Statistics of Markov processes with applications in insurance and public health: life tables and life expectancies

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The natural setting of survival (or event history) analysis is the Markov process framework, where the X_t process takes on values in a finite set of states S. Survival analysis deals with the less complicated case of only two states: life and death. In the multi-state case one would consider one-dimensional aggregate indices, such as Disability Adjusted Life Expectancy (DALE). A valuation of states can be introduced for this purpose, and the expected value of the life should be estimated. With a discount factor can be expressed the age discriminating and not perfectly justifiable view, that older life counts less. Discounting however perfectly justifiable in financial applications, dealing with cash flows depending from the process. More exactly the process X_t generates a filtration $\mathcal{F}_t$ and one can consider stochastic cash flows adapted to this filtration. Actuarial premium calculation and reserving principles of life insurance can be derived by taking expectations of present values of the appropriate cash flows. Finally consider two different processes with the same set of states S, taking the same functional of the two processes (e.g. life expectancy). It is important to find a decomposition of the difference of the values of the functional of the two processes to contributions attributable to changes of transition intensities. The decomposition of differences of life expectancies has been done for causes of death (one life and many death's) by Arriaga. Pollard derived his decomposition not only for life expectancies, but for many other functionals. These results are generalised for more general Markov processes.

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