influence this might have on regional rankings, the same sub-indexes are computed on the basis of the classical EU-SILC definition of disposable income. Regional rankings based on the non-adjusted disposable income are shown in Tables 4.38 and 4.39 where they are compared with the ones based on adjusted disposable income. Only the components directly depending on disposable income are presented.

The analysis of Tables 4.38 and 4.39 clearly indicates that, as expected, housing costs do matter and, in some cases, matter a lot.

The Relative Poverty component is particularly affected by the inclusion of housing costs. We can separately consider (1) regions where the inclusion of housing costs causes a lower estimate of the level of relative poverty (negative differences) and (2) regions where the inclusion of housing costs has the effect of increasing the level of relative poverty (positive differences). Figure 4.55 shows the two groups of regions. Most top regions/countries are those for which not including housing costs has the effect of underestimating the level of relative poverty (more people are considered poor with the inclusion of HC). The opposite happens for the lower group of regions/countries in Figure 4.55 where the inclusion of housing costs has the effect of decreasing the level of relative poverty (people are assumed to be richer). The former group of regions are those where HC are a relevant component of cost of living, thus reflecting relatively high HC, while in the latter group HC are relatively cheaper.

The Earning and Incomes component is affected to a lesser extent by the inclusion of housing costs than the Relative Poverty component. This is due to the fact that only one out of three indicators is actually affected by the inclusion of housing costs (I1=median income in PPS that is directly computed from EU-SILC). Figure 4.56 shows the different groups of regions. The ones located on the top part of the picture are those where housing costs are relatively high so that their inclusion has the effect of decreasing the overall, effective level of Earnings and Incomes. We can see that the country which 'wins' is by far United Kingdom. Unfortunately a sub-national analysis is not possible for UK, not even by considering the USS survey as it does not provide any comparable variable on housing costs.

[9] A total of 88 regions are included in the analysis.

COUNTRY	region label	REGIONAL RANKING							
		RELATIVE POVERTY SUB-COMPONENT				EARNINGS AND INCOMES SUB-COMPONENT			
		WITHOUT HC	WITH HC	DIFFERENCE		WITHOUT HC	WITH HC	DIFFERENCE	
AT	AT1	28	27	↑	-1	7	7	○	0
AT	AT2	22	11	↑	-11	16	13	↑	-3
AT	AT3	8	3	↑	-5	11	10	↑	-1
BE	BE1	75	87	↓	12	5	8	↓	3
BE	BE2	12	16	↓	4	6	5	↑	-1
BE	BE3	52	63	↓	11	22	22	○	0
BG	BG3	78	75	↑	-3	86	86	○	0
BG	BG4	57	55	↑	-2	79	79	○	0
CY	CY0	31	10	↑	-21	20	16	↑	-4
CZ	CZ01	1	4	↓	3	10	12	↓	2
CZ	CZ02	3	7	↓	4	59	60	↓	1
CZ	CZ03	2	5	↓	3	63	63	○	0
CZ	CZ04	36	53	↓	17	69	69	○	0
CZ	CZ05	4	21	↓	17	65	65	○	0
CZ	CZ06	5	25	↓	20	62	62	○	0
CZ	CZ07	14	35	↓	21	67	67	○	0
CZ	CZ08	33	52	↓	19	64	64	○	0
DE	DE	51	70	↓	19	15	23	↓	8
DK	DK	32	49	↓	17	49	53	↓	4
EE	EE	64	46	↑	-18	73	73	○	0
ES	ES11	69	42	↑	-27	45	43	↑	-2
ES	ES12	47	17	↑	-30	27	24	↑	-3
ES	ES13	48	19	↑	-29	33	32	↑	-1
ES	ES21	40	22	↑	-18	4	3	↑	-1
ES	ES22	11	1	↑	-10	8	4	↑	-4
ES	ES23	61	56	↑	-5	30	30	○	0
ES	ES24	50	31	↑	-19	21	17	↑	-4
ES	ES30	44	54	↓	10	9	9	○	0
ES	ES41	71	67	↑	-4	40	39	↑	-1
ES	ES42	77	73	↑	-4	51	49	↑	-2
ES	ES43	86	81	↑	-5	58	58	○	0
ES	ES51	53	58	↓	5	19	19	○	0
ES	ES52	65	60	↑	-5	43	42	↑	-1
ES	ES53	58	66	↓	8	28	29	↓	1
ES	ES61	85	77	↑	-8	53	51	↑	-2
ES	ES62	83	78	↑	-5	54	52	↑	-2
ES	ES70	81	74	↑	-7	48	47	↑	-1
FI	FI13	37	38	↓	1	55	54	↑	-1
FI	FI18	9	23	↓	14	37	36	↑	-1
FI	FI19	27	33	↓	6	47	46	↑	-1
FI	FI1A	24	29	↓	5	50	48	↑	-2
FR	FR10	15	20	↓	5	2	2	○	0
FR	FR20	19	13	↑	-6	32	33	↓	1
FR	FR30	43	39	↑	-4	38	40	↓	2

Table 4.38: Living Standards dimension: regional rankings comparisons without and with housing costs. The difference is computed as rank with HC and rank without HC.

In summary, the analysis of EU-SILC, 2007-08-09 waves, clearly indicates that the inclusion of housing costs is a big source of variation in living costs and, therefore, in disposable income. Moreover the effect of inclusion of housing costs is not equal for all regions. Not adjusting for differences in housing costs leads to a relevant overestimation of poverty in low cost areas and an underestimation of poverty in high cost areas.

COUNTRY	region label	REGIONAL RANKING					
		RELATIVE POVERTY SUB-COMPONENT			EARNINGS AND INCOMES SUB-COMPONENT		
		WITHOUT HC	WITH HC	DIFFERENCE	WITHOUT HC	WITH HC	DIFFERENCE
FR	FR40	17	8	-9	25	25	0
FR	FR50	7	2	-5	34	34	0
FR	FR60	29	32	3	26	26	0
FR	FR70	13	9	-4	18	18	0
FR	FR80	55	61	6	29	31	2
GR	GR1	73	86	13	46	50	4
GR	GR2	76	84	8	52	55	3
GR	GR3	41	65	24	23	27	4
GR	GR4	60	68	8	44	45	1
HU	HU1	6	6	0	42	44	2
HU	HU2	10	14	4	71	71	0
HU	HU3	38	47	9	76	77	1
IE	IE0	35	26	-9	31	28	-3
IT	ITC	25	30	5	12	11	-1
IT	ITD	16	15	-1	17	15	-2
IT	ITE	46	34	-12	24	20	-4
IT	ITF	84	82	-2	57	57	0
IT	ITG	87	85	-2	56	56	0
LT	LT0	67	59	-8	70	70	0
LU	LU0	23	24	1	1	1	0
LV	LV0	72	71	-1	78	78	0
MT	MT0	30	18	-12	39	37	-2
NL	NL	21	37	16	3	6	3
PL	PL1	39	36	-3	66	66	0
PL	PL2	42	40	-2	72	72	0
PL	PL3	70	64	-6	80	80	0
PL	PL4	54	50	-4	75	75	0
PL	PL5	49	43	-6	74	74	0
PL	PL6	56	45	-11	77	76	-1
PT	PT	59	44	-15	61	59	-2
RO	RO11	82	83	1	83	83	0
RO	RO12	79	79	0	84	84	0
RO	RO21	80	76	-4	88	88	0
RO	RO22	88	88	0	87	87	0
RO	RO31	62	51	-11	85	85	0
RO	RO32	68	62	-6	60	61	1
RO	RO41	74	80	6	82	82	0
RO	RO42	66	69	3	81	81	0
SE	SE1	26	41	15	13	14	1
SE	SE2	34	48	14	35	38	3
SE	SE3	45	57	12	41	41	0
SI	SI	18	12	-6	36	35	-1
SK	SK0	20	28	8	68	68	0
UK	UK	63	72	9	14	21	7

Table 4.39: Living Standards dimension: regional rankings comparisons without and with housing costs. The difference is computed as rank with HC and rank without HC (continue).

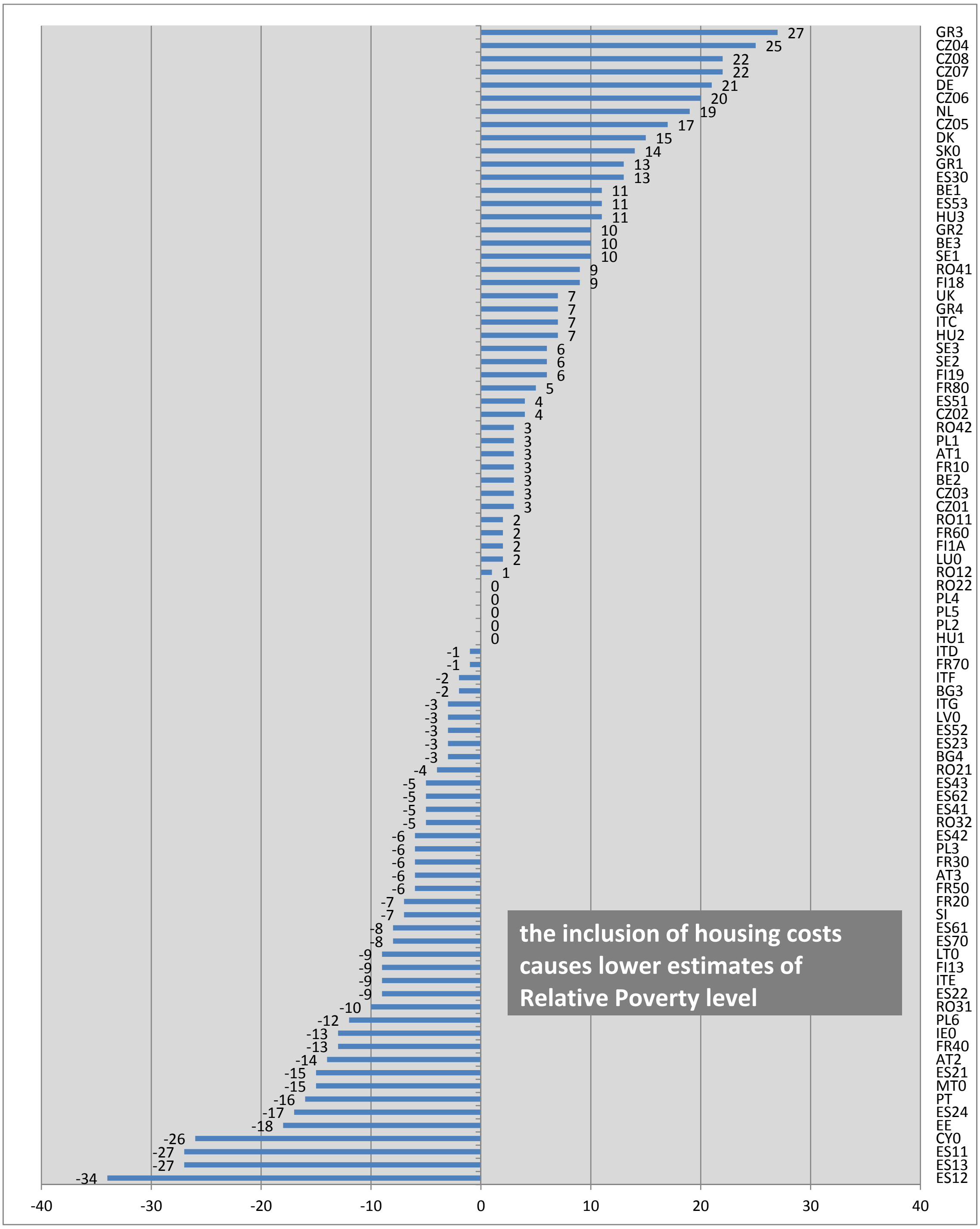


Figure 4.55: Relative Poverty component: regional rankings comparisons without and with housing costs. The difference is computed as rank with HC and rank without HC.

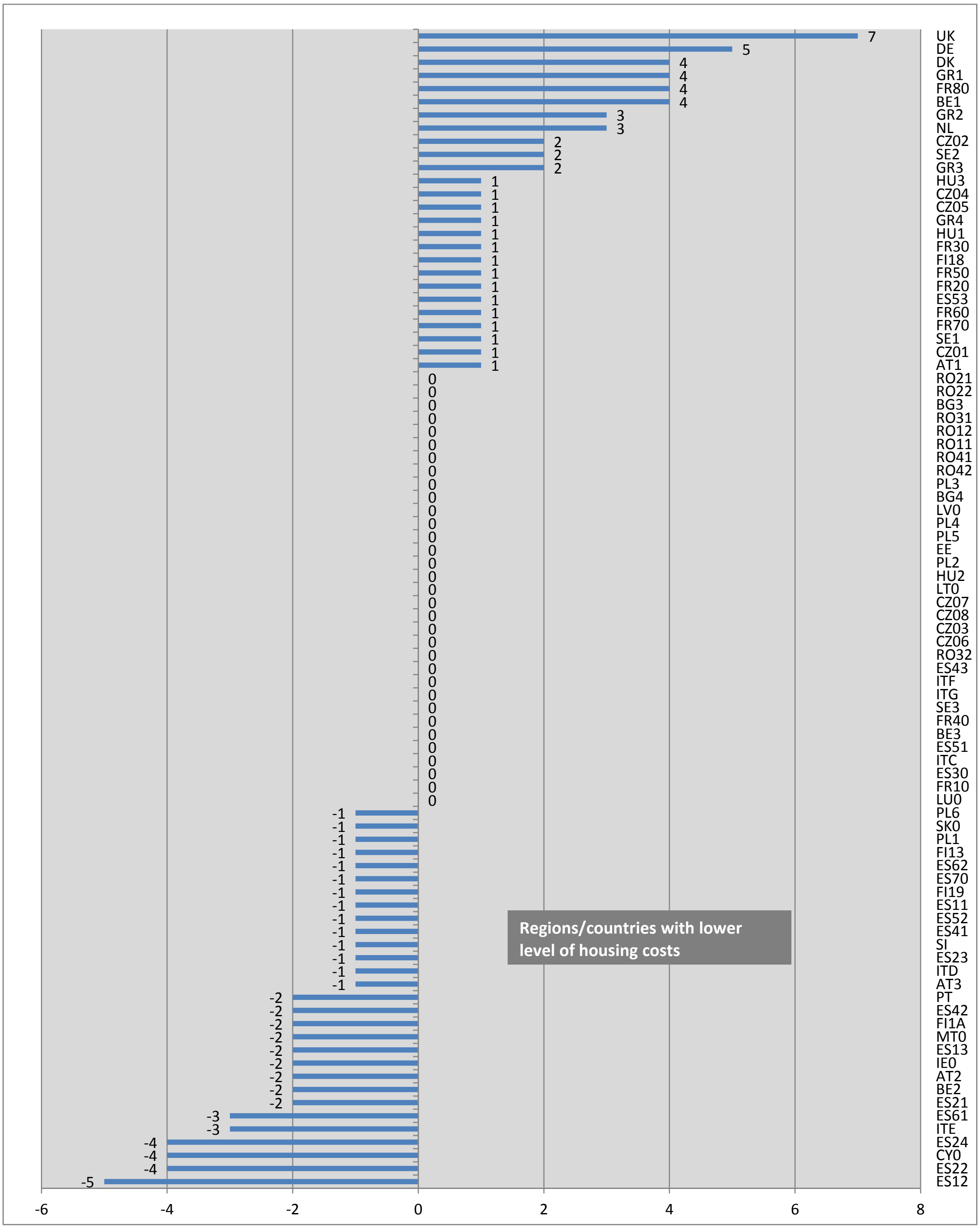


Figure 4.56: Earnings and Incomes component: regional rankings comparisons without and with housing costs. The difference is computed as rank with HC and rank without HC.

4.6 Perceived standards of living

In order to be in line with the most recent recommendations on the measurement of well-being (see Chapter 2) we tried to include in each dimension of QoL a part describing citizens' perceptions. In order to measure the perception of standard of living one variable from the European Quality of Life Survey (EQLS) 2007 describing current satisfaction with the present standard of living is analysed. In total 24 countries are analysed. The sample size is around 1000 per country. For France, Italy, Poland and the UK the sample size is approximately 1500, while in Germany 2000. In most of the countries, the households were selected using a multi-stage, stratified and clustered design with a random walk procedure. The overall response rate was 57.9% with significant country variations in response rates ranging from 88% in Romania to 33.5% in the UK. The survey can be considered representative at the country level only. Data are downloaded from the EurLIFE (an interactive database on quality of life in Europe). The variable is measured on a qualitative scale that ranges from 1 to 10, where 1 means 'very dissatisfied' and 10 means 'very satisfied' with the present standard of living. Figure 4.57 shows the countries ranked according to the mean score of perceived standard of living from EQLS 2007.

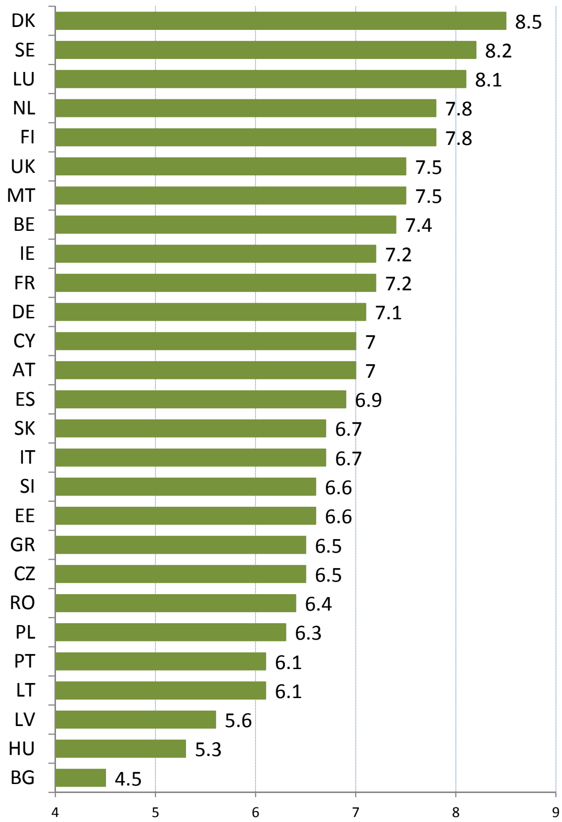


Figure 4.57: Mean score, on a scale 1-10 (the higher the better), of the perceived standard of living (source EQLS 2007).

Chapter 5

Health

Individual health condition, both objective and self-assessed, and a good health-care are basic needs for a society welfare. They are indeed basic functionings constituting the necessary condition for higher aspirations. Similarly to the Living Standards dimension, the description of all the different aspects related to the concept of health requires a multidimensional approach.

Both objective and self-reported measures of health are included in this dimension but kept separated into different health components. The aim is to describe health in terms of individuals' ability to work as well as wellness status, both important aspects when measuring health related factors of QoL. For instance, indicators on the presence of chronic illness or activity limitations due to health conditions, available in EU-SILC as self-reported variables, are important to describe the capability to work. Objective measures of health, like infant mortality and life expectancy, are more suitable to describe the general health condition of individuals.

A huge literature is available on different types of health measures and both advantages and flaws have been discussed in relation to objective and self-reported measures of health. The main argument against self-reported measures is that subjective judgments on personal health are not entirely comparable across respondents and, in general, internal assessments are seriously limited by the individual's social experience (Sen, 2002). In self-reported measures, the likelihood of false negative reporting, which happens when an individual does not report to have a chronic illness or activity limitation when in fact she or he has it, is generally related to income and social conditions and is higher for individuals living in low-income households (Sen, 2002; Johnston et al., 2007). In other words, there is a problem of awareness. As discussed later in this report, we anticipate here that the indicators of chronic illness and activity limitations, extracted from EU-SILC micro-data and initially included in our analysis, had been detected as somehow 'misbehaving' by multivariate analysis and were therefore excluded from further analysis.

On the other hand, some authors argue in favor of using self-reported information: some emphasize that self-reported measures of health are better than most of objective ones as less flawed (Bound, 1991); others claim the existence of a large literature which documents the validity of selfreported health measures. Poor self-reported health has been found strongly correlated with mortality even after controlling for indices of functional capacity, the presence of specific medical conditions, and physician health assessments (from Rosen and Wu (2004), p. 462).

Taking into account these premises together with data availability and sub-national level coverage, our Health dimension consists of two components: Objective Health, derived from Eurostat regional statistics and measured at the NUTS2 level, and Subjective Health, derived from EU-SILC data and measured at the NUTS1/NUTS2 level for most member states (Figure 5.1).

Besides, a measure of the perceived quality of the health-care system is derived from a specific Eurobarometer - Special Eurobarometer EB 327 on Patient Safety and quality of healthcare - but referes to the national level only.

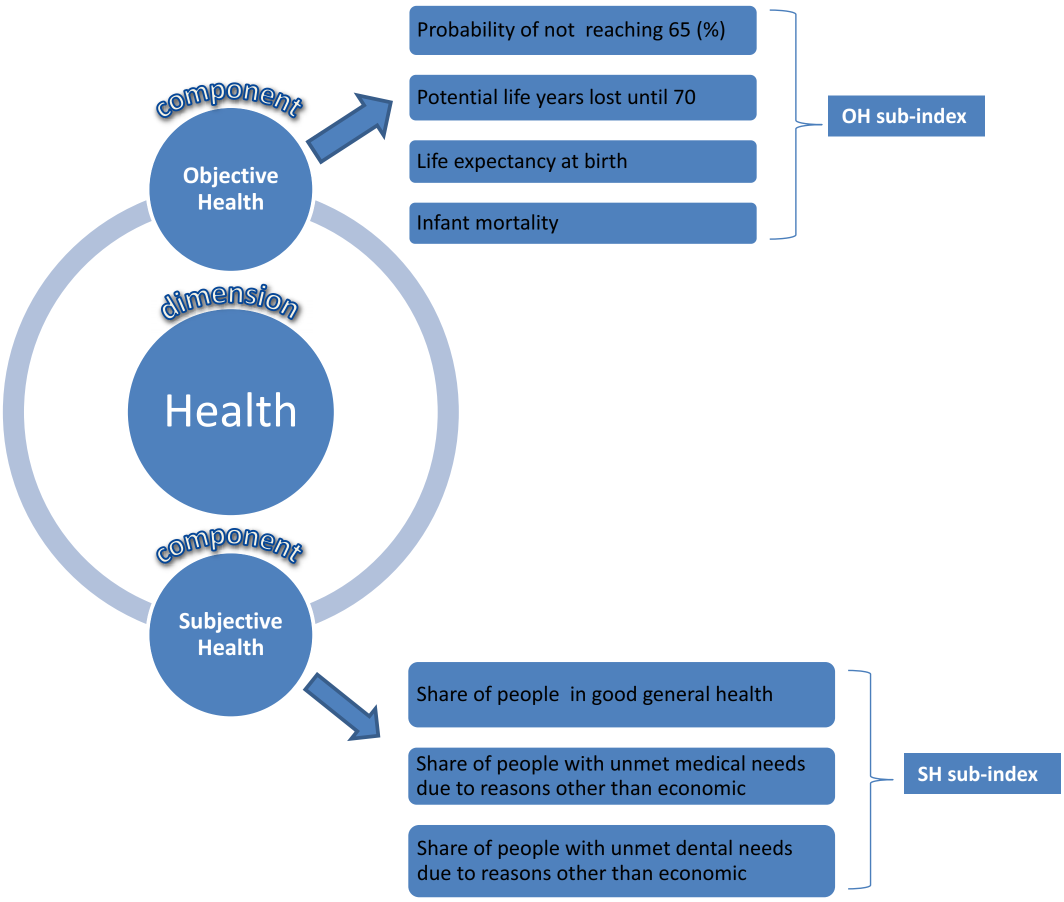


Figure 5.1: Health dimension: framework.

5.1 Objective health

Indicators listed in Table 5.1 are included as objective measures of health. They are meant to measure the actual effectiveness of the health-care system: for example, a region where infant mortality is low and life expectancy is high is likely to have a health-care with good prevention schemes during pregnancy and during the whole life-cycle of an individual.

indicators	**source**	**geographical level**	**unit of measurement**	**reference years**
probability of not reaching age of 65	Eurostat Regional Demographic Statistics	NUTS2	population share as a percentage	average 2007-2009
Potential life years lost until age of 70	Eurostat Regional Demographic Statistics	NUTS2	number of years	average 2007-2009
Life expectancy at birth	Eurostat Regional Demographic Statistics	NUTS2	number of years	average 2007-2009
Infant mortality	Eurostat Regional Demographic Statistics	NUTS2	number of deaths of children under 1 year of age during the year to the number of live births in that year	average 2007-2009

Table 5.1: Indicators included in the Objective Health component

All the indicators are derived from Eurostat - Regional Demographic Statistics, which means that they describe objective health concept at NUTS2 level (270 regions).

5.2 Subjective health

In line with the most recent recommendations on the measurement of well-being (see Chapter 2) we tried to include in each dimension of QoL a part describing citizens' perceptions. In order to measure the perception of health and health-care system data from the following surveys have been analyzed:

1. The European Union Statistics on Income and Living Conditions (EU-SILC) (see Section 3.1)
2. European Social Survey (ESS)
3. European Quality of Life Survey (EQLS)
4. European Working Conditions Survey (EWCS)
5. German Social Economic Panel (SOEP)
6. Understanding Society - UK Household Longitudinal Study (USS)

Our first choice is always EU-SILC, because it has greater sample sizes, which is of paramount importance here as the attempt is to provide a picture at the regional level. When the same or similar questions are present both in EU-SILC and in another survey, the one from EU-SILC is preferred. Such a situation occurred with respect to ESS and EQLS surveys. ESS includes questions about general health and limitation of the daily activities due to longstanding illness, disability, infirmity or mental health problems. EQLS also includes questions on general health, longstanding physical and mental health problem, illness or disability and limitation of the daily activities due to physical or mental health problem, illness or disability. In both cases there are not more questions concerning health which are not already present in EU-SILC.
EWCS also includes questions related o health issues but they mostly refer to the working conditions. Due to that our decision was not using ESS, EQLS and EWCS.

5.2.1 EU-SILC

From EUSILC indicators listed in 5.2 from 2007, 2008 and 2009 waves have been extracted and appropriately recoded. The geographical level of the indicators is the lowest possible: NUTS2 wherever possible, NUTS1 or country level in the other cases. Table 3.1 in Section 3.1 lists the lowest possible geographical level in different EU-SILC surveys. All the indicators are recoded in order to have the higher the value the better the QoL level.
The first three indicators in Table 5.2 describe the self-perceived health condition in general and with respect to long-standing illnesses and/or limitations in activities. They are simply recoded to compute, within each region, the percentage of persons in good conditions. The last two indicators, unmet medical and dental need, are in connection with economic constraints when in need of some health treatment. They shall be considered in conjunction with the reasons for the unmet need. If the respondent experienced unmet need, she is asked a second question about the cause, indicators PH050 and PH070 for medical and dental unmet need respectively. This second question allows for a more detailed analysis of the pathways of unmet need for health-care. The possible different causes play a different role with respect to our final goal. These are:

1. cannot afford: economic issues
2. waiting list: system efficiency
3. no time because of work, kids care or others: personal reasons
4. too far to travel/no means of transportation: accessibility
5. fear of doctor/hospitals/examination/treatment: personal reasons
6. prefer to wait and see if problems gets better: personal reasons
7. do not know any good doctor: system quality/trust
8. other reasons: not classifiable

In our case it is clearly not relevant to detail all the alternatives. We instead chose to classify the reasons for unmet needs into four broader categories: reason 1 stands by itself being related to economic constraints, i.e. *affordability*. Reasons 2, 4 and 7 are all recoded in the same way as they are related to not strictly economic factors as system *efficiency* (waiting list), *accessibility* (too far too travel) and system *quality/trust* (no knowledge of any good doctor); reasons 3, 5, 6 and 8 are of minor relevance as they are related to characteristics of the individual. Last, the best possible scenario is of course when the respondent declares that there was no unmet need. Following this classification, unmet medical and dental need are both recoded as described in Table 5.2.

Two variables are then computed from the recoded and combined EU-SILC variables to compute: 1. the percentage of people who experienced unmet need due to economic constraints and hence could not afford the medical or dental treatment and 2. the percentage of people who decided not to go for treatment because of issues related to efficiency, accessibility and/or quality. Variables related to affordability, for either medical or dental treatments, is not included in the Health dimension but in the Absolute poverty component of Living Standards (Section 4). The percentage of people falling in category 2, for both medical and dental unmet need, is instead used as a variable describing issues related to major reasons not due to economic problems which is included in the Health dimension.

The original EUSILC personal cross sectional weights used for all household members aged 16 and over - called PB040 in the survey - are used as sample weights for all the variables and all the countries with the exception of Denmark, Finland, Slovenia and Sweden.[1] These four countries adopt a different sampling approach as they do not interview all eligible household members to collect variables. In these cases the correct weight is the personal cross-sectional weight used for selected respondent - PB060.

5.2.2 SOEP and USS

To supply the lack of EU SILC data at the regional level for big countries like Germany and the United Kingdom, national household surveys are also considered: the German Social Economic Panel (SOEP, for *SOzio-OEkonomisches* Panel) and the Understanding Society - UK Household Longitudinal Study (USS)(see Section 3.3 for a short description of the surveys). Data in the surveys are longitudinal so only one year is considered in our analysis (the year which is closest to 2009, that is the most recent year in EUSILC). For each survey the lowest possible geographical level is the NUTS1 level, with all the limits discussed in 3.5 linked to the sub-national use of data from surveys designed to be representative at the national level only. Health variables from these national surveys are recoded in the attempt to make them as comparable as possible to the ones extracted from EU SILC.

In Table 5.3 variables from the SOEP German survey are listed together with the recoding procedure adopted in order to make these variables as comparable as possible to the EUSILC ones. Some comments are due with this regard. The question on General Health is slightly different as it refers to the current health, thus including temporary diseases, while EUSILC the question refers clearly to general rather than the present state of health. This may cause the German variable to slightly under-estimate the health condition with respect to the EUSILC one (as German data include also temporary illnesses). As for Activity Limitations, the SOEP survey is more specific than EUSILC. To cope with that, we recode the three types of limitations into a combined dichotomous indicator which is equal to 0 whenever the respondent declares to have at least one type of limitation. Unfortunately no information about unmet need with regard to health issues is collected in the German survey.

[1]To detect the countries with a different sampling approach we used the flag EUSILC variable ‘PB060_f ’which has value 1 in case the country does not interview all eligible household members.

indicator (EUSILC code)	**source**	**measured aspect**	**original categories**	**recoded categories (the higher the better)**
General Health (PH010)	EU SILC personal data (P-file)	Self-perceived general state of health	bad - very bad very good - good - fair	{bad - very bad} → {0} {very good - good - fair} → {1}
Chronic Illness (PH020)	EU SILC personal data (P-file)	Suffering from any chronic illness or condition	yes - no	{yes} → {0} {no} → {1}
Activity Limitations (PH030)	EU SILC personal data (P-file)	Limitation in activities because of health problems	strongly limited - limited not limited	{strongly limited - limited} → {0} {not limited} → {1}
Unmet medical need (PH040 and PH050)	EU SILC personal data (P-file)	Unmet need for medical examination or treatment on at least one occasion	yes (cannot afford) yes (waiting list, too far, do not know any good doctor) yes (minor reasons) no, never occurred	{yes, cannot afford} → {1} {yes, waiting list, . . .} → {2} {yes, minor reasons} → {3} {no} → {4}
Unmet dental need (PH060 and PH070)	EU SILC personal data (P-file)	Unmet need for dental examination or treatment on at least one occasion	yes (cannot afford) yes (waiting list, too far, do not know any good doctor) yes (minor reasons) no, never occurred	{yes, cannot afford} → {1} {yes, waiting list, . . .} → {2} {yes, minor reasons} → {3} {no} → {4}

Table 5.2: EU-SILC indicators included in the Subjective Health component of *Health*

The sample weights used for SOEP health data are the ones provided by The German Social Economic Panel (SOEP) for cross-sectional analysis and for individuals (individual-level weights YPHRF for 2008 and ZPHRF for 2009). The weights are described in more detail in Section 3.2.2. The UK-USS survey includes questions on

general health, chronic health problems or disabilities and limitations in activities. Table 5.4 lists original variables and recoded ones. USS is a longitudinal survey which started in 2009 and is carried out every year. The data from the first wave have already been available. No data on unmet need with regard to health issues are included in this survey either.

The sample weights used for USS health data are the ones provided in the original database for cross-sectional analysis and for individuals (full interview, respondent aged 16+, variable original name a_indpxus.xw). The weights are described in more detail in Section 3.3.2.

Some slight differences with respect to EUSILC variables are present in this case as well. However the questions about general health and chronic illness are comparable very well. They differ in several words but their meaning is almost perfectly the same. Similarly to the SOEP case, the two indicators referring to activity limitations are merged into a single dichotomous one which has the value of 0 when the respondent has at least one type of limitation.

indicator (SOEP label)	**reference year**	**measured aspect**	**original categories**	**recoded categories (the higher the better)**
General Health (zp95)	2009	Self-perceived current state of health	poor -bad satisfactory - good - very good	{poor - bad} → {0} {very good - good - satisfactory} → {1}
Chronic Illness (zp103)	2009	Suffering for at least one year or chronically from any illness	yes - no	{yes} → {0} {no} → {1}
Activity Limitations - stairs (yp100) (combined together with yp101 and yp102)	2008	Limitation when ascending stairs	greatly limited slightly limited - not at all	{greatly limited} → {0} {slightly or not limited} → {1}
Activity Limitations - tiring tasks (yp101) (combined together with yp100 and yp102)	2008	Limitation when coping with tiring everyday tasks	greatly limited slightly limited - not at all	{greatly limited} → {0} {slightly or not limited} → {1}
Activity Limitations - work/everyday tasks (yp102) (combined together with yp100 and yp101)	2008	Limitation when coping with tasks at work, everyday tasks or social activity (only subquestions 102.07 and 102.10 selected)	always - often - sometimes almost - never	{always, often or sometimes} → {0} {almost or never limited} → {1}

Table 5.3: SOEP indicators included in the Subjective Health component of *Health*

indicator (USS label)	**reference year**	**measured aspect**	**original categories**	**recoded categories (the higher the better)**
General Health (a_sf1)	2009	Self-perceived general state of health	poor - fair good - very good - excellent	{fair - poor} → {0} {excellent - very good - good} → {1}
Chronic Illness (a_health)	2009	Suffering from any long-standing illness or impairment	yes no	{yes} → {0} {no} → {1}
Activity Limitations - moderate activities (a_sf2a) (combined together with a_sf2b)	2009	Limitation in daily typical activities	yes, limited a lot yes, limited a little no	{yes, limited a lot yes, limited a little} → {1} {no} → {0}
Activity Limitations - climbing stairs (M6) (combined together with a_sf2a)	2009	Limitation in climbing stairs	yes, limited a lot yes, limited a little no	{yes, limited a lot - yes, limited a little} → {1} {no} → {0}

Table 5.4: USS indicators included in the Subjective Health component of *Health*

5.3 The Health dimension: Statistical Assessment

5.3.1 Univariate analysis

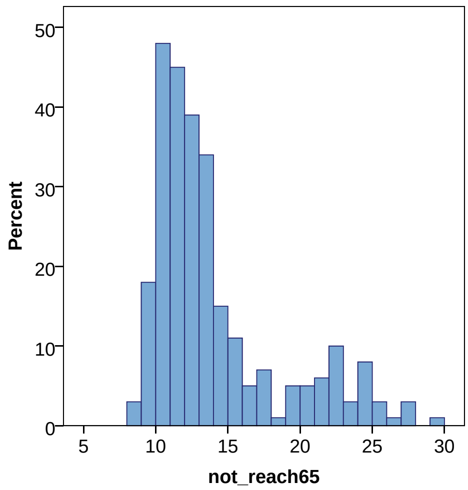
Objective Health

Table 5.5 shows the descriptive statistics for the indicators included in Objective Health component. For each indicator, apart from basic statistics, we present its orientation, upward (downward) arrow meaning positive (negative) orientation, and the regions corresponding to the extreme values. Histograms are shown in Figure 5.2.

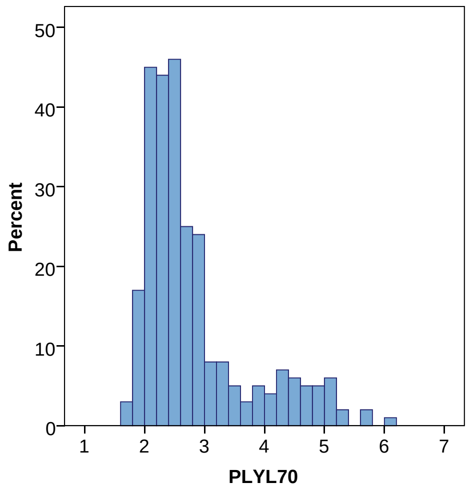
short label	not_reach65	PLYL70	life_exp	inf_mort
indicator description	probability of not reaching age of 65 (%)	Potential life years lost until age of 70	life expectancy at birth	infant mortality
source	EUROSTAT	EUROSTAT	EUROSTAT	EUROSTAT
indicator orientation	⇩	⇩	⇧	⇩
mean	14.07	2.82	79.37	4.23
sd	4.50	0.90	2.63	1.99
cv	0.32	0.32	0.03	0.47
skewness	1.41	1.48	-1.20	2.13
kurtosis	4.07	4.40	3.50	8.26
p25	10.99	2.21	78.60	3.08
p50	12.52	2.51	80.20	3.73
p75	15.08	2.99	81.27	4.64
interquartile range	4.09	0.78	2.67	1.57
max	29.25	6.07	82.95	12.50
region corresponding to maximum value	LT00	LT00	ITE3	BG34
min	8.50	1.75	72.03	1.13
region corresponding to minimum value	ITE3	ITE3	LT00	FI20

Table 5.5: Descriptive statistics of objective health indicators.

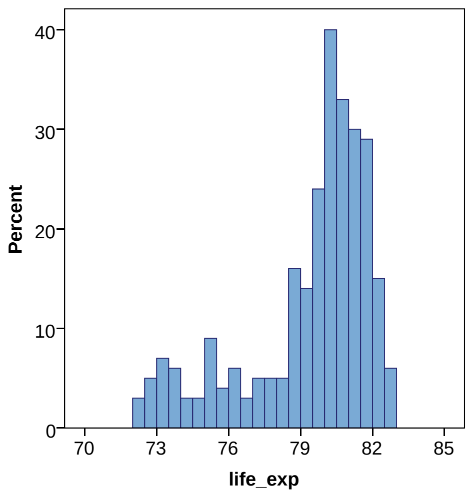
To better illustrate the performance of EU regions according to the objective health indicators, for each indicator a map is provided where regions are classified into five groups according to the indicator's percentile values P_{20}, P_{40}, P_{60} and P_{80} (Figures 5.3 and 5.4).



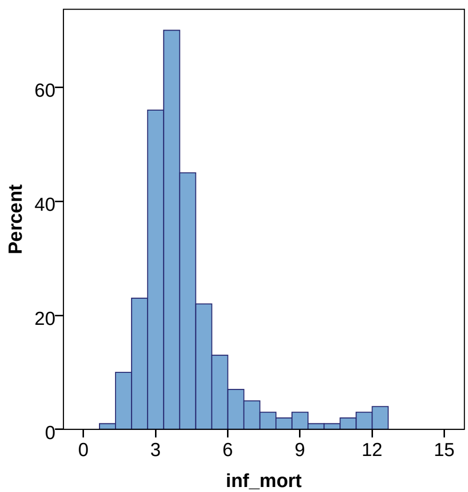
Prob. of not reaching 65



Potential years lost until 70

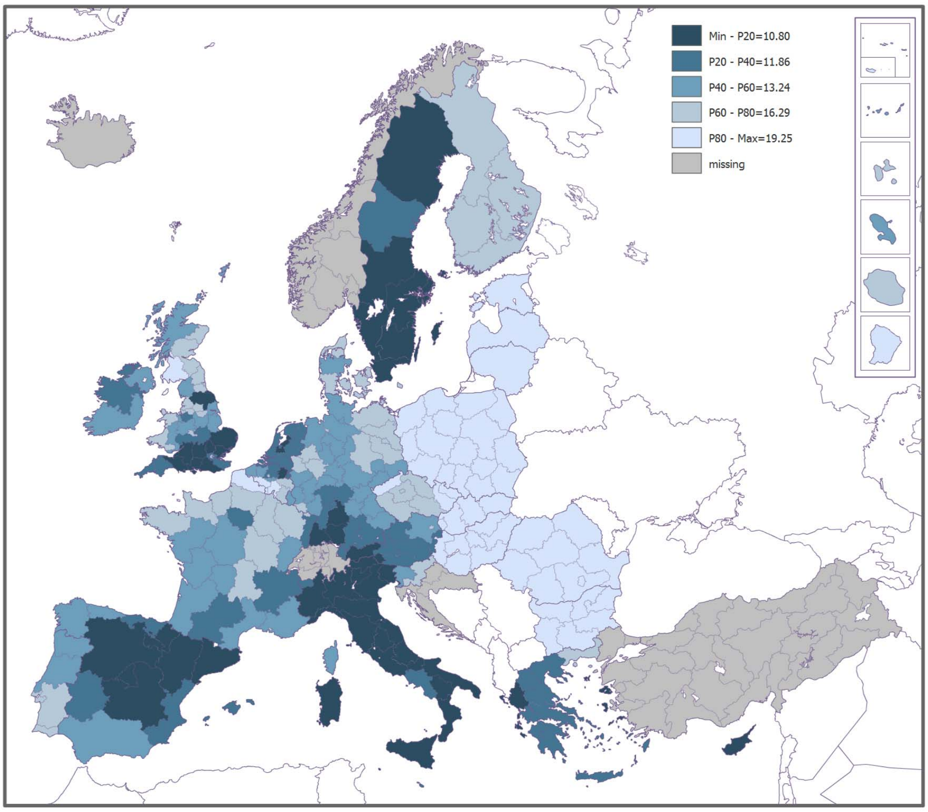


Life expectancy

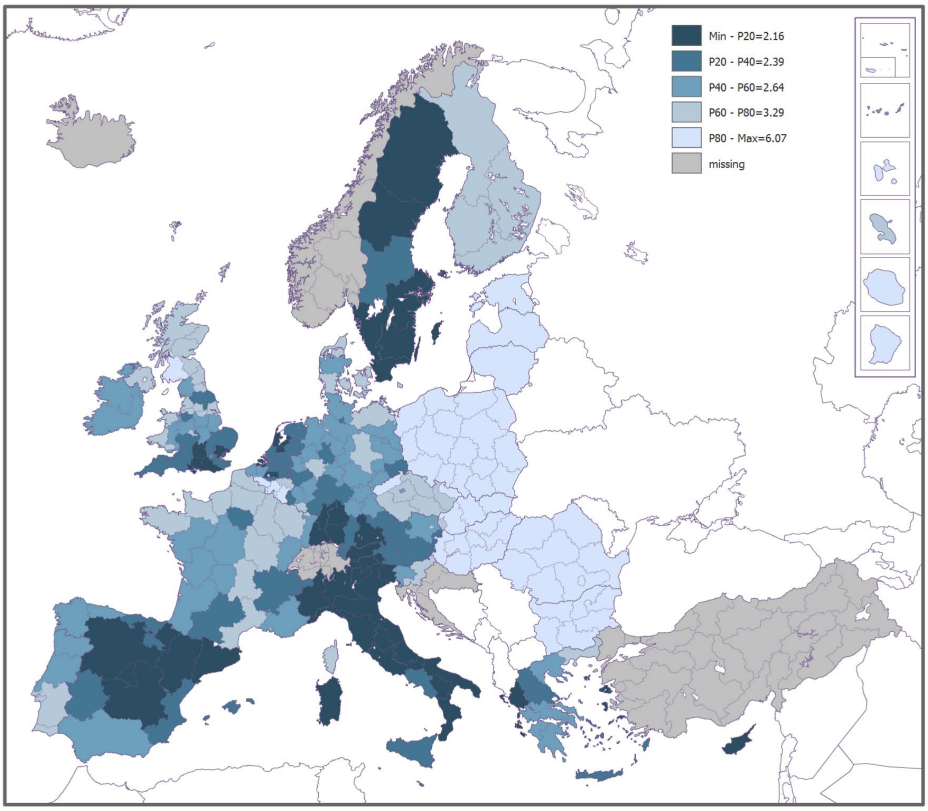


Infant mortality

Figure 5.2: Objective Health component - Histograms.

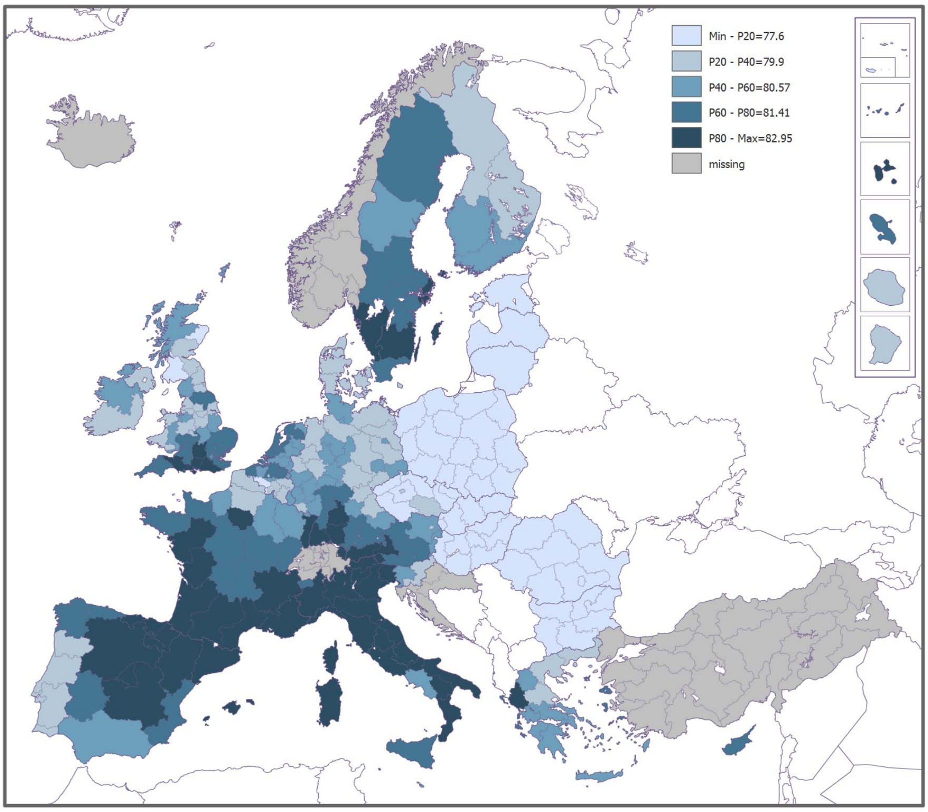


Prob. of not reaching 65

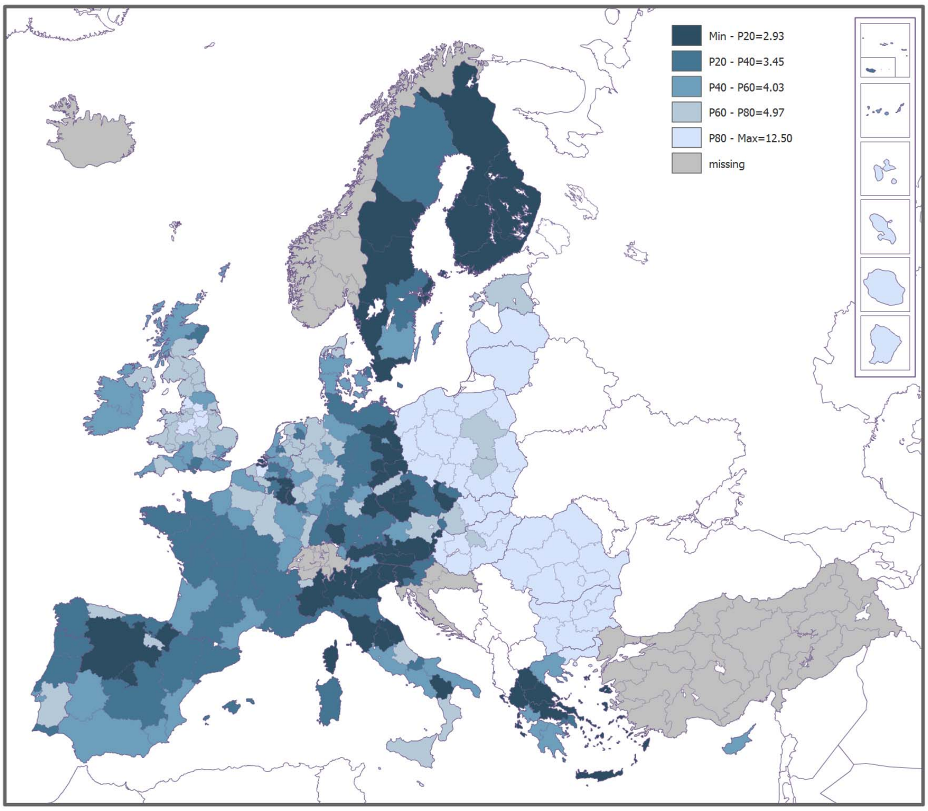


Potential years lost until 70

Figure 5.3: Objective Health component - Maps (the darker the better).



Life expectancy



Infant mortality

Figure 5.4: Objective Health component - Maps (the darker the better).

Subjective Health

The full description of the indicators included in the Subjective Health component is presented in the Section 5.2.1. Here we recall them and provide the short labels that are used in the presentation of the results of univariate analysis.

The indicators used in the component are following (in brackets we present short labels):

1. percentage of people in good general health (GH_mean),
2. percentage of people without chronic illness (CI_mean),
3. percentage of people without health limitations (HL_mean),
4. percentage of people with unmet medical need (MN_mean),
5. percentage of people with unmet dental need (DN_mean).

In Tables 5.6, 5.7, 5.8 we present the descriptive statistics for the indicators included in the Subjective Health component. Again, since the EU SILC indicators are not perfectly comparable with SOEP and USS indicators, we decided to prepare separate tables for EU SILC countries, Germany and United Kingdom. For each indicator, apart from basic statistics, we present its orientation (the higher, the better or the higher, the worse) and regions which scores the worst and the best. To better illustrate the performance of EU regions according to the health indicators, for each indicator we grouped regions into five groups (according to the quintiles values) and present them on the maps, again separately for EU SILC regions (Figures 5.5, 5.6, 5.7), Germany (Figure 5.8) and UK (Figure 5.9).

The distribution of each indicator is presented in Figure 5.10 for EU-SILC and Figures 5.11 and 5.12 for Germany and the United Kingdom respectively.

short label	GH_mean	CI_mean	HL_mean	MN_mean	DN_mean
indicator description	% of people in good general health	% of people without chronic illness	% of people without health limitations	% of people with unmet medical need	% of people with unmet dental need
source	EU SILC 2007-2009	EU SILC 2007-2009	EU SILC 2007-2009	EU SILC 2007-2009	EU SILC 2007-2009
indicator orientation	↑	↑	↑	↓	↓
mean	89.38	70.87	76.54	1.08	0.50
sd	3.78	6.25	4.52	1.33	0.46
cv	0.04	0.09	0.06	1.23	0.92
skewness	-0.75	-0.12	-0.30	1.92	1.83
kurtosis	3.07	2.48	2.74	6.31	6.85
p25	87.58	66.07	73.98	0.23	0.21
p50	90.33	70.52	77.08	0.54	0.35
p75	91.87	75.44	79.60	1.19	0.63
interquartile range	4.29	9.37	5.61	0.96	0.42
max	97.36	83.44	87.44	6.55	2.49
region corresponding to maximum value	IE	RO42	MT	EE	ES22
min	78.26	54.50	65.51	0.02	0.01
region corresponding to minimum value	HU3	FI13	FI13	BE2	UK*** PL6

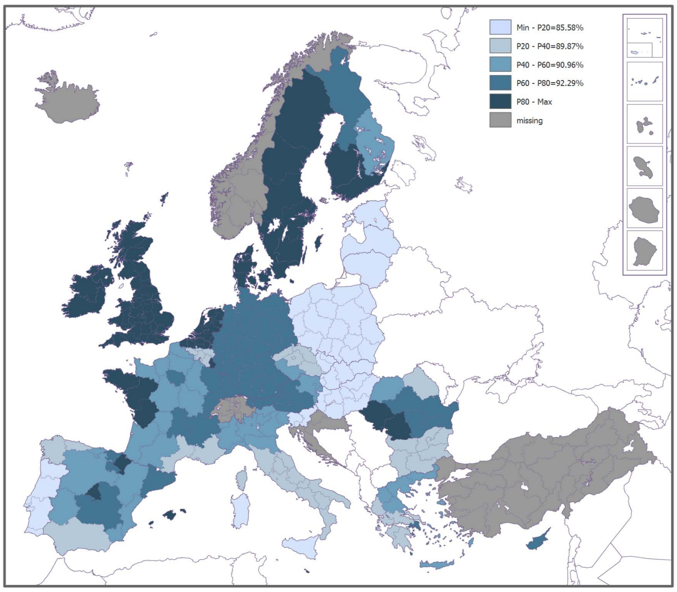
Table 5.6: Descriptive statistics of Subjective Health indicators - EU SILC.

short label	GH_mean	CI_mean	HL_mean
indicator description	% of people in good general health	% of people without chronic illness	% of people without health limitations
source	SOEP 2009	SOEP 2009	SOEP 2009
indicator orientation	↑	↑	↑
mean	80.50	62.02	95.25
sd	2.87	4.76	0.93
cv	0.04	0.08	0.01
skewness	0.35	0.19	0.76
kurtosis	4.05	3.01	3.38
p25	79.32	58.73	94.49
p50	80.47	61.07	95.35
p75	82.05	64.83	95.74
interquartile range	2.73	6.10	1.24
max	87.60	71.56	97.56
region corresponding to maximum value	DE6	DEB	DE6
min	75.02	52.15	94.12
region corresponding to minimum value	DE5	DE3	DEG

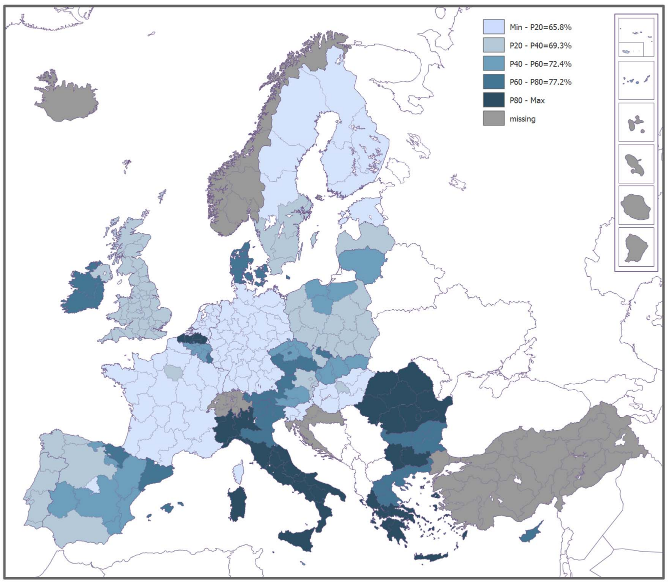
Table 5.7: Descriptive statistics of Subjective Health indicators - Germany.

short label	GH_mean	CI_mean	HL_mean
indicator description	% of people in good general health	% of people without chronic illness	% of people without health limitations
source	SOEP 2009	SOEP 2009	SOEP 2009
indicator orientation	⬆	⬆	⬆
mean	80.50	62.02	95.25
sd	2.87	4.76	0.93
cv	0.04	0.08	0.01
skewness	0.35	0.19	0.76
kurtosis	4.05	3.01	3.38
p25	79.32	58.73	94.49
p50	80.47	61.07	95.35
p75	82.05	64.83	95.74
interquartile range	2.73	6.10	1.24
max	87.60	71.56	97.56
region corresponding to maximum value	DE6	DEB	DE6
min	75.02	52.15	94.12
region corresponding to minimum value	DE5	DE3	DEG

Table 5.8: Descriptive statistics of Subjective Health indicators - UK.

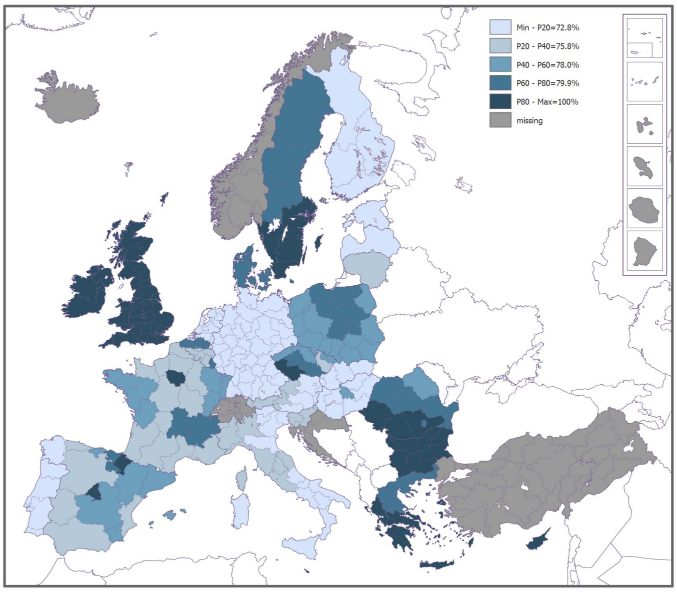


EU-SILC: percentage of people in good general health

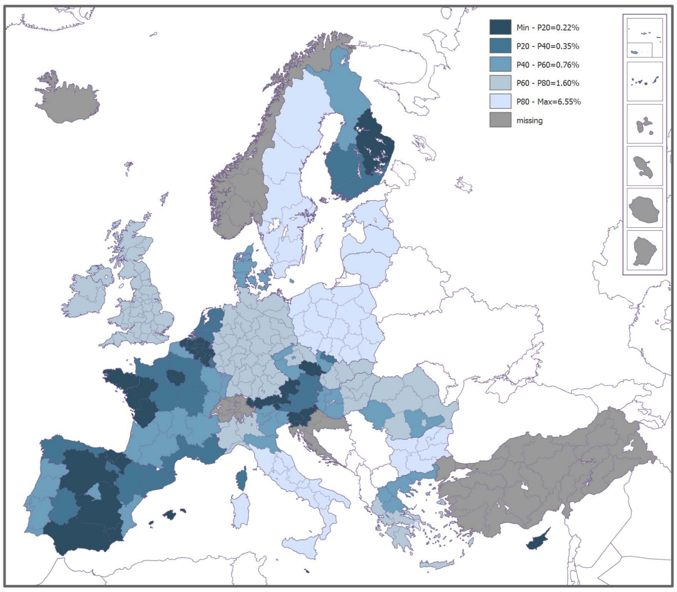


EU-SILC: percentage of people without chronic illness

Figure 5.5: EU-SILC - Subjective Health component - Maps (values recorded into five classes).

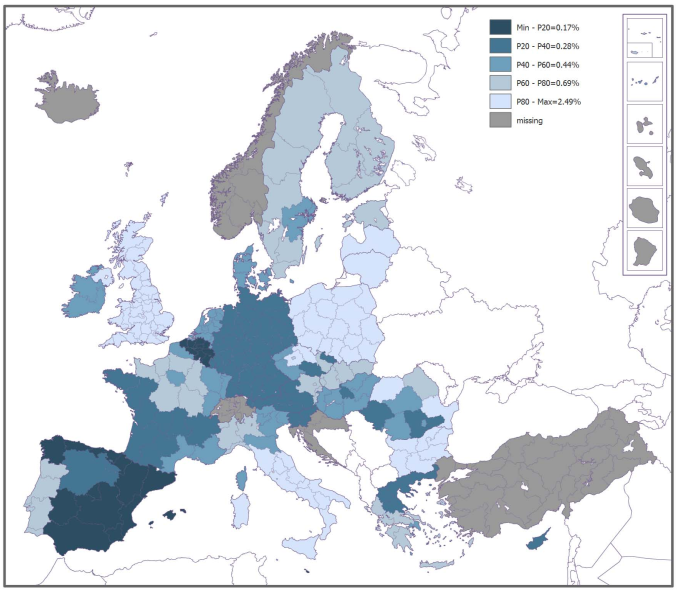


EU-SILC: percentage of people without health limitations



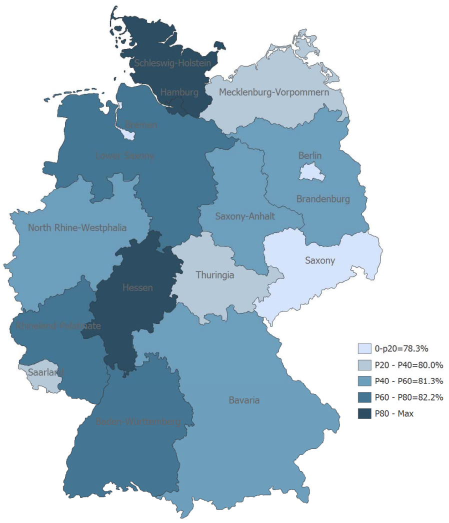
EU-SILC: percentage of people with unmet medical need

Figure 5.6: EU-SILC - Subjective Health component - Maps (values recorded into five classes).

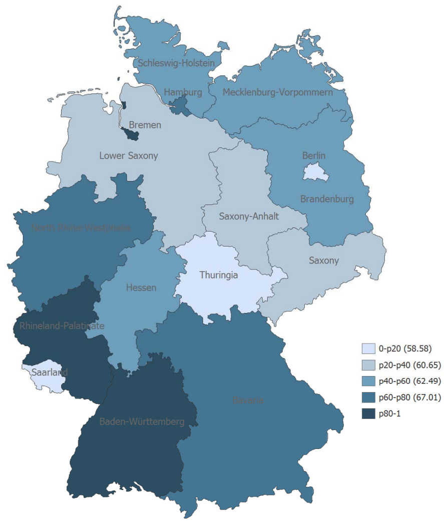


EU-SILC: percentage of people with unmet dental need

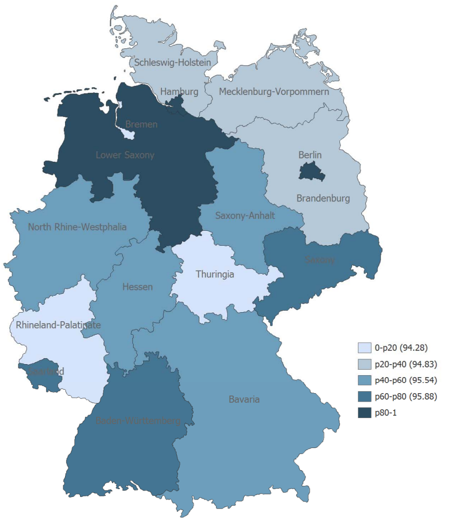
Figure 5.7: EU-SILC - Subjective Health component - Maps (values recorded into five classes).



SOEP: percentage of people in good general health

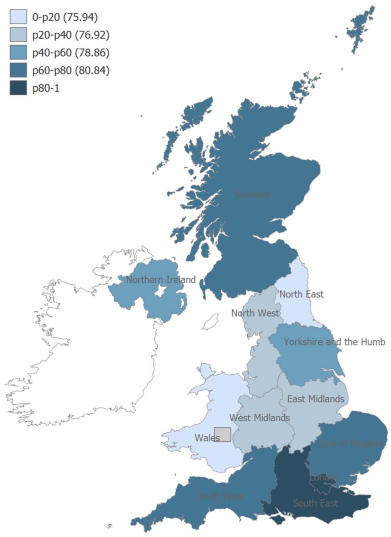


SOEP: percentage of people without chronic illness

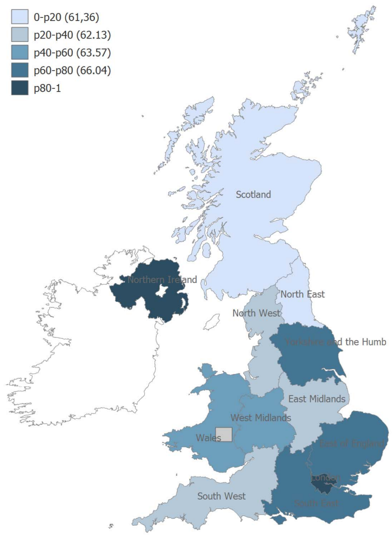


SOEP: percentage of people without health limitations

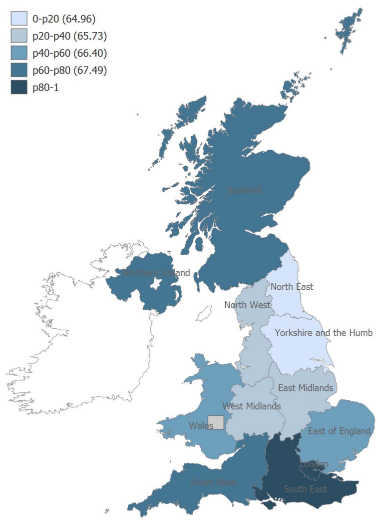
Figure 5.8: SOEP - Subjective Health component - Maps (values recorded into five classes).



USS: percentage of people in good general health

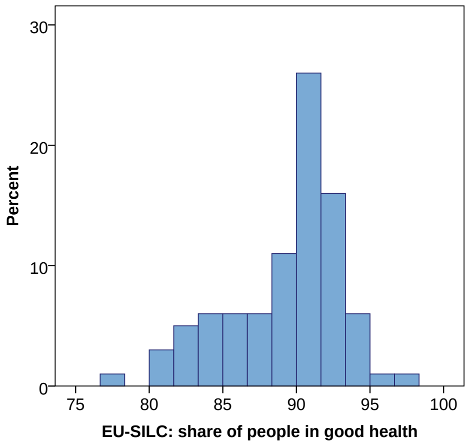


USS: percentage of people without chronic illness

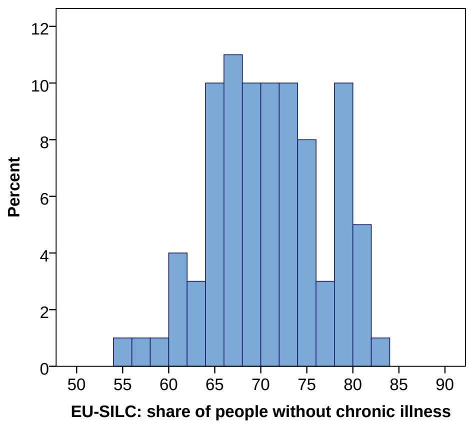


USS: percentage of people without health limitations

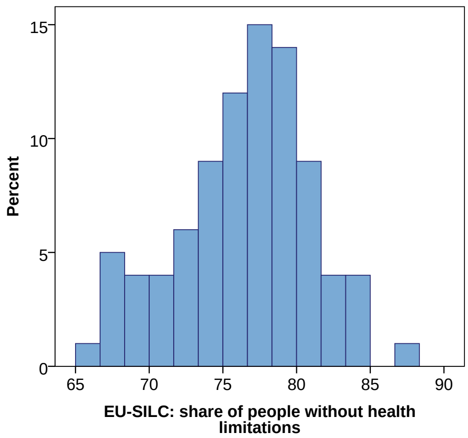
Figure 5.9: USS - Subjective Health component - Maps (values recorded into five classes).



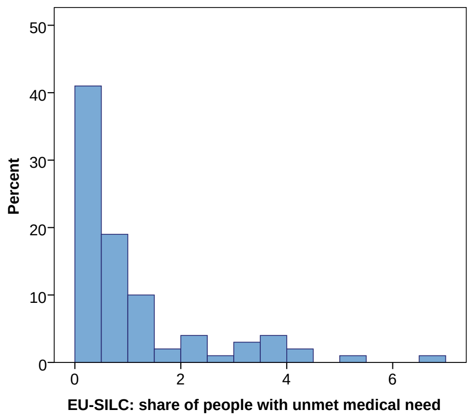
(GH_mean)



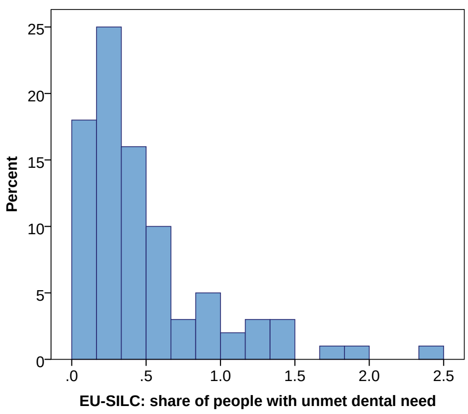
(CI_mean)



(HL_mean)



(MN_mean)



(DN_mean)

Figure 5.10: EU-SILC - Subjective Health component - Histograms.

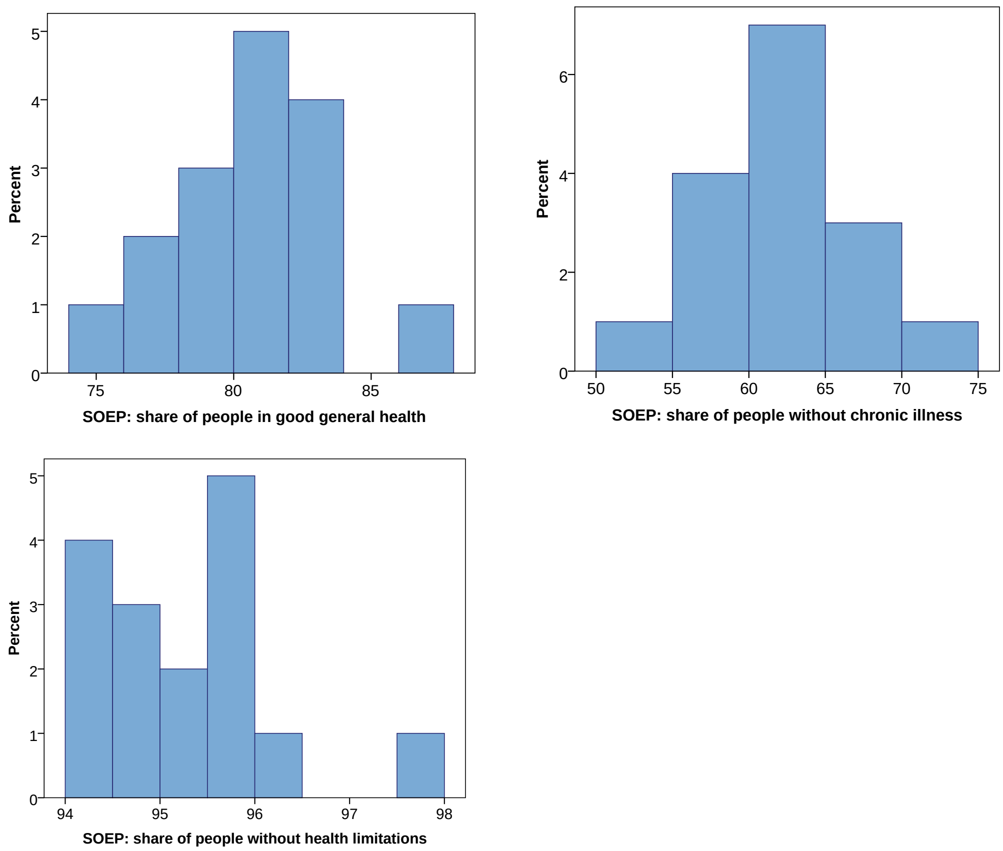


Figure 5.11: Distribution of Subjective Health indicators - Germany (SOEP).

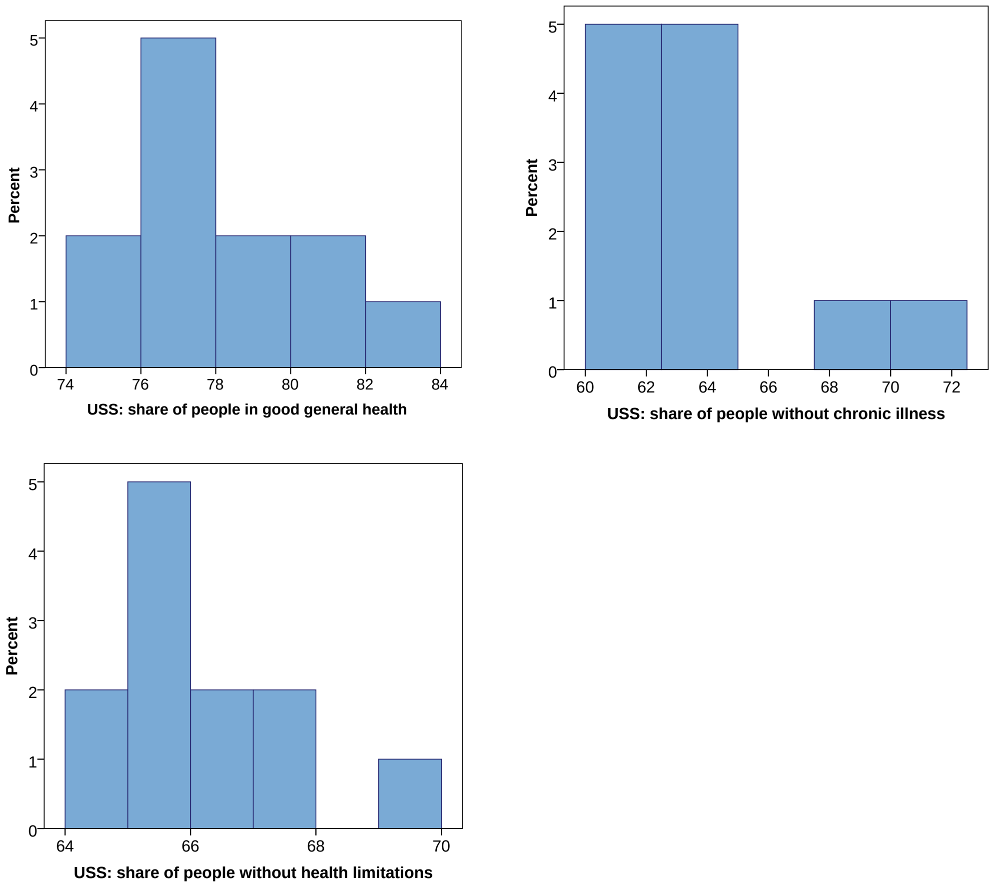


Figure 5.12: Distribution of Subjective Health indicators - UK (USS)

5.3.2 Multivariate analysis

Objective Health

In order to build up health sub-indexes Principal Component Analysis (PCA) is employed to assess internal consistency of the indicators included in each component. PCA, being a multivariate explorative technique (Morrison, 2005) that allows for checking internal data consistency of the variables populating each component (see Dijkstra et al. (2011)), is employed to check the dimensionality and internal consistency of a set of variables populating each component. Our aim is to detect possible non-influencing variables or variables describing something different or something more than they are supposed to.

The description of PCA outcomes for the Subjective Health component is provided for EU-SILC indicators. We specifically present ((Morrison, 2005)):

- correlation coefficients and associated p-values,
- eigenvalues of PCA components and associated scree plot,
- correlations between each indicator and the PCA components (eigenvectors).

The correlation matrix of the four indicators included in Objective Health is shown in Table 5.9, while Figure 5.13 presents PCA outcomes which clearly indicate the presence of a single underlying latent dimension explaining 88% of total variance. All the indicators contribute to this dimension almost equally (Table 5.10) with a negative contribution of Life Expectancy as this indicator has opposite orientation with respect to the others. PCA on Objective Health indicators demonstrates a ideal condition of internal consistency.

	not_r~65	PLYL70	life_exp	inf_mort
not_reach65	**1.0000**			
PLYL70	**0.9857** **0.0000**	**1.0000**		
life_exp	**-0.9674** **0.0000**	**-0.9546** **0.0000**	**1.0000**	
inf_mort	**0.6719** **0.0000**	**0.7493** **0.0000**	**-0.6827** **0.0000**	**1.0000**

Table 5.9: Objective Health component: Correlation matrix and p-values

Variable	Comp1	Comp2	Comp3	Comp4
not_reach65	**0.5187**	**-0.3202**	**0.3258**	**0.7227**
PLYL70	**0.5264**	**-0.1420**	**0.5056**	**-0.6687**
life_exp	**-0.5154**	**0.2840**	**0.7969**	**0.1365**
inf_mort	**0.4338**	**0.8925**	**-0.0562**	**0.1094**

Table 5.10: Objective Health component: Correlation coefficients between indicators and principal components.

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	**3.52343**	**3.10094**	**0.8809**	**0.8809**
Comp2	**.422491**	**.375381**	**0.1056**	**0.9865**
Comp3	**.0471099**	**.0401457**	**0.0118**	**0.9983**
Comp4	**.00696415**	**.**	**0.0017**	**1.0000**

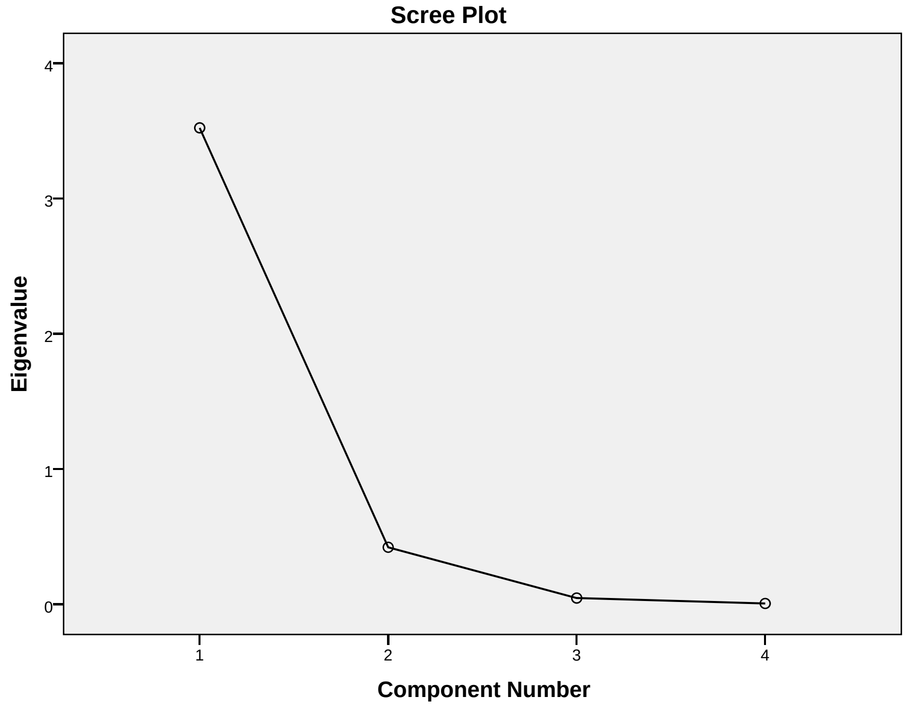


Figure 5.13: Objective Health component: Explained variance and scree plot.

Subjective Health

The Correlation matrix for the five variables included in the Subjective health component is shown in Table 5.11. We remind the reader that MN_mean and DN_mean are counter-oriented with respect to the others, and they are indeed negatively correlated with GH_mean, CI_mean and HL_mean. It can be noted that variables describing chronic illness (CI_mean) and health limitations (HL_mean), although significantly correlated with each other and with general health variable (GH_mean), are not significantly correlated with medical and dental need variables (MN_mean and DN_mean respectively). Variables general health, medical need and mental need are instead significantly correlated. This correlation pattern is also reflected by the results of PCA. As shown in Figure 5.14 and Table 5.12 data are underlying two latent factors: the former consisting of general health, medical and dental need variables (explaining 42.5% of data variability); the latter consisting of chronic illness and health limitations variables (explaining 32.1% of data variability). The presence of chronic illnesses and limitations due to health problems are then detected by PCA as behaving in a way different from the rest of the variables. This might be related to the false negative reporting issue, mentioned at the beginning of this Chapter, which has been found to be related to the social-economic condition of the individual: the lower the status the lower the level of awareness/sensitivity of the individual with respect to health problem. In other words, . . . *a person brought up in a community with a great many diseases and few medical facilities may be inclined to take certain symptoms as 'normal' when they are clinically preventable* . . . (from Sen (2002), p. 860). This may be a possible explanation for the strange behavior of EU-SILC derived indicators on chronic illness and activity limitations, actually spoiling our measures. Indicators CI_mean and HL_mean are consequently excluded from the rest of the analysis which is then lacking a measure of capability to work.

	GH_mean	CI_mean	HL_mean	MN_mean	DN_mean
GH_mean	**1.0000**				
CI_mean	**0.2084** **0.0514**	**1.0000**			
HL_mean	**0.4024** **0.0001**	**0.5675** **0.0000**	**1.0000**		
MN_mean	**-0.4436** **0.0000**	**-0.0285** **0.7922**	**0.0547** **0.6126**	**1.0000**	
DN_mean	**-0.3659** **0.0005**	**-0.0246** **0.8202**	**-0.0129** **0.9053**	**0.7003** **0.0000**	**1.0000**

Table 5.11: Subjective Health component: Correlation matrix and p-values (EU-SILC related indicators)

The PCA analysis on the remaining three variables - GH_mean, MN_mean and DN_mean - (Figure 5.15) shows that they are clearly mono-dimensional and explain 67.4% data variability.

The aggregated value of Subjective Health component is based only on these three variables.

Since in the case of SOEP data and USS we do not have data describing medical and dental need, only the univariate analysis of the General Health variable is provided.

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	**2.12402**	**.516434**	**0.4248**	**0.4248**
Comp2	**1.60759**	**.975235**	**0.3215**	**0.7463**
Comp3	**.632355**	**.249556**	**0.1265**	**0.8728**
Comp4	**.382798**	**.129566**	**0.0766**	**0.9494**
Comp5	**.253232**	**.**	**0.0506**	**1.0000**

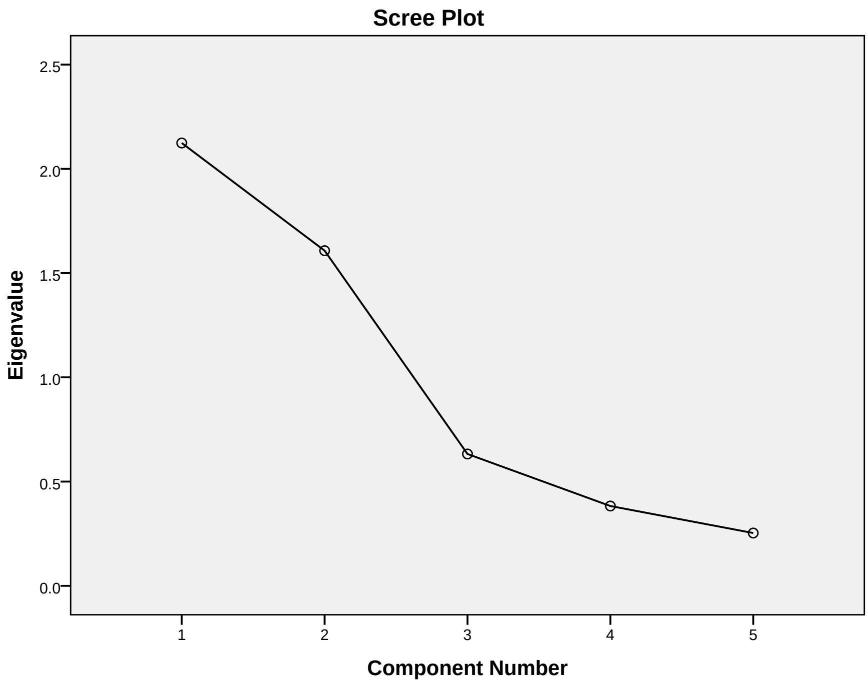


Figure 5.14: Subjective Health component: Explained variance and scree plot (EU-SILC related indicators).

Variable	Comp1	Comp2	Comp3	Comp4	Comp5
GH_mean	**0.5372**	**0.0830**	**0.6928**	**0.3466**	**0.3232**
CI_mean	**0.2834**	**0.5660**	**-0.6061**	**0.4245**	**0.2275**
HL_mean	**0.3159**	**0.6116**	**0.1607**	**-0.5801**	**-0.4047**
MN_mean	**-0.5212**	**0.3987**	**0.1834**	**-0.2834**	**0.6748**
DN_mean	**-0.5095**	**0.3737**	**0.3053**	**0.5319**	**-0.4740**

Table 5.12: Subjective Health component: Correlation coefficients between indicators and principal components (EU-SILC related indicators).

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	**2.02162**	**1.33653**	**0.6739**	**0.6739**
Comp2	**.685083**	**.391781**	**0.2284**	**0.9022**
Comp3	**.293302**	**.**	**0.0978**	**1.0000**

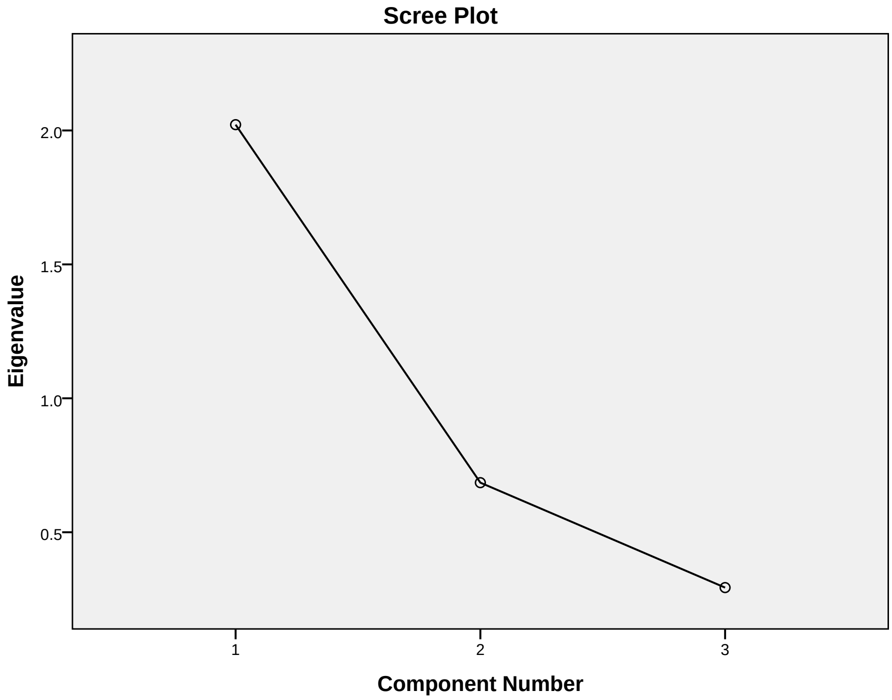


Figure 5.15: Subjective Health component: Explained variance and scree plot on a subset of variables.

5.3.3 Inequality-adverse aggregation and uncertainty analysis

Similarly to the Living Standards dimension, in each Health component indicators are first standardized using population weighted z-scores then the generalized mean of power 0.5 is employed to calculate sub-indexes. The value of the power β is tested by Uncertainty Analysis to assess the stability of regions scores/ranking with respect to different β values randomly sampled from the uniform distribution $U[0, 1]$. For each components a total number of 2000 different scenarios is simulated, each corresponding to a different generalized mean.

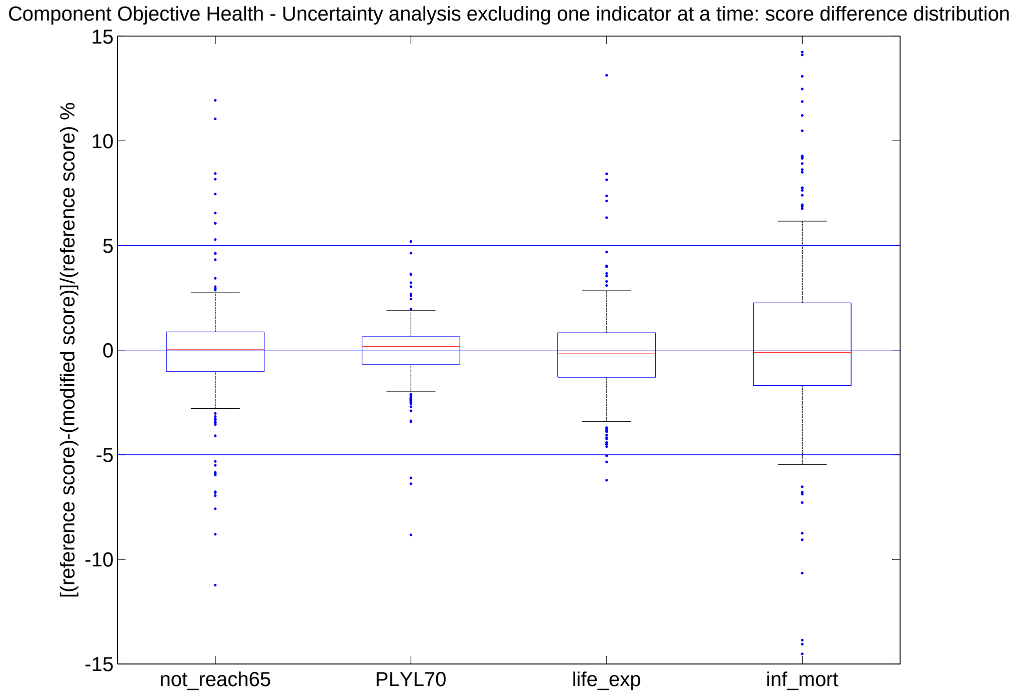
Objective Health

Prior to aggregation, indicators Probability of not reaching 65, Potential life years lost until 70 and Infant mortality are reversed in order to be positively oriented with respect to QoL. The final Objective Health sub-index is positively oriented with respect to QoL (the higher the better).

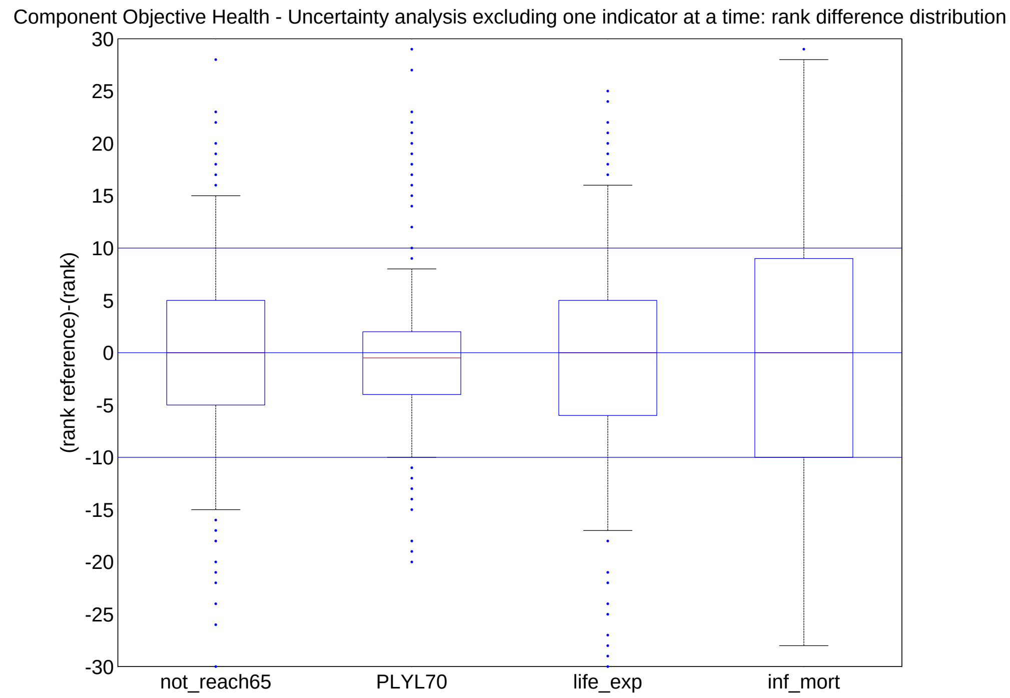
The effect of region scores of different β values can be seen in Figure 5.16 showing for each region the boxplot of the distribution of the percentage score differences with respect to the reference score ($\beta = 0.5$). It can be seen that the impact of different β values is negligible as the percentage difference in scores is always well between -5 and +5.

Figure 5.16: Objective Health component: effect of different β values on region scores.

The effect of each single indicator on Objective Health sub-index scores is assessed by setting the order of the weighted mean to its reference value $\beta = 0.5$ and computing region scores and ranks discarding one indicator at a time. Results are shown in Figure 5.17 which shows the percentage differences in scores (top) and the differences in ranks (bottom). The percentage difference is almost always in the range $\pm 3\%$ with indicator Infant Mortality being the most influencing indicator and indicator Probability of not reaching 70 being the least influencing one. These results show that the component is quite well balanced across the indicators included, confirming its internal consistency.



Percentage differences in scores



Differences in ranks

Figure 5.17: Objective Health component: UA on the influence of the indicators.

Subjective Health

Indicators MN_mean and DN_mean included in Subjective Health are first reversed to be positively oriented. The effect of region scores of different β values can be seen in Figure 5.18 showing for each region the boxplot of the distribution of the percentage score differences with respect to the reference score ($\beta = 0.5$).

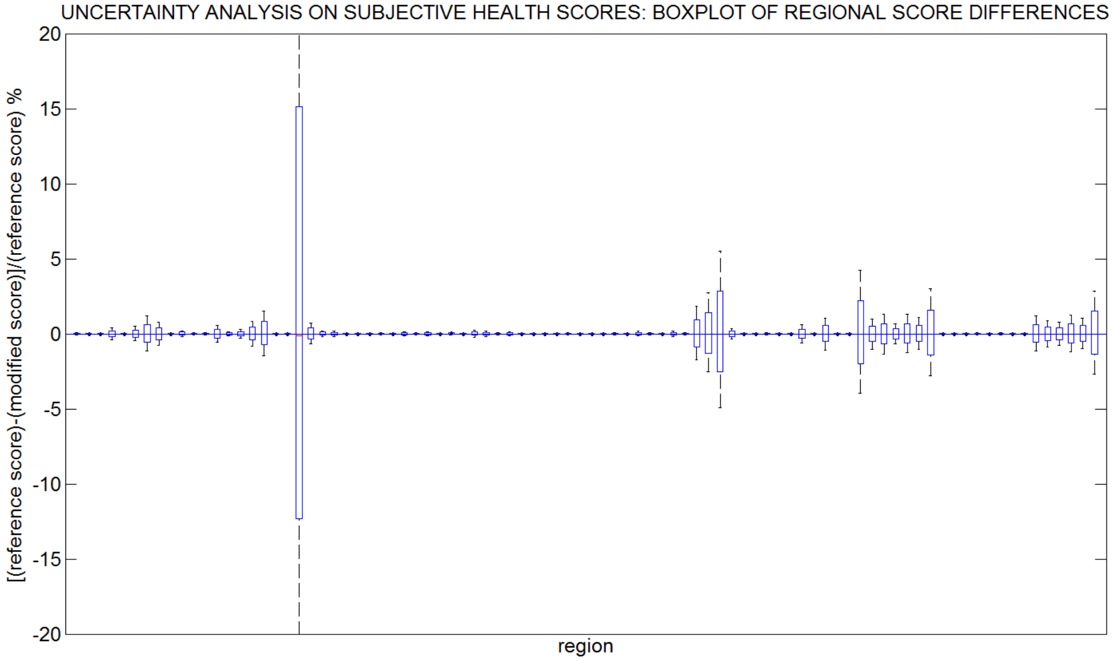


Figure 5.18: Subjective Health component: effect of different β values on region scores.

The boxes, which represents 50% of the distribution, are always, apart from one region, well between the band ± 2.5, meaning that for all regions the score change is less that 2.5% for most cases. Estonia is an outlier region. To investigate further this case, four radar charts for four regions are presented in Figure 5.19: Estonia (Figure 5.19 - top, left) is compared to two more 'regular 'ones (AT1 and CZ08) (Figure 5.19 - bottom) and one less 'regular'(UK). The United Kingdom is one of the best regions in terms of the self-reported health condition - in the UK the percentage of people describing their health condition as good is one of the highest among all analyzed regions - but the worst with regard to unmet dental need - the UK percentage of people with unmet dental need is the highest among all analyzed regions. Similarly, Estonia is the worst with regard to unmet medical need but not so bad with regard to the other two indicators. Radar plots highlights the presence of possible compensability for United Kingdom and Estonia which are not present for example in the other two more regular regions taken as example- AT1 and CZ08. In the case of Estonia the effect of value of β is not negligible for the presence of compensability across indicators which affects the aggregated scores and, consequently, the final ranking.

Table 5.13 shows the the median rank of the regions and the associated 90% CI computed across all the 2000 scenarios. Only regions for which the estimated 90% CI is at least equal to 1 are displayed. The width of the 90% confidence interval is always below 3 with the exception of UK for which the CI is equal to 7.

Finally, Table 5.14 shows the frequency matrix of modified ranks which displays, for each region, the percentage

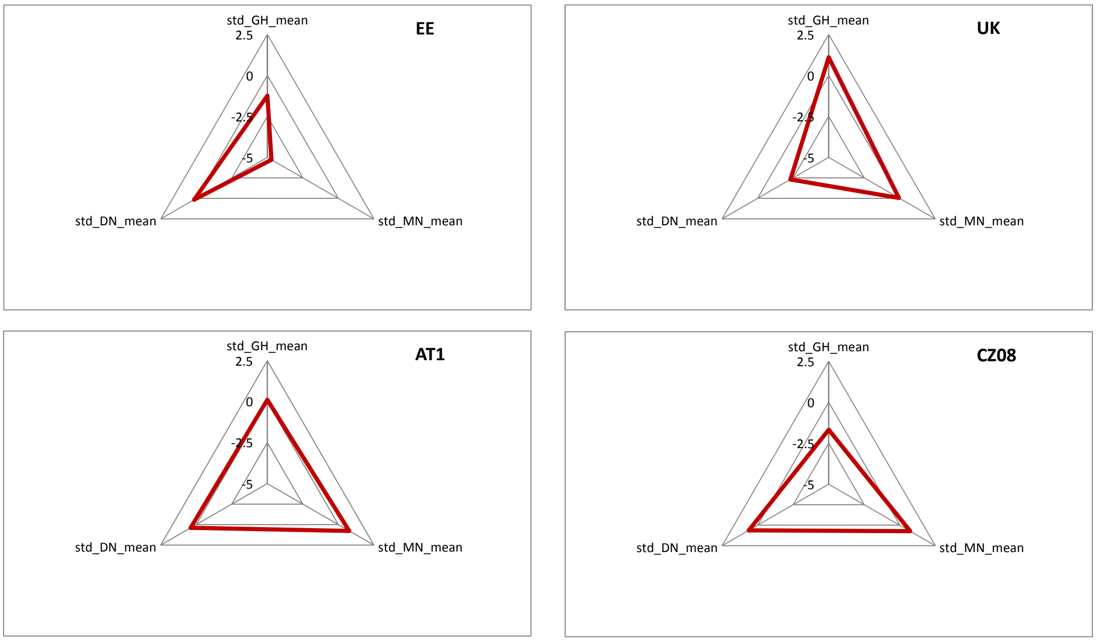


Figure 5.19: Subjective Health indicators of four regions: UK, EE, AT1 and CZ08.

of times the region ranks in certain rank interval calculated over all the 2000 simulated scenarios. The frequency matrix shows most and least stable regions and provides a synthesized picture of the overall regional ranking stability. Regions are reordered from best to worst according to their reference Subjective Health rank. A region is considered 'stable' if its rank frequency is higher or equal to 95% (highlighted in blue in Table 5.14). As expected there is almost no volatility in ranks, all the regions are stable with respect to the type of aggregation. Regions with low and stable levels of subjective perception of health are BG3 (Severna i Iztochna Bulgaria), PL3 (Region Wschodni), PL5 (Region Południowo Zachodni), Estonia, PL6 (Region Północny), Lithuania, PL1 (Region Centralny). At the opposite side we find Malta, Ireland, the Netherlands, Belgian region BE2 (Vlaams Gewest)and four Spanish regions (ES21=País Vasco, ES22=Comunidad Foral de Navarra, ES30=Comunidad de Msdrid, ES53=Illeas Baleares). In these regions the level of subjective health is high and stable in all the simulations with different choices of the order β.

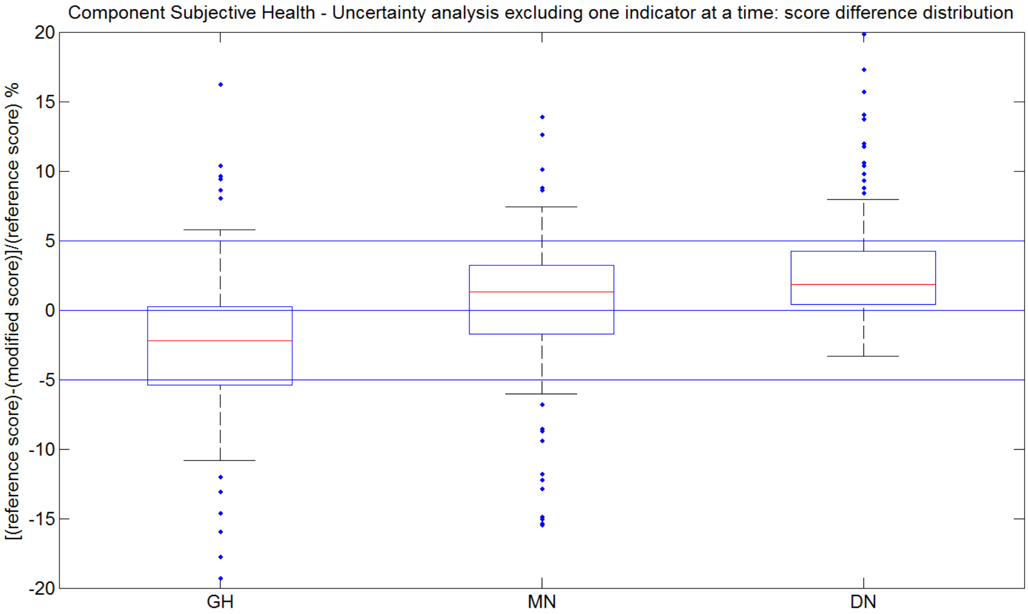
Similarly to the Objective Health component, the effect of each single indicator on Subjective Health sub-index scores is tested. Figure 5.20 summarizes the outcome of the analysis and shows shows the percentage difference in scores (top) and differences in ranks (bottom). The score difference is almost always in the range $\pm 3\%$ with indicator GH (general health) being the most influencing indicator and indicator DN (dental need) being the least influencing one. The interquartile ranges of rank difference distributions for MN and DN indicators are within the band ± 5, meaning that for all the simulations the maximum shift of the region rank is up to 5 positions in the 50% of the cases. The interquartile range for GH indicator is broader ranging from -8 to 5 indicating that exclusion of this indicator may influence the Subjective Health ranks considerably.

Region label	Absolute poverty rank	median rank	rank P5%	rank P95%	90% CI
ES53	4	4	4	5	1
IE0	5	5	4	5	1
ES62	17	17	17	18	1
AT2	18	18	17	18	1
ES23	29	29	29	30	1
FR40	30	30	30	31	1
BE1	31	31	29	32	3
RO41	32	32	31	32	1
DE	35	36	35	36	1
FR60	36	36	35	37	2
BE3	37	37	35	38	3
GR1	38	38	37	38	1
FI13	42	42	42	43	1
AT1	43	43	42	43	1
RO12	49	49	49	50	1
ES11	50	50	49	50	1
ITC	53	53	53	55	2
SE2	54	54	53	54	1
SE1	55	55	54	55	1
SI	56	56	56	58	2
CZ01	57	57	56	57	1
GR4	58	58	57	58	1
GR2	60	60	60	62	2
RO21	61	61	61	62	1
SE3	62	62	60	63	3
CZ04	63	63	62	63	1
ITE	67	67	67	68	1
HU1	68	68	67	68	1
CZ07	69	69	69	70	1
SK0	70	70	69	70	1
BG4	74	75	74	75	1
HU3	75	74	74	76	2
ITF	76	76	75	76	1
ITG	77	77	77	78	1
PL2	78	78	78	79	1
PL4	79	79	79	80	1
UK	80	80	77	84	7
LV0	81	81	80	81	1
BG3	82	82	81	82	1
PL3	83	83	82	83	1
PL5	84	84	83	84	1
EE	85	85	85	88	3
LT0	87	87	85	87	2
PL1	88	88	87	88	1

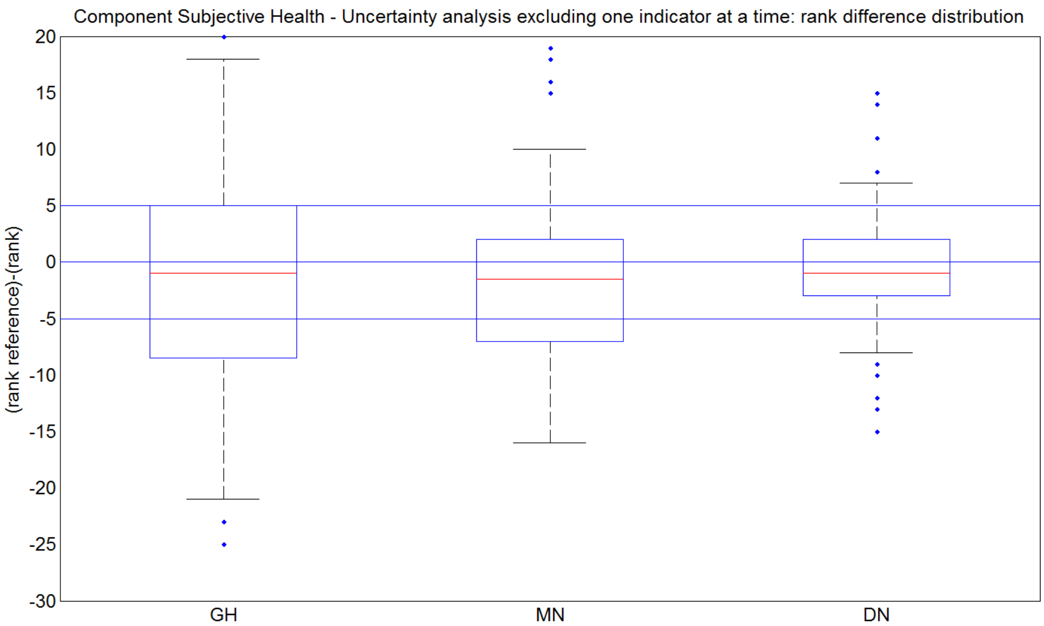
Table 5.13: Subjective Health component: effect of different β values on region ranks (median and estimated 90% CI).

	only frequencies >5%																
Country	**[1,5]**	**[6,10]**	**[11,15]**	**[16,20]**	**[21,25]**	**[26,30]**	**[31,35]**	**[36,40]**	**[41,45]**	**[46,50]**	**[51,55]**	**[56,60]**	**[61,65]**	**[66,70]**	**[71,75]**	**[76,80]**	**[81,88]**
MT0	100																
BE2	100																
IE0	100																
ES53	100																
NL	100																
ES22		100															
ES21		100															
ES30		100															
FR50		100															
LU0		100															
FR10			100														
AT3			100														
ES51			100														
CY0			100														
AT2			100														
ES42				100													
ES24				100													
DK				100													
ES62				100													
FI19				100													
RO42					100												
ES13					100												
FR70					100												
ES41					100												
FI18					84	16											
ES61					16	84											
ES23						100											
FR40						90	10										
ES43						100											
RO41						58	42										
ES52						10	90										
ES12						42	58										
RO31							100										
BE1							100										
FI13							100										
FI1A								100									
AT1								100									
FR60								100									
ES70								100									
DE								100									
FR30									100								
GR1									100								
BE3									100								
CZ06									100								
FR80									100								
CZ03										100							
ITD										100							
RO32										100							
FR20										100							
RO12										100							
ES11											100						
ITC											100						
GR3											100						
CZ01											100						
SE2											55	45					
RO11											45	55					
RO21												100					
SE1												100					
GR4												100					
SI												69	31				
GR2												31	69				
SE3													100				
CZ04													100				
RO22													100				
CZ05													67	33			
CZ08													33	67			
ITE														100			
CZ02														100			
CZ07														100			
SK0														60	40		
HU1														40	60		
UK															100		
HU2															100		
PT															100		
ITF															100		
BG4																100	
HU3																100	
ITG																100	
PL2																100	
PL4																100	
BG3																	100
LV0																	100
PL3																	100
PL5																	100
PL6																	100
LT0																	100
PL1																	100
EE																	100

Table 5.14: Subjective Health component: UA on different β values - frequency matrix.



Percentage differences in scores



Differences in ranks

Figure 5.20: Subjective Health component: UA on the influence of the indicators.

5.3.4 Health sub-indexes

The final aggregated sub-index for the Objective Health and Subjective Health is computed as generalized mean of order $\beta = 0.5$ of population weighted standardised indicators. As aforementioned, both components have positive orientation with respect to QoL, that is the higher, the better.

Objective Health

Table 5.15 shows descriptive statistics of the Objective Health sub-index, with the Spanish region Comunidad Foral de Navarra (ES22) being the best performer and the Romanian region Nord-Est (RO21) being the worst performer. Sub-index scores and region ranks are displayed in the Tables 5.16 and 5.17 where regions are presented in alphabetical order with their respective score and rank. A min-max transformation is applied to the scores for an easier interpretation. Score distribution is shown in the histogram of Figure 5.21. The distribution is negatively skewed meaning that most of the regions share an overall good objective index score but there are some hotspots with critically low value. In order to spatially visualize the distribution of the Objective Health scores min-max normalized values are grouped into five classes according to the distribution percentiles P_{20}, P_{40}, P_{60} and P_{80} (Figure 5.22).

short label	**OH**
indicator description	Objective Health sub-index
indicator orientation	
mean	4.99
sd	0.94
cv	0.19
p25	4.47
p50	5.38
p75	5.58
interquartile range	1.11
max	5.98
region corresponding to maximum value	ES22
min	2.62
region corresponding to minimum value	RO21

Table 5.15: Descriptive statistics of Objective Health sub-index.

Region	Objective Health sub-index norm score	Objective Health sub-index rank	Region	Objective Health sub-index norm score	Objective Health sub-index rank	Region	Objective Health sub-index norm score	Objective Health sub-index rank
AT11	84.27	83	DE72	79.98	126	FI20	100.00	1
AT12	76.44	158	DE73	76.42	159	FR10	87.68	50
AT13	68.08	200	DE80	72.49	179	FR21	70.05	190
AT21	87.01	54	DE91	79.08	134	FR22	68.28	199
AT22	85.78	69	DE92	75.61	163	FR23	73.22	173
AT31	83.05	98	DE93	77.71	151	FR24	82.42	103
AT32	89.86	35	DE94	74.28	168	FR25	77.66	152
AT33	92.08	17	DEA1	72.60	177	FR26	79.07	135
AT34	86.82	56	DEA2	81.02	115	FR30	64.66	212
BE10	74.46	166	DEA3	73.04	175	FR41	75.10	164
BE21	85.04	75	DEA4	80.44	122	FR42	80.00	125
BE22	87.59	51	DEA5	71.87	184	FR43	80.41	123
BE23	70.13	189	DEB1	76.85	156	FR51	84.47	81
BE24	85.69	70	DEB2	77.92	149	FR52	76.68	157
BE25	78.99	138	DEB3	80.93	116	FR53	82.58	102
BE31	86.01	64	DEC	73.89	170	FR61	83.53	94
BE32	56.36	220	DED1	80.67	121	FR62	87.75	49
BE33	71.23	185	DED2	84.09	87	FR63	81.76	108
BE34	68.30	198	DED3	84.13	85	FR71	88.71	40
BE35	65.70	208	DEE0	72.49	178	FR72	78.62	142
BG31	9.23	260	DEF0	79.19	133	FR81	79.33	130
BG32	20.66	257	DEG0	77.32	154	FR82	84.71	78
BG33	12.57	258	DK01	72.44	180	FR83	84.68	80
BG34	0.00	270	DK02	67.69	202	FR91	62.57	216
BG41	31.08	247	DK03	72.29	182	FR92	62.06	217
BG42	21.58	256	DK04	76.12	161	FR93	25.88	252
CY00	86.24	63	DK05	69.51	192	FR94	55.23	221
CZ01	78.52	146	EE00	30.10	248	GR11	65.99	207
CZ02	66.69	204	ES11	84.39	82	GR12	78.55	145
CZ03	69.26	193	ES12	78.57	143	GR13	87.53	52
CZ04	48.68	229	ES13	88.35	45	GR14	85.09	73
CZ05	68.04	201	ES21	88.03	47	GR21	91.97	18
CZ06	68.30	197	ES22	96.87	4	GR22	92.96	16
CZ07	63.13	214	ES23	85.79	68	GR23	79.94	127
CZ08	54.65	222	ES24	89.88	34	GR24	83.82	91
DE11	89.30	38	ES30	96.06	7	GR25	79.32	131
DE12	88.14	46	ES41	91.60	21	GR30	81.97	106
DE13	88.44	43	ES42	91.23	24	GR41	85.51	71
DE14	91.51	22	ES43	84.71	79	GR42	90.97	25
DE21	87.85	48	ES51	90.68	28	GR43	87.11	53
DE22	82.31	104	ES52	85.08	74	HU10	42.53	235
DE23	80.85	118	ES53	86.88	55	HU21	28.02	249
DE24	77.52	153	ES61	79.61	129	HU22	36.46	238
DE25	78.70	141	ES62	84.23	84	HU23	26.80	250
DE26	85.20	72	ES63	62.70	215	HU31	6.92	263
DE27	83.63	93	ES64	74.31	167	HU32	23.67	255
DE30	78.31	147	ES70	80.79	119	HU33	24.68	254
DE40	78.72	140	FI13	70.54	188	IE01	81.10	114
DE50	64.34	213	FI18	79.04	136	IE02	78.93	139
DE60	80.87	117	FI19	78.27	148	ITC1	91.89	19
DE71	84.77	77	FI1A	75.89	162	ITC2	81.27	112

Table 5.16: Objective Health component: scores and ranks (part 1).

Region	Objective Health sub-index norm score	Objective Health sub-index rank	Region	Objective Health sub-index norm score	Objective Health sub-index rank	Region	Objective Health sub-index norm score	Objective Health sub-index rank
ITC3	91.32	23	PL31	37.45	237	SK03	36.11	240
ITC4	94.66	12	PL32	53.13	224	SK04	26.46	251
ITD1	95.33	9	PL33	44.66	232	UKC1	71.09	186
ITD2	99.70	2	PL34	47.17	230	UKC2	73.17	174
ITD3	94.84	11	PL41	42.20	236	UKD1	77.79	150
ITD4	96.30	6	PL42	34.57	243	UKD2	79.00	137
ITD5	94.28	13	PL43	34.05	244	UKD3	65.21	211
ITE1	96.31	5	PL51	31.15	246	UKD4	65.51	210
ITE2	95.61	8	PL52	48.96	228	UKD5	65.55	209
ITE3	99.00	3	PL61	35.88	241	UKE1	73.84	171
ITE4	90.26	30	PL62	36.38	239	UKE2	85.91	65
ITF1	86.75	57	PL63	43.67	234	UKE3	69.66	191
ITF2	90.70	27	PT11	79.80	128	UKE4	66.25	206
ITF3	80.38	124	PT15	68.45	196	UKF1	74.22	169
ITF4	89.96	33	PT16	80.68	120	UKF2	78.57	144
ITF5	94.08	14	PT17	73.59	172	UKF3	76.28	160
ITF6	85.80	67	PT18	68.89	194	UKG1	81.93	107
ITG1	83.44	96	PT20	52.77	225	UKG2	72.93	176
ITG2	90.20	31	PT30	49.44	227	UKG3	61.87	219
LT00	6.61	265	RO11	6.69	264	UKH1	84.83	76
LU00	86.47	59	RO12	12.52	259	UKH2	83.03	99
LV00	5.70	267	RO21	2.20	269	UKH3	86.49	58
MT00	72.10	183	RO22	2.85	268	UKI1	74.81	165
NL11	81.22	113	RO31	6.55	266	UKI2	84.05	88
NL12	81.50	109	RO32	35.36	242	UKJ1	86.29	62
NL13	85.87	66	RO41	7.61	261	UKJ2	88.41	44
NL21	81.38	110	RO42	7.47	262	UKJ3	89.02	39
NL22	81.34	111	SE11	95.06	10	UKJ4	82.62	101
NL23	83.64	92	SE12	90.13	32	UKK1	86.45	60
NL31	88.67	41	SE21	90.34	29	UKK2	86.45	61
NL32	83.52	95	SE22	91.66	20	UKK3	84.04	90
NL33	83.44	97	SE23	93.02	15	UKK4	82.99	100
NL34	90.82	26	SE31	89.73	36	UKL1	70.65	187
NL41	84.10	86	SE32	89.34	37	UKL2	77.09	155
NL42	82.06	105	SE33	88.44	42	UKM2	68.61	195
PL11	25.21	253	SI01	66.73	203	UKM3	54.11	223
PL12	44.07	233	SI02	84.04	89	UKM5	66.67	205
PL21	51.40	226	SK01	61.96	218	UKM6	79.23	132
PL22	31.62	245	SK02	46.39	231	UKN0	72.42	181

Table 5.17: Objective Health component: scores and ranks (part 2).

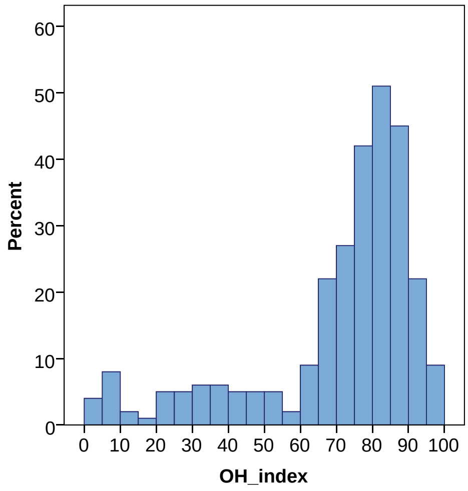


Figure 5.21: Objective Health sub-index: min-max normalized sub-index distribution.

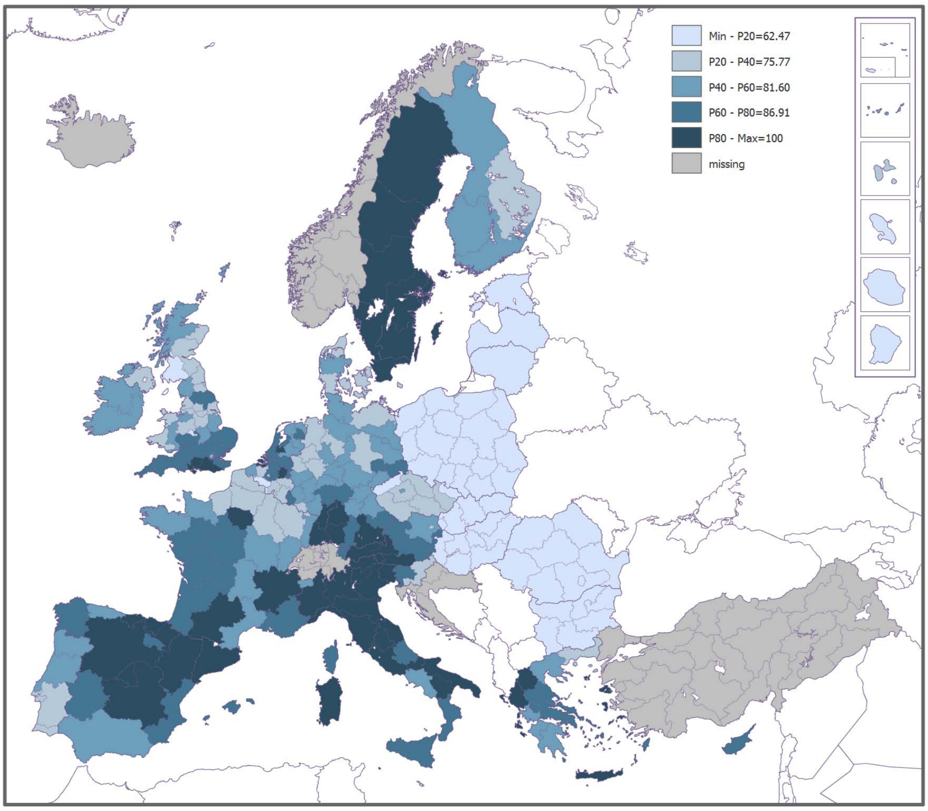


Figure 5.22: Objective Health sub-index - Map (normalized values recoded into five classes - the darker the better).

Subjective Health

Table 5.18 shows descriptive statistics of the Subjective Health sub-index. Malta shows up as the best performer in terms of self-reported health while the worst performer is Estonia.

short label	SH
sub-index description	Subjective Health sub-index
source	EU SILC 2007-2009
sub-index orientation	↑
mean	71.52
median	80.61
sd	22.19
interquartile range	21.22
p20	58.98
p40	74.62
p60	82.51
p80	87.14
max	100
region corresponding to maximum value	MT0
min	0
region corresponding to minimum value	EE

Table 5.18: Descriptive statistics of Subjective Health sub-index.

Sub-index scores and region ranks are displayed in the Table 5.19 with regions presented in alphabetical order with their respective score and rank.

Reordered regions, from best to worst, are shown in Figure 5.23. Scores are min-max transformed for an easier interpretation.

In terms of Subjective Health the group of regions in the bottom 20% of the distribution, which corresponds to the lowest level of subjective health perception, includes all Polish and Bulgarian regions, two (HU3=Alföld És Észak and HU2=Dunántél) out of three Hungarian regions, two out of five Italian regions (the southern ones - ITF=Sud and ITG=Isole), three Baltic Republics (Lithuania, Latvia and Estonia), Portugal and the United Kingdom. Among the top 20% there are Malta, Cyprus, The Netherlands, Ireland, Luxembourg, seven Spanish regions (ES21=Pais Vasco, ES22=Comunidad Foral de Navarra, ES24=Aragón, ES30=Comunidad de Madrid, ES42=Castilla-La Mancha, ES51=Cataluña, ES53=Illes Balears), two French regions (FR50=Ouest and FR10=Ile de France), two Austrian regions (AT2=Südösterreich and AT3=Westösterreich) and one Belgium region (BE2=Vlaams Gewest).

The differences among regions are the largest in the lowest group. This is also evident from the distribution of the min-max normalised sub-index, Figure 5.24, which is negatively skewed meaning that there are quite a few regions with critically low level of Subjective Health sub-index.

In order to spatially visualize the distribution of the sub-index scores we classify the min-max normalized values of each index into five groups according to the distribution percentiles P_{20}, P_{40}, P_{60} and P_{80}. Results are shown

Region	Subjective Health sub-index norm score	Subjective Health sub-index rank	Region	Subjective Health sub-index norm score	Subjective Health sub-index rank	Region	Subjective Health sub-index norm score	Subjective Health sub-index rank
AT1	82.36	37	ES43	85.17	29	ITF	49.46	75
AT2	88.05	15	ES51	89.59	13	ITG	42.00	78
AT3	89.62	12	ES52	85.06	31	LT0	15.78	86
BE1	83.57	34	ES53	93.36	4	LU0	90.32	10
BE2	97.72	2	ES61	85.45	26	LV0	27.17	82
BE3	81.21	43	ES62	86.76	19	MT0	100.00	1
BG3	28.29	81	ES70	82.14	39	NL	93.18	5
BG4	44.56	76	FI13	82.94	35	PL1	7.94	87
CY0	88.63	14	FI18	85.63	25	PL2	30.90	79
CZ01	73.13	54	FI19	86.39	20	PL3	24.46	83
CZ02	62.11	68	FI1A	82.41	36	PL4	30.39	80
CZ03	79.73	46	FR10	89.83	11	PL5	23.66	84
CZ04	68.93	63	FR20	78.75	49	PL6	17.73	85
CZ05	66.11	65	FR30	81.88	41	PT	50.99	74
CZ06	81.14	44	FR40	85.17	28	RO11	72.79	56
CZ07	60.85	69	FR50	90.37	9	RO12	78.48	50
CZ08	65.52	66	FR60	82.31	38	RO21	71.73	57
DE	81.94	40	FR70	85.95	23	RO22	67.68	64
DK	87.39	18	FR80	80.08	45	RO31	84.70	33
EE	0.00	88	GR1	81.57	42	RO32	78.85	48
ES11	75.97	51	GR2	70.32	61	RO41	85.09	30
ES12	85.04	32	GR3	75.00	53	RO42	86.18	21
ES13	85.97	22	GR4	71.08	59	SE1	71.21	58
ES21	91.25	7	HU1	58.91	71	SE2	72.92	55
ES22	93.15	6	HU2	54.45	73	SE3	69.50	62
ES23	85.38	27	HU3	42.26	77	SI	71.01	60
ES24	87.42	17	IE0	94.79	3	SK0	59.09	70
ES30	91.17	8	ITC	75.66	52	UK	55.25	72
ES41	85.66	24	ITD	79.58	47			
ES42	87.84	16	ITE	62.36	67			

Table 5.19: Subjective Health component: scores and ranks.

in Figure 5.25.

5.3.5 Objective vs Subjective Health

It is well known that objective and self-reported indicators are intrinsically different and this is even more valid in case of health, which is the most important aspect in one's life. Comparing the two measures is then particularly interesting. To this aim, the two sub-indexes of objective and subjective health are first min-max normalized and then compared in the scatterplot in Figure 5.26. The plot is divided into four quadrants and it can be noted that for the most part of the regions subjective and objective health measures matches (high-high and low-low quadrants) with a prevalence of high-high points that means that most people are in good health. Romanian regions behave in a peculiar way: they declare to be in a general good health condition despite a low level of objective health. This can be related to an *awareness issue* which can bias self-reported health measures. A person living in a community with many diseases and poor health-care system may be inclined to underestimate his own health condition, taking as normal symptoms which are clinically preventable and/or treatable (Sen, 2002). It is also worth noting the two most souther Italian regions which, even if very close to the border, are the only ones belonging to the low-high quadrant. People here are behaving in the opposite way than Rumanians: they perceive to have a low-intermediate health condition despite a pretty good objective health. Are they incline to complain? It can be. But other reasons certainly underly this outcome, reasons that are not correctly captured by our limited set of indicators.

Finally, we compared health sub-indexes with the health related variable recently collected at the regional level in the Flash Eurobarometer 356 - Public opinion in EU regions (see Section 3.4). For the comparison we consider question $Q3.8$ which is the percentage of people in the region who consider that *the healthcare system is the most important issue for the region* (EC, 2012). An association between this variable and our health sub-index is observed, as expected. Table 5.20 shows that there is a significant (negative) correlation between $Q3.8$ and both objective and subjective sub-indexes. The association is negative as our health measures are positively oriented withe respect QoL while $Q3.8$ is negatively oriented.

Correlations

		SH_sub_index	OH_sub_index	Eurobarometer_Q3_8
SH_sub_index	Pearson Correlation	1	.633**	-.446**
	Sig. (2-tailed)		.000	.000
	N	74	74	74
OH_sub_index	Pearson Correlation	.633**	1	-.453**
	Sig. (2-tailed)	.000		.000
	N	74	74	74
Eurobarometer_Q3_8	Pearson Correlation	-.446**	-.453**	1
	Sig. (2-tailed)	.000	.000	
	N	74	74	74

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5.20: Correlations between our regional health measures and the health question in Flash Eurobarometer 356 - $Q3.8$.

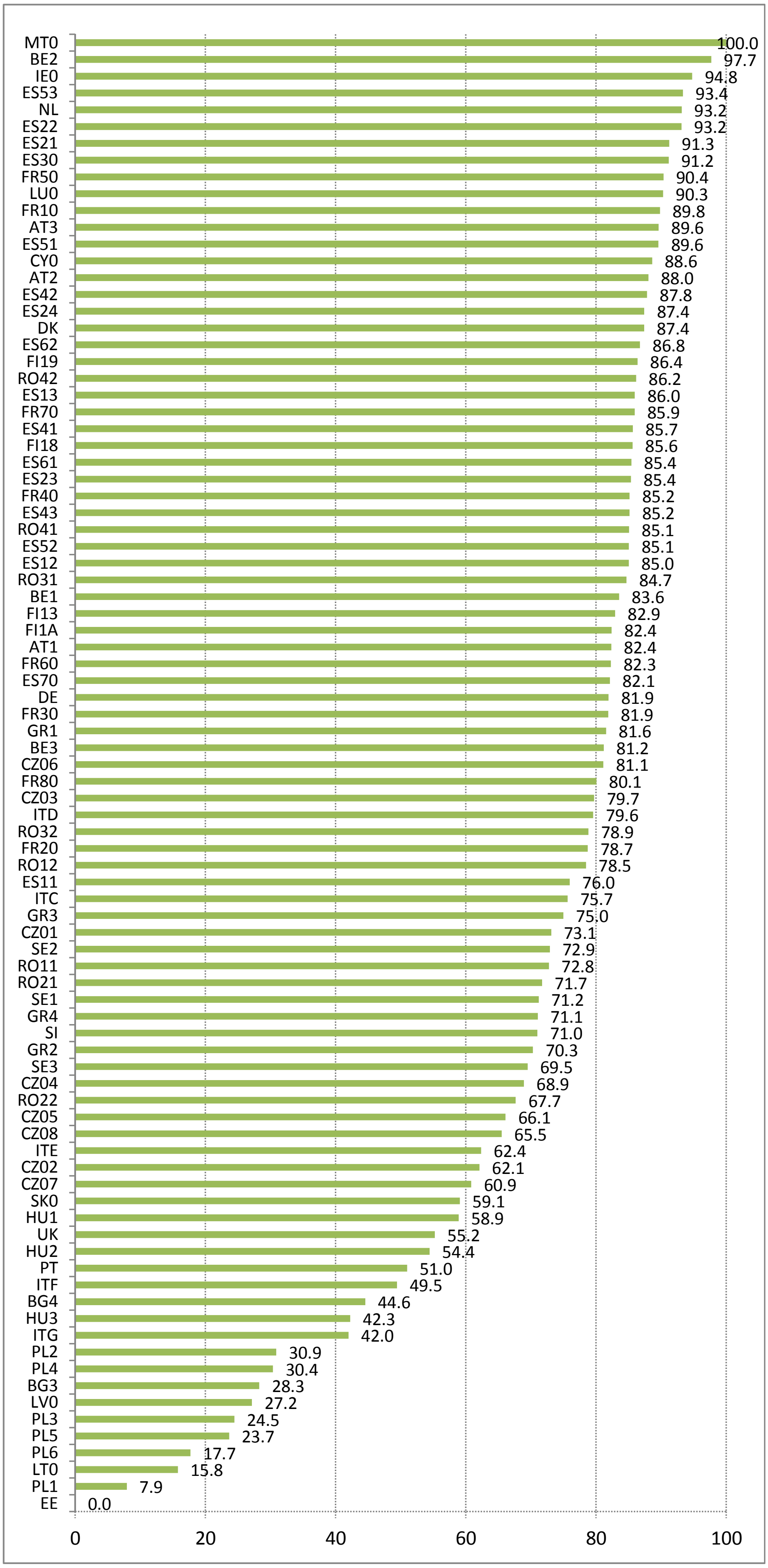


Figure 5.23: Subjective Health component: ranking.

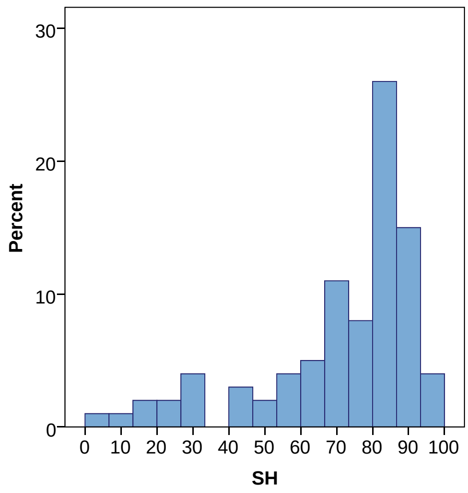


Figure 5.24: Subjective Health sub-index: min-max normalized sub-index distribution.

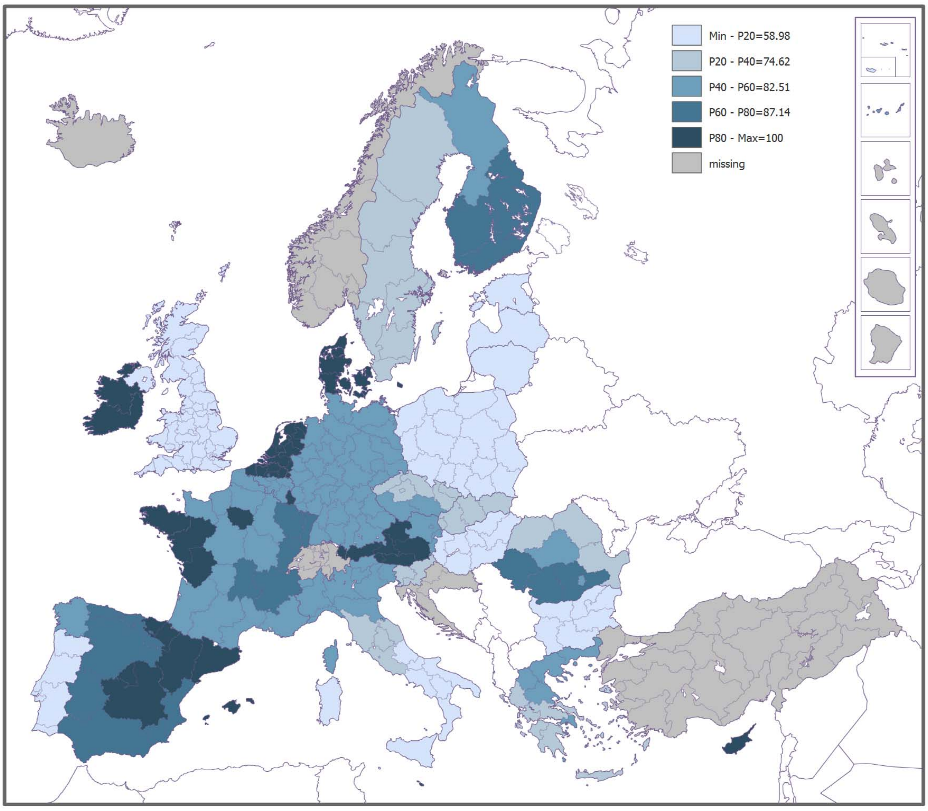


Figure 5.25: Subjective Health sub-index - Map (normalized values recoded into five classes).

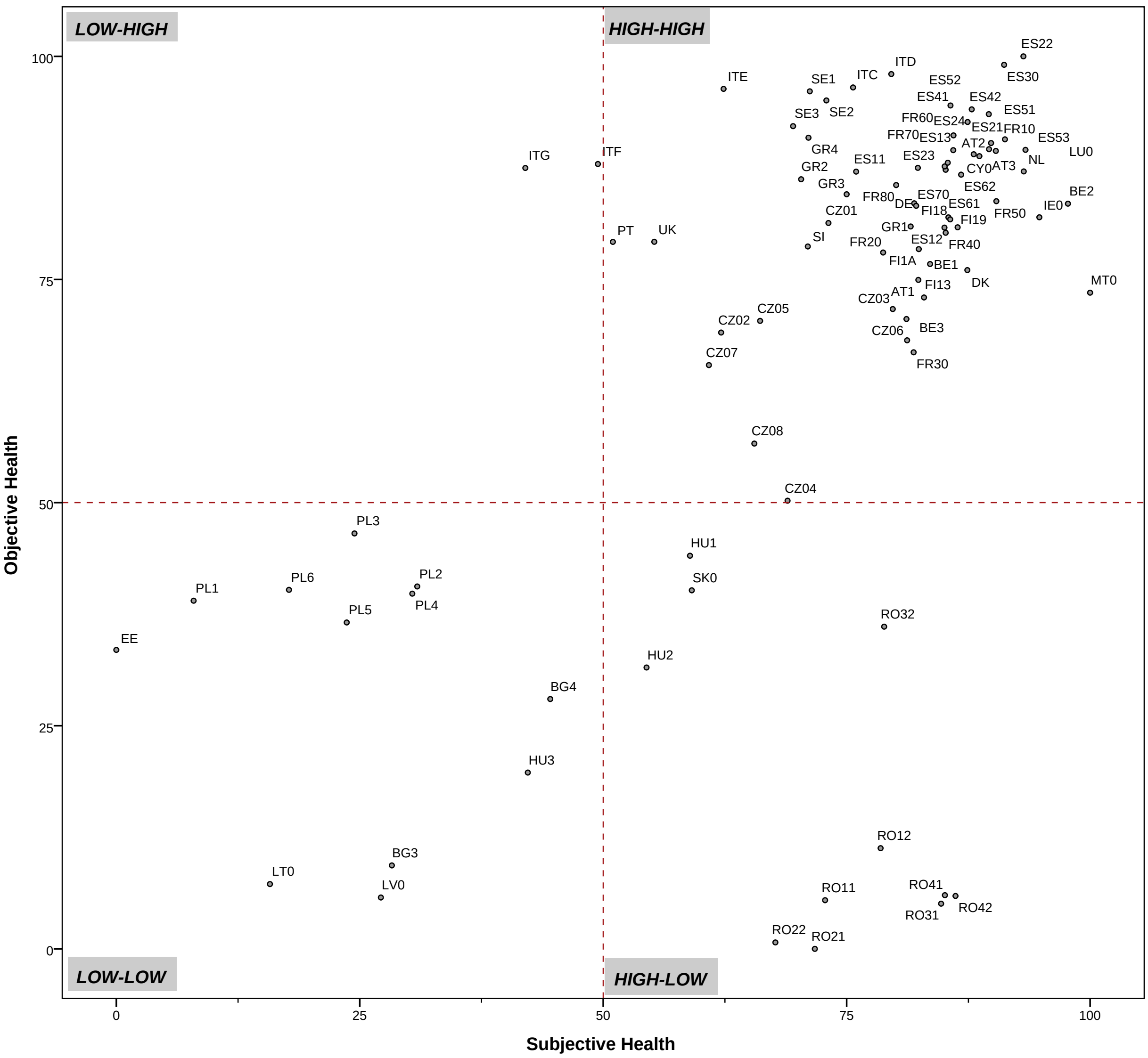


Figure 5.26: Subjective sub-index vs Objective sub-index (normalized min-max values).

5.4 Quality of the health system at the country level

Since many aspects of perception of health are not covered in EU SILC, our study is complemented by the analysis of a specific survey on people's perception on the quality of healthcare system. To this goal we selected the Special Eurobarometer - Patient safety and quality of healthcare (see Section 3.4) which allows for describing aspects of the health care system different form those covered by EU- SILC, SOEP or USS.

Describing the quality of the health-care system as perceived by the citizens is not an easy task. The only data available to reach are specific Eurobarometer surveys (Section 3.4 which are representative of the country level only. A national analysis of perception on the quality of the heathcare system is carried out on the basis of the Special Eurobarometer on *Patient safety and quality of healthcare* (EC, 2010c) shortly described in Section 3.4. Data were collected in 2009 and the representativeness is at the national level only.

A preliminary analysis allowed us to select three variables from the survey, listed in Table 5.21. All the variables are qualitative of ordinal type. We adopted a common recoding procedure in order to have the orientation of the type 'the higher the better'and the 'don't know'category treated as missing. The first variable describes the perceived overall quality of the health-care system, while the other two variables describe the level of trust in the hospital care system and non-hospital one.[2] The category frequencies are shown Table 5.22.

indicator (survey code)	**measured aspect**	**original categories**	**recoded categories (the higher the better)**
Overall Quality (QD2)	Perceived overall quality of healthcare	very good fairly good fairly bad very bad don't know	{very bad} → {1} {fairly bad} → {2} {don't know} → {missing} {fairly good} → {3} {very good} → {4}
Trust in hospital care (QD4a)	Perceived probability of being harmed by hospital care	very likely fairly likely not very likely not al all likely don't know	{very likely} → {1} {fairly likely} → {2} {don't know} → {missing} {not very likely} → {3} {not al all likely} → {4}
Trust in non hospital care (QD4b)	Perceived probability of being harmed by non-hospital care	very likely fairly likely not very likely not al all likely don't know	{very likely} → {1} {fairly likely} → {2} {don't know} → {missing} {not very likely} → {3} {not al all likely} → {4}

Table 5.21: National analysis of the health system quality. Questions selected from the Special Eurobarometer survey 327

Given the nature of Eurobarometer data, qualitative data on a Likert scale (Smith and Smith, 2004), The Rasch

[2] Non-hospital care is understood as receiving diagnosis, treatment or medicine in a clinic or surgery of your general practitioner or from a pharmacy.

Question	categories	n	%
QD2. How would you evaluate the overall quality of healthcare in your country?	1=very bad	2192	8.2
	2=fairly bad	6614	24.8
	3=fairly good	13963	52.4
	4=very good	3525	13.2
	do not know=missing	369	1.4
QD4a. How likely do you think it is that patients could be harmed by hospital health care in your country?	1=very likely	2852	11.1
	2=fairly likely	11097	43.3
	3=not very likely	10484	40.9
	4=not at all likely	1207	4.7
	do not know = missing	1023	3.8
QD4b. How likely do you think it is that patients could be harmed by non-hospital health care in your country?	1=not at all likely	2621	10.3
	2=not very likely	10830	42.5
	3=fairly likely	10879	42.7
	4=very likely	1127	4.4
	do not know = missing	1206	4.5

Table 5.22: Quality and trust in health-care system: Frequency table of variables included in the analysis

Partial Credit model is used to summarize the information contained in the three variables (see Appendix 4 for details on the Rasch models and interpretation of results). Basic diagnostic of the Partial Credit Model are shown in Table 5.23.

Question	Rasch Measure (S.E.)	Infit MNSQ	Outfit MNSQ
QD2. How would you evaluate the overall quality of healthcare in your country?	-0.94 (0.01)	1.07	1.00
QD4a. How likely do you think it is that patients could be harmed by hospital health care in your country?	0.54 (0.01)	0.83	0.75
QD4b. How likely do you think it is that patients could be harmed by non-hospital health care in your country?	0.40 (0.01)	0.87	0.80

Table 5.23: Quality and trust of health-care - Results from the Rasch Partial Credit Model

For all the three variables the response scale structure is satisfactory - both average measures for response categories and thresholds between categories are monotonous, thus respecting the original ordinal scale of measurement. Fit statistics for each question are also satisfactory as their value is always close to 1, indicating little distortion of the measurement system. The variance explained by the Rasch measure is 64% which is rather satisfactory, as shown from the analysis of the standardized residuals (Figure 5.27). The eigenvalue of the first contrast amounts to 1.9 which is below the critical value 2 treated as the maximum value that enables to treat the second dimension in the data as negligible.

The final ranking of the EU countries according to the level of perceived quality of the health-care system is shown

Dimensionality

Table of STANDARDIZED RESIDUAL variance (in Eigenvalue units)

		-- Empirical --			Modeled
Total raw variance in observations	=	8.3	100.0%		100.0%
Raw variance explained by measures	=	5.3	64.0%		62.9%
Raw variance explained by persons	=	3.8	45.3%		44.5%
Raw Variance explained by items	=	1.6	18.8%		18.4%
Raw unexplained variance (total)	=	3.0	36.0%	100.0%	37.1%
Unexplned variance in 1st contrast	=	1.9	22.8%	61.3%	
Unexplned variance in 2nd contrast	=	.9	10.8%	29.0%	
Unexplned variance in 3rd contrast	=	.3	3.6%	9.7%	

Figure 5.27: Quality and trust of health-care. Results from the Rasch Partial Credit Model: analysis of standardized residuals.

in Figure 5.28.

Finally, two recent Special Eurobarometer surveys, on Tobacco use (EC, 2010d) and on Sport and physical activity (EC, 2010e) were analysed to refine the description of the health condition of EU citizens. After the selection of the most relevant questions in each of the surveys, the Partial Credit Rasch model was used following the same approach as that used for the analysis of the health-care system quality. Rasch outcomes show that is not possible to summarize into one synthetic measure neither the Tobacco use survey nor the Sport activity survey[3]. Too many factors influence the answers to these surveys. We then decided not to consider these data for further analysis.

[3]Results of the analysis are not shown here but are available from the authors upon request

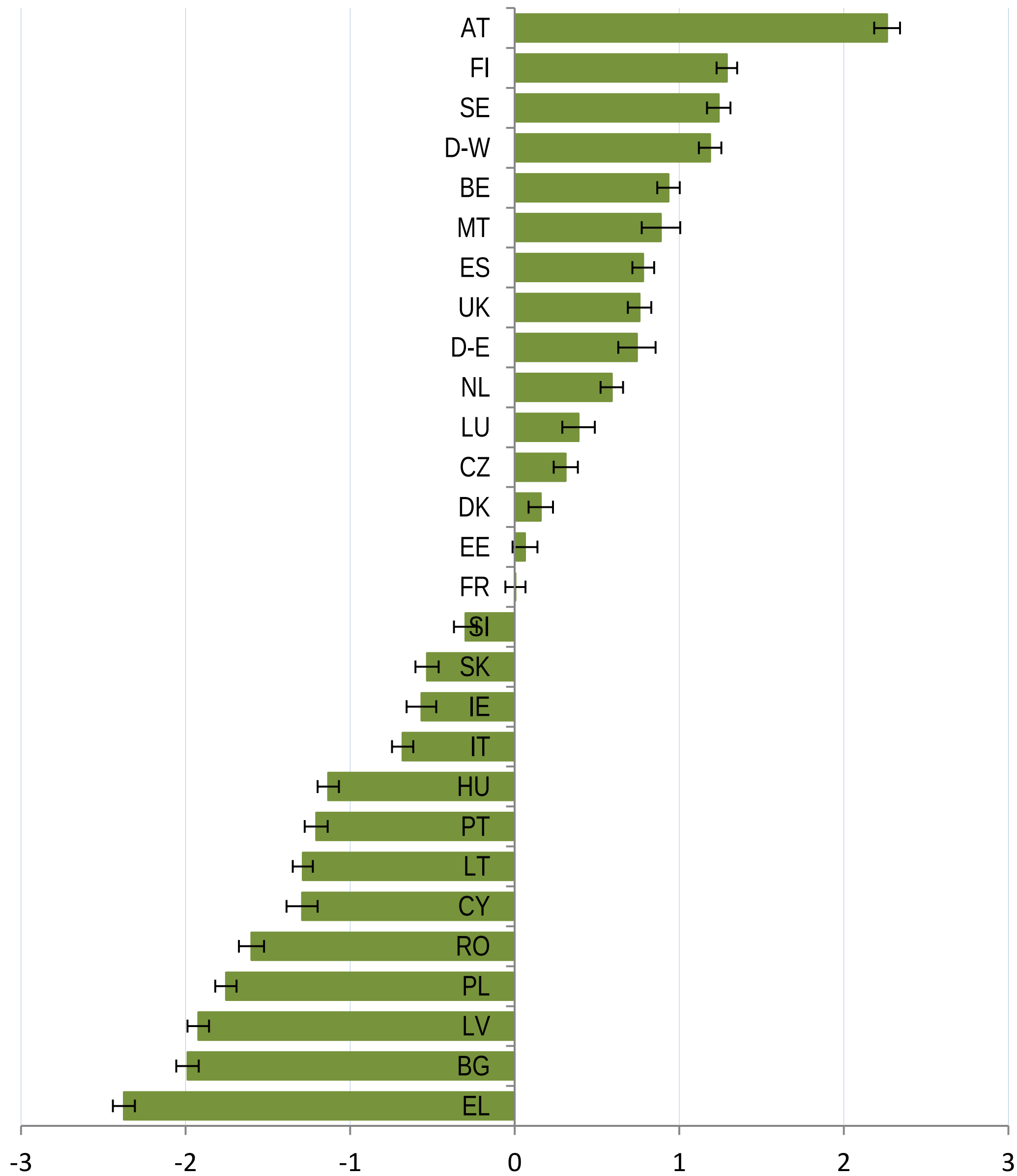


Figure 5.28: Quality and trust of health-care. Results from the Rasch Partial Credit Model: final country ranking.

Chapter 6

The Inequality dimension: work in progress

6.1 Proposed estimates of inequalities

The importance of measures of inequality in the various aspects of QoL is undoubtable and discussed earlier in this report. The most classical measures of inequality are economic ones and typically refer to income, whatever income is defined. But even more interesting are the interconnections between income level and education, heath-care accessibility, work-life balance, and in general all the other aspects of QoL. A necessary condition for the analysis of interdependencies is that different QoL indicators are simultaneously measured together with the income level for the same individual. Multi-dimensional social-economic surveys like EU-SILC, which is indeed our core data source, allow for this kind of analysis. In the process of populating the QoL dimensions, our aim is to include at least one measure of inequality for each dimension in order to have, eventually, an Inequality dimension in the QoL framework. As this report discusses two dimensions only, Living Standards and Health, the Inequality dimension is a work in progress and includes only preliminary results. More analyses are envisaged for the next phase of the project including more and different types of inequality measures, like the ones based on concentration curves (Atkinson et al., 2010).

As a measure of income inequality we include the quantile ratio $\frac{S_{80}}{S_{20}}$, that is the ratio of the total income received by the top 20% of the population (with the highest income, top quintile) to that received by the bottom 20% of the population (with the lowest income, bottom quintile). Micro-data from EU-SILC, SOEP and USS are used to compute regional values of $\frac{S_{80}}{S_{20}}$. In the computation of S_{20} negative incomes are set to zero to avoid distorting effects[1].

Computation of inequalities referred to dimensions other than income is more complex. For the health dimension we compute a simple measure of inequality in health-care affordability following these steps. The population is

[1] Negative incomes are present only in EU-SILC data. SOEP and USS do not include negative income values.

first split into two sub-groups, poor and rich, defined respectively as persons with individual income not higher than 20th percentile P_{20} or not lower than 80th percentile P_{80} within each region. Consistently with the rest of the analysis individual income is computed including housing costs. The shares of people not affording medical and dental treatment and declaring not to be in good health are computed for the sub-populations of poor and rich. The difference between the shares within poor and rich is taken as a simple measure of inequality: the higher this difference, the higher the distance between the status of poor and rich people.
The major drawback of this approach is related to sample sizes: by splitting the sample in each region into the sub-populations of poor and rich the sample representativeness is decreased even further. Aware of that, the analysis of inequality indicators is solely a qualitative one.

6.2 Qualitative analysis of inequality levels

The following inequality indicators have been computed so far:

1. income inequality $\frac{S_{80}}{S_{20}}$ - IN1,
2. inequality in affordability of medical treatment when needed - IN2,
3. inequality in affordability of dental treatment when needed - IN3,
4. inequality in the self-perceived general health condition - IN4.

The first three indicators are closely related with each others as they all refer to the individual's economic condition. The last one is more generally referring to self-reported health. All of them measure the inequality level, meaning that their orientation is the higher, the worse. Indicator values are recoded into five classes on the basis of the percentiles P_{20}, P_{40}, P_{60} and P_{80} (Table 6.1).

indicator value	**class number**
$x < P_{20}$	1
$P_{20} \leq x < P_{40}$	2
$P_{40} \leq x < P_{60}$	3
$P_{60} \leq x < P_{80}$	4
$x \geq P_{80}$	5

Table 6.1: Recoding of inequality indicators.

Recoded inequality indicators are shown in Table 6.2. One of the most striking features of these data is that in quite a number of cases low levels of inequality in the first three indicators correspond to high levels of inequality in the fourth indicator and the other way round. Take for example the Czech Republic: almost all the NUTS2 regions have low levels of monetary inequality indicators (IN1, IN2, IN3) but high levels of the health-inequality indicator. Romanian regions behave exactly in the opposite way: despite high level of economic inequality, the perception of general health is almost the same between poor and rich. Is it related to the awareness issue in the measurement of self-reported health, as advocated by Sen (2002) long ago? It may be one of the reasons.

region_label	Income inequality S80/S20	Inequality medical treatment	Inequality dental treatment	Inequality general health		region_label	Income inequality S80/S20	Inequality medical treatment	Inequality dental treatment	Inequality general health
AT1	2	2	2	3		FR40	1	3	3	2
AT2	1	3	2	2		FR50	1	3	4	1
AT3	1	2	1	3		FR60	3	4	3	1
BE1	5	3	3	5		FR70	2	3	3	2
BE2	1	2	2	3		FR80	3	4	5	2
BE3	3	3	3	5		GR1	5	5	4	2
BG3	5	5	5	5		GR2	5	4	4	3
BG4	5	5	5	5		GR3	5	5	5	1
CY0	1	4	4	5		GR4	5	5	5	4
CZ01	3	2	1	5		HU1	2	3	3	5
CZ02	2	2	1	5		HU2	1	4	2	4
CZ03	1	2	1	4		HU3	2	4	2	2
CZ04	3	3	2	4		IE0	2	3	1	1
CZ05	1	2	1	4		ITC	3	4	4	3
CZ06	1	2	1	4		ITD	3	4	4	4
CZ07	2	2	1	5		ITE	3	4	4	3
CZ08	2	1	1	5		ITF	4	5	5	1
DE	5	4	3	3		ITG	4	5	5	1
DK	3	1	2	2		LT0	4	3	3	5
EE	3	3	5	5		LU0	2	3	1	3
ES11	2	1	2	4		LV0	5	5	5	5
ES12	2	1	2	1		MT0	1	3	2	1
ES13	2	1	2	4		NL	3	1	1	2
ES21	2	1	2	4		PL1	5	4	4	5
ES22	2	2	2	2		PL2	4	4	3	4
ES23	3	1	3	3		PL3	3	4	4	3
ES24	3	1	2	4		PL4	4	4	3	3
ES30	4	2	4	2		PL5	4	5	4	5
ES41	4	1	2	3		PL6	3	4	3	3
ES42	4	1	3	3		PT	4	5	5	5
ES43	4	1	1	2		RO11	5	5	4	1
ES51	4	1	2	2		RO12	5	5	5	1
ES52	3	1	4	1		RO21	5	5	5	2
ES53	4	1	3	1		RO22	5	5	5	1
ES61	4	1	3	3		RO31	4	5	5	1
ES62	4	2	3	4		RO32	5	5	5	3
ES70	4	3	5	3		RO41	5	5	4	1
FI13	1	2	1	4		RO42	5	5	4	2
FI18	2	2	2	4		SE1	3	3	5	2
FI19	1	2	1	4		SE2	2	3	4	2
FI1A	1	1	1	3		SE3	1	2	4	4
FR10	3	4	5	1		SI	1	2	1	5
FR20	1	3	3	1		SK0	2	3	1	5
FR30	1	4	3	1		UK	5	1	1	2

Table 6.2: Categorized inequality indicators.

Table 6.3 shows the rank correlation coefficients (Spearman's ρ) between inequality indicators. The choice of computing the correlations of ranks is in line with the need of a qualitative analysis. As expected, the correlation pattern confirms what already noted. The inequality indicator related to general health - IN4 - is clearly not (rank) correlated with the others. There might be various reasons for this but the most important one is the the fact that the first three indicators are all monetary ones while IN4 is more generally related to the individual's health condition. The inequality indicator related to general health has been discarded from further analysis.

An overview of regions classification is provided in Table 6.4 where the reddish regions are the most unequal (red and dark red correspond to classes 4 and 5, that is inequality levels higher than P_{60}), while bluish regions are the least unequal (blue and dark blue correspond to classes 1 and 2, that is inequality levels lower than P_{40}).

Least unequal regions are those in Finland and the Czech Republic, the Vlaams Gewest region in Belgium (BE2) and some Spanish regions in the North West (ES1). The most unequal regions are located in Bulgaria, Greece,

Correlations

			IN1	IN2	IN3	IN4
Spearman's rho	IN1	Correlation Coefficient	1.000	.485**	.609**	-.162
		Sig. (2-tailed)	.	.000	.000	.133
		N	88	88	88	88
	IN2	Correlation Coefficient	.485**	1.000	.754**	-.131
		Sig. (2-tailed)	.000	.	.000	.225
		N	88	88	88	88
	IN3	Correlation Coefficient	.609**	.754**	1.000	-.208
		Sig. (2-tailed)	.000	.000	.	.052
		N	88	88	88	88
	IN4	Correlation Coefficient	-.162	-.131	-.208	1.000
		Sig. (2-tailed)	.133	.225	.052	.
		N	88	88	88	88

**. Correlation is significant at the 0.01 level (2-tailed).

Table 6.3: Rank correlation coefficients for inequality indicators.

Latvia, Portugal, Romania, plus the most southern regions in Italy (Sud e Isole, ITF and ITG) and two regions in Poland, the capital region Centralny (PL1) and the south-western region Poludniowo-Zachodni (PL5).

Further analysis is foreseen to expand and improve the measurement of inequality levels in European regions.

region	Income inequality S80/S20	Inequality medical treatment	Inequality dental treatment	region	Income inequality S80/S20	Inequality medical treatment	Inequality dental treatment
FI1A	1	1	1	FR70	2	3	3
AT3	1	2	1	HU1	2	3	3
CZ03	1	2	1	HU3	2	4	2
CZ05	1	2	1	BE3	3	3	3
CZ06	1	2	1	CY0	1	4	4
CZ08	2	1	1	ES62	4	2	3
FI13	1	2	1	SE2	2	3	4
FI19	1	2	1	ES30	4	2	4
SI	1	2	1	FR60	3	4	3
BE2	1	2	2	LT0	4	3	3
CZ02	2	2	1	PL6	3	4	3
CZ07	2	2	1	BE1	5	3	3
ES11	2	1	2	EE	3	3	5
ES12	2	1	2	ITC	3	4	4
ES13	2	1	2	ITD	3	4	4
ES21	2	1	2	ITE	3	4	4
NL	3	1	1	PL2	4	4	3
AT1	2	2	2	PL3	3	4	4
AT2	1	3	2	PL4	4	4	3
CZ01	3	2	1	SE1	3	3	5
DK	3	1	2	DE	5	4	3
ES22	2	2	2	ES70	4	3	5
ES24	3	1	2	FR10	3	4	5
ES43	4	1	1	FR80	3	4	5
FI18	2	2	2	GR2	5	4	4
IE0	2	3	1	PL1	5	4	4
LU0	2	3	1	PL5	4	5	4
MT0	1	3	2	GR1	5	5	4
SK0	2	3	1	ITF	4	5	5
ES23	3	1	3	ITG	4	5	5
ES41	4	1	2	PT	4	5	5
ES51	4	1	2	RO11	5	5	4
FR20	1	3	3	RO31	4	5	5
FR40	1	3	3	RO41	5	5	4
HU2	1	4	2	RO42	5	5	4
SE3	1	2	4	BG3	5	5	5
UK	5	1	1	BG4	5	5	5
CZ04	3	3	2	GR3	5	5	5
ES42	4	1	3	GR4	5	5	5
ES52	3	1	4	LV0	5	5	5
ES53	4	1	3	RO12	5	5	5
ES61	4	1	3	RO21	5	5	5
FR30	1	4	3	RO22	5	5	5
FR50	1	3	4	RO32	5	5	5

Table 6.4: Classification of regions according to inequality indicators. Dark blue regions are the least unequal; dark red regions are the most unequal. The intermediate class is associated to green.

Appendices

.1 OECD compendium: Indicators included in the three macro-dimensions (OECD, 2011a)

1. **Economic well-being**, describing major material living conditions. This includes 3 pillars:

   1.1 Income and wealth measured with the indicators: Household net adjusted disposable income; Household financial net wealth per person.

   1.2 Jobs and earnings measured with the indicators: Employment rate; Long term unemployment rate.

   1.3 Housing measured with the indicators: Number of rooms per person; Dwelling with basic facilities.

2. **Quality of life**, describing non-monetary factors. This includes 8 pillars:

   2.1 Health status measured with the indicators: Life expectancy at birth; Self-reported health status as % of people reporting good/very good health.

   2.2 Work and Life measured with the indicators: Employees working very long hours as % of employees working more than 50 hours a week; Time devoted to leisure and personal care as hours per day for the population aged 25-64; Employment rate of women with children of compulsory school age.

   2.3 Education and skills measured with the indicators: Educational attainment as % of adults with at least upper secondary school; Literacy as PISA scores in reading

   2.4 Social connections measured with the indicators: Contact with others as % of people socialising with friends or relatives at least once a week during a usual year; Social network support as % of people who have relatives or friends they can count on.

   2.5 Civic engagement and governance measured with the indicators: Voter turnout in most OECD countries; Consultation on rule-making.

   2.6 Environmental quality measured with the indicator: Air pollution as PM10 concentrations.

   2.7 Personal security measured with the indicators: Intentional homicides; Self-reported victimisation as % of people declaring that they have been assaulted over the previous 12 months.

   2.8 Subjective well-being measured with the indicator: Life satisfaction.

3. **Sustainability**, describing sustainability of the socioeconomic and natural systems. Despite the relevance of this aspect, authors are aware that suitable indicators for measuring this are still lacking. This macro dimension is excluded by the analysis at this stage.

.2 Canadian Index of Wellbeing: Indicators included in the Index (Michalos et al., 2010)

Leisure and Culture:

1. Average % of time spent on the previous day in social leisure activities
2. Average % of time spent on the previous day in arts and cultural activities
3. Average number of hours in past year volunteering for culture and recreation organizations
4. Average monthly frequency of participation in physical activity lasting over 15 minutes
5. Average attendance per performance in past year at all performing arts performances
6. Average visitation per site in past year to all National Parks and National Historic Sites
7. Average number of nights away per trip in the past year on vacation trips to destinations over 80 km from home
8. Expenditures in past year on all aspects of culture and recreation as a % of total household expenditures

Democratic Engagement:

1. Voter turnout at federal elections (%)
2. Interest in politics
3. Volunteer rate for political activities
4. Policy impact perception
5. Satisfaction with democracy
6. Ratio of registered to eligible voters
7. Representation of women in parliament
8. Net Official Development Assistance as % of Gross National Income

Community Vitality:

1. Participation in group activities
2. Volunteering
3. Number of close relatives
4. Providing assistance to others

5. Property crime
6. Violent crime
7. Walking alone after dark
8. Trust (in people)
9. Experience of discrimination
10. Caring for others
11. Belonging to community

Education:

1. Availability of childcare spaces for children 0-5
2. Developmental health in kindergarten (age 5)
3. Student-educator ratio in the public school system
4. Self report on peer belonging, friendship intimacy, self-concept, prosocial behavior, empathy, and bullying
5. Math, reading, and science skill test scores
6. Relationship between students educational skill test scores/postsecondary education participation and their parents socioeconomic status

Environment:

1. Air - Population Weight Ground Ozone
2. Air - Criteria air contaminant emissions index
3. Air - Absolute Greenhouse gas emissions
4. Energy - Primary energy production
5. Energy - Energy use final demand
6. Freshwater - Water quality index
7. Freshwater - Water yield in southern Canada
8. Freshwater - Daily per capita residential water use
9. Non-renewable sources - Viable Non-Renewable Energy Reserves Index
10. Non-renewable sources - Viable Metal Reserves Index

11. Non-renewable sources - Combined Per Capita Waste Disposal and Diversion Rate
12. Biotic resources - Canadian Living Planet Index
13. Biotic resources - Marine Trophic Index
14. Biotic resources - Timber Sustainability Index

Healthy population:

1. Self-rated health
2. Health-adjusted life expectancy
3. Diabetes
4. Depression
5. Life expectancy at birth
6. Infant mortality
7. Smoking
8. Patient satisfaction with health services
9. Population with a regular family doctor
10. Influenza immunization among age 65+

Living standards The set of candidate indicators selected by (Sharpe and Arsenault, 2009) included also ‘Persistence of low income’ and ‘Prevalence of food insecurity’, which were eventually excluded due to the lack of consistent time series estimates. The final set if indicator is:

1. After-tax median income
2. Income distribution (ratio of top to bottom quintile)
3. Incidence of low income as number of households below the Low Income Cut-Off (LICO) [2]
4. Wealth distribution
5. Aggregate Economic Security Index (computed by the Centre for the Study of Living Standards - CSLS)
6. Long-term unemployment
7. Employment rate

[2] LICOs are thresholds used in Canada to determine the number of people with ‘low’ income. They are computed as the level of income at which a family of a certain size would have to spend 20 percentage points more of its income on basic needs, food, shelter and clothing, than the average family of the same size Sharpe and Arsenault (2009).

8. Employment Quality Index (computed by the Canadian Imperial Bank of Commerce, CIBC).
9. Housing Affordability Index (computed by the The Royal Bank of Canada, RBC)

Time use:

1. Working age: Working non-standard hours
2. Working age: Working long hours
3. Working age: Experiencing time pressure
4. Working age: Time spent providing care to seniors
5. Retired seniors: Time spent in active leisure
6. Retired seniors: Time spent in formal volunteering
7. Youth: Adolescents exceeding recommended screen time
8. Youth: Participation in organized extracurricular activities
9. Youth: Parental reading to preschoolers
10. Youth: Adolescents eating meals with parents at home

.3 Franco-German Report: Proposed indicators in the three domains (de Boissieu et al., 2010)

1. **Economic performance**, describing economic performance and material wellbeing. This includes 6 indicators:

   1.1 GDP per capita

   1.2 GDP per hours worked

   1.3 Employment rate (age group 15-64)

   1.4 Net national income per capita

   1.5 Final consumption expenditure per capita (including government consumption)

   1.6 Distribution measure of net income per consumption unit (income quantile ratio)

2. **Quality of life**, describing non-monetary factors. This includes 7 indicators:

   2.1 Health Potential years of life lost by OECD (defined as the difference between age at death and 70 computed for each person who died below age 70, related to 100000 people)

   2.2 Education Students (ISCED 1-6) age 15-24

   2.3 Personal activities Employees working on shift work

   2.4 Political voice and governance Voice and Accountability by the World Bank Institute (the indicator is one of the Worldwide Governance Indicators)

   2.5 Social connections and relationships Frequency of time spent with people at sport, culture, communal organization (question proposed to be included in the annual EU SILC program - recent data not yet available)

   2.6 Environmental conditions Population-weighted mean concentration of particulate matter PM10 at urban background stations in agglomerations by Eurostat

   2.7 Personal and economic insecurity Not-at-risk-of-poverty rate measured as the share of persons with an equivalized disposable income below the risk-of-poverty threshold, which is set at 60% of the national median equivalized disposable income after social transfer

3. **Sustainability**, to ascertain whether the current level of wellbeing can be maintained for future generations. This includes 12 indicators:

   3.1 Economic Private sector net fixed capital formation as % of GDP

   3.2 Economic R&D investment as % of GDP

   3.3 Economic Cyclically adjusted fiscal balance as % of GDP

   3.4 Economic Fiscal sustainability gap S2

3.5 Economic Total private credit to GDP gap

3.6 Economic Real equity price gap

3.7 Economic Real property price gap

3.8 Environmental Level of greenhouse gas emissions

3.9 Environmental Greenhouse gas emissions per capita

3.10 Environmental GDP relative to non-renewable domestic material input

3.11 Environmental Non-renewable domestic material consumption per capita

3.12 Environmental Biodiversity, measured by a preliminary ‘bird index’

.4 The Rasch models: Technical description

The Rasch models are statistical models which provide the means for constructing quantitative (interval) measures from qualitative data measured an a dichotomous or ordinal scale (Smith and Smith, 2004). The Rasch approach is generally applied to the measurement of human performance, aptitude or perception when observed raw data are derived from commonly used survey rating scales as strongly agree - agree - disagree - strongly disagree. Raw counts (percentage of people in a certain category) cannot be relied upon to serve as measures while the Rasch models have been designed to construct proper inference from observations of this kind.

Rasch analysis has been conceived as a psychometric tool for the social sciences and it has been applied mostly to the medical and educational fields. The starting point of a Rasch analysis is always a data matrix with scores (ordinal scores) obtained by a set of *persons* on a set of tasks (questions, physical or intellectual tests, ...) that are called *items* in the Rasch model terminology. The Rasch approach provides a statistical model to estimate the probability of a person with a certain ability succeeding on an item of a certain difficulty. The two key concepts of these models are then the person's ability θ and the item's difficulty δ. Since individuals are usually involved, concepts as *ability* and *difficulty* usually refer to human perceptions.

When used in the evaluation of Eurobarometer surveys, it is necessary to translate the concepts of *ability* and *difficulty* to the context under investigation as for example in the case of perceived quality of the national health-care system (discussed in Section 5.4). In this case the individuals are the survey respondents and individual's *ability* is meant as the individual's overall perceived quality of the health-care system. The higher the score of an individual the higher his ability, i.e, the more positive his opinion about the health system. Citizens' perception is measured by asking different questions (items). These variables are designed to describe different aspects of the health-care system quality: variables which more often score high values, are those on which more persons showed a positive opinion. In terms of Rasch parameters, items which frequently score high values are associated to a lower *difficulty*. That means that the lower the item *difficulty* the higher the number of persons who have a positive perception about that item. In other words, the item is less difficult and hence it gets more often high scores (see also Figure 1.

The simplest Rasch model is the one for dichotomous variables, of the type yes-no or agree-disagree. In this model the probability of the observed responses is a function of person n ability θ_n and item i difficulty δ_i. The probability that person n answers '1'on item i is formulated as:

$$\text{Pr}(X_{ni} = 1|\theta_n, \delta_i) = \frac{\exp(\theta_n - \delta_i)}{1 + \exp(\theta_n - \delta_i)} \tag{1}$$

In the more complicated case of ordinal variables (more than two categories) the Rasch Partial Credit model can be used instead (Wright and Masters, 1982; Smith and Smith, 2004). The Partial Credit model is one of the extensions of the dichotomous model that handles cases where multiple-choice answers are allowed. Rating Scale is also capable to model such cases but, whereas the rating scale model is to be used only when the definition of the rating scale is the same for all items (same number of categories for all the variables), Partial Credit should be used when the rating scale differs from one item to the other, as it is generally the case in Eurobarometer questionnaires.

In the Partial Credit model, the probability of observing category h on item i for person n is modeled as:

$$\Pr(X_{ni} = h|\theta_n, \delta_i, \delta_{h(i)}) = \frac{\exp[(\theta_n - (\delta_i + \delta_{h(i)})]}{\sum_{h=1}^{k_i} \exp[(\theta_n - (\delta_i + \delta_{h(i)})]} \quad (2)$$

where $\delta_{h(i)}$ are category thresholds for variable i which is measured on a scale of k_j different categories. The other parameters are as in the dichotomous model. Category thresholds are defined as difficulties of each successive step within the item (Wright and Masters, 1982). They reflect the additional ability a person should be endorsed with to pass from one category (e.g. 'do not agree') to the next one (e.g. 'agree'). Under proper model assumptions[3], the row and column marginal frequencies of data matrix are sufficient (statistics) for estimating parameters of a Rasch model.

In the analysis of Eurobarometer surveys, Partial Credit model is used for a twofold aim: 1. to check if the chosen set of questions actually measure a unique latent phenomenon and 2. to describe this latent phenomenon with a single measure. Using the terminology of the Rasch measurement this single measure is called the 'ability measure'. An interesting feature of the Rasch family models is the possibility to present all parameter estimates on a common scale. It is also possible to visualize the estimates on their common scale by means of the construct maps (Wilson, 2005). Figure 1 shows an example of this map for the analysis of Special Eurobarometer on Quality and trust of health-care (EC, 2010c) presented in Section 5.4. The software used to carry out the Rasch analysis is WINSTEPS (Linacre, 2011).

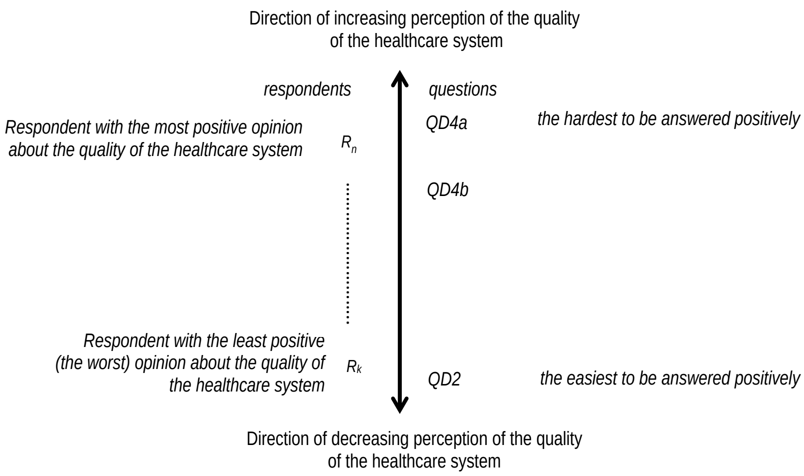


Figure 1: Rasch construct map for the Eurobarometer analysis on Quality and trust of health-care.

A rich diagnostics is available to evaluate the quality of a Rasch model. The statistics used for the analysis of Eurobarometer surveys are:

- fit statistics for questions - Infit Mean Square and Outfit Mean Square - to diagnose misfit;

[3] The so-called property of *local independence* is requested for estimating parameters of a Rasch model.

- structure of the response scale - thresholds and average abilities - to check for the qualitative understanding of the response categories;
- the level of variance explained by the Rasch measure;
- Principal component analysis on standardized residuals - to verify the one-dimensionality assumption.

Fit statistics show the extent to which items satisfy the requirement for mono-dimensionality, with misfit type depending on too high or too low fit statistics. For example fit statistics equals to 1.3 indicate 30% more variation in the observed data than the Rasch model predicts. This is interpreted as some responses to the item being influenced by other features that are not related to the underlying phenomenon. On the other hand, a low value of fit statistics, as for example 0.60, indicate 40% less variation in the observed response pattern than it was modeled. These items can then be considered redundant, since they add little information with respect to the information already provided by other items. Critical values of fit statistics are derived by approximate *t* distribution, after proper transformations of infit and outfit statistics. Table 5 shows the rule of thumb to be followed when interpreting fit statistics (Linacre, 2011).

MNSQ	Interpretation
> 2.0	Distorts or degrades the measurement system.
$1.5 - 2.0$	Unproductive for construction of measurement, but not degrading.
$0.5 - 1.5$	Productive for measurement.
< 0.5	Less productive for measurement, but not degrading.May produce misleadingly good reliabilities and separations.

Table 5: Rasch diagnostics: Interpretation of mean-square fit statistics

In the process of the assessment of the response scale functioning we check on thresholds and average measures monotonicity. In case of disordered categories, that is estimated thresholds not respecting the order of original categories, adjacent categories are merged.

In addition to fit statistics, the analysis of residuals is used to ascertain that the explained variance is at the 'noise' level. If so, the single latent dimension assumption is supported: no other dimensions, other than the Rasch dimension, are shared by the data (Smith and Smith, 2004). In the Rasch model residuals are assumed to have independent, then uncorrelated, unit normal distributions. The basic assumption underlying Rasch models is that all information in the data is explained by the latent variable. If so, residuals would simply represent random noise, normally distributed and independent from each other. However real data always differ to some extent from theoretical assumptions. Principal component analysis of standardized residuals helps in identifying characteristics shared in common among items which are often indications of secondary dimensions in the data. If such sub-dimensions are relevant, proper actions and diagnosis should be undertaken. Following such premises, a PCA analysis of standardized Rasch residuals is adopted to uncover possible additional dimensions. Simulation studies indicate that the presence of additional dimensions can be detected by eigenvalues larger than about 2 as reported by Linacre (2011).

Given these premises, the approach followed to compute the Rasch measure for selected questions of Eurobarometer surveys consists of the following steps. After selecting appropriate questions from the Eurobarometer questionnaire, a Partial Credit model is run and standard diagnostics is checked. If not satisfactory, we consider deletion of the most misfitting questions in a step-by-step process, that means that with more than two misfitting questions we firstly discard the most misfitting one and check again the diagnostics. Having obtained the optimal set of questions, in terms of fit statistics, dimensionality analysis and structure of the response scale of each questions are checked. The final model is always the one satisfying all the diagnostic criteria.

.5 EU-SILC negative individual disposable incomes (euro), different wave years.

EU-SILC 2007	without housing costs			with housing costs		
region	N	%	min	N	%	min
AT1	0	0.0%	300	55	0.9%	-7,538
AT2	1	0.0%	-4,200	12	0.3%	-12,112
AT3	0	0.0%	50	32	0.5%	-5,133
BE1	3	0.2%	-7,283	38	2.0%	-16,489
BE2	26	0.3%	-19,480	95	1.1%	-30,991
BE3	9	0.2%	-1,638	34	0.7%	-7,017
BG0	5	0.0%	-182	400	3.3%	-3,336
CY0	0	0.0%	631	7	0.1%	-6,838
CZ01	0	0.0%	1,464	3	0.2%	-1,886
CZ02	0	0.0%	1,176	8	0.3%	-2,370
CZ03	0	0.0%	1,065	10	0.4%	-15,195
CZ04	0	0.0%	222	26	1.0%	-3,511
CZ05	0	0.0%	872	16	0.5%	-2,214
CZ06	0	0.0%	0	27	0.7%	-12,657
CZ07	0	0.0%	321	20	0.6%	-6,595
CZ08	0	0.0%	1,096	15	0.5%	-441
DE	194	0.6%	-174,068	933	2.9%	-177,692
DK0	64	0.4%	-247,252	123	0.8%	-250,768
EE0	12	0.1%	-1,296	103	0.7%	-3,208
ES11	0	0.0%	0	18	0.7%	-2,318
ES12	0	0.0%	0	5	0.3%	-8,064
ES13	0	0.0%	0	7	0.8%	-3,352
ES21	1	0.1%	-394	26	1.5%	-5,693
ES22	1	0.1%	-11,171	5	0.4%	-12,848
ES23	0	0.0%	0	11	1.1%	-3,508
ES24	6	0.4%	-5,395	34	2.3%	-12,372
ES30	1	0.0%	-1,244	56	2.5%	-4,724
ES41	11	0.5%	-3,334	48	2.1%	-8,414
ES42	0	0.0%	0	17	1.0%	-3,955
ES43	0	0.0%	101	13	0.9%	-2,056
ES51	7	0.2%	-1,051	84	2.2%	-24,225
ES52	0	0.0%	0	28	1.1%	-4,312
ES53	0	0.0%	400	33	2.7%	-8,558
ES61	15	0.3%	-3,565	80	1.8%	-14,141
ES62	13	0.7%	-3,847	35	2.0%	-7,226
ES70	13	0.7%	-5,215	43	2.4%	-7,200
FI13	4	0.1%	-3,261	27	0.7%	-8,721
FI18	0	0.0%	0	69	0.6%	-13,818
FI19	1	0.0%	-2,324	35	0.5%	-16,520
FI1A	1	0.0%	-79	17	0.5%	-7,697
FR10	4	0.1%	-39,687	42	1.0%	-655,536
FR20	10	0.2%	-318	18	0.4%	-43,649
FR30	2	0.1%	-17,161	12	0.6%	-18,591
FR40	0	0.0%	1,868	3	0.1%	-1,637
FR50	5	0.1%	-744	13	0.3%	-3,774
FR60	4	0.1%	-7,946	15	0.5%	-280,647
FR70	6	0.2%	-1,085	14	0.5%	-376,402
FR80	8	0.3%	-18,352	32	1.1%	-19,531
GR1	7	0.1%	-2,800	99	1.8%	-6,746
GR2	24	0.7%	-21,759	79	2.3%	-25,067
GR3	8	0.2%	-4,000	80	1.9%	-7,282
GR4	12	0.7%	-2,171	35	2.1%	-3,046
HU1	0	0.0%	0	60	1.1%	-8,917
HU2	4	0.1%	-45	72	1.1%	-5,542
HU3	0	0.0%	0	115	1.1%	-6,666
IE0	1	0.0%	-736	99	0.7%	-61,319
ITC	38	0.3%	-17,553	153	1.3%	-24,485
ITD	32	0.3%	-7,686	126	1.0%	-12,299
ITE	30	0.2%	-60,090	148	1.2%	-68,906
ITF	39	0.3%	-10,379	274	2.3%	-15,754
ITG	16	0.4%	-9,350	108	2.4%	-11,900
LT0	2	0.0%	-579	89	0.7%	-1,449
LU0	7	0.1%	-11,489	49	0.5%	-16,343
LV0	23	0.2%	-248	212	1.9%	-8,400
NL	70	0.3%	-34,495	529	2.0%	-463,600
PL1	4	0.0%	-1,035	71	0.8%	-1,848
PL2	1	0.0%	-51	96	1.1%	-2,481
PL3	2	0.0%	-20	61	0.7%	-1,803
PL4	0	0.0%	359	43	0.7%	-1,384
PL5	2	0.0%	-26	94	2.3%	-1,126
PL6	2	0.0%	-82	53	0.8%	-2,136
PT	0	0.0%	393	59	0.5%	-3,606
RO0	27	0.1%	-1,464	579	3.0%	-7,828
SE0	19	0.1%	-5,734	186	1.0%	-18,081
SI	4	0.0%	-115,163	133	0.5%	-117,972
SK0	9	0.1%	-201	252	1.7%	-9,945
UK	64	0.3%	-8,414	568	2.6%	-551,330

EU-SILC 2008	without housing costs			with housing costs		
region	N	%	min	N	%	min
AT1	0	0.0%	300	26	0.5%	-3,923
AT2	0	0.0%	100	6	0.2%	-4,559
AT3	0	0.0%	0	9	0.2%	-3,400
BE1	2	0.1%	-33,307	39	2.1%	-36,074
BE2	20	0.2%	-16,625	133	1.6%	-63,179
BE3	6	0.1%	-98,519	66	1.3%	-103,247
BG3	1	0.0%	-62	112	1.8%	-1,574
BG4	0	0.0%	37	122	2.1%	-3,292
CY0	0	0.0%	298	17	0.2%	-7,851
CZ01	0	0.0%	875	21	1.0%	-16,699
CZ02	0	0.0%	176	43	1.6%	-26,653
CZ03	0	0.0%	303	66	2.0%	-18,748
CZ04	0	0.0%	348	29	1.0%	-9,152
CZ05	0	0.0%	0	67	1.6%	-12,584
CZ06	0	0.0%	502	96	2.2%	-10,705
CZ07	0	0.0%	217	65	1.8%	-13,229
CZ08	0	0.0%	540	53	1.4%	-9,851
DE	112	0.4%	-83,706	764	2.6%	-160,618
DK0	49	0.3%	-51,057	151	1.0%	-62,752
EE0	9	0.1%	-657	52	0.4%	-2,873
ES11	4	0.2%	-1,923	28	1.1%	-5,676
ES12	0	0.0%	0	13	0.8%	-4,684
ES13	1	0.1%	-6,080	21	2.0%	-11,228
ES21	10	0.5%	-18,426	32	1.7%	-19,988
ES22	1	0.1%	-361	10	0.8%	-2,954
ES23	9	0.8%	-14,747	32	2.9%	-16,118
ES24	7	0.5%	-4,295	14	0.9%	-10,848
ES30	14	0.5%	-44,032	61	2.3%	-44,741
ES41	6	0.3%	-1,969	27	1.2%	-6,288
ES42	15	0.8%	-11,844	37	2.0%	-12,271
ES43	10	0.7%	-1,330	24	1.6%	-2,820
ES51	14	0.4%	-17,882	87	2.3%	-19,042
ES52	10	0.4%	-22,917	46	1.7%	-28,016
ES53	6	0.5%	-18,184	42	3.5%	-19,102
ES61	39	0.8%	-56,668	116	2.5%	-59,509
ES62	10	0.6%	-6,280	69	4.2%	-7,347
ES70	10	0.5%	-4,000	44	2.4%	-10,113
FI13	1	0.0%	-450	15	0.4%	-6,177
FI18	0	0.0%	215	43	0.4%	-21,083
FI19	3	0.0%	-118	31	0.4%	-10,593
FI1A	0	0.0%	460	14	0.4%	-6,960
GR1	27	0.5%	-40,432	196	3.3%	-41,685
GR2	9	0.2%	-5,555	100	2.7%	-8,058
GR3	26	0.5%	-24,250	178	3.3%	-25,572
GR4	9	0.5%	-9,881	29	1.5%	-14,229
HU1	5	0.1%	-967	51	1.0%	-2,895
HU2	3	0.0%	-7,795	45	0.7%	-10,277
HU3	3	0.0%	-209	92	0.9%	-2,398
IE0	2	0.0%	-8,707	76	0.6%	-16,487
ITC	39	0.3%	-21,552	137	1.2%	-22,958
ITD	19	0.2%	-30,349	123	1.0%	-36,812
ITE	22	0.2%	-14,046	176	1.4%	-19,121
ITF	43	0.4%	-9,423	311	2.6%	-12,151
ITG	20	0.4%	-7,791	88	1.9%	-9,035
LT0	4	0.0%	-23	119	1.0%	-2,085
LU0	19	0.2%	-72,604	53	0.5%	-81,324
LV0	27	0.2%	-2,800	129	1.0%	-11,514
NL	54	0.2%	-85,075	176	0.7%	-428,454
PL1	7	0.1%	-53	88	1.1%	-2,114
PL2	8	0.1%	-4,440	97	1.2%	-6,882
PL3	8	0.1%	-1,436	77	0.9%	-3,489
PL4	9	0.1%	-654	65	1.0%	-2,676
PL5	5	0.1%	-2,907	54	1.4%	-4,176
PL6	14	0.2%	-2,009	79	1.3%	-3,658
PT	0	0.0%	287	88	0.7%	-17,383
RO01	1	0.0%	-15	130	4.2%	-3,544
RO02	1	0.0%	-21	112	4.6%	-2,505
RO03	0	0.0%	10	86	2.6%	-2,878
RO04	3	0.1%	-87	72	3.5%	-2,518
RO05	11	0.6%	-54	60	3.4%	-2,623
RO06	8	0.3%	-36	44	1.8%	-2,375
RO07	0	0.0%	72	39	1.6%	-2,986
RO08	0	0.0%	42	25	1.7%	-3,208
SE1	10	0.1%	-403,988	68	1.0%	-409,336
SE2	14	0.2%	-2,638	72	0.8%	-6,909
SE3	6	0.2%	-2,203	42	1.2%	-7,501
SI	2	0.0%	-44,910	95	0.3%	-47,003
SK0	11	0.1%	-3,567	108	0.7%	-26,520
UK	62	0.3%	-31,487	568	2.7%	-48,215

EU-SILC 2009	without housing costs			with housing costs		
region	N	%	min	N	%	min
AT1	0	0.0%	0	34	0.6%	-12,066
AT2	0	0.0%	46	10	0.3%	-4,582
AT3	1	0.0%	-14,370	16	0.3%	-18,072
BE1	7	0.4%	-11,048	49	2.6%	-14,618
BE2	23	0.3%	-223,150	48	0.6%	-257,112
BE3	5	0.1%	-40,704	32	0.6%	-45,318
BG3	0	0.0%	0	12	0.2%	-11,857
BG4	0	0.0%	0	2	0.0%	-184
CY0	0	0.0%	0	11	0.1%	-6,223
CZ0	2	0.0%	-1,030	139	0.6%	-10,174
DE	30	0.1%	-24,396	523	1.8%	-91,939
DK0	166	1.1%	-463,708	277	1.8%	-480,711
EE0	9	0.1%	-9,605	83	0.6%	-10,781
ES1	49	0.9%	-25,403	151	2.8%	-32,344
ES2	39	0.7%	-32,978	130	2.2%	-45,877
ES3	26	0.9%	-75,001	116	3.8%	-90,465
ES4	73	1.3%	-21,388	214	3.7%	-28,984
ES5	97	1.2%	-26,075	291	3.7%	-33,004
ES6	71	1.0%	-18,267	339	4.8%	-19,372
ES7	9	0.5%	-31,316	53	2.9%	-35,084
FI1	6	0.0%	-267	137	0.5%	-41,823
FR1	9	0.2%	-33,660	28	0.7%	-36,539
FR2	1	0.0%	-200	18	0.4%	-16,451
FR3	0	0.0%	30	10	0.5%	-4,620
FR4	0	0.0%	2,170	0	0.0%	40
FR5	0	0.0%	10	24	0.6%	-5,680
FR6	0	0.0%	580	9	0.3%	-7,576
FR7	0	0.0%	0	7	0.3%	-12,075
FR8	1	0.0%	-1,520	26	0.9%	-3,550
GR1	50	0.8%	-22,000	239	3.7%	-29,488
GR2	23	0.6%	-23,022	153	3.9%	-26,852
GR3	37	0.7%	-27,103	195	3.5%	-27,695
GR4	24	1.2%	-8,231	40	1.9%	-12,657
HU1	1	0.0%	-52	33	0.6%	-2,576
HU2	0	0.0%	406	29	0.4%	-1,646
HU3	6	0.1%	-1,455	40	0.3%	-2,092
IE0	2	0.0%	-2,800	106	0.8%	-11,339
ITC	22	0.2%	-54,150	199	1.7%	-56,030
ITD	9	0.1%	-9,720	110	0.9%	-13,829
ITE	21	0.2%	-24,667	164	1.4%	-26,565
ITF	8	0.1%	-2,152	269	2.3%	-13,080
ITG	12	0.3%	-159	93	2.1%	-4,213
LT0	5	0.0%	-4,317	128	1.0%	-6,298
LU0	14	0.1%	-21,444	44	0.4%	-39,240
LV0	34	0.2%	-4,042	184	1.3%	-6,945
MT0	2	0.0%	-2,046	84	0.8%	-13,128
NL	43	0.2%	-196,365	185	0.8%	-196,365
PL1	0	0.0%	179	48	0.6%	-3,360
PL2	2	0.0%	-4	50	0.7%	-6,169
PL3	0	0.0%	14	43	0.5%	-2,082
PL4	0	0.0%	133	80	1.4%	-2,713
PL5	0	0.0%	256	14	0.4%	-1,794
PL6	1	0.0%	-6,663	21	0.4%	-10,763
PT	0	0.0%	168	71	0.5%	-6,327
RO1	8	0.2%	-81	39	0.8%	-1,911
RO2	14	0.3%	-80	92	1.7%	-2,050
RO3	15	0.3%	-109	51	1.1%	-2,865
RO4	7	0.2%	-122	66	1.8%	-3,448
SE1	9	0.1%	-64,277	61	0.9%	-73,897
SE2	23	0.3%	-29,605	113	1.3%	-32,339
SE3	9	0.3%	-24,569	37	1.1%	-41,699
SI	3	0.0%	-2,620	3	0.0%	-5,266
SK0	8	0.0%	-2,206	135	0.8%	-872,679
UK	60	0.3%	-1,937	501	2.6%	-16,494

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Abstract

This study is the outcome of the European Commission joint project DG JRC / DG REGIO on the measure of quality of life of European regions. European Union cohesion policy supports the economic and social development of regions, especially lagging regions, throughout an integrated approach with the ultimate goal of improving citizens' wellbeing. In this setting, measuring quality of life at the sub-national level is the first step for assessing which regions can assure or have the potential to assure good quality of life and which cannot.

The project simultaneously features three innovative points. First the attempt to measure QoL for the European Union regions (NUTS1/NUTS2). Second, the adoption of a type of aggregation, at the lowest level of QoL dimensions,, which penalizes inequality across indicators, for mitigating compensability effects. Third, the inclusion of housing costs in the computation of individual's disposable income. In line with the most recent international literature, after-housing income is considered as providing a better indication of financial disadvantage than before-housing income.

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