ALTERNATIVE METHODS FOR CONSTRUCTION OF ACTIVE AGEING COMPOSITE INDICATOR

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Abstract

The Active Ageing Index **(** *AAI* **)** is a newly designed tool to measure the performance of European countries in active ageing. The index is based on twenty-two indicators grouped in four domains that cover the employment of older people, their participation in the society, the level of independent, secure and healthy living as well as the capacity and environment for active ageing in a country. A simple aggregation of the observed values for individual indicators is used to produce sub-indices for the domains, and consequently to aggregate the sub-indices to the AAI and determine the ranking of the countries. The aim of this contribution is to present and discuss alternative approaches to the construction of a composite index based on the same indicators, but using different methods to set the weights for the aggregation. We show that data envelopment analysis applied to calculate the composite index is capable to provide policy makers with additional valuable information on untapped potential of individual countries in active ageing.

Key words: active ageing, composite indicator, benefit of doubt weights, data envelopment analysis

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Introduction

One of the most typical demographic processes in developed countries all over the world is population ageing. Demographic ageing trends are the result of the combination of declining fertility and falling death rates, which, together with decreases in disease and disability, leads to increased longevity. Indeed, many European states have the lowest fertility rates and highest life expectancy rates in the world. Accompanying this trend, the share of the population aged 65 years and over rises from 17 per cent in 2010 to 30 per cent in 2060, with those aged 80 and over being the fastest growing age group, increasing from 5 to 12 per cent over the same period (Walker, Maltby, 2012).

Older people do not want only to live longer, but also to achieve healthy and active ageing including doing regular physical activity, actively participate socially and engage with others, have access to healthcare, security and lifelong learning.

Active ageing is defined as "the process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age" (WHO, 2002, p. 12). "Active ageing applies to both individuals and population groups. It allows people to realize their potential for physical, social, and mental well-being throughout the life course and to participate in society according to their needs, desires and capacities, while providing them with adequate protection, security and care when they require assistance" (WHO, 2002, p. 12). For measuring the level of older people´s participation in the labor market and in the social and family activities in European countries was constructed the Active Ageing Index (Zaidi, 2017).

1 Research methodology

The Active Ageing Index (AAI) is a tool to monitor active ageing outcomes at the country level and to describe the untapped potential of older people to participate actively in economic and social life, with the objective of promoting an active role for older people.

Measures in the area of employment aim at creating better opportunities and employability for older workers; measures in the area of participation are to be focused on combating the social exclusion of older people by fostering their active participation in the society (by encouraging voluntary activities and support for informal cares); measures in the area of independent living should encourage healthy ageing and independent self-reliant living by emphasizing a preventive approach in health and social care, making transport more accessible, and making the environment more age friendly (Sidorenko, Zaidi, 2012).

1.1 Construction of AAI using UNECE methodology

The AAI is a composite measure, obtained by aggregating scores from four domains. For each European country the same indicators in the employment domain (E), participation in society domain (P), independent and secure living domain (L), and capacity and enabling environment for active ageing domain (C) are selected (see Table 1). For construction of individual indicators are used data mainly from major European household surveys. They are: EU Labour Force Survey, EU Survey on Income and Living Conditions. European Quality of Life Survey, European Social Survey. Indicators for life expectancy and healthy life expectancy are provided

by EU project European health and Life Expectancy Information system. Data for indicator "Use of ICT" was collected by Eurostat´s ICT Survey.

Tab. 1: Indicators considered in the domains of the active ageing performance

Domain	Indicator	Definition
E	E1 - Employment rate 55-59	• is the percentage of employed persons of the age 55-59 in relation to the total population aged 55-59
	E2 - Employment rate 60-64	• is the percentage of employed persons of the age 60-64 in relation to the total population aged 60-64
	E3 - Employment rate 65-69	• is the percentage of employed persons of the age 65-69 in relation to the total population aged 65-69
	E4 - Employment rate 70-74	• is the percentage of employed persons of the age 70-74 in relation to the total population aged 70-74
P	P1 - Voluntary activities	• Percentage of older population (aged 55+) providing unpaid voluntary work through the organizations (at least once a week)
	P2 - Care to children, grandchildren	• Percentage of older population (aged 55+) who provide care to their children and grandchildren (at least once a week)
	P3 - Care to older adults	• Percentage of older population (aged 55+) providing personal care to elderly or disabled relatives (at least once a week)
	P4 - Political participation	• Percentage of older population (aged 55+) taking part in the activities or meetings of a trade union, political party or political action group, or signing petitions, including email and online ones
L	L1 - Physical exercise	• Percentage of people aged 55 years and older undertaking physical exercise or sport almost every day
	L2 - No unmet needs of health and dental care	• Percentage of people aged 55 years and older who report no unmet need for medical and dental examination or treatment during the last 12 months preceding the survey
	L3 - Independent living arrangements	• Percentage of people aged 75 years and older who live in a single household alone or in a couple household
	L4 - Relative median income	• Ratio of the median equivalised disposable income of people aged 65 and above to the median equivalised disposable income of those aged below 65
	L5 - No poverty risk	• 100 – Percentage of people aged 65 years and older who are at risk of poverty (using the 50 per cent of median income threshold)
	L6 - No material deprivation	• 100 – Percentage of people aged 65 years and older who are severely materially deprived (having an enforced inability to afford at least 4 out of the 9 selected items)
	L7 - Physical safety	• Percentage of people aged 55 years and older who are feeling very safe or safe to walk after dark in their local area
	L8 - Lifelong learning	• Percentage of people aged 55 to 74 who stated that they received education or training in the four weeks preceding the survey
C	C1 - RLE achievement of 50 years at age 55	• Remaining life expectancy at age 55 as a proportion of 50 years goalpost (RLE at 55 divided by 50 to calculate the proportion of life expectancy achievement in the target of 105 years of life expectancy)
	C2 - Share of healthy life years in the RLE at age 55	• Share of healthy life years in the remaining life expectancy at age 55
	C3 - Mental well-being	• An index that measures self-reported feelings of positive happy moods and spirits
	C4 - Use of ICT	• Share of people aged 55 to 74 using the Internet at least once a week
	C5 - Social connectedness	• Share of people aged 55 or more that meet socially with friends, relatives or colleagues at least once a week
	C6 - Educational attainment	• Percentage of older persons aged 55 to 74 with upper secondary or tertiary educational attainment

Source: AAI in brief, 2012.

The data for the construction of indicators and for the construction of the *AAI* was collected in line with Concept, methodology and final results of the project Active Ageing Index, UNECE grant No: ECE/GC/2012/003.

All indicators are expressed with a positive normative judgement, meaning that the higher the value, the better the active ageing outcome. Indicators are at first aggregated within each domain. The overall value of the *AAI* results from a weighted aggregation of the domain specific indices (Zaidi, et al., 2012) while it was decided to use weights recommended by the Expert Group (Tab. 2).

Tab. 2: Weights assigned to individual indicators and domain sub-indices by Expert group for weighting (UNECE methodology)

domain	E				P				L								C					
domain weights	0,35				0,35				0,1								0,2					
indicator	E1	E2	E3	E4	P1	P2	P3	P4	L1	L2	L3	L4	L5	L6	L7	L8	C1	C2	C3	C4	C5	C6
indicator weights	0,25	0,25	0,25	0,25	0,25	0,25	0,3	0,2	0,1	0,2	0,2	0,1	0,1	0,1	0,1	0,1	0,33	0,23	0,17	0,07	0,13	0,07

Source: the authors based on AAI in brief, 2012.

1.2 Measuring of Active Ageing Performance Using Benefit of Doubt Weighting

We apply an alternative approach to aggregate sub-indices for the domains into the composite indicator of active ageing performance, based on the method called benefit of the doubt. This synthetic macroeconomic performance measure was introduced by Melyn and Moesen (1991). The technique was inspired by the data envelopment analysis CCR model, first introduced by Charnes, Cooper and Rhodes (1978).

The CCR model was originally designed for the assessment of efficiency of decision-making units in their transformation of inputs into outputs. In order to apply benefit of doubt technique, we consider a unit input for all countries while the four sub-indices reflecting the national performance in the specified domains are outputs. We use the output-oriented CCR-O data envelopment analysis model for the calculation of efficiency score for each country as a composite active ageing performance measure alternative to AAI.

The efficiency score S_n for a country n is calculated using the following linear program:

$$\max S_n = w_1.E_n + w_2.P_n + w_3.L_n + w_4.C_n \qquad (1)$$

subject to

$$w_1.E_i + w_2.P_i + w_3.L_i + w_4.C_i \leq 1, \quad \textit{for any country } i \qquad (2)$$

$$w_1, w_2, w_3, w_4 \geq 0 \qquad (3)$$

The objective function (1) is maximized with respect to the weights of domains w_1, w_2, w_3, w_4. Since the values of domain sub-indices E_i (employment), P_i (participation in society), L_i (independent and secure living), and C_i (capacity and enabling environment for active ageing) are non-negative for each country i, the constraints (2) and (3) imply that the efficiency score S_n for the country n is non-negative and less than or equal to 1. If there exists a non-zero set of weights w_1, w_2, w_3, w_4 such that the optimum value $S_n^* = 1$, the country n is identified (technically) efficient by the model, otherwise it is called inefficient.

The linear program needs to be solved for each country to produce a country-specific set of weights that depend on the reached values of domain sub-indices used for the construction of the objective function. Hence, the methodology allows us to set unequal weights of the four sub-indices for each country in contrast with the fixed expert weights for the domains used in the construction of AAI by UNECE. Indeed, these domain weights are not predefined. Instead, they are calculated during the process of composite index construction as the optimum values for each country in the sense that they maximize the value of composite ageing performance indicator for the country. Thus, each country benefits from the doubts about setting the right weights.

However, even applying the best weights for a given country does not assure that the calculated efficiency score will reach the maximum possible value since there may exist other country whose performance calculated with the same weights is higher. If it really happens, the country in consideration is clearly inefficient in the active ageing performance and the country (or countries) with better performance under the same weights are considered as reference peer(s) that form the efficiency frontier for given country.

The distance of an inefficient country from the efficiency frontier determines the range of inefficiency which is expressed by efficiency score lower than one. Note that the efficiency scores resulting from the CCR-O model do not include a complete information on the inefficiency range since they only capture the possibility of proportional improvements of all sub-indices. The possible non-proportional improvements of sub-indices are expressed by slacks that may be rather different for individual domains in each country. However, both proportional and non-proportional improvements are reflected by the projection of the observed performance to the efficiency frontier that results from CCR-O model as well. Therefore, the projection can be viewed as an ideal performance recommended for the country (of course, the projection for an efficient country coincides with its observed performance).

2 Results

The main results of the analysis are presented in Tab. 3. The EU 28 countries are sorted by their ranking in UNECE AAI index. For each country, the efficiency score and the rank resulting from CCR-O model are given. Moreover, the data of four domain sub-indices calculated by UNECE methodology, their recommended projections, and differences between these two values expressed in percentage are provided. The results reveal the weak points of individual countries on the level of the four active ageing performance domains.

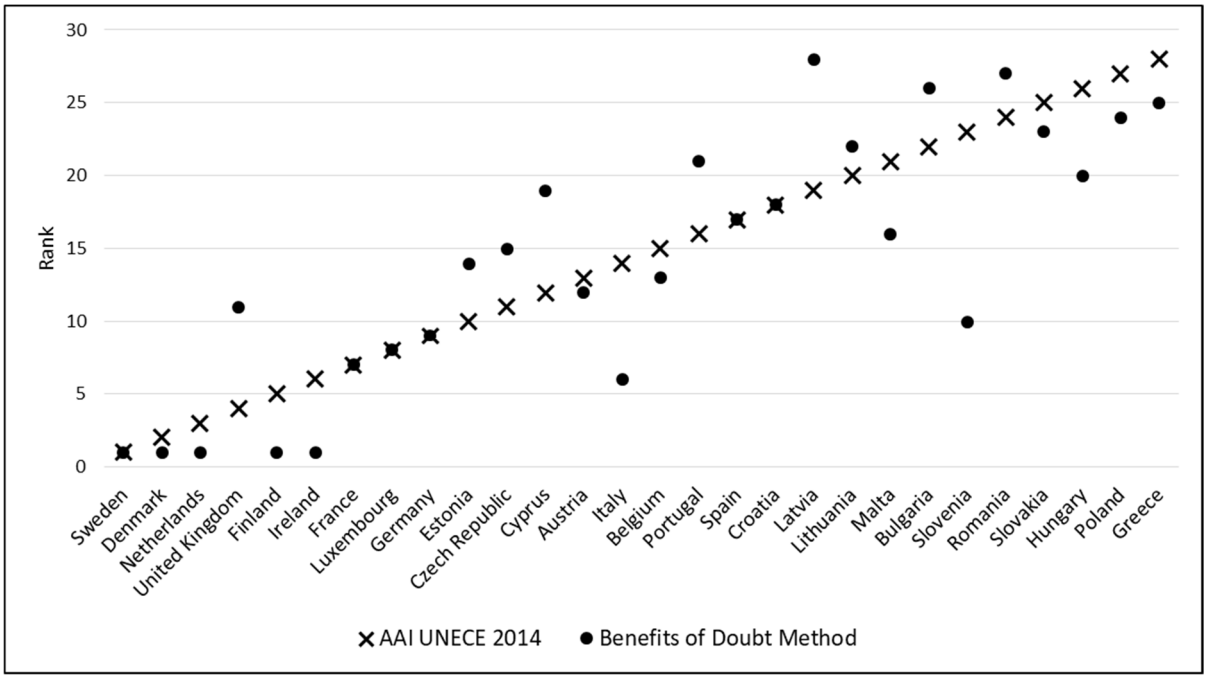
Tab. 3: Results of the benefit of doubt methodology

				Employment			Participation			Independent living			Capacity		
No.	Country	Score	Rank	Data	Projection	Diff.(%)	Data	Projection	Diff.(%)	Data	Projection	Diff.(%)	Data	Projection	Diff.(%)
1	Sweden	1	1	43.4	43.4	0.0	22.9	22.9	0.0	78.6	78.6	0.0	69.7	69.7	0.0
2	Denmark	1	1	35.8	35.8	0.0	19.6	19.6	0.0	79.0	79.0	0.0	65.0	65.0	0.0
3	Netherlands	1	1	33.9	33.8	0.0	22.4	22.4	0.0	78.9	78.9	0.0	63.0	63.0	0.0
4	United Kingdom	0.9391	11	35.8	42.9	19.9	21.6	23.0	6.5	73.7	78.5	6.5	62.2	69.3	11.3
5	Finland	1	1	33.7	35.2	4.4	20.5	20.5	0.0	79.0	79.0	0.0	59.1	64.4	8.9
6	Ireland	1	1	30.6	30.6	0.0	24.1	24.1	0.0	74.9	74.9	0.0	60.2	60.2	0.0
7	France	0.9789	7	24.1	39.8	64.9	22.8	23.3	2.2	75.9	77.6	2.2	58.2	67.0	15.1
8	Luxembourg	0.9655	8	21.9	42.6	94.9	22.2	23.0	3.6	75.7	78.4	3.6	65.4	69.1	5.6
9	Germany	0.9425	9	34.4	36.5	6.1	13.6	19.9	46.1	74.4	79.0	6.1	56.2	65.4	16.4
10	Estonia	0.9148	14	39.7	43.4	9.3	12.8	22.9	79.0	67.3	78.6	16.8	43.8	69.7	59.1
11	Czech Republic	0.9022	15	28.0	35.0	24.8	18.8	20.8	10.8	71.2	78.9	10.8	53.4	64.2	20.1
12	Cyprus	0.8613	19	31.4	36.5	16.1	18.1	21.0	16.1	68.0	78.9	16.1	53.6	65.2	21.8
13	Austria	0.9343	12	24.7	35.8	44.8	18.2	19.6	7.4	73.8	79.0	7.0	59.2	65.0	9.8
14	Italy	0.9983	6	23.0	30.6	32.8	24.1	24.1	0.2	69.0	74.9	8.5	54.8	60.2	9.8
15	Belgium	0.9197	13	21.0	36.2	72.6	20.2	21.9	8.7	72.5	78.8	8.7	59.6	64.8	8.7
16	Portugal	0.8529	21	32.6	38.3	17.2	14.1	20.7	46.8	67.3	78.9	17.2	53.7	66.5	23.8
17	Spain	0.8837	17	23.3	35.4	52.0	17.8	20.1	13.2	69.8	79.0	13.2	57.0	64.7	13.3
18	Croatia	0.8801	18	21.7	34.7	60.1	18.7	21.3	13.6	69.5	78.9	13.6	54.1	63.9	18.1
19	Latvia	0.7465	28	32.0	42.8	34.0	13.8	22.7	63.9	58.7	78.7	34.0	47.6	69.3	45.5
20	Lithuania	0.8379	22	30.5	36.4	19.3	14.7	19.9	35.1	66.2	79.0	19.3	43.9	65.4	48.9
21	Malta	0.8875	16	20.1	35.8	78.6	17.3	19.6	13.5	70.1	79.0	12.7	57.5	65.0	13.0
22	Bulgaria	0.7947	26	25.1	37.5	49.2	12.5	20.3	63.2	62.7	78.9	25.8	52.5	66.0	25.8
23	Slovenia	0.9397	10	19.1	35.8	87.4	16.3	19.6	20.5	74.2	79.0	6.4	49.9	65.0	30.4
24	Romania	0.7827	27	31.0	39.6	27.8	12.7	21.3	67.6	61.7	78.8	27.8	42.5	67.3	58.4
25	Slovakia	0.8331	23	21.9	35.8	63.5	13.7	19.6	43.2	65.8	79.0	20.0	47.8	65.0	35.9
26	Hungary	0.8608	20	19.3	35.8	85.7	15.4	19.6	27.6	68.0	79.0	16.2	47.7	65.0	36.2
27	Poland	0.8220	24	22.4	35.8	60.2	12.1	19.6	61.4	64.9	79.0	21.7	46.8	65.0	38.8
28	Greece	0.8207	25	20.4	35.8	75.3	13.7	19.6	43.2	64.8	79.0	21.8	47.4	65.0	37.2
	Average			27.9		39.3	17.7		24.8	70.6		12.0	54.7		21.8

Source: the authors.

We see that only five countries (Sweden, Denmark, the Netherlands, Finland, and Ireland) are considered efficient by the applied CCR model. The countries of Eastern Europe, with the exception of Slovenia, Estonia and the Czech Republic, are identified significantly worse in their active ageing performance compared to the countries of Western and Northern Europe.

Fig. 1: Ranking of countries by the values of composite active ageing performance indicators calculated by UNECE and by benefit of doubt methodology



Source: the authors.

The rankings of EU countries resulting from both approaches are compared in Fig. 1. We can see relatively big differences in the positions of several countries. The application of the benefit of doubt methodology significantly improves the rank of Slovenia (which reaches relatively good sub-index in the independent living domain) and the rank of Italy (which dominates in the participation domain). On the other hand, lower positions of the United Kingdom, Cyprus, and Latvia are due to the fact these countries have no strong points compared to other countries with comparable active ageing performance.

3 Active ageing in Slovakia

The population in EU is ageing rapidly due to increasing longevity and low birth rates. With the demographic trends as they are, the age cohorts that are growing the fastest both in Europe and in Slovakia are those aged 50+. This is the result of lower fertility rate (1.58 in Europe (EU 28) in 2015, 1.48 in Slovakia in 2016) and a rising life expectancy (77.9 for men, 83.3 for women in Europe in 2015 and 73.7 years for men, 80.4 for women in Slovakia, in 2016). In addition, post war baby boom resulted in a high increase of the population that is now reaching retiring age. In spite of growing, the old-age dependency ratio in Slovakia is still considerably

lower than in some other EU countries and the EU average. All these changes are inevitably reflected also in the change in pension systems (Špirková, Spišiaková, 2014, 2016).

For active ageing situation in Slovakia are typical low employment rates in oldest age categories, their low participation in voluntary activities, lifelong learning, the political participation, use of ICT and mental well-being but high proportion of unpaid work in the area of childcare or adult care (see also Kaščáková, Kubišová, Nedelová, 2015). The lower active ageing outcomes of Slovakia as in many of the Central and Eastern European countries are partly due to their lower scores in the domain of "capacity and enabling environment for active ageing" (Zaidi, 2012).

Conclusion

The solution to the challenges arising from a rapidly rising share of older people lies largely in promoting active ageing. The goal is to create more opportunities for older people to stay longer in work, to contribute to society as volunteers and carers and to remain independent for as long as possible. This requires policy makers and stakeholders to work together to improve conditions in areas as diverse as employment, health care, social services, adult learning, volunteering, housing, IT services and transport.

The complexity of the problem makes a challenge for finding appropriate measures of active ageing performance of individual countries and their mutual comparison. In order to attract the attention of decision-makers and the public, official measures like AAI need to be simple enough for the calculation and interpretation of the results. However, both the methodology and the datasets provide a unique opportunity for further study and a deeper insight to the situation from different perspectives.

Using fixed expert weights for the aggregation of the values of partial indicators into domain sub-indices as well as for the consecutive aggregation of domain sub-indices into AAI may be considered as discriminating for some countries. Our approach follows the assumption that all identified domains are significant for determining the current active ageing performance, but the level of their development and importance may be different in various countries, due to many historical, demographic, and social factors. That is why we applied the benefit of doubt method to assign individual weights for sub-indices to European countries so that the value of composite active ageing performance indicator was optimized for each country. Further development and adjustment of this alternative approach may bring more detailed and useful information for policy makers acting in the area.

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