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Gamma-Gompertz life expectancy at birth

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Abstract

Background: The gamma-Gompertz multiplicative frailty model is the most common parametric model applied to human mortality data at adult and old ages. The resulting life expectancy has been calculated so far only numerically.

Objective: Properties of the gamma-Gompertz distribution have not been thoroughly studied. The focus of the paper is to shed light onto its first moment or, demographically speaking, characterize life expectancy resulting from a gamma-Gompertz force of mortality. The paper provides an exact formula for gamma-Gompertz life expectancy at birth and a simpler high-accuracy approximation that can be used in practice for computational convenience. In addition, the article compares actual (life-table) to model-based (gamma-Gompertz) life expectancy to assess on aggregate how many years of life expectancy are not captured (or overestimated) by the gamma-Gompertz mortality mechanism.

Comments: A closed-form expression for gamma-Gompertz life expectancy at birth contains a special (the hypergeometric) function. It aids assessing the impact of gamma-Gompertz parameters on life expectancy values. The paper shows that a high-accuracy approximation can be constructed by assuming an integer value for the shape parameter of the gamma distribution. A historical comparison between model-based and actual life expectancy for Swedish females reveals a gap that is decreasing to around 2 years from 1950 onwards. Looking at remaining life expectancies at ages 30 and 50, we see this gap almost disappearing.

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