HIERARCHICAL STRUCTURES IN THE AGGREGATION OF PREMIUM RISK FOR INSURANCE UNDERWRITING

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Abstract
In the valuation of the Solvency II Capital Requirement, the correct appraisal of risk interdependencies acquires particular importance. These interdependencies refer to the recognition of risk diversification in the aggregation process. There are different levels of aggregation and hence different kind of diversification: the first level aggregates the stand-alone line of business, the second level regards the aggregation of different kind of risks like market and underwriting, a third level could be the aggregation of different entity in a group.
Solvency II allows companies to capture these diversification effects but the identification of a proper method can represent a delicate issue. In fact, while Internal Models permit to obtain the portfolio multivariate distribution in independence case, only the use of copula functions can consent to obtain the same multivariate distribution under dependence assumptions.
However the choice of the copula and the parameter estimation could be very problematic when only few data are available. So it could be useful to find a closed formula based on Internal Models independence results with the aim to obtain the Capital Requirement under dependence assumption too. QIS Aggregation Formula represents a first simple way to do that, but it could underestimate the diversification effect.
In this paper we present an alternative method, based on the idea (proposed by Sandstrom) to correct QIS Aggregation Formula with proper calibration factors and opportunely extended with the aim to consider very skewed distribution too.
In the last part we compare the Capital Requirements obtained, for only premium risk, applying the aggregation formula to different non-life multi-line insurers, with the results derived by elliptical copulas and Hierarchical Archimedean Copulas.

Keywords: Aggregation and dependency in non-life insurance, Premium Risk, Internal Model, Hierarchical archimedean copulas, reinsurance treaties