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Ageing unequally in Europe

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Abstract

To shed light on the quality of the ageing experience in Europe and its heterogeneity, this study adapts and computes the Active Ageing Index—an index constructed at the country level to monitor ageing quality in Europe—at the individual level. This strategy allows the measuring of inequality in the experience of active ageing and is flexible enough to consider different value judgements in the overall assessment of the quality of life while ageing. The study examines the predictors of this inequality by using regressions with a Gini-recentred influence function. It finds that education plays a very significant role in reducing inequality, though its influence varies across countries. Furthermore, the study uncovers large variance in the quality of the ageing experience across Europe. For instance, more than 50% of the populations of Romania, Lithuania and Bulgaria show a level of active ageing quality lower than that of the bottom decile of the distribution in Sweden.

Key words: active ageing, old age, inequality, well-being, Europe, RIF-Gini

JEL classification: I14 health and inequality, I31 general welfare, wellbeing, J14 economics of the elderly

1. Introduction

Although the continual rise in life expectancy is an important achievement, older individuals still require active and healthy lifestyles to flourish in their later years. Based on the theoretical principles of active and healthy ageing, the United Nations (UN) and other institutions have developed tools to study and monitor the quality of ageing across countries. These tools primarily take the form of composite indicators that consider the domains of life regarded as important for the well-being of the elderly. One of these indicators is the Active Ageing Index (AAI), which the UN and the European Commission (EC) jointly developed to monitor active ageing in the European Union (EU)'s 28 countries.[1] This tool aims to measure the active and healthy ageing of older individuals in an aggregate way. Similar to the Human Development Index, the AAI is computed at the country level (and also by gender) and relies on different data sources.

This study adapts and computes the AAI at the individual level to shed light on the discrepancies in quality of ageing experience within countries and to contrast the distributions of quality of ageing experience across European countries. While the AAI can be informative about countries' overall performance, it does not tell us much about the distribution of quality of life during ageing among the individuals of a particular country. For instance, some countries that are otherwise highly ranked in quality of active ageing could conceivably have a less equal internal distribution than lower ranked countries. To fill this gap, this study proposes a method to compute and compare the distributions of active ageing. These distributions are used in a flexible way to incorporate normative judgements of how to rank countries according to elements of efficiency (a higher AAI) and equality (a greater internally egalitarian distribution of the AAI).

Like other composite indexes aimed at measuring multidimensional well-being, the AAI presents some common challenges. Among these limitations are, for example, the choice of relevant domains, the use of appropriate weights and the difficulty in accounting for individual heterogeneity in the index (see Decancq and Lugo (2013) for more general indicators of well-being). Although all these limitations are worth investigating, this study focusses on the challenge of accounting for individual heterogeneity in the index in order to present more refined evidence about the active ageing quality and its distribution in Europe. In this strategy, the domains and weights established in the AAI method are not contested; hence, the results of this study can be readily incorporated in policy discussions about trends and differences in Europe.

Because each individual must receive a value for active ageing, this study only uses one comprehensive data set. This data set is the European Quality of Life Survey (EQLS) of 2016, which is one of the main data sources of several indicators used to compute the AAI. The sample consists of 13 120 individuals aged 55 years and over.

The exercises used to compute the rankings of countries in active ageing quality involve distinct scenarios of normative judgements about the distribution of active ageing quality and show that these views can affect the comparisons across countries and rankings. Countries with similar averages of active ageing quality may show different levels of internal inequality, and therefore any conclusions about which countries are better for ageing must be drawn with caution. For example, Spain and Latvia rank 19th and 13th when there are no equality concerns, but given the relatively low Gini index of active ageing in Spain, the ranks change to 17th and 18th, respectively, when considering inequality. In this case, the Gini coefficient indicates a certain normative way to weigh the welfare of poorer individuals, but other inequality indices are able to show different concerns about inequality. This study uses the S-Gini family of inequality indices (Donaldson and Weymark, 1980) to show how different views about the importance of inequality lead to different valuations of welfare regarding active ageing. For example, Latvia drops to the 22nd rank when the concern for

1 Specifically, the United Nations Economic Commission for Europe (UNECE), the European Commission's Directorate General for Employment, Social Affairs and Inclusion and the European Centre for Social Welfare Policy and Research joined to develop it (see Zaidi *et al.*, 2017).

inequality is greater. Nevertheless, it is noticeable that countries performing well in the AAI also show a more equal distribution of the AAI, while some countries experience the double burden of having low levels of the AAI and higher inequality.

Furthermore, the computation of AAI distributions can identify large gaps in the quality of active ageing. More than 50% of the population of Romania, Lithuania and Bulgaria show a level of active ageing quality lower than that of the bottom decile of the distribution in Sweden. There are striking differences in the AAI distribution in Europe. Some evidence of these differences is provided by the distinctive cases of Romania, Italy and Sweden. Approximately 60% and 30% of older adults in Romania and Italy, respectively, have a lower quality of ageing than do the bottom decile of older Swedes. Computing the AAI at the individual level helps to uncover the size of discrepancies in the circumstances of the elderly across EU countries.

One novelty of this study is its use of regressions with a Gini-recentred influence function (RIF-Gini) to find the predictors of inequality in active ageing experience. This method can compute the degree of the association between a small change in one covariate and a change in an inequality statistic (e.g. on the Gini index). This study finds that a greater share of married individuals and a larger share of individuals with higher education levels contribute to equalizing the distribution of active ageing in the country, while a higher share of men is associated with an increase in inequality.

This study is organized as follows. The next section contains a discussion of the AAI. Section 3 presents the data and methods. Section 4 presents and discusses the results of the statistical analysis. Section 5 provides some concluding remarks.

2. AAI

Active ageing is the process through which individuals optimize their opportunities for health, participation and security in order to enhance their quality of life (WHO, 2002). Zaidi *et al.* (2017) define active ageing as a concept that captures continued participation in social, economic, cultural, spiritual and civic lives, as well as well-being, autonomy and independence. The labelling of the year 2012 as the European Year for Active Ageing and Solidarity between Generations (EY2012) by the EU highlights the importance given to active ageing in European policy circles. Indeed, the first set of results of the AAI project were released in 2012 in the context of the EY2012.

From a policy perspective, one of the main goals of the AAI project is to identify areas in which policies can help older adults fulfil their potential and contribute to society. Therefore, it is necessary to identify which countries are doing better than others and in which areas, as well as reflect on how the gap between countries can be reduced (Zaidi and Stanton, 2015). Importantly, the AAI project can be useful in establishing policy priorities in certain areas of the quality of ageing. In line with other composite indicators, the AAI goes beyond money-metric measures (mostly pension income for this age group) of well-being and includes other areas of life such as health, careers and participation in society.

The AAI is a composite index that measures the 28 countries of the European Union (EU28) and captures the contributions of the elderly through activity, engagement and independent living, which in turn can be considered prerequisites for well-being. One important goal of the AAI is comparing the quality of ageing across countries and monitoring its evolution over time.

Table 1. Structure of the AAI

Domain	Indicator	Age group (years)	Weight indicator	Weight domain	Data source
1. Employment	1.1 Employment rate 55–59	55–59	0.25	0.35	LFS
	1.2 Employment rate 60–64	60–64	0.25		LFS
	1.3 Employment rate 65–69	65–69	0.25		LFS
	1.4 Employment rate 70–74	70–74	0.25		LFS
2. Participation in society	2.1 Voluntary activities	55+	0.25	0.35	EQLS
	2.2 Care to older children, grandchildren	55+	0.25		EQLS
	2.3 Care to older adults	55+	0.30		EQLS
	2.4 Political participation	55+	0.20		EQLS
3. Independent, healthy and secure living	3.1 Physical exercise	55+	0.10	0.10	EQLS
	3.2 Access to health and dental care	55+	0.20		SILC
	3.3 Independent living arrangements	75+	0.20		SILC
	3.4 Relative median income of 65+ relative to those aged below 65	65+	0.10		EQLS, SILC
	3.5 No poverty risk for older persons	65+	0.10		EQLS, SILC
	3.6 No severe material deprivation rate	65+	0.10		SILC
	3.7 Physical safety	55+	0.10		ESS
	3.8 Lifelong learning	55–74	0.10		LFS
4. Capacity and enabling environment for active ageing	4.1 Remaining life expectancy at age 55	55	0.33	0.20	EHLEIS
	4.2 Share of healthy life expectancy at age 65	55	0.23		EHLEIS
	4.3 Mental well-being	55+	0.17		EQLS
	4.4 Use of information and communications technology (ICT)	55–74	0.07		Eurostat, ICT Survey
	4.5 Social connectedness	55+	0.13		ESS
	4.6 Educational attainment	55–74	0.07		LFS

LFS: European Union Labour Force Survey; SILC: European Union Statistics on Income and Living Conditions; EQLS: European Quality of Life Survey; ESS: European Social Survey; EHLEIS: European Health and Life Expectancy Information System; ICT Survey: Community Survey on ICT Usage in Households and by Individuals.

The AAI includes 22 indicators grouped into 4 domains: (a) employment; (b) participation in society; (c) independent, healthy and secure living; and (d) capacity and enabling environment for active ageing. Table 1 shows these domains and their indicators, weights and data sources.

The AAI was originally constructed in such a way that it scores from 0 to 100. The goal is to ensure that any conceivable community, from the least to the highest developed, can fit into this range. Each domain has a specific weight in the computation of the AAI. Within each domain, the indicators have a specific weight as well. The choice of indicators and weights can be classified as 'expert choices' as the decisions emerge from discussions among field experts in the AAI project, in order to ensure policy relevance (Zaidi and Stanton, 2015). Zaidi *et al.* (2013) and Zaidi *et al.* (2017) provide methodological and conceptual details regarding the domains and indicators of the AAI.

In this study, the index is simulated at the individual level for all individuals aged 55 years and over. This is an important difference from the dissimilar age groups used in the standard AAI method. As mentioned in the Introduction section, the simulation uses EQLS data as this is the only comprehensive survey to compute individual AAI for all 28 countries in the EU.

In the AAI method, the first domain is *employment* and includes the employment rates for four age groups (between 55 years and 74 years), but the simulation focusses on all individuals aged 55 years and over and assigns a value of one for the individual who is employed and zero otherwise. The second domain is *participation in society* and involves four indicators for voluntary activities, care of older children or grandchildren, care of older adults and political participation. In this domain, there are no differences between the indicators used in the AAI method and the simulation at the individual level.

The third domain, *independent, healthy, and secure living*, originally included eight indicators, of which one (*3.8 lifelong learning*, which is current participation in training) is not available in the EQLS data. The indicators for the relative median income and poverty risk (3.4 and 3.5) are computed using both EQLS data and the European Union Statistics on Income and Living Conditions (EU-SILC).

The fourth domain, *capacity and enabling environment for active ageing*, includes six indicators. The indicators for remaining life expectancy and healthy life expectancy (HLE) (4.1 and 4.2) are computed with life tables estimated with auxiliary data from the Wittgenstein Centre for Demography and Global Human Capita (WIC data) and EU-SILC.

Although the present study gives the first comprehensive set of results on individual AAI for the EU28, a recent study by Barslund *et al.* (2019) also estimates individual AAI in 13 countries. However, the studies are different in a number of ways. The current study estimates individual AAI for the 28 EU countries, so that it can have more policy potential. The use of the more comprehensive S-Gini family of indices allows accounting for different views about inequality beyond the Gini index. This is particularly important when we attempt to weigh the trade-off between efficiency and equity captured in the social welfare functions computed for all of the countries. Furthermore, this study includes indicators left out by the other study—'3.4 Relative median income' and '4.1 Remaining life expectancy'—and computes the individual life expectancy and HLE by age, sex, cohort, country and educational level.

Another study concerned with individual AAI is that of Piñeiro Vázquez *et al.* (2018). They use macro-level data (from secondary sources) to compute eight indicators in Galicia and their own survey (a sample of 404 individuals in Galicia) to compute the other 14 indicators. Their ultimate goal is to study how Galicia fares with respect to national levels and other countries.

3. Data and methods

3.1 Data

The data are drawn from the fourth round of the EQLS, which was collected between September 2016 and February 2017. The survey is financed by Eurofound, which is a European agency. The EU has carried out this survey about every four years since 2003 in all of its 28 countries. The targeted population are the residents aged 18 years and over in each country. The sample is multi-stage, stratified and randomly selected in each country.[2] In most countries, the target sample is 1000 individuals, although this increases for countries with larger populations. Among the EU28 countries, the average final sample size is 1100. The EQLS sample includes weights to account for unequal selection probabilities at the PSU, household and respondent levels and to compensate for unequal responses from different groups (region, urbanization, age, gender, employment status and household size).

One of the main goals of the EQLS is to provide evidence of the objective circumstances of European citizens and their views on different dimensions of their well-being. It provides measures for different issues such as employment, income, education, housing, family, health and subjective well-being.

This study uses a sample from the survey of 13 120 individuals aged 55 years and over with complete information on the variables of interest. This age range is chosen because most of the indicators in the AAI are computed for individuals aged 55 years and over.

3.2 Simulation of the index

The AAI is simulated by closely following the AAI method. This study computes 21 out of 22 indicators. It keeps all the weights corresponding to the indicators and domains as in the original method with the exception of the weights for the indicators within the third domain, *independent, healthy*, and *secure living*, where one indicator is not available in the EQLS data (*3.8 lifelong learning*). In this case, the weights of the available indicators are adapted in order to sum up to 100% and to keep their relative importance within the domain. The details of the adaptation of the indicators to the AAI method are summarized in Table A1 in the Online Appendix. Instead of ranging from 0 to 100 as in the original figures, the simulated values of the AAI range from 0 to 1.

The first domain, *employment*, reflects whether the individual is employed. This indicator equals one if the individual is employed and zero otherwise. In the second domain, *participation in society*, the indicator 2.1 equals one if the individual provides unpaid voluntary work through an organisation at least once a week. The indicator 2.2 equals one if the individual provides care to their children and/or grandchildren at least once a week. The indicator 2.3 equals one if the individual provides care to elderly or disabled relatives at least once a week. The indicator 2.4 equals one if the individual takes part in various forms of political activities. These indicators equal zero otherwise. The country averages of all the simulated indicators of the second domain have the same magnitudes as in the published AAI figures.

In the third domain, *independent, healthy, and secure living*, the indicator 3.1 equals one if the individual undertakes physical exercise or sport almost every day. The indicator 3.2

2 The samples are stratified by region and urbanisation in each country, and the primary sampling units (PSUs) are randomly selected from each strata proportional to the population size. The random samples of individuals or households are drawn from each PSU. A respondent is randomly selected in each household, unless individual-level registers are used (Eurofound 2017, 2018*a*,*b*).

equals one if the individual reports no unmet needs for medical and dental examinations. The indicator 3.3 equals one if the individual is living in a single or married household. The indicator 3.4 originally measured the ratio of the median equivalized disposable income of people aged 65 years and over to the median equivalized disposable income of those aged below 65 years. The simulated indicator measures the ratio of the equivalized disposable income of the individual to the median equivalized disposable income of those aged 25–54 years.[3] This last figure is obtained from Eurostat Statistics and is based on EU-SILC 2016. The indicator 3.5 equals one if the individual is not at risk of poverty; that is, the individual's equivalized disposable income is larger than 50% of the national median equivalized disposable income (this 50% cut-off is used in the AAI method). These last figures are also retrieved from Eurostat Statistics and are based on EU-SILC 2016.

The indicator 3.6 equals one if the individual is not severely materially deprived; that is, he or she can afford four or more items from a list of six. The EQLS only includes a total of six items, while EU-SILC lists nine items. The indicator 3.7 equals one if the individual feels safe walking alone after dark (indicated by strongly agree, agree or neither agree nor disagree). The original method uses the following question from the European Social Survey (ESS): 'How safe do you—or would you—feel walking alone in this area (respondent's local area or neighbourhood) after dark?' These indicators equal zero otherwise.

Regarding the fourth domain, *capacity and enabling environment for active ageing*, the indicator 4.1 measures the remaining life expectancy of the individual. An important innovation of this study is that it uses life tables estimated with auxiliary data that allow computing life expectancy by sex, age, cohort, country and education. This is the Wittgenstein Centre for Demography and Global Human Capital (WIC data; see Lutz *et al.* (2018) for more details about the data). The procedure to estimate these life tables is described in the Online Appendix. The indicator 4.2 measures the share of HLE at the corresponding age of each individual. HLE measures the expected years that will be spent in good health. Eurostat uses the Sullivan method (Eurostat 2016) to estimate their official statistics about HLE in European countries. For the simulated AAI, the computation of HLE utilizes the previously estimated life expectancies and information on the prevalence of bad or very bad health extracted from SILC 2016. Interestingly, the indicator also distinguishes by sex, age, cohort, country, and education.[4] The Online Appendix contains the details of the HLE estimation.

The indicator 4.3 equals one if the individual obtains 14 or more points on the scale of depression and zero otherwise. In this scale (0–25), zero represents the worst possible case, while 25 represents the best possible quality of life.[5] The indicator 4.4 equals one if the individual uses the Internet other than for work (every day, almost every day or at least once a

3 The income variable includes 1345 observations (about 11.4% of the analysed sample) with imputed incomes. The imputation includes the interactions of countries with an urban area, household size, number of children, property of the dwelling, material deprivation, self-assessed financial situation, unemployment, employment, types of received income and being in arrears.

4 In line with the AAI method, the indicators 4.1 and 4.2 are computed as *LE/(105-age)* and *HLE/(105-age)*, respectively.

5 The World Health Organization (WHO) indicates that a raw score below 13 represents poor well-being and may indicate a need to test for depression under the Major Depression Inventory (ICD-10).

Table 2. Simulated values of the AAI

Country	AAI (published figures)		Simulated AAI		
	AAI	Rank	AAI	Rank	Gini
Sweden	0.472	1	0.422	1	0.271
Denmark	0.430	2	0.408	2	0.276
The Netherlands	0.427	3	0.402	3	0.281
UK	0.413	4	0.379	4	0.287
Luxembourg	0.352	16	0.377	5	0.307
Finland	0.408	5	0.377	6	0.271
Belgium	0.377	10	0.364	7	0.295
Germany	0.396	6	0.362	8	0.302
Ireland	0.391	7	0.355	9	0.293
France	0.386	8	0.348	10	0.284
Estonia	0.379	9	0.344	11	0.326
Austria	0.358	12	0.339	12	0.278
Latvia	0.353	15	0.329	13	0.341
Cyprus	0.357	13	0.325	14	0.315
Malta	0.354	14	0.318	15	0.290
Italy	0.338	17	0.317	16	0.312
Czech Republic	0.365	11	0.315	17	0.297
Slovakia	0.323	21	0.314	18	0.321
Spain	0.337	18	0.307	19	0.291
Lithuania	0.334	20	0.306	20	0.346
Hungary	0.305	25	0.284	21	0.320
Poland	0.310	24	0.280	22	0.303
Slovenia	0.311	23	0.279	23	0.324
Portugal	0.335	19	0.277	24	0.316
Romania	0.302	26	0.271	25	0.339
Croatia	0.293	27	0.268	26	0.320
Bulgaria	0.318	22	0.267	27	0.350
Greece	0.277	28	0.266	28	0.311

Note: The published AAI values correspond to the most recent version made publicly available by UNECE (April 2019).

week). The indicator 4.5 equals one if the individual has frequent direct face-to-face contact with people living outside his or her household (every day, almost every day, or at least once a week). The indicator 4.6 equals one if the individual has an upper secondary or tertiary education level. All of these indicators equal zero otherwise.

The aggregation of the simulated index across individuals in the country cannot be identical to the published version of the AAI index due to the adjustments made in the computations, although both indexes should be highly correlated. Table 2 reports the original index and the one computed with the individual indices at the country level. The values for each domain of the index are reported in Table A2 of the Online Appendix. Table A2 shows that the domain *employment* shows the largest discrepancies. The reason is that employment rates are computed for younger ages (55–74 years) in the original figures, while the simulation considers the employment of individuals who are aged between 55 years and 95 years. The aggregation of individual employment rates can result in a lower overall employment rate because it reflects older people, who are mostly retired.

The value of the simulated index is lower than that of the published AAI value for each country, except for Luxembourg, although the correlation of indices is very high at 0.94. The average values of the original and simulated indices are 0.357 and 0.328. Sweden and Greece are the countries with the highest and lowest performances in active ageing in both indices. There are no differences in the ranks of eight countries, while there is a difference in rank of one for seven countries, of two for six countries, and of three or more for seven countries. Luxembourg and the Czech Republic are the countries that present the largest discrepancy in the ranks, mainly due to differences in the employment domain.[6] Yet, the Spearman correlation of the ranks is also very high, at 0.92.

Furthermore, the correlation between the original and simulated domains and indicators (overall and broken down by sex) of the AAI is also high. The average correlation for domains is 0.88, while the average correlation among indicators is 0.79. Table A3 in the Online Appendix shows the values of all the possible correlations between the original and simulated indices. For the remainder of this study, any mention of the AAI refers to the simulated index.

3.3 Introducing value judgements

The last column of Table 2 shows the Gini indices for the AAI. A quick look at the Gini and means show a negative correlation; that is, the countries with better active ageing are also places with a more equitable distribution of active ageing. However, this relation is not uniform, as Figure 1 illustrates. For example, Germany has a better level of the AAI with respect to France, but France has a lower Gini and hence a more equitable distribution. Certainly, having a higher average level of active ageing is a desirable outcome. However, distributional concerns can also be of great importance for some policy decisions, particularly in the current context of rising inequalities in old age (OECD, 2017). The question then arises naturally: How can we determine which country is a better place for ageing if both the level and distribution of active ageing are important? Answering this question involves the use of normative judgements. One extreme normative view argues that inequality is not important when assessing the ageing conditions of a country, so that the only variable that matters is the AAI mean. Other views argue that inequality of the AAI needs to be accounted for at different degrees in the evaluation of a country.

One way to consider different degrees of the importance given to inequality is by using an inequality index that is able to explicitly show the involved normative judgements. For this purpose, the inequality indices from the S-Gini set of indices (Donaldson and Weymark, 1980) are particularly useful to include, in an explicit way, different views on the importance of inequality:

6 In Luxembourg, while the simulated employment domain is 0.257, the published value is 0.202. This difference explains 80% of the discrepancy magnitude in the AAI values. In the Czech Republic, the simulated employment domain is 0.216 and the published value is 0.342. This difference explains 87% of the discrepancy magnitude in the AAI values.

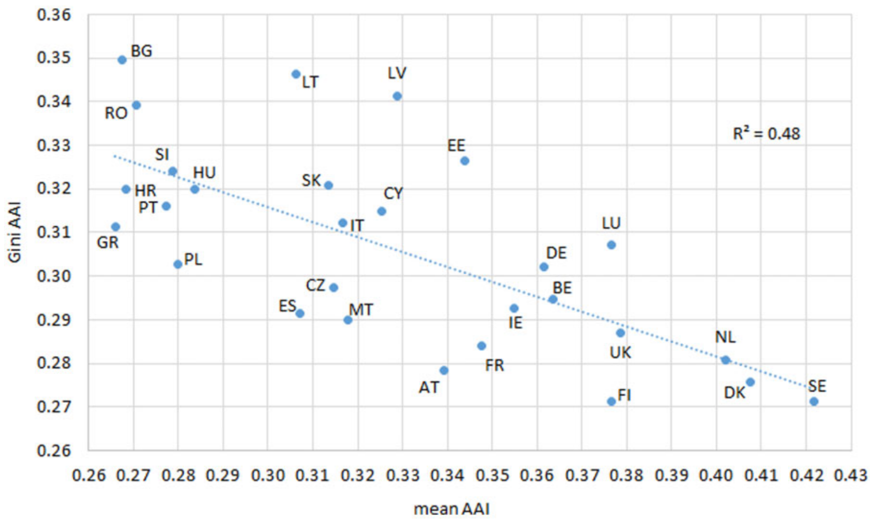

Figure 1. Gini and mean of the AAI.

$$I_\rho = 1 - \sum_{i=1}^{n} \left[\left(\frac{n-i+1}{n} \right)^\rho - \left(\frac{n-i}{n} \right)^\rho \right] \frac{AAI_i}{\mu} \tag{1}$$

Inequality is measured as the weighted average of the ratios of the individual's AAI (AAI_i) and the average AAI (μ) for each individual. In Equation (1), i indicates the position of the individual in the ranking of the AAI distribution (with $AAI_i \le AAI_{i+1}$). The expression in brackets indicates the relative weight that each individual receives for the computation of inequality. Similar to the parameter e of the Atkinson index (Atkinson, 1970), which indicates the degree of aversion to inequality, the parameter ρ shows how important the concerns for equality are. Thus, normative judgements can be incorporated into the evaluation of active ageing. If $\rho = 1$, then the welfare of all individuals receives the same relative weight and the index of inequality becomes $I_\rho = 0$. In this extreme case, there is no concern for inequality. For values $\rho > 1$, the welfare of individuals with a lower AAI is relatively more important than the welfare of individuals with a higher AAI. Larger values of ρ indicate more concern for equality. The most well-known indicator in this set of indices is the Gini coefficient that is obtained when $\rho = 2$. This is another reason for preferring the use of the S-Gini family of indices over others. The analysis uses different values for the parameter:[7] $\rho = 1,\ \rho = 2,\ \rho = 5$ and $\rho = 10$.

The attributes of an AAI distribution (mean and inequality) can be compared across countries by using a social welfare function (SWF $= W_\rho$), which also captures the tension

7 There is no unanimous set of values for the parameter ρ. The goal of the studies performing welfare analysis is to show results for a variety of values of ρ. For example, Avram *et al.* (2014) and Decoster and Ooghe (2003) use the values 1.5, 2 and 3 in their analyses of the redistributive effects of taxes and benefits in Europe and personal income tax reform in Belgium, respectively. Decancq and Lugo (2012) use the values 2 and 5, whereas Barrett and Donald (2009) use the values 1.5, 2, 3 and 5. Bosmans *et al.* (2014) use several values between 1 and 35.

between efficiency and equity concerns. The desirable properties of this function are that its value increases with the mean of the AAI and reduces with the level of inequality (Lambert, 2001). Equation (2) shows this function.

$$\text{SWF} = W_\rho = \mu(1 - I_\rho) \tag{2}$$

The SWF is equal to the mean under the extreme view that equity concerns do not matter at all (i.e., when $\rho = 1$). If one considers that inequality is important for assessing the quality of ageing among countries, then the parameter ρ must be higher than one. For the same distribution, I_ρ will increase with ρ and therefore the value of the SWF will decrease. The SWF can be used to make a new ranking of countries. The AAI project reports a ranking based on the average AAI, which implicitly holds the view that inequality in the AAI does not matter and that the SWF is equal to the average AAI.

3.4 Predictors of active ageing inequality

The determinants of AAI inequality are assessed by using the 're-centred influence function' (RIF) regressions proposed by Firpo *et al.* (2009). These regressions capture how marginal changes in the distribution of covariates affect the distributive statistics of interest (Choe and Van Kerm, 2018). This study focusses on Gini-RIF regressions. These regressions consist of two stages. First, the influence function (IF) (Hampel *et al.*, 1986) of each individual on the distribution of the AAI is computed. So one must compute the influence of each individual on the Gini index of the AAI as a function of his or her AAI and of the distribution of the AAI. Intuitively, the tails of the AAI distribution increase inequality, while a higher share of people situated around the mean reduces inequality in active ageing. In the second stage, this computed Gini influence is linearly regressed against some covariates of interest such as sex or age. For example, a positive coefficient for an age group means that marginally increasing the share of this age group—and holding the distribution of all the other covariates constant—will lead to an increase in the Gini index. The size of this coefficient will indicate the size of the increase in the Gini index if all individuals belonged to that age group. A possible statement in the regression results could be 'a change of x% in the share of the covariate z is associated with a change of y% on the Gini index'.

As pointed out by Choe and Van Kerm (2018), some of the advantages of the RIF regressions over more standard methods of inequality decomposition (Shorrocks, 1984) is that these regressions can be applied generally to any conventional statistic to assess the distributive effect of the key covariates both unconditionally and conditionally. For example, if the interest is to study the distributive effect of the level of education on the AAI, then some covariates (such as health and career trajectories) that may account for differences in the AAI between different educational levels could be held constant.

In a more formal way, let $v(F)$ be a statistic of interest (a function) that is calculated in the distribution F. In the analysis, the inequality metric is the Gini index but it could be, for example, the mean, median, the Atkinson index or a top income share. The influence function of v is a function of income y and F and is defined as:

$$\text{IF}(y; v, F) = \lim_{\in \to 0} \frac{v\big((1-\epsilon)F + \epsilon\Delta_y\big) - v(F)}{\epsilon} \tag{3}$$

The IF captures the effect on $v(F)$ of an infinitesimal contamination of F at point mass y. Expressions for IF($y; v; F$) exist (or can be derived) for a wide range of statistics.[8]

Equation (4) shows the second stage of the Gini-RIF regressions. The subscripts i and c refer to individual and country. The dependent variable is the IF, which was previously estimated in the first stage, of each individual divided by the AAI Gini index of the corresponding country ($IF_{i,c}$). Therefore, the dependent variable measures the relative contribution of each individual to the AAI Gini index of the country. The individual covariates ($X_{i,c}$) included in the regressions are dummy variables for the age groups of 65–74 years and 75 years and over (55–64 is the reference group), lower secondary education, upper secondary education, and tertiary education (primary education is the reference group), male, being married and living alone. The dummy variable $country_c$ captures the country fixed effects, and the error term $\varepsilon_{i,c}$ is assumed to be normally distributed. β_1 and β_2 are vectors of coefficients to be estimated for each covariate embedded in $X_{i,c}$ and $country_c$.

$$IF_{i,c} = \alpha + \beta_1 X_{i,c} + \beta_2 country_c + \varepsilon_{i,c} \tag{4}$$

4. Results

4.1 Welfare assessment

Table 3 shows the results of the S-Gini computations and the new country rankings based on the SWF values. As explained before, the values of the SWF when $\rho = 1$ are identical to the AAI mean. The concern for inequality grows with the other values of this parameter. Under the Gini criteria ($\rho = 2$), there are no changes in the ranking for the best three countries (Sweden, Denmark and The Netherlands), i.e. the ranks based on the means of the AAI for these countries are the same as the ranks based on the SWF. Thus, under the assumption that the Gini index is the relevant statistic for inequality, the ranks of those countries are maintained even after including inequality concerns.

Latvia and Spain illustrate an interesting case. Spain ranks 19th when there are no equality concerns, but given its relatively low Gini for active ageing, the country moves up to 17th after considering these concerns ($\rho = 2$). The country continues improving in the rankings when the concerns for equality are higher (13th when $\rho = 5$ and 12th when $\rho = 10$). However, Latvia moves down from 13th to 18th (when $\rho = 2$) because its Gini index is relatively large. As the concern for equality increases, its position in the ranking deteriorates: 20th ($\rho = 5$) and 22th ($\rho = 10$). Thus, when the AAI average is all that matters, Latvia (13th) is a better place for ageing than Spain (19th). But if equality concerns are also important (e.g. $\rho = 5$), then Spain (13th) is better than Latvia (20th). Austria is another country that changes positions considerably. It moves from 12th when equality concerns do not matter to 5th when equality concerns are very important ($\rho = 10$). Sweden is always located in first place, whether concerns for equality are null or very high.

8 See, for example, Essama-Nssah and Lambert (2012) for a catalogue of IFs relevant to analysing income distribution. The RIF is obtained by adding the statistic of interest to the IF. Using the RIF assures that the change in its average value over time is equal to the change in the statistic of interest (Davies *et al.*, 2017). The formula for the case of the RIF of Gini (G) is $RIF(y; G) = 2\frac{y}{\mu} G + 1 - \frac{y}{\mu} + \frac{2}{\mu}\int_0^y F(z)dz$.

Table 3. SWF under different parameter values

Country	($\rho=1$)		($\rho=2$)			($\rho=5$)			($\rho=10$)		
	AAI	Rank	S-Gini	SWF	Rank	S-Gini	SWF	Rank	S-Gini	SWF	Rank
Sweden	0.422	1	0.271	0.307	1	0.485	0.217	1	0.564	0.184	1
Denmark	0.408	2	0.276	0.295	2	0.497	0.205	2	0.578	0.172	3
The Netherlands	0.402	3	0.281	0.289	3	0.494	0.203	4	0.575	0.171	4
UK	0.379	4	0.287	0.270	5	0.493	0.192	5	0.564	0.165	6
Luxembourg	0.377	5	0.307	0.261	6	0.518	0.182	7	0.593	0.153	8
Finland	0.377	6	0.271	0.274	4	0.456	0.205	3	0.526	0.178	2
Belgium	0.364	7	0.295	0.257	7	0.502	0.181	8	0.578	0.153	9
Germany	0.362	8	0.302	0.252	8	0.521	0.173	11	0.594	0.147	11
Ireland	0.355	9	0.293	0.251	9	0.493	0.180	9	0.563	0.155	7
France	0.348	10	0.284	0.249	10	0.488	0.178	10	0.569	0.150	10
Estonia	0.344	11	0.326	0.232	12	0.559	0.152	16	0.640	0.124	16
Austria	0.339	12	0.278	0.245	11	0.449	0.187	6	0.508	0.167	5
Latvia	0.329	13	0.341	0.217	18	0.577	0.139	20	0.660	0.112	22
Cyprus	0.325	14	0.315	0.223	14	0.541	0.149	17	0.626	0.122	17
Malta	0.318	15	0.290	0.226	13	0.490	0.162	12	0.575	0.135	14
Italy	0.317	16	0.312	0.218	16	0.519	0.152	15	0.599	0.127	15
Czech Republic	0.315	17	0.297	0.221	15	0.495	0.159	14	0.570	0.135	13
Slovakia	0.314	18	0.321	0.213	19	0.536	0.145	18	0.620	0.119	20
Spain	0.307	19	0.291	0.218	17	0.478	0.160	13	0.552	0.138	12
Lithuania	0.306	20	0.346	0.200	20	0.567	0.133	23	0.636	0.111	24
Hungary	0.284	21	0.320	0.193	22	0.520	0.136	22	0.597	0.114	21
Poland	0.280	22	0.303	0.195	21	0.493	0.142	19	0.572	0.120	18
Slovenia	0.279	23	0.324	0.188	24	0.532	0.130	25	0.623	0.105	26
Portugal	0.277	24	0.316	0.190	23	0.501	0.138	21	0.568	0.120	19
Romania	0.271	25	0.339	0.179	27	0.545	0.123	27	0.627	0.101	27
Croatia	0.268	26	0.320	0.182	26	0.523	0.128	26	0.608	0.105	25
Bulgaria	0.267	27	0.350	0.174	28	0.549	0.121	28	0.625	0.100	28
Greece	0.266	28	0.311	0.183	25	0.502	0.132	24	0.581	0.112	23

The previous results show that the best countries in active ageing are Sweden, Denmark, The Netherlands and Finland, while the worst-ranked countries are Romania, Bulgaria, Greece and Croatia. As in other areas of social progress (Stiglitz *et al.*, 2009), the Nordic countries and The Netherlands outperform other regions with regards to active ageing.[9] The countries at the bottom are also countries with lower living conditions. Romania and Bulgaria are among the worst places in terms of active ageing and were also the two poorest countries among the EU28 in 2016. The UK and Ireland, which are liberal regimes in a standard welfare-state classification (Esping-Andersen, 1990), show good performance in active

9 Indeed, Olivera (2018) shows that the social-democratic regime of a welfare state (Nordic countries), with its strong redistributive policies, is the most favourable for active ageing.

Table 4. Gini RIF regression for AAI inequality

Variable	Coeff.	SE	Coeff.	SE
Age 65–74	−0.20***	(0.05)	−0.20***	(0.05)
Age 75+	0.02	(0.04)	0.02	(0.04)
Lower secondary education	−0.06*	(0.03)	−0.07*	(0.03)
Upper secondary education	−0.10***	(0.03)	−0.12***	(0.04)
Tertiary education	−0.11***	(0.03)	−0.12***	(0.04)
Male	0.04**	(0.02)	0.04**	(0.02)
Married	−0.07**	(0.03)	−0.07**	(0.03)
Living alone	0.03	(0.03)	0.04	(0.03)
Constant	1.16***	(0.03)	1.19***	(0.03)
N	13 093		13 093	
R^2	0.07		0.07	
Country fixed effects	No		Yes	

Notes: Standard errors are robust and clustered by country. The dependent variable is the IF of each individual in the Gini of the AAI in the country (and divided by the Gini index of the corresponding country). The reference variable for the age groups is 'age 55–64', and for education, it is 'primary education or less'.
$^{***}P < 0.01$, $^{**}P < 0.05$, $^{*}P < 0.10$.

ageing. The UK and Ireland are placed 4th and 9th when there is no concern about equality, and they switch to positions 6th and 7th when the concern for equality is very high at $\rho = 10$.[10]

Although the main analysis is performed with the S-Gini indices, it is possible to test the results with other inequality measures that also consider explicit judgement values. This is the case of the Atkinson index (see Table A4 and Figure A1 in the Online Appendix). In general, the results hold. Varying the aversion to inequality (parameter e in the Atkinson index) also changes the SWF and the position of the country, while the best- and worst-placed countries are practically the same.

4.2 Predictors of active ageing inequality

Table 4 shows the results of the RIF-Gini regressions for the pooled sample of countries. The first set of estimations in the table does not include country fixed effects, while the second set includes them. Although the coefficients for both sets are similar, a focus on the results including country fixed effects is preferable because this specification controls for unobserved heterogeneity at the level of the country, which leads to less biased estimations. The coefficients are interpreted as percentage points. For example, the coefficient −0.20 for the age group 65–74 years means that an increase of 1% in the proportion of individuals of this age in the country is associated with a decrease of approximately 0.20% in the AAI Gini index. In contrast, changes in the proportion of the oldest individuals (aged 75 years and over) are not statistically related to changes in AAI inequality. The association of lower secondary, upper secondary and tertiary education with AAI inequality is negative. An increase

10 The plots of the SWFs for countries and their corresponding confidence intervals are shown in Figure A2 in the Online Appendix.

of 1% in the share of individuals with lower secondary, upper secondary or tertiary education is associated with a reduction of 0.07, 0.12 or 0.12% in AAI inequality, respectively.

There is one variable positively associated with AAI inequality: an increase of 1% in the proportion of men is associated with an increase of 0.05% in AAI inequality. Although not reported, there is a considerable gender gap in the AAI. On average, the AAI of men is 14% larger than the AAI of women. Cyprus is the country showing the largest gap (33%), and Finland is the country showing the lowest gap (–4%), with an AAI of women 4% higher than that of men. The result of a positive coefficient for the share of men in the Gini-RIF regression confirms the existence of a gender gap in active ageing in favour of men, which is conditional on the distribution of the other covariates.

Overall, the previous RIF-Gini regressions uncover the predictors for the distribution of active ageing in Europe, but they can still mask important heterogeneity among countries. In order to inspect these predictors in a cross-country comparison, the RIF-Gini regressions are run separately by country. Table 5 reports the coefficients resulting from this exercise for each country. Focussing attention on the statistically significant results, in most countries the coefficient for the share of individuals aged 65–74 years on AAI inequality is negative (in 20 countries) and is positive only in Denmark. Thus, having relatively more people who are already in retirement contributes to equalizing the distribution of active ageing. One reason behind this may be that the AAI of the 65–74 age group is more equally distributed due to the equalizing role of public pension systems in Europe on incomes during retirement (Marx *et al.*, 2015). Another reason—implied by the construction of the AAI—is that the value of the employment domain is zero for most individuals aged 65 years and over, and hence, there is much less variation in the AAI of these individuals than in the AAI of the 55–64 age group. There is no clear trend for the oldest group. In six countries, the association between the share of the oldest group and inequality is negative, while in nine countries this relationship is positive.

The association of lower secondary education with AAI inequality is negative and statistically significant in 10 countries and is positive and statistically significant only in the Czech Republic. When statistically significant, the association of upper secondary education and tertiary education with AAI inequality is always negative; that is, an increase in the share of individuals with these levels of education is associated with a more equal distribution of active ageing. The coefficients for upper secondary and tertiary education are statistically significant in 20 and 12 countries, respectively, and their sizes are particularly strong in The Netherlands, Sweden and Slovenia. For example, an increase of 1% in the share of individuals with tertiary education in these countries is associated with a reduction of 0.46, 0.39 and 0.47% in the AAI Gini, respectively. One potential channel by which an increase in education can reduce AAI inequality is via the attenuation of inequalities of other dimensions. For example, individuals with low levels of education also tend to show poorer health and lower incomes and life expectancy (Cutler *et al.*, 2006; Cutler and Lleras-Muney, 2010). An increase in education for these individuals may compensate for shortfalls in other dimensions and hence equalize the distribution of the AAI. In the context of the RIF-Gini regressions, the individuals with tertiary education, and particularly upper secondary education, are mostly located in a section of the distribution of the AAI associated with negative values in the influence function. In this way, upper secondary and tertiary education contribute negatively to AAI inequality.

Table 5. Gini RIF regressions for AAI inequality by country

Country	Age 65–74	Age 75+	Lower secondary education	Upper secondary education	Tertiary education	Male	Married	Living alone	Constant	N	R^2
Austria	−0.28***	−0.24***	0.19	−0.00	0.13	0.19***	−0.07	−0.00	1.04***	338	0.13
Belgium	−0.19***	0.07	−0.07	−0.16**	−0.14*	0.01	−0.08	−0.03	1.20***	438	0.09
Bulgaria	−0.27***	−0.07	−0.18	−0.30**	−0.18	−0.04	−0.05	0.04	1.39***	459	0.12
Cyprus	−0.11**	0.03	−0.29***	−0.29***	−0.23***	0.01	−0.32***	−0.16*	1.46***	468	0.17
Czech Republic	−0.24***	−0.15	0.34*	0.17	−0.02	0.13**	0.26***	0.43***	0.63***	411	0.14
Germany	−0.01	0.19***	0.02	−0.07	−0.08	−0.01	−0.13	−0.05	1.08***	659	0.10
Denmark	0.10**	0.40***	−0.05	−0.11	−0.16	−0.00	−0.01	0.07	0.96***	458	0.18
Estonia	0.02	0.10	−0.13	−0.36*	−0.38*	0.05	−0.14**	0.08	1.33***	441	0.18
Greece	−0.28***	−0.17**	−0.04	−0.07	0.03	0.17***	−0.23***	−0.12	1.26***	474	0.07
Spain	−0.47***	−0.12	−0.14**	0.04	0.06	0.06	−0.27***	−0.06	1.38***	382	0.23
Finland	−0.27***	−0.18***	−0.17*	−0.22***	−0.24***	0.02	−0.01	0.05	1.33***	619	0.09
France	−0.31***	−0.12	−0.18**	−0.04	−0.26***	0.07	0.03	0.12	1.19***	436	0.10
Croatia	−0.27***	−0.09	−0.28**	−0.29**	−0.22	0.17**	−0.01	0.15	1.26***	368	0.09
Hungary	−0.30***	−0.13**	−0.20**	−0.22**	−0.09	−0.06	0.02	0.10	1.29***	475	0.11
Ireland	−0.11**	0.12*	−0.08	−0.19***	−0.25***	0.00	−0.13	−0.06	1.26***	382	0.16
Italy	−0.29***	−0.06	−0.20***	−0.17***	−0.13**	0.10***	−0.10**	0.00	1.26***	820	0.12
Lithuania	−0.07	−0.02	0.02	−0.16**	−0.15*	−0.01	−0.24**	−0.06	1.30***	448	0.14
Luxembourg	−0.01	0.18***	−0.02	−0.16**	−0.02	−0.01	−0.09	0.02	1.08***	327	0.09
Latvia	−0.01	0.12**	0.09	−0.15	−0.17	0.02	−0.20***	−0.05	1.20***	425	0.17
Malta	−0.24***	0.07	−0.11	−0.10*	−0.01	0.11**	−0.02	0.13	1.06***	457	0.08
The Netherlands	−0.09*	0.22***	−0.34***	−0.50***	−0.46***	0.04	−0.04	0.01	1.38***	447	0.18
Poland	−0.28***	−0.20***	−0.05	−0.36***	−0.16	−0.01	0.05	0.15**	1.33***	428	0.11
Portugal	−0.42***	−0.18**	0.01	−0.17*	0.16	0.09*	−0.00	0.13	1.17***	485	0.16
Romania	−0.30***	−0.06	−0.08	−0.20*	−0.06	0.21**	−0.07	0.13	1.18***	434	0.14

continued

Table 5. *Continued*

Country	Age 65–74	Age 75+	Lower secondary education	Upper secondary education	Tertiary education	Male	Married	Living alone	Constant	N	R^2
Sweden	0.03	0.20***	−0.21*	−0.38***	−0.39***	0.01	0.05	0.09	1.21***	582	0.13
Slovenia	−0.33***	−0.07	−0.54***	−0.55***	−0.47***	0.00	−0.06	0.05	1.65***	445	0.14
Slovakia	−0.15***	0.19**	−0.09	−0.17*	−0.10	0.09	−0.10	0.01	1.16***	495	0.11
UK	−0.02	0.10**	−0.06	−0.17**	−0.17**	0.04	−0.10	0.06	1.13***	492	0.09

Notes: Standard errors are robust and are available on request. Each row contains the coefficients of Ordinary Least Squares (OLS) regressions by country. The dependent variable is the IF of each individual in the Gini of the AAI in the country (and divided by the Gini index of the corresponding country). The reference variable for the age groups is ‘age 55–64’, and for education, it is ‘primary education or less’.
***$P < 0.01$, **$P < 0.05$, *$P < 0.10$.

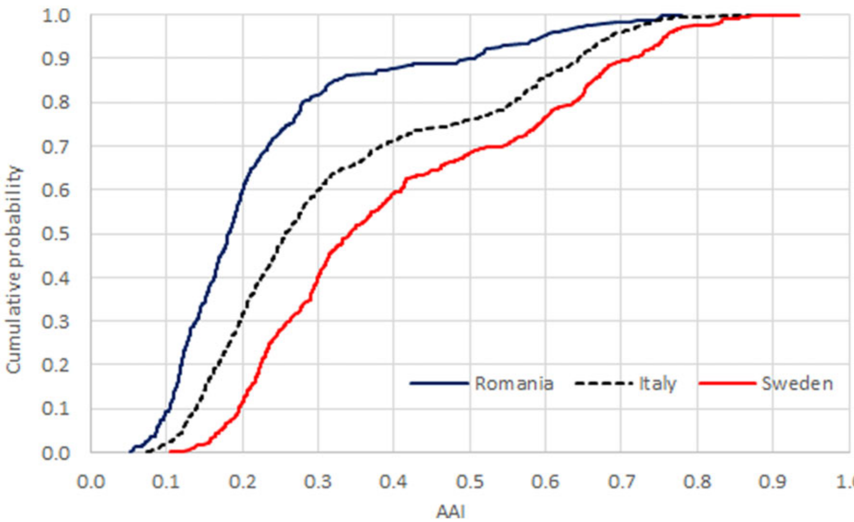

Figure 2. Cumulative distribution of AAI in three countries.

When significant, the share of men in the country is always positively associated with AAI inequality (in eight countries). Living alone is positively associated with inequality only in the Czech Republic and Poland, but it is negative in Cyprus. An increase of 1% in the share of individuals living alone is associated with an increase of 0.43% and 0.15% in the AAI Gini index in the Czech Republic and Poland, respectively.

The Gini-RIF results show that education is important for ensuring a more equitable distribution of the quality of ageing. However, a direct conclusion from the analysis in the short run is difficult to make because the analysed population made their educational decisions long ago. Yet, this analysis highlights the long-term effects of education acquisition on the quality of ageing and its distribution. In any case, a takeaway from these results is that the effects of education run beyond income potential and can affect the quality of ageing and its distribution.

4.3 Comparing distributions

Another way to compare the quality of ageing across countries and to assess the distance between countries is by looking at some sections of the distribution of active ageing. Figure 2 illustrates the cumulative distribution of AAI for three countries with remarkably different distributions: Sweden, Romania and Italy. There is a clear dominance by Sweden over Italy and Italy over Romania for all levels of AAI, and hence one can be reassured that the average and distribution of active ageing is better in Sweden than in Italy and that it is better in Italy than in Romania. This type of graph is also useful when comparing different parts of the AAI distribution. For example, take the bottom decile or quintile of the distribution of the AAI in Sweden and trace a vertical line from the corresponding value of the AAI. Strikingly, this line shows that 57% and 68% of Romanians have a quality of ageing lower than that of the bottom 10% and bottom 20% of Swedish individuals, respectively. Table 6 shows this exercise for all countries compared to Sweden.

Table 6. Percentage of population in the country with an AAI below the bottom 10% and 20% of Sweden

Country	Lower than the bottom 10% of Sweden	Lower than the bottom 20% of Sweden
Sweden	10	20
Finland	13	26
Austria	15	28
The Netherlands	15	26
Denmark	19	28
Germany	22	29
Luxembourg	23	29
UK	23	34
Belgium	24	30
France	26	36
Spain	27	37
Ireland	27	39
Italy	30	40
Malta	31	39
Estonia	33	43
Czech Republic	35	45
Cyprus	36	45
Slovakia	37	44
Poland	37	50
Latvia	39	49
Slovenia	40	51
Greece	43	54
Croatia	44	54
Portugal	45	55
Hungary	47	55
Lithuania	53	59
Bulgaria	53	61
Romania	57	68

Between 45% and 57% of the older population of Portugal, Hungary, Lithuania, Bulgaria and Romania report an AAI lower than that of the bottom 10% of the AAI distribution in Sweden. For richer countries like France, Spain, Ireland and Italy, about 26–30% of their older population is also below Sweden's bottom 10% in terms of active ageing.

5. Conclusions

This study uncovers significant heterogeneity in the quality of ageing among older adults in Europe. It is not only important to measure the average of active ageing to rank countries but also to quantify its distribution. Knowledge about the distribution means value judgements can be introduced to better assess active ageing within and between countries. Countries showing similar averages in active ageing can present a very different distribution, such that conclusions about which is a better place for ageing should be made with caution.

For example, Spain and Latvia rank 19th and 13th when there are no equality concerns, but given the more egalitarian distribution of active ageing in Spain, the ranks move to 12th and 22th, respectively, when equality is a concern.

One novelty of this study is the use of RIF-Gini regressions to find the predictors of inequality in active ageing. By this method, this study was able to compute how a small change in one covariate can change the distribution of active ageing and its inequality statistic. The study finds that a larger proportion of individuals with a higher level of education and who are married contributes to equalizing the distribution of active ageing, while a higher share of men is associated with an increase in inequality. The analysis with RIF-Gini regressions shows encouraging directions for research that incorporates insights from the income distribution literature into the analysis of active ageing, but it cannot be overemphasized that the results are exploratory by nature. With cross-sectional data and no exogenous variation in active ageing in the countries analysed, any causal interpretation is clearly hazardous.

The study finds large gaps in the quality of active ageing in Europe. For example, more than 50% of the population of Romania, Lithuania and Bulgaria show a level of active ageing lower than that of the bottom 10% of the AAI distribution in Sweden. The extreme cases of Sweden and Romania are illustrative. For older adults, 57% and 68% in Romania have a level of active ageing lower than the first and second deciles of the AAI distribution in Sweden. More research efforts will be needed to better uncover and understand these gaps, and importantly, what policies could be designed to help close them.

Some limitations of this study are worth mentioning. The EQLS data were chosen because the data cover all of the EU28 countries and almost all of the AAI indicators. However, the analysed sample is relatively small in some countries. The average sample size is 469 individuals, with Luxembourg ($n = 327$) being the smallest and Italy ($n = 820$) the largest. Some indicators were estimated as they were not included in the EQLS. However, the nature of these indicators (life expectancy and HLE) make them difficult to estimate at the individual level.

Finally, this study complements the discussion started by the OECD with its report *Preventing Ageing Unequally* (OECD, 2017) on the inequalities suffered in old age and how these are related to early life conditions. The report gives suggestive evidence of current and future increases in economic inequality in old age due to several factors such as pension and health system reforms, larger differences in unemployment periods and digitalization at work. Beyond economic inequalities, this study finds inequalities in active ageing and compares them across countries, and therefore better captures the differences in well-being that are relevant and valuable to older adults.

Supplementary material

Supplementary material is available at *SOCECO* online.

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