

Frailty Models for Modeling Heterogeneity: Simulation Study and Application to Quebec Pension Plan

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Abstract : When referring to actuarial analysis of lifetime, only models accounting for observable risk factors have been developed. Within this context, Cox proportional hazards model (CPH model) is commonly used to assess the effects of observable covariates as gender, age, smoking habits, on the hazard rates. These covariates may fail to fully account for the true lifetime interval. This may be due to the existence of another random variable (frailty) that is still being ignored. The aim of this paper is to examine the shared frailty issue in the Cox proportional hazard model by including two different parametric forms of frailty into the hazard function. Four estimated methods are used to fit them. The performance of the parameter estimates is assessed and compared between the classical Cox model and these frailty models through a real-life data set from the Quebec Pension Plan and then using a more general simulation study. This performance is investigated in terms of the bias of point estimates and their empirical standard errors in both fixed and random effect parts. Both the simulation and the real dataset studies showed differences between classical Cox model and shared frailty model.

Keywords : life insurance-pension plan, survival analysis, risk factors, cox proportional hazards model, multivariate failure-time data, shared frailty, simulations study

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