

## **Modeling and forecasting mortality rates: an application of the Lee-Carter model to Norway mortality data**

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Mortality data is an important element in the fields of actuarial science, health, epidemiology and national planning. Mortality levels are generally regarded as indicators of a general welfare of a national population and its subgroups. It reflects the quality of life within quantity. Population forecasting is essential for all long term planning for the provision of services of a nation. Therefore developing a model for forecasting mortality rate will help a nation to develop its quality of life. The Lee and Carter (LC) stochastic mortality model was used in our study for fitting and forecasting the mortality rate of Norway which is considered as the country with the highest living standards based on the human development index. LC model was used since it is regarded as the golden model for mortality data due to the simplicity in parameter estimation. Moreover, it gives a good fit over a wide range of ages. The data set contained Norway mortality data from 1846 -2014. The Singular Value Decomposition (SVD) approach was used for estimating the parameters of LC model. Auto Regressive Integrated Moving Average (ARIMA) time series model was used for forecasting the mortality values.

In this study 97.5 % temporal variance of Norway mortality data could be explained by the 1<sup>st</sup> SVD component. The best fitting ARIMA model for Norway data was identified as ARIMA (3,2,1) which gave the lowest Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) values. The general pattern of mortality showed higher child mortality for ages below 4 years and an accidental hump around ages 20 and nearly exponential increase after the age of 25. The sensitivity of mortality showed mortality decline at high rate for ages 20-25 years. Mortality index showed decreasing trend and two spikes due to World War I and World War II. The predicted Lee Carter model gives a good fit to Norway data over a wide range of ages but shows poor performance below age of 4 years and after age of 55 years. Therefore an improvement in the LC model is needed to obtain better predictions for these two age categories. This proposed model can be used to construct the life table for Norway and also for pension scheme planning and actuarial science applications. Furthermore, it can also be extended to handle mortality data of any other country.