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WORKING PAPER

Demographic ageing:
the rigidity of conventional metrics and the need for their revision

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1. Introduction

Demographic ageing is an unavoidable topic in today's societies. There are countless scientific works, journalistic articles or reports on the subject.

References to demographic ageing are based on the analysis of statistical data grouped into large age groups, usually close to the stages of the economic life cycle: youth, the education phase, up to 15/20 years of age; active age, participation in the labour market, from 15/20 years of age to 65 years of age; elderly, the retirement phase, from 65 years of age and over.

Our age composition as a population is changing due to low fertility levels and, above all, low mortality levels. The sheer numbers of people living to old and very old age are increasing, leading to a "rectangularisation" of survival curves (Briggs 1998). And, with declining and low fertility levels, the proportion of people in older age groups grows even further. So, the high life expectancy observed in developed countries considered the most aged of the world, such as Europe, is a key factor of population ageing and is now its main driver (Bonnet et al. 2021: 217).

The relationship between this age composition changes and the development of societies seems evident, with the more developed regions having a higher concentration of people in older age groups.

ABSTRACT

This article aims to discuss the scope and value of the conventional metrics used to assess and compare levels of ageing between different populations. The age brackets for classifying if the population is ageing or aged are typically based on chronological age and are very close to the stages of the economic tripartite life cycle: the school/education phase; the labour market participation phase; the retirement phase.

Those conventional metrics produce distortions in capturing the levels of demographic ageing. If the change in the age structure is rooted in social development, not in a social crisis, having more people in older ages should be related to that. Living longer, on average, does not only mean living more years but also a change in people's social profile, which the usual metrics for measuring ageing do not capture.

Because of the central place that demographic ageing occupies in the framework of social, political and scientific reflection on the present and future of societies, Demographic Science should contribute with new metrics reflecting the real social improvements in populations age structures.

This reflection supports the need to undertake a critical analysis of the way demographic ageing has usually been presented; stresses the need to advance ageing metrics that match societies' development by considering the life expectancy; and presents a new indicator for measurement demographic ageing that compares what we observe with what we can expect from the age structure at any given mortality level.

Keywords: population ageing; demographic ageing metrics; chronological and prospective age; life expectancy; economic life cycle

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But if it is widely recognised 'ageing as a triumph of development' (United Nations Population Fund & HelpAge International 2012: 12), the anxiety and the 'negative' perception about what is happening, particularly in the more developed regions that show higher proportions of older people, is increasing essentially since the 1990s (Mullan 2002: 215). The substantial impacts of the evolution of the age composition on economic and social protection are obvious. But the problem is the ageing population (i.e. more people of advanced ages) or having more people in retirement ages and fewer people in the working ages, according to the dominant economic life cycle? We will try to answer this question through a critical evaluation of the indicators commonly used to measure population ageing.

2. Conventional metrics for demographic ageing assessment

In demographic terms, we tend to say that a population is aged if it shows a lower proportion of young people (bottom aged) and/or a higher proportion of people at older ages (top aged) than another population. The concept is relative since it is only applicable in reference to some other population. For example, if a population 'A' has a proportion of people at the upper ages of 0.3, this does not mean that it is *per se* top aged. It may be less aged at the 'top' than population 'B' if the latter has a higher proportion of older people; it will be more aged at the 'top' than population 'C' if the latter has a lower proportion of older people. Thus, a population may be more or less aged than another depending on the benchmark used.

The second aspect, which further reinforces the relativeness of the concept, has to do with how it is usually measured. Various statistical metrics exist to measure population ageing, such as percentages of older people, number of older people per 100 young people, number of working-age people per older person, number of old-age per 100 persons of working age, etc.. All these indicators have something in common: they categorise the population into major age groups (e.g., young people, working-age, elderly) based on the year of birth (i.e. chronological age). Such categorisations often assume close proximity between each age group and different life phases – education/work/retirement. It is customary to classify young people as those below 15 or 20 years old and the elderly as people aged 65 or over.

The fact that this concept is associated with a rigid classification over time – the United Nations already suggested this age-group categorisation in the chapter of the Demographic Yearbook in 1948 – seems to give it a greater degree of accuracy. But this is not true. Indicators are used to capture realities, and these are not independent from the contexts that give them meaning. What, for example, do people aged 65 living in a developed region in the 21st century have to do with people of the same age living at the beginning of the 20th century or in a developing region, namely in terms of skills, health status, lifestyles, life expectancy, etc.? Very little, to be sure. Yet, statistics consider these two populations comparable.

Paraphrasing Ponthière (2017, our translation) "Although the age of 65 is often used as a dividing line between the elderly and the rest of us, there is no natural or universal dividing line between a «young» and an «old» person, and the way in which ageing is defined and measured is not neutral neither for the representation of current demographic trends nor for the study of the consequences of ageing".

3. From Chronological age to Prospective age

The chronological age is not necessarily an independent indicator to measure levels of ageing between populations.

The traditional lenses that we use to measure demographic ageing, based on the year of birth and using fixed criteria such as age 65, do not allow us to have a correct enough reading of reality. Chronological age is insensitive to social changes and progress and does not consider the different stages of life expectancy in which populations find themselves.

We know that the evolution of life expectancy represents much more than the greater or lesser capacity to control specific diseases. Above all, it reflects better levels of physical, mental and social well-being (World Health Organization), so when we talk about progress in life expectancy, we are considering myriad causal factors at work behind this increase, namely: better health, better nutrition, better medical care, better education, better technology, better sanitation and better income (L. Gratton & A. Scott, 2017: 29). Thus, considering population groups from different times or territories as comparable based on the same chronological age may generate distorted analyses of reality.

In this regard, recently, the United Nations report (2019) presents the results of an exercise developed by Sanderson & Scherbov (2005 and 2007). The ageing level of the world and its regions would decrease significantly, and population ageing would not be exponential if, instead of using the conventional measurement based on the proportion of people aged 65 and above, we considered the proportion of people in the population with 15 years of life remaining (according to life expectancy). Also, taking remaining age as a criterion blurs the difference between ageing levels at the 'top' in Africa (the least aged world region) and Europe (the oldest world region) (Figure 1).

In sum, based on the remaining life expectancy, the ageing panorama would be less intense than, or contrary to, what is usually presented. For instance, when considering prospective age, the ageing of the population of Portugal (country regarded as one of the most aged in the world, by using conventional metrics based on chronological age) would be below that of Bulgaria, contrary to what the conventional metric would suggest (Figure 2).

Figure 1: Percentages of the population 65 + and with remaining life expectancy 15 years or less – World and Regions
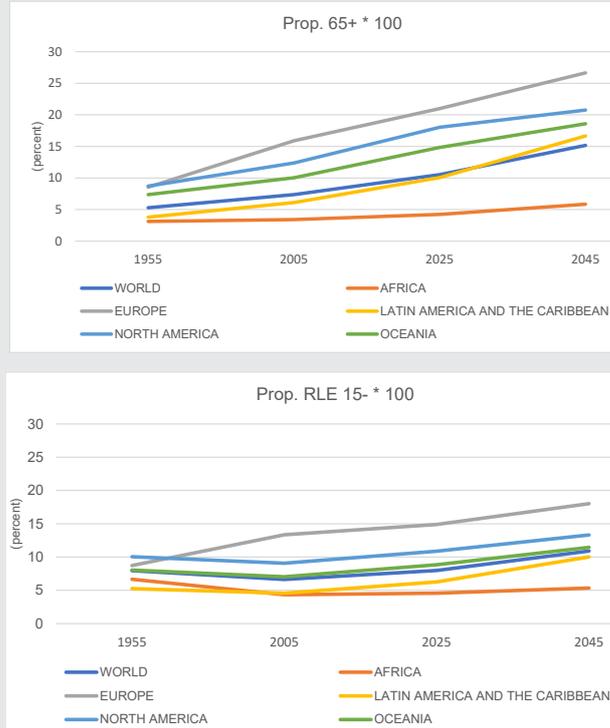
Data Source: © 2008 Population Reference Bureau. [companion to Warren Sanderson and Sergei Scherbov, "Rethinking Age and Aging," Population Bulletin 63, no.4 (2008)].

Figure 2: Percentages of the population 65 + and with remaining life expectancy 15 years or less – Portugal and Bulgaria
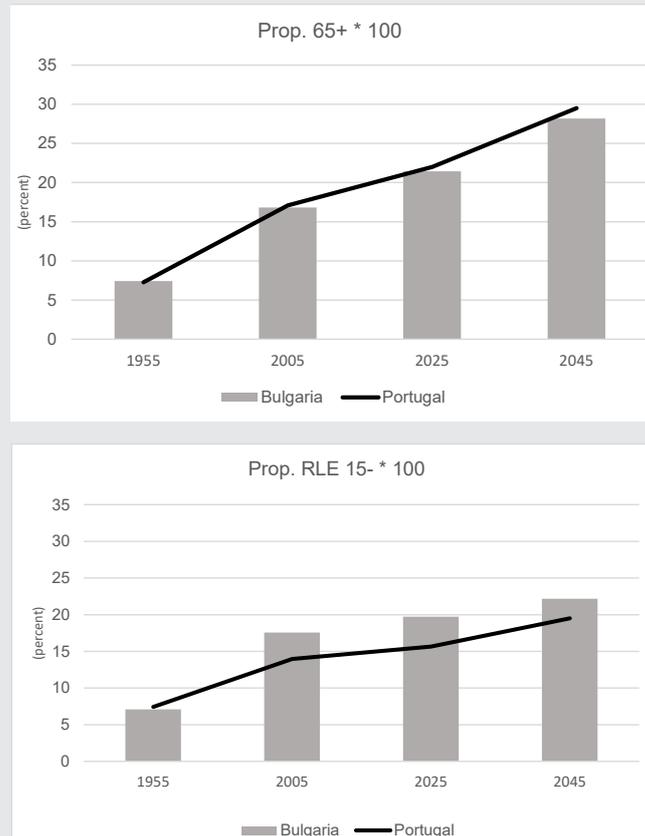
Data Source: © 2008 Population Reference Bureau. [companion to Warren Sanderson and Sergei Scherbov, "Rethinking Age and Aging," Population Bulletin 63, no.4 (2008)].

4. MEDE: Demographic Ageing Measurer

There is no 'absolute' measure to conclude whether a population is aged. The comparative terms, 'more than' or 'less than', are often used to assess how aged a given population is. The same goes for other usual indicators to determine if a population is really aged (independent of the comparison with other), like percentages of young people lower than older people.

Due to the importance that the issue of demographic ageing deserves, it makes perfect sense to improve the indicators for its measurement. In a recent publication (Rosa 2020:124-125), the Demographic Ageing Measurer (MEDE) was presented as a proposal to measure the degree of population ageing, regardless of their status in relation to another population observed in another territory or time moment.

In this reasoning, a population is aged if the proportion of young people is lower than theoretically expected or if the proportion of older people is higher than theoretically expected, according to the life expectancy values observed.

The notion of expectable is associated with later stages of the health and mortality transition, where mortality levels are low and most deaths occur at older ages (Weeks 2002), a feature that, despite differences between regions, characterises today's world. The concept proposed is close to the stationary population (Rowland 2003: 300-343): migration is excluded, the number of births compensates for the number of deaths and the natural growth of the population equals zero.

It is assumed that all ages would have approximately the same importance, depending on the population's expected number of life years. As such, the age pyramid associated with that theoretical/expectable population would be rectangular, representing the age structures of developed countries converge.

The variation scale of MEDE results ranges from zero – maximum young people, everyone would be young – to 100 – maximum ageing, everyone would be elderly.

Consider the following example of the application of this reasoning. A life expectancy at 65 of 15.2 years would mean that the life expectancy of this population would be around 80.2 years (15.2 + 65 years). Therefore, if the population were equally divided between the various ages, each age should equal 1.25% of the total ([1/80.2]*100). Thus, at a life expectancy at age 65 of 15.2 years, the age group up to 20 years should represent, in theoretical terms, 25.0% of the population (20 years x 1.25) and the age group 65 and over should represent 19.0% of the population (15.2 years x 1.25). The difference between this theoretical value and the observed one indicates the overall ageing level of a population.

Let us then apply this gauge to the population of Portugal, which observes in 2020 (Eurostat) 18.9% of people up to 20 years of age and 22.1% of people aged 65 and over. (Table 1). In the case of the younger population, the observed value is lower than the theoretical value, which means that the population of Portugal is older at the 'bottom' than expected, the deviation being 4.7 p.p.. As for the 'top', the population is less aged than the theoretical: the deviation is 1.4 p.p.. So, the population of Portugal is, according to average life expectancy expectations, only aged at the 'bottom'. Thus, if a population is considered old because it has an excessive number of older people, Portugal is not an aged country.

Returning to the comparison with Bulgaria, according to conventional metrics, Portugal is as aged at the 'bottom' as Bulgaria, but more aged at the 'top' (Table 1). However, considering life expectancy at 65 in Portugal at 19.9 years and Bulgaria at 15.2 years, we conclude that the previous inferences are not confirmed based on conventional metrics. According to MEDE, Portugal is globally less aged than Bulgaria.

Applying the reasoning to the world and its different regions suggests that, although all populations are ageing, they cannot be considered aged (except Europe in 2045), because the MEDE values are below the equilibrium level, which corresponds to the value 50. (Figure 3)

Formulae:

$$100+\{-50+[-(B4-100*B2/(65+B1))+(B5-100*(65+B1-B3)/(65+B1))]/2\}$$

Where:

$B1$: life expectancy at the age of 65 years old;

$B2$: upper age threshold of the young people group;

$B3$: lower age threshold of the elderly group;

$B4$: percentage of young people;

$B5$: percentage of elderly people.

**Table 1: Ageing population levels observed and expected, 2020 (Both sexes)
– Portugal and Bulgaria**

Age group	Portugal (e65= 19.9)			Bulgaria (e65= 15.2)		
	Observed	Theoretically expected	difference	Observed	Theoretically expected	difference
0-19	18.9%	23.6%	+ 4.7 p.p. aged at the 'bottom'	18.9%	25.0%	+ 6.1 p.p. aged at the 'bottom'
65+	22.1%	23.5%	-1.4 p.p. aged at the 'top'	21.6%	19.0%	+2.6 p.p. aged at the 'top'
∑ diferences			+3.3 p.p.			+8.7 p.p.
Mean difference (∑ dif./2)			+1.65			+4.35
MEDE			51.65			54.35

Data Source: Eurostat, https://ec.europa.eu/eurostat/web/main/data/database (accessed 17 November 2021).
Author's calculations.

Figure 3: Demographic Ageing Measurer (MEDE) 1955, 2020 and 2050 – World and Regions
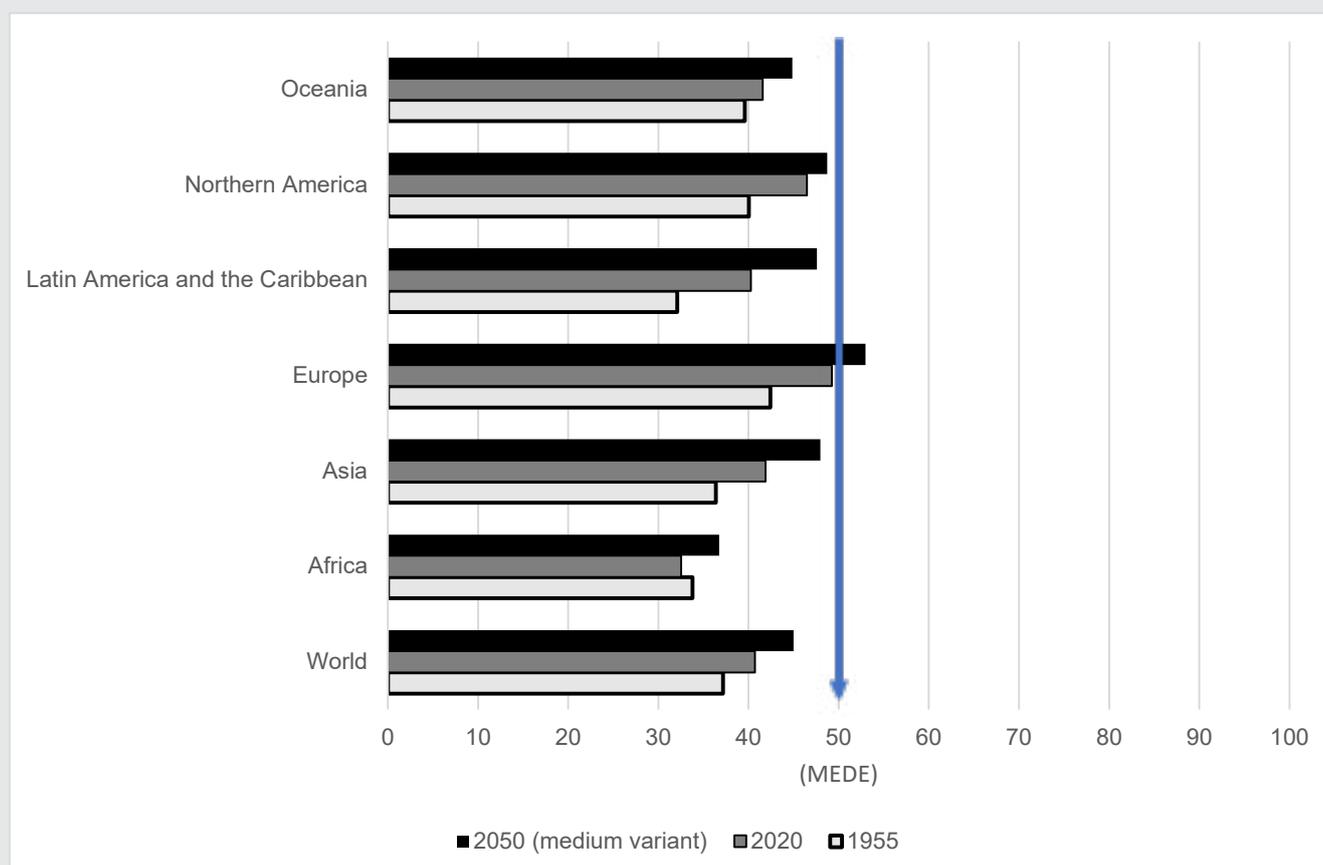
Data Source: United Nations, World Population Prospects 2019. https://population.un.org/wpp/Download/Standard/Mortality/ (accessed 17 November 2021). Author's calculations.

5.Final Remarks

Demographic ageing occupies a central place in the framework of social, political and scientific reflection on the present and future of societies.

Conventional metrics produce distortions in capturing the levels of demographic ageing. Metrics based on rigid chronological criteria are used, mainly because they are considered 'proxies' of the economic model of the tripartite life cycle – the school/education phase; the labour market participation phase; the retirement phase – based on defined age marks. We do not question the interest of using indicators based on chronological 'proxies' of the economic cycle to gauge the impact of specific age structure changes on economic balances or social protection.

Instead, we question the conclusions on demographic ageing drawn only from these changes in age composition. Conventional metrics are not good enough to measure levels of ageing between populations with diverse mortality levels, as they do not compare real differences between populations profiles. Only evaluates people belonging to each chronological age category as a good "proxy" for understanding the economic implications of population ageing. But, if the change in the age structure is rooted in social development, not in a social crisis, having more people in older ages should be related to that. The design of public policies in response to the changes in the age structure is likely to be ineffective if it relies on an inflexible and decontextualised evaluation of the reality.

The social progress over time in the world, expressed by increased life expectancy, is real, despite differences between countries. We also know that living longer, on average, does not only mean living more years but also a change in people's social profile. So, for measuring ageing the only way to compare populations in distinct stage of mortality levels is to use new population composition metrics, freeing from rigid indicators exclusively based on chronological criteria.

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