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Title:

Cautionary remarks about conclusions from the observation of record-life expectancy

Indication of topic:

Topic 1: Biometric risks and their securitization

Abstract:

The debate about the future development of longevity is ongoing. Oeppen and Vaupel in [1] contributed to this discussion with a striking and often cited observation. Using historical data they produced a plot of world-wide record life-expectancy over time and observed that this indicator

- Shows a strong trend of improvement without any signs of deceleration
- And shows almost no deviation from linearity.

This paper discusses some conclusions regarding the improvement of life-expectancy specific to a country which can and cannot be drawn from this observed behaviour of world-wide record life-expectancy and will point out potential pitfalls. Academics and practitioners might encounter these pitfalls when naively transferring observations on world-wide *record* life-expectancy to the improvement of life-expectancy of any nation. These pitfalls are created because the improvement of world-wide *record* life-expectancy, i.e. the time development of *maximum* life expectancy of a portfolio of nations, is an upward biased estimator for the improvement of the underlying life-expectancies themselves.

We show for example that improvement of record life-expectancy will always be larger than the improvement of all underlying life-expectancies. Indeed record life-expectancy can show an improvement trend even if none of the underlying life-expectancies will have any. Furthermore, we will discuss the influence certain key parameters will have on this upward bias.

This will be achieved by Monte-Carlo analysis of a simple but reasonable “laboratory model” of mortality improvements of a portfolio of nations based on the Lee-Carter model. Within this setting we jointly simulate paths of life expectancy improvements and compare simulated trends of record life-expectancy with the initial trend parameters within the underlying portfolio of nations. Since the model is fully parametric, we can also study the impact of key parameters (like correlation structure of improvements and number of nations within the portfolio) on the strength of the bias.

Our analysis demonstrates the danger of being misled by upward bias when naively transferring trends in record life expectancy to trends in individual nations. The only possibilities to avoid this danger are either to analyse each nation on a stand-alone basis and thus to avoid any bias altogether or to analyse the assumptions underlying the stochastic model of joint mortality improvement to correct for the bias induced by the maximum function.

[1] Jim Oeppen and James W. Vaupel: "Broken Limits to Life Expectancy", Science 10 May 2002:Vol. 296. no. 5570, pp. 1029 - 1031

Keywords:

Longevity, mortality improvement, biometric risk, Monte-Carlo simulation, Lee-Carter model, record life-expectancy, biased estimator