A GRAVITY MODEL OF MORTALITY RATES FOR TWO POPULATIONS

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Abstract

The mortality rate dynamics between two related but different sized populations are modelled consistently using a gravity model. The larger population is modelled independently, but the spreads in the period and cohort effects between the larger and smaller populations depend on gravity or spread reversion parameters for the two effects. The larger the two gravity parameters, the more strongly the smaller population's mortality rates move in line with those of the larger population in the long run. This is important where it is believed that the mortality rates between related populations should not diverge over time on grounds of biological reasonableness. The model is illustrated using an extension of the Age-Period-Cohort model and mortality rate data for English & Welsh males representing a large population and CMI assured male lives representing a smaller related population.

Keywords: Gravity model, stochastic mortality, two populations, small sub-populations, mortality spreads, age effect, period effect, cohort effect, basis risk, parameter uncertainty.