Can we speak about a new demographic dividend?
A coherent perspective from aging populations.

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Abstract

Contemporaneous populations in developed countries present lower size cohorts than ever, but new opportunities to study and evaluate population aging impacts are emerging. Despite the declining number in absolute births, increasing lifespans can create opportunities for a new demographic dividend on the top of the population pyramid by taking advantage of Oeppen's CoDa mortality forecasting approach to forecast fertility and elaborate medium-term population projections with a coherent probabilistic perspective, and Sanderson and Scherbov's 'prospective age' to measure contemporaneous population aging. With a coherent approach, we contribute with methodological advances, produce population projections, and evaluate the possible impact of COVID19 toll in future mortality and fertility.

This study main objective is to evaluate the development of the Portuguese population structure over time and develop coherent population projections to 1) evaluate the real necessity of attaining the 2.1 TFR replacement level; 2) evaluate aging as a new demographic dividend for developed countries; 3) combine the cohort-component population projections method with a CoDa improvement; 4) re-evaluate population pyramid double-aging from an original perspective; and 5) to measure the COVID19 pandemic possible impact on future fertility and mortality trends.

Preliminary results reveal that that current mortality and fertility trends are expected to not change dramatically to impact positively population structures. While mortality tends to overcome the impact of a recent pandemic at a slow pace, fertility presents low recovering. Old-age RLE is increasing, creating new opportunities for societies to understand the changing meaning of aging and to benefit with it.

1. Background and aim of the study

Survivorship is generally increasing (specially at older ages), resulting in a constant growth of the oldest-old population segment group (85+) supported by a record life expectancy that is increasing on average by 3 months per year for the last 160+ years Oeppen and Vaupel 2019, breaking old theorized biological limits to lifespan (Oeppen and Vaupel 2002) and population aged 80+ are projected to increase more than seven-fold by 2100 (United Nations 2015). Research suggests that, overall, individuals are not stretching their senescence, but rather shifting it to older ages, reaching this late life stage in better physiological condition and this implies that who live longer may share a similar health profile with many younger individuals (Vaupel 2010).

Contemporaneous populations in developed countries present lower size cohorts than ever. Portugal is one of those countries and together with a high negative migration impact due a recent world economic crisis, followed by the COVID19 pandemic, which accurate impact is far to be completely understood from the social and demographic perspectives, new opportunities to study and evaluate population aging impacts are emerging. Despite the declining number in absolute births, increasing lifespans can create opportunities for a new demographic dividend on the top of the population pyramid. We take advantage of Oeppen's (2008) CoDa equivalent Lee-Carter method for mortality forecasting and develop a similar approach to forecast fertility trends in a compositional form, aiming to elaborate coherent medium-term population projections, i.e., to develop cohort-component projections with a coherent probabilistic perspective. Additionally, we also employ Sanderson and Scherbov's (2007) prospective age proposal to measure contemporaneous population aging.

The main objective is to evaluate the development of the Portuguese (chosen as a privileged area of observation of changes in demographic dynamics) population structure over time and develop coherent population projections based on compositional data to forecast mortality and fertility patterns to 1) evaluate the social and demographic necessity of attaining the 2.1 TFR replacement level; 2) evaluate aging as a new demographic dividend for developed countries, identifying possible opportunities for developed countries based on empirical knowledge from Portugal; 3) propose an innovative approach to develop population projections, adding to the cohort-component widely used model a coherent CoDa improvement; 4) re-evaluate population pyramid double-aging from an original perspective; and 5) to measure the COVID19 pandemic possible impact on future fertility and mortality trends.

Resuming, we develop coherent population projections employing innovative methods, this study contributes with not only methodological advances to Demographic projections, but also to produce CoDa fertility forecasts and new accurate perspectives of social and demographic aging opportunities. Lastly, the impact of COVID19 toll on demographic components is also evaluated.

2. Methods

When we are dealing with many vectors of information expressed in percentages or densities, all having the same sum, we end up with compositional data. A composition thus, is defined as a vector of D positive components $x = [x_1, ..., x_D]$ summing up to a given constant k (Oeppen, 2008; Boogaart and Tolosana-Delgado, 2013).

Aitchison (1986) argued that compositional data is significant for many subjects, revealing frequently noticeable variability from vector to vector. Despite that a typical example of compositional data concerns different subjects as Geology, Chemistry or Economics. Oeppen (2008) introduced it in demographic forecasts by modeling lifetable d_x, which always sum to the life-table radix (l_0) and we adapt it to fertility-tables. The best way to deal with sum-constrained data is to work on the simplex. Nevertheless, working with relative information is not always straightforward, mainly because the unit-sum "*it is either ignored or improperly incorporated into the statistical modeling and from there, results an inadequate or irrelevant analysis with a doubtful or distorted inference*" (Aitchison, 1986), and the solution is employing a log-ratio transformation.

Additionally, we employ the widely used cohort-component approach to produce population projections over age aver time.

3. Conclusion

Current mortality and fertility trends are expected to not change dramatically to impact positively population structures in countries as Portugal. Nevertheless, the coherent methodologic employed methodologic approach preliminary results aim at different developments for mortality and fertility trends. While the first tends to overcome the impact of a recent pandemic at a slow pace, that could be explained by the delay in diagnosing different diseases, the second one presents a low improvement due to the end of pandemic but stabilizing at low TFR values followed by a still increasing in the mean age at childbearing. Additionally, the remaining life expectancy at older ages is expected to increase accordingly, creating new opportunities for societies to understand the changing meaning of aging and to benefit with it: old active individuals are extremely valuable to societies.

Main references

Aitchison, J. (1986). The statistical analysis of compositional data. London: Chapman and Hall.

Oeppen J., Vaupel J.W. (2019) The Linear Rise in the Number of Our Days. In: Bengtsson T., Keilman N. (eds) Old and New Perspectives on Mortality Forecasting. Demographic Research Monographs (A Series of the Max Planck Institute for Demographic Research). Springer, Cham. https://doi.org/10.1007/978-3-030-05075-7_13

Oeppen, J. and Vaupel, J.W. (2002). Broken limits to life expectancy. Science 296, 1029-1031.

Sanderson, W.C. and S. Scherbov. 2007. A new perspective on population aging. Demographic Research 16: 27–57.

United Nations Department of Economic and Social Affairs/Population Division (2015). World population prospects: the 2015 revision, Key findings, and advance tables.

Vaupel, J.W. (2010). Biodemography of human aging. Nature 7288, 536-542.