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Name : WAN ZAKIYATUSSARIROH BINTI WAN HUSIN

Title : DYNAMIC FORECASTING MODEL FOR SHORT SERIES AGE-SPECIFIC MORTALITY

Supervisor : DR. NORAZAN MOHAMED RAMLI (MS)

This thesis presents results of a research in developing a model to forecast mortality using a combination of existing demographic and time series models, specifically proposing a common factor model for forecasting Malaysia mortality using the available mortality data set. This research has been motivated by three (3) factors. Firstly, the need for a mortality forecasting model "tailored" to Malaysia data set which has been borne out of the scarcity of studies in forecasting Malaysia mortality, crucial to government pensions and social security as well as to practitioners in related fields. Secondly, over the last decades, different models for forecasting mortality have been used to produce mortality projections for different countries. However, no "universal" model, applicable to all countries, has been developed, more so for short-series historical mortality data. Hence, there is a need to develop and apply an appropriate model to produce good forecasts of Malaysia mortality. Thirdly, while undertaking a literature review to gain insights into current mortality forecasting models, it became apparent that a gap existed between the current models used for forecasting and projecting Malaysia mortality and the current practice of incorporating state-space methodology in mortality forecasting models, specifically in modelling high-dimensional short series mortality data. Hence, the research gap has to be narrowed. The first objective of this research is to establish a comprehensive literature review on modeling and forecasting mortality data. The second objective is to assess the feasibility of applying the benchmark Lee-Carter (LC) model and its variants and extensions to Malaysia age-specific mortality data. The third objective is to develop the LC model within a state space framework (LC-SS model) as a common factor model with single and multiple common trends for forecasting Malaysia age-specific mortality. The fourth objective is to evaluate and validate the performance of the LC-SS model while the fifth objective is to generate Malaysia age-specific mortality forecasts. The first stage of the research assessed the feasibility of applying the benchmark LC model together with its variants and extensions which included the Hyndman-Ullah (HU) model to Malaysia age-specific mortality data (i.e., the age-specific death rate – ASDR). In the second stage, three variants of LC models in state space framework (LC-SS model) were proposed using algorithm for a large number of series with a short time period. These are the LC-SS model with multiple common trends (LC-DFA model), the LC-SS model with single common trends; LC-SSequal and LC-SSunequal models. The performance of these models were evaluated using time series cross validation. Results indicated that the LC-SS models were able to fit and forecast Malaysia mortality well, with the LC-DFA model outperforming the LC-SSequal and LC-SSunequal models. This study has shown that it is feasible to improve the benchmark LC model by incorporating a state space model to provide good forecasts for short non-stationary age-specific Malaysia mortality. Results of this research also revealed that Malaysia ASDR is expected to decline in the future with the increase in life expectancy. These results contribute useful insights into mortality patterns using age-specific base model in modelling and forecasting Malaysia mortality. The feasibility of developing causal forecasting models for Malaysia ASDR using socioeconomic explanatory data could next be explored, along with the development of appropriate model evaluation techniques.