Multidimensional Well-being and Inequality across the European Regions with Alternative Interactions between the Well-being Dimensions

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Abstract. This paper uses recent multidimensional well-being measurements to examine multidimensional well-being and inequality across the European regions in 2000 and 2014 with the use of eleven well-being indicators from the OECD Better Life Index. We use generalized mean aggregation method with alternative parameters to allow different substitutability and complementarity levels between well-being dimensions, which range between perfect substitutability and some degree of complementarity between the dimensions, to examine well-being and inequality across the European regions. Accounting for the interactions between the well-being dimensions matters for the multidimensional well-being and inequality across the European regions. The results show that the multidimensional well-being across the European regions are relatively lower when the dimensions are more seen as complements compared to the case when they are considered to be perfect substitutes. Furthermore, there is also a higher degree of multidimensional inequality across the European regions when the dimensions are considered to have some complementarity. Changes in well-being dimensions between 2000 and 2014 indicates that multidimensional well-being improved and inequality decreased in the personal and community well-being categories, but remained unchanged in material well-being category across the European regions irrespective of interaction levels between well-being dimensions. Policy implications of these multidimensional well-being indices are also evaluated by using these indices to determine the eligible regions for the European Union structural funds where the number eligible regions shows some variation depending on whether the dimensions are perfect substitutes or more of complements.

Keywords: Regional well-being; Better Life Index; Multidimensional well-being; Multidimensional inequality; Interaction between dimensions; Europe

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1. Introduction

It has been widely accepted that well-being is a multidimensional phenomenon (Fleurbaey and Blanchet, 2013) which requires consideration of many dimensions of well-being. For instance, the European Commission's "Going beyond GDP" initiative[1] and Stiglitz *et al.* (2009) point out that the well-being progress should be examined by considering well-being indicators that are beyond standard of living and should include dimensions of well-being such as health, education, political voice and governance, environmental factors, among other dimensions.

Until recently, the analysis of the multidimensional well-being has been at country level. For instance, the most commonly known composite index measuring multidimensional well-being is the United Nations' Development Programme (UNDP)'s Human Development Index (HDI), which offers countries' average achievement in income, education and health dimensions (Malik, 2013). Environmental Sustainability Index (ESI), on the other hand, aggregates various dimensions of well-being and sustainability (Esty et al., 2005) by using the weighted average achievements across different set of dimensions. Finally, OECD's Better Life Index (BLI) offers multidimensional well-being index by aggregating achievements in 11 indicators through preferences of individuals on different well-being indicators (Durand, 2015).[2] Only very recently, the OECD has proposed a computation of the BLI at a regional level thanks to the availability of well-being macro-level data at regional level for OECD countries (OECD, 2014) enabling one to construct regional well-being indices, which is the aim of this paper.

Above-mentioned composite indices provide a more holistic measure of well-being by including more dimensions into measuring social progress. However, most of the composite indices aggregated through weighted averages where each dimension is given a relative weight suggesting its intrinsic importance (Alkire and Santos, 2014). However, one of the characteristics of weighted average aggregation that is overlooked by public and policymakers is that this aggregation method assumes perfect substitution between well-being dimensions (see Decancq and Lugo, 2013 for a detailed discussion on this issue). This has been something that has been taken into account by the new aggregation method of the HDI, a geometric mean, where the intention of the UNDP is to make sure that the poor performances in some dimensions are reflected in the HDI since unbalanced achievements across the well-being dimensions are reflected in the composite HDI scores. For instance, Zambrano (2014) examines the normative properties of geometric mean aggregation and suggests that the geometric mean aggregation of the HDI penalizes both low and uneven achievements across all dimensions of human development, whereas the old formulation is not sensitive to such uneven development. This is something that is also in the lines with the Cobb-Douglas utility (production) function since education and health dimensions are considered to be part of the production function where achievements in education and health

[1] See http://ec.europa.eu/environment/beyond_gdp/background_en.html for details.
[2] The choice of weights is still based on individual preferences and can be considered as paternalistic (see Decancq et al., 2015). Alternative well-being measures based on equivalent incomes use a flexible specification where individual preferences determine the curvature of the iso-well-being curves (see e.g., Fleurbaey and Blanchet (2013) for an extensive survey and Decancq and Schokkaert (2016) for an application with European data, for instance).

complement each other to lead different levels of income per capita across countries.[3] In this respect, we use generalized mean aggregation method, which is general enough to take into account the normative judgments of individuals and policymakers with respect to the weight allocation across well-being dimensions and also the interaction levels between the well-being dimensions (see e.g., Decancq, 2017 for a recent implementation of the generalized mean aggregation method to obtain distribution-sensitive well-being scores for the OECD countries).

Taking into account interactions between well-being dimensions (i.e., whether well-being dimensions are substitutes or complements) are particularly important since this would give different signals to regions to improve their multidimensional well-being. For instance, if the multidimensional well-being index obtained with arithmetic mean aggregation (i.e., dimensions are perfect substitutes), policymaker in a given region can choose to improve "easy" dimensions to improve overall well-being, which can then lead to unbalanced composition of development. For instance, if the dimensions are considered to be perfect substitutes, an improvement in any dimension would be sufficient to improve overall index outcome and policymakers could choose to improve the dimensions that are less costly (or relatively easier to manipulate). Whereas, if two dimensions are more seen as complements, then a policymaker should prioritize balanced improvement in both dimensions since the uneven achievements across all dimensions would not improve the well-being as much as the balanced ones. Hence, identifying and taking into account these interactions are important since different interaction levels across well-being dimensions would prioritise different policies to improve the aggregate well-being outcomes. In this respect, it is important to understand the priorities set by the policymakers in Europe to determine the levels of interaction across the well-being dimensions when constructing a regional well-being index for the European regions.

One of the first objectives of the European Union (EU) since its establishment has been to decrease the income disparities across its regions by allocating funds to regions that have gross domestic product (GDP) per inhabitant less than 75% of the EU average, which is found to be an effective way of decreasing the income disparities across regions (see e.g., Bosker, 2009; Becker et al., 2013). Recent policy documents on the regional development also consider the inclusion of social and environmental dimensions beyond GDP per capita when determining the allocation of EU structural funds (European Committee of the Regions, 2011) suggesting the relevance of multidimensional well-being in policymaking. Furthermore, European Commission (EC)'s goals set for 2020 aim to promote "a balanced and sustainable pattern of territorial development" by increasing employment, investment in R&D and tertiary degrees, and decreasing emissions and the poverty across the regions (European Commission, 2010). Hence, EC clearly suggests that their aim is to promote balanced achievements across various well-being dimensions and regions, which gives an indication to consider the dimensions more of complements. Hence, in this paper, we offer a generalized mean aggregation method that provides an aggregation method that is flexible enough to take into account different degrees of complementarity between the well-being dimensions. In other words, given the priority of balanced and sustainable pattern of territorial development, we prioritize even achievements across well-being dimensions (or penalize uneven achievements across well-being dimensions) by allowing

[3] See for example Glaeser et al., 2004 for education's importance in economic growth, and Behrman and Rosenzweig (2004) for health's effect on economic growth.

dimensions not to be perfect substitutes (or allowing dimensions to be complementary). Although we offer an aggregation where the dimensions are seen more of complements, we also compute well-being indices where the dimensions are considered as perfect substitutes to compare the outcomes obtained with different approaches.

Overall, contributions of this paper are threefold. Firstly, this paper offers multidimensional well-being and inequality measures for European regions which goes beyond the GDP per capita comparisons by integrating more dimensions into analysis.[4] Secondly, we propose an aggregation methodology that is flexible enough to capture the interactions between the well-being dimensions.[5] In particular, we consider that the well-being dimensions to be seen more of complements which enables one to capture how balanced the achievements across the dimensions are. Thirdly, we assess the potential policy implications of these indices by determining the eligible regions for the EU structural funds if these indices are used as eligibility criteria rather than the GDP per capita.

The remainder of the paper is organized as follows. The next section, we introduce well-being dimensions and categories that are used in the construction of regional well-being index. We also offer generalized mean aggregation methodology which allows different degree of substitution and complementary across well-being dimensions. Section 3 presents the multidimensional well-being and inequality measures, ranking analysis, and over-time changes in multidimensional well-being and inequality between 2000 and 2014 for the European regions. Section 4 provides analysis on how normative preferences could lead to distinctive policy outcomes when EU structural funds are allocated based on the composite well-being indices. Finally, Section 5 concludes.

2. Construction of multidimensional well-being index

Constructing a multidimensional well-being index is a non-trivial task. In general, it requires the definition of the concept to be measured, selection of the indicators, normalization of the indicators, and the choice of the aggregation method (see OECD, 2008 for detailed steps on the construction of composite indicators).

In general, there are two conceptual measurement models: formative or reflective (see e.g., Coltman et al., 2008; Diamantopoulos et al., 2008). In general, reflective measurement model's causality is from the concept to the indicators where the opposite direction of causality (from the indicators to the concept) is the case for the formative measurement model. Since the objective of this paper is to measure regional well-being, and that the well-being depends on the indicators and not vice versa, this paper follows the formative measurement model (see e.g., Maziotta and Pareto, 2016; Mazziotta and Pareto, 2018 for further discussion on the difference between reflective and

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[4] Majority of the regional inequality across the European regions are based on income per capita (see e.g., Hoffmeister, 2009; Fredriksen, 2012; Doran and Jordan, 2013) where we offer a multidimensional inequality measures for the European regions in this paper.

[5] Even though multidimensional well-being (or poverty) in Europe is evaluated (see e.g., Bárcena-Martín et al., 2014; Binelli et al., 2015), these composite measures allow perfect substitution between the dimensions, but did not consider the complementarity between the well-being dimensions (i.e., sensitivity of policy makers to the evenness of achievements across well-being dimensions), which we take into account in this paper.

formative models when measuring well-being). In the next sub-sections, we will offer the well-being dimensions and categories chosen to measure well-being, normalization and aggregation methods to obtain composite well-being indices for the European regions.

2.1. Well-being dimensions and categories

We use the nine dimensions considered in the OECD regional well-being index (OECD, 2016) and compiled them into three categories of well-being (i.e., material, personal and community) to track the progress in three general categories of well-being in the regions of Europe.

Table 1 offers the dimensions and categories of well-being and indicators used in each dimension, and the details of how each indicator is measured. Material well-being category consists of achievements of the regions in income (measured by the average household disposable income per capita), jobs (measured by the employment and unemployment rates), and housing (number of rooms available per person) dimensions. Personal well-being category consists of education (measured by the share of the labor force with at least secondary education), health (measured by the life expectancy and mortality rates), and access to services (which measures the share of households with broadband access) dimensions. Finally, community well-being category includes the civic engagement (measured by voter turnout), environmental quality (measured by air pollution levels) and safety (measured by homicide rates) dimensions. For potential policy implications of the proposed index, we only consider achievements of European regions in these dimensions in 2000 and 2014.[6]

<Table 1 approximately here>

2.2. Normalization procedure

Since the indicators are measured in different units, we need to normalize the indicators prior to the aggregation. There are numerous methods of normalization such as standardization (or z-scores), rescaling (or min-max), and distance to reference points, and one can choose a specific normalization procedure depending on the problem at hand (see OECD, 2008 for further discussion on the benefits and disadvantages of various normalization procedures). In this paper, we follow the OECD approach to

[6] We consider the regions of 24 OECD countries that are located in Europe. 21 of these countries are part of the EU and 3 of them are not part of the EU (Iceland, Norway, and Switzerland). We do not include regions of seven countries that are part of the EU (Bulgaria, Croatia, Cyprus, Latvia, Lithuania, Malta, Romania) since they are not OECD member and hence we do not have any data for these regions. 2000 and 2014 reference points were made by the OECD for comparison reasons; however, closest available data is used for year 2000 and 2014. See Table 3 of OECD (2016) for further details.

normalize the indicators in order to have comparisons across space and time. To avoid the effects of large outliers in each indicator, indicators are censored in the lower and upper limits (i.e., 4th and 96th percentile of the distribution).[7] Then min-max formula is used to normalize all indicators between 0 and 1:

$$z_{ij}^{t} = \left[\frac{X_{ij}^{t} - \min(X_j)}{\max(X_j) - \min(X_j)}\right]$$

where z_{ij}^{t} and X_{ij}^{t} are normalized and actual outcomes in region *i* for a given indicator *j* at a given time *t*, respectively. $\max(X_j)$ and $\min(X_j)$ represent the maximum and minimum value for a given indicator *j* during the period of the comparison.[8] It should be noted that the higher normalized values represent higher welfare levels.[9] Once the indicators are normalized, we then have normalized scores in nine dimensions.[10]

Table 2 presents the Spearman and Kendall rank correlation matrices for the nine well-being dimensions across the European regions where the first and second rows between pairs of dimensions represent the Spearman and Kendall rank correlation coefficients between pairs of dimensions, respectively. Even though most of the well-being dimensions are positively correlated, some well-being dimensions are either negatively correlated with each other or some of them have no significant rank correlation coefficients. If all well-being dimensions were highly and positively correlated, any index constructed from these well-being dimensions would hardly provide additional information or would have been redundant (see e.g., McGillivray, 2005; Cahill, 2005; Berenger and Verdier-Chouchane, 2007; Permanyer, 2011; Foster et al., 2013 among many others that examine the redundancy of composite indices based on correlation analysis). Hence, the existence of negative and insignificant correlation coefficients (and in some cases low positive correlation coefficients) between well-being dimensions is reassuring to construct multidimensional well-being indices as the index would provide additional set of information. In the next subsection, we propose the generalized mean aggregation methodology, which we use to obtain multidimensional well-being indices.

[7] Note that OECD uses 10th and 90th percentiles of the homicide data as lower and upper limits to avoid low and high clusters of the data.
[8] As any normalization procedure, the one adapted by the OECD have some defects such as the rigidity of a method that considers a range [0, 1] or the problem of variability assigned to elementary indicators (see e.g., OECD, 2008 and Mazziotta and Pareto, 2017 for further discussion on this issue). However, we adapt the same normalization procedure as the contribution of this paper is to examine the effect of different parameter choices in aggregation procedure on the composite scores and rankings.
[9] For indicators where lower value correspond to higher welfare such as the homicide rate, air pollution, mortality rate and unemployment rate, normalized values are subtracted from one.
[10] If a dimension has more than one indicator, we obtain the normalized achievement level in that dimension by averaging the achievements in indicators used under that dimension.

<Table 2 approximately here>

2.3. Aggregation method

As discussed before, we offer a generalized mean aggregation method which is flexible enough to take into account various value judgments of the decision maker (individuals and/or policymakers): a weighting vector for the dimensions and a parameter that express the degree of substitution (complementarity) between the dimensions. To capture the degree of substitution (complementarity) between the well-being dimensions, normalized achievement levels can be aggregated by taking a generalized weighted mean of order β to obtain a multidimensional well-being index as follows:

$$WI_i^t = \left(\sum_{j=1}^{d} w_j \times \left(z_{ij}^t\right)^{\beta}\right)^{\frac{1}{\beta}}$$

where w_j is the weight attached to well-being dimension j, z_{ij}^t is the normalized achievement level of a region i in dimension j at time t. The parameter β is the main parameter of interest in this paper which captures the value judgment of the decision maker with respect to the degree of substitution (complementarity) between the dimensions.[11]

Clearly, when β=1, the aggregation pins down to arithmetic mean aggregation where there is a perfect substitutability between the dimensions. In this case, a lower achievement in one dimension can be compensated by the higher achievement in another dimension. In this case, the regions can concentrate on some dimensions which can be easily manipulated (or less costly to achieve) to increase their regional well-being given the compensation across dimensions, which might lead to unbalanced achievement across the well-being dimensions. For instance, one of the criticisms of the arithmetic mean aggregation of the dimensions of the HDI was that perfect substitutability between dimensions led to uneven achievements where some research papers suggested a lower degree of substitutability (or some level of complementarity) between dimensions (e.g. Herrero et al. (2010) suggested the use of geometric mean to aggregate the dimensions of the HDI).[12]

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[11] See Decancq and Lugo (2013) for the list of papers using this method to obtain multidimensional well-being index.

[12] Similarly, Ravallion (1997, 2012) calculated the implicit trade-offs between the dimensions of the HDI and found that the valuation of some the dimensions are way higher than the economic returns or cost of improving the dimension.

Another popular use with the above case is obtained when β is set to 0 where the aggregation function becomes a geometric mean. This is referred as the Cobb-Douglas utility function (see the recent use of this aggregation by the UNDP's HDI).[13] In this case, trade-offs across the well-being dimensions depend on both relative weights and level of achievements across well-being dimensions. A percentage decrease in one dimension can be compensated by the percent increase in other dimensions. In this case, the aggregation would penalize regions with unbalanced achievements in the well-being dimensions, hence reflecting some degree of complementarity between the dimensions rather than perfect substitutability.[14]

Beyond these two special cases, when parameter β decreases, this makes it increasing difficult to compensate a decrease in one dimension by an increase in another. In particular, when β is set to $-\infty$, multidimensional well-being of a region is determined by the worst outcome across all dimensions of well-being. In other words, change in any other dimension which is not the worst achieved dimension does not affect the composite well-being outcome. For the case when β is set to $-\infty$, a region that wants to improve the composite well-being is implied to focus on the dimension in which the achievement level is the worst one. This choice clearly favors a case in which regions to promote perfectly balanced achievements between the well-being dimensions.

In the evaluation of complex multidimensional well-being (sustainability) regional (country) performances, the choice of various parameters in the aggregation procedure conveys the preferences of decision makers (e.g., policymakers and the general public). Given the complexity of aggregation procedure for the decision makers, there is a stream of literature that elicit decision makers' preferences through questionnaire to obtain necessary parameters for the aggregation to increase the acceptability and applicability of these aggregation methods in policy-making (see e.g., Guh et al., 2008 for discussion generalized mean aggregation). For the derivation of questionnaires to obtain decision-maker preferences on interactions between the well-being (sustainability) indicators, interested readers are referred to Meyer and Pontiere, 2011; Garmendia and Gamboa, 2012; Rowley et al., 2012; Carraro et al., 2013; Merad et al., 2013; Pinar et al., 2014; Bertin et al., 2018 among many others. In this paper, we obtain overall regional well-being outcomes in three categories (i.e., material, personal and community) by allowing different degrees of complementarity (substitution) between well-being dimensions by choosing specific β parameters while keeping the weights between the dimensions equal. There is an extensive literature concerning the effects of choice of weights on both the ranking and composite achievement levels (see e.g., Chowdhury and Squire 2006; Cherchye et al., 2008; Permanyer, 2011; Foster et al., 2013; Pinar et al. 2013; Tofallis 2013; Athanassoglou, 2015; Pinar et al., 2015; Pinar et al., 2017). However, in this paper, our main focus is to allow different degrees of substitutability (complementarity) between the dimensions when obtaining composite well-being indices and to examine whether this normative preference has any effect on

[13] For the formal axioms of the generalized mean aggregation (or some form of generalized mean aggregation), we refer the interested readers to Chakravarty (2003); Herrero et al. (2010); Chakravarty (2011); Zambrano (2014, 2017).
[14] See for example Herrero et al. (2010) and Klugman et al. (2011) for the detailed comparison of arithmetic and geometric mean aggregation of the dimensions of the HDI.

the composite scores and allocation of resources across the European regions. Hence, when obtaining the overall, material, personal and community multidimensional well-being index, we keep the allocation of the weights between the dimensions equal.[15] For instance, the BLI allows its users to choose relative weight allocation across well-being dimensions in its interactive web application, however, this feature does not allow individuals to reflect their preferences on whether they consider the well-being dimensions as substitutes and/or complements of each other.[16] In this paper, we will examine the effect of this choice of the multidimensional well-being achievements on the European regions and also examine how this choice affects the multidimensional inequality across the European regions in the next section.

3. Multidimensional well-being indices and inequality

To obtain overall multidimensional well-being outcomes and multidimensional well-being outcomes for each category (i.e., material, personal, and community) for 213 regions of Europe[17], we use three β parameters: 1 (i.e., arithmetic mean aggregation), 0 (i.e., geometric mean aggregation)[18], and -1 (an aggregation that allows higher degree of complementarity between the dimensions).[19] In this section, we concentrate on the composite achievement levels in different categories and overall multidimensional well-being in 2014, but we will also analyze the over-time improvements in composite well-being outcomes and changes in the multidimensional inequality in the next sub-sections.

Table 3 provides descriptive statistics on the welfare dimensions and composite well-being indices in 2014.[20] Average achievement levels of the European regions in jobs, civic engagement and environment dimensions are lower than that of income dimension, yet the average achievement levels in housing, education, health, access to services and safety dimensions are higher than that of income dimension. On the other hand, when we look at the inequality measures (i.e., coefficient of variation and Gini coefficients), regional inequality in income dimension is relatively larger than in any other well-being dimensions.[21] When we move to the descriptive statistics of the

[15] We allocate weights of 1/9 to each dimension when obtaining overall well-being index, and allocate 1/3 weight to dimensions that belong to the material, personal and community categories when obtaining multidimensional well-being indices in each category, respectively.
[16] See http://www.oecdbetterlifeindex.org for the interactive web application of the BLI.
[17] See Table 1 of supplementary material for the full list of European regions.
[18] For instance, the new aggregation method of the HDI (i.e., geometric mean) provides a middle ground between perfect substitution and complementarity between dimensions, which is characterized by some level of both complementarity and substitutability, and is well-suited for capability approach (see e.g., for Klugman et al., 2011 for further discussion on this).
[19] One can also allow higher degree of complementarity between dimensions by allowing β parameter to be less than -1 if that person is more concerned about the balanced nature of achievements between the dimensions.
[20] Note that both the achievement levels and inequality measures refer to normalized well-being dimensions.
[21] All inequality measures presented in the paper are population weighted measures where we use the regions' populations in 2000 and 2014 to obtain population weighted coefficient of variation and Gini coefficients.

composite scores obtained in 2014 with the use of different set of β parameters, we observe clear patterns in average achievement levels and inequality measures. While the average composite scores in overall, material, personal and community well-being categories increase with the increase in the β parameter, multidimensional inequality measures across the European regions decrease with the increase in the parameter of β.[22] In other words, if decision makers (individuals and/or policymakers) consider the well-being dimensions as complements of each other at some degree or prefer and prioritize rounded achievements between well-being dimensions (i.e., the cases when $\beta = 0$ and $\beta = -1$), composite achievement scores are lower compared to the case when the dimensions are considered perfect substitutes of each other (i.e., the case when $\beta = 1$). This is an expected outcome since complementarity at some degree between the dimensions leads to relatively lower composite scores for the regions that have unrounded achievements between the well-being dimensions.[23] On the other hand, when decision makers allow perfect substitution between the dimensions (i.e., the case when $\beta = 1$), multidimensional inequality measures are the lowest compared to inequality measures in other individual dimensions. For instance, multidimensional inequality in material, personal and community categories (i.e., Gini coefficients are 0.189, 0.068, and 0.126, respectively) are lower than the inequality in the dimensions that are used to obtain composite scores in these categories. The reason why we observe a higher degree of multidimensional inequality across European regions when the dimensions are considered as complements of each other at some degree is that the composite achievement scores in the regions that have balanced achievements between the dimensions and the composite scores in regions with unbalanced achievements between the dimensions diverge from each other.[24]

<Table 3 approximately here>

Overall, above comparisons show that policymaker's valuation of well-being dimensions (i.e., whether they consider dimensions as perfect substitutes or some degree of complements, or whether they prioritize balanced achievements between the dimensions or not) leads to extremely different levels of achievement and inequality in the European regions, which may alter the policy interventions that are based on composite indices. In the next section, we will examine whether normative preferences on well-being dimensions (whether dimensions are considered as complements or substitutes) have any effect on decision making when composite indices are used as a criteria

[22] Assessment of well-being and inequality in different well-being categories (i.e., community, personal, material, and overall well-being) can be considered as influence analysis (see e.g., Mazziotta and Pareto, 2017) to examine robustness of composite indices and inequality measures when some well-being dimensions are excluded from the analysis

[23] Note that we conducted our analysis with alternative β parameters ranging between -20 and +20 where we observed a similar pattern in multidimensional well-being achievements and inequality; hence we do not present the results to preserve space but these results are available upon request from author.

[24] For instance, consider two regions with the same population that have achievements scores in three dimensions as follows: Region A=(0.5,0.5,0.5) and Region B=(0.4,0.5, 0.6). The composite achievements with $\beta = -1, 0$ and 1 for region A and B are (0.5, 0.5, 0.5) and (0.4865, 0.4932, 0.5), respectively. Achievement with the perfect substitution between the dimensions leads to the same composite achievement (i.e., 0.5) with no inequality. When the degree of complementarity between the dimensions increases (i.e., when β parameter decreases), composite achievement of region B decreases, which leads to higher inequality between two regions.

to allocate the EU structural funds. However, before the evaluation of the policy implications of these indices, we first examine the multidimensional well-being and inequality in the European countries and assess the within- and cross-country variation in multidimensional well-being scores and inequality.

3.1. Multidimensional well-being and inequality in European countries

In this subsection, we examine the average achievements in income, overall, material, personal, and community composite well-being outcomes among European countries in 2014. We also look at within- and cross-country multidimensional well-being inequality in the European regions. Table 4 summarizes the average achievement levels of European countries in income, overall, material, personal, and community composite well-being outcomes (with different β parameters), and within- and cross-country inequality in income dimension and composite indices in 2014. This table is quite heavy to follow but let us provide the details of the general patterns of achievements and inequality measures across the European countries. We can see that the within-country income inequality is small in relatively rich countries and large for the relatively poor countries suggesting a negative correlation between average income of a country and within-country income inequality (see Fig. 1 which plots the average income and within-country income inequality in the European countries).[25] Similar pattern is observed in overall, material, and community well-being when well-being dimensions are considered to be complements at some degree (i.e., cases when $\beta \leq 0$). Countries that have a composite achievement level of 0.5-0.6 or above (below) have relatively low (high) levels of within-country inequality in overall, material and community well-being indices. With the exception of Portugal, both within- and cross-country inequality levels in personal well-being are relatively lower compared to other multidimensional well-being categories suggesting relatively balanced achievements between the education, health and access to services dimensions.[26] Finally, when β parameter is decreased from 0 to -1 (i.e., higher degree of complementarity between the dimensions), we observe that within- and cross-country inequality increases and the increase in within-country inequality is relatively higher for the countries that have lower multidimensional well-being scores.[27]

<Table 4 approximately here>

<Fig. 1 approximately here>

[25] The correlation coefficient between average income and within-country income inequality (i.e., Gini coefficients for income distribution within the country) is -0.79.
[26] See Figure 1 of supplementary material which plots the average overall, material, personal, and community well-being and within-country inequality with respective multidimensional well-being category when $\beta = 0$).
[27] There are two expectations to this general trend. Overall well-being inequality in Estonia and material well-being inequality in Slovak Republic is higher when $\beta = 0$ than that of when $\beta = -1$.

When well-being dimensions are considered to be perfect substitutes (i.e., when β=1), by definition, overall, material, personal, and community well-being increases (or at most remains unchanged) compared to the cases when $\beta \leq 0$. In particular, increases in the average achievement levels in each multidimensional well-being category are relatively higher for the set of countries that have unbalanced achievements between the dimensions (i.e., set of countries that have multidimensional achievement levels in each category that are less than 0.5-0.6 when β=0). For instance, when β parameter is increased to 1 from 0 (i.e., when well-being dimensions are aggregated with arithmetic mean rather than geometric mean), overall well-being scores of Estonia, Greece, Slovak Republic, Portugal, Poland, and Italy increased by 0.36, 0.27, 0.26, 0.20, 0.16, and 0.14, respectively. On the other hand, there have been limited increments in the multidimensional well-being scores of the regions that belong to countries that are relatively wealthier and have balanced achievements between the dimensions when β parameter is increased from 0 to 1.[28] Finally, there is smaller within-country inequality when there is perfect substitution between the dimensions, which then leads to a smaller cross-country inequality in multidimensional well-being categories[29].

Overall, there are distinctive differences in multidimensional well-being scores, and within- and cross-country inequality measures when dimensions are considered to be perfect substitutes (i.e., β=1) or have some degree of complementarity between them (i.e., $\beta \leq 0$). In this subsection, we analyzed the average achievement scores and within- and cross-country inequality in different multidimensional well-being categories. In the next subsection, we analyze the sensitivity of composite scores and rankings to the choice of β parameters.

3.2. Regional composite well-being scores and rankings

In this subsection, we analyze composite well-being scores and rankings of European regions in each well-being category when different β parameters are used in the aggregation procedure. In particular, we will examine how sensitive composite scores and rankings are to the choice of β parameter (i.e., how composite scores and rankings vary when dimensions are considered to be perfect substitutes or complements).

First of all, we examine the rank correlation coefficients when multidimensional well-being composite indices are obtained with different β parameters in 2014.[30] We find that the composite well-being index rankings are positively and significantly correlated with each other even though we allow the dimensions to be perfect complements or complementary at some degree. In the lines with the literature that analyzed the redundancy of composite indices, one might argue that the composite well-being indices obtained with alternative β parameters are redundant and an index with a single β parameter would be sufficient to rank regions since the rankings are positively

[28] For instance, multidimensional well-being achievements in each category increased at most by 0.06 in Norway, Sweden, Germany, Finland, Iceland, the UK, Denmark, Austria, Netherlands, France, Ireland, and Belgium when β parameter is increased from 0 to 1.
[29] See Figure 2 of supplementary material that plots the average overall, material, personal and community well-being in countries and within-country inequality in each respective multidimensional well-being when β=1.
[30] The lowest correlation coefficient between composite indices obtained with alternative β parameters is 0.84.

and significantly correlated with each other. However, we argue that even though rankings are highly and positively correlated with each other when different β parameters are used, they convey distinctively different outcomes for two reasons. First, rankings obtained with different β parameters can be very similar, but they produce very different multidimensional well-being scores, within- and cross-country inequality measures. For instance, depending on whether well-being dimensions are considered to be perfect substitutes or complements at some degree, composite well-being scores and inequality measures do vary dramatically (see Table 4 for average multidimensional well-being scores in different categories, and within- and cross-country inequality measures with different β parameters). When well-being dimensions are considered as perfect substitutes (complements at some degree), there is a lower (higher) within- and cross-country inequality and higher (lower) multidimensional well-being across the European regions. As some of the most important goals and policy decisions of the EU are based on tracking the multidimensional well-being (e.g., the European Commission's "Going beyond GDP" initiative) and decreasing regional inequality (e.g., the main objective of the EU structural funds is to reduce the income inequality), composite indices that are obtained with different β parameters gives distinctively different signals to policymakers.

The plots in Fig. 2 compare overall, material, personal and community well-being scores obtained when the sub-dimensions are considered as perfect substitutes (i.e., when β=1 or arithmetic mean of dimensions) with the composite well-being scores obtained when the sub-dimensions are considered as complements at some degree (i.e., when β=-1). This figure clearly shows that there is a major variation in composite scores achieved by the most European regions when different β parameters are used. It can be seen in this figure that regions that achieved a higher composite score (i.e., high performers) are located close to the 45-degree line which suggests that their composite scores in different well-being categories are less sensitive to the choice of β parameter. These regions have relatively balanced achievements across the sub-dimensions. On the other hand, composite scores of regions with unbalanced achievements across the sub-dimensions are more sensitive to the choice of β parameter and these regions are the ones that are located far away from the 45-line degree. For instance, Table 5 presents some regions whose composite scores are extremely sensitive to the choice of β parameter and that these regions would have had very different overall, personal, material, and community well-being scores when the dimensions are considered as perfect substitutes (β=1) or complements at some degree (β=-1). The variation in composite scores for these regions are quite high when β increased from -1 to +1. For instance, overall well-being score of Lombardy would have been 0.692 lower if one were consider dimensions to be complements at some degree (i.e., β=-1) rather than them being perfect substitutes (i.e., β=1). Most of these regions that see major changes in their composite well-being scores when two different β parameters used are located at the southern Europe (e.g., regions of Italy, Spain, Greece, and Portugal) and eastern Europe (e.g., regions of Estonia, Czech Republic, and Hungary). Common characteristic of these regions is that they have relatively unbalanced performances in sub-dimensions. In one hand (when β=1), relatively poor performances in some sub-dimensions are compensated by good performances in other sub-dimensions and on the other hand (when β=-1), poor performances in some sub-dimensions are reflected in lower composite well-being scores.[31]

<Fig. 2 approximately here>

<Table 5 approximately here>

We furthermore show that there are major rank reversals when different β parameters are used to obtain composite scores even though the rankings obtained with different β parameters are positively and significantly correlated with each other.[32] The plots in Fig. 3 compare overall, material, personal and community composite well-being ranks in 2014 when β is set to -1 and +1. This figure reveals that the high performing regions are less sensitive to the choice of β parameter as they are located near the 45-line degree. On the other hand, rankings of some regions are extremely sensitive to the choice of β parameter as they are far off from the 45-line degree. For instance, some regions are ranked higher when sub-dimensions are considered as complements (i.e., plots that are located at the upper left of the 45-line degree) and some others are ranked in relatively higher positions if one were to consider sub-dimensions as substitutes of each other (i.e., plots that are located at the lower right of the 45-line degree). Table 6 provides some of the regions that would experience major rank reversals in composite well-being indices when β=1 and β=-1 are used to obtain composite well-being indices. Panel A (B) of Table 6 represents some set of regions that would have been ranked in higher positions when sub-dimensions are considered to be complements at some degree (perfect substitutes) compared to the case when the dimensions are considered as perfect substitutes (complement at some degree). For instance, Zurich and Åland rank at the 88th and 39th positions based on their overall well-being achievement when the dimensions are considered to be perfect substitutes (i.e., when β=1), whereas, these two regions would have been ranked at the 155th and 102nd positions when dimensions are more seen as complements (i.e., β=-1), respectively. The reason why these regions rank in lower positions when β=-1 is used to obtain overall well-being index is that their achievements in civic engagement dimension are relatively low. On the other hand, East Macedonia of Greece ranks at the 177th (213th) position when β=-1 (β=1) is used to obtain overall well-being score. Even though East Macedonia region of Greece have low achievements in some well-being dimensions, neither of its achievements in well-being dimensions are at the lowest possible levels allowing this region to achieve relatively higher position when dimensions are considered to be complements. Most of the regions that East Macedonia region of Greece surpass when the dimensions have some complementarity are the ones that have the lowest achievement score in one or more dimensions moving them to lower ranking positions when

[31] See Table 2 of supplementary material for the detailed overall, material, personal, and community well-being composite indices and absolute change in composite scores when different β parameters are used to obtain the composite indices.
[32] See Table 3 of supplementary material for the detailed rankings of European regions based on their achievements in overall, material, personal and community well-being composite indices when different β parameters are used to obtain the composite indices.

dimensions are considered as complements. Similar patterns are observed for the remaining set of regions that moved to higher positions when dimensions are seen more of complements compared to the case where they are considered to be perfect substitutes.

<Fig. 3 approximately here>

<Table 6 approximately here>

Overall, even though the rankings are positively and significantly correlated with each other, there are also major differences between two rankings when the dimensions are more seen as substitutes or complements, respectively (i.e., β=1 and β=-1, respectively). Regions that have relatively balanced (unbalanced) achievements between the dimensions move to higher rankings when dimensions are considered to be complementary (perfect substitutes).

3.3. Over-time changes in multidimensional well-being and inequality

In the previous sections, we analyzed the multidimensional well-being and inequality across the European regions depending on the β parameter choice and in this subsection, we will examine the well-being improvements and changes in inequality measures between 2000 and 2014.[33] Table 7 offers average achievement and inequality measures in income dimension and composite indices in 2000 and 2014 when different β parameters are used to aggregate dimensions. Panel A of Table 7 offers the average achievement in income and composite well-being outcomes and multidimensional inequality (i.e., Gini measures) in 2000 and 2014 for 103 regions that have overlapping information for all well-being dimensions in both years. Whereas, Panel B of Table 7 offers the same information for different number of regions where we have information for all dimensions that are used each respective composite well-being category, respectively.

<Table 7 approximately here>

Since both panels of Table offer roughly similar outcomes, we discuss the results from the panel A of Table 7. Irrespective of the β measure, average overall well-being index increased and multidimensional inequality across the European regions are decreased between 2000 and 2014. However, the increase in average overall well-being index is relatively higher when dimensions are considered to have some degree of complementarity compared to the case when dimensions are perfect substitutes (e.g., average overall well-being index increased by 0.206, 0.202, and 0.165 between 2000 and 2014 when β is set to be -1, 0, and 1, respectively). This suggests that the improvements in well-being dimensions across the European regions between 2000 and 2014 were towards rounded achievements across well-being dimensions. Similarly,

[33] It should be noted that we only used the regions that have overlapping information for the dimensions used for each multidimensional well-being category to examine the changes in multidimensional well-being and inequality.

Gini coefficients in 2014 were smaller than the ones in 2000 suggesting that the inequality in overall well-being across European regions declined between 2000 and 2014. Similarly, decrease in Gini coefficient is relatively higher when dimensions are considered to have some complementarity (i.e., $\beta \leq 0$). When we move to composite well-being categories, average achievement and inequality levels in material well-being across the European regions roughly remained to be the same irrespective of the β parameter choice.[34] The composite well-being category in which European regions experienced the largest improvement during the period is personal well-being one. Average achievement in this category roughly doubled between 2000 and 2014, and there is distinctive decrease in inequality measures when well-being dimensions are considered to have some degree of complementarity (i.e., Gini coefficients dropped from 0.423 and 0.377 to 0.165 and 0.130 when β is set to -1 and 0, respectively). This suggests that well-being improvements in this category across the European regions were towards rounded achievements across the well-being dimensions in this category (i.e., health, education, access to services). Community well-being index also improved between 2000 and 2014, and these improvements were roughly similar irrespective of the β parameter choice (i.e., average improvements in community composite index were 0.143, 0.137, and 0.128 when β is equal to -1, 0, and 1, respectively). Finally, average achievement in income dimension increased from 0.488 to 0.582 and the Gini coefficient dropped from 0.308 to 0.276 between 2000 and 2014, respectively. Comparing income dimension with other composite well-being indices, we observe that improvements in overall, personal and community well-being categories between 2000 and 2014 were higher than the improvement in the income dimension over the same period irrespective of the β parameter choice. Similarly, decreases in overall, personal, and community well-being inequality were relatively higher than the decrease in income inequality between 2000 and 2014. On the other hand, achievements in material well-being (which also includes income dimension) is higher than income dimension when well-being dimensions are considered to be perfect substitutes (i.e., β=1). Overall, given the changes in composite well-being categories and income dimension, we can suggest that multidimensional well-being improvements were relatively higher compared to the improvements in income dimension, which also led to a lower degree of multidimensional inequality across the European regions.

To analyze the effects of β parameter choice on the changes in the regional well-being outcomes, Panels A, B, and C of Table 8 offer achievements of some regions in well-being dimensions in material, personal, community categories, and composite well-being outcomes with different β parameters in 2000 and 2014, respectively. Each panel consists of two regions that experienced changes in well-being outcomes that were towards balanced (uneven) composition of development across the well-being dimensions.[35] Furthermore, to assess whether the changes in well-being achievements between 2000 and 2014 were towards balanced (uneven) composition of development

[34] To be precise, there is a small increase in material well-being category (this increase ranges between 0.025 and 0.038 depending β parameter choice), but this increase is minimal considering the comparison period (i.e., between 2000 and 2014). Similarly, there is also a slight increase in inequality measures when dimensions are treated as complements.

[35] In this comparison, we only report some regions for illustrative reasons; however, detailed comparisons for all regions are available from author upon request.

across the well-being dimensions, we obtain a "deviation" measure which calculates the level of evenness of achievements across well-being categories.[36] The lower (higher) this score, the more rounded (unbalanced) the achievements across the well-being dimensions in each category are.

<Table 8 approximately here>

Panel A of Table 8 offers two regions that experienced changes in income, jobs and housing dimensions that were towards balanced (unbalanced) achievements across the well-being dimensions in material well-being category. Standard of living and job conditions (income and jobs dimensions) in Vienna deteriorated between 2000 and 2014 but the region experienced major improvement in housing, which led to a more rounded composition of development in this category (e.g., "deviation" measure dropped from 1.23 to 0.61 between 2000 and 2014). Even though the aggregate improvement across the three dimensions is limited (i.e., aggregate change in achievements in the three dimensions was 0.015), achievements across the dimensions were more rounded in 2014 than in 2000, which can also be seen by looking at the changes in composite scores when β=0 and β=-1 are used in the aggregation (i.e., composite index outcomes for Vienna increased by 0.042 and 0.083 when respective β parameters are used). Similar case is observed for Saxony-Anhalt region of Germany. This region experienced improvements in all dimensions, however, the major improvement had been in the dimension that was the least achieved one in 2000 (i.e., jobs dimension). Improvements in this region were towards rounded achievements across the three dimensions, which are also reflected in the composite score improvements when β=0 and β=-1 are used in aggregation since the changes in composite scores are higher than the change in the index that is obtained with arithmetic mean. On the other hand, over-time improvements in central Estonia and Wallonia region of Belgium were towards unrounded achievements across the three dimensions. Wallonia region experienced a deterioration in jobs dimension (which was the least achieved dimension in 2000) and an improvement in housing dimension (which was the most achieved dimension in 2000), which led to a divergence in achievements across the well-being dimensions (i.e., deviation measure increased by 0.56 between 2000 and 2014). Whereas, even though there had been an improvement in all dimensions in the central Estonia, the major increase was observed in jobs dimension (which was the highest achieved dimension in 2000). Even though, equally-weighted index (i.e., when β=1) does not differentiate whether the improvements were towards even (unbalanced) composition of development across the three dimensions, improvements in composite scores are relatively lower when dimensions allowed to have some degree of complementarity (i.e., when composite indices are obtained with β=0 and β=-1). Panels B and C of Table 8 also offer two regions that experienced changes in well-being dimensions in personal and community well-being categories that were towards rounded (unbalanced) achievements across the three dimensions, respectively (see respective panels in Table 8 for the details).

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[36] This measure is obtained by sum of absolute deviation across the well-being dimensions in a given well-being category. In particular, since each well-being category has three well-being dimensions, this measure is obtained by |Achievement in dimension 1 – Achievement in dimension 2| + |Achievement in dimension 1 – Achievement in dimension 3| + |Achievement in dimension 2 – Achievement in dimension 3|. "Deviation" measure would be zero if achievements across the three well-being dimensions are equal, suggesting that the achievements in well-being dimensions are fully rounded.

Overall, in this section, we showed that the over-time improvements in composite scores are different when dimensions are considered to be complementary at some degree when the over-time changes in achievement levels in dimensions are towards balanced (or unbalanced) composition of development across the dimensions or not. Even (uneven) composition of the development across the dimensions are reflected in the composite indices that are obtained with $\beta \leq 0$ by having relatively higher (lower) changes in composite well-being scores than the changes in the composite index obtained with arithmetic mean. This feature of aggregation is particularly important since the choice of β parameter for aggregation (i.e., whether policymakers are sensitive to the even composition of development across the dimensions or not) would lead to different approaches by the regional policymakers to improve regional composite well-being outcomes. For instance, if a composite index is obtained with the arithmetic mean aggregation method (i.e., when β is set to be 1), regional policymakers can choose to improve any dimension they wish irrespective of whether this dimension is the least or most achieved dimension. In this case, regions may choose to improve "easy" dimensions (i.e., well-being dimensions that are relatively easier to improve or less costly to manipulate) since any aggregate improvement in these dimensions would be reflected similarly in the composite score irrespective of whether this dimension is the least or most achieved one. However, if aggregation procedure prioritizes balanced composition of development or penalizes uneven composition of development (i.e., the cases when $\beta \leq 0$), regions would prioritize improvements in dimensions in which their achievements are relatively weak since this would lead to a higher improvement in their composite scores (see the cases in Table 8). Therefore, if the aim is to promote balanced composition of development across well-being dimensions, policymakers should integrate this feature in their aggregation procedure to give the right signals to the policymakers.

4. EU structural fund allocations with composite well-being indices

In this section, we evaluate how the EU structural funds would have been distributed if one were to use the composite indices as a criteria to determine the eligible regions rather than the GDP per capita criteria. Before our analysis, let us offer a brief discussion on what the EU structural funds are and how they are distributed. Under the convergence objective of the European Commission, regions are allocated EU structural funds if their GDP per capita in purchasing power parties (PPP) is lower than the 75% of the EU average (European Parliament and Council of the European Union, 2013). The idea behind this objective is to improve the standard of living in the eligible regions so that they can catch up with other regions' standard of living. Recent papers found that this is an effective allocation of funds to eliminate income disparities across the EU regions (see e.g., Bosker, 2009; Becker et al., 2013). Even though GDP per capita might be a reasonable benchmark, it lacks to capture the well-being in a more holistic way and there are EU policy documents which also consider the inclusion of additional dimensions beyond GDP per capita when determining the allocation of EU structural funds (European Committee of the Regions, 2011). Hence, in this section we examine how the composite indices obtained with different β parameters would allocate the regional funding if one were to use them to determine the eligible regions. In other words, if the European Commission were to use composite indices to choose regions that are eligible for the EU structural funds, would the composite indices that are obtained with different β parameters allocate funds different than GDP per capita criteria?

To be consistent with the EU structural fund allocation, we only consider 197 regions that are part of the EU for this evaluation.[37] Table 9 offers the EU average achievement levels in income dimension, and overall, material, personal and community well-being composite indices that are obtained with different β parameters, and the threshold achievement levels for each case to determine the eligible regions for the EU structural funds (i.e., regions would be eligible for the EU structural funds if their achievement is below the 75% of the average score in each respective criteria).

<Table 9 approximately here>

Given these thresholds in each respective criteria, Table 10 summarizes the set of regions that are eligible to the EU structural funds in 2014 with the income dimension, and composite indices that are obtained with different β parameters (see Table 12 in Appendix for the list of regions that are eligible for the EU structural funds when income and different composite indices are used as criteria to determine the eligible regions). 77 regions with a total population of 129.7 million are eligible to the EU structural funds if income dimension is used as a criteria, more than the number of eligible regions when the composite indices are used as a criteria (irrespective of the β parameter choice). On the other hand, if overall well-being index is used as a criteria to determine the eligible regions, 51, 65, and 70 regions are eligible for the funds when β parameters are set to 1, 0 and -1, respectively. The reason why less number of regions is eligible for the funds when the dimensions are perfect substitutes is that the perfect substitution between the dimensions (i.e., when composite index is obtained with β=1) produces a more equal distribution of composite achievements across the regions (i.e., see Table 4 for the within- and cross-country multidimensional well-being inequality when different β parameters are used to obtain composite indices). Whereas, when some complementarity between dimensions are allowed (i.e., β≤0), there are 15 and 19 more regions eligible for the EU structural funds compared to the case when dimensions are perfect substitutes (i.e., β=1). The difference in the number of eligible regions when different β parameters are used to obtain composite indices highlights the importance of β parameter choice for the EU regional policy if they were to use composite indices to allocate the EU structural funds.

<Table 10 approximately here>

When we move to the sub-composite indices (i.e., material, personal and community composite indices), the number of eligible regions with the material well-being does not differ much from those funded with income dimension irrespective of the β parameter. This outcome was expected since the income dimension not only belongs to the material well-being category but also it is significantly and positively correlated with other dimensions in the material well-being category (i.e., jobs and housing dimensions). Yet, the number of eligible regions with material well-being slightly differs from those funded with income dimension. For instance, 10 regions that are eligible for the funds with income dimension would not have been eligible for the funds if the material well-being composite index is used to determine eligible regions (see the row

[37] For EU structural fund allocation, we only consider the regions from the countries that are part of the EU and exclude the regions from our analysis that are not part of the EU (i.e., regions of Iceland, Norway, and Switzerland). One should also note that we do not have any data for regional well-being dimensions for the regions of seven countries, which are part of the EU (Bulgaria, Croatia, Cyprus, Latvia, Lithuania, Malta, and Romania). Hence, this analysis should be seen as an illustrative example on how β parameter choice in the aggregation procedure could have an effect on policy decisions.

in Table 10 that gives the details about the number of regions that are eligible for the funds with income dimension but not with the composite index). On the other hand, the number of eligible regions with the personal well-being criteria would be the least since both within- and cross-country multidimensional inequality is the lowest in this category compared to any other composite well-being (see Table 4 for the details). Yet, the number of eligible regions with the personal well-being category differs when composite well-being is obtained with different β parameters. For instance, there would be only 11 regions eligible for the funds when composite index obtained with β=1 and this number increases to 31 when composite index is obtained with β=-1 highlighting the importance of the choice of β parameter when composite indices are used to determine eligible regions. Finally, there are relatively less number of regions that are eligible for funding when community well-being index is used as a criteria compared to income dimension. Similar trend of having more regions eligible for the funds can be seen when the dimensions are seen more complements compared to the case when they are perfect substitutes.

Table 10 also demonstrates that the eligible regions that are identified with the composite indices show some similarity and differences from the ones identified with the income criteria. In one hand, most of the eligible regions that are identified with the composite index criteria are also identified to be eligible regions with the income criteria. In other words, the number of regions that are eligible for funds with the composite index (these number are given at the first row of Table 10) is roughly similar to the number of regions that are eligible for the funds with both income dimension and composite index criteria (see the third row of Table 10 for the details). In the light of the above case, one can suggest that identification of eligible regions for the EU structural funds with income dimension is closely associated with the identification of composite indices. However, there are also distinctive differences between the identified regions when composite indices and income dimension are used as criteria. For instance, there are at least 14, 10, 50, and 25 regions that would have been eligible for the funds if income dimension is used for funding criteria but these regions would not have been eligible for the funds when overall, material, personal and community well-being composite indices are used as criteria (see the seventh row of Table 10 for the detailed set of differences). This is due to the fact that the European regions have relatively equal distributions of achievements in other well-being dimensions compared to the income dimension (see Table 3 for the inequality across the European regions in different well-being dimensions) and an index obtained with the combination of these well-being dimensions identifies less number of regions eligible for the EU structural funds if used as a criteria.

Up to now, we used a threshold values that are *relative* to the average achievement level of a given criteria to identify the eligible regions for the EU structural funds (i.e., 75% of the EU average) since the aim of this fund is to eliminate inequality across the European regions. However, if the aim was to target the most deprived regions, absolute achievement scores would have been more suitable measures for identifying eligible regions. The concept is similar to the relative and absolute measures of poverty (see e.g., Foster, 1998; Duclos and Gregoire, 2002; Notten and de Neubourg, 2011 for detailed discussion) where the former is based on the percentage of a median or mean of a group of population (e.g., 75% of the mean GDP per capita or the 60% of the median income), whereas the latter considers a threshold of well-being that is need to sustain basic human needs (e.g., the extreme poverty threshold of $1.25 a day). Even though both relative and absolute well-being groups could be the same, there might be some regions that are eligible for funds with the relative measure but not eligible with absolute well-being measures or vice versa, which depends on the average achievement level, absolute threshold level and how the well-being is distributed. To provide a complete picture of how well-being outcomes are distributed in each composite well-being and income dimension, we carry out our analysis by looking at the eligible regions when we use the absolute achievement scores as threshold to determine the eligible number of regions and total population that would benefit from these funds.

Table 11 lists the number of regions and total population that would be eligible for funds when different absolute normalized achievement scores with 0.1 increments are used as threshold for determining the eligible regions.[38] The importance of the β parameter choice is more evident with the use of absolute scores as thresholds to determine eligible regions. For instance, if policy makers choose to allocate funds to the most deprived regions by setting the threshold to 0.3, there would be 50 regions that would be eligible for the funds based on the achievements in income dimension. On the other hand, there would be 57 and 40 regions that would be eligible for funds based on the overall well-being achievements when β is set to -1 and 0, respectively. However, if the dimensions are treated as perfect substitutes, no regions would be qualified for the funds given the 0.3 threshold. Similar trend is seen when absolute achievement levels in material, personal, and community well-being indices are used to determine eligible regions. Furthermore, for all different absolute well-being thresholds, there is always more regions that are eligible for the EU structural funds when we look at the achievements in income dimension compared to the achievements in composite indices when the well-being dimensions are perfect substitutes (i.e., when $\beta=1$).[39] On the other hand, when dimensions are more seen as complements (i.e., when $\beta \leq 0$), there are cases where higher number of regions are eligible for funds when we consider the achievements in composite index compared to the one in income dimension. For instance, when $\beta=-1$, more regions are eligible for the funds if one consider the achievements in overall well-being index as criteria compared to the achievements in income dimension at all threshold levels up to 0.4. For threshold of 0.5, similar number of regions is qualified for the funds, but the affected population is higher with the composite index criteria. For threshold of 0.6, more regions are qualified for the funds with income dimension criteria but higher number of people will be affected if the funds are distributed based on composite index criteria (i.e., regions that are eligible with the overall well-being index criteria are relatively more populated). Finally, if one were to use threshold of 0.7, total population that would benefit from these funds and the number of eligible regions are higher with income criteria.

<Table 11 approximately here>

Overall, not only there is a distinctive difference between the number of eligible regions based on the achievements in composite indices and income dimension at different absolute thresholds, but also there are considerable differences in the number of eligible regions based on the choice of β parameter when achievements in composite

[38] Since the highest achievable score in income and respective composite indices is 1, we use 0.7 as the highest threshold to determine the eligible regions for the funds and consider that the regions that have achievement above 0.7 are relatively well-off regions.

[39] The identified regions obviously differ with composite indices compared to the income dimension, which are available upon request from the author, yet with income dimension criteria, there are more regions eligible for the funds compared to the eligible regions with the composite index obtained with arithmetic mean.

index are used to distribute the funds. Finally, we should also note that the identification of the threshold is also an important criteria when distributing the regional funds. For instance, when we use relative thresholds, there were clearly less number of regions that were eligible for the funds with the composite index criteria compared to the income criteria. However, when we examine the distribution of the achievements in composite scores and income dimension, we have seen that there are more eligible regions for funds based on the achievements in income dimension than the eligible regions based on the composite well-being index outcomes, or vice versa depending on the absolute well-being threshold. Hence, the policymakers should also consider the robustness of the allocation of funds based on different thresholds since distribution of funds might alter based on two different criteria.

5. Conclusions

It has been well-accepted that the societal progress should be measured by considering achievements in many well-being dimensions. Furthermore, policymakers emphasized the need for a balanced and sustainable pattern of regional development across well-being dimensions and regions (which is emphasized by the EU policy papers and 2020 goals to achieve a balanced and sustainable pattern of territorial development, and adaptation of the geometric mean aggregation of the dimensions of the HDI by the UNDP). In this paper, we take into account these two requirements for measuring multidimensional well-being measurement. We not only aggregate various well-being dimensions to measure the EU regional well-being to go beyond single measure of well-being but also we use generalized mean aggregation procedure to measure whether the well-being achievements in regions have balanced composition of development or not by allowing the dimensions to be more seen as complements.

Our results show that the multidimensional well-being across the European regions are relatively lower when the dimensions are more seen as complements compared to the case when they are considered to be perfect substitutes. Furthermore, there is also a higher multidimensional inequality across the European regions when the dimensions are considered to have some complementarity. Both within- and cross-country multidimensional inequality levels are higher when the dimensions are more seen as complementary due to the fact that regions have unbalanced achievements across the well-being dimensions. In particular, we observe that the Europe consists two clusters of regions that have different composition of development. In one hand, the eastern and southern EU regions (e.g., regions of Estonia, Greece, Slovak Republic, Portugal, Poland, and Italy) have unbalanced composition of development (i.e., achievements across the dimensions are unevenly distributed) where their multidimensional well-being and inequality scores vary dramatically when the dimensions are seen more of complements or perfect substitutes. On the other hand, the western and northern regions of Europe (e.g., regions of Norway, Sweden, Germany, Finland, Iceland, the UK, Denmark, Austria, Netherlands, France, Ireland, and Belgium) have balanced achievements across the dimensions of well-being, which leads to high multidimensional well-being scores and low multidimensional inequality within these countries irrespective of the interaction levels between the dimensions. We also examined the over-time changes in the multidimensional well-being in the European regions between 2000 and 2014, and found that multidimensional well-being improved and inequality decreased in personal and community categories but remained unchanged in material well-being category across the European regions between 2000 and 2014 irrespective of interaction levels between well-being dimensions.

We also examine the redundancy of composite indices that are obtained with different interactions between the dimensions. Even though these multidimensional well-being indices that are obtained with alternative interactions between the dimensions are highly and positively correlated, these indices with alternative interactions convey different multidimensional well-being and inequality outcomes, which then can lead to different policy implications. Furthermore, there is also a good range of rank reversals when different interaction levels between the dimensions (i.e., perfect substitution or more of a complementarity between the dimensions) are allowed.

We also examine some of the EU policy implications of the different interaction levels between the dimensions (i.e., the choice of the β parameter in the generalized mean aggregation). In particular, we discuss whether the use of multidimensional well-being indices would have any effect on the choice of eligible regions for the EU structural funds. We find that the number of regions that are eligible for the funds differs depending on the interaction levels between the dimensions. If the dimensions are more seen as perfect substitutes (i.e., if the dimensions are aggregated through standard arithmetic mean aggregation procedure), there is always a less number of regions is eligible for the funds since this aggregation procedure produces a more equal distribution of composite achievements across the European regions. Whereas, if the dimensions are more seen as complements, there is higher number of regions eligible for the funds since the unbalanced composition of development (i.e., unbalanced achievements between the dimensions) are reflected in the composite outcomes, which leads to higher multidimensional inequality across the European regions. In particular, the inequality between the eastern and southern regions of the Europe and western and northern regions arises when the dimensions are more seen as complements. Hence, the choice of interaction levels between the dimensions has major EU policy implications.

In this paper, we aggregate the dimensions with a generalized mean aggregation procedure that is flexible enough to allow different levels of interaction between the dimensions. Since the 'true' interactions between the well-being dimensions are not known, interactions between the dimensions will be based on the choices of public and policymakers, which depend on their perceptions of well-being and policy targets. For instance, policymakers can determine set of well-being dimensions that are more seen as substitutes and therefore use arithmetic mean aggregation to obtain index outcomes. On the other hand, they can also cluster set of dimensions in which they prefer to obtain rounded achievements across the well-being dimensions (in this case, well-being dimensions are more seen as complements) and allow a different degree of complementarity by choosing a suitable β parameter to use in the generalized mean aggregation procedure. If the policymakers are more (less) sensitive about the balanced composition of development between the well-being dimensions, their preferences can be reflected in the aggregation procedure by increasing (decreasing) the degree of complementarity with the change in β parameter.

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Appendix

<Table 12 approximately here>

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Tables and Figures

Table 1 Categories and dimensions of well-being

Categories / Dimensions	Indicators	Measurement
Material well-being		
1. Income	Household disposable income per capita	Real U.S. dollar per capita in PPP of 2010
2. Jobs	Employment rate	Ratio between employed people and working age population
	Unemployment rate	Ratio between unemployed and labour force
3. Housing	Number of rooms per person	Number of rooms per person in a dwelling
Personal well-being		
1. Education	Share of labour force with at least secondary education	Percentage of labour force that has completed at least upper secondary education.
2. Health	Life expectancy at birth	Number of years a new born can expect to live
	Age adjusted mortality rate	Age-specific death rates of one region to the age distribution of a standard population
3. Access to services	Share of households with broadband access	Percent of households with internet broadband access
Community well-being		
1. Civic engagement	Voter turnout	Ratio between the number of voters to the number of persons with voting rights
2. Environmental quality	Average exposure to air pollution	Weighted average value of PM2.5 for each region
3. Safety	Homicide rate	Number of reported homicides per 100 000 inhabitants

Table 2 Spearman and Kendall rank correlation matrices for the nine well-being dimensions									
	Income	Jobs	Housing	Education	Health	Access to service	Civic engagement	Environment	Safety
Income	1.000								
Jobs	0.541***	1.000							
	0.377***								
Housing	0.593***	0.317***	1.000						
	0.416***	0.223***							
Education	0.033	0.448***	-0.265***	1.000					
	0.075	0.300***	-0.174**						
Health	0.449***	-0.092	0.283***	-0.543***	1.000				
	0.317***	-0.030	0.164**	-0.371***					
Access to service	0.515***	0.730***	0.412***	0.281***	-0.025	1.000			
	0.347***	0.535***	0.288***	0.180***	0.009				
Civic engagement	0.522***	0.234***	0.465***	-0.246***	0.437***	0.336***	1.000		
	0.340***	0.159**	0.309***	-0.142*	0.305***	0.229***			
Environment	0.105	0.036	0.363***	-0.314***	0.219***	0.099	0.248***	1.000	
	0.067	0.028	0.256***	-0.220***	0.153**	0.070	0.168**		
Safety	0.488***	0.336***	0.437***	-0.182***	0.435***	0.291***	0.429***	0.191***	1.000
	0.343***	0.241***	0.291***	-0.143*	0.307***	0.207***	0.294***	0.135	

Notes: *, **, and *** denote significance at the 10, 5, and 1% level, respectively. The first and second rows between pairs of dimensions represent the Spearman and Kendall tau rank correlation coefficients between pairs of dimensions, respectively.

Table 3 Well-being achievements and inequality among European regions

Dimensions / Composite indices	Mean	Median	Coefficient of variation	Gini coefficient
Income	0.656	0.731	0.422	0.236
Jobs	0.635	0.689	0.414	0.227
Housing	0.695	0.769	0.386	0.207
Education	0.711	0.779	0.319	0.170
Health	0.796	0.831	0.232	0.124
Access to services	0.834	0.829	0.134	0.076
Civic engagement	0.604	0.624	0.411	0.230
Environment	0.590	0.583	0.361	0.202
Safety	0.766	0.847	0.297	0.152
Overall well-being ($\beta = -1$)	0.563	0.706	0.493	0.259
Overall well-being ($\beta = 0$)	0.627	0.728	0.342	0.180
Overall well-being ($\beta = 1$)	0.698	0.747	0.192	0.104
Material well-being ($\beta = -1$)	0.606	0.704	0.472	0.259
Material well-being ($\beta = 0$)	0.627	0.712	0.426	0.234
Material well-being ($\beta = 1$)	0.662	0.721	0.339	0.189
Personal well-being ($\beta = -1$)	0.733	0.786	0.225	0.112
Personal well-being ($\beta = 0$)	0.755	0.791	0.184	0.091
Personal well-being ($\beta = 1$)	0.780	0.797	0.126	0.068
Community well-being ($\beta = -1$)	0.566	0.635	0.419	0.222
Community well-being ($\beta = 0$)	0.596	0.656	0.368	0.193
Community well-being ($\beta = 1$)	0.653	0.682	0.231	0.126

Table 4 Income and multidimensional well-being (inequality) across the European countries in 2014

Country	Income		Overall ($\beta = -1$)		Overall ($\beta = 0$)		Overall ($\beta = 1$)		Material ($\beta = -1$)		Material ($\beta = 0$)		Material ($\beta = 1$)		Personal ($\beta = -1$)		Personal ($\beta = 0$)		Personal ($\beta = 1$)		Community ($\beta = -1$)		Community ($\beta = 0$)		Community ($\beta = 1$)	
	Av	Gini	Av	Gini	Av	Gini	Av	Gini	Av	Gini	Av	Gini	Av	Gini	Av	Gini	Av	Gini	Av	Gini	Av	Gini	Av	Gini	Av	Gini
Austria	0.95	0.02	0.74	0.04	0.76	0.03	0.78	0.03	0.81	0.04	0.82	0.04	0.83	0.04	0.82	0.01	0.82	0.01	0.82	0.01	0.63	0.08	0.67	0.06	0.70	0.05
Belgium	0.71	0.06	0.64	0.07	0.69	0.06	0.73	0.04	0.72	0.10	0.74	0.08	0.77	0.06	0.79	0.04	0.79	0.04	0.79	0.04	0.51	0.06	0.56	0.05	0.63	0.03
Czech Rep.	0.23	0.20	0.39	0.17	0.46	0.12	0.54	0.05	0.35	0.10	0.41	0.08	0.47	0.07	0.70	0.06	0.73	0.05	0.76	0.04	0.33	0.21	0.35	0.20	0.40	0.10
Denmark	0.57	0.02	0.76	0.01	0.77	0.01	0.78	0.01	0.69	0.01	0.70	0.01	0.71	0.01	0.75	0.02	0.76	0.02	0.77	0.02	0.85	0.04	0.86	0.03	0.87	0.03
Estonia	0.06	0.53	0.00	0.06	0.17	0.16	0.53	0.06	0.11	0.51	0.17	0.41	0.37	0.07	0.65	0.10	0.70	0.08	0.74	0.06	0.07	0.87	0.12	0.59	0.47	0.10
Finland	0.63	0.08	0.77	0.03	0.78	0.02	0.79	0.02	0.69	0.04	0.69	0.04	0.70	0.04	0.87	0.01	0.87	0.01	0.88	0.01	0.76	0.03	0.78	0.02	0.81	0.01
France	0.80	0.07	0.73	0.05	0.74	0.04	0.76	0.04	0.67	0.05	0.68	0.04	0.69	0.04	0.82	0.03	0.83	0.03	0.83	0.03	0.72	0.09	0.74	0.08	0.75	0.07
Germany	0.92	0.06	0.78	0.02	0.80	0.02	0.81	0.02	0.91	0.04	0.92	0.04	0.92	0.04	0.84	0.02	0.85	0.02	0.85	0.01	0.63	0.02	0.65	0.02	0.67	0.03
Greece	0.15	0.53	0.01	0.80	0.16	0.14	0.43	0.06	0.09	0.47	0.13	0.41	0.23	0.14	0.66	0.08	0.67	0.07	0.69	0.06	0.12	0.68	0.14	0.54	0.38	0.06
Hungary	0.09	0.44	0.24	0.27	0.36	0.12	0.46	0.06	0.14	0.33	0.19	0.23	0.28	0.13	0.48	0.13	0.56	0.09	0.64	0.06	0.44	0.05	0.45	0.05	0.47	0.06
Iceland	0.51	0.00	0.75	0.02	0.78	0.01	0.81	0.01	0.62	0.00	0.64	0.00	0.67	0.00	0.75	0.06	0.78	0.04	0.81	0.03	0.95	0.01	0.95	0.01	0.95	0.01
Ireland	0.71	0.04	0.70	0.02	0.72	0.02	0.73	0.01	0.69	0.02	0.71	0.01	0.72	0.01	0.79	0.02	0.79	0.02	0.79	0.02	0.63	0.02	0.66	0.02	0.69	0.01
Italy	0.65	0.19	0.38	0.40	0.51	0.21	0.65	0.09	0.51	0.25	0.54	0.21	0.58	0.17	0.65	0.07	0.68	0.06	0.71	0.05	0.44	0.40	0.49	0.33	0.66	0.10
Netherlands	0.58	0.07	0.73	0.03	0.75	0.02	0.76	0.01	0.73	0.03	0.74	0.03	0.75	0.02	0.80	0.02	0.81	0.01	0.83	0.01	0.67	0.06	0.69	0.05	0.71	0.05
Norway	0.88	0.05	0.87	0.01	0.87	0.01	0.88	0.01	0.89	0.01	0.89	0.01	0.89	0.01	0.85	0.03	0.85	0.03	0.86	0.03	0.87	0.03	0.87	0.03	0.88	0.03
Poland	0.21	0.23	0.19	0.42	0.30	0.22	0.46	0.05	0.14	0.37	0.18	0.33	0.28	0.15	0.64	0.06	0.68	0.05	0.72	0.03	0.23	0.28	0.28	0.20	0.37	0.11
Portugal	0.40	0.10	0.11	0.44	0.33	0.16	0.53	0.03	0.51	0.06	0.53	0.06	0.56	0.07	0.06	0.59	0.17	0.32	0.45	0.05	0.40	0.20	0.48	0.14	0.59	0.07
Slovak Rep.	0.24	0.38	0.04	0.87	0.20	0.18	0.45	0.05	0.21	0.15	0.25	0.18	0.29	0.20	0.59	0.04	0.65	0.03	0.71	0.02	0.03	0.88	0.06	0.46	0.35	0.03
Slovenia	0.35	0.05	0.42	0.07	0.49	0.04	0.55	0.03	0.43	0.03	0.44	0.03	0.46	0.03	0.80	0.04	0.80	0.04	0.81	0.03	0.28	0.11	0.33	0.05	0.38	0.00
Spain	0.54	0.19	0.44	0.31	0.54	0.18	0.66	0.06	0.34	0.36	0.40	0.30	0.51	0.14	0.56	0.15	0.63	0.11	0.69	0.07	0.73	0.04	0.75	0.04	0.77	0.03
Sweden	0.71	0.08	0.81	0.01	0.82	0.01	0.83	0.01	0.71	0.02	0.72	0.03	0.73	0.03	0.87	0.02	0.87	0.02	0.87	0.02	0.89	0.03	0.89	0.03	0.90	0.03
Switzerland	0.81	0.07	0.37	0.13	0.60	0.03	0.72	0.02	0.74	0.04	0.76	0.04	0.78	0.04	0.90	0.02	0.90	0.02	0.90	0.02	0.19	0.20	0.32	0.09	0.49	0.03
UK	0.80	0.10	0.76	0.03	0.77	0.03	0.78	0.03	0.82	0.04	0.82	0.04	0.83	0.04	0.83	0.04	0.83	0.04	0.84	0.04	0.65	0.04	0.67	0.04	0.69	0.04
Cross-country	0.66	0.20	0.56	0.23	0.63	0.16	0.70	0.09	0.61	0.24	0.63	0.21	0.66	0.17	0.73	0.10	0.75	0.08	0.78	0.05	0.57	0.18	0.60	0.16	0.65	0.11

Notes: Av and Gini represent the average achievement and within-country Gini coefficient in a given country (given in row) for a given measure of well-being (given in column), respectively. The last row represents the average achievement and cross-country Gini coefficient in a given measure of well-being.

Table 5 Regions that have major differences in their composite well-being scores when composite scores are obtained with β=1 compared to the case β=-1

Overall well-being			Material well-being			Personal well-being			Community well-being		
Country	Region	Difference	Country	Region	Difference	Country	Region	Difference	Country	Region	Difference
Italy	Lombardy	0.692	Estonia	West Estonia	0.377	Portugal	North Portugal	0.434	Portugal	Azores	0.628
France	Corsica	0.603	Estonia	South Estonia	0.369	Portugal	Central Portugal	0.409	Italy	Lombardy	0.598
Estonia	West Estonia	0.578	Spain	Andalusia	0.342	Portugal	Madeira	0.404	France	Corsica	0.526
Estonia	North Estonia	0.576	Spain	Extremadura	0.299	Portugal	Azores	0.349	Estonia	North Estonia	0.489
Spain	Andalusia	0.561	Estonia	Central Estonia	0.282	Portugal	Alentejo	0.305	Italy	Piedmont	0.434
Portugal	Azores	0.500	Slovakia	Bratislava	0.271	Spain	Extremadura	0.285	Estonia	Central Estonia	0.413
Estonia	South Estonia	0.496	Italy	Calabria	0.252	Hungary	North Hungary	0.264	Poland	Warminsko-Mazurskie	0.412
Greece	Attica	0.494	Poland	Swietokrzyskie	0.245	Estonia	Northeast Est.	0.239	Greece	Attica	0.410
Czech Rep.	Moravia-Silesia	0.488	Poland	Malopolskie	0.230	Portugal	Algarve	0.235	Italy	Sicily	0.405
Portugal	Madeira	0.482	Greece	Ionian Islands	0.222	Spain	Ceuta	0.235	Italy	Veneto	0.402

Table 6 Major rank reversals in composite well-being indices when different β parameters are used to obtain composite indices

Panel A Regions that have higher ranking positions when β=-1 is used to obtain composite indices

Overall well-being				Material well-being				Personal well-being				Community well-being			
Country	Region	Rank	Δ	Country	Region	Rank	Δ	Country	Region	Rank	Δ	Country	Region	Rank	Δ
GRC	East Macedonia-Thrace	177-213	36	SVK	Central Slovakia	165-189	24	GRC	Central Macedonia	152-179	27	CZE	Central Moravia	163-203	40
HUN	Southern Great Plain	170-202	32	SVK	East Slovakia	181-204	23	BEL	Wallonia	136-157	21	POL	Slaskie	167-206	39
CZE	Northwest	150-181	31	POL	Opolskie	166-185	19	FRA	Picardy	127-148	21	GRC	East Macedonia-Thrace	159-197	38
POL	Lódzkie	164-193	29	POL	Dolnoslaskie	162-179	17	GRC	West Greece	176-196	20	POL	Lódzkie	174-210	36
POL	Zachodniopomorskie	172-201	29	POL	Zachodniopomorskie	179-195	16	BEL	Brussels-Capital Region	120-139	19	SVK	Bratislava Region	166-202	36
POL	Dolnoslaskie	157-185	28	SVK	West Slovakia	160-176	16	GRC	Thessaly	164-183	19	CZE	Northwest	169-204	35
POL	Slaskie	160-186	26	GRC	Crete	189-203	14	FRA	Lorraine	78-96	18	CZE	Southeast	152-187	35
FRA	Lorraine	78-103	25	GRC	West Macedonia	196-210	14	GRC	Ionian Islands	174-192	18	CZE	Prague	161-194	33
HUN	Southern Transdanubia	166-191	25	ITA	Veneto	74-88	14	GRC	West Macedonia	179-197	18	HUN	Southern Great Plain	157-189	32
ITA	Umbria	83-106	23	POL	Podlaskie	172-186	14	IRL	Border-Midland- Western	115-133	18	HUN	Southern Transdanubia	150-179	29

Panel B Regions that have higher ranking positions when β=1 is used to obtain composite indices

Overall well-being				Material well-being				Personal well-being				Community well-being			
Country	Region	Rank	Δ	Country	Region	Rank	Δ	Country	Region	Rank	Δ	Country	Region	Rank	Δ
CHE	Zurich	155-88	-67	ESP	Basque Country	106-65	-41	EST	North Estonia	102-69	-33	PRT	Azores	191-127	-64
FIN	Åland	102-39	-63	EST	West Estonia	199-164	-35	ESP	Balearic Islands	192-168	-24	FIN	Åland	134-70	-64
ITA	Lombardy	179-123	-56	EST	South Estonia	201-166	-35	ISL	Other Regions	155-131	-24	ITA	Veneto	170-112	-58
CHE	Eastern Switzerland	152-101	-51	ESP	Navarra	100-68	-32	ESP	Catalonia	165-144	-21	ITA	Lombardy	192-139	-53
PRT	Azores	209-164	-45	ESP	Andalusia	200-169	-31	HUN	Central Hungary	157-136	-21	FRA	Corsica	193-150	-43
CHE	Northwest Switzerland	143-98	-45	NLD	Drenthe	104-72	-32	SVK	East Slovakia	177-156	-21	ITA	Piedmont	181-138	-43
EST	South Estonia	208-166	-42	ESP	Extremadura	191-162	-29	NLD	Zeeland	101-81	-20	ITA	Bolzano-Bozen	113-72	-41
CHE	Central Switzerland	118-77	-41	NLD	Friesland	103-74	-29	SVK	Central Slovakia	184-165	-19	EST	North Estonia	194-156	-38
ISL	Other Regions	85-48	-37	EST	Central Estonia	184-160	-24	ISL	Capital Region	61-43	-18	CHE	Eastern Switzerland	183-151	-32
FRA	Corsica	180-144	-36	SVK	Bratislava Region	153-130	-23	CZE	Southeast	104-86	-18	PRT	Madeira	175-143	-32

Notes: First and second numbers given in the columns named "rank" are the ranking of a given region when composite well-being is obtained with β=-1 and β=1, respectively. Δ columns represent the rank difference of regions when β=1 and β=-1 are used to obtain composite indices, respectively. Positive (negative) rank differences suggest that region ranks higher when β=-1 (β=1) is used to obtain the composite index.

Table 7 Average achievement in composite well-being outcomes and inequality measures in 2000 and 2014

Panel A Composite well-being and inequality measures for 103 regions

	β=-1		β=0		β=1		
Overall	Mean	Gini	Mean	Gini	Mean	Gini	No regions
2014	0.527	0.296	0.597	0.204	0.679	0.111	103
2000	0.321	0.437	0.396	0.309	0.514	0.145	103
Material							
2014	0.548	0.295	0.575	0.262	0.624	0.197	103
2010	0.523	0.279	0.547	0.253	0.586	0.202	103
Personal							
2014	0.681	0.165	0.713	0.130	0.753	0.087	103
2010	0.307	0.423	0.331	0.377	0.423	0.182	103
Community							
2014	0.587	0.198	0.611	0.181	0.660	0.126	103
2010	0.443	0.284	0.474	0.250	0.533	0.177	103
Income	Mean	Gini					
2014	0.582	0.276					103
2010	0.488	0.308					103

Panel B Composite well-being and inequality for different number of regions

	B=-1		B=0		B=1		
Material	Mean	Gini	Mean	Gini	Mean	Gini	No regions
2014	0.658	0.219	0.677	0.198	0.707	0.161	145
2010	0.587	0.209	0.605	0.192	0.631	0.162	145
Personal							
2014	0.721	0.124	0.745	0.101	0.774	0.073	159
2010	0.322	0.375	0.354	0.326	0.439	0.167	159
Community							
2014	0.553	0.255	0.584	0.221	0.649	0.141	197
2010	0.383	0.384	0.414	0.347	0.505	0.223	197
Income	Mean	Gini					
2014	0.689	0.205					183
2010	0.608	0.236					183

Notes: Mean columns represent the average achievement scores in respective well-being index and income dimension. Gini coefficients measure the inequality in these well-being categories and income dimension.

Table 8 Changes in composite well-being scores between 2000 and 2014 with balanced and unbalanced changes in well-being dimensions

Panel A Set of regions with balanced and unbalanced changes in material well-being dimensions

Country	Region	Year	Income	Jobs	Housing	β=-1	β=0	β=1	Dev.	Δβ=-1	Δβ=0	Δβ=1
Austria	Vienna	2014	0.915	0.610	0.615	0.689	0.700	0.714	0.611			
		2000	1.000	0.741	0.385	0.606	0.658	0.708	1.231	0.083	0.042	0.005
Germany	Saxony-Anhalt	2014	0.716	0.763	1.000	0.809	0.817	0.826	0.568			
		2000	0.580	0.266	0.846	0.450	0.507	0.564	1.160	0.359	0.310	0.262
Estonia	Central Estonia	2014	0.044	0.755	0.385	0.112	0.233	0.394	1.422			
		2000	0.006	0.413	0.208	0.018	0.081	0.209	0.813	0.094	0.152	0.185
Belgium	Wallonia	2014	0.610	0.448	1.000	0.616	0.649	0.686	1.104			
		2000	0.591	0.498	0.769	0.600	0.609	0.619	0.543	0.016	0.039	0.067

Panel B Set of regions with balanced and unbalanced changes in personal well-being dimensions

Country	Region	Year	Education	Health	Service	β=-1	β=0	β=1	Dev.	Δβ=-1	Δβ=0	Δβ=1
Austria	Salzburg	2014	0.858	0.880	0.896	0.878	0.878	0.878	0.075			
		2000	0.750	0.565	0.230	0.403	0.460	0.515	1.040	0.475	0.417	0.363
Austria	Styria	2014	0.866	0.848	0.819	0.844	0.844	0.844	0.094			
		2000	0.724	0.519	0.166	0.322	0.397	0.470	1.115	0.522	0.447	0.375
Spain	Melilla	2014	0.378	0.794	0.870	0.594	0.639	0.681	0.984			
		2000	0.226	0.441	0.422	0.331	0.348	0.363	0.428	0.262	0.291	0.318
Netherlands	Zeeland	2014	0.574	0.851	1.000	0.766	0.787	0.808	0.852			
		2000	0.430	0.611	0.601	0.533	0.541	0.548	0.363	0.232	0.247	0.261

Panel C Set of regions with balanced and unbalanced changes in community well-being dimensions

Country	Region	Year	Civic eng.	Envi.	Safety	β=-1	β=0	β=1	Dev.	Δβ=-1	Δβ=0	Δβ=1
France	Languedoc-Roussillon	2014	0.906	0.765	0.770	0.809	0.811	0.814	0.283			
		2000	0.708	0.588	0.080	0.193	0.322	0.459	1.256	0.616	0.489	0.355
Italy	Abruzzo	2014	0.745	0.749	0.885	0.788	0.790	0.793	0.281			
		2000	0.790	0.428	1.000	0.652	0.697	0.739	1.144	0.136	0.094	0.053
Portugal	North	2014	0.308	0.807	0.885	0.535	0.604	0.667	1.153			
		2000	0.465	0.519	0.425	0.467	0.468	0.470	0.187	0.068	0.136	0.197
Czech Rep.	Southwest	2014	0.345	0.439	0.885	0.475	0.511	0.556	1.081			
		2000	0.316	0.267	0.119	0.196	0.216	0.234	0.394	0.280	0.296	0.687

Notes: β=-1, β=0, and β=1 represent the composite well-being outcomes in each category when respective β parameters are used to aggregate well-being dimensions in each category. Δβ=-1, Δβ=0, and Δβ=1 represent the changes in composite scores between 2000 and 2014 when β parameters are used to aggregate well-being dimensions in each category. "Dev." is the deviation measure that calculates how balanced the achievements across well-being categories are. The higher the deviation measure, the higher the deviation between the well-being dimensions are.

Table 9 EU average in income dimension and composite indices, and the thresholds for the EU structural funds eligibility

Dimension/Index	Beta parameter	EU average	Threshold levels (75% of the EU average)
Income dimension		0.651	0.488
Overall well-being	-1	0.563	0.422
	0	0.625	0.469
	1	0.696	0.522
Material well-being	-1	0.600	0.450
	0	0.622	0.466
	1	0.657	0.493
Personal well-being	-1	0.729	0.546
	0	0.751	0.563
	1	0.777	0.583
Community well-being	-1	0.570	0.427
	0	0.597	0.448
	1	0.653	0.490

Table 10 Summary of eligible regions for the EU structural funds with income dimension and composite indices that are obtained with different β parameters

		Overall well-being			Material well-being			Personal well-being			Community well-being		
	Income	β=-1	β=0	β=1	β=-1	β=0	β=1	β=-1	β=0	β=1	β=-1	β=0	β=1
Total eligible regions	77	70	65	51	72	68	67	31	20	11	63	59	55
Total eligible population (in millions)	129.7	128.6	118.9	76.1	123.2	117.9	116.4	63.7	34.6	14.6	104.7	95.7	80.1
Number of regions that are eligible for the funds with both income dimension and composite index		63	61	49	67	67	67	27	18	9	53	52	53
Population eligible for the funds with both income dimension and composite index (in millions)		111.4	107.9	76.5	115.2	115.2	116.4	59.1	33.9	13.9	80.8	78.5	79.1
Number of regions that are not eligible for the funds with income dimension but eligible with the composite index		7	4	2	5	1	0	4	2	2	10	7	2
Population not eligible for the with income dimension but eligible with the composite index (in millions)		17.2	11.0	0.7	8.1	2.7	0.0	4.6	0.7	0.7	23.9	17.2	1.1
Number of regions that are eligible for the funds with income dimension but not with the composite index		14	16	28	10	10	10	50	59	68	24	25	24
Population eligible for funds with income but not with the composite index (in millions)		18.3	21.8	53.2	14.5	14.5	13.3	70.6	95.8	115.8	48.9	51.2	50.6

Table 11 Distribution of eligible regions based on achievements in composite indices and income dimension at different threshold levels

			Overall well-being			Material well-being			Personal well-being			Community well-being		
Threshold level	Eligible regions / populations	Income	β=-1	β=0	β=1	β=-1	β=0	β=1	β=-1	β=0	β=1	β=-1	β=0	β=1
0.1	# of regions	21	38	5	0	25	18	0	4	2	0	26	23	0
	Population (in millions)	16.6	58.9	2.7	0.0	32.1	25.2	0.0	9.0	3.1	0.0	37.4	33.3	0.0
0.2	# of regions	39	46	30	0	48	32	10	5	4	0	31	26	1
	Population (in millions)	42.0	73.2	37.1	0.0	80.9	40.5	12.9	9.7	9.0	0.0	46.8	36.6	1.0
0.3	# of regions	50	57	40	0	58	52	35	8	5	0	43	35	6
	Population (in millions)	67.5	101.0	61.7	0.0	104.6	90.0	46.7	12.4	9.7	0.0	74.1	54.0	7.7
0.4	# of regions	67	69	54	8	67	61	54	11	7	1	58	55	37
	Population (in millions)	115.6	123.3	92.3	3.6	116.9	108.0	91.1	21.1	11.3	0.2	97.4	90.7	46.0
0.5	# of regions	79	79	69	49	79	74	68	22	11	5	71	67	56
	Population (in millions)	132.9	148.1	124.7	74.7	133.1	127.3	117.6	37.4	21.5	9.7	114.1	111.3	82.2
0.6	# of regions	100	90	81	69	92	87	82	47	31	12	92	82	68
	Population (in millions)	157.7	166.0	147.6	116.1	167.7	155.9	144.6	81.5	57.0	23.0	165.7	143.1	109.3
0.7	# of regions	125	113	103	92	125	120	115	77	71	54	133	124	115
	Population (in millions)	224.4	218.2	189.7	175.2	229.5	222.1	217.8	134.3	124.3	85.9	335.1	306.6	290.1

Table 12 Regions eligible for the EU structural funds based on 75% of the average criteria

				Overall well-being			Material well-being			Personal well-being			Community well-being		
Country	Region	Population	Income	β=-1	β=0	β=1	β=-1	β=0	β=1	β=-1	β=0	β=1	β=-1	β=0	β=1
Austria	Carinthia	555,743	0	0	0	0	0	0	0	0	0	0	1	0	0
Belgium	Brussels-Capital	1,172,750	0	1	0	0	1	0	0	0	0	0	1	1	0
Czech Rep.	Central Bohemian	1,302,340	1	0	0	0	1	1	0	0	0	0	1	1	1
Czech Rep.	Central Moravia	1,222,660	1	1	1	1	1	1	1	0	0	0	1	1	1
Czech Rep.	Moravia-Silesia	1,221,830	1	1	1	1	1	1	1	0	0	0	1	1	1
Czech Rep.	Northeast	1,506,500	1	0	0	0	1	1	1	0	0	0	0	0	1
Czech Rep.	Northwest	1,125,430	1	1	1	1	1	1	1	1	0	0	1	1	1
Czech Rep.	Prague	1,243,200	1	0	0	0	0	0	0	0	0	0	1	1	1
Czech Rep.	Southeast	1,680,290	1	0	0	0	1	1	1	0	0	0	1	1	1
Czech Rep.	Southwest	1,210,180	1	0	0	0	1	1	0	0	0	0	0	0	0
Estonia	Central Estonia	124,684	1	1	1	1	1	1	1	1	0	0	1	1	1
Estonia	North Estonia	572,103	1	1	1	0	1	1	1	0	0	0	1	1	1
Estonia	Northeast Estonia	149,483	1	1	1	1	1	1	1	1	1	0	1	1	1
Estonia	South Estonia	322,052	1	1	1	1	1	1	1	0	0	0	1	1	1
Estonia	West Estonia	147,497	1	1	1	0	1	1	1	0	0	0	0	0	0
France	Corsica	324,212	0	1	1	0	0	0	0	0	0	0	1	1	0
Greece	Attica	3,863,760	1	1	1	1	1	1	1	0	0	0	1	1	1
Greece	Central Greece	559,214	1	1	1	1	1	1	1	0	0	0	1	1	1
Greece	Central Macedonia	1,903,360	1	1	1	1	1	1	1	0	0	0	1	1	1
Greece	Crete	630,889	1	1	1	1	1	1	1	0	0	0	1	1	1
Greece	East Macedonia-Thrace	608,214	1	1	1	1	1	1	1	1	1	1	1	1	1
Greece	Epirus	341,046	1	1	1	1	1	1	1	0	0	0	1	1	1
Greece	Ionian Islands	207,664	1	1	1	1	1	1	1	0	0	0	1	1	1
Greece	North Aegean	198,581	1	1	1	1	1	1	1	0	0	0	1	1	1
Greece	Peloponnese	585,155	1	1	1	1	1	1	1	0	0	0	1	1	1
Greece	South Aegean	334,802	1	1	1	1	1	1	1	0	0	0	1	1	1
Greece	Thessaly	737,686	1	1	1	1	1	1	1	0	0	0	1	1	1
Greece	West Greece	677,727	1	1	1	1	1	1	1	0	0	0	1	1	1
Greece	West Macedonia	278,706	1	1	1	1	1	1	1	0	0	0	1	1	1
Hungary	Central Hungary	2,965,410	1	1	1	0	1	1	1	0	0	0	0	0	1
Hungary	Central Transdanubia	1,069,190	1	1	1	1	1	1	1	1	1	0	0	0	0
Hungary	North Great Plain	1,484,380	1	1	1	1	1	1	1	1	1	1	1	1	1

Hungary	North Hungary	1,176,890	1	1	1	1	1	1	1	1	1	1	0	0	0
Hungary	South Great Plain	1,279,480	1	1	1	1	1	1	1	1	1	0	1	1	1
Hungary	South Transdanubia	917,492	1	1	1	1	1	1	1	1	1	0	1	1	1
Hungary	West Transdanubia	984,521	1	1	1	1	1	1	1	1	0	0	0	0	1
Italy	Apulia	4,090,270	1	1	1	0	1	1	1	1	0	0	0	0	0
Italy	Basilicata	578,391	1	0	0	0	1	1	1	0	0	0	0	0	0
Italy	Calabria	1,980,530	1	1	1	1	1	1	1	0	0	0	1	1	1
Italy	Campania	5,869,970	1	1	1	1	1	1	1	1	0	0	0	0	0
Italy	Friuli-Venezia Giulia	1,229,360	0	0	0	0	0	0	0	0	0	0	1	0	0
Italy	Lombardy	9,973,400	0	1	1	0	0	0	0	0	0	0	1	1	0
Italy	Molise	314,725	1	0	0	0	1	1	1	0	0	0	0	0	0
Italy	Piedmont	4,436,800	0	1	0	0	0	0	0	0	0	0	1	1	0
Italy	Sardinia	1,663,860	1	0	0	0	1	1	1	1	0	0	0	0	0
Italy	Sicily	5,094,940	1	1	1	1	1	1	1	1	0	0	1	1	1
Italy	Veneto	4,926,820	0	0	0	0	0	0	0	0	0	0	1	0	0
Netherlands	Drenthe	488,988	1	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	Friesland	646,317	1	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	Groningen	582,728	1	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	Overijssel	1,139,700	1	0	0	0	0	0	0	0	0	0	0	0	0
Poland	Dolnoslaskie	2,869,580	1	1	1	1	1	1	1	0	0	0	1	1	1
Poland	Kujawsko-Pomorskie	2,068,420	1	1	1	1	1	1	1	0	0	0	1	1	1
Poland	Lódzkie	2,498,860	1	1	1	1	1	1	1	1	1	0	1	1	1
Poland	Lubelskie	2,134,410	1	1	1	1	1	1	1	0	0	0	1	1	1
Poland	Lubuskie	1,008,560	1	1	1	1	1	1	1	0	0	0	1	1	1
Poland	Malopolskie	3,316,100	1	1	1	1	1	1	1	0	0	0	1	1	1
Poland	Mazowieckie	5,292,570	1	1	1	0	1	1	1	0	0	0	1	1	1
Poland	Opolskie	960,226	1	1	1	1	1	1	1	0	0	0	1	1	1
Poland	Podkarpackie	2,083,550	1	1	1	1	1	1	1	0	0	0	1	1	0
Poland	Podlaskie	1,165,450	1	1	1	1	1	1	1	0	0	0	1	1	1
Poland	Pomorskie	2,264,820	1	1	1	1	1	1	1	0	0	0	1	1	1
Poland	Slaskie	4,548,180	1	1	1	1	1	1	1	0	0	0	1	1	1
Poland	Swietokrzyskie	1,253,040	1	1	1	1	1	1	1	0	0	0	1	1	1
Poland	Warminsko-Mazurskie	1,421,260	1	1	1	1	1	1	1	0	0	0	1	1	1
Poland	Wielkopolskie	3,441,440	1	1	1	1	1	1	1	0	0	0	1	1	1
Poland	Zachodniopomorskie	1,691,400	1	1	1	1	1	1	1	0	0	0	1	1	1
Portugal	Alentejo	743,306	1	1	1	0	0	0	0	1	1	1	0	0	0
Portugal	Algarve	442,358	0	1	1	1	0	0	0	1	1	1	1	1	1

Portugal	Azores	247,440	0	1	1	1	0	0	0	1	1	1	1	1	0
Portugal	Central Portugal	2,281,160	1	1	1	0	0	0	0	1	1	1	1	0	0
Portugal	Madeira	2,807,530	1	1	1	1	0	0	1	1	1	1	1	1	0
Portugal	North Portugal	3,644,200	1	1	1	0	0	0	0	1	1	1	0	0	0
Slovak Rep.	Bratislava Region	618,380	0	1	0	0	1	0	0	0	0	0	1	1	1
Slovak Rep.	Central Slovakia	1,347,230	1	1	1	1	1	1	1	1	0	0	1	1	1
Slovak Rep.	East Slovakia	1,613,670	1	1	1	1	1	1	1	0	0	0	1	1	1
Slovak Rep.	West Slovakia	1,836,660	1	1	1	1	1	1	1	0	0	0	1	1	1
Slovenia	Eastern Slovenia	1,094,710	1	1	1	0	1	1	1	0	0	0	1	1	1
Slovenia	Western Slovenia	966,376	1	0	0	0	0	0	1	0	0	0	1	1	1
Spain	Andalusia	8,388,880	1	1	1	0	1	1	1	1	1	0	0	0	0
Spain	Asturias	1,058,980	0	0	0	0	1	0	0	0	0	0	0	0	0
Spain	Balearic Islands	1,115,840	0	0	0	0	0	0	0	1	0	0	0	0	0
Spain	Canary Islands	2,114,850	1	1	1	0	1	1	1	1	1	0	0	0	0
Spain	Castile and León	2,495,690	0	0	0	0	1	0	0	0	0	0	0	0	0
Spain	Castile-La Mancha	2,075,200	1	1	0	0	1	1	1	1	1	0	0	0	0
Spain	Ceuta	84,674	1	1	1	1	1	1	1	1	1	1	1	1	1
Spain	Extremadura	1,096,420	1	1	1	1	1	1	1	1	1	1	0	0	0
Spain	Galicia	2,747,230	0	0	0	0	1	1	0	1	0	0	0	0	0
Spain	Melilla	83,870	1	1	1	0	1	1	1	0	0	0	1	1	1
Spain	Murcia	1,461,800	1	1	0	0	1	1	1	1	1	0	0	0	0
Spain	Valencia	4,956,430	1	0	0	0	1	1	1	1	0	0	0	0	0
Total eligible regions			*77*	*70*	*65*	*51*	*72*	*68*	*67*	*31*	*20*	*11*	*63*	*59*	*55*
Total population (in millions)			*129.7*	*128.6*	*118.9*	*76.1*	*123.2*	*117.9*	*116.4*	*63.7*	*34.6*	*14.6*	*104.7*	*95.7*	*80.1*

Notes: Columns represent the criteria (income, overall, material, personal, and community well-being composite indices obtained with different β parameters) used to determine the eligible regions. 0 (1) suggests that a given region is not eligible (eligible) for the funds based on its achievement in a given criteria.

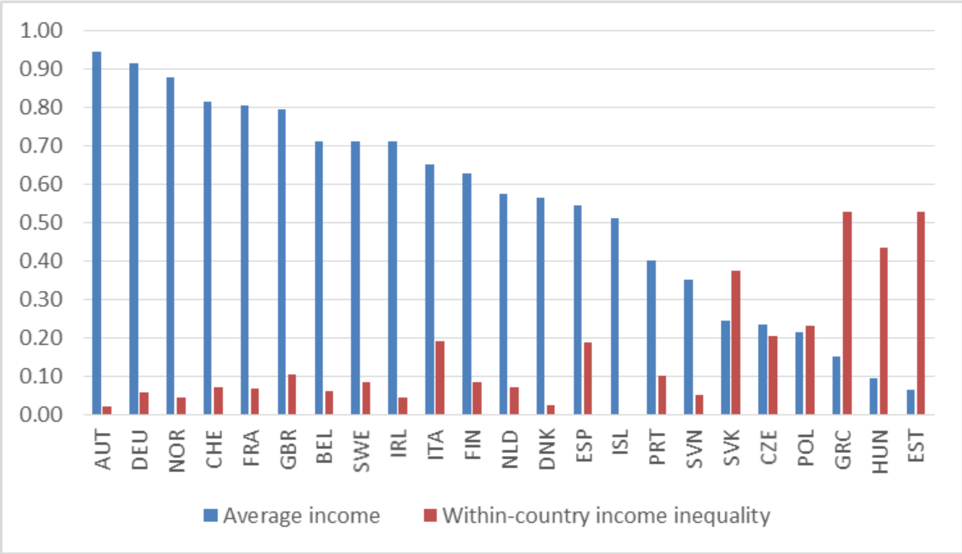

Fig.1 The association between average income and within-country income inequality

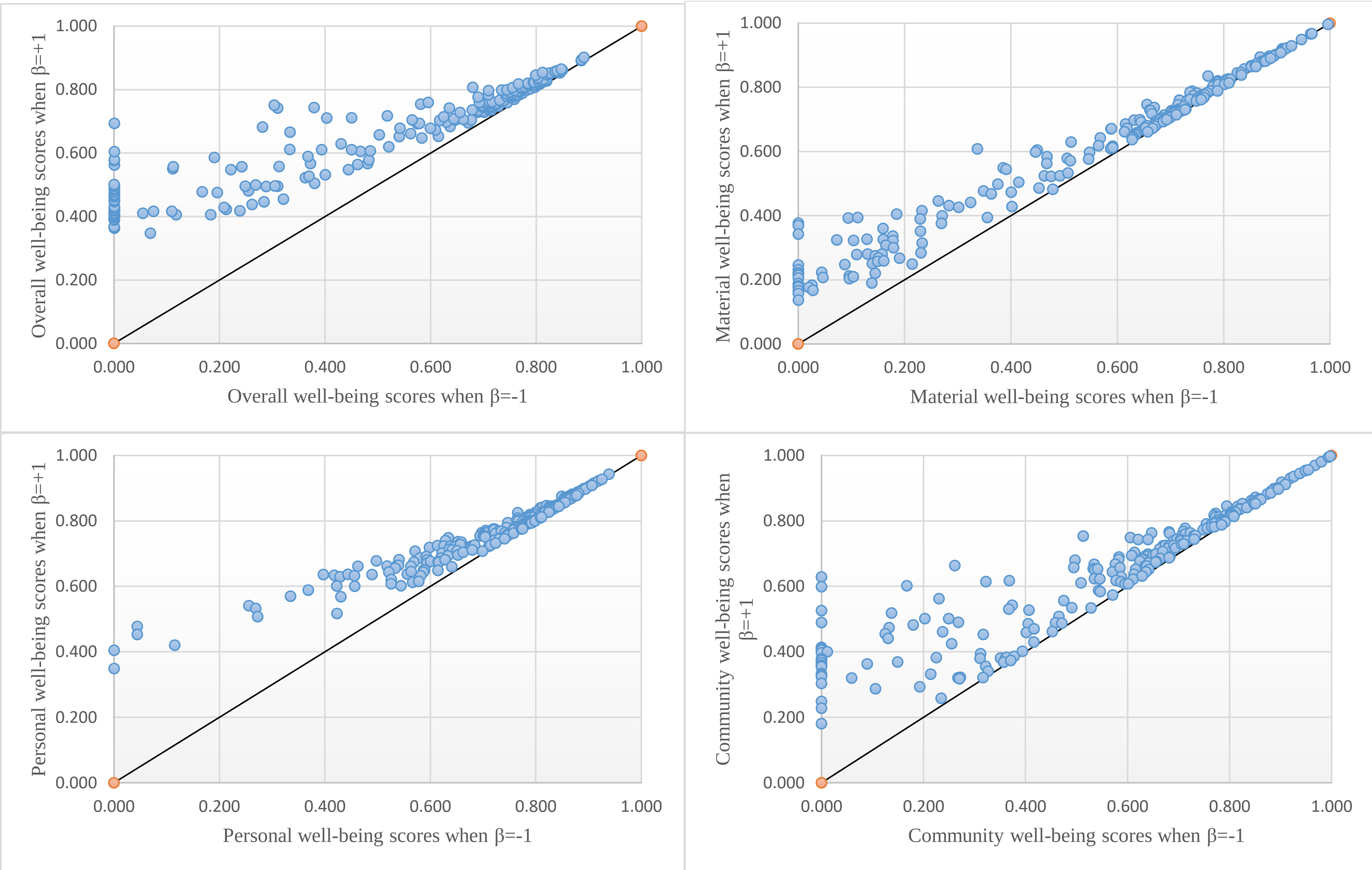

Fig. 2 Scatter plots of overall, material, personal and community composite well-being scores in 2014 when β=-1 and β=+1

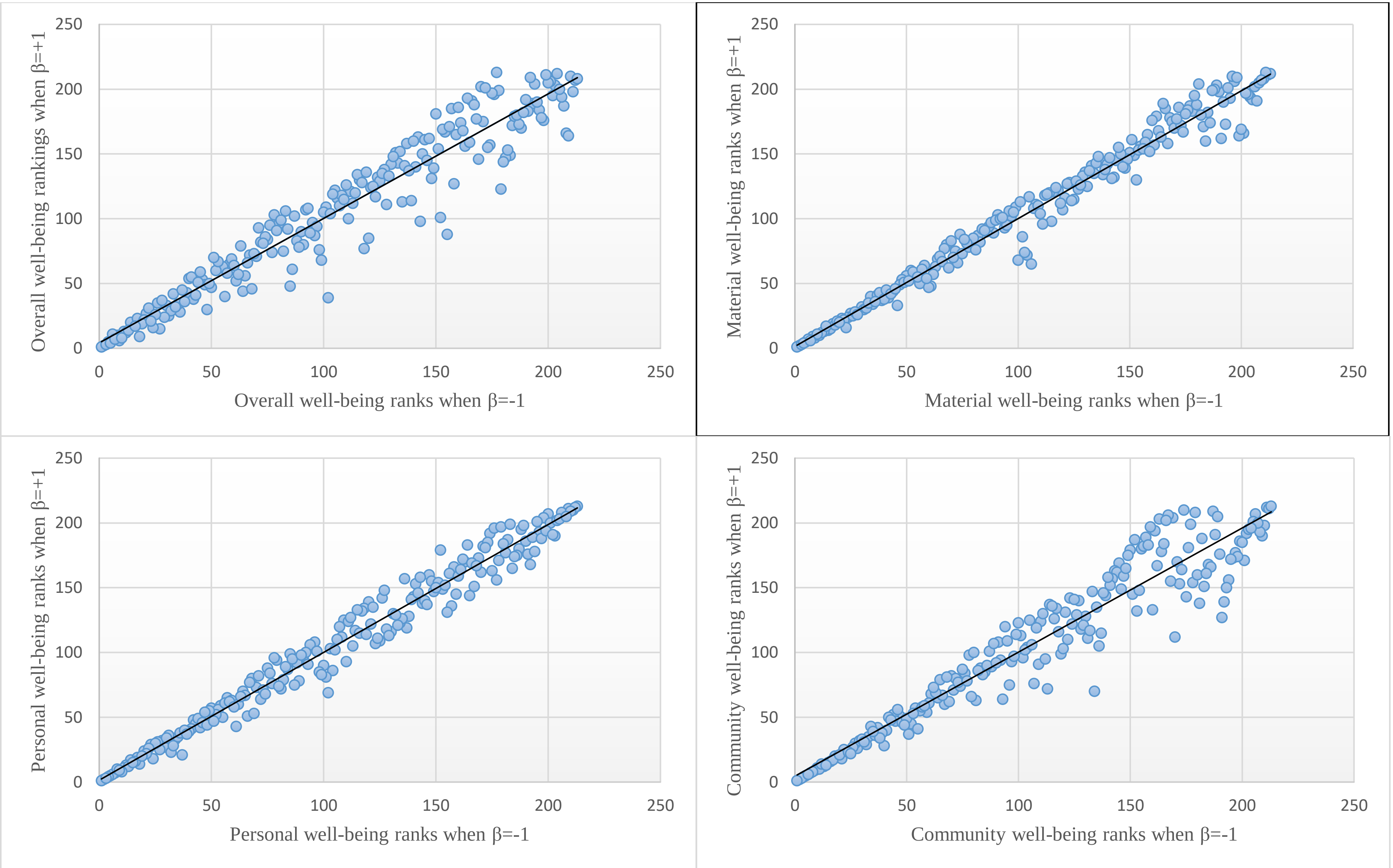

Fig. 3 Scatter plots of overall, material, personal and community composite well-being ranks in 2014 when β=-1 and β=+1

Supplementary material

Multidimensional Well-being and Inequality across the European Regions with Alternative Interactions between the Well-being Dimensions

Table 1. List of the European regions

Table 2. Overall, material, personal and community composite scores obtained with different β parameters

Table 3. Rankings based on overall, material, personal and community composite scores obtained with different β parameters

Figure 1. Average well-being and within-country inequality in different multidimensional well-being categories when β=0

Figure 2. Average well-being and within-country inequality in different multidimensional well-being categories when β=1

Table 1. List of the European regions		
Country	Region	Population in 2014
Austria	Burgenland	287318
Austria	Carinthia	555743
Austria	Lower Austria	1626260
Austria	Salzburg	534185
Austria	Styria	1214930
Austria	Tyrol	721574
Austria	Upper Austria	1425980
Austria	Vienna	1765580
Austria	Vorarlberg	375323
Belgium	Brussels-Capital Region	1172750
Belgium	Flemish Region (Vlaams Gewest)	6421950
Belgium	Wallonia (Région wallonne)	3586140
Czech Republic	Central Bohemian Region	1302340
Czech Republic	Central Moravia	1222660
Czech Republic	Moravia-Silesia	1221830
Czech Republic	Northeast	1506500
Czech Republic	Northwest	1125430
Czech Republic	Prague	1243200
Czech Republic	Southeast	1680290
Czech Republic	Southwest	1210180
Denmark	Capital (DK)	1749410
Denmark	Central Jutland	1277540
Denmark	Northern Jutland	581057
Denmark	Southern Denmark	1202510
Denmark	Zealand	816726
Estonia	Central Estonia	124684
Estonia	North Estonia	572103
Estonia	Northeast Estonia	149483
Estonia	South Estonia	322052
Estonia	West Estonia	147497
Finland	Åland	28666
Finland	Eastern and Northern Finland	1300850
Finland	Helsinki-Uusimaa	1585470
Finland	Southern Finland	1161880
Finland	Western Finland	1374400

France	Alsace	1872950
France	Aquitaine	3343330
France	Auvergne	1360460
France	Brittany	3276540
France	Burgundy	1642550
France	Centre (FR)	2577440
France	Champagne-Ardenne	1339300
France	Corsica	324212
France	Franche-Comté	1178070
France	Île-de-France	12027600
France	Languedoc-Roussillon	2751590
France	Limousin	738120
France	Lorraine	2342400
France	Lower Normandy	1479380
France	Midi-Pyrénées	2979160
France	Nord-Pas-de-Calais	4076060
France	Pays de la Loire	3690660
France	Picardy	1930100
France	Poitou-Charentes	1797700
France	Provence-Alpes-Côte d'Azur	4983440
France	Rhône-Alpes	6460510
France	Upper Normandy	1856270
Germany	Baden-Württemberg	10631300
Germany	Bavaria	12604200
Germany	Berlin	3421830
Germany	Brandenburg	2449190
Germany	Bremen	657391
Germany	Hamburg	1746340
Germany	Hesse	6045430
Germany	Lower Saxony	7790560
Germany	Mecklenburg-Vorpommern	1596510
Germany	North Rhine-Westphalia	17571900
Germany	Rhineland-Palatinate	3994370
Germany	Saarland	990718
Germany	Saxony	4046390
Germany	Saxony-Anhalt	2244580
Germany	Schleswig-Holstein	2815960

Germany	Thuringia	2160840
Greece	Attica	3863760
Greece	Central Greece	559214
Greece	Central Macedonia	1903360
Greece	Crete	630889
Greece	East Macedonia - Thrace	608214
Greece	Epirus	341046
Greece	Ionian Islands	207664
Greece	North Aegean	198581
Greece	Peloponnese	585155
Greece	South Aegean	334802
Greece	Thessaly	737686
Greece	West Greece	677727
Greece	West Macedonia	278706
Hungary	Central Hungary	2965410
Hungary	Central Transdanubia	1069190
Hungary	Northern Great Plain	1484380
Hungary	Northern Hungary	1176890
Hungary	Southern Great Plain	1279480
Hungary	Southern Transdanubia	917492
Hungary	Western Transdanubia	984521
Iceland	Capital Region	208752
Iceland	Other Regions	116919
Ireland	Border, Midland and Western	1232780
Ireland	Southern and Eastern	3372720
Italy	Abruzzo	1333940
Italy	Aosta Valley	128591
Italy	Apulia	4090270
Italy	Basilicata	578391
Italy	Calabria	1980530
Italy	Campania	5869970
Italy	Emilia–Romagna	4446350
Italy	Friuli-Venezia Giulia	1229360
Italy	Lazio	5870450
Italy	Liguria	1591940
Italy	Lombardy	9973400
Italy	Marche	1553140

Italy	Molise	314725
Italy	Piedmont	4436800
Italy	Province of Bolzano-Bozen	515714
Italy	Province of Trento	536237
Italy	Sardinia	1663860
Italy	Sicily	5094940
Italy	Tuscany	3750510
Italy	Umbria	896742
Italy	Veneto	4926820
Luxembourg	Luxembourg	549680
Netherlands	Drenthe	488988
Netherlands	Flevoland	399893
Netherlands	Friesland	646317
Netherlands	Gelderland	2019690
Netherlands	Groningen	582728
Netherlands	Limburg	1120010
Netherlands	North Brabant	2479270
Netherlands	North Holland	2741370
Netherlands	Overijssel	1139700
Netherlands	South Holland	3577030
Netherlands	Utrecht	1253670
Netherlands	Zeeland	380621
Norway	Agder and Rogaland	751632
Norway	Hedmark and Oppland	382230
Norway	Northern Norway	478033
Norway	Oslo and Akershus	1209990
Norway	South-Eastern Norway	969415
Norway	Trøndelag	441193
Norway	Western Norway	875475
Poland	Dolnoslaskie	2869580
Poland	Kujawsko-Pomorskie	2068420
Poland	Lódzkie	2498860
Poland	Lubelskie	2134410
Poland	Lubuskie	1008560
Poland	Malopolskie	3316100
Poland	Mazowieckie	5292570
Poland	Opolskie	960226

Poland	Podkarpackie	2083550
Poland	Podlaskie	1165450
Poland	Pomorskie	2264820
Poland	Slaskie	4548180
Poland	Swietokrzyskie	1253040
Poland	Warminsko-Mazurskie	1421260
Poland	Wielkopolskie	3441440
Poland	Zachodniopomorskie	1691400
Portugal	Alentejo	743306
Portugal	Algarve	442358
Portugal	Azores	247440
Portugal	Central Portugal	2281160
Portugal	Lisbon	261313
Portugal	Madeira	2807530
Portugal	North (PT)	3644200
Slovak Republic	Bratislava Region	618380
Slovak Republic	Central Slovakia	1347230
Slovak Republic	East Slovakia	1613670
Slovak Republic	West Slovakia	1836660
Slovenia	Eastern Slovenia	1094710
Slovenia	Western Slovenia	966376
Spain	Andalusia	8388880
Spain	Aragon	1331300
Spain	Asturias	1058980
Spain	Balearic Islands	1115840
Spain	Basque Country	2167170
Spain	Canary Islands	2114850
Spain	Cantabria	587682
Spain	Castile and León	2495690
Spain	Castile-La Mancha	2075200
Spain	Catalonia	7416240
Spain	Ceuta	84674
Spain	Extremadura	1096420
Spain	Galicia	2747230
Spain	La Rioja	315223
Spain	Madrid	6378300
Spain	Melilla	83870

Spain	Murcia	1461800
Spain	Navarra	636450
Spain	Valencia	4956430
Sweden	Central Norrland	368617
Sweden	East Middle Sweden	1605350
Sweden	North Middle Sweden	829134
Sweden	Småland with Islands	819426
Sweden	South Sweden	1426830
Sweden	Stockholm	2163040
Sweden	Upper Norrland	510548
Sweden	West Sweden	1921920
Switzerland	Central Switzerland	774123
Switzerland	Eastern Switzerland	1134780
Switzerland	Espace Mittelland	1808480
Switzerland	Lake Geneva Region	1545820
Switzerland	Northwestern Switzerland	1104350
Switzerland	Ticino	346539
Switzerland	Zurich	1425540
United Kingdom	East Midlands	4618250
United Kingdom	East of England	5986850
United Kingdom	Greater London	8478150
United Kingdom	North East England	2614650
United Kingdom	North West England	7117150
United Kingdom	Northern Ireland (UK)	1830300
United Kingdom	Scotland	5337800
United Kingdom	South East England	8833650
United Kingdom	South West England	5400300
United Kingdom	Wales	3087000
United Kingdom	West Midlands	5694550
United Kingdom	Yorkshire and The Humber	5348400

Table 2. Overall, material, personal and community composite scores obtained with different β parameters

		Overall well-being index				Material well-being index				Personal well-being index				Community well-being index			
Country	Region	β=-1	β =0	β =1	Δ	β =-1	β =0	β =1	Δ	β =-1	β =0	β =1	Δ	β =-1	β =0	β =1	Δ
Austria	Burgenland	0.794	0.810	0.823	0.028	0.861	0.863	0.865	0.004	0.825	0.826	0.826	0.002	0.713	0.746	0.777	0.064
Austria	Carinthia	0.581	0.692	0.754	0.172	0.810	0.812	0.814	0.004	0.826	0.829	0.831	0.004	0.368	0.492	0.617	0.249
Austria	Lower Austria	0.755	0.784	0.806	0.050	0.864	0.869	0.874	0.010	0.798	0.799	0.799	0.001	0.640	0.694	0.743	0.103
Austria	Salzburg	0.784	0.803	0.820	0.035	0.839	0.848	0.857	0.018	0.878	0.878	0.878	0.000	0.670	0.697	0.724	0.054
Austria	Styria	0.796	0.806	0.815	0.019	0.833	0.836	0.838	0.004	0.844	0.844	0.844	0.000	0.723	0.743	0.763	0.040
Austria	Tyrol	0.757	0.770	0.782	0.025	0.788	0.802	0.816	0.028	0.843	0.845	0.846	0.003	0.664	0.675	0.685	0.021
Austria	Upper Austria	0.791	0.806	0.819	0.028	0.873	0.877	0.881	0.008	0.809	0.809	0.809	0.000	0.710	0.739	0.768	0.058
Austria	Vienna	0.662	0.685	0.705	0.043	0.689	0.700	0.714	0.025	0.806	0.811	0.815	0.009	0.543	0.566	0.588	0.044
Austria	Vorarlberg	0.745	0.774	0.799	0.054	0.887	0.892	0.897	0.011	0.840	0.842	0.843	0.003	0.585	0.617	0.657	0.072
Belgium	Brussels-Capital Region	0.393	0.514	0.610	0.217	0.447	0.523	0.598	0.151	0.724	0.728	0.732	0.008	0.250	0.358	0.501	0.252
Belgium	Flemish Region	0.709	0.751	0.783	0.074	0.833	0.839	0.846	0.013	0.846	0.847	0.849	0.003	0.541	0.595	0.653	0.112
Belgium	Wallonia	0.609	0.640	0.672	0.063	0.616	0.649	0.686	0.070	0.699	0.703	0.707	0.009	0.535	0.574	0.623	0.088
Czech Rep.	Central Bohemian	0.480	0.520	0.566	0.086	0.415	0.454	0.504	0.090	0.697	0.731	0.764	0.066	0.417	0.423	0.430	0.014
Czech Rep.	Central Moravia	0.380	0.439	0.504	0.124	0.302	0.360	0.426	0.124	0.705	0.735	0.765	0.060	0.317	0.319	0.321	0.005
Czech Rep.	Moravia-Silesia	0.001	0.181	0.489	0.488	0.269	0.318	0.376	0.107	0.626	0.675	0.723	0.097	0.000	0.028	0.367	0.366
Czech Rep.	Northeast	0.462	0.515	0.563	0.102	0.348	0.411	0.477	0.128	0.704	0.727	0.751	0.047	0.453	0.457	0.462	0.009
Czech Rep.	Northwest	0.321	0.386	0.454	0.133	0.271	0.333	0.400	0.129	0.521	0.583	0.643	0.122	0.267	0.295	0.320	0.053
Czech Rep.	Prague	0.467	0.534	0.605	0.137	0.468	0.520	0.584	0.115	0.849	0.862	0.875	0.026	0.322	0.339	0.355	0.034
Czech Rep.	Southeast	0.444	0.493	0.547	0.103	0.363	0.411	0.468	0.104	0.764	0.783	0.802	0.038	0.371	0.372	0.373	0.002
Czech Rep.	Southwest	0.486	0.547	0.606	0.120	0.376	0.434	0.498	0.123	0.708	0.736	0.764	0.056	0.475	0.511	0.556	0.081
Denmark	Capital (DK)	0.752	0.766	0.780	0.028	0.701	0.708	0.716	0.014	0.787	0.794	0.801	0.015	0.773	0.799	0.823	0.050
Denmark	Central Jutland	0.767	0.780	0.792	0.025	0.672	0.683	0.694	0.022	0.765	0.773	0.781	0.016	0.896	0.898	0.901	0.005
Denmark	Northern Jutland	0.774	0.788	0.802	0.028	0.701	0.713	0.724	0.023	0.714	0.720	0.726	0.011	0.955	0.955	0.956	0.001
Denmark	Southern Denmark	0.756	0.769	0.781	0.024	0.682	0.694	0.705	0.023	0.730	0.737	0.745	0.014	0.883	0.888	0.892	0.010
Denmark	Zealand	0.738	0.751	0.765	0.027	0.681	0.691	0.700	0.019	0.722	0.731	0.742	0.019	0.825	0.839	0.852	0.027
Estonia	Central Estonia	0.001	0.163	0.476	0.475	0.112	0.233	0.394	0.282	0.526	0.576	0.621	0.095	0.000	0.032	0.414	0.413
Estonia	North Estonia	0.001	0.208	0.577	0.576	0.233	0.302	0.416	0.183	0.765	0.796	0.825	0.059	0.000	0.037	0.490	0.489
Estonia	Northeast Estonia	0.000	0.064	0.392	0.391	0.000	0.019	0.206	0.205	0.397	0.518	0.636	0.239	0.000	0.026	0.333	0.333
Estonia	South Estonia	0.001	0.129	0.497	0.496	0.000	0.029	0.369	0.369	0.648	0.687	0.722	0.074	0.011	0.108	0.400	0.389
Estonia	West Estonia	0.001	0.231	0.579	0.578	0.000	0.031	0.377	0.377	0.594	0.634	0.671	0.077	0.584	0.639	0.690	0.106
Finland	Åland	0.680	0.756	0.806	0.127	0.910	0.915	0.920	0.010	0.731	0.738	0.746	0.015	0.513	0.638	0.753	0.240
Finland	Eastern and Northern	0.707	0.732	0.754	0.047	0.628	0.635	0.643	0.015	0.847	0.851	0.854	0.007	0.682	0.725	0.766	0.084
Finland	Helsinki-Uusimaa	0.820	0.826	0.831	0.012	0.758	0.760	0.762	0.004	0.901	0.904	0.906	0.005	0.812	0.819	0.826	0.015
Finland	Southern Finland	0.758	0.771	0.783	0.025	0.671	0.675	0.679	0.007	0.853	0.856	0.859	0.006	0.773	0.793	0.812	0.039
Finland	Western Finland	0.767	0.782	0.796	0.029	0.676	0.681	0.687	0.011	0.881	0.882	0.883	0.002	0.770	0.794	0.817	0.046
France	Alsace	0.699	0.724	0.743	0.044	0.687	0.690	0.693	0.007	0.830	0.831	0.833	0.004	0.614	0.661	0.704	0.090
France	Aquitaine	0.801	0.807	0.813	0.012	0.718	0.721	0.725	0.007	0.839	0.844	0.848	0.009	0.861	0.863	0.865	0.003
France	Auvergne	0.798	0.803	0.808	0.010	0.752	0.757	0.762	0.010	0.789	0.792	0.794	0.005	0.859	0.863	0.867	0.009

France	Brittany	0.820	0.823	0.827	0.007	0.763	0.765	0.768	0.005	0.824	0.826	0.827	0.003	0.881	0.883	0.885	0.004
France	Burgundy	0.745	0.752	0.759	0.013	0.698	0.706	0.713	0.015	0.773	0.777	0.781	0.008	0.770	0.776	0.782	0.012
France	Centre	0.767	0.775	0.783	0.016	0.716	0.722	0.727	0.012	0.788	0.793	0.799	0.011	0.805	0.814	0.823	0.019
France	Champagne-Ardenne	0.703	0.717	0.730	0.027	0.654	0.664	0.674	0.020	0.748	0.752	0.756	0.008	0.714	0.738	0.760	0.046
France	Corsica	0.001	0.246	0.604	0.603	0.476	0.499	0.522	0.046	0.742	0.753	0.764	0.022	0.000	0.039	0.526	0.526
France	Franche-Comté	0.774	0.781	0.788	0.015	0.695	0.700	0.704	0.010	0.838	0.841	0.845	0.008	0.805	0.810	0.816	0.011
France	Île-de-France	0.696	0.722	0.747	0.051	0.631	0.663	0.698	0.066	0.869	0.875	0.881	0.012	0.635	0.649	0.662	0.027
France	Languedoc-Roussillon	0.725	0.741	0.755	0.029	0.591	0.602	0.612	0.021	0.827	0.833	0.838	0.011	0.809	0.811	0.814	0.005
France	Limousin	0.813	0.819	0.824	0.011	0.749	0.753	0.758	0.009	0.797	0.799	0.802	0.005	0.910	0.910	0.911	0.002
France	Lorraine	0.715	0.726	0.736	0.021	0.638	0.649	0.659	0.021	0.792	0.793	0.793	0.001	0.733	0.745	0.755	0.022
France	Lower Normandy	0.772	0.780	0.788	0.016	0.729	0.731	0.732	0.003	0.747	0.753	0.759	0.013	0.851	0.862	0.872	0.021
France	Midi-Pyrénées	0.808	0.814	0.820	0.012	0.722	0.725	0.727	0.005	0.886	0.889	0.892	0.006	0.834	0.837	0.841	0.007
France	Nord-Pas-de-Calais	0.615	0.634	0.652	0.038	0.546	0.562	0.576	0.030	0.758	0.760	0.762	0.004	0.578	0.598	0.618	0.040
France	Pays de la Loire	0.807	0.811	0.816	0.010	0.728	0.729	0.730	0.003	0.858	0.861	0.865	0.007	0.848	0.851	0.854	0.006
France	Picardy	0.672	0.684	0.695	0.023	0.630	0.639	0.647	0.017	0.711	0.717	0.722	0.012	0.679	0.698	0.716	0.037
France	Poitou-Charentes	0.789	0.796	0.802	0.013	0.706	0.716	0.725	0.019	0.826	0.827	0.829	0.003	0.851	0.852	0.853	0.002
France	Alpes-Côte d'Azur	0.630	0.667	0.697	0.068	0.634	0.642	0.651	0.017	0.818	0.824	0.830	0.012	0.509	0.561	0.610	0.102
France	Rhône-Alpes	0.758	0.767	0.776	0.019	0.717	0.720	0.724	0.007	0.858	0.862	0.867	0.010	0.716	0.727	0.739	0.023
France	Upper Normandy	0.728	0.738	0.747	0.019	0.636	0.646	0.656	0.020	0.786	0.789	0.792	0.005	0.784	0.790	0.795	0.011
Germany	Baden-Württemberg	0.799	0.825	0.845	0.046	0.966	0.966	0.967	0.001	0.874	0.875	0.875	0.001	0.635	0.664	0.693	0.058
Germany	Bavaria	0.812	0.834	0.854	0.042	0.996	0.996	0.996	0.000	0.868	0.869	0.870	0.002	0.650	0.672	0.696	0.046
Germany	Berlin	0.715	0.731	0.744	0.030	0.757	0.760	0.762	0.005	0.851	0.854	0.857	0.006	0.587	0.601	0.614	0.026
Germany	Brandenburg	0.703	0.726	0.749	0.046	0.860	0.865	0.870	0.011	0.826	0.834	0.842	0.017	0.529	0.531	0.534	0.006
Germany	Bremen	0.720	0.737	0.754	0.034	0.885	0.890	0.895	0.010	0.778	0.786	0.793	0.015	0.571	0.572	0.573	0.002
Germany	Hamburg	0.771	0.790	0.807	0.036	0.914	0.916	0.918	0.004	0.859	0.864	0.868	0.009	0.613	0.624	0.636	0.023
Germany	Hesse	0.796	0.810	0.823	0.027	0.928	0.929	0.929	0.002	0.859	0.862	0.865	0.005	0.655	0.665	0.674	0.019
Germany	Lower Saxony	0.786	0.800	0.813	0.027	0.919	0.921	0.922	0.003	0.829	0.834	0.840	0.012	0.657	0.666	0.676	0.019
Germany	Mecklenburg-Vorpommern	0.743	0.761	0.779	0.036	0.780	0.790	0.802	0.022	0.803	0.811	0.820	0.018	0.663	0.688	0.714	0.051
Germany	North Rhine-Westphalia	0.760	0.780	0.798	0.038	0.884	0.886	0.888	0.004	0.813	0.819	0.824	0.010	0.629	0.655	0.682	0.053
Germany	Rhineland-Palatinate	0.803	0.821	0.837	0.033	0.964	0.965	0.966	0.002	0.832	0.835	0.838	0.006	0.669	0.687	0.706	0.037
Germany	Saarland	0.751	0.763	0.775	0.023	0.872	0.877	0.881	0.009	0.796	0.804	0.812	0.015	0.629	0.630	0.631	0.002
Germany	Saxony	0.771	0.788	0.804	0.033	0.852	0.858	0.865	0.012	0.865	0.871	0.877	0.012	0.641	0.656	0.672	0.031
Germany	Saxony-Anhalt	0.698	0.726	0.751	0.052	0.809	0.817	0.826	0.017	0.812	0.827	0.841	0.029	0.547	0.565	0.584	0.037
Germany	Schleswig-Holstein	0.787	0.802	0.816	0.029	0.947	0.948	0.949	0.003	0.835	0.841	0.846	0.011	0.641	0.647	0.651	0.010
Germany	Thuringia	0.766	0.780	0.794	0.028	0.852	0.859	0.867	0.015	0.855	0.863	0.871	0.016	0.636	0.640	0.644	0.008
Greece	Attica	0.001	0.184	0.495	0.494	0.179	0.240	0.300	0.120	0.773	0.774	0.775	0.002	0.000	0.033	0.410	0.410
Greece	Central Greece	0.001	0.125	0.363	0.362	0.096	0.140	0.212	0.116	0.589	0.618	0.649	0.060	0.000	0.022	0.227	0.227
Greece	Central Macedonia	0.001	0.143	0.403	0.402	0.000	0.012	0.166	0.166	0.641	0.650	0.660	0.020	0.363	0.373	0.383	0.020
Greece	Crete	0.001	0.139	0.417	0.417	0.097	0.133	0.203	0.107	0.615	0.645	0.675	0.061	0.000	0.032	0.374	0.373
Greece	East Macedonia - Thrace	0.069	0.224	0.347	0.278	0.026	0.071	0.183	0.157	0.423	0.471	0.517	0.094	0.327	0.333	0.340	0.013
Greece	Epirus	0.001	0.135	0.398	0.397	0.102	0.141	0.209	0.107	0.628	0.653	0.681	0.053	0.000	0.027	0.303	0.303

Greece	Ionian Islands	0.000	0.066	0.367	0.367	0.000	0.021	0.222	0.222	0.581	0.606	0.632	0.051	0.000	0.023	0.248	0.248
Greece	North Aegean	0.001	0.129	0.431	0.430	0.044	0.102	0.223	0.179	0.679	0.695	0.711	0.032	0.000	0.030	0.359	0.359
Greece	Peloponnese	0.001	0.138	0.402	0.402	0.104	0.142	0.209	0.106	0.587	0.614	0.644	0.057	0.000	0.030	0.354	0.354
Greece	South Aegean	0.001	0.157	0.426	0.425	0.150	0.200	0.258	0.108	0.652	0.673	0.695	0.043	0.000	0.029	0.324	0.324
Greece	Thessaly	0.001	0.151	0.402	0.402	0.000	0.015	0.177	0.176	0.614	0.631	0.649	0.034	0.362	0.372	0.382	0.020
Greece	West Greece	0.000	0.054	0.390	0.389	0.000	0.008	0.157	0.157	0.578	0.596	0.615	0.037	0.000	0.033	0.397	0.397
Greece	West Macedonia	0.075	0.245	0.416	0.342	0.028	0.056	0.167	0.139	0.566	0.588	0.612	0.046	0.417	0.445	0.470	0.053
Hungary	Central Hungary	0.370	0.448	0.527	0.157	0.230	0.277	0.352	0.122	0.629	0.687	0.740	0.111	0.459	0.474	0.489	0.030
Hungary	Central Transdanubia	0.305	0.401	0.496	0.191	0.179	0.230	0.322	0.144	0.456	0.548	0.632	0.176	0.491	0.511	0.535	0.044
Hungary	Northern Great Plain	0.055	0.241	0.410	0.355	0.020	0.063	0.176	0.156	0.430	0.502	0.568	0.138	0.405	0.440	0.486	0.080
Hungary	Northern Hungary	0.110	0.275	0.416	0.306	0.047	0.108	0.208	0.161	0.269	0.400	0.533	0.264	0.465	0.485	0.508	0.042
Hungary	Southern Great Plain	0.183	0.306	0.405	0.222	0.088	0.148	0.247	0.160	0.457	0.531	0.600	0.143	0.357	0.363	0.368	0.011
Hungary	Southern Transdanubia	0.213	0.330	0.422	0.209	0.110	0.183	0.278	0.168	0.422	0.515	0.601	0.179	0.378	0.382	0.386	0.008
Hungary	Western Transdanubia	0.310	0.405	0.495	0.185	0.178	0.233	0.337	0.159	0.518	0.593	0.662	0.144	0.471	0.479	0.487	0.015
Iceland	Capital Region	0.766	0.793	0.818	0.051	0.614	0.636	0.662	0.048	0.820	0.834	0.847	0.026	0.938	0.941	0.945	0.007
Iceland	Other Regions	0.710	0.756	0.797	0.087	0.618	0.643	0.672	0.054	0.634	0.694	0.749	0.114	0.967	0.968	0.969	0.002
Ireland	Border, Midland and Western	0.646	0.676	0.704	0.058	0.643	0.669	0.699	0.056	0.741	0.743	0.745	0.005	0.576	0.620	0.668	0.092
Ireland	Southern and Eastern	0.719	0.732	0.745	0.026	0.711	0.720	0.728	0.017	0.806	0.807	0.808	0.002	0.655	0.676	0.699	0.043
Italy	Abruzzo	0.637	0.661	0.683	0.046	0.507	0.520	0.533	0.025	0.681	0.702	0.725	0.044	0.788	0.790	0.793	0.005
Italy	Aosta Valley	0.579	0.641	0.693	0.114	0.708	0.716	0.726	0.018	0.569	0.621	0.674	0.105	0.497	0.591	0.679	0.183
Italy	Apulia	0.313	0.461	0.557	0.244	0.160	0.241	0.326	0.166	0.533	0.594	0.655	0.122	0.683	0.687	0.690	0.007
Italy	Basilicata	0.521	0.571	0.619	0.098	0.356	0.375	0.394	0.038	0.616	0.643	0.673	0.057	0.755	0.772	0.790	0.036
Italy	Calabria	0.167	0.361	0.478	0.311	0.073	0.177	0.324	0.252	0.587	0.617	0.650	0.063	0.402	0.430	0.459	0.057
Italy	Campania	0.288	0.417	0.495	0.206	0.145	0.208	0.275	0.130	0.544	0.574	0.601	0.057	0.602	0.605	0.608	0.006
Italy	Emilia–Romagna	0.692	0.728	0.759	0.067	0.749	0.754	0.760	0.011	0.719	0.748	0.775	0.055	0.621	0.685	0.743	0.122
Italy	Friuli-Venezia Giulia	0.518	0.645	0.717	0.199	0.765	0.771	0.776	0.011	0.723	0.742	0.761	0.038	0.323	0.469	0.615	0.292
Italy	Lazio	0.701	0.715	0.728	0.027	0.592	0.604	0.616	0.025	0.762	0.771	0.782	0.020	0.785	0.786	0.787	0.003
Italy	Liguria	0.690	0.709	0.728	0.039	0.702	0.715	0.727	0.025	0.662	0.683	0.704	0.042	0.706	0.729	0.753	0.047
Italy	Lombardy	0.001	0.282	0.693	0.692	0.704	0.712	0.721	0.016	0.701	0.731	0.760	0.059	0.000	0.043	0.599	0.598
Italy	Marche	0.731	0.749	0.766	0.035	0.657	0.660	0.662	0.004	0.694	0.724	0.754	0.060	0.874	0.878	0.882	0.008
Italy	Molise	0.562	0.615	0.661	0.099	0.401	0.437	0.473	0.072	0.633	0.663	0.693	0.060	0.792	0.804	0.817	0.024
Italy	Piedmont	0.334	0.552	0.666	0.332	0.671	0.679	0.687	0.015	0.651	0.680	0.709	0.058	0.168	0.364	0.601	0.434
Italy	Bolzano-Bozen	0.690	0.736	0.776	0.086	0.737	0.761	0.784	0.047	0.747	0.771	0.794	0.047	0.606	0.681	0.749	0.143
Italy	Trento	0.722	0.737	0.751	0.029	0.693	0.696	0.699	0.006	0.782	0.797	0.811	0.029	0.697	0.721	0.744	0.047
Italy	Sardinia	0.450	0.537	0.610	0.160	0.324	0.382	0.441	0.116	0.462	0.565	0.661	0.199	0.706	0.718	0.729	0.023
Italy	Sicily	0.001	0.159	0.447	0.446	0.129	0.218	0.327	0.197	0.526	0.567	0.608	0.082	0.000	0.033	0.405	0.405
Italy	Tuscany	0.711	0.730	0.748	0.037	0.700	0.703	0.706	0.007	0.659	0.698	0.735	0.077	0.786	0.794	0.802	0.016
Italy	Umbria	0.711	0.722	0.734	0.022	0.628	0.633	0.637	0.008	0.734	0.751	0.768	0.034	0.792	0.794	0.796	0.005
Italy	Veneto	0.450	0.618	0.711	0.261	0.711	0.713	0.714	0.003	0.700	0.728	0.755	0.055	0.261	0.456	0.664	0.402
Luxembourg	Luxembourg	0.840	0.850	0.859	0.020	0.826	0.835	0.845	0.019	0.880	0.884	0.888	0.009	0.816	0.830	0.844	0.028
Netherlands	Drenthe	0.749	0.772	0.792	0.043	0.661	0.697	0.729	0.068	0.785	0.799	0.813	0.028	0.821	0.828	0.836	0.015

Netherlands	Flevoland	0.677	0.690	0.704	0.027	0.656	0.668	0.680	0.025	0.788	0.799	0.810	0.022	0.611	0.616	0.622	0.011
Netherlands	Friesland	0.744	0.767	0.787	0.043	0.663	0.696	0.728	0.065	0.766	0.782	0.799	0.032	0.820	0.828	0.835	0.015
Netherlands	Gelderland	0.690	0.713	0.734	0.044	0.714	0.730	0.746	0.032	0.803	0.815	0.827	0.024	0.588	0.609	0.629	0.041
Netherlands	Groningen	0.703	0.732	0.758	0.055	0.588	0.630	0.670	0.082	0.776	0.786	0.798	0.023	0.783	0.793	0.805	0.022
Netherlands	Limburg	0.679	0.708	0.735	0.056	0.732	0.746	0.759	0.027	0.769	0.786	0.802	0.033	0.570	0.607	0.644	0.074
Netherlands	North Brabant	0.717	0.740	0.762	0.045	0.750	0.767	0.782	0.032	0.789	0.804	0.819	0.030	0.631	0.657	0.684	0.053
Netherlands	North Holland	0.752	0.769	0.784	0.032	0.769	0.776	0.783	0.013	0.829	0.837	0.845	0.016	0.674	0.700	0.725	0.050
Netherlands	Overijssel	0.708	0.724	0.740	0.032	0.665	0.692	0.717	0.052	0.789	0.802	0.815	0.025	0.682	0.685	0.687	0.006
Netherlands	South Holland	0.733	0.748	0.763	0.031	0.726	0.733	0.740	0.014	0.799	0.812	0.825	0.026	0.682	0.702	0.724	0.042
Netherlands	Utrecht	0.808	0.816	0.825	0.016	0.802	0.806	0.809	0.007	0.853	0.860	0.867	0.014	0.773	0.785	0.797	0.024
Netherlands	Zeeland	0.635	0.696	0.742	0.106	0.717	0.739	0.760	0.043	0.766	0.787	0.808	0.042	0.495	0.578	0.657	0.162
Norway	Agder and Rogaland	0.886	0.890	0.894	0.008	0.907	0.910	0.912	0.004	0.835	0.837	0.839	0.003	0.920	0.926	0.931	0.011
Norway	Hedmark and Oppland	0.850	0.855	0.861	0.012	0.883	0.887	0.890	0.007	0.775	0.775	0.776	0.001	0.902	0.910	0.918	0.016
Norway	Northern Norway	0.841	0.847	0.854	0.013	0.895	0.896	0.897	0.003	0.813	0.819	0.826	0.013	0.820	0.829	0.837	0.017
Norway	Oslo and Akershus	0.890	0.896	0.901	0.011	0.869	0.882	0.894	0.026	0.907	0.910	0.912	0.005	0.896	0.897	0.897	0.001
Norway	South-Eastern Norway	0.845	0.849	0.852	0.007	0.879	0.880	0.881	0.003	0.817	0.822	0.826	0.009	0.842	0.846	0.850	0.008
Norway	Trøndelag	0.885	0.888	0.891	0.006	0.877	0.879	0.881	0.004	0.855	0.856	0.856	0.001	0.926	0.931	0.936	0.009
Norway	Western Norway	0.848	0.856	0.864	0.016	0.897	0.900	0.902	0.004	0.874	0.876	0.878	0.004	0.781	0.797	0.812	0.031
Poland	Dolnoslaskie	0.284	0.362	0.446	0.162	0.231	0.255	0.284	0.053	0.638	0.680	0.722	0.084	0.214	0.274	0.332	0.118
Poland	Kujawsko-Pomorskie	0.001	0.136	0.418	0.417	0.000	0.018	0.188	0.188	0.622	0.662	0.701	0.079	0.090	0.210	0.363	0.273
Poland	Lódzkie	0.239	0.321	0.418	0.179	0.160	0.237	0.360	0.200	0.489	0.563	0.636	0.146	0.235	0.247	0.258	0.024
Poland	Lubelskie	0.209	0.310	0.428	0.219	0.131	0.181	0.281	0.150	0.642	0.676	0.711	0.069	0.193	0.244	0.293	0.100
Poland	Lubuskie	0.001	0.124	0.364	0.363	0.140	0.183	0.251	0.111	0.563	0.611	0.661	0.098	0.000	0.017	0.180	0.180
Poland	Malopolskie	0.001	0.175	0.465	0.464	0.000	0.021	0.231	0.230	0.730	0.749	0.769	0.039	0.312	0.346	0.394	0.082
Poland	Mazowieckie	0.401	0.467	0.532	0.131	0.284	0.350	0.431	0.148	0.702	0.732	0.762	0.059	0.394	0.398	0.402	0.008
Poland	Opolskie	0.001	0.162	0.451	0.450	0.191	0.221	0.267	0.076	0.657	0.692	0.727	0.071	0.000	0.028	0.357	0.357
Poland	Podkarpackie	0.001	0.154	0.469	0.468	0.000	0.013	0.137	0.136	0.744	0.762	0.779	0.035	0.269	0.369	0.490	0.222
Poland	Podlaskie	0.196	0.337	0.475	0.280	0.161	0.199	0.259	0.098	0.684	0.705	0.726	0.042	0.131	0.271	0.441	0.310
Poland	Pomorskie	0.269	0.387	0.499	0.230	0.151	0.201	0.268	0.117	0.721	0.749	0.775	0.054	0.317	0.386	0.453	0.135
Poland	Slaskie	0.262	0.351	0.437	0.176	0.165	0.233	0.308	0.142	0.580	0.633	0.687	0.106	0.271	0.294	0.318	0.047
Poland	Swietokrzyskie	0.001	0.135	0.406	0.405	0.000	0.020	0.246	0.245	0.620	0.652	0.686	0.066	0.106	0.190	0.287	0.181
Poland	Warminsko-Mazurskie	0.000	0.070	0.410	0.410	0.000	0.017	0.181	0.181	0.556	0.597	0.638	0.082	0.000	0.034	0.412	0.412
Poland	Wielkopolskie	0.255	0.369	0.480	0.226	0.158	0.214	0.280	0.122	0.652	0.695	0.736	0.084	0.255	0.337	0.425	0.169
Poland	Zachodniopomorskie	0.118	0.266	0.405	0.287	0.145	0.180	0.220	0.075	0.601	0.638	0.676	0.075	0.059	0.164	0.320	0.260
Portugal	Alentejo	0.242	0.440	0.556	0.314	0.548	0.572	0.598	0.050	0.115	0.251	0.421	0.305	0.536	0.595	0.650	0.115
Portugal	Algarve	0.249	0.373	0.495	0.246	0.588	0.598	0.609	0.021	0.272	0.391	0.508	0.235	0.150	0.221	0.369	0.219
Portugal	Azores	0.000	0.087	0.500	0.500	0.492	0.508	0.524	0.031	0.000	0.029	0.349	0.349	0.000	0.045	0.628	0.628
Portugal	Central Portugal	0.112	0.381	0.550	0.439	0.589	0.631	0.671	0.082	0.044	0.189	0.453	0.409	0.407	0.463	0.527	0.120
Portugal	Lisbon	0.584	0.617	0.647	0.063	0.652	0.664	0.674	0.022	0.564	0.606	0.645	0.081	0.546	0.585	0.622	0.077
Portugal	Madeira	0.001	0.183	0.483	0.482	0.479	0.480	0.482	0.003	0.000	0.033	0.405	0.404	0.230	0.387	0.562	0.332
Portugal	North	0.112	0.388	0.556	0.444	0.463	0.492	0.524	0.061	0.044	0.196	0.478	0.434	0.535	0.604	0.667	0.132

Slovakia	Bratislava Region	0.372	0.471	0.567	0.194	0.337	0.475	0.608	0.271	0.705	0.739	0.770	0.065	0.272	0.297	0.322	0.050
Slovakia	Central Slovakia	0.001	0.157	0.420	0.419	0.214	0.230	0.249	0.035	0.541	0.613	0.682	0.141	0.000	0.027	0.329	0.329
Slovakia	East Slovakia	0.001	0.149	0.426	0.425	0.138	0.162	0.190	0.052	0.571	0.642	0.708	0.137	0.000	0.032	0.379	0.379
Slovakia	West Slovakia	0.001	0.174	0.462	0.461	0.233	0.267	0.314	0.081	0.598	0.660	0.719	0.121	0.000	0.030	0.354	0.354
Slovenia	Eastern Slovenia	0.363	0.456	0.522	0.159	0.402	0.415	0.428	0.026	0.745	0.750	0.755	0.010	0.225	0.305	0.382	0.157
Slovenia	Western Slovenia	0.483	0.529	0.578	0.095	0.453	0.468	0.486	0.034	0.865	0.866	0.866	0.002	0.351	0.366	0.381	0.029
Spain	Andalusia	0.001	0.217	0.562	0.561	0.000	0.029	0.343	0.342	0.368	0.481	0.588	0.220	0.730	0.743	0.754	0.024
Spain	Aragon	0.625	0.672	0.714	0.089	0.513	0.572	0.629	0.116	0.648	0.684	0.721	0.074	0.765	0.777	0.790	0.025
Spain	Asturias	0.542	0.619	0.678	0.136	0.386	0.468	0.549	0.163	0.677	0.700	0.723	0.045	0.683	0.724	0.762	0.079
Spain	Balearic Islands	0.541	0.599	0.652	0.111	0.506	0.541	0.579	0.073	0.498	0.591	0.678	0.180	0.640	0.671	0.698	0.058
Spain	Basque Country	0.735	0.768	0.798	0.063	0.656	0.703	0.746	0.090	0.769	0.786	0.803	0.034	0.795	0.821	0.845	0.050
Spain	Canary Islands	0.221	0.413	0.547	0.326	0.104	0.205	0.323	0.218	0.443	0.543	0.637	0.193	0.583	0.633	0.682	0.100
Spain	Cantabria	0.617	0.664	0.702	0.085	0.468	0.514	0.562	0.095	0.703	0.728	0.754	0.052	0.771	0.781	0.791	0.021
Spain	Castile and León	0.575	0.638	0.692	0.117	0.450	0.524	0.604	0.155	0.592	0.641	0.691	0.099	0.765	0.774	0.782	0.017
Spain	Castile-La Mancha	0.333	0.492	0.611	0.278	0.185	0.284	0.405	0.219	0.429	0.529	0.629	0.200	0.790	0.794	0.799	0.009
Spain	Catalonia	0.599	0.640	0.678	0.079	0.512	0.543	0.571	0.059	0.613	0.671	0.724	0.111	0.704	0.721	0.738	0.034
Spain	Ceuta	0.001	0.149	0.389	0.388	0.000	0.021	0.216	0.216	0.335	0.454	0.569	0.235	0.311	0.341	0.380	0.069
Spain	Extremadura	0.190	0.406	0.585	0.395	0.094	0.209	0.393	0.299	0.256	0.394	0.541	0.285	0.802	0.812	0.822	0.021
Spain	Galicia	0.503	0.582	0.657	0.154	0.391	0.463	0.544	0.153	0.536	0.601	0.663	0.127	0.647	0.708	0.764	0.116
Spain	La Rioja	0.656	0.693	0.728	0.072	0.568	0.604	0.642	0.074	0.636	0.674	0.713	0.077	0.805	0.816	0.828	0.023
Spain	Madrid	0.706	0.735	0.759	0.053	0.565	0.593	0.618	0.053	0.808	0.824	0.839	0.030	0.806	0.813	0.820	0.014
Spain	Melilla	0.001	0.169	0.452	0.451	0.000	0.022	0.214	0.214	0.594	0.639	0.681	0.087	0.237	0.348	0.461	0.224
Spain	Murcia	0.367	0.488	0.589	0.221	0.230	0.305	0.390	0.160	0.418	0.528	0.634	0.216	0.704	0.722	0.743	0.038
Spain	Navarra	0.711	0.737	0.761	0.049	0.670	0.705	0.737	0.067	0.721	0.747	0.773	0.052	0.749	0.760	0.773	0.024
Spain	Valencia	0.430	0.545	0.629	0.199	0.263	0.351	0.445	0.182	0.539	0.603	0.664	0.125	0.757	0.767	0.777	0.021
Sweden	Central Norrland	0.827	0.838	0.849	0.022	0.709	0.717	0.725	0.016	0.824	0.826	0.828	0.004	0.994	0.994	0.994	0.000
Sweden	East Middle Sweden	0.802	0.811	0.821	0.019	0.687	0.692	0.698	0.011	0.862	0.864	0.866	0.004	0.888	0.893	0.898	0.011
Sweden	North Middle Sweden	0.809	0.819	0.829	0.021	0.686	0.691	0.696	0.010	0.811	0.811	0.811	0.000	0.980	0.981	0.981	0.000
Sweden	Småland with Islands	0.843	0.851	0.859	0.016	0.752	0.760	0.769	0.017	0.851	0.853	0.855	0.004	0.949	0.951	0.954	0.005
Sweden	South Sweden	0.782	0.790	0.798	0.016	0.666	0.669	0.672	0.006	0.856	0.857	0.858	0.002	0.857	0.861	0.865	0.007
Sweden	Stockholm	0.826	0.840	0.852	0.026	0.741	0.766	0.788	0.047	0.906	0.907	0.909	0.002	0.847	0.854	0.860	0.012
Sweden	Upper Norrland	0.836	0.846	0.857	0.021	0.710	0.716	0.721	0.011	0.848	0.850	0.851	0.003	0.998	0.998	0.998	0.000
Sweden	West Sweden	0.805	0.815	0.825	0.020	0.716	0.724	0.732	0.016	0.876	0.878	0.881	0.006	0.843	0.853	0.862	0.019
Switzerland	Central Switzerland	0.595	0.697	0.759	0.164	0.789	0.805	0.820	0.031	0.911	0.913	0.915	0.005	0.374	0.460	0.542	0.168
Switzerland	Eastern Switzerland	0.310	0.598	0.741	0.431	0.790	0.799	0.808	0.018	0.894	0.896	0.897	0.003	0.137	0.299	0.519	0.381
Switzerland	Espace Mittelland	0.403	0.607	0.710	0.307	0.737	0.749	0.762	0.026	0.866	0.866	0.867	0.002	0.203	0.344	0.501	0.298
Switzerland	Lake Geneva Region	0.281	0.545	0.682	0.400	0.645	0.669	0.692	0.047	0.891	0.895	0.898	0.007	0.125	0.271	0.455	0.330
Switzerland	Northwestern Switzerland	0.379	0.610	0.743	0.363	0.789	0.804	0.819	0.030	0.926	0.926	0.927	0.001	0.180	0.305	0.482	0.302
Switzerland	Ticino	0.565	0.643	0.704	0.139	0.698	0.703	0.708	0.010	0.866	0.870	0.875	0.008	0.367	0.435	0.530	0.163
Switzerland	Zurich	0.303	0.589	0.750	0.447	0.771	0.804	0.835	0.064	0.939	0.941	0.943	0.004	0.133	0.269	0.474	0.341
UK	East Midlands	0.770	0.782	0.793	0.023	0.813	0.819	0.825	0.012	0.820	0.826	0.831	0.011	0.691	0.708	0.725	0.034

UK	East of England	0.779	0.795	0.808	0.029	0.908	0.908	0.908	0.000	0.847	0.852	0.856	0.008	0.638	0.649	0.662	0.024
UK	Greater London	0.748	0.767	0.785	0.037	0.805	0.814	0.824	0.019	0.919	0.921	0.922	0.003	0.595	0.602	0.608	0.012
UK	North East England	0.700	0.727	0.750	0.050	0.744	0.758	0.774	0.031	0.770	0.776	0.782	0.012	0.608	0.653	0.694	0.085
UK	North West England	0.713	0.729	0.742	0.029	0.764	0.771	0.779	0.015	0.785	0.791	0.797	0.012	0.616	0.634	0.652	0.036
UK	Northern Ireland	0.644	0.680	0.708	0.063	0.685	0.691	0.696	0.011	0.758	0.765	0.772	0.015	0.533	0.596	0.654	0.121
UK	Scotland	0.758	0.764	0.769	0.011	0.788	0.789	0.789	0.000	0.758	0.766	0.774	0.016	0.731	0.738	0.744	0.013
UK	South East England	0.822	0.835	0.846	0.024	0.918	0.920	0.923	0.004	0.892	0.895	0.898	0.005	0.694	0.705	0.717	0.023
UK	South West England	0.814	0.823	0.832	0.018	0.888	0.889	0.890	0.002	0.868	0.872	0.875	0.007	0.710	0.720	0.730	0.019
UK	Wales	0.751	0.766	0.781	0.030	0.785	0.796	0.809	0.024	0.786	0.789	0.794	0.008	0.691	0.716	0.740	0.049
UK	West Midlands	0.724	0.742	0.756	0.032	0.775	0.782	0.789	0.013	0.777	0.782	0.787	0.011	0.639	0.667	0.693	0.054
UK	Yorkshire and Humber	0.715	0.733	0.748	0.033	0.760	0.768	0.777	0.016	0.782	0.787	0.792	0.010	0.624	0.652	0.677	0.052

Notes: β=-1, β=0, and β=1 represent the composite well-being scores in each category when respective β parameters are used to aggregate well-being dimensions in each category. Δ columns represent the absolute composite score difference between composite scores obtained with β=1, β=0 and β=-1.

Table 3. Rankings based on overall, material, personal and community composite scores obtained with different β parameters

		Overall well-being ranks				Material well-being ranks				Personal well-being ranks				Community well-being ranks			
Country	Region	β=-1	β =0	β =1	Δ	β =-1	β =0	β =1	Δ	β =-1	β =0	β =1	Δ	β =-1	β =0	β =1	Δ
Austria	Burgenland	31	28	25	6	25	26	27	2	57	62	65	8	67	61	60	7
Austria	Carinthia	120	107	85	35	34	36	40	6	54	56	59	5	153	140	132	21
Austria	Lower Austria	56	43	40	16	24	24	24	0	75	80	88	13	96	85	75	21
Austria	Salzburg	36	32	28	8	29	29	29	0	14	15	17	3	85	84	85	1
Austria	Styria	30	31	33	3	30	31	32	2	42	43	48	6	64	63	65	2
Austria	Tyrol	54	55	62	8	42	41	39	3	43	42	45	3	87	93	101	14
Austria	Upper Austria	32	30	29	3	21	22	23	2	68	73	80	12	69	65	62	7
Austria	Vienna	106	109	116	10	89	89	89	0	70	72	73	3	127	134	140	13
Austria	Vorarlberg	64	52	44	20	15	14	14	1	44	45	49	5	118	117	116	2
Belgium	Brussels-Capital Region	141	144	140	4	143	135	132	11	120	132	139	19	172	165	153	19
Belgium	Flemish Region	86	71	61	25	31	30	30	1	41	41	41	0	128	127	118	10
Belgium	Wallonia	116	121	130	14	120	113	107	13	136	139	157	21	130	132	128	4
Czech Rep.	Central Bohemian	132	142	151	19	144	147	145	3	137	130	119	18	145	153	169	24
Czech Rep.	Central Moravia	142	154	163	21	155	155	156	1	130	126	116	14	163	173	203	40
Czech Rep.	Moravia-Silesia	184	186	172	14	158	159	165	7	159	154	145	14	209	206	190	19
Czech Rep.	Northeast	134	143	152	18	152	151	149	3	131	134	130	4	143	147	163	20
Czech Rep.	Northwest	150	162	181	31	157	158	159	2	190	189	186	4	169	178	204	35
Czech Rep.	Prague	133	140	143	10	138	136	134	4	37	28	21	16	161	170	194	33
Czech Rep.	Southeast	137	145	158	21	150	152	151	2	104	97	86	18	152	159	187	35
Czech Rep.	Southwest	130	136	142	12	149	149	146	3	128	125	118	10	139	138	144	6
Denmark	Capital (DK)	58	63	65	7	82	83	87	5	84	84	87	3	51	42	37	14
Denmark	Central Jutland	46	49	53	7	97	101	102	5	103	104	103	1	13	12	12	1
Denmark	Northern Jutland	39	41	43	4	83	81	82	2	126	136	142	16	5	5	5	0
Denmark	Southern Denmark	55	57	63	8	94	94	93	1	118	124	134	16	15	15	15	0
Denmark	Zealand	67	70	72	5	95	99	95	4	122	128	135	13	28	27	26	2
Estonia	Central Estonia	198	190	176	22	184	170	160	24	188	190	195	7	201	199	171	30
Estonia	North Estonia	183	183	149	34	161	161	157	4	102	83	69	33	194	194	156	38
Estonia	Northeast Estonia	212	212	207	5	206	207	202	5	203	200	190	13	210	210	198	12
Estonia	South Estonia	208	206	166	42	201	200	166	35	149	147	147	2	190	190	176	14
Estonia	West Estonia	181	180	147	34	199	199	164	35	169	170	173	4	119	110	99	20
Finland	Åland	102	68	39	63	9	9	8	1	117	123	132	15	134	111	70	64
Finland	Eastern and Northern	88	86	83	5	118	120	122	4	40	39	39	1	81	70	63	18
Finland	Helsinki-Uusimaa	15	15	18	3	52	56	60	8	7	7	7	0	33	34	35	2
Finland	Southern Finland	52	54	60	8	99	104	109	10	34	34	33	1	52	49	45	7

Finland	Western Finland	47	45	49	4	96	102	106	10	12	13	13	1	55	44	41	14
France	Alsace	95	96	97	2	91	100	103	12	50	55	57	7	109	100	91	18
France	Aquitaine	26	29	35	9	68	72	80	12	45	44	42	3	18	18	20	2
France	Auvergne	28	33	37	9	54	59	58	5	79	87	94	15	19	19	19	0
France	Brittany	14	18	20	6	50	53	56	6	59	60	63	4	16	16	16	0
France	Burgundy	63	69	79	16	86	84	90	6	95	100	104	9	54	56	57	3
France	Centre	45	51	59	14	72	71	75	4	83	85	89	6	36	36	36	0
France	Champagne-Ardenne	92	99	107	15	108	109	111	3	109	113	125	16	66	66	67	1
France	Corsica	180	177	144	36	137	140	144	7	114	112	117	5	193	193	150	43
France	Franche-Comté	40	46	54	14	87	90	94	7	46	46	46	0	37	40	42	5
France	Île-de-France	97	98	94	4	115	111	98	17	18	17	14	4	101	107	113	12
France	Languedoc-Roussillon	72	75	82	10	123	126	128	5	53	54	56	3	34	39	43	9
France	Limousin	17	21	23	6	58	61	64	6	76	78	84	8	10	10	11	1
France	Lorraine	78	93	103	25	112	114	118	6	78	86	96	18	61	62	68	7
France	Lower Normandy	41	50	55	14	64	66	69	5	111	111	124	13	21	20	18	3
France	Midi-Pyrénées	21	24	27	6	67	69	77	10	11	11	11	0	27	28	30	3
France	Nord-Pas-de-Calais	115	123	134	19	130	131	136	6	107	110	120	13	121	125	131	10
France	Pays de la Loire	22	25	31	9	65	68	71	6	28	31	32	4	23	25	24	2
France	Picardy	105	110	122	17	116	118	121	5	127	137	148	21	83	83	88	5
France	Poitou-Charentes	33	36	42	9	79	77	79	2	56	57	61	5	22	24	25	3
France	Alpes-Côte d'Azur	112	114	121	9	114	117	120	6	62	63	60	3	135	136	135	1
France	Rhône-Alpes	53	59	67	14	70	73	83	13	29	29	27	2	65	69	79	14
France	Upper Normandy	71	77	93	22	113	115	119	6	85	90	99	14	47	51	51	4
Germany	Baden-Württemberg	27	16	15	12	2	2	2	0	17	18	19	2	102	99	96	6
Germany	Bavaria	18	14	9	9	1	1	1	0	20	22	24	4	92	94	94	2
Germany	Berlin	80	87	96	16	53	57	59	6	35	36	35	1	117	124	134	17
Germany	Brandenburg	90	92	90	2	26	25	25	1	55	52	50	5	133	137	147	14
Germany	Bremen	75	79	84	9	16	15	15	1	91	96	97	6	123	133	142	19
Germany	Hamburg	42	39	38	4	8	8	9	1	27	26	25	2	110	115	124	14
Germany	Hesse	29	27	24	5	5	5	5	0	26	30	31	5	91	98	108	17
Germany	Lower Saxony	35	35	34	1	6	6	7	1	52	51	52	1	89	97	107	18
Germany	Mecklenburg-Vorpommern	66	66	66	0	44	44	44	0	73	70	71	3	88	86	89	3
Germany	North Rhine-Westphalia	50	47	47	3	17	18	19	2	64	67	70	6	104	103	104	1
Germany	Rhineland-Palatinate	24	19	16	8	3	3	3	0	49	50	55	6	86	87	90	4
Germany	Saarland	59	65	69	10	22	23	22	1	77	76	76	1	105	114	125	20
Germany	Saxony	43	42	41	2	27	28	28	1	24	20	18	6	95	102	109	14
Germany	Saxony-Anhalt	96	94	87	9	35	34	34	1	66	58	51	15	125	135	141	16

Germany	Schleswig-Holstein	34	34	32	2	4	4	4	0	48	47	44	4	94	108	120	26
Germany	Thuringia	49	48	50	2	28	27	26	2	32	27	23	9	100	109	123	23
Greece	Attica	188	184	170	18	168	167	178	11	96	103	108	12	196	196	173	23
Greece	Central Greece	204	207	212	8	190	192	198	8	171	174	182	11	211	212	212	1
Greece	Central Macedonia	203	199	203	4	212	212	211	1	152	163	179	27	155	158	180	25
Greece	Crete	202	200	195	7	189	193	203	14	163	164	170	7	199	201	186	15
Greece	East Macedonia - Thrace	177	181	213	36	197	196	206	10	200	204	207	7	159	172	197	38
Greece	Epirus	201	203	206	5	188	191	200	12	158	161	166	8	206	209	207	3
Greece	Ionian Islands	210	211	210	1	204	204	194	10	174	179	192	18	212	211	211	1
Greece	North Aegean	207	205	187	20	195	195	193	2	141	144	153	12	202	202	192	10
Greece	Peloponnese	200	201	205	5	187	190	199	12	173	176	185	12	203	203	195	8
Greece	South Aegean	193	193	189	4	177	181	187	10	147	156	160	13	205	205	201	4
Greece	Thessaly	194	196	204	10	210	210	208	2	164	172	183	19	156	160	182	26
Greece	West Greece	213	213	208	5	213	213	212	1	176	184	196	20	197	197	177	20
Greece	West Macedonia	176	178	196	20	196	198	210	14	179	188	197	18	144	149	162	18
Hungary	Central Hungary	145	152	161	16	163	163	168	5	157	148	136	21	142	143	157	15
Hungary	Central Transdanubia	154	159	167	13	169	173	175	6	196	195	193	3	138	139	146	8
Hungary	Northern Great Plain	178	179	199	21	198	197	209	12	198	202	204	6	147	150	159	12
Hungary	Northern Hungary	175	175	197	22	194	194	201	7	207	206	206	1	141	141	152	11
Hungary	Southern Great Plain	170	173	202	32	192	189	190	3	195	197	201	6	157	164	189	32
Hungary	Southern Transdanubia	166	170	191	25	185	184	182	3	201	201	200	1	150	157	179	29
Hungary	Western Transdanubia	153	158	169	16	170	169	170	1	191	186	176	15	140	142	158	18
Iceland	Capital Region	48	38	30	18	121	119	116	5	61	53	43	18	7	7	7	0
Iceland	Other Regions	85	67	48	37	119	116	112	7	155	145	131	24	4	4	4	0
Ireland	Border, Midland & Western	108	112	118	10	111	107	96	15	115	120	133	18	122	116	110	12
Ireland	Southern and Eastern	76	85	95	19	75	74	73	2	71	74	82	11	90	92	92	2
Italy	Abruzzo	110	116	126	16	133	137	141	8	140	140	143	3	44	50	52	8
Italy	Aosta Valley	121	119	124	5	78	76	78	2	178	173	171	7	136	129	105	31
Italy	Apulia	151	150	154	4	173	166	172	7	187	185	180	7	78	88	98	20
Italy	Basilicata	127	134	138	11	151	154	161	10	162	165	172	10	59	58	54	5
Italy	Calabria	171	167	175	8	193	187	173	20	172	175	181	9	148	152	165	17
Italy	Campania	156	155	171	16	178	178	183	5	183	191	199	16	114	121	137	23
Italy	Emilia–Romagna	98	90	76	22	57	60	61	4	125	118	109	16	107	89	76	31
Italy	Friuli-Venezia Giulia	128	117	111	17	48	49	53	5	121	121	122	1	160	144	133	27
Italy	Lazio	93	100	108	15	122	125	127	5	105	105	102	3	46	52	56	10
Italy	Liguria	101	102	109	8	81	79	76	5	143	150	158	15	71	68	71	3
Italy	Lombardy	179	174	123	56	80	82	85	5	134	129	123	11	192	192	139	53

Italy	Marche	70	72	71	2	105	112	117	12	138	135	128	10	17	17	17	0
Italy	Molise	124	127	132	8	146	148	150	4	156	158	161	5	41	41	40	1
Italy	Piedmont	148	135	131	17	98	103	105	7	148	152	155	7	181	163	138	43
Italy	Bolzano-Bozen	99	81	68	31	61	54	48	13	110	106	93	17	113	91	72	41
Italy	Trento	74	80	86	12	88	93	97	9	89	82	78	11	74	73	74	1
Italy	Sardinia	136	139	141	5	154	153	153	1	194	193	178	16	70	76	82	12
Italy	Sicily	196	192	184	12	183	175	171	12	189	192	198	9	198	198	174	24
Italy	Tuscany	84	88	92	8	84	87	92	8	144	142	138	6	45	47	47	2
Italy	Umbria	83	97	106	23	117	121	124	7	116	114	115	2	42	46	50	8
Italy	Veneto	135	125	113	22	74	80	88	14	135	133	126	9	170	148	112	58
Luxembourg	Luxembourg	9	7	6	3	32	32	31	1	13	12	12	1	32	29	29	3
Netherlands	Drenthe	61	53	52	9	104	91	72	32	87	81	75	12	29	31	32	3
Netherlands	Flevoland	104	108	119	15	107	108	108	1	82	79	79	3	111	118	130	19
Netherlands	Friesland	65	61	56	9	103	92	74	29	100	98	90	10	30	32	33	3
Netherlands	Gelderland	100	101	105	5	73	67	66	7	72	68	64	8	116	119	126	10
Netherlands	Groningen	91	84	80	11	125	123	115	10	93	93	91	2	48	48	46	2
Netherlands	Limburg	103	103	104	1	63	63	63	0	98	95	85	13	124	120	122	4
Netherlands	North Brabant	77	76	74	3	56	51	50	6	81	75	72	9	103	101	102	2
Netherlands	North Holland	57	56	58	2	47	47	49	2	51	48	47	4	84	82	83	2
Netherlands	Overijssel	87	95	102	15	102	95	86	16	80	77	74	6	80	90	100	20
Netherlands	South Holland	69	73	73	4	66	65	67	2	74	69	68	6	82	81	86	5
Netherlands	Utrecht	20	22	22	2	37	37	41	4	33	32	28	5	50	53	49	4
Netherlands	Zeeland	111	105	100	11	69	64	62	7	101	91	81	20	137	131	115	22
Norway	Agder and Rogaland	2	2	2	0	11	10	10	1	47	49	54	7	9	9	9	0
Norway	Hedmark and Oppland	4	5	5	1	18	17	18	1	94	102	106	12	11	11	10	1
Norway	Northern Norway	8	9	10	2	13	13	13	0	65	66	67	2	31	30	31	1
Norway	Oslo and Akershus	1	1	1	0	23	19	16	7	5	5	5	0	12	13	14	2
Norway	South-Eastern Norway	6	8	11	5	19	20	21	2	63	65	66	3	26	26	27	1
Norway	Trøndelag	3	3	3	0	20	21	20	1	31	35	36	5	8	8	8	0
Norway	Western Norway	5	4	4	1	12	12	12	0	16	16	16	0	49	43	44	6
Poland	Dolnoslaskie	157	166	185	28	162	165	179	17	153	151	149	4	177	180	199	22
Poland	Kujawsko-Pomorskie	206	202	194	12	208	208	205	3	160	159	159	1	188	187	191	4
Poland	Lódzkie	164	171	193	29	174	168	167	7	193	194	189	5	174	184	210	36
Poland	Lubelskie	167	172	188	21	182	185	180	5	151	153	154	3	179	185	208	29
Poland	Lubuskie	199	208	211	12	180	183	188	8	181	178	177	4	213	213	213	0
Poland	Malopolskie	185	187	179	8	205	205	192	13	119	117	114	5	164	167	178	14
Poland	Mazowieckie	140	149	160	20	156	157	154	3	133	127	121	12	149	154	175	26

Poland	Opolskie	191	191	183	8	166	174	185	19	145	146	140	6	208	207	193	15
Poland	Podkarpackie	197	195	178	19	211	211	213	2	113	109	105	8	168	161	155	13
Poland	Podlaskie	168	169	177	9	172	182	186	14	139	138	141	3	185	181	168	17
Poland	Pomorskie	159	161	165	6	176	180	184	8	123	116	107	16	162	156	167	11
Poland	Slaskie	160	168	186	26	171	171	177	6	175	171	163	12	167	179	206	39
Poland	Swietokrzyskie	205	204	200	5	207	206	191	16	161	162	164	3	187	188	209	22
Poland	Warminsko-Mazurskie	211	210	198	13	209	209	207	2	182	183	187	5	195	195	172	23
Poland	Wielkopolskie	161	165	174	13	175	176	181	6	146	143	137	9	171	171	170	1
Poland	Zachodniopomorskie	172	176	201	29	179	186	195	16	166	169	169	3	189	189	205	16
Portugal	Alentejo	163	153	156	10	129	130	133	4	209	209	211	2	129	128	121	8
Portugal	Algarve	162	164	168	6	126	127	129	3	206	208	208	2	182	186	188	6
Portugal	Azores	209	209	164	45	135	139	143	8	213	213	213	0	191	191	127	64
Portugal	Central Portugal	174	163	157	17	124	122	114	10	211	211	210	1	146	145	149	4
Portugal	Lisbon	119	126	136	17	109	110	110	1	180	180	184	4	126	130	129	4
Portugal	Madeira	187	185	173	14	136	142	148	12	212	212	212	0	175	155	143	32
Portugal	North	173	160	155	18	140	141	142	2	210	210	209	1	131	122	111	20
Slovakia	Bratislava Region	144	148	150	6	153	143	130	23	129	122	113	16	166	177	202	36
Slovakia	Central Slovakia	190	194	192	4	165	172	189	24	184	177	165	19	207	208	200	8
Slovakia	East Slovakia	195	198	190	8	181	188	204	23	177	166	156	21	200	200	185	15
Slovakia	West Slovakia	186	188	180	8	160	164	176	16	167	160	151	16	204	204	196	8
Slovenia	Eastern Slovenia	147	151	162	15	145	150	155	10	112	115	127	15	176	175	181	6
Slovenia	Western Slovenia	131	141	148	17	141	145	147	6	23	24	29	6	158	162	183	25
Spain	Andalusia	182	182	153	29	200	201	169	32	204	203	202	2	63	64	69	6
Spain	Aragon	113	113	112	1	131	129	125	6	150	149	150	1	56	55	55	1
Spain	Asturias	125	124	129	5	148	144	139	9	142	141	146	5	79	71	66	13
Spain	Balearic Islands	126	130	135	9	134	133	135	2	192	187	168	24	97	95	93	4
Spain	Basque Country	68	58	46	22	106	86	65	41	99	94	83	16	40	33	28	12
Spain	Canary Islands	165	156	159	9	186	179	174	12	197	196	188	9	120	113	103	17
Spain	Cantabria	114	115	120	6	139	138	138	1	132	131	129	3	53	54	53	1
Spain	Castile and León	122	122	125	3	142	134	131	11	170	167	162	8	57	57	58	1
Spain	Castile-La Mancha	149	146	139	10	167	162	158	9	199	198	194	5	43	45	48	5
Spain	Catalonia	117	120	128	11	132	132	137	5	165	157	144	21	72	74	80	8
Spain	Ceuta	192	197	209	17	203	203	196	7	205	205	203	2	165	169	184	19
Spain	Extremadura	169	157	146	23	191	177	162	29	208	207	205	3	39	38	38	1
Spain	Galicia	129	133	133	4	147	146	140	7	186	182	175	11	93	79	64	29
Spain	La Rioja	107	106	110	4	127	124	123	4	154	155	152	3	38	35	34	4
Spain	Madrid	89	82	78	11	128	128	126	2	69	64	53	16	35	37	39	4

Spain	Melilla	189	189	182	7	202	202	197	5	168	168	167	1	173	166	164	9
Spain	Murcia	146	147	145	2	164	160	163	4	202	199	191	11	73	72	77	5
Spain	Navarra	82	78	75	7	100	85	68	32	124	119	111	13	60	60	61	1
Spain	Valencia	138	137	137	1	159	156	152	7	185	181	174	11	58	59	59	1
Sweden	Central Norrland	11	12	13	2	77	75	81	6	58	59	62	4	2	2	2	0
Sweden	East Middle Sweden	25	26	26	1	90	96	99	9	25	25	30	5	14	14	13	1
Sweden	North Middle Sweden	19	20	19	1	92	97	100	8	67	71	77	10	3	3	3	0
Sweden	Småland with Islands	7	6	7	1	55	55	55	0	36	37	38	2	6	6	6	0
Sweden	South Sweden	37	40	45	8	101	105	113	12	30	33	34	4	20	21	21	1
Sweden	Stockholm	12	11	12	1	60	52	47	13	6	6	6	0	24	22	23	2
Sweden	Upper Norrland	10	10	8	2	76	78	84	8	38	40	40	2	1	1	1	0
Sweden	West Sweden	23	23	21	2	71	70	70	1	15	14	15	1	25	23	22	3
Switzerland	Central Switzerland	118	104	77	41	39	38	37	2	4	4	4	0	151	146	145	6
Switzerland	Eastern Switzerland	152	131	101	51	38	42	43	5	8	8	10	2	183	176	151	32
Switzerland	Espace Mittelland	139	129	114	25	62	62	57	5	22	23	26	4	178	168	154	24
Switzerland	Lake Geneva Region	158	138	127	31	110	106	104	6	10	10	8	2	186	182	166	20
Switzerland	Northwestern Switzerland	143	128	98	45	40	39	38	2	2	2	2	0	180	174	160	20
Switzerland	Ticino	123	118	117	6	85	88	91	6	21	21	22	1	154	151	148	6
Switzerland	Zurich	155	132	88	67	46	40	33	13	1	1	1	0	184	183	161	23
UK	East Midlands	44	44	51	7	33	33	35	2	60	61	58	3	76	78	84	8
UK	East of England	38	37	36	2	10	11	11	1	39	38	37	2	99	106	114	15
UK	Greater London	62	60	57	5	36	35	36	1	3	3	3	0	115	123	136	21
UK	North East England	94	91	89	5	59	58	54	5	97	101	101	4	112	104	95	17
UK	North West England	81	89	99	18	49	48	51	3	88	88	92	4	108	112	119	11
UK	Northern Ireland	109	111	115	6	93	98	101	8	108	108	112	4	132	126	117	15
UK	Scotland	51	64	70	19	41	45	45	4	106	107	110	4	62	67	73	11
UK	South East England	13	13	14	1	7	7	6	1	9	9	9	0	75	80	87	12
UK	South West England	16	17	17	1	14	16	17	3	19	19	20	1	68	75	81	13
UK	Wales	60	62	64	4	43	43	42	1	86	89	95	9	77	77	78	1
UK	West Midlands	73	74	81	8	45	46	46	1	92	99	100	8	98	96	97	2
UK	Yorkshire and Humber	79	83	91	12	51	50	52	2	90	92	98	8	106	105	106	1

Notes: β=-1, β=0, and β=1 represent the rankings in each category when respective β parameters are used to aggregate well-being dimensions in each category. Δ columns represent the absolute ranking difference between rankings of composite indices obtained with β=1, β=0 and β=-1.

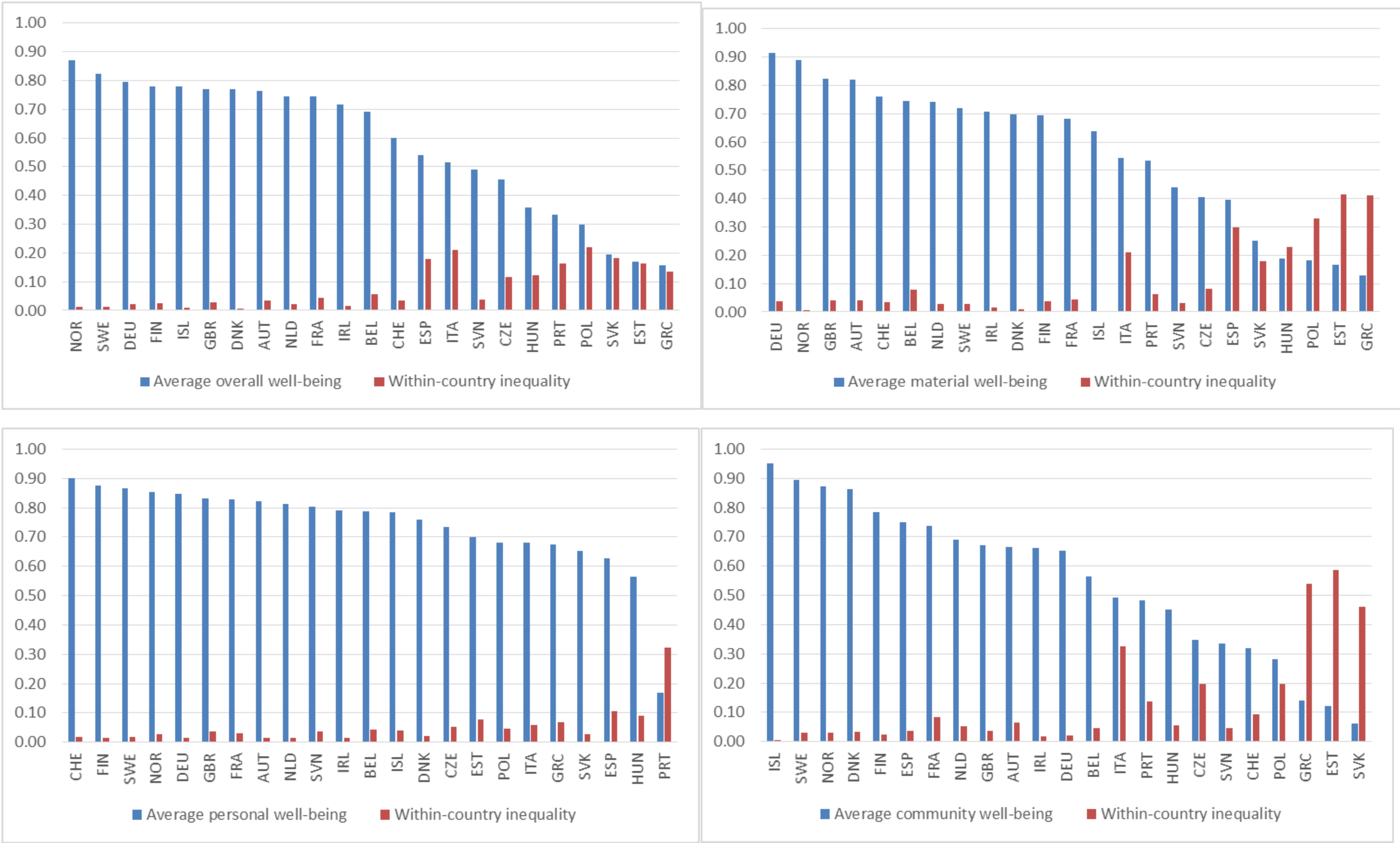

Figure 1. Average well-being and within-country inequality in different multidimensional well-being categories when β=0

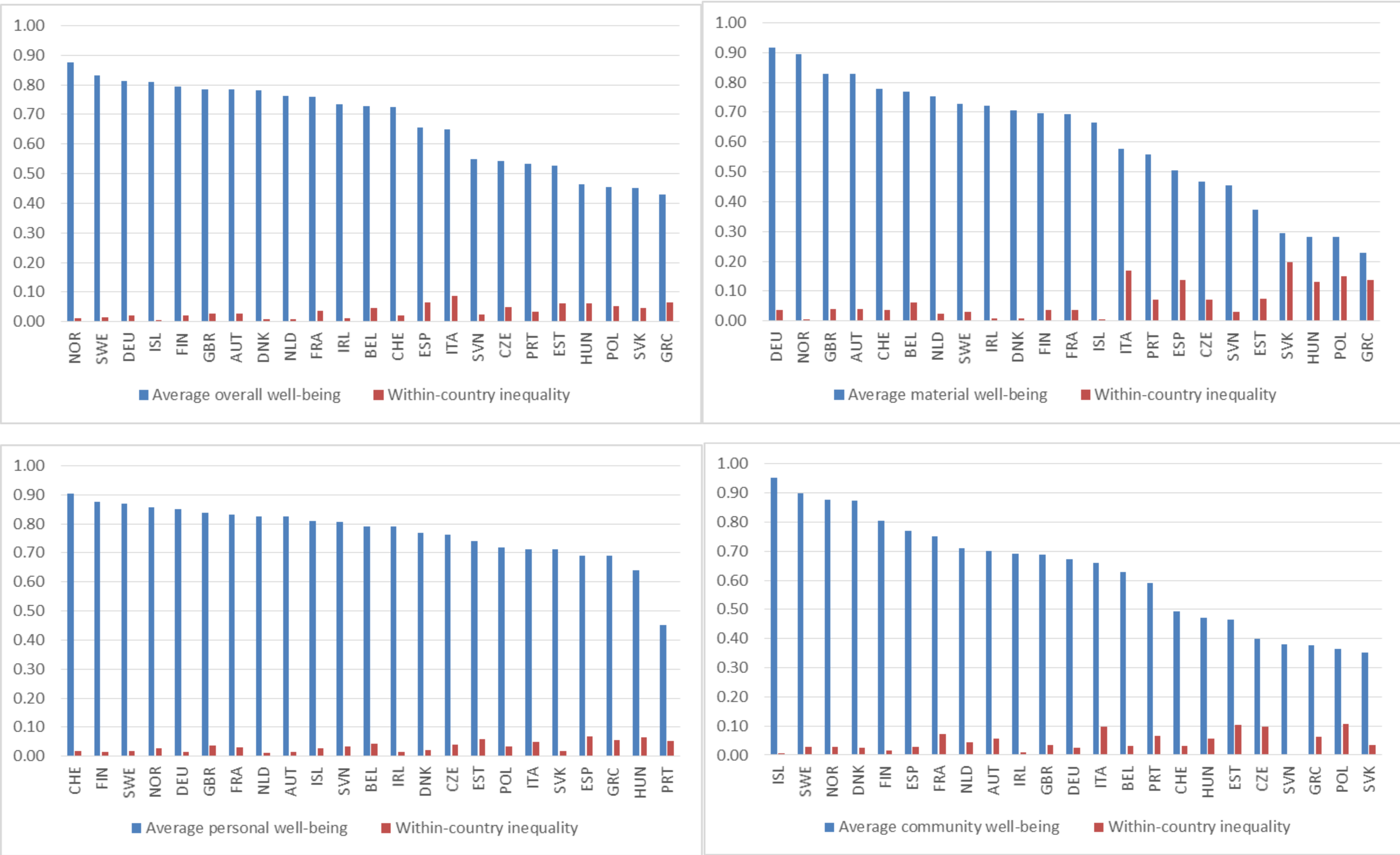

Figure 2. Average well-being and within-country inequality in different multidimensional well-being categories when β=1