A Contribution to Solvency Analysis: The Extreme Value Theory

The main concern of this investigation is solvency in insurance companies and the Extreme Value Theory is the tool to achieve the objective.

As far as these events can put in danger the whole stability of a company, the unusual behaviour of a random event might have more interest than the normal behaviour, which has been long studied by the classic risk theory.

Even more, the classic theory does not consider the outliers, not to raise the variance of central observations. This means that the law of large numbers and the central limit theorem are not adequate for modelling a complete loss distribution.

In the future this will lead to mixtures of distributions.

The frame of this investigation is the Solvency II project. The proposals are based on the distribution of large claims to describe fat tails.

After a revision of the origin of the theory, the fundamentals of the extreme value theory are summarized.

Generalized Extreme Value Distribution and Generalized Pareto Distribution are the main models that describe large events.

After the theoretical background we make an empirical study using two claim portfolios of two insurance companies based over a ten year period.

Tendencies, seasonality and mean times are studied to describe the behaviour of large claims.

Through asymptotic approaches this study gets an appropriate model for large claims in order to determine future losses and probabilities. A Generalized Pareto distribution is obtained to shape the excesses over a threshold. Each company has its own model with different layers.

Because extreme values are scarce, the inference can reach levels never observed but likely to happen.

Through these models we find relations with the solvency capital requirements determined by Solvency II, calculating measures like Value at Risk or Tail Value at Risk.

Other applications to Excess Loss Reinsurance are developed from the angle of the reinsurer and from the point of view of the cedent company.

Further investigations will be aimed at asymptotic mathematics and its application to insurance and other fields such as financial market or natural disasters