

# Semi-Coherent Multi-Population Mortality Modeling: The Impact on Longevity Risk Securitization

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## Abstract

Multi-population mortality models play an important role in longevity risk transfers involving more than one population. Most of the existing multi-population mortality models are built upon the hypothesis of coherence, which stipulates the differential between the mortality rates of two related populations at any given age to revert to its corresponding long-term equilibrium, thereby preventing diverging long-term forecasts that do not seem to be biologically reasonable. However, the coherence assumption may be perceived by market participants as too strong and is in fact not always supported by empirical observations. In this paper, we introduce a new concept called ‘semi-coherence’, which is less stringent in the sense that it permits the mortality trajectories of two related populations to diverge, as long as the divergence does not exceed a specific tolerance corridor, beyond which mean-reversion will come into effect. We further propose to produce semi-coherent mortality forecasts by using a vector threshold autoregression. The proposed modeling approach is illustrated with mortality data from US and English and Welsh male populations, and is applied to the Kortis deal that was recently launched by Swiss Re.

*Keywords:* Longevity bonds; Population basis risk; Vector threshold autoregression

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