

# The Chain Ladder Reserve Uncertainties Revisited

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## Abstract

Chain ladder (CL) is still one of the most popular and most used reserving method for the insurance practice. In 1993 Mack presented the distribution-free CL-model and derived a formula for the uncertainty of the CL-reserves, which refers to the *ultimate prediction uncertainty* measured by the *mean square error of prediction*. For calculating the reserve risk and the cost-of-capital loading in solvency (SST and solvency II) one also needs estimators for the *one-year prediction uncertainty* of all future accounting years until final development.

In a recent paper of end 2014 Merz and Wüthrich considered the different prediction uncertainties, that is the ultimate prediction uncertainty as well as the one year prediction uncertainties for all future accounting years until final development within the framework of a specific Bayesian-CL model. Taking a non-informative prior and after a first Taylor approximation they received the already existing result of Mack for the ultimate prediction uncertainty and formulas for the one-year run-off uncertainties for all future accounting years until final settlement of the run-off. However the Bayesian-CL model and the distribution free CL-model of Mack are two different pairs of shoes. Thus the results derived are results with regard to a different model and we do not know, whether they are also appropriate in the classical chain ladder model of Mack.

In this paper we derive the different kinds of prediction uncertainties strictly within the framework of the distribution-free CL model of Mack. By doing so, we gain more insight into the differences between the two model approaches and find the following main results: a) the formulas for the one-year prediction uncertainty in the classical Mack-model are different to the Merz-Wüthrich formulas, b) the Merz-Wüthrich formulas are obtained by a first order Taylor expansion, c) the Mack formula as well as the Merz-Wüthrich formulas for the total over all accident years can be written in a simpler way, d) we can see "behind the formulas", as they can be interpreted in an intuitive and understandable way.