

# The Application of Affine Processes in Multi-Cohort Mortality Model

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## Abstract:

Cohort effects have been identified in many countries. However, some mortality models only consider the modeling and projection of age-period effects. Others, though incorporate cohort effects, do not consider cohort specific survival curves that are important for pricing and hedging purposes. In this paper, we consider modeling mortality development on a cohort basis and develop a multi-cohort mortality model in affine framework. We model the mortality intensity with common factors that affect all the cohorts as well as cohort specific factors that only affect specific cohorts, so that the correlations among cohorts are not perfect. In particular, we consider a three-factor case. The three-factor multi-cohort model is implemented on Danish males mortality data. The two common factors are extracted using Kalman Filter algorithm and cohort specific factors are estimated by minimizing the calibration error. The calibration results show clear signs of cohort effects. The out-of-sample forecast performance of the proposed model, the RH model (age-period-cohort model developed by Renshaw and Haberman (2006)) and the CBD model (age-period model developed by Cairns et al. (2006)) are analyzed and compared to the true mortality data. The result shows that the proposed model produces the most satisfactory cohort survival curve.

**Keywords:** Multi-cohort mortality model; Affine framework; Common factors; Cohort specific factors; Mortality projections.