Title : An ODE Model for IBNR Estimation Using Cumulative Paid and Outstanding Case Reserves

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ABSTRACT

Estimating incurred but not reported (IBNR) claims is an important task in loss reserving. Although the Chain-Ladder method is widely used in practice, it does not clearly describe how claims develop over time. This study proposes an ordinary differential equation (ODE) model to represent the relationships among paid losses, case reserves for reported claims, and IBNR by using claims data from 2019–2024 and estimating the parameters α_0, λ and β by using numerical approximation and linear regression. The results show that the proposed model provides IBNR estimates that are structurally consistent and reasonable for insurance applications, with almost no negative values, while the Chain-Ladder method produces negative estimates in several cohorts. Back-testing shows that both methods have similar predictive accuracy and the proposed model offers a clearer structural framework and meaningful interpretation of parameters for insurance practice.

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