Statistical Approach to Operational Risk Management

Giulio Mignola and Roberto Ugoccioni,
Sanpaolo IMI Group, Torino, Italy

Banking supervising authorities require that, starting from 2007, banks calculate a regulatory capital for operational risks. Operational risks involve failures of normal business processes, e.g. mistakes, robberies, frauds, liabilities. In the most sophisticated approach, the capital requirement has to be computed taking into account both backward-looking historical loss data and forward-looking scenario analysis. No particular method is prescribed, but the risk measure at group level should provide a confidence level of 99.9% with a holding period of one year.

Because an industry best-practice in this field does not yet exists, the development of suitable methods required a tools which is both powerful and flexible, and an open source one was chosen to avoid an early lock-up in proprietary software.

Within Sanpaolo IMI, R is used at three levels:

- methodological research
- application prototyping
- production environment (in limited cases)

In historical loss data analysis, frequency and severity distributions of individual losses in a given risk class are studied, several distributions are fitted to the data with maximum likelihood estimation of parameters, establishing goodness-of-fit and choosing a best-fit distribution. The one-year period aggregate loss distribution is then computed from the characteristic functions via fast-Fourier-transform techniques and directly from the cdf via Monte Carlo techniques. The aggregated distributions for the different risk classes are then put together taking into account empirical correlations by making use of the copulas formalism. The regulatory capital is computed as the 99.9% quantile of the resulting total loss distribution.

In scenario analysis, in order to compute an equivalent figure, one has to obtain from "experts" within the bank (local managers) an estimate of the frequency and severity distributions: the method of moments and quantile matching has been chosen in order to gather from the interviewed the smallest and most precise information. To achieve this objective, one has to avoid open-answer questions and carefully choose answer ranges by calibrating a frequency dependent severity scale on the basis of the projected final risk measure. Again to focus the answers onto precise problems, the level of granularity in scenario analysis is greater than in loss data analysis, and it breaks the risk classes into event type sub-classes. This methodology requires preparing in advance, for each frequency and severity distribution type, curves of iso-UL (locus of points in parameter space with the same yearly aggregated unexpected loss), from which to compute answer ranges while the interview proceeds.

The risk measures from historical losses and scenario analysis are finally compound using Bayesian methods.